VISVESVARAYA TECHNOLOGICAL UNIVERSITY
"JNANA SANGAMA" BELAGAVI-590018

A PROJECT REPORT
ON
" GENERATING ORGAINC FERTILIZER FROM THE RESIDENTAL WASTE "

Submitted in partial fulfillment for the award of
BACHELOR OF DEGREE IN ELECTRICAL AND ELECTRONICS ENGINEERING
during the academic year 2021-22

BY

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
RAO BAHADUR Y. MAHABALESWARAPPA ENGINEERING COLLEGE
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RAO BAHADUR Y. MAHABALESWARAPPA ENGINEERING COLLEGE

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

CERTIFICATE

This is to certify project work entitled "GENERATING ORGANIC FERTILIZER FROM THE RESIDENTAL WASTE" is a bonafide work carried out by the project group in the partial fulfillment for the award of bachelor degree in ELECTRICAL AND ELECTRONICS ENGINEERING from Visvesvaraya Technological University, Belagavi, during the academic year 2021-2022.

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ACKNOWLEDGEMENT

It is indeed a great pleasure to recall the people who have helped us in carrying out this project work. Naming all the people who have helped us in achieving this goal would be impossible, yet we attempt to thank a selected fewwho have helped us in diverse ways.

The satisfaction that accompanies the successful culmination of any task would be incomplete without mentioning those who made it possible because success is the epitome of hard work, determination, concentration and dedication.

We are grateful to our beloved Principal **Dr. T HANUMANTHA REDDY** for providing facilities and untiring zeal, which constantly inspired us towards the attainment of everlasting knowledge throughout the course

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Finally, we would like to thank all the teaching and non-teaching staff members of Electrical and Electronics Engineering department for their guidance and support during our bachelor's degree. We are also thankful to our family and friends for their extended support and encouragement.

DECLARATION

We hereby declare that the presented report of project titled **"GENERATING ORGANIC FERTILIZER FROM THE RESIDENTAL WASTE"** is the original data and given the information to the best of our knowledge in the project report carried by us under the guidance of **Mr. Hanumantha Reddy** at the Department of Electrical and Electronics Engineering, Rao Bahadur Y. Mahabaleswarappa Engineering College, Bellary affiliated to Visvesvaraya Technological University, Belagavi-590018, during the year 2021-2022

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ABSTRACT

The operation of microbial inoculants(biofertilizers) is a promising technology for unborn sustainable agriculture systems in view of quickly dropping phosphorus stocks and the need to more efficiently use available nitrogen(N). Bio-fertilizers with organic soils are the neat new-age tools and a gift of our farming knowledge as a relief to our conventional diseases. Conventional diseases contain compost, home wastes, and green sewerages which aren't as effective as chemical diseases. So, growers frequently try to use chemical diseases in the field for crop development. But obviously, the chemical diseases aren't terrain friendly because of their chemical toxin that can beget water, air, and soil pollution and can spread cancer-causing agents. also, they may destroy the fertility of the soil in a long run. Scientists have developed the way of organic husbandry by use of "Bio-fertilizers" along with natural coprolites to help chemical pollution in farmlands. Bio-fertilizer contains microorganisms that promote the acceptable force of nutrients from organic soils to the host shops and ensure their proper development of growth and regulation in their physiology. Bio-fertilizer being essential factors of organic agriculture plays a vital part in maintaining long-term soil fertility and sustainability. It can be concluded that the operation of bio-fertilizer with organic soil could upgrade the product on the sustainable root.

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CHAPTER -1

INTRODUCTION

The role of essential micro nutrients such as nitrogen, phosphorous, potassium and other secondary elements is known for increasing the productivity of the land. Bio- fertilizers contain live cells of specific isolated strain of bacteria and fungi which is formulated in suitable carriers. These microbes upon applications to soil under suitable condition secrete metabolism and enzymes which makes deficient element available to theplant in the suitable form. Nitrogen fixing bacteria solubilize insoluble fixed phosphorous insoluble, potassium mobilizing bacteria mobilize the immobile potassium in soil and similarly other microbes mobilize the element in soil and make it available to the plant. In this project we are going to produce manure automatically by using green waste and enzymes.

Organic manures are naturally available mineral sources that contain a moderate quantity of manufactory essential nutrients. They're able of helping problems associated with synthetic manures. The ethical use in-situ of Agri- grounded organic wastes to produce compost and bio-organic compost on the farm for adding natural suppressiveness of soil to soil-borne works pathogens has been a better way for a longer time for design new sustainable cropping systems without using chemical fumigants. Biofertilizers contain living cells or free cells of fruitful strains of microorganisms that help crop factories uptake of nutrients by their relations in the rhizosphere when applied through seed or soil. They accelerate certain microbial processes in the soil which accelerate the extent of the fullness of nutrients in a form smoothly assimilated by works. Compost is produced from organic waste, which not only contains organic matter but also is rich in micro and macronutrients. The application of compost as soil fertilizer or correction could restore the soil quality and ameliorate soil structure and fertility, which not only serves an important part in farming produce but also is of great significance for enriching the ecological context. The exercise of compost could promote soil productivity and enrich the crop amount and quality.

Agriculture plays a pivotal role in the growth and survival of nations; therefore, maintaining its quantity and quality is essential for feeding the population and economic exports. Over the years, agriculture has undergone various scientific innovations in order to make it more efficient. Modern agriculture involves usage of pesticides and chemical fertilizers with an essence of increasing the world's food production, as these serve as a fast food for plants causing them to grow more rapidly and efficiently. Continuous application of chemical fertilization leads to the decay of soil quality and fertility and mightlead to the collection of heavy metals in plant tissues, affecting the fruit nutritional value and edibility. Hence, in the recent years, many organic fertilizers have been introduced that act as natural stimulators for plant growth.

A particular group of organic fertilizers includes outcomes based on plant growth-promoting microorganisms identified as 'Biofertilizers'. These biofertilizers comprised efficient strains of nitrogen fixing or phosphate solubilizing microorganism. Organic farming has appeared as a prime concern area globally in aspect of the growing demand for safe and healthy food, durable sustainability and issue on environmental pollution associated with random use of agrochemicals. wastes, domestic sewage, animal manure, and microorganisms, such as fungi and bacteria. They are used toenhance fixation of nutrients in the rhizosphere, produce plants of growth stimulants, effective in soil stability, offer biological control, biodegrade substances, recycle nutrients, support mycorrhiza symbiosis The bio-fertilizers supply also enhance the productivity per area in a comparatively short time, consume smaller amounts of energy, reduce contamination of soil and water, increase soil fertility.

1.1 OVERVIEW OF THE PROJECT

Shifting focus towards organic farming and reduction of chemical residues in the environment. Bio-fertilizer are selective live micro-organism like bacteria, fungi and algae. Theyprovide a cost effective, eco-friendly & renewable source of nutrients. Bio-fertilizers improve the nutrient availability to the crops in which biological process is involved. They

play a vital role in improving soil fertility and ensure maintaining long term sustainability.

Bio-fertilizer became popular to counter the negative impact of unsystematic use of chemical fertilizers. Chemical fertilizers and pesticides have placed have played an important role in boosting the agricultural production for past 50 years in India, since their introduction during green revolution. Their immediate action and low cost resulted in the widespread acceptance and inclusion in the cultivation practices. However, their long-term application contributed in loss of soil fertility along with addition of salts to the soil. This led to concern for reviving the soil health and use of alternate sources of fertilizers. Thus came the concept of Bio-fertilizer, which proved to be a good supplement for chemical fertilizer.

Bio-fertilizer is the need of modern agriculture since demand for safe and residue free food in increasing. In view of the environment, it is necessary to promote the production of bio-fertilizers in large scale by the private sector to cater the current demand. Bio-fertilizers help in fixing atmospheric nitrogen, converting soil phosphate and potashinto soluble form to make them available to plants. Continuous use of bio-fertilizers makes the soil rich in essential nutrients, which promotes good yield. The bio-fertilizer can be manufactured both in solid as well as in liquid form.

1.2 OBJECTIVE OF THE PROJECT

The objective of the is project is to generating bio-fertilizer by using green waste. It is done automatically by using electrical and electronics equipment and proximity sensor hence it reduces the manpower required for the production of bio fertilizer.

CHAPTER -2

LITERATURE SURVEY

1. **Arun KS. 2007. Bio-fertilizers for sustainable agriculture. Mechanism of P-solubilization. Sixth edition, Agribios Publishers, Jodhpur, India, pp.196-197.**

Biofertilizers are the nutrient availability systems in which biological processes are involved. These biological systems are the essential part of life of several microbes found in soils and provide nutrients like nitrogen, phosphorus and several beneficial compounds for crop. Presence of these microbes makes soil alive and capable for sustainable support to the life of crop, another life. During the last fifty years due to the high use of synthetic fertilizers not only: overall soil fertility is decreased but also these biological systems the adversely affected, visible in the decreasing trend of production even after using higher doses of fertilizers. Besides, the use of synthetic fertilizers is causing several environmental problems.

2. **Mishra DJ, Singh Rajvir, Mishra UK and Kumar SS. 2013. Role of Bio-Fertilizer in Organic Agriculture: A Review, Research Journal of Recent Sciences, Vol. 2(ISC-2012), 39-41.**

Bio-fertilizers are one of the best modern tools for agriculture. Biofertilizers are applied in the agricultural field as a replacement to our conventional fertilizers. Conventional fertilizers contain compost; household wastes and green manure. Those are not as effective as chemical fertilizers. So, farmers often try to use chemical fertilizers in the field for crop development. But obviously the chemical fertilizers are not environment friendly. They are responsible for water, air and soil pollution and can spread cancer causing agents. Moreover, they may destroy the fertility of the soil in a long run. Scientists have developed Biofertilizers to prevent pollution and to make this world healthy for everybody in a natural way.

Bio-fertilizer contains microorganisms which promote the adequate supply of nutrients to the host plants and ensure their proper development of growth and regulation in their physiology. Living microorganisms are used in the preparation of biofertilizers. Only those microorganisms are used which have specific functions to enhance plant growth and reproduction. There are different types of microorganisms which are used in the bio-fertilizers. Bio-fertilizer being essential components of Organic farming play vital role in maintaining long term soil fertility and sustainability.

3. **Vessey, J. Kevin (2003). "Plant growth promoting rhizobacteria as biofertilizers". Plant and Soil. 255 (2): 571–586.**

Numerous species of soil bacteria which flourish in the rhizosphere of plants, but which may grow in, on, or around plant tissues, stimulate plant growth by a plethora of mechanisms. These bacteria are collectively known as PGPR (plant growth promoting rhizobacteria). The search for PGPR and investigation of their modes of action are increasing at a rapid pace as efforts are made to exploit them commercially as biofertilizers. After an initial clarification of the term biofertilizers and the nature of associations between PGPR and plants (i.e., endophytic versus rhizospheric), this review focuses on the known, the putative, and the speculative modes-of-action of PGPR. These modes of action include fixing N_2, increasing the availability of nutrients in the rhizosphere, positively influencing root growth and morphology, and promoting other beneficial plant–microbe symbioses. The combination of these modes of actions in PGPR is also addressed, as well as the challenges facing the more widespread utilization of PGPR as biofertilizers.

4. **John RP, Tyagi RD, Brar SK, Surampalli RY, Prévost D (September 2011). "Bio-encapsulation of microbial cells for targeted agricultural delivery". Critical Reviews in Biotechnology. 31 (3): 211–226.**

Biofertilizers, namely Rhizobium and biocontrol agents such as Pseudomonas and Trichoderma have been well established in the field of agricultural practices for many decades. Nevertheless, research is still going on in the field of inoculant production to find methods to improve advanced formulation and application in fields. Conventionally used solid and liquid formulations encompass several problems with respect to the low viability of microorganisms during storage and field application. There is also lack of knowledge regarding the best carrier in conventional formulations. Immobilization of microorganisms however improves their shelf-life and field efficacy. In this context, microencapsulation is an advanced technology which has the possibility to overcome the drawbacks of other formulations, results in extended shelf-life, and controlled microbial release from formulations enhancing their application efficacy. This review discusses different microencapsulation technologies including the production strategies and application thereof in agricultural practices.

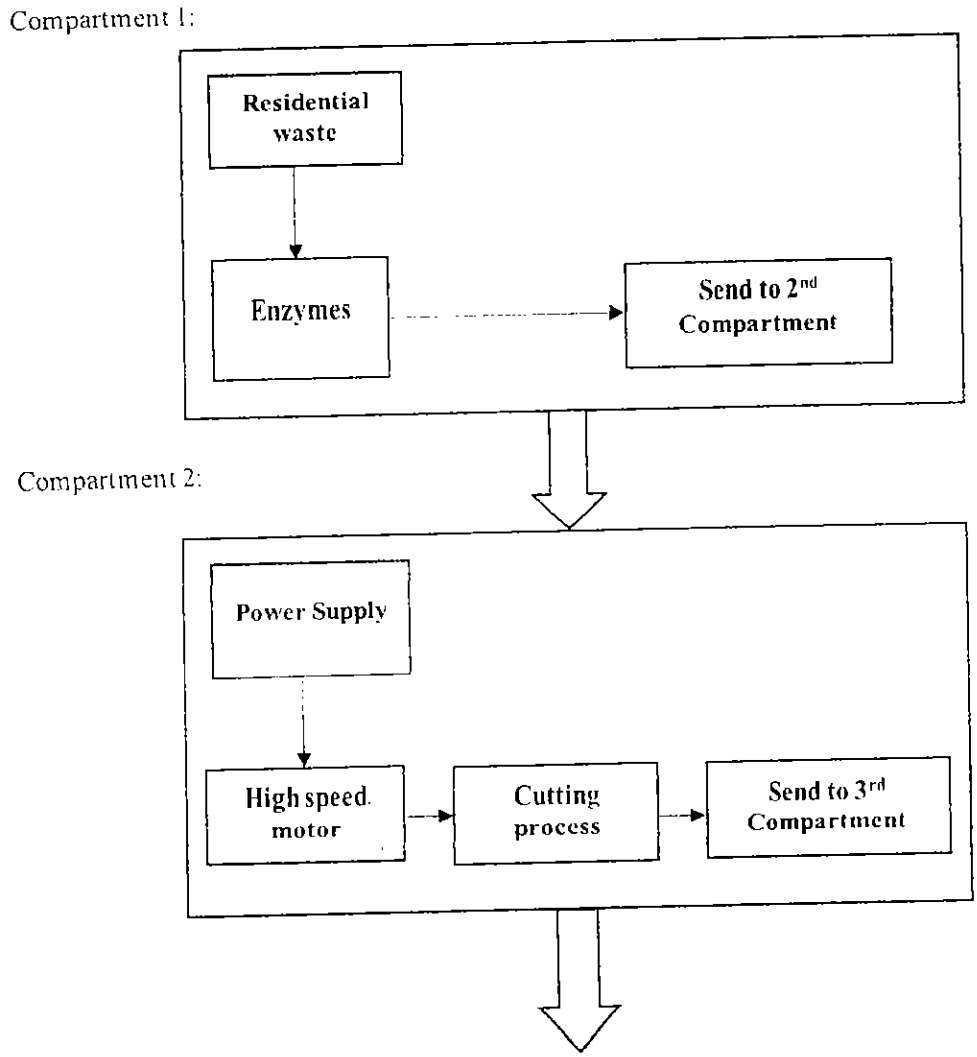
2.1 PROBLEM STATEMENT

1. Availability of chemical fertilizers decreased the significance of green manuring.
2. Where the effects of the microorganism on the plant are usually plainly visible asdamage to root tissue
3. Much emphasis has been paid to composting of MSW (Managing solid waste) management in recent years.
4. The generalization can then be made those plants of different kinds may be affected by(interact with) specific microbes in the soil environment.
5. A microbe which destroys one plant species may be without effect on a differentspecies
6. Low temperature is another factor that can lead to an accumulation of volatile organic acids.

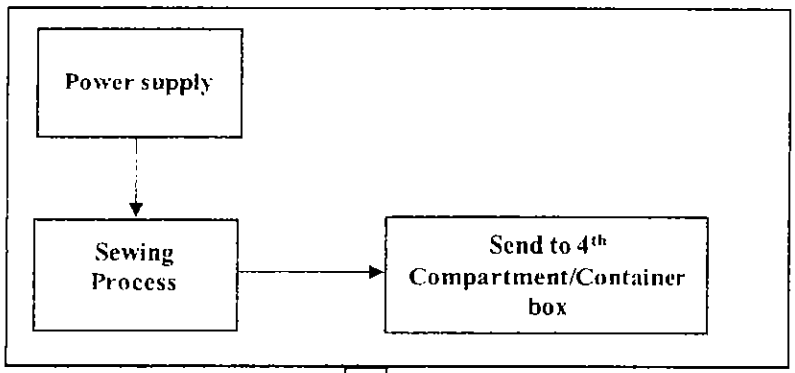
CHAPTER-3

BLOCK DIAGRAM OF PROPOSED SYSTEM

The block diagram of proposed system "Generating Organic Fertilizer from the Residential Waste" is as shown in fig 3.1



Compartment 3:



Compartment 4:

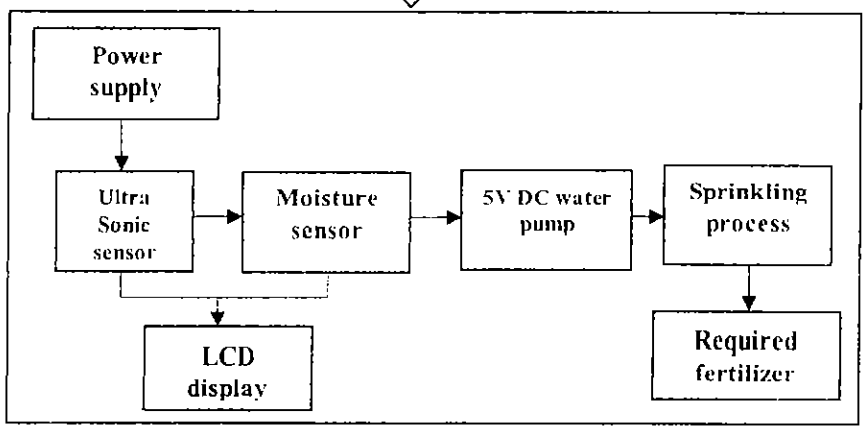


Fig 3.1: Block Diagram representation

3.1 FLOW CHAT

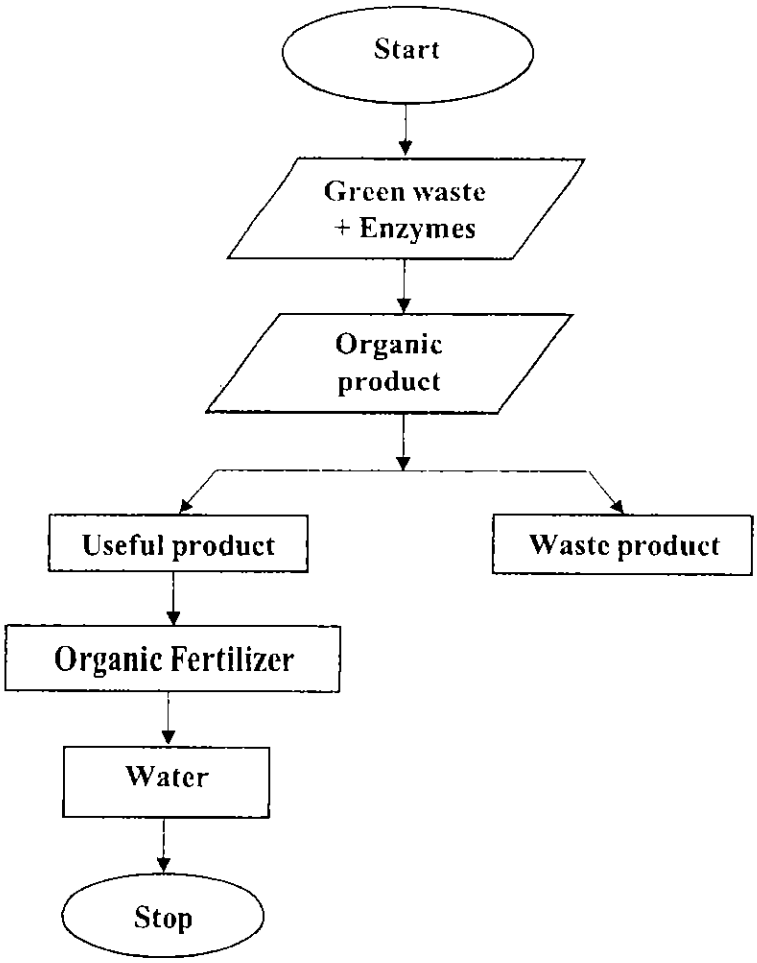


Fig 3.2: Flow Chat representation

3.2 STEPS INVOLVED IN GENERATION OF FERTILIZER

Compartment 1:

First collect the residential waste and green waste and then dump it into the funnel. After dumping the green waste completely, then green waste should decompose with some of enzymes. The added enzymes help for the decomposition for the further process. Then the product will move to the 2nd compartment.

Compartment 2:

The product is received from 1st compartment for further process. The compartment contains high speed motor with power supply and that motor is connected to counter cutting blades. Here the cutting process of the waste takes placed and finely chopped waste product will go to 3rd compartment.

Compartment 3:

In this compartment sewing process is carried out. The equally chopped pieces from compartment two are received here, waste is sewed from the specified sewing plates. Sewed product is sent to 4th compartment.

Compartment 4:

In this compartment decaying process is carried out. In this compartment we used ultra-sonic sensor and soil moisture sensor are being used here. Moisture sensor checks the presence of moisture content that is present in the compost of residential waste and enzymes where the moisture content is calculated. In our project percentage of moisture content should be around 25-30% is taken into consideration and if this reaches below then the water is sprinkled using water sprinkler to maintain the moisture level throughout the decaying process. Enzymes are added for decaying process over the period of 30-40 days. The water collected from the product can be used for agriculture purpose. And finally, the required fertilizer is obtained at the end.

CHAPTER -4

HARDWARE DESIGN AND ITS DEVELOPMENT

4.1 HARDWARE COMPONENTS:

1. Induction motor-2HP
2. Ultra Sonic Sensor
3. Moisture sensor
4. LCD display
5. Water Pump
6. Arduino UNO
7. Power Distributer
8. Solid State Relay
9. Single Channel Relay
10. Buzzer

4.2 INDUCTION MOTOR-2HP:

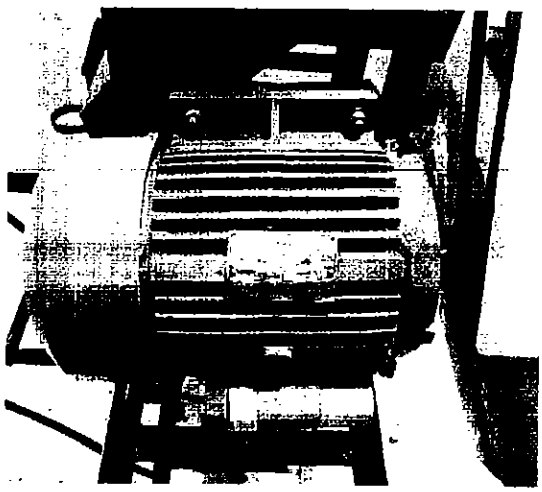


Fig 4.1: Capacitor-Start Capacitor-Run Single Phase Induction Motor

The capacitor-start capacitor-run motor is a type of single-phase induction motor. The capacitor-start capacitor-run induction motor is also known as two value capacitor motor. The capacitor-start capacitor-run induction motor consists of a squirrel cage rotor and its stator has two windings, viz. the **starting** or **auxiliary winding** and the **main** or **running winding**. The two windings are displaced by an angle of 90° in the space. This motor uses two capacitors – the **starting capacitor** (C_S) and the **running capacitor** (C_R). The two capacitors are connected in parallel at the instant of starting. In order to obtain a high starting torque, a large starting current is required. For this, the capacitive reactance in the starting winding should be low.

Since the reactance of the starting capacitor is given by,

$$X_S = 1/\omega C_S$$

Hence, for X_S to be small, the value of starting capacitor (C_S) should be large. The starting capacitor C_S is a short-time rated electrolytic capacitor.

During the normal operation of the motor, the rated line current should be smaller than the starting current. Therefore, the capacitive reactance of the running capacitor should be high and is given by,

$$X_R = 1/\omega C_R$$

Hence, for X_R to be high, the value of the running capacitor (C_R) should be small. The running capacitor is a long-time rated capacitor and is usually of oil-filled paper construction.

As the motor attains the normal speed, the starting capacitor (C_S) is disconnected from the motor circuit by a centrifugal switch (S) and the running capacitor (C_R) remains permanently connected in the circuit. Since one capacitor (C_S) is used only at starting and the other capacitor (C_R) for continuous running, the motor is known as capacitor-start capacitor-run motor.

The phasor diagram of the capacitor-start capacitor-run motor is shown below. At starting both the capacitors are in the circuit, therefore, the phase angle φ is greater than 90°. When

the starting capacitor *(C_S)* is disconnected from the circuit, then the phase angle becomes 90° electrical.

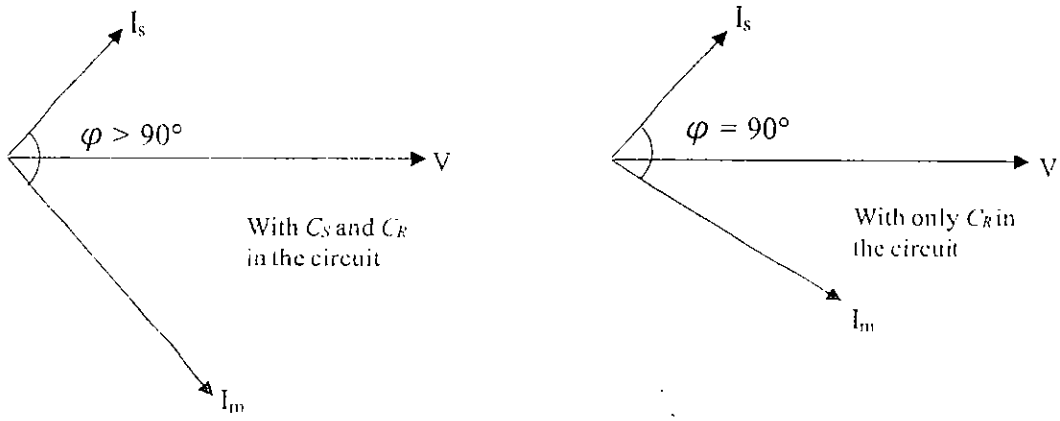


Fig 4.2: Characteristics of Capacitor-Start Capacitor-Run Induction Motor

4.3 ULTRA SONIC SENSOR:

Fig 4.3: Ultra Sonic Sensor

An ultrasonic sensor is an electronic device that measures the distance of a target object by emitting ultrasonic sound waves. and converts the reflected sound into an electrical signal. Ultrasonic waves travel faster than the speed of audible sound. Ultrasonic sensors are used primarily as proximity sensors. They can be found in automobile self-parking technology and anti-collision safety systems. Ultrasonic sensors are also used in robotic obstacle detection systems, as well as manufacturing technology. In comparison to infrared (IR) sensors in

proximity sensing applications, ultrasonic sensors are not as susceptible to interference of smoke, gas, and other airborne particles.

Specifications:

- Working voltage: DC 3V-5.5V
- Working current: 5.3mA
- Working temperature: -40 ° C -85 ° C
- Output method: GPIO
- Induction angle: less than 15 degrees
- Detection distance: 2cm-600cm
- Detection accuracy: 0.1cm+1%

4.4 SOIL MOISTURE SENSOR:

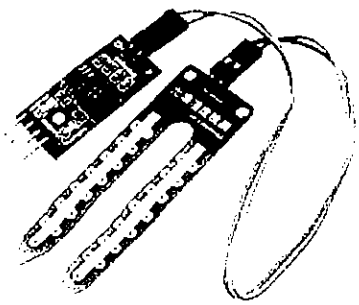


Fig 4.4: Soil Moisture Sensor

This sensor can be used to test the moisture of soil, when the soil is having water shortage,the module output is at high level, else the output is at low level. By using this sensor one can automatically water the flower plant, or any other plants requiring automatic watering technique. Module triple output mode, digital output is simple, analog output more accurate, serial output with exact readings.

4.4.1 FEATURES:

- Sensitivity adjustable.
- Has fixed bolt hole, convenient installation.
- Threshold level can be configured.
- Module triple output mode, digital output is simple, analog output more accurate, serial output with exact readings.

4.4.2 WORKING:

Soil moisture sensors measure the water content in soil. A soil moisture probe is madeup of multiple soil moisture sensors. One common type of soil moisture sensors in commercial use is a Frequency domain sensor such as a capacitance sensor. Another sensor,the neutron moisture gauge, utilizes the moderator properties of water for neutrons.

Soil moisture content may be determined via its effect on dielectric constant by measuring the capacitance between two electrodes implanted in the soil. Where soil moistureis predominantly in the form of free water (e.g., in sandy soils), the dielectric constant is directly proportional to the moisture content.

The probe is normally given a frequency excitation to permit measurement of the dielectric constant. The readout from the probe is not linear with water content and is influenced by soil type and soil temperature. Therefore, careful calibration is required and long-term stability of the calibration is questionable.

4.5 16*2 LCD DISPLAY:

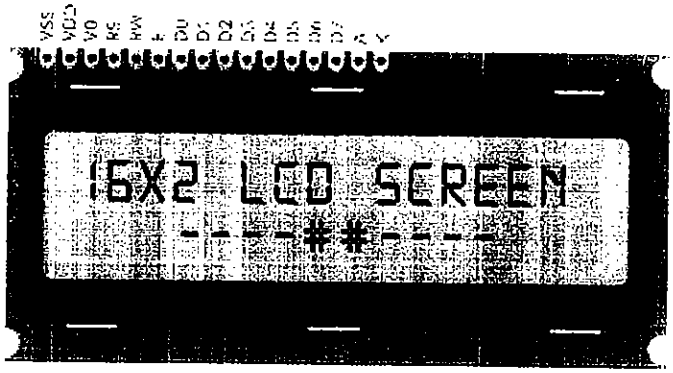


Fig 4.5: LCD display

LCD Modules can present textual information to user. It's like a cheap "monitor" that you can hook in all of your gadgets. They come in various types. The most popular one is 16x2 LCD Module. It has 2 rows and 16 columns.

4.5.1 LCD DISPLAY PIN CONFIGURATION:

1. GND- GND
2. +5V- VCC
3. VLC- LCD HEADER Vo
4. RS - bit 0 of that PORT
5. RD - bit 1
6. EN - bit 2
7. D4 - bit 4
8. D5 - bit 5
9. D6 - bit 6
10. D7 - bit 7

Leave other pins of the LCD open, i.e., do not connect them anywhere. These connections that you have to make will also appear when you are using CVAVR WizardScreen.

4.5.2 I2C CONVERTER FOR LCD DISPLAY:

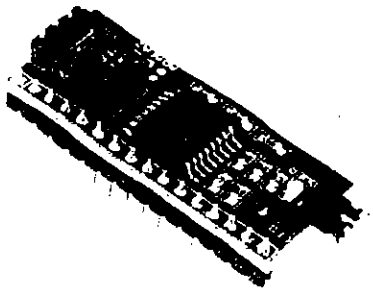


Fig 4.6: I2C converter for LCD display

I2C LCD is an easy-to-use display module; it can make display easier. Using it can reduce the difficulty of make, so that makers can focus on the core of the work. We developed the Arduino library for I2C LCD, user just need a few lines of the code canachieve complex graphics and text display features. It can replace the serial monitor of Arduino in some place, you can get running information's without a computer.

More than that, we also develop the dedicated picture data convert software (bitmap converter) now is available to support PC platform of windows, Linux, Mac OS. Through the bitmap convert software you can get your favorite picture displayed on I2C LCD, without the need for complex programming.

4.6 WATER PUMP:

Fig 4.7: Pump

A pump is a device that moves fluids (liquids or gases), or sometimes slurries, by mechanical action. Pumps can be classified into three major groups according to the method they use to move the fluid: direct lift, displacement, and gravity pumps. Pumps operate by some mechanism (typically reciprocating or rotary), and consume energy to perform mechanical work by moving the fluid. Pumps operates energy sources, including manual operation, electricity, engines, or wind power, come in many sizes, from microscopic for use in medical applications to large industrial pumps.

Mechanical pumps serve in a wide range of applications such as pumping water from wells, aquarium filtering, pond filtering and aeration, in the car industry for water- cooling and fuel injection, in the energy industry for pumping oil and natural gas or for operating cooling towers. In the medical industry, pumps are used for biochemical processes in developing and manufacturing medicine, and as artificial replacements for body parts, in particular the artificial heart and penile prosthesis. In biology, many different types of chemical and bio-mechanical pumps have evolved, and bio mimicry is sometimes used in developing new types of mechanical pumps.

4.7 ARDUINO UNO:

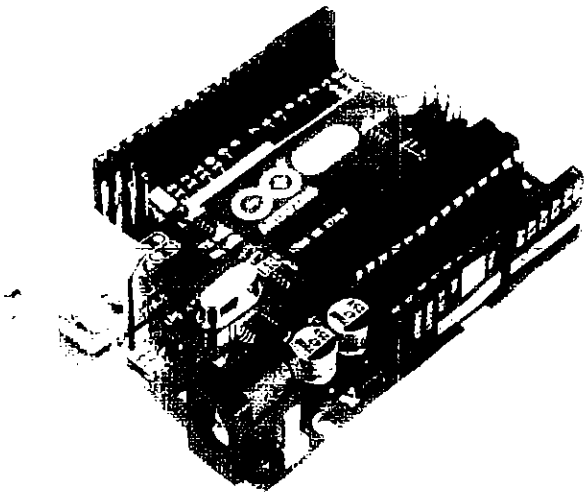


Fig 4.8: Arduino UNO board

ATmega328P is a high performance yet low power consumption 8-bit AVR microcontroller that's able to achieve the most single clock cycle execution of 131 powerful instructions thanks to its advanced RISC architecture. It can commonly be found as a processor in Arduino boards such as Arduino Fio and Arduino Uno. It has High endurance non-volatile memory segments in system self-programmable flash program memory and has Programming Lock for software security. Processors are simpler to use, with the usage of 8bit and 16bit instead of 32/64bit which are more complex. Readily usable without additional computing components with 32k bytes of onboard self-programmable flash program memory as well as 23 programmable I/O lines. The ATmega328P is supported with a full suite of program and system development tools which includes: C compilers, macro assemblers, program debugger/simulators, in-circuit emulators, and evaluation kits

TECHNICAL SPECIFICATION:

1. Arduino UNO microcontrollerOperating Voltage 5V
2. Input Voltage (recommended) 7-12VInput Voltage (limits) 6-20V
3. Digital I/O Pins 54 (of which 14 provide PWM output)Analog Input Pins 16
4. DC Current per I/O Pin 40 mA DC Current for 3.3V Pin 50 mA
5. Flash Memory 256 KB of which 8 KB used by bootloaderSRAM 8 KB
6. EEPROM 4 KB
7. Clock Speed 16 MH

4.7.1 ARDUINO UNO PIN CONFIGURATION:

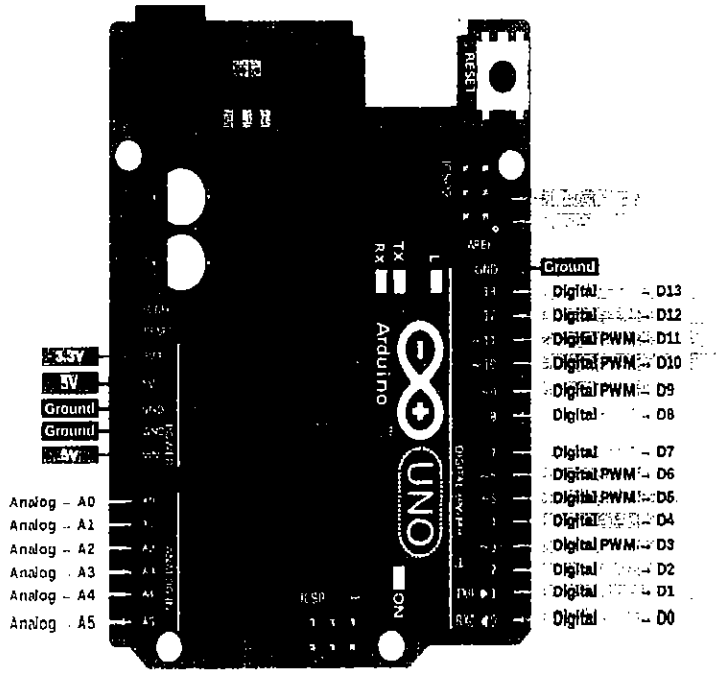


Fig 4.9: PIN configuration

PIN CONFIGURATION OF THE FOLLOWING MODELS:

1. Arduino Uno(R3)
2. Arduino Mega (R3)
3. Arduino Nano
4. Arduino Leonardo
5. Arduino Due
6. Lily Pad Arduino
7. Arduino Micro
8. Arduino Pro Mini

V_{in}: This is the input voltage pin of the Arduino board used to provide input supply from an external power source.

5V: This pin of the Arduino board is used as a regulated power supply voltage and it is used to give supply to the board as well as onboard components.

3.3V: This pin of the board is used to provide a supply of 3.3V which is generated from a voltage regulator on the board.

GND: This pin of the board is used to ground the Arduino board.

Reset: This pin of the board is used to reset the microcontroller. It is used to Resets the microcontroller.

Analog Pins: The pins A0 to A5 are used as an analog input and it is in the range of 0-5V.

Digital Pins: The pins 0 to 13 are used as a digital input or output for the Arduino board.

Serial Pins: These pins are also known as a UART pin. It is used for communication between the Arduino board and a computer or other devices. The transmitter pin number 1 and receiver pin number 0 are used to transmit and receive the data resp.

External Interrupt Pins: This pin of the Arduino board is used to produce the External interrupt and it is done by pin numbers 2 and 3.

PWM Pins: This pin of the board is used to convert the digital signal into an analog by varying the width of the Pulse. The pin numbers 3,5,6,9,10 and 11 are used as a PWM pin.

SPI Pins: This is the Serial Peripheral Interface pin; it is used to maintain SPI communication with the help of the SPI library. SPI pins include:

1. SS: Pin number 10 is used as a Slave Select

2. MOSI: Pin number 11 is used as a Master Out Slave In
3. MISO: Pin number 12 is used as a Master in Slave Out
4. SCK: Pin number 13 is used as a Serial Clock

LED Pin: The board has an inbuilt LED using digital pin-13. The LED glows only when the digital pin becomes high.

AREF Pin: This is an analog reference pin of the Arduino board. It is used to provide a reference voltage from an external power supply.

4.8 POWER DISTRIBUTER:

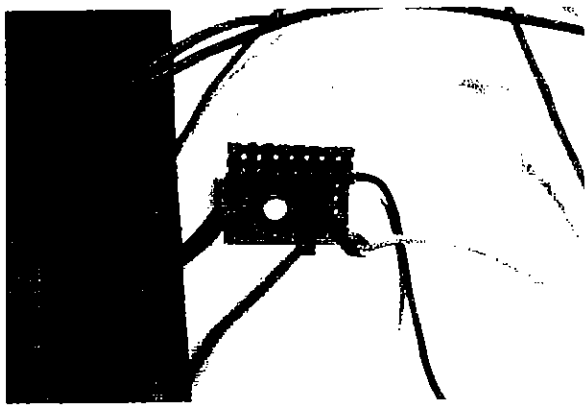


Fig 4.10: Power Distributer

A power distributor is an electrical engineer tasked with distributing and regulating the flow of electrical currents across electric power lines to generating stations and load centers. Power distributors monitor and inspect equipment to ensure that the correct amount of power is going to the proper load centers at all times. They also might be responsible for repairing equipment malfunctions.

4.9 SOLID STATE RELAY:

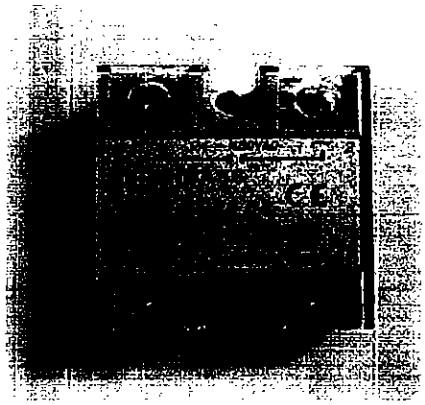


Fig 4.11: Solid State Relay

A solid-state relay (SSR) is an electronic switching device that switches on or off when an external voltage (AC or DC) is applied across its control terminals. In terms of operation, SSRs are not very different from mechanical relays that have moving contacts. SSRs, however, employ semiconductor switching elements, such as thyristors, triacs, diodes, and transistors.

Specifications:

Input: 3V – 32V DC Supply

Output: 24V - 480V AC Supply

4.10 SINGLE CHANNEL RELAY:

Fig 4.12: Single Channel Relay

This is 1 Channel 5V Relay Board Module for Arduino PIC AVR DSP ARM. A wide range of microcontrollers such as Arduino, AVR, PIC, ARM and so on can control it. Each one needs 15mA - 20mA driver current and equipped with high current relay: DC 5V / 10A, AC 250V / 10A. Standard interface that can be compatible with microcontroller.

Specification and Features:

- 1 channel relay board
- Operating Voltage 5V
- Max Current: 20mA
- Relay Contact Current Capacity at AC250V: 10A
- Relay Contact Current Capacity at DC5V: 10A

4.11 BUZZER:

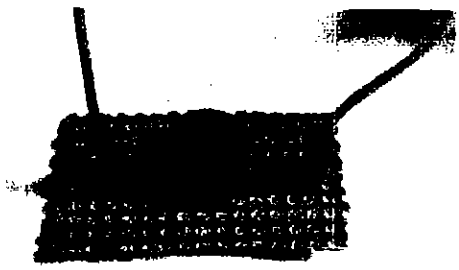


Fig 4.13: Buzzer

A buzzer or beeper is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric. The buzzer is a sounding device that can convert audio signals into sound signals. It is usually powered by DC voltage. It is widely used in alarms, computers, printers and other electronic products as sound devices. It is mainly divided into piezoelectric buzzer and electromagnetic buzzer, represented by the letter "H" or "HA" in the circuit. According to different designs and uses, the buzzer can emit various sounds such as music, siren, buzzer, alarm, and electric bell.

4.12 COMPARTMENT 1:

4.12.1 GRAIN FUNNEL

Fig 4.14: Grain Funnel

A funnel is a tube or pipe that is wide at the top and narrow at the bottom, used for guiding liquid or powder into a small opening. Funnels are usually made of stainless steel, aluminum, glass, or plastic. The material used in its construction should be sturdy enough to withstand the weight of the substance being transferred, and it should not react with the substance. Here fiber funnel is used to dump the residential waste and to control the flow of waste we have grain input adjuster.

4.12.2 GREEN CROP FEEDER

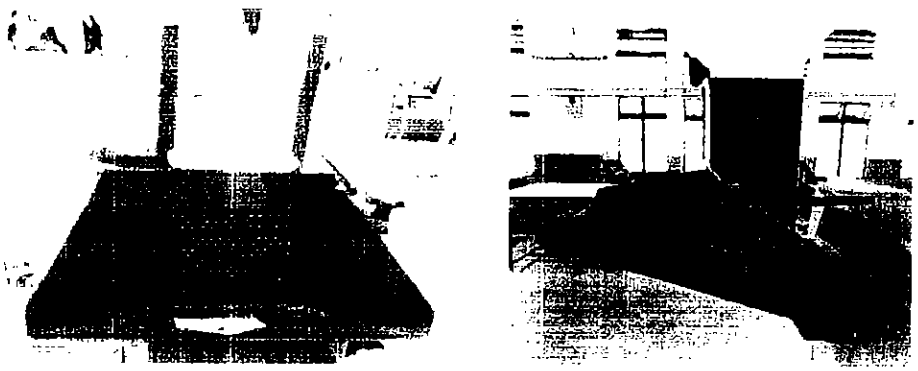


Fig 4.15: Green crop feeder

Green crop feeder is placed here to dump large residential waste like rotten fruits and vegetables and to control the flow of waste the grain crop feeder cover is placed and to lift that we have a handle as shown in above figure. The dumped waste will be moved to the second compartment.

4.13 COMPARTMENT 2:

4.13.1 COUNTER CUTTING BLADE

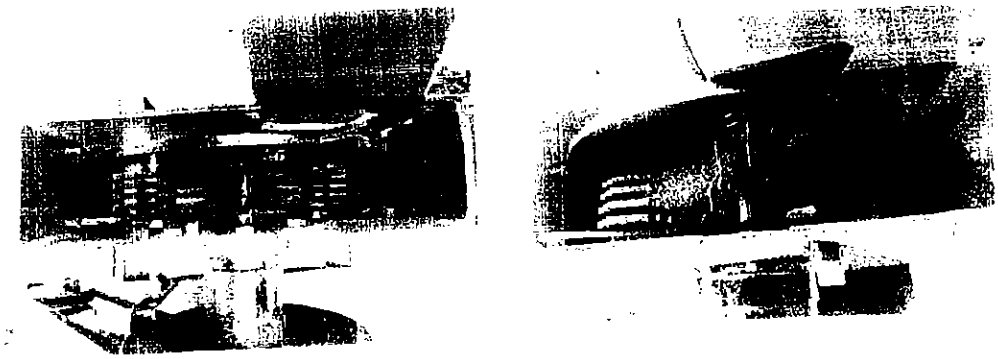


Fig 4.16: Counter Cutting Blade

Periodic tightening of screws as well as the adjustment of the counter cutting blades are essential. The adjustment is done by loosening the hexagon nut as in figure and by displacing the counter cutting blade **until the cutting blades pass at a distance of approximately** 1.5 mm from the counter cutting blade. The counter cutting blade must be replaced whenever it shows wear signs or cracks, it is also possible to reverse its side and sharpen it following the same angle.

4.13.2 SIEVES

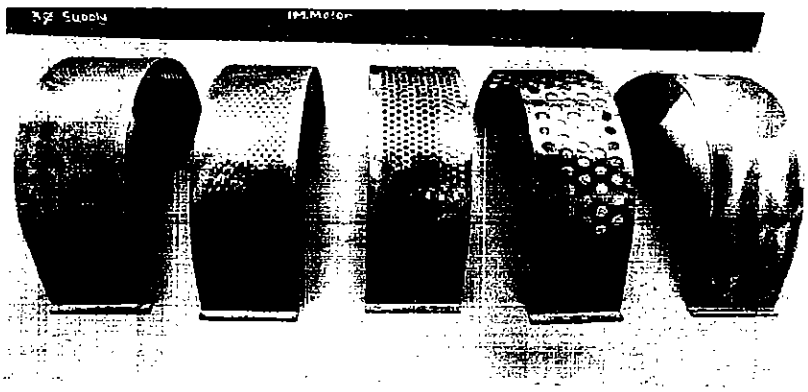


Fig 4.17: Sieves

A sieve, fine mesh strainer, or sift, is a device for separating wanted elements from unwanted material or for controlling the particle size distribution of a sample, using a screen such as a woven mesh or net or perforated sheet material. There are different sizes of sieves as mentioned in figure i.e., from left 0.8mm, 3mm, 5mm, 12mm & flat strainer.

4.13.3 STANDARD V-BELT

Fig 4.18: A-45 V-Belt

A v-belt is a flexible machine element used to transmit power between a set of grooved pulleys or sheaves. They are characterized as belts having a trapezium cross-section. V-belts are used because of their ability to wedge tightly into the grooves of the pulley. In the above diagram we used A-45 V-belt and the thickness of this belt is 9mm and the length is 45inch.

Some of the properties of V-belt are as follows,

a. Flex Resistant
b. Heat Resistant
c. Oil Resistant
d. Static electricity prevention.

4.14 CODE FOR ARDUINO

```
#include <LiquidCrystal.h>
#include "ultrasonic.h"

// defines pins numbers
const int trig_pin = 4;
const int echo_pin = 5;
const int soil_pin = A0;
const int relay1_pin = 2;
const int relay2_pin = 3;
const int Buz_Pin=12;

//Bin leangths
const int BIN_ID = 101;
const int BIN_LEN = 100;

void ini_iot();
void lcd_str(String , char , char );
const int rs = 6, en = 7, d4 = 8, d5 = 9, d6 = 10, d7 = 11;
long _Start;
LiquidCrystal lcd(rs, en, d4, d5, d6, d7);
long duration, soil_level, gas_level;
void setup()
{

 Serial.begin(9600);
 pinMode(trig_pin, OUTPUT); // Sets the trig_pin as an Output
 pinMode(echo_pin, INPUT); // Sets the echo_pin as an Input
 pinMode(soil_pin, INPUT);
```

```
 pinMode(relay1_pin, OUTPUT);
 pinMode(relay2_pin, OUTPUT);
 pinMode(Buz_Pin, OUTPUT);
 lcd.begin(16, 2);
 lcd_str("  Welcome To  ", 0, 0);
 lcd_str("    RYMEC ", 0, 1);
 delay(2000); lcd.clear();
 delay(1000);

}

void loop()
{
 //--> Read Ultrasonic
 int distance = read_dist(trig_pin, echo_pin);
 //delay(1000);

 if (distance == 0)
 {
  distance = BIN_LEN + 1;
 }

 if (distance > BIN_LEN)
 {
  distance = BIN_LEN;
 }

 int bin_level = map(distance, 0, BIN_LEN, 100, 0);
 Serial.println(bin_level);
 lcd.clear();
 lcd_str("Bin_level:" + String(bin_level), 0, 1);
 if (bin_level >= 75)                    // if it is high
 {
  // Serial.println(analogRead(soil_pin));
  digitalWrite(relay1_pin, 0);           // relay (motor) should be on
  digitalWrite(Buz_Pin, 1);
 }
 else
 {
```

```
  digitalWrite(relay1_pin, 1);
  digitalWrite(Buz_Pin, 0);
  // Serial.println(analogRead(soil_pin));
 }

 soil_level = map((int)analogRead(soil_pin), 0, 1023, 0, 100);   // reading data from soil
moisture sensor
 Serial.println("soil_level:" + String(soil_level));
 lcd_str("Soil_level:" + String(soil_level), 0, 0);
 if (soil_level >= 80)                    // if it is high
 {
  // Serial.println(analogRead(soil_pin));
  digitalWrite(relay2_pin, 0);            // relay (motor) should be on
 }
 else
 {
  digitalWrite(relay2_pin, 1);
  // Serial.println(analogRead(soil_pin));
 }

 Serial.println("..........");
 delay(500);

}

void lcd_str(String str, char col, char row)
{
 lcd.setCursor(col, row);
 lcd.print(str);
}
int read_dist(const int trig_pin,const int echo_pin)
{
long duration;
int distance;

 digitalWrite(trig_pin, LOW);
 delayMicroseconds(50);
 digitalWrite(trig_pin, HIGH);  // Sets the trig_pin on HIGH state for 10 micro seconds
 delayMicroseconds(10);
```

```
 digitalWrite(trig_pin, LOW);
 duration = pulseIn(echo_pin, HIGH);      // Reads the echo_pin, returns the sound wave
travel time in microseconds
 distance= duration*(0.034/2);            // Calculating the distance in default cm
 //delay(2000);
return distance;
}
```

CHAPTER -5

RESULTS AND DISCUSSION

To promote organic farming in the country by making available the organic inputs such as bio-fertilizers, bio-pesticides, fruit & vegetable market waste compost and there by better return for the produce. To prevent pollution and environment degradation by proper conversion and utilization of organic waste. By conducting this project for the production of bio-fertilizers automatically dry and healthy bio-fertilizers obtained as the end product.

We have made the whole model by 4 compartments:

In the 1st compartment we dump the residential waste and green waste into the funnel. We will add some of the enzymes for further decomposition and the compost goes to the 2nd compartment.

In the 2nd compartment we placed high speed motor that is connected to counter cutting blades, by this process the waste is finely chopped and then it goes to 3rd compartment.

In the 3rd compartment the sewing process takes place and the chopped waste is moved to the container that is 4th compartment.

In the 4th compartment there are 2 sensors and they are used to measure the soil moisture and level of container to be filled. In this container we placed a plate with small holes so that the liquid fertilizer is separated. Later on, the compost is kept to decompose for 30-40 days. After completion of decay process, the required fertilizer will be obtained.

Model Pictures

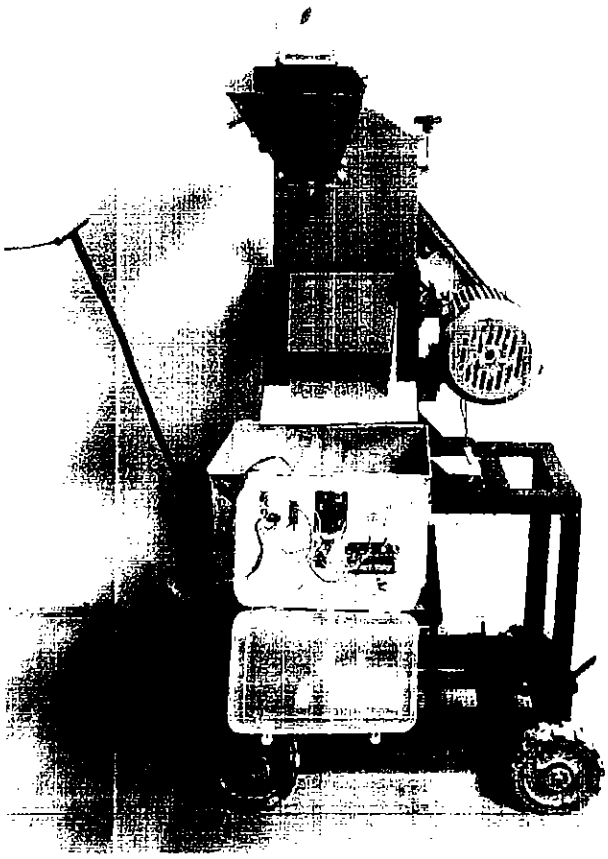


Fig 5.1: Front View

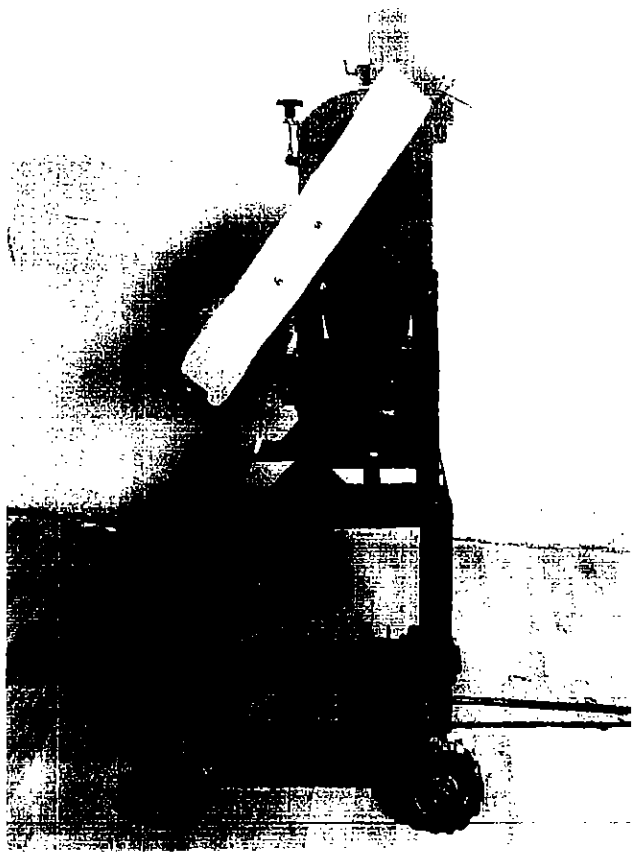


Fig 5.2: Back view

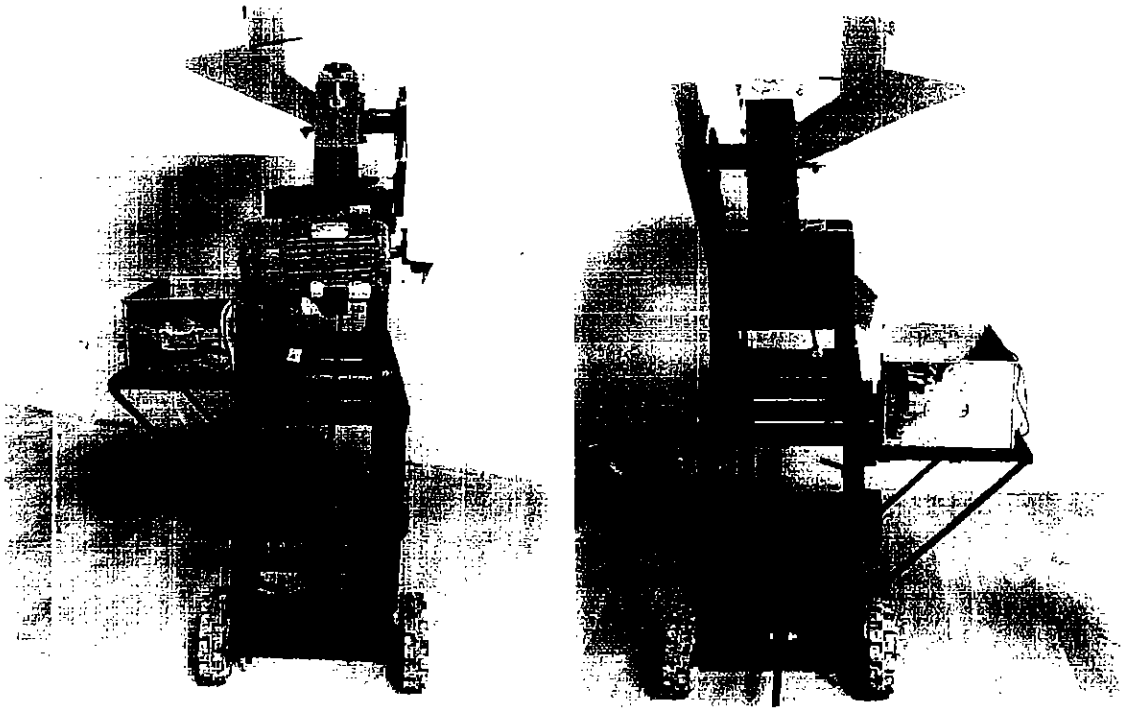


Fig 5.3: Side Views

Container

Fig 5.4: Front View

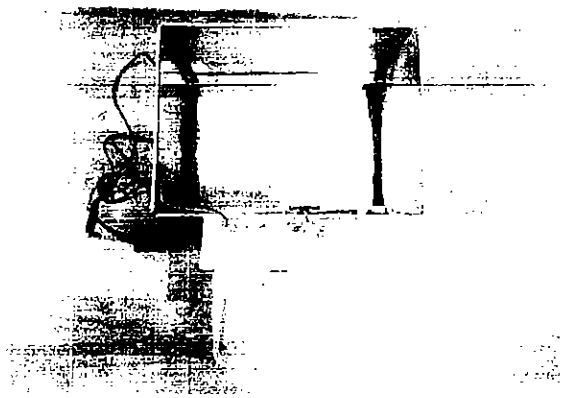


Fig 5.5: Top View

CHAPTER-6

ADVANTAGES AND APPLICATIONS

6.1 ADVANTAGES:

- Increased soil carbon and reduced atmospheric carbon level.
- Reduced soil erosion and runoff.
- Reduced energy demand for natural gas
- In addition to releasing nutrients, it improves soil structure.
- Increases the water holding capacity.
- No risk of forming toxic build-up of chemicals.
- Renewable, biodegradable and eco-friendly.

6.2 APPLICATIONS:

- Supermarkets and food producers (who dump unused food waste in municipal landfills at a rate that is alarming many conservationists) have found a use for converter technology.
- Ship-generated waste is either held and disposed of in port waste disposal facilities or can be converted directly on the vessel for easier storage and at times (depending on waste composition) for additional fuel.
- **Seed treatment:** Each packet (200g) of inoculant is mixed with 200ml of rice gruel or jaggery solution. The seeds required for one hectre are mixed in the slurry so it can have uniform coating of the inoculants over the seeds and then shade dried for 30 minutes. The treated seeds should be used within 24 hours. One packet of inoculant is sufficient to treat to 10 kg seeds. Rhizobium, Azospirillum, Azotobacter and Phosphobacteria are applied as seed treatment.
- **Seedling root dip:** This method is used for transplanted crops. Five packets (1.0 kg) of the inoculants are required for one ha and mixed with 40 liters of water. The root portion of the seedlings is dipped in the solutions for 5 to 10 minutes and then

transplanted. Azospirillum is used for seedling root dip particularly for rice.

- **Soil treatment:** 4 kg each of the recommended biofertilizers are mixed in 200 kg of compost and kept overnight. This mixture is incorporated in the soil at the time of sowing or planting.

CHAPTER -7

CONCLUSION & FUTURE SCOPE

7.1 CONCLUSION:

To promote organic farming in the country by making available the organic inputs such as the bio fertilizers, bio pesticides, fruits and vegetable market waste compost and there by better return for the produce. To prevent pollution and environment degradation by proper conversion and utilization of organic waste. By conducting this project for the production of bio fertilizers automatically dry and healthy bio fertilizers obtained as the end product.

7.2 FUTURE SCOPE:

From this project we can concluded that, by implementing this project we can reduce the man power used for the production of the bio fertilizer and it improves the soil chemical and physical properties. By using green waste is increase the composts stability and helps to enrich the fertilizer. Here we used the ultra-sonic sensor so that we can test and correct the required height level.

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GENERATING THE ORGANIC FERTILIZER FROM THE BIO-DEGRADABLE WASTE

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Abstract: The operation of microbial inoculants(biofertilizers) is a promising technology for unborn sustainable agriculture systems in view of quickly dropping phosphorus stocks and the need to more efficiently use available nitrogen(N). Bio-fertilizers with organic soils are the neat new-age tools and a gift of our farming knowledge as a relief to our conventional diseases. Conventional diseases contain compost, home wastes, and green sewerages which aren't as effective as chemical diseases. So, growers frequently try to use chemical diseases in the field for crop development. But obviously, the chemical diseases aren't terrain friendly because of their chemical toxin that can beget water, air, and soil pollution and can spread cancer-causing agents. also, they may destroy the fertility of the soil in a long run. Scientists have developed the way of organic husbandry by use of "Bio-fertilizers" along with natural coprolites to help chemical pollution in farmlands. Bio-fertilizer contains microorganisms that promote the acceptable force of nutrients from organic soils to the host shops and ensure their proper development of growth and regulation in their physiology. Bio-fertilizer being essential factors of organic agriculture plays a vital part in maintaining long-term soil fertility and sustainability. It can be concluded that the operation of bio-fertilizer with organic soil could upgrade the product on the sustainable root.

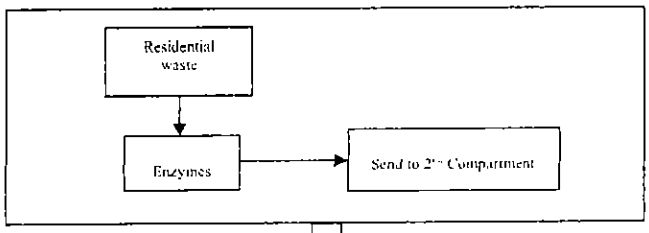
I. INTRODUCTION:

Organic manures are naturally available mineral sources that contain a moderate quantity of manufactory essential nutrients. They're able of helping problems associated with synthetic manures. The ethical use in-situ of Agri- grounded organic wastes to produce compost and bio-organic compost on the farm for adding natural suppressiveness of soil to soil-borne works pathogens has been a better way for a longer time for design new sustainable cropping systems without using chemical fumigants. Biofertilizers contain living cells or free cells of fruitful strains of microorganisms that help crop factories uptake of nutrients by their relations in the rhizosphere when applied through seed or soil. They accelerate certain microbial processes in the soil which accelerate the extent of the fullness of nutrients in a form smoothly assimilated by works. Biofertilizers keep the soil environment rich in all kinds of micro and macro-nutrients via nitrogen fixation, phosphate, and potassium solubilization or mineralization, the release of factory growth regulating substances, a product of antibiotics, and biodegradation of organic matter in the soil. The operation of chemical pesticides can increase crop yields rapidly, but they also could create soil hardening and drop soil organic matter and pH after a long period of exercise, working in loss of soil productivity. still, the utmost proportion of the chemical diseases will be run off or percolated due to rain and heavy irrigation, accordingly leading to environmental pollution and lower toxin effect. Compost is produced from organic waste, which not only contains organic matter but also is rich in micro and macronutrients. The application of compost as soil fertilizer or correction could restore the soil quality and ameliorate soil structure and fertility, which not only serves an important part in farming produce but also is of great significance for enriching the ecological context. The exercise of compost could promote soil productivity and enrich the crop amount and quality, as well as increase the income of the agriculturists.

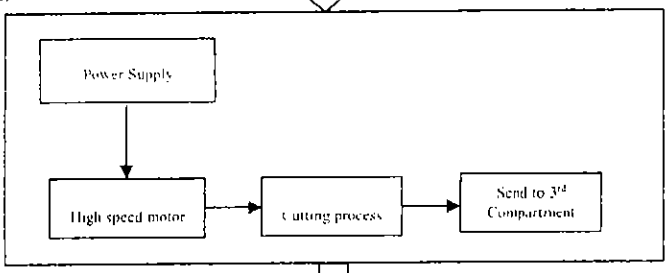
Thus, the intention of this system is to develop a real-time design at a field scale in this region to evaluate the feasibility of implanting the composting technology not only for the charge of the organic waste fluxes from the food market and gardening conditioning to be measured- up in other developing regions but also to gain an end-product with a marketable value as organic fertilizer. The results obtained indicated that all the organic fertilizers, including the added value in economic terms related to nutrient contents.

II. METHODOLOGY:

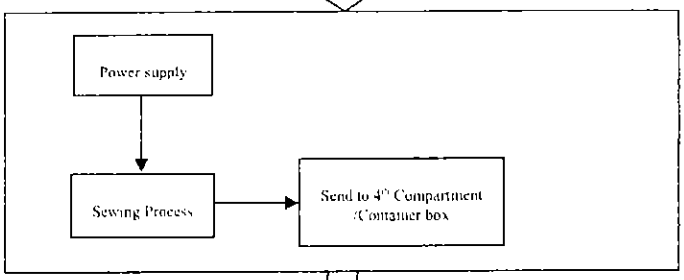
Compartment 1:



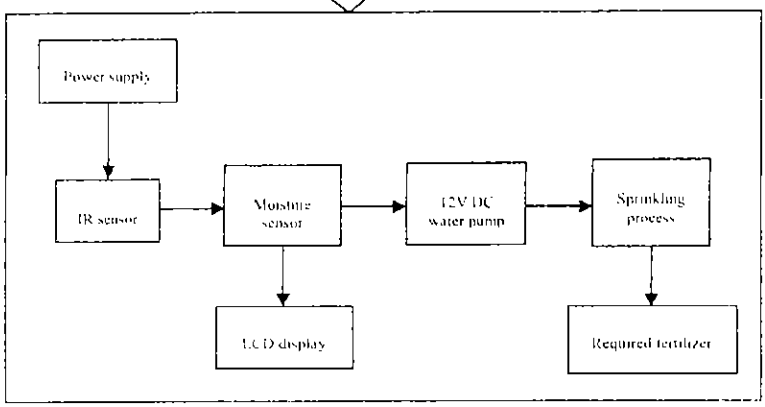
Compartment 2:



Compartment 3:



Compartment 4/ Container box:



Compartment 1:

- Firstly, collect the residential waste up to required level.
- After collecting the residential waste, the waste should be dumped in the first compartment.
- The Enzymes will be added to the waste for the further process of decomposition.
- The Enzymes (microbes) helps for decomposition like bacteria, fungi and actinomycetes.

Compartment 2:

- This compartment contains high speed DC motor with power supply and it is connected to cutting blades.
- Here the cutting process takes place and the finely grinded waste product is transferred into the third compartment.

Compartment 3:

- In this compartment the sewing process being carried out.
- Sewing process is done by using sewing plates that is connected to DC motor connected to the camshaft then movement of motor makes sew plates to move upwards and downwards
- In this process the waste and useful product gets separated.
- The waste produced is transferred to fourth compartment.

Compartment 4: Container box:

- After sewing the required product will come to next compartment.
- The product is decomposed for 30-35 days in container with enzymes.
- ¾ of the compartment is to be filled, to detect that we used IR Sensor and also we placed Moisture sensor to detect the moisture of the product, it should be around 25-30%.
- If the product is below the moisture level, then water sprinkle is done with the help of 12V DC water pump.
- Metal sheet with small holes is placed to separate water and required fertilizer is kept to decompose, separated water is used as liquid fertilizer.
- The end product is called as bio fertilizer.

III. ADVANTAGES:

1. Increased soil carbon and reduced atmospheric carbon level.
2. Reduced soil erosion and runoff.
3. Reduced nitrate leaching.
4. Reduced energy demand for natural gas
5. In addition to releasing nutrients, it improves soil structure. Increases the water holding capacity.
6. No risk of forming toxic build-up of chemicals.
7. Renewable, biodegradable and eco-friendly.

IV. APPLICATIONS:

The application of bio-fertilizers is one of the management practices that can help to maintain or increase the content organic matter (OM) and improve soil fertility in arable soils.

V. EXPECTED RESULT:

We get bio fertilizer as manure. It reduces the usage of chemical fertilizers. This project also reduces manpower. It overcomes chemical fertilizer over organic fertilizer. It improves the soil's chemical and physical properties It reduces the accumulation of the volatile organic acid components.

VI. ACKNOWLEDGEMENT:

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DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

COURSE OUTCOME AND PROGRAM OUTCOMES 2021-22

COURSE OUTCOME STATEMENTS

C413	COURSE OUTCOME STATEMENTS
	Students will be able to
C413.1	Identify the topic relevance and carry out the literature survey. Project work done on: GENERATNG ORGANIC FERTILIZER FROM THE RESIDENTIAL WASTE.
C413.2	Analyze the problem, develop and judiciously execute the project schedule and harness modern tool usage (ARDUINO UNO).
C412.3	Design and interpret the results establish the scope for the future work and execute economically feasible project of social relevance.
C412.4	Document, present report and work effectively as a team.

COURSE OUTCOME AND PROGRAM OUTCOMES MATRICES

C413	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
C413.1	3	3	3	2	3	3							3	3
C413.2	3	3	3	1	3	3						2	3	3
C412.3	3	3	3	3	3	3	3	2				3	3	3
C412.4								2	3	3	3	3		
Avg	3	3	3	2	3	3	3	2	3	3	3	2.66	3	3

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M2: To establish a continuous industry-institute interaction, Participation Collaboration to contribute skilled Engineers.

M3: To develop human values, social values, entrepreneur skills and professional ethics among the technocrats.

M4: To focus on innovation and development of technology by engaging and in cutting edged research areas.

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3. Graduates will have capacity for lifelong learning with emerging technologies in academics, as an entrepreneur or in research and development.

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2. Apply modern software tools for design simulation and analysis of electrical systems to engage in lifelong learning and to successfully adapt in multidisciplinary environment.

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2. **Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigation of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and Team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project Management and Finance:** Demonstrate knowledge and understanding of the and receive clear instructions. engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long Learning:** Recognize the need for, and have the preparation and ability to engage in Independent and life-long learning in the broadest context of technological change.

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VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

PROJECT REPORT ON
" REAL TIME TRANSFORMER HEALTH MONITORING SYSTEM USING IOT AND GSM "

Submitted in the partial fulfilment of the requirement for the award of degree of Bachelor of Engineering during the Academic year 2020-21

PROJECT ASSOCIATES

NAME	USN
1. SHIVANANDA B	3VC18EE451
2. VEERA NARENDRA BABU B P	3VC18EE460
3. JAYAPRAKASH RAO M	3VC17EE026
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Professor

Project Coordinators
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Dr.U.M.Netravati Professor

HOD
Dr.S.Kotresh

Principal
Dr.T.Hanumantha Reddy

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
RAO BAHADUR Y. MAHABALESWARAPPA ENGINEERING COLLEGE
CANTONMENT, BALLARI-583104, KARNATAKA
AFFILIATED TO VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI APPROVED BY AICTE, NEW DELHI
2020-21

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

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2020-21

RAO BAHADUR Y MAHABALESWARAPPA ENGINEERING COLLEGE

ACCREDITED BY NAAC WITH B++

VEERASHAIVA VIDYAVARDHAKA SANGHA'S

RAO BAHADUR Y MAHABALESHWARAPPA ENGINEERING COLLEGE

(AFFILIATED TO VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI & APPROVED BY AICTE, NEW DELHI)

BALLARI-583104, KARNATAKA

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

CERTIFICATE

This is to certify that project work entitled "REAL TIME TRANSFORMER HEALTH MONITORING SYSTEM USING IOT AND GSM" is bonafied Work carried out by SHIVANANDA B(3VC18EE451), VEERA NARENDRA BABU B P(3VC18EE460), JAYAPRAKASH RAO M(3VC17EE026), V M HUSNA(3VC16EE092) of 8th Semester in Partial fulfilment for the award of degree of Bachelor of Engineering in Electrical& Electronics Engineering of the Visvesvaraya Technological University, Belgaum during the year 2020-2021. It is certified that all corrections / suggestions indicated for internal assessment have been incorporated in the report. The project report has been approved as it satisfies the academic requirement in respect of project work prescribed for the **Bachelor of Engineering Degree.**

Signature of guide

Mr.Hanumantha Rao A
Professor

Signature of Project Coordinators

Dr.B.Dodda Basavanagoud
Professor

Dr.U.M.Netravati
Professor

Signature of HOD

Dr.S.Kotresh

Signature of Principal

Name of Examiners:
1) Hanumantha Rao A
2)

Signature with Date
12/8/2021
12/8/2021

ACKNOWLEDGEMENT

I would like to express our regards and acknowledgement to all those who helped in making this Project work possible.

I am grateful to our beloved **Principal Dr. T.Hanumantha Reddy for** providing facilities and untiring zeal, which constantly inspired me towards the attainment of everlasting knowledge throughout the course.

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I am grateful to our beloved **Professors of EEE and Project Coordinators Dr. B.Dodda Basavanagoud** and **Dr.U.M.Netravati,** for their valuable suggestions and constant support during Project work.

I would like to thank our guide, **Mr.Hanumantha Rao A,** Electrical & Electronics Engineering department for the constant guidance for the successful completion of project.

Finally, I would like to thank all the teaching and Non-teaching staff members of Electrical and Electronics Engineering department for their guidance and support during my Bachelors Degree. I am also thankful to my family members and friends for their extended support and encouragement.

DECLARATION

We hereby declare that the entire work embodied in this Project work entitled **"REAL TIME TRANSFORMER HEALTH MONITORING SYSTEM USING IOT AND GSM"** has been carried out by us under the guidance of **'Mr.Hanumantha Rao A'** at Electrical & Electronics Engineering Department, Rao Bahadur Y.Mahabaleswarappa Engineering College. Ballari affiliated to Visvesvaraya Technological University Belagavi.

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TABLE OF CONTENTS

CHAPTER 1

Abstract

Transformers are the main building block in a power system. Any damages in transformers adversely affects the balance of a power system. The damages are mainly occurring due to overloading and inefficient cooling. The main objective of the real time monitoring of the health conditions of the distribution transformer using IOT technology and GSM Module. The parameters such as temperature, voltage, current and oil level of a transformer are monitored, processed and update in servers. For this purpose, we use sensors interfaced with atmega328 microcontroller. The data can be send using Wi-Fi module and accessed from anywhere around the world using IOT technology. This helps in identifying problem before a failure without human monitoring. Using this project we will able to monitor locally using 16X2 LCD display and as well as remote location monitoring using IOT cloud services and GSM.

CHAPTER 2

INTRODUCTION

Electricity plays an important role in our life. Every moment of our life depends upon electricity. Electricity has several components and equipment helping human to transfer and regulate the distribution according to usage. The most crucial equipment of transmission and distribution of electric power is transformer. In Power system, an electrical component transformer directly distributes power to the low-voltage users and its operation condition is a criteria of the entire network operation. The majority of the devices have been in service for many years in different (electrical, mechanical, environmental) conditions. They are the main components and constitute the large portion of capital investment. Operation of distribution transformer under rated condition (as per specification in their name plate) guarantees their long service life. However their life is significantly reduced if they are subjected to overloading, heating low or high voltage current resulting in unexpected failure and loss of supply to a large number of customers thus is effecting system reliability.

As a large number of transformers are distributed over a wide area in present electric systems, it's difficult to measure the condition manually of every single transformer. So we need a distribution transformer system to monitor all essential parameters operation, and send to the monitoring system in time. It provides the necessary information about the health of the transformer. It is installed with transformer. The output values of sensors are processed in the system memory. If there is any abnormality on the system, details are automatically updated in the internet and alert on GSM through serial communication.. Transformer Health Measuring will help to identify or recognize unexpected situations before any serious failure which leads to a greater reliability and significant cost savings. Transformer is one of the important electrical equipment that is used in power system. Monitoring transformer for the problem before they occur can prevent faults that are costly to repair and result in a loss of electricity. Currently, failure of the transformer can be detected by color changing of silica gel and decreasing the quality and viscosity of oil. The main aim of the project is to acquire real-time data of transformer remotely

CHAPTER 3

3.1 LITERATURE SURVEY

In most power companies. for online monitoring of power transformers. use supervisory control and data acquisition (SCADA) system, but for online monitoring of power transformer, the extending the SCADA system is an expensive proposition. Power transformers are currently monitored manually, where a person visits a transformer site. for maintenance and taking records purpose. But main drawbacks of these systems are. it cannot provide information about overloads (Voltage & Current) and overheating of transformer oil & windings. Due to these, the transformer life is reduced.

Real Time Transformer Health Monitoring System using IOT

Assistant Professor, UG scholar, Department of Electronics Engineering Priyadarshini College of Engineering. Nagpur. India.

- Monika Agarwal,

This paper represents that they are designing a system where there exits communication between system and operator. For this we are using Transformer. microcontroller. logic level converter and GSM i.e. global system for mobile communication modem. This GSM modem helps to monitor transformer health by sending message to the system.

- Hongyan Mao,

This paper represents a large number of power distribution transformer stations and they are far away from city, wireless GPRS transmission provides a good communication solution to supervise power distribution transformer stations. The scheme of remote wireless monitoring system for power distribution transformer station based on GPRS wireless network was designed in this paper. A control terminal system implement was mainly given. which adopted LPC2132 as main processor. GR47 as the date communication module. The monitor terminal software and flow chart were also designed. At last, the way of configuring the GPRS module to connect network is analyzed.

If any abnormality or an emergency situation occurs the system sends SMS (short message service) This mobile system will help the transformers to operate smoothly and identify problems before any catastrophic failure.

Transformer Monitoring and Control Using IOT

Deepraj Duttachowdhury, Vivek Patil, Arya Parab, Raj Patel.
(Electrical, Atharva College Of Engineering, India)

Distribution Transformers Are Monitored Physically Where A Man Visits the Transformer Site And Analyses the Parameters. Incidental Overload And Overheating Of Transformer Oil And Windings If Not Monitored Properly These Parameters Can Decrease The Transformer Life Which Is Unachievable By The Current Operation System. A Single Transformer Parameter Is Generally Detected by a Normal Transformer.
E.g.: Control Current Voltage While Some Ways Could Recognize Multipara meter. It Takes Too Long for the Parameter Operation and Testing Pace Is Dull.

A Monitoring System Is Not Able To Monitor All Useful Data Of Distribution Transformer To Reduce Costs. But Can Only Monitor The Operating State. Auspicious Detection Data Will Not Be Sent To Observing Centers in Time Which Cannot Judge Distribution Transformer Three Phase Equilibrium Detection System Is Not Reliable. The Main Principle Execution Is the Devoice Itself Instability, Poor Anti Jamming Capability, Low Measurement Accuracy of Data.

In Done Research Using GSM Technology Which Is Not Reliable, Cheap And Compact As Compared To The Proposed Methodology. In States An Innovative Design To Develop A System Which Is Based On AVR Microcontroller That Is Used For Logging The Voltage, Current And Temperature Of A Power Transformer In A Substation And To Protect The System From Any Uncertainty Conditions. In Et Al M. V. Ramesh This Design Incorporates Effective Solutions For Problems Faced By Indians' Electricity Distribution System Such As Power Theft And Transmission Line Fault and Various Other Faults. In Stated Above Right Away Monitoring Of

Distribution Transformer By The Use Of Internet. In Helps to Understand Various Transformer Faults and the Parameters Affecting It.

The Growth Of The Incipient Faults And Other Faults Can Be Kept In Check Instantaneously. So Which Will Help The Utilities To Optimally Use Their Transformers And Keep Them In Operation In Longer Period. This Will Also Identify Problems Before Any Catastrophic Failure. Which Can Result In A Significant Cost Savings And Greater Reliability.

Monitoring and Control of Operational Parameters of Distribution Transformer using IOT Technology

Vishwanath. M. Soppimath. Pavitra Sheeri. Rajakumar Kalakaraddi Chawan Sagar Kumar

Department of Electrical and Electronics Engineering. KLE Institute of Technology. Hubballi, Karnataka

Design and implementation of a mobile embedded system to monitor and record operational parameters of distribution transformer such as loading condition. transformer oil level and winding temperature etc. Abnormal values of operational parameters message will be sent to mobile device using a GSM network Monitoring of loading condition of power lines and communicating to control room using SMS based GSM technology. This methodology is design and implementation using embedded system to monitor and record load fluctuations with respect to current and voltage in power lines and it isolates the power lines during abnormal loads. Online monitoring system integrates the GSM modem with a single chip microcontroller and sensors. It is implemented at the distribution transformer side. Also this system to protect distribution transformers from overheating and overloading Comparison of many combinations ways of internet of things and power. the oil based transformer monitoring system is analyzed, but it has high cost. loss data and feedback control of function. This system uses a single basmati point temperature measurement method and GSM network remote control and data processing combined. so that speed of the temperature and its analysis becomes improved also accuracy of system is also

improved, reducing the cost of temperature monitoring system and using the remote control module to avoid the failure of

transformers. Design and implementation of a system to monitor and record operations of a distribution transformer like overvoltage, over current, temperature, rise or fall of oil level.

3.2 OBJECTIVE AND SCOPE

The main objective of this proposal is to acquire real time condition of transformer health remotely over the GSM module alert and internet using Interret of Things technology. We are going to monitor the transformer parameter such as voltage, temperature, current, oil level. These data will be sent over internet using TCP / IP protocol. From there we will able to read from anywhere of world location.

This system is distribution transformer monitoring using IOT also, it sends SMS to a central database via the GSM modem for alert. The idea of on-line monitoring system mixes a global service mobile (GSM) Modem, with chip micro controller and different sensors. Here transformers damage is depends on different parameters and environmental conditions.

3.3 PROBLEM STATEMENT

• Transformer is a static device which convert the voltage from one level to other level without change in frequency and power. Load is connected at secondary winding of the transformer. Due to many factor suddenly increase in load can cause overloading, over-voltages and overheating that can harmful to the transformer windings insulation and severe damage can be occur on the secondary side of transformer.

• Transformer can cause failure due to the different faults occur. Various faults like over currents, over voltage faults, under voltage and also rise in temperature of transformer.

• Localized heating caused by eddy currents in parts of the winding.

• Thermal heating caused by overloading.

3.4 FAULTS IN TRANSFORMER

The major faults occurring in a transformer are overload, over under voltage, temperature rise, oil level fault etc.

Overload / Overcurrent: Overload / Overcurrent is the flow of fault current occurring in the power system through the transformer.

Temperature Rise: Transformers are generally designed to work for 24 hours with an average ambient temperature. Many factor causes an increase of temperature which induce failure of transformer winding.

Over Voltage . Under Voltage: over voltage and under voltage the flow of voltage fault occurring in the power system through the transformer.

Oil level fault: Oil present in transformers provides cooling and insulation. Temperature could reduce the oil level and its reduction beyond a required level affects cooling and insulation.

Disadvantage of Existing System

1. Firing of transformer can easily occurs.
2. Not accurate.
3. Man power required for monitor
4. Oil tank empty maximum time.
5. No automatic shutdown option

3.5 PROPOSED SYSTEM

The proposed project is about acquiring real time status of transformer health parameters. Temperature, voltage and current of transformers are monitored and send over internet and fault alert on GSM. The live monitoring of these parameters can be done using IOT technology from anywhere around the world. This is cost effective in nature. Thus the responsible authority can access information on any power failure or maintenance. The transformers play a vital role in distribution part of power system. Therefore the monitoring and protection of transformer is very crucial. This system introduces a new and improved method of transformer health parameter monitoring using IOT and GSM. The sensors incorporated in the system collect the data of transformer health parameters such as voltage, temperature and current and oil level. In case any fault detected the transformer will get automatic shutdown.

ALGORITHM OF PROPOSED SYSTEM:

1) Start

2) Initialize proposed system with GPIO pin.

3) All sensors such as current sensor, temperature sensor, oil level sensor, take the reading.

4) All analog values convert them into digital.

5) All parameter values are passed to microcontroller.

6) Microcontroller display these values on LCD.

7) Compare with threshold value.

8) If fault detected, GSM alert and alarm.

7) Sends these values on IOT Cloud server.

3.6 Working

For This Proposed Real-Time Framework We Take a Voltage sensor, oil level, A Current sensor And a LM35 Temperature Sensor for Monitoring Voltage, Current, Temperature, Respectively Data of the Transformer and Then Send Them to a Desired Location Anywhere in the World as well as fault alert using GSM Module. These Three Analog Values Are taken in analog pin of Programmable Microcontroller Arduino. Microcontroller will read all sensor value one by one and then it will process the sensor data. Then The Values Are Then Sent Directly Through An Wi-Fi Module Under TCP IP Protocol To A Dedicated IP That Displays The Data In Real Time Chart Form In Any internet Connected IOT section for monitoring . All value will compare with threshold value, if any fault detected the microcontroller will send information and command to GSM Module and based on command to GMS module will send alert. The Supply Of Power Is Given Through Step Down Transformer 230/12V, Which Steps Down The Voltage To 12V AC. This Is Converted to DC Using a Bridge Rectifier and It Is Then Regulated To +5V Using a Voltage Regulator 7805 Which Is Required for the Operation of the Arduino, LCD display and other interfaced sensors.

CHAPTER 4

METHODOLOGY

Distribution transformers are as of now observed physically where a man intermittently visits a transformer site for support and records parameter of significance. This type of monitoring can't give data about incidental over-load and overheating of transformer oil and windings. Every one of these variables can essentially decrease transformer life. Normal transformer measurement system generally detects a single transformer parameter, for example, control, current, voltage, and stage. While some ways could recognize multi-parameter, the time of acquisition and operation parameters is too long, and testing pace is not sufficiently quick. A monitoring system can only monitor the operation state or guard against steal the power, and is not able to monitor all useful data of distribution transformers to reduce costs. It leads to Online monitoring of key operational parameters of distribution transformers can provide useful information about the health of transformers which will help the utilities to optimally use their transformers and keep the asset in operation for a longer period. This will also help identify problems before any catastrophic failure which can result in a significant cost savings and greater reliability.

4.1 BLOCK DIAGRAM

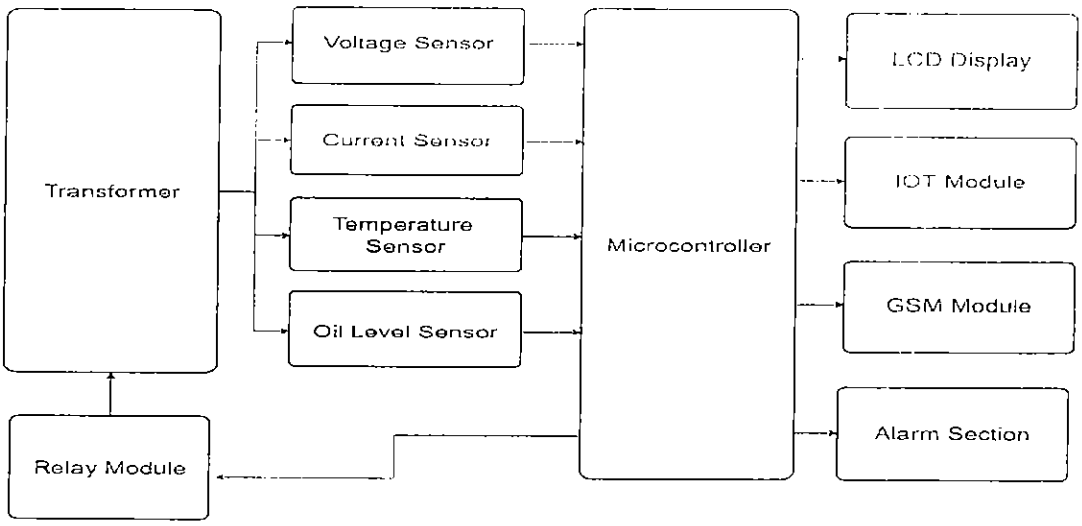
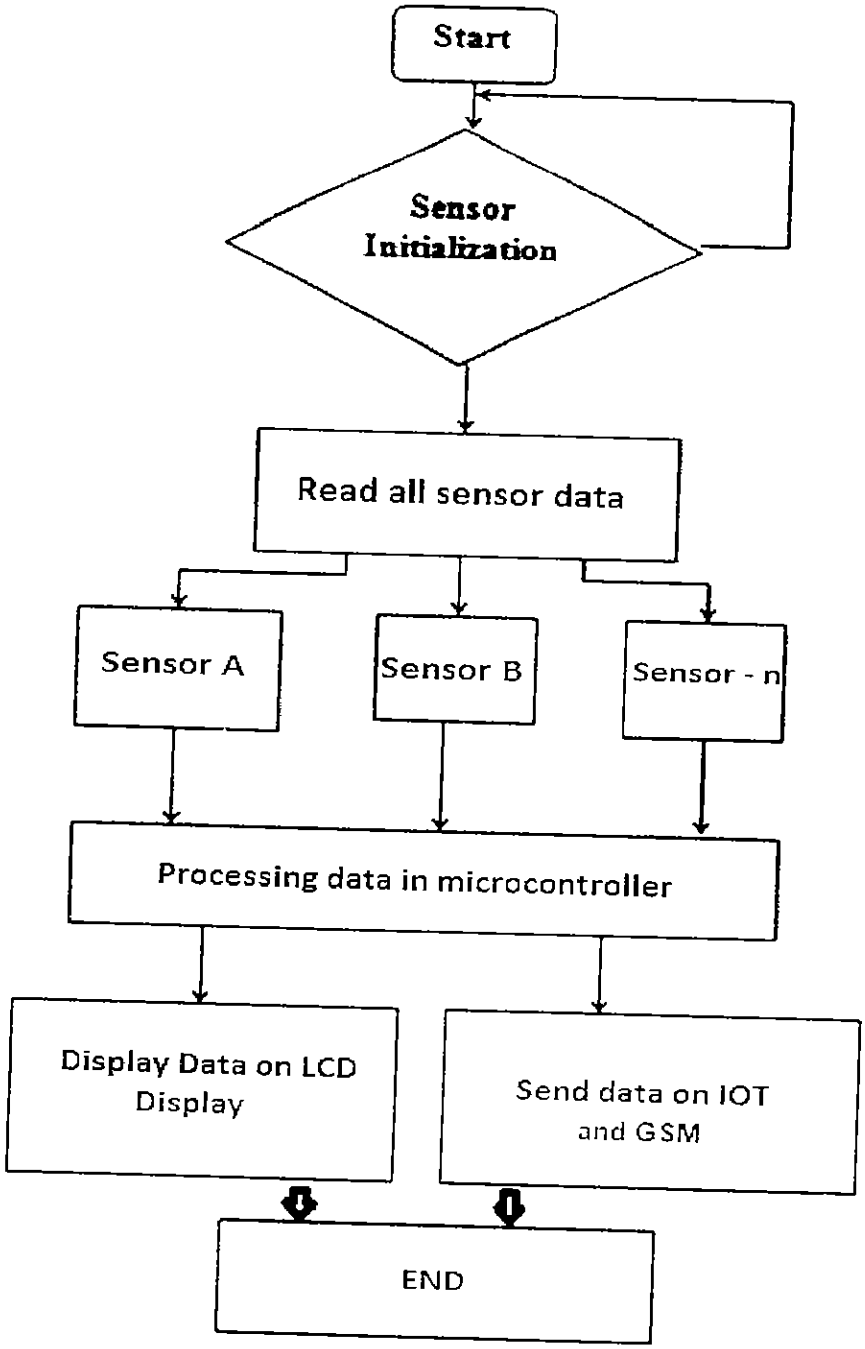


Fig: Block Diagram

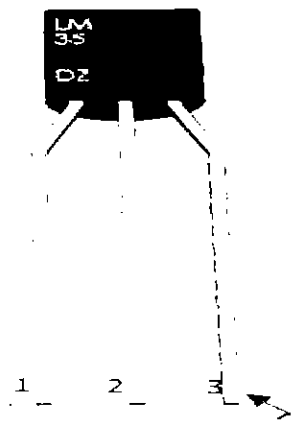
4.2 FLOW CHART



4.3 COMPONENTS & COMPONENTS DISCRIPTIONS

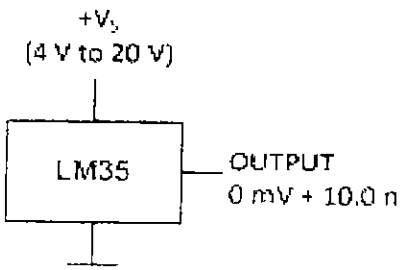
LM35

The LM35 is an integrated circuit sensor that can be used to measure temperature with an electrical output proportional to the temperature (in °C). It can measure temperature more accurately than a using a thermistor. The sensor circuitry is sealed and not subject to oxidation. The LM35 generates a higher output voltage than thermocouples and may not require that the output voltage be amplified. The LM35 has an output voltage that is proportional to the Celsius temperature. The scale factor is .01V/°C.



The LM35 does not require any external calibration or trimming and maintains an accuracy of +/-0.4°C at room temperature and +/-0.8°C on a range of 0°C to +100°C.Another important characteristic of the LM35 is that it draws only 60 micro amps from its supply and possesses a low self-heating capability. The LM35 comes in many different packages such as TO-92 plastic transistor-like package, T0-46 metal can transistor-like package,8-lead surface mount SO-8 small outline package.

Power the IC by applying a regulated voltage like +5V (V_S) to the input pin and connected the ground pin to the ground of the circuit. Now, you can measure the temperate in form of voltage as shown below.



If the temperature is 0°C, then the output voltage will also be 0V. There will be rise of 0.01V (10mV) for every degree Celsius rise in temperature. The voltage can convert into temperature using the below formulae.

$$V_{OUT} = 10\ mv/°C \times T$$

where

- V_{OUT} is the LM35 output
- T is the temperature in °

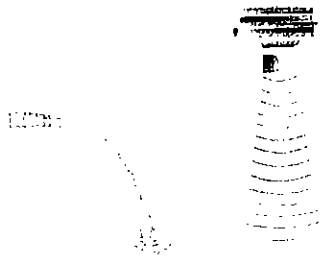
LM35 Regulator Features:

- Minimum and Maximum Input Voltage is 35V and -2V respectively. Typically, 5V.
- Can measure temperature ranging from -55°C to 150°C
- Output voltage is directly proportional (Linear) to temperature (i.e.) there will be a rise of 10mV (0.01V) for every 1°C rise in temperature.
- ±0.5°C Accuracy
- Drain current is less than 60uA
- Low cost temperature sensor
- Small and hence suitable for remote applications
- Available in TO-92, TO-220, TO-CAN and SOIC package

OIL LEVEL (ULTRASONIC SENSOR)

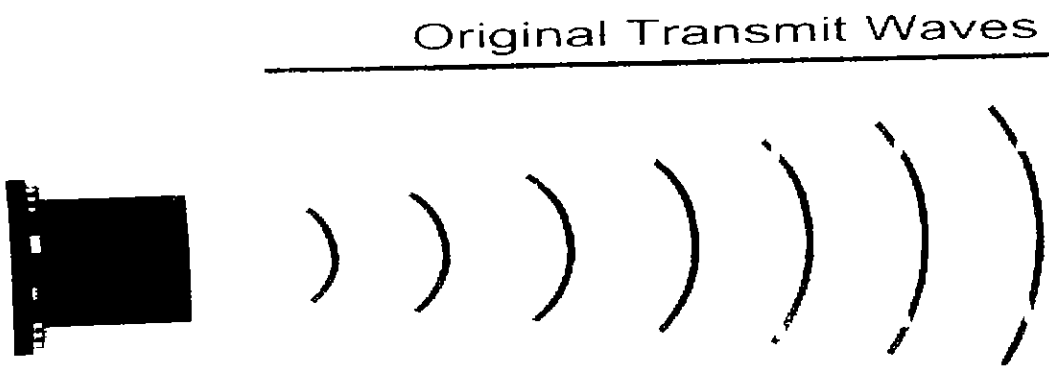
An ultrasonic level transmitter is mounted on the top of the tank and transmits an ultrasonic pulse down into the tank. This pulse, travelling at the speed of sound, is reflected back to the transmitter from the liquid surface. The transmitter measures the

time delay between the transmitted and received echo signal and the on-board microprocessor calculates the distance to the liquid surface using the formula.



How does an ultrasonic distance sensor work?

Ultrasonic sensors work by emitting sound waves with a frequency too high for a human to hear. These sound waves travel through the air at the speed of sound, roughly 343 m/s. If there is an object in front of the sensor, the sound waves get reflected back and the receiver of the ultrasonic sensor detects them. By measuring how much time passed between sending and receiving the sound waves, the distance between the sensor and the object can be calculated.



At 20°C the speed of sound is roughly 343 m/s or 0.034 cm/µs. Let's say that the time between sending and receiving the sound waves is 2000 microseconds. If you multiply the speed of sound by the time the sound waves traveled, you get the distance that the sound waves traveled.

Distance = Speed x Time

But that is not the result we are looking for. The distance between the sensor and the object is actually only half this distance because the sound waves traveled from the sensor to the object and back from the object to the sensor. So you need to divide the result by two.

Distance (cm) = Speed of sound (cm/µs) × Time (µs) ÷ 2

And so for the example this becomes:

Distance (cm) = 0.0343 (cm/µs) × 2000 (µs) ÷ 2 = 34.3 cm

Temperature dependence of the speed of the speed of sound

The speed of sound actually depends strongly on temperature and to a far lesser degree on the humidity of the air. Wikipedia states that the speed of sound increases with roughly 0.6 m/s per degree Celsius. For most cases at 20°C you can just use 343 m/s but if you want to get more accurate readings, you can calculate the speed of sound with the following formula:

V (m/s) = 331.3 + (0.606 × T)

V = Speed of sound (m/s)

T = Air Temperature (°C)

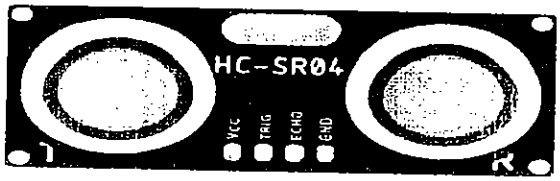
This formula doesn't include the humidity since its effect on the speed of sound is only very small.

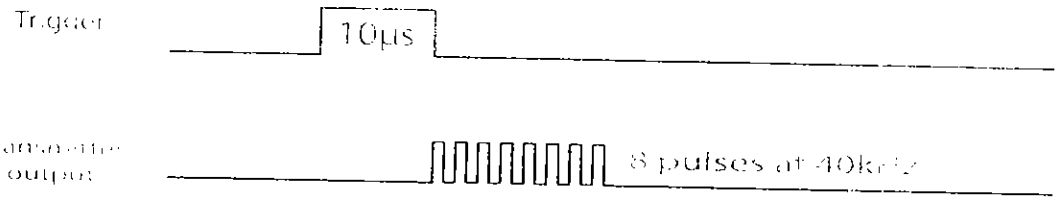
Below you can find a tutorial on how to use a DHT11 temperature and humidity sensor to calibrate the speed of sound and get a more accurate distance reading with the HC-SR04.

How the HC-SR04 works At the front of the HC-SR04 sensor you can find two silver cylinders (ultrasonic transducers), one is the transmitter of the sound waves and the other is the receiver. To let the sensor generate a sonic burst, you need to set the Trig

pin high for at least 10 µs. The sensor then creates an 8 cycle burst of ultrasound at 40 kHz.

This sonic burst travels at the speed of sound, bounces back and gets received by the receiver of the sensor. The Echo pin then outputs the time that the sound waves traveled in microseconds.





You can use the **pulseIn()** function in the Arduino code to read the length of the pulse from the Echo pin. After that, you can use the formula mentioned above to calculate the distance between the sensor and the object.

Distance = (Speed of sound in air x time delay) / 2

Once the transmitter is programmed with the bottom reference of the application – usually the bottom of the tank – the liquid level is calculated by the microcontroller. The basic equation for calculating the tank level is

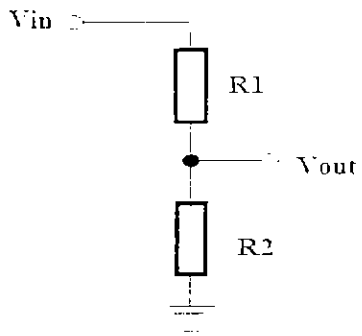
Level = Tank Height - Distance

Voltage Sensor

A voltage sensor is a sensor is used to calculate and monitor the amount of voltage in an object. Voltage sensors can determine both the AC voltage and DC voltage level. The input of this sensor can be the voltage whereas the output is the switches, analog voltage signal, a current signal, an audible signal, etc.

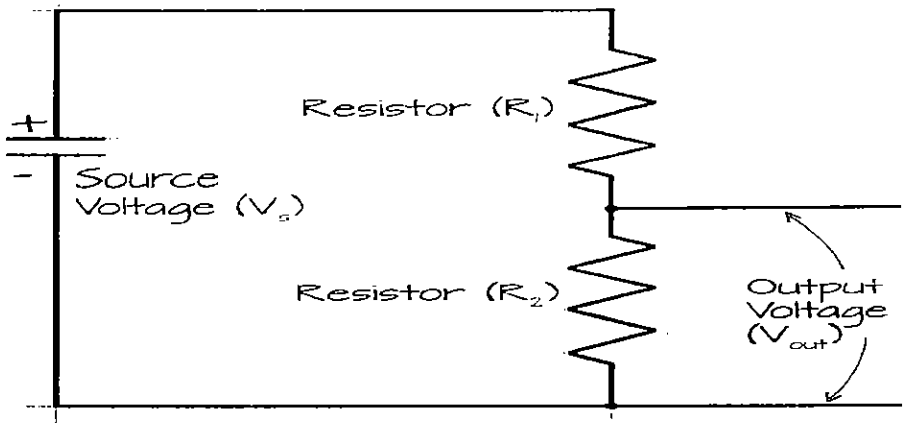
Sensors are basically a device which can sense or identify and react to certain types of electrical or some optical signals. This sensor mainly includes voltage divider circuit. The resistor in the circuit works as a sensing element. The voltage can be separated into

two resistors like a reference voltage & variable resistor to make a circuit of the voltage divider.



voltage-sensor

A voltage supply is applied to this circuit. The output voltage can be decided by the resistance used in the circuit. So, the voltage change can be amplified. We can say that this circuit will read high voltage and output of this circuit will be less than 5 volts. Because microcontroller can read less than 5 Volts. Voltage Detection Sensor Module is a simple and very useful module that uses a potential divider to reduce any input voltage by a factor of 5. This allows us to use the Analog input pin of a microcontroller to monitor voltages higher than it capable of sensing.



A voltage divider circuit is a very common circuit that takes a higher voltage and converts it to a lower one by using a pair of resistors. The formula for calculating the output voltage is based on Ohms Law and is shown below.

$$V_{OUT} = \frac{V_S \times R_2}{(R_1 + R_2)}$$

Where:

V_S is the source voltage, measured in volts (V),

R_1 is the resistance of the 1st resistor, measured in Ohms (Ω).

R_2 is the resistance of the 2nd resistor, measured in Ohms (Ω).

V_{out} is the output voltage, measured in volts (V),

ZMCT103C CURRENT SENSOR MODULE

The module is designed using the ZMCT series of small size high-precision micro CT and high-precision operational amplifier circuits for more accurate sampling and proper signal compensation. It is best solution for the signal acquisition of AC current within 5A range.

The corresponding output voltage Analog AC signal can be adjusted using the potentiometer. You can adjust the amplification ratio and the amplification range (0-100 times), but the max voltage at the output will not more than half of VCC applied voltage.

ZMCT103C AC current Sensor is the best for the purpose of the DIY project and industrial application, where we need to measure the accurate AC current with current transformer. This is a perfect choice to measure the AC current using Arduino/ESP8266/Raspberry Pi like an opensource platform. In many electrical projects, engineer directly deals with measurements with few basic requirements like

- High galvanic isolation
- High accuracy
- Good Consistency

This is a high precision micro current Transformer. This module makes it easy to monitor AC mains current up to 5 Amps. ZMCT103 is a PCB mount current transformer with 1000:1 turns ratio and Dimensions: 28 x 12 x 15 mm (L*W*H).

Specification and Features:

- Weight: 14 gm.
- Onboard
- Rated input current: 5A
- Rated output current: 5mA
- Change: 1000: 1
- The linear range: 0 ~ 10A (100 ohms)
- Linearity: 0.2%
- Precision Rating: 0.2
- Uses isolation voltage: 3000V Measurement
- Sealing material: epoxy resin
- Operating temperature: – 40 Celsius to – 70 Celsius
- Onboard sampling resistor and micro-precision current transformer

• Modules 5A can be measured within an alternating current, the analog output corresponding to 5A/5mA

LCD Interfacing

The display units are very important in communication between the human world and the machine world. The display unit work on the same principle, it does not depend on the size of the display it may be big or the small. We are working with the simple displays like 16×1 and 16×2 units. The 16×1 display unit has the 16 characters which present in one line and 16×2 display units have 32 characters which are present in the 2 line.

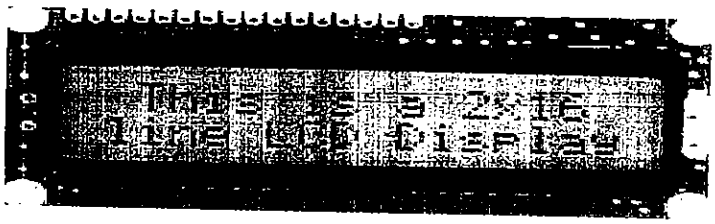
We should know that to display the each character there are 5×10 pixels. Thus to display one character all the 50 pixels should be together. In the display, there is a controller which is HD44780 it is used to control the pixels of characters to display.

What is a Liquid Crystal Display?

The liquid crystal display uses the property of light monitoring of liquid crystal and they do not emit the light directly. The Liquid crystal display is a flat panel display or the electronic visual display.

With low information, content the LCD' s are obtained in the fixed image or the arbitrary image which are displayed or hidden like present words, digits, or 7 segment display. The arbitrary images are made up of large no of small pixels and the element has larger elements.

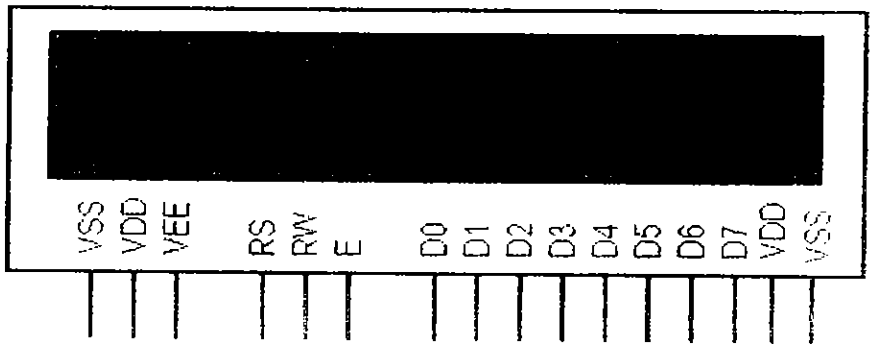
LIQUID CRYSTAL DISPLAY



Pin No	Pin Name	Pin Description
Pin 1	GND	This pin is a ground pin and the LCD is connected to the Ground
Pin 2	VCC	The VCC pin is used to supply the power to the LCD
Pin 3	VEE	This pin is used for adjusting the contrast of the LCD by connecting the variable resistor in between the VCC & Ground.
Pin 4	RS	The RS is known as register select and it selects the Command/Data register. To select the command register the RS should be equal to zero. To select the Data register the RS should be equal to one.
Pin 5	R/W	This pin is used to select the operations of Read/Write. To perform the write operations the R/W should be equal to zero. To perform the read operations the R/W should be equal to one.
Pin 6	EN	This is a enable signal pin if the positive pulses are passing through a pin. then the pin function as a read/write pin.
Pin 7	DB0 to DB7	The pin 7 contains total 8 pins which are used as a Data pin of LCD.
Pin 15	LED +	This pin is connected to VCC and it is used for the pin 16 to set up the glow of backlight of LCD.

Pin 16	LED –	This pin is connected to Ground and it is used for the pin 15 to set up the glow of backlight of the LCD.

- Command Register
- Data Register

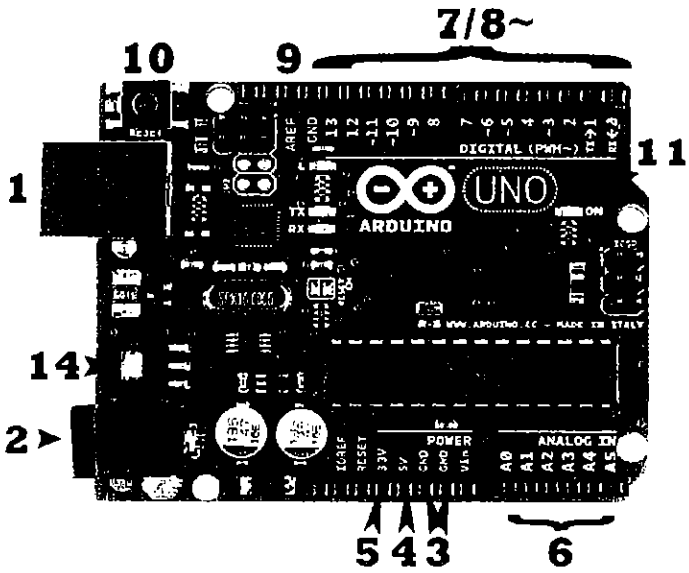


Command Registe: This register is used to insert a special command in the LCD. The command is a special set of data and it is used to give the internal command to the liquid crystal display like clear screen, move to line 1 character 1, setting the curser and etc.**r**

Data Register: The data registers are used to enter the line in the LCD

Arduino (Atmega328)

There are many varieties of Arduino boards (explained on the next page) that can be used for different purposes. Some boards look a bit different from the one below, but most Arduinos have the majority of these components in common:



Power (USB / Barrel Jack)

- Every Arduino board needs a way to be connected to a power source. The Arduino UNO can be powered from a USB cable coming from your computer or a wall power supply (like this) that is terminated in a barrel jack. In the picture above the USB connection is labeled (1) and the barrel jack is labeled (2).
- The USB connection is also how you will load code onto your Arduino board. More on how to program with Arduino can be found in our Installing and Programming Arduino tutorial.
- NOTE: Do NOT use a power supply greater than 20 Volts as you will overpower (and thereby destroy) you're Arduino. The recommended voltage for most Arduino models is between 6 and 12 Volts.
- Pins (5V, 3.3V, GND, Analog, Digital, PWM, AREF)
- The pins on your Arduino are the places where you connect wires to construct a circuit (probably in conjunction with a breadboard and some wire. They usually have black plastic 'headers' that allow you to just plug a wire right into the board. The Arduino has several different kinds of pins, each of which is labeled on the board and used for different functions.

- GND (3): Short for 'Ground'. There are several GND pins on the Arduino, any of which can be used to ground your circuit.
- 5V (4) & 3.3V (5): As you might guess, the 5V pin supplies 5 volts of power, and the 3.3V pin supplies 3.3 volts of power. Most of the simple components used with the Arduino run happily off of 5 or 3.3 volts.
- Analog (6): The area of pins under the 'Analog In' label (A0 through A5 on the UNO) are Analog In pins. These pins can read the signal from an analog sensor (like a temperature sensor) and convert it into a digital value that we can read.
- Digital (7): Across from the analog pins are the digital pins (0 through 13 on the UNO). These pins can be used for both digital input (like telling if a button is pushed) and digital output (like powering an LED).
- PWM (8): You may have noticed the tilde (~) next to some of the digital pins (3, 5, 6, 9, 10, and 11 on the UNO). These pins act as normal digital pins, but can also be used for something called Pulse-Width Modulation (PWM). We have a tutorial on PWM, but for now, think of these pins as being able to simulate analog output (like fading an LED in and out).
- AREF (9): Stands for Analog Reference. Most of the time you can leave this pin alone. It is sometimes used to set an external reference voltage (between 0 and 5 Volts) as the upper limit for the analog input pins.
- Reset Button
- Just like the original Nintendo, the Arduino has a reset button (10). Pushing it will temporarily connect the reset pin to ground and restart any code that is loaded on the Arduino. This can be very useful if your code doesn't repeat, but you want to test it multiple times. Unlike the original Nintendo however, blowing on the Arduino doesn't usually fix any problems.
- Power LED Indicator
- Just beneath and to the right of the word "UNO" on your circuit board, there's a tiny LED next to the word 'ON' (11). This LED should light up whenever you plug your Arduino into a power source. If this light doesn't turn on, there's a good chance something is wrong. Time to re-check your circuit!
- TX RX LEDs

- TX is short for transmit, RX is short for receive. These markings appear quite a bit in electronics to indicate the pins responsible for serial communication. In our case, there are two places on the Arduino UNO where TX and RX appear -- once by digital pins 0 and 1, and a second time next to the TX and RX indicator LEDs (12). These LEDs will give us some nice visual indications whenever our Arduino is receiving or transmitting data (like when we're loading a new program onto the board).
- Main IC
- The black thing with all the metal legs is an IC, or Integrated Circuit (13). Think of it as the brains of our Arduino. The main IC on the Arduino is slightly different from board type to board type, but is usually from the ATmega line of IC's from the ATMEL Company. This can be important, as you may need to know the IC type (along with your board type) before loading up a new program from the Arduino software. This information can usually be found in writing on the top side of the IC. If you want to know more about the difference between various IC's, reading the datasheets is often a good idea.
- Voltage Regulator
- The voltage regulator (14) is not actually something you can (or should) interact with on the Arduino. But it is potentially useful to know that it is there and what it's for. The voltage regulator does exactly what it says -- it controls the amount of voltage that is let into the Arduino board. Think of it as a kind of gatekeeper; it will turn away an extra voltage that might harm the circuit. Of course, it has its limits, so don't hook up your Arduino to anything greater than 20 volts.
- The Arduino Family
- Arduino makes several different boards, each with different capabilities. In addition, part of being open source hardware means that others can modify and produce derivatives of Arduino boards that provide even more form factors and functionality. If you're not sure which one is right for your project, check this guide for some helpful hints. Here are a few options that are well-suited to someone new to the world of Arduino:
- Arduino Uno (R3)

- The Uno is a great choice for your first Arduino. It's got everything you need to get started, and nothing you don't. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a USB connection, a power jack, a reset button and more. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

Atmega328

Atmega 328 has 1KB Electrically Erasable Programmable Read Only Memory (EEPROM). This property shows if the electric supply supplied to the micro-controller is removed, even then it can store the data and can provide results after providing it with the electric supply. Moreover, ATmega-328 has 2KB Static Random Access Memory (SRAM). Other characteristics will be explained later. ATmega 328 has several different features which make it the most popular device in today's market. These features consist of advanced RISC architecture, good performance, low power consumption, real timer counter having separate oscillator, 6 PWM pins, programmable Serial USART, programming lock for software security, throughput up to 20 MIPS etc. ATmega-328 is mostly used in Arduino. The further details about ATmega 328 will be given later in this section.

Introduction to ATmega328

- **ATmega328** is an 8-bit and 28 Pins AVR Microcontroller, manufactured by Microchip, follows RISC Architecture and has a flash type program memory of 32KB.
- It has an EEPROM memory of 1KB and its SRAM memory is of 2KB.
- It has 8 Pin for ADC operations, which all combines to form Porta (PA0 – PA7).
- It also has 3 built-in Timers, two of them are 8 Bit timers while the third one is 16-Bit Timer.
- You must have heard of Arduino UNO, UNO is based on atmega328 Microcontroller. It's UNO's heart.
- It operates ranging from 3.3V to 5.5V but normally we use 5V as a standard.
- Its excellent features include the cost efficiency, low power dissipation, programming lock for security purposes, and real timer counter with separate oscillator.

- It's normally used in Embedded Systems applications. You should have a look at these Real Life Examples of Embedded Systems. we can design all of them using this Microcontroller.
- The following table shows the complete features of ATmega328:

ATMEGA328 FEATURES

No. of Pins	28
CPU	RISC 8-Bit AVR
Operating Voltage	1.8 to 5.5 V
Program Memory	32KB
Program Memory Type	Flash
SRAM	2048 Bytes
EEPROM	1024 Bytes
ADC	10-Bit
Number of ADC Channels	8
PWM Pins	6
Comparator	1

ATMEGA328 FEATURES

Packages (4)	8-pin PDIP 32-lead TQFP 28-pad QFN/MLF 32-pad QFN/MLF
Oscillator	up to 20 MHz
Timer (3)	8-Bit x 2 & 16-Bit x 1
Enhanced Power on Reset	Yes
Power Up Timer	Yes
I/O Pins	23
Manufacturer	Microchip
SPI	Yes
I2C	Yes
Watchdog Timer	Yes

ATMEGA328 FEATURES

Brown out detect (BOD)	Yes
Reset	Yes
USI (Universal Serial Interface)	Yes
Minimum Operating Temperature	-40 C to +85 C

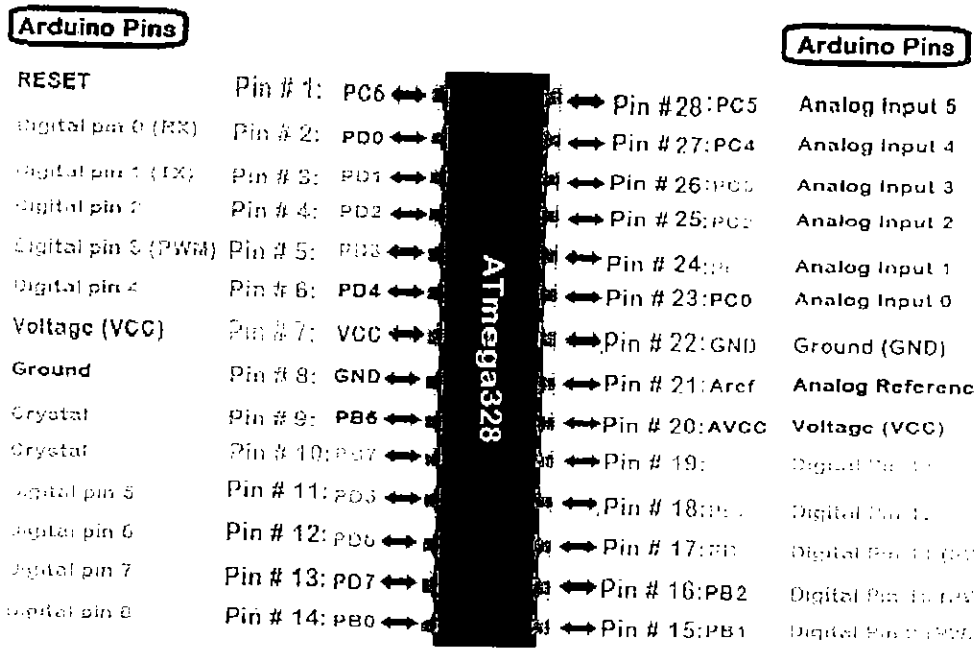
ATmega328 Pins

- ATmega-328 is an AVR Microcontroller having twenty eight (28) pins in total.
- All of the pins in chronological order, are listed in the table shown in the figure given below.

ATmega328 Pinout

- Through pinout diagram we can understand the configurations of the pins of any electronic device, so you are working on any Engineering Project then you must first read the components' pinout.
- ATmega 328 pinout diagram is shown in the figure given below.

ATmega328 Pinout



ATmega328 Pins Description

- Functions associated with the pins must be known in order to use the device appropriately.
- ATmega-328 pins are divided into different ports which are given in detail below.

VCC is a digital voltage supply.

AVCC is a supply voltage pin for analog to digital converter.

GND denotes Ground and it has a 0V.

Port A consists of the pins from **PA0** to **PA7**. These pins serve as analog input to analog to digital converters. If analog to digital converter is not used, **port A** acts as an eight (8) bit bidirectional input/output port.

Port B consists of the pins from **PB0** to **PB7**. This port is an 8 bit bidirectional port having an internal pull-up resistor.

Port C consists of the pins from **PC0** to **PC7**. The output buffers of **port C** has symmetrical drive characteristics with source capability as well high sink.

Port D consists of the pins from **PD0** to **PD7**. It is also an 8 bit input/output port having an internal pull-up resistor.

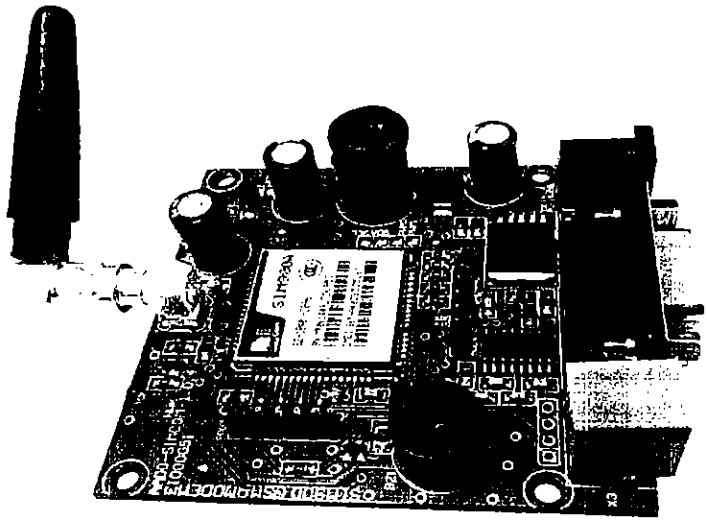
- All of the AVR ports are shown in the figure given below.

AREF is an analog reference pin for analog to digital converter.

- So this was the brief of all the pins in ATmega 328 AVR micro-controller.

GSM Module

A GSM module or a GPRS module is a chip or circuit that will be used to establish communication between a mobile device or a computing machine and a GSM or GPRS system. The modem (modulator-demodulator) is a critical part here.



Sim900A GSM Module

Global System for Mobile communication (GSM) is digital cellular system used for mobile devices. It is an international standard for mobile which is widely used for long distance communication There are various GSM modules available in market like SIM900, SIM700, SIM800, SIM808, SIM5320 etc.

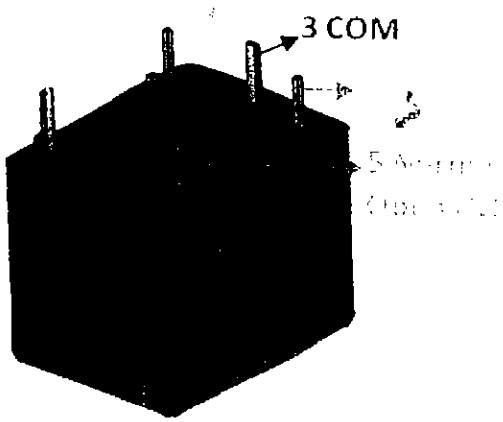
SIM900A module allows users to send/receive data over GPRS, send/receive SMS and make/receive voice calls.

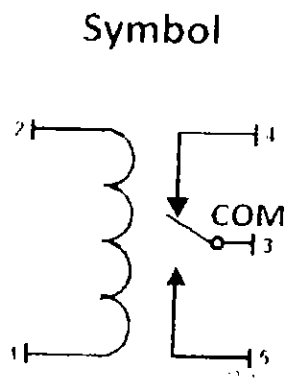
The GSM/GPRS module uses USART communication to communicate with microcontroller or PC terminal. AT commands are used to configure the module in different modes and to perform various functions like calling, posting data to a site, etc.

Specifications

- Quad-Band 850/ 900/ 1800/ 1900 MHz
- GPRS multi-slot class 10/8
- GPRS mobile station class B
- Compliant to GSM phase 2/2+
- Class 4 (2 W @850/ 900 MHz)
- Class 1 (1 W @ 1800/1900MHz)
- Dimensions: 24* 24 * 3 mm
- Weight: 3.4g
- Control via AT commands (GSM 07.07 ,07.05 and SIMCOM enhanced AT Commands)
- SIM application toolkit
- Supply voltage range 3.4 – 4.5 V
- Low power consumption
- Operation temperature: -30 °C to +80 °C

RELAY





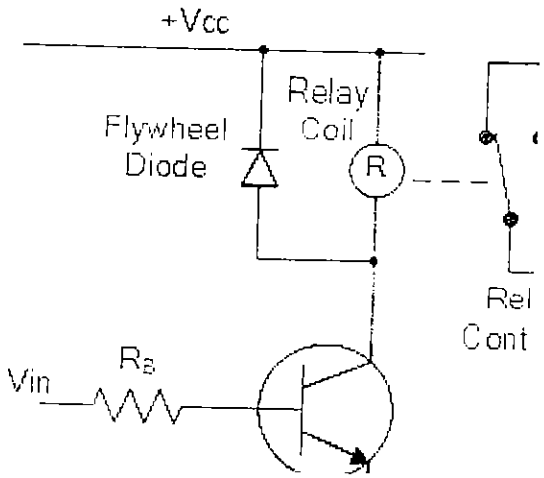
How to Use a Relay?

Relays are most commonly used switching device in electronics. There are two important parameters of relay, first is the Trigger Voltage, this is the voltage required to turn on the relay that is to change the contact from Common → NC to Common → NO.

The other parameter is your Load Voltage & Current, this is the amount of voltage or current that the NC, NO or Common terminal of the relay could withstand, in our case for DC it is maximum of 30V and 10A. Make sure the load you are using falls into this range.

The relay's switch connections are usually labelled COM, NC and NO:

- **COM** = Common, always connect to this, it is the moving part of the switch.
- **NC** = Normally Closed, COM is connected to this when the relay coil is **off**.
- **NO** = Normasssssslly Open, COM is connected to this when the relay coil is **on**.



A transistor works best as a switch when it is connected with a common emitter configuration, meaning the emitter of the BJT must be always connected directly with "ground" line. Here the "ground" refers to the negative line for an NPN and the positive line for a PNP BJT.

If an NPN is used in the circuit, the load must be connected with the collector, which will allow it to be switched ON/OFF by switching its negative line ON/OFF.

Relay Specifications:

- Rated Load: 10A 250VAC, 10A 30VDC
- Max Switching Current: 10A
- Max Switching Voltage: 110VDC / 250VAC

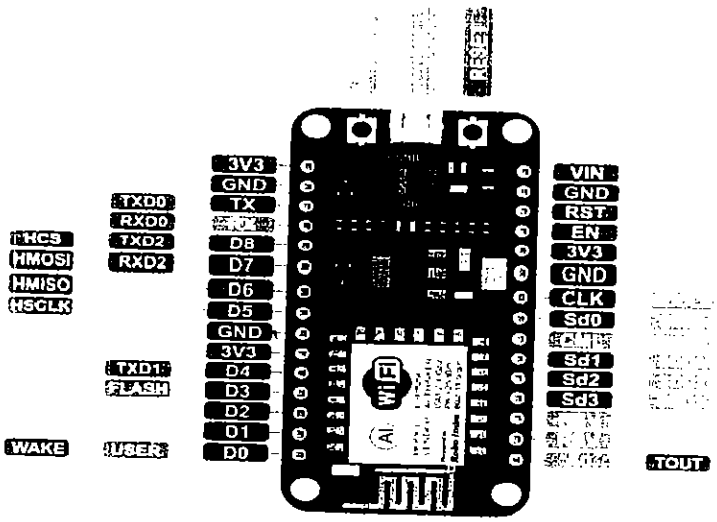
- Coil power 0.45W
- Contact Arrangement: C:1 (NO/NC)
- Dimensions: 19 x 15 x 15 mm

IOT Module Node MCU

Node MCU V3 is an open-source firmware and development kit that plays a vital role in designing your own IOT product. Multiple GPIO pins on the board allow you to connect the board with other peripherals and are capable of generating PWM, I2C, SPI, and UART serial communications.

Node MCU is an open source platform based on ESP8266 which can connect objects and let data transfer using the Wi-Fi protocol. In addition, by providing some of the most important features of microcontrollers such as GPIO, PWM, ADC, and etc., it can solve many of the project's needs alone.

Please note that this causes quite some confusion. The numbers on the pins DO NOT map to the numbers of pins of the ESP8266. For example - pin D1 of the board does not map to GPIO1 as you would expect, but to GPIO5 instead!



The above layout indicates how to interpret the mapping. For clarity, you can also see the mapping list between Node MCU pins and GPIO below:

D0 = GPIO16

D1 = GPIO5

D2 = GPIO4

D3 = GPIO0

D4 = GPIO2

D5 = GPIO14

D6 = GPIO12

D7 = GPIO13

D8 = GPIO15

D9 = GPIO3

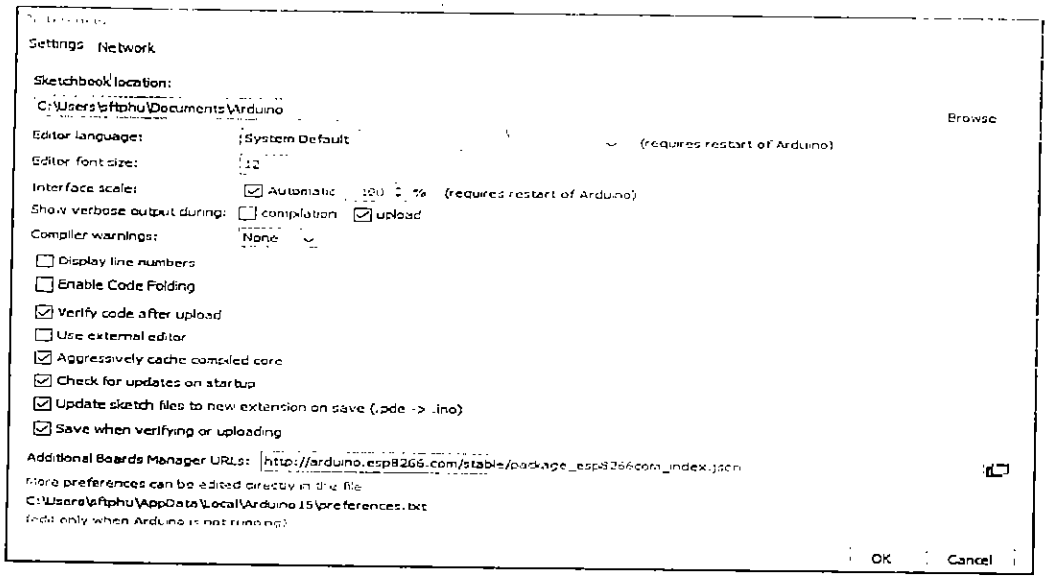
D10 = GPIO1

LED_BUILTIN = GPIO16 (ausxiliary constant for the board LED, not a board pin)

Also note, that many libraries include the mapping already, so you don't have to worry about the translation. If you write to D1 for instance, you will get this interpreted correctly as GPIO5 (PIN5). Check the does.

Setting up in Arduino IDE

Open 'Arduino IDE' and click **File – Preferences**

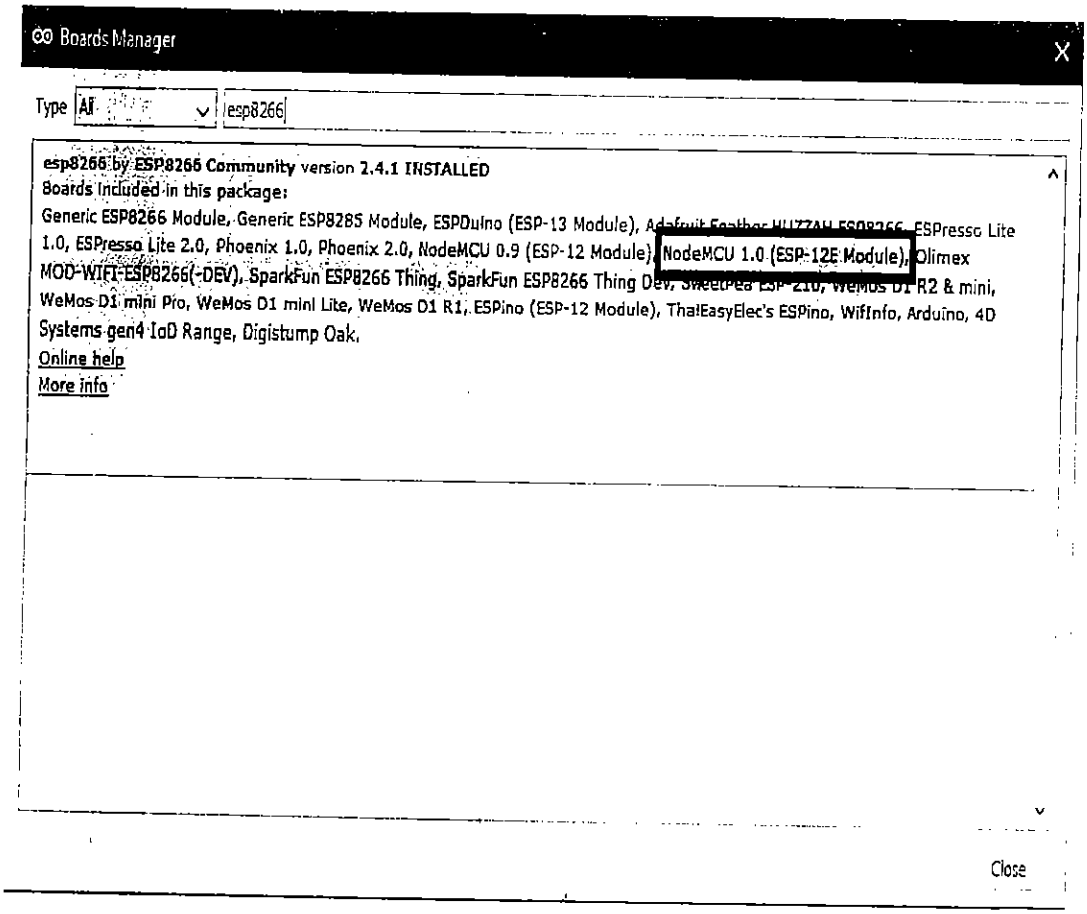


Copy the URL below into the section **Additional boards Manager** and click OK to close the Preferences tab

[redacted]

Go to **Tools - Board ... - Board Manager**

Locate the **esp8266 by esp8266 community** entry and install the software for Arduino (notice the Node MCU entry in this board list)



Done. You can now select the Node MCU in the Boards menu.

CHAPTER 5

5.1 ADVANTAGES

- Low cost.
- Real-time monitoring using IOT.
- GSM SMS alert
- High Accuracy.
- Remote monitoring

5.2 DISADVANTAGES

- Per transformer some cost will increase for this setup.
- Internet connection is required for IOT to work
- Improve system reliability.

5.3 APPLICATIONS

- Distribution Transformer.
- Industrial Applications.
- On High Grade Motors.
- GRID Monitoring

CHAPTER 6

6.1 FUTURE SCOPE

In future work we can develop database of all parameters of distribution transformer. which are placed at different places. We can get all information by placing the proposed system modules at every transformer. We can send the data through Wi-Fi module and through Ethernet router. With server, we can store data on webpage or website. A Wi-Fi module connects to nearby network and sends information to monitoring node.

6.2 CONCLUSION

An IOT and GSM based transformer monitoring system for power transformer was designed, implemented and tested.An IOT module added to this system to periodically receive and parameters information about the transformers in an IOT application. After detected signal on any abnormality, immediate action to prevent using relay tripping and SMS alert for transformers. We need not have to check all power transformers and currents, temperature and voltages and thus we can detect the fault in less time and uncertain failures thus resulting in significant cost saving as well as improving system reliability.

The proposed technique with results that the protection scheme works properly with accuracy, sensitivity of this scheme very high for the abnormal and faulty conditions. Transformer Health Monitoring will help to identify or recognize unexpected situations before any serious failure, which leads to greater reliability and significant cost savings. If transformer is in abnormal condition, we can know from anywhere. No human power need to monitor the transformer. Details about the transformer are automatically updated in IOT and fault alert using GSM.

REFERENCES

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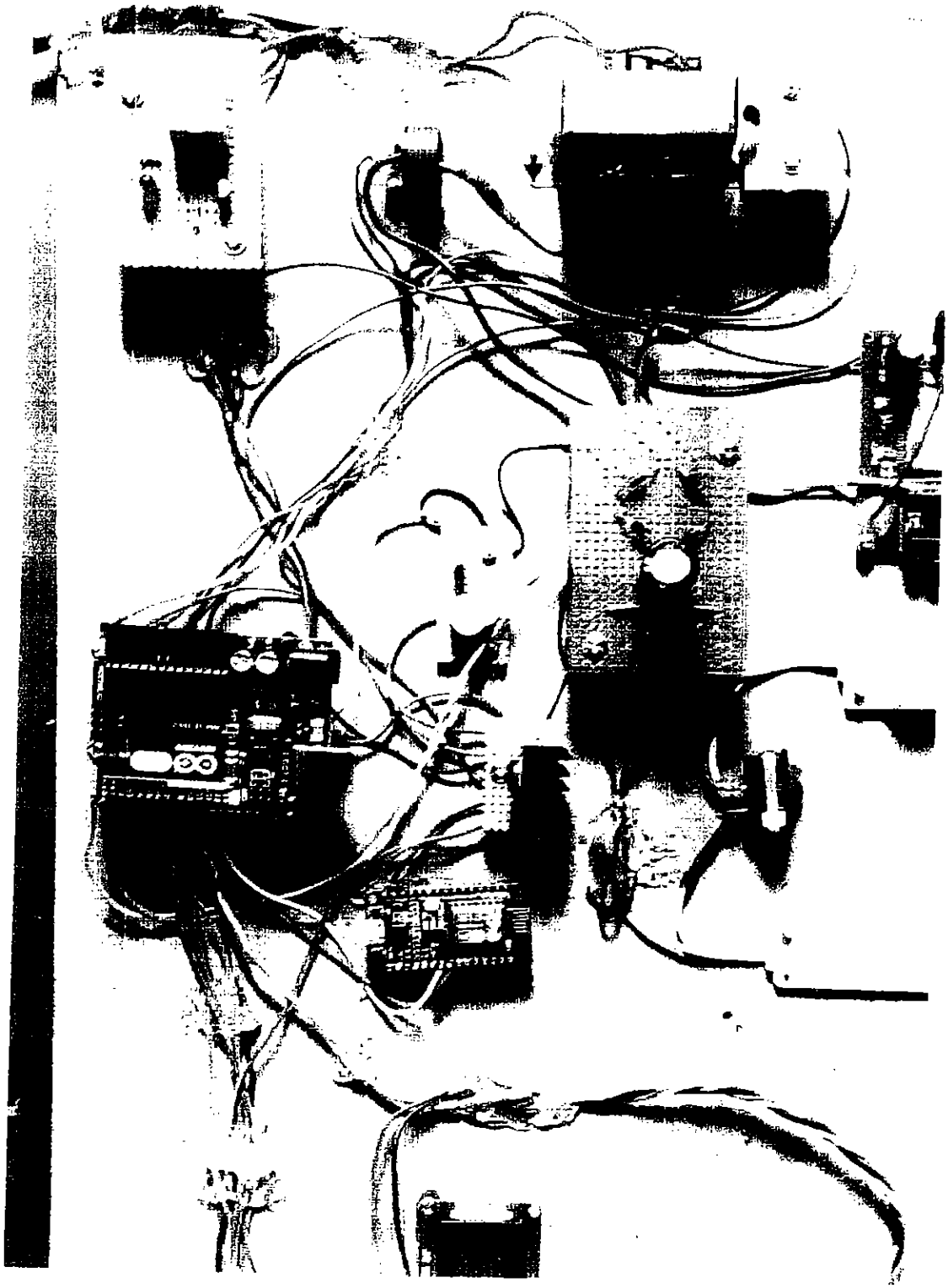
[2]. Mrs. A. P. Khandait1, Swapnil Kadaskar2, Girish Thakare3, "Real Time Monitoring of Transformer, using IOT" , International Journal of Engineering Research & Technology (IJERT),Vol. 6 Issue 03, March2017.

[3]. Ansuman Sharma, Rajesh Behura: "GSM based Distribution Transformer Monitoring System", May 2013.

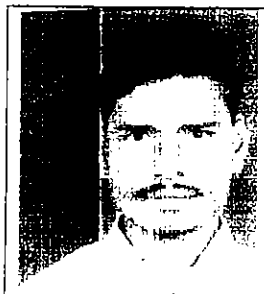
[4]. Par S.Tenbohlen,T Stirl, M. Rösner, "Benefit of sensors for on-line monitoring system for power transformers".

[5]. http://dfe.petrsu.ru/koi/posob/avrlab/ATMega16.pdf.

REAL TIME TRANSFORMER HEALTH MONITORING SYSTEM USING IOT AND GSM PROJECT MODULE



PROJECT TEAM MEMBERS



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3VC18EE460

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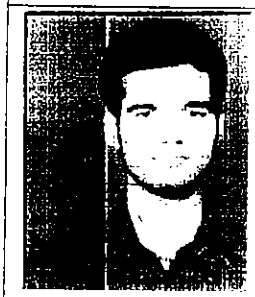
RAO BAHADHUR Y MAHABALESHWARAPPA ENGINEERING COLLEGE ,BALLARI



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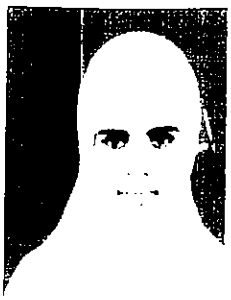

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"Jnana Sangama" Belagavi - 590018

A PROJECT REPORT
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during the academic year 2021-22

BY

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2. B Shravani	USN:3VC18EE010
3. Dharani T	USN:3VC18EE015
4. Megana PL	USN:3VC18EE030

UNDER THE GUIDANCE OF

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Asst-Professor

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

CERTIFICATE

This is to certify project work entitled "AUTOMATIC MONITORING OF DEFORESTATION USING ARDUINO" is a bonafide work carried out by the project group in the partial fulfillment for the award of bachelor degree in ELECTRICAL AND ELECTRONICS ENGINEERING from Visvesvaraya Technological University, Belagavi, during the academic year 2021-2022.

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External viva-voce

Name of the Examiner	Signature with date
1. Dr. U. M. Netravati	26.07.22
2. Dr. D.B Goud	26.07.2022

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We sincerely thank to **Mr. Aladalli Sharanabasappa,** Project guide, Department Of Electrical and Electronics Engineering, Rao Bahadur Y Mahabaleswarappa Engineering College, Bellary, for his immense support and encouragement in successful completion of this project.

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We express our sincere gratitude and thanks to our **parents** for their unconditional support, suggestions, guidance, advice and valuable help.

DECLARATION

We Hereby declare that the presented report of project titled **"AUTOMATIC MONITORING OF DEFORESTATION USING ARDUINO"** is the original data and given the information to the best of our knowledge in the project report carried by us under the guidance of **'Mr. Aladalli Sharanabasappa'** at the Department Of Electrical and Electronics Engineering, Rao Bahadur Y Mahabaleswarappa Engineering College, Bellary affiliated to Visvesvaraya Technological University, Belagavi-590018, during the year 2021-2022.

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ABSTRACT

The manual monitoring of the forest to prevent unauthorized activities is practically difficult job. The four major operations that are essential in monitoring the forest are developed in this work, namely tree cutting detection, fire detection, smuggling and contaminated water detection using metal sensor, fire sensor, vibration sensor and pH sensor respectively. The outputs of these sensors are given to Arduino Uno, which is connected along with the microcontroller i.e., esp8266 Wi-Fi module to communicate to central server in forest office from remote place in the forest. The sensed data from sensors is collected and given to esp8266 Wi-Fi module. The system uses esp8266 Wi-Fi module to upload the information to the cloud, and then transfers the alerting message to forest officer mobile phone via registered Email-id of forest officer or any other authorized person and also displays the alerting message in the forest monitoring system in the forest office and simultaneously turn on the buzzer in the forest office. Thus, intimating the unauthorized activities that are carried out in the forest to the operating person of forest office.

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CHAPTER-01

INTRODUCTION

Forest is very important in our life: we totally depend on the forest for survival. The forest trees help us to breathe by pumping out the oxygen and absorb carbon dioxide. Forest is house to many living organisms. It is a precious resource provided by nature. The organisms living in forests are independent on each other. Life in forest is governed by factors like air, water and sunlight. There are variety of plants available in most forests: herbs, shrubs and trees depending upon the climate of the region. Plants make their own food by the process of photosynthesis and animals depend on plants and other animals for their food. Sometimes plants also depend on animals for processes like pollination and seed dispersal. There are many forests spread over large area across the globe. Forest can be classified as: tropical, evergreen, partly evergreen, deciduous and dry forests based on the climatic conditions and types of trees present. Forest also comprises non-living components such as lakes, ponds, soil, rocks, etc. A forest is defined as an area forming an ecosystem.

Forest help in maintaining the water cycle on the earth. Plants absorb water from the soil through their roots. The process of releasing excess water by plants into the atmosphere in the form of water vapors is known as transpiration. The process in which water vapors from ocean rises and condenses to form clouds is known as condensation and the process of moving clouds to land due to sea breeze is known as precipitation and this eventually leads to rainfall. All these processes together from the water cycle and hence forests play a significant role in continuing water cycle. Forest help in preventing global warming. The increased amount of carbon dioxide (greenhouse gas) in the atmosphere results in the greenhouse effect and thus causes global warming. Forests prevent soil erosion. Trees present in the forests hold the soil particles strongly with the roots and prevent them from erosion

The most common hazard in the forests is forest fire. Forest fires are as old as the forests themselves. They pose a threat not only to the forest wealth but also to the entire regime to fauna and flora seriously disturbing the bio-diversity and the ecology and environment of a region. During summer, when there is no rain for months, the forests become littered with dry senescent leaves and twinges, which could burst into flames ignited by the slightest spark. An uncontrolled forest fire can devastate everything in its path, spread for miles, crossing rivers and roads. Each year, between 60,000 and 80,000 forest fires occur, destroying between 3 and 10 million hectares. While forest fires have different impacts on the environment, depending on their size and frequency, the causes are also diverse. A few hundred years ago, forest fires were a natural "activity" caused mostly by rare phenomena, such as a volcanic eruption or an earthquake, that occur in very specific geographical areas.

Therefore, it is not them, but lightning, that is the main cause of the departure of forest fires from natural sources. For example, it accounts for about 2% of fires in the Mediterranean zone and close to 30% in Quebec! In Spain, 5% of fires are due to natural causes, especially in dry, hot places.

In some parts of the country (Aragon, Pyrenean chains, etc.), thunderstorms and lightning, in the absence of rain, are responsible for 25% of forest fire departures. Other exceptional circumstances and very unusual phenomena, such as the collision of two silicious rocks producing a spark, may also have a (minimal) impact on fires. Fires of natural origin are often quickly channeled since they usually have only one outbreak. But today, natural causes are much less frequent and now give place to human activities, whether voluntary or not 43% of forest fires caused by humans are linked to imprudence"s (cigarette butts, garbage deposits, burning).

They can also occur as a result of surges, damage to power lines or military accidents as happened in 2016 and 2017 at Captious military camp in Gironde (caused by military fire, destroying 1300 hectares of pines) or at Le Mans military camp in April2017. Finally, recklessness is often linked to recreational activities, agricultural or forestry work (55% of fires) 25% of forest fires caused by humans are caused by pyromaniacs, revenge or political or administrative strategy. To prevent this we are using fire sensor it will detect fire happens in the forest and send the signal to Arduino UNO.

Most days we read in the newspapers about trees trafficking. These trees are very expensive. These are very useful in medical science and cosmetics. Because of the large amount of money involved in such sales of tree trunks and many incidents occur by cutting a tree and their smuggling. The problem we saw is there no medium or system to detect illegal logging and smuggling of trees. The explanation there is, in our work, we can know what happens to the trees in the forests or places should be monitored. Such a plan will help you to find and detect the illegal logging and cutting of trees, and also it will alert us to take the action. By considering this problem in mind a system designed to help and to achieve our goal of protecting trees by smugglers. For years we have been plagued by illegal activity such as smuggling precious and commercial trees such as teakwood, sandalwood, sagwan etc., from protected forest areas. These trees are very expensive and numerous commercial demands in the global market. Trees are there it is generally considered to be protected by marking others tags by hand. This will not be helpful and reliable from then on anyone can interrupt it. And in times of natural trees it may somehow be damaged. The default smart unit has it thus it was designed to address these issues. A combination of latest wireless and embedded communication systems solutions provide us with such modules.

CHAPTER-02

LITERATURE SURVEY

1. Wireless sensor-based conservation of illegal logging of forest trees.

Authors: L.K Hema, Dr. D Murugar, R Mohan Priya.

Applications: This system is suitable for large-scale forest monitoring for illegal logging. Here the cluster of sensor nodes are used to monitor the cutting of trees.

Future Scope: It is used in medicines, that provide interpretive data that significantly improves the capability and performance of its system.

2. GPS-Arduino based tacking and alarm system for protection of forest:

Authors: M Gor, J Vora, S Tanwar, S Tyagi.

Applications: Providing alarm indicating fire accidents and illegal logging of trees in the forest.

Future Scope: The GPS tracking system with location and positioning technology continuing to improve to new levels, including the most modern GPS tracking and sleeve of other technologies such as geo-fencing

3. Forest fire monitoring system:

Authors: V. N Vasyukov, A. Yu Zaitseva.

Applications: Detection of fire in the forest in order to minimize deforestation.

Future Scope: Fire monitoring plays an important role in forest malls. industries, residential areas, etc.

4. Smart pH sensor:

Authors: Pabitra Mohan Khilal, Rajesh Patil.

Applications: Monitoring the quality of water in forests.

Future Scope: The pH sensor helps in measuring acidity or alkalinity of a fluid.

CHAPTER-03

PROBLEM STATEMENT AND OBJECTIVES

3.1 PROBLEM STATEMENT:

The challenges that are faced in forest include the effects of changing climate, worsening fire seasons, smuggling and contamination of forest water bodies. The loss of tress and other vegetation can cause climate change, desertification, soil erosion, fewer crops, flooding, increased greenhouse gases in the atmosphere, and a host of problems for indigenous people.

3.2 OBJECTIVES:

→ Protection and conservation of flora, fauna, forests and wildlife.
→ Protection of the environment in order to promote sustainable development.
→ To protect and maintain long term forest.

CHAPTER-04

METHODOLOGY

The proposed system consists of four sensors namely fire sensor namely, vibration sensor, metal sensor and pH sensor. In addition to sensors, the system also consists of V-module, Arduino UNO, esp8266 Wi-Fi module, Smart phone, buzzer and computer.

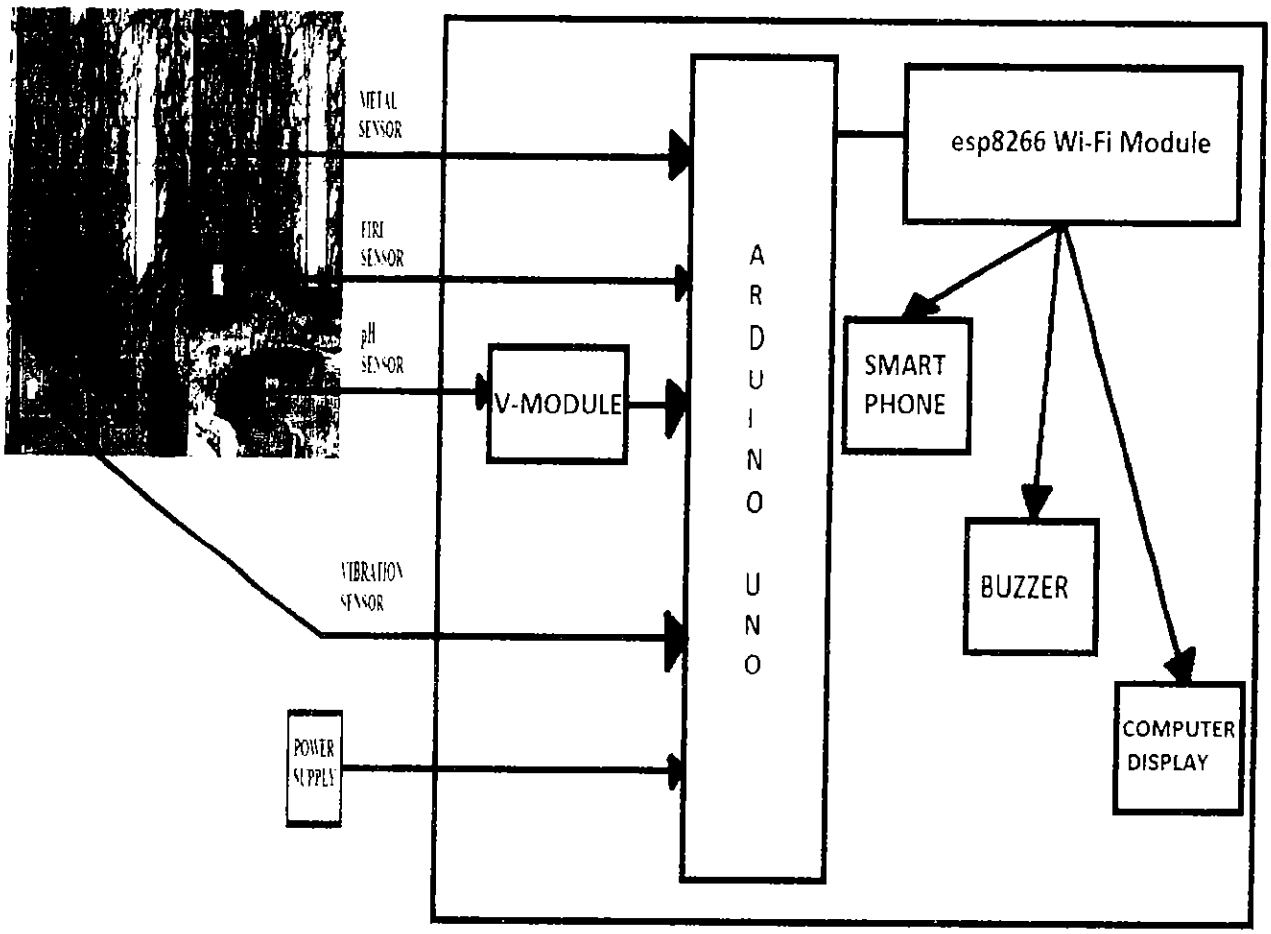


Figure 4.1: Block diagram

The four sensors which are used in this system are placed at different areas of forest. The distance between the adjacent sensors is decided based on their sensitivity. The outputs of all the sensors are collected in the control room. The operating system in control room receives the signal and analyzes the signal if the signal is an alerting message, then the operating system sends the corresponding alerting message to the forest officer or to the authorized person and even it triggers the buzzer in the control room in order to give the alert signal to the operators of control room.

The fire sensors are placed in different areas of the forest. If a fire happens by high temperature or by human activities in any parts of forest. The high temperature or the flame of fire will be detected by the fire sensor and this sensor sends the alerting analog signal to the Arduino UNO module. This module uploads the received o. Arduino UNO analyses the received signal and further sends the alerting message to microcontroller. The microcontroller used in this system is esp8266 Wi-Fi module. This module uploads the received information to the Thingsboard cloud platform. Further, the alerting mail is sent to the forest officer mail id and along with this the buzzer in the forest in the forest office is turned on automatically in order to give intimation to the officers who are present in the forest office.

Set up the vibration sensors in the forest area where the precious sandalwood trees present and also near to the roadways. Suppose unknown people or thief try to do smuggling, the vibration sensor senses the vibration caused by large trucks and any other vehicles that the people used to carry heavy and precious trees. After sensing the vibration, the vibration sensor sends the alerting analog signal to the Arduino UNO. Arduino UNO analyzes the received signal and further sends the alerting message to microcontroller. The microcontroller used in this system is esp8266 module. This module uploads the received information to the Thingsboard cloud platform. Further, the alerting mail is sent to the forest officer mail id and analog with this the buzzer in the forest office is turned on automatically in order to give intimation to the officers who are present in the forest office.

Similarly, set up the metal sensors in different areas of forest. Suppose a thief try to cut the trees, the metal equipment that try to cut the trees. the metal equipment which is used to by the person to cut the trees will be detected by the metal sensors. After sensing the metal, metal sensor sends the alerting message to Arduino UNO along with esp8266, Wi-Fi module analyzes the received signal, and uploads the information to the cloud platform and both together sends an alerting mail to forest officer mail id and also automatically turn on the buzzer in the forest office.

pH sensor is placed at various water bodies of forest. This pH sensor is used to detect whether the water is contaminated or not to determine the quality of water in forest which is essential for trees and animals. The fire sensors, vibration sensors and metal sensors produce the analog signal hence they are directly connected to Arduino UNO. But the pH sensor produces digital signal hence it is connected to V-module. The V-module is in turn connected to esp8266 Wi-Fi module. The pH sensor always indicates the contamination level and quality of water by the pH meter.

All the outputs are always indicated on the screen of forest office computer system in Thingsboard cloud platform dashboard. At the time of sensing operation, the alerting message will be displayed as "Metal Detected", "Vibration Detected" and "Fire Detected" along with the turned-on-buzzer and alerting mail to forest office mobile phone. The computer display always shows th pH meter indicating the quality of water in the forest.

4.1 PROGRAM:

```
#include <SoftwareSerial.h>

////Initialise Arduino to NodeMCU (5=Rx & 6=Tx)

SoftwareSerialnodemcu(5, 6);

int LED_Pin = 13;

int vibr_Pin =9;

float calibration_value = 21.34 - 0.7;

int phval = 0;

unsigned long int avgval;

int buffer_arr[10],temp;

String p1,p2,p3,p4;

float ph_act;

// for the OLED display


void setup(){

pinMode(LED_Pin, OUTPUT);

pinMode(vibr_Pin, INPUT); //set vibr_Pin input for measurment

 Serial.begin(9600); //init serial 9600

nodemcu.begin(9600);

 pinMode(11,OUTPUT);

 // Serial.println("..... Vibration demo.....");

}

void loop(){
```

```
for(int i=0;i<10;i++)
 {
 buffer_arr[i]=analogRead(A0);
delay(30);
 }
for(int i=0;i<9;i++)
 {
for(int j=i+1;j<10;j++)
 {
 if(buffer_arr[i]>buffer_arr[j])
 {
 temp=buffer_arr[i];
 buffer_arr[i]=buffer_arr[j];
 buffer_arr[j]=temp;
 }
 }
 }
 avgval=0;
for(int i=2;i<8;i++)
 avgval+=buffer_arr[i];
 float volt=(float)avgval*5.0/1024/6;
ph_act = -5.70 * volt + calibration_value;
long measurement =TP_init();
delay(50);
 int vibration =0;
if(measurement>10)
 {
```

```
    vibration =1;
    }
    else
    {
    vibration =0;
    }
  // Serial.print("vibration = ");
  // Serial.println(vibration);
    Serial.print("Metaldetector  ");
   int metal=digitalRead(2);
  // Serial.println(metal);
 // Serial.print("Fire = ");
   int fire=digitalRead(4);
 // Serial.println(fire);
 // Serial.print("pH Val: ");
 // Serial.println(ph_act);
 delay(1000);
 if( fire ==0 || vibration ==1 ){
 digitalWrite(11,1);
  }
  else
  {
 digitalWrite(11,0);
  }
  //<ph>,<metal>,<fire>,<vibration>
  p1 = String(ph_act)+","+String(metal)+","+String(fire)+","+String(vibration);
  Serial.println(p1);
```

```
nodemcu.println(pl);
}
long TP_init(){
delay(10);
 long measurement=pulseIn (vibr_Pin, HIGH); //wait for the pin to get HIGH and returns measurement
 return measurement;
}
```

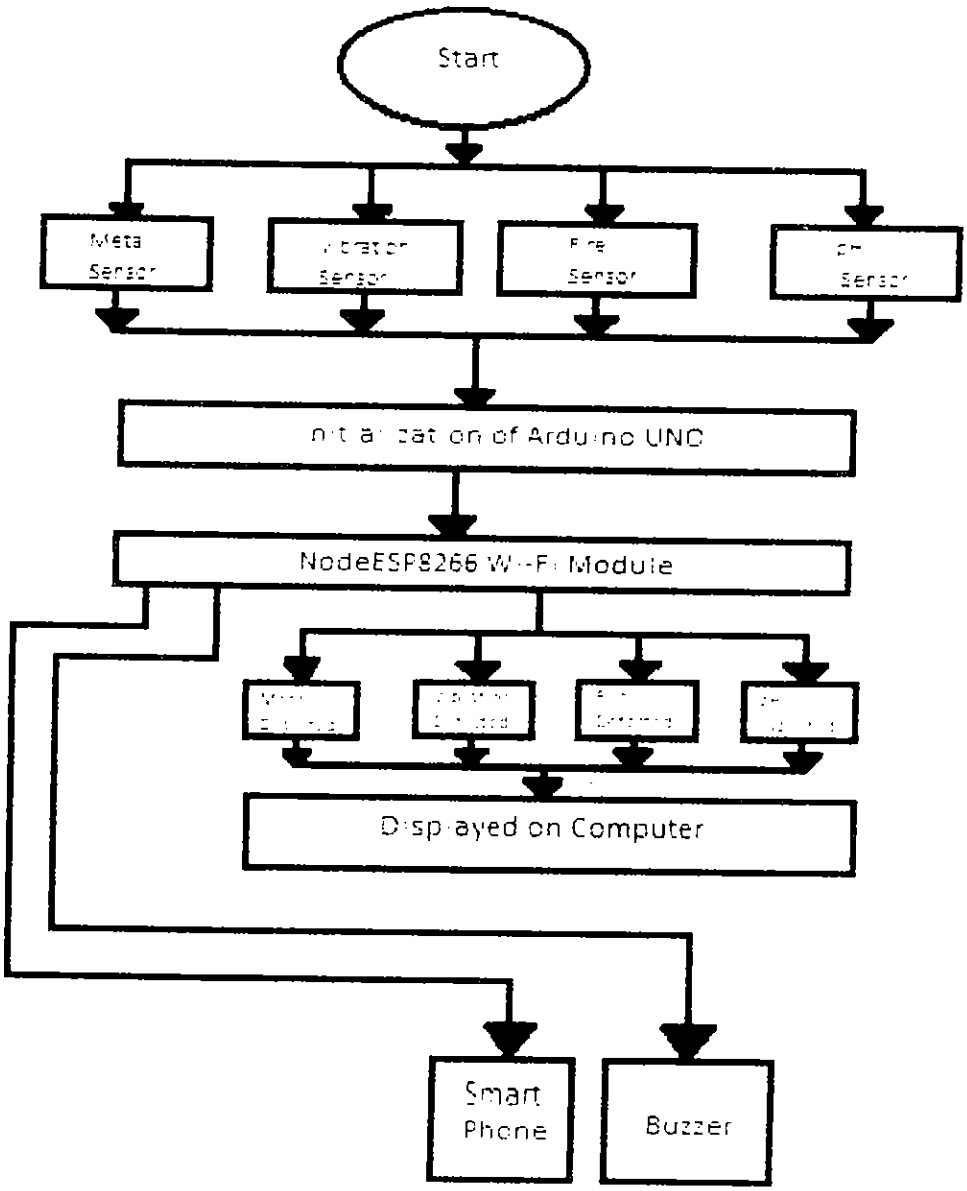


Figure 4.2: Flowchart

CHAPTER-05

COMPONENTS

1. Metal sensor.
2. Fire sensor.
3. Vibration sensor.
4. pH sensor.
5. Arduino UNO.
6. NodeESP8266 Wi-Fi Module.
7. V-Module.
8. Buzzer.
9. Computer.
10. Smart Phone

5.1 METAL SENSOR:

A metal sensor is also known as metal detector. It is an instrument that detects the presence of metal nearby. Metal detectors are useful for finding metal inclusions hidden within objects, or metal object buried under ground. The clever part of the design is the single rectangular coil made by etching one condition track on the printed circuit board.

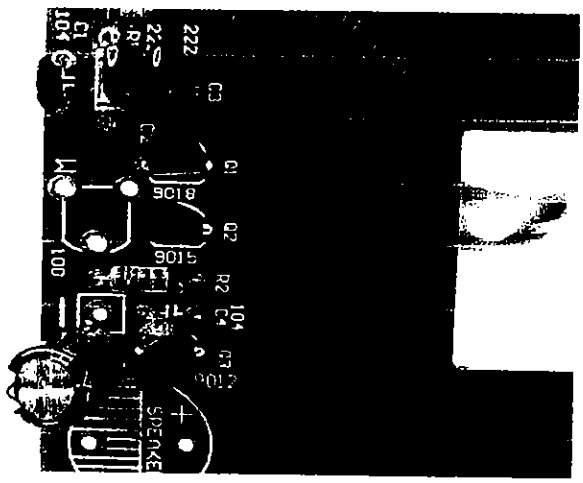


Figure 5.1: Metal sensor

The rectangular coil is tapped at one turn that is a single coil with a precise tapping at one turn. The coil starts at the top side of the double-sided printed circuit board and makes square loops towards the center, A via in the center of the printed circuit board takes the coil to the other side of the printed circuit board and the same set of tracks are on the bottom side.

A commonly available discrete component remains including three bipolar junction transistors, a few resistors, and capacitors. The sounder in the module is a standard active piezo-buzzer, and there"s also a small trimpot to fine-tune the circuit.

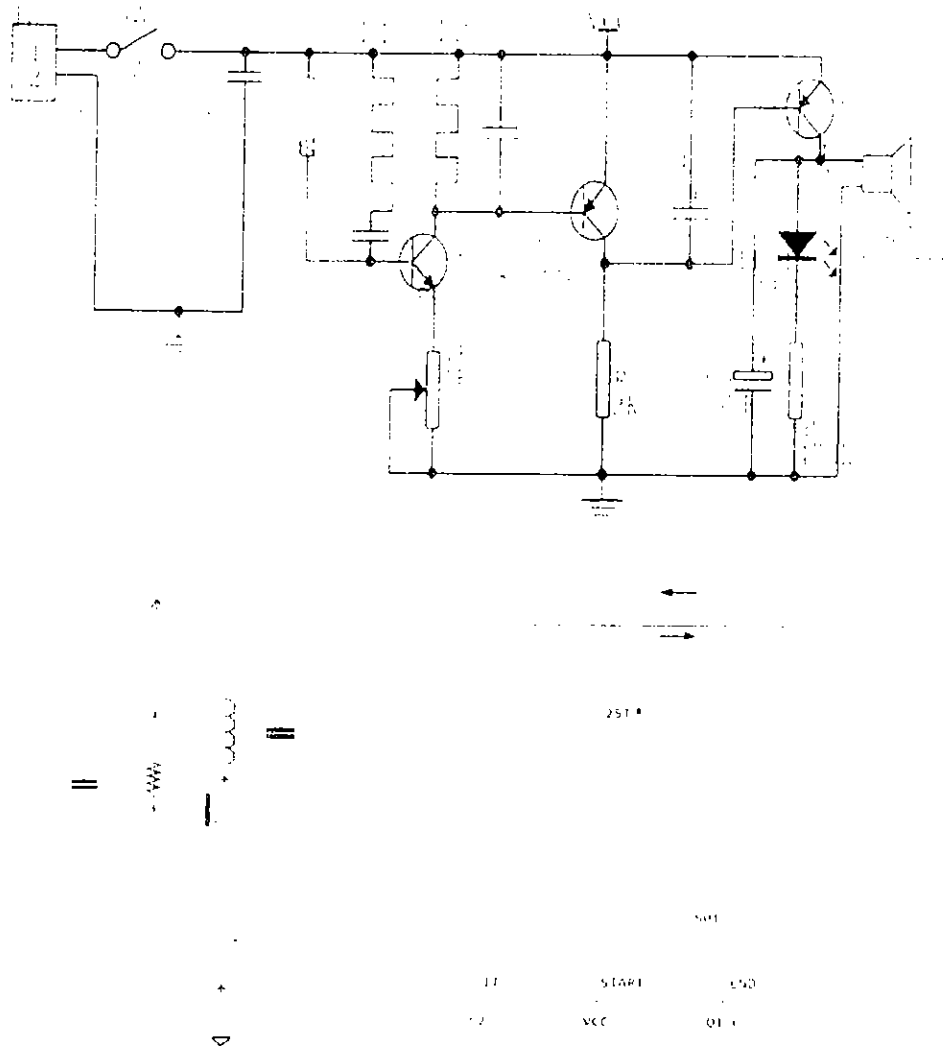


Figure 5.2: Circuit diagram

The above figure shows the schematic diagram of the metal detector module that has a circular coil etched on the printed circuit board and annunciator LED too. The sensor head of the circuit is 50 turns (25T top + 25T bottom)"printed" coil tapped at first turn. The single (1T) feedback coil (L1) is routed to the base of Q1 via C2, and base of Q1 is biased by R1 while end of the coil and the capacitor across it, and hardly needs any other components. But Q1 helps the tuned circuit to generate the sine wave signal as Q1 supplies the essential pulse of energy at the right moment in each cycle.

The signal coming out from L1 is out-of-phase with that L2. L1 will deliver a signal that increases the noise produced by Q1 to create an oscillator that as a certain amplitude. We can control the amplitude by trimpot VR1.

The signal is passed to Q2 were it gets an uplift and prevents C4 being charged via R2, thus disables Q3 and the piezo-sounder SP1 does not make a noise in idle state.

On the other hand, if a metal object is placed in the close vicinity of the coil, amplitude of the magnetic waves from L2 is reduced somewhat together with the amplitude of the oscillator. This effectively disables Q2 but puts a small voltage across the base and emitter of Q3 to fire it slightly. The piezo-sounder then makes a noticeable tone because a small dc voltage is available across its terminals.

The major advantage of this type of metal sensor circuitry is simple construction of both the device and its search-head(coil), but one drawback is its poor sensitivity. This module designed to be operated by any low-current 3V-5VDC power supply, but a 3V(1.5V*2AA or AAA) battery operation is recommended. The oscillator frequency of the circuitry is about 300kHz.

Figure: 5.3: Output Waveform

5.2 FIRE SENSOR:

A fire sensor is a device that can be used to detect presence of a fire sources. There are several ways to implement a fire sensor but the module used in this project is an infrared radiation sensitive sensor.

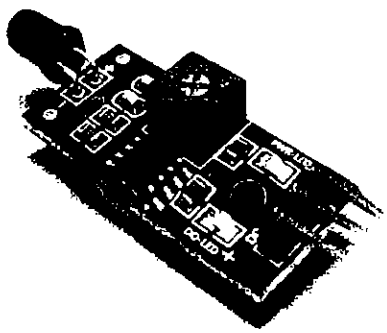


Figure 5.4: Fire Sensor

The figure shows the infrared type flame sensor. This particular flame sensor is based on YG1006 NPN transistor. The black object at the front of the module is this photo transistor. The YG1006 NPN photo transistor looks like a black LED but it is a three terminal NPN transistor, where we long LED is the emitter and the shorter one is the collector (there is no base terminal as the light it detects will enables the flow of current).

This photo transistor is coated with black epoxy, making it sensitive to infrared radiations and this particular photo transistor (YG1006) is sensitive to infrared radiation in the wavelength range of 760mm to 1100nm. Using this particular type of flame sensor, we can detect infrared light up to a distance of 100cm within its 60^0 of deviation angle. The flame sensor that we are using in this project has only digital output.

5.2.1 COMPONENTS OF FLAME SENSOR MODULE:

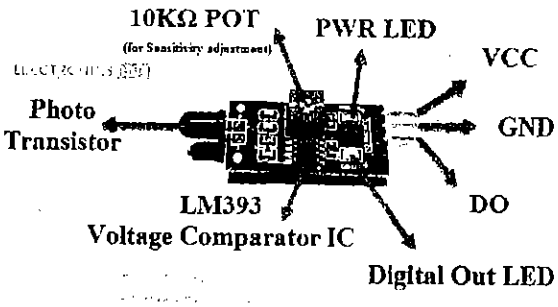


Figure 5.5: Fire Sensor module

The figure shows the components of typical flame sensor module. They are-

- Photo transistor
- LM3933 Voltage Comparator IC
- Digital Out LED.
- DO.
- GND
- VCC
- PWR LED.
- 10KΩ POT

5.2.2 CIRCUIT DIAGRAM OF FLAME SENSOR MODULE:

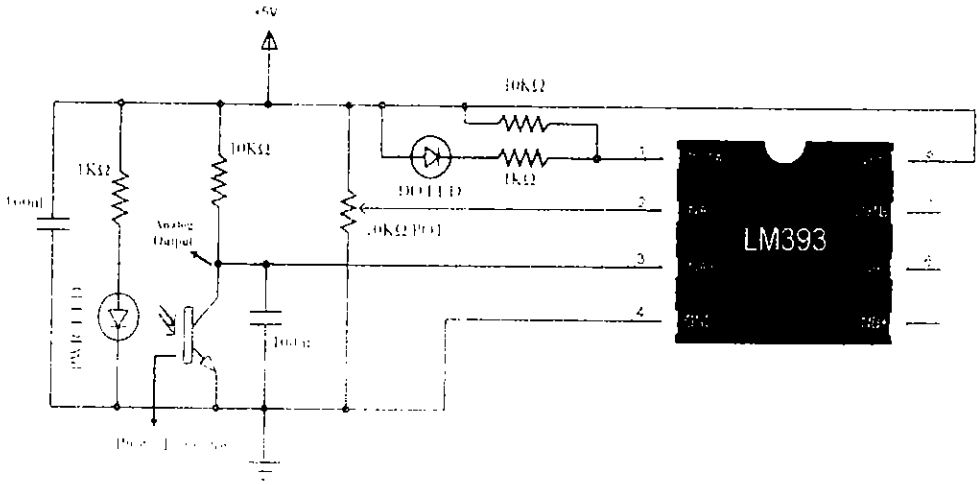


Figure 5.6: Circuit diagram of flame sensor module

5.2.3 CIRCUIT DIAGRAM OF ARDUINO FLAME SENSOR INTERFACE:

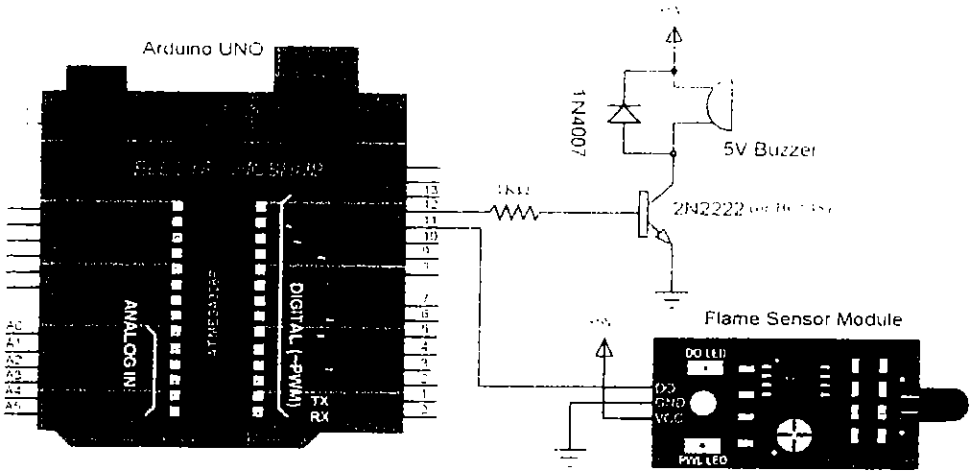


Figure 5.7: Circuit diagram of Arduino flame sensor interface.

Components required-

→ Arduino UNO.
→ Flame Sensor.
→ 2N2222 NPN Transistor.
→ 5V Buzzer.
→ IN4007 PN Junction diode.
→ 1KΩ Resistor.
→ Connecting Wires.
→ Mini breadboard.
→ Power supply.

5.2.4 CIRCUIT DESIGN:

Flame sensor has three pins (some may have four pins(: VCC, GND, and DO. connect VCC and GND to +5V and GND of the power supply (can be connected to Arduino +5V). The DO (short for digital output) is connected to digital I/O Pin 11 of Arduino. In order to indicate the detection of a flame or fire, a buzzer is used. The buzzer circuit consists of a 1KΩ Resistor, an NPN transistor (like 2N2222 or BC548), a 5V buzzer and a PN Junction Diode. The buzzer is driven through digital I/O 12 pin of Arduino UNO

CODE: The code of the Arduino fire sensor is very simple and shown below.

```
int buzzerPin =
int flamePin =
int Flame = HIGH;

void setup()
{
        (buzzerPin, OUTPUT);
        (flamePin, INPUT);
  Serial.    (      );
}

void loop()
{
  Flame =              (flamePin);
if (Flame == LOW)
  {
  Serial.        ("Fire!!!");
            (buzzerPin, HIGH);
  }
else
  {
```

```
        Serial.        ("No worries");
                       (buzzerPin, LOW);
    }
}
```

5.2.5 WORKING:

Make the necessary connections and upload the code to Arduino Uno. To test the functionality of the flame sensor, place a fired lighter or a match stick in front of the sensor. Under the normal conditions, the output from the flame sensor is HIGH. When the sensor detects any fire, its output becomes LOW. Arduino detects this LOW signal on its input pin and activates the buzzer. The on-board 10KΩ potentiometer can be used to adjust the sensitivity of the sensor.

5.2.6 APPLICATIONS:

Flame sensors are very important devices in detecting fire and they can be used in a variety of applications/areas like-

→ Car or Automobile.
→ Fire fighting robots.
→ Garage safety equipment.
→ Warehouse.

5.3 VIBRATION SENSOR:

Hardware:

→ Osoyoo UNO Board (Fully compatible with Arduino UNO rev.3) * 1
→ Bread Board * 1
→ Vibration Sensor Module * 1
→ Jumpers
→ USB Cable * 1
→ PC * 1

Software:

→ Arduino IDE (Version 1.6.4 -)

About vibration sensor module:

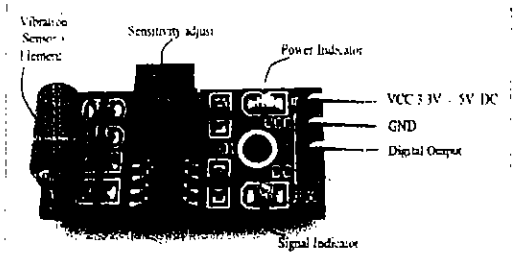


Figure 5.8: Vibration sensor

Vibration sensor module comes with SW-420 vibration sensor, integrated with adjustable sensitivity via on board potentiometer. There are also LED indicators for power and the digital output status on board. It has a simple and straight forward 3-pin interface, VCC, GND, and DO (Digital Output). It supports 3.3V or 5V power.

This vibration sensor module is compatible with any microcontroller that has a digital input, so of course any popular microcontroller such as PIC, Arduino and Raspberry Pi are compatible. A direct interface is essential by using this sensor. The DO pin will be low when there is no vibration, and indicator LED will lit-up.

5.3.1 MODULE FEATURES:

→ SW-420 using the company's production of normally closed type vibration sensor.

→ The compensator output, the signal is clean waveform, the driving ability to exceed 15mA.

→ Operating voltage 3.3V to 5V.

→ The output in the form of: Digital switching outputs (0 and 1).

→ A fixed bolt hole for easy installation.

→ A small board PCB size: 3.2cm * 1.4cm.

→ Wide voltage LM393 compensator.

5.3.2 USES:

The vibration sensor can be used to detect vibration from any angle. There is an on-board potentiometer to adjust for the threshold of vibration. It outputs logic high when this module not triggered while logic low when triggered.

5.3.3 APPLICATION IDEA:

→ Automobiles alarm.

→ Movement detection.

→ Vibration detecting application features.

5.3.4 EXAMPLES:

Connect VCC-pin of sensor board to 5V pin of Arduino board, connect GND pin to GND pin of Arduino. Connect DO output signal pin of sensor board to Arduino digital pin D3. Do some calibration and calibration and adjust the sensitivity threshold, then upload the following sketch to Arduino board.

Vibration Sensor Module	OSOYOO UNO
VCC	5V
GND	GND
DO	PIN3

Table 5.1: Examples

5.3.5 ARDUINO CODE FOR LOGIC STATE OUPUT:

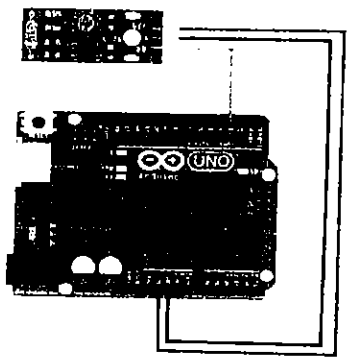


Figure 5.9: Arduino code for logic state output

In this project, we will connect Arduino with vibration sensor and LED. When no vibration is detected, vibration sensor output is 0 (low voltage), otherwise its output is 1 (high voltage). If Arduino get 0 (no vibration) from vibration sensor it will turn on green LED and turn off Red LED. If Arduino get 1 form vibration sensor, it will turn on Red LED and turn off green LED. (Please choose the correct board type and correct port com for your Arduino IDE).

```
vib_pin = 3;

led_pin = 13;

    () 

{

    (vib_pin,      );

    (led_pin,      );

}
```

```
                ()
{
  val;
val =                (vib_pin);
  (val == 1)
{
                (led_pin,        );
        (1000);
                (led_pin,        );
        (1000);
}

                (led_pin,        );
}
```

5.3.6 ARDUINO CODE FOR VALUE READING:

Arduino code for value reading and serial printing vibration value, this code turns ON the onboard LED when measurement goes greater than 1000, you can adjust this threshold to your need.

```
LED_pin = 13;
vibr_pin = 3;
                ()
{
                (LED_pin,        );
                (vibr_pin,       );
                Begin(9600)
}
                ()
```

```
{
    measurement = TP_init();
delay (50);
Serial.println (measurement);
}
if (measurement>1000)
{
digitalWrite (LED_pin,      );
}
else
{
digitalWrite (LED_pin,      );
}
{
    Tp_init()
}
delay (10);
    measurement = pulseIn (vib_pin,      );
    return measurement;
}
```

5.4 pH SENSOR:

Figure 5.10: Arduino pH meter

pH scale is used to measure the acidity and basicity of a liquid. It can have readings ranging from 1-14 where 1 shows the most acidic liquid and 14 shows the most basic liquid. 7pH is for neutral substances that are neither acidic nor basic. Now, pH plays a very important role in our lives and it is used in various applications. pH measurements is used in a wide variety of applications like agriculture, waste treatment, industries, environmental monitoring, etc.

In this project, we are going to make an Arduino pH meter and learn how to measure the pH of a solution using a gravity pH sensor and Arduino. A 16 * 2 LCD is used to show the pH value on the screen. We will also learn how to calibrate the pH sensor to determine the accuracy of the sensor. The module has an on-board voltage regulator chip which supports the wide voltage supply of 3.3-5.5V DC, which is compatible with 5V and 3.3V of any control board like Arduino. The output signal is being filtered by hardware low jitter.

Required components-

→ Arduino UNO.
→ 16 * 2 Alphanumeric LCD.
→ I2C Module for LCD.
→ Gravity analog pH sensor.
→ Connecting wires.
→ Breadboard.

5.4.1 SIGNAL CONVERSION MODULE:

→ BNC Probe Connector
→ High Accuracy: ±0.1 @ 25 °C
→ Detection Range: 0- 15
→

5.4.2 pH ELECTRODE:

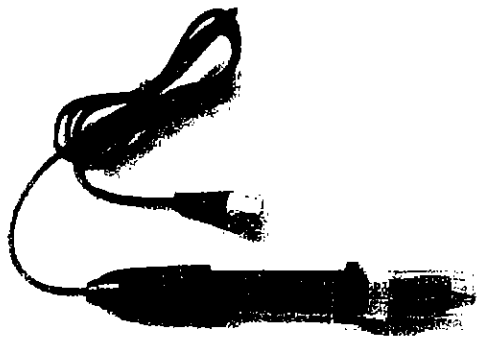


Figure 5.11: pH Sensor.

→ Operating Temperature Range: 5~60°C
→ Zero (Neutral) point: 7±0.5
→ Easy calibration
→ Internal Resistance:~250MΩ

5.4.3 pH SIGNAL CONVERSION BOARD:

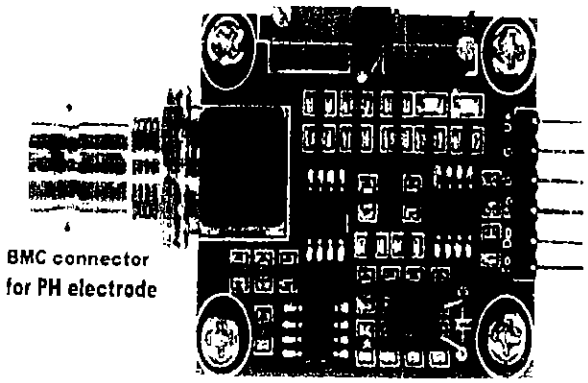


Figure 5.12: pH Sensor Conversion Board

5.4.4 PIN DESCRIPTION:

V+ :5V DC input
G : Ground pin
Po : pH analog output
Do : 3.3V DC output
To : Temperature output

5.4.5 pH ELECTRODE CONSTRUCTION:

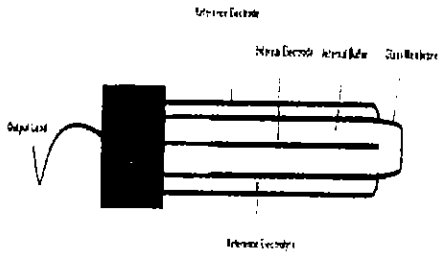


Figure 5.13: pH Electrode

The construction of a pH sensor is shown beside. The pH sensor looks like rod usually made of a glass material having a tip called "Glass membrane". This membrane is filled with a buffer solution of known pH (typically pH=7).This electrode design ensures an environment with the constant binding of H^+ ions inside of the glass membrane. When the probe is dipped into the solution to be tested, hydrogen ions in the test solution start exchanging with other positively charged ions on the glass membrane, which creates an electrochemical potential across the membrane which is fed to electronic amplifier module which measures the potential determines the pH value based on Nernst equation.

5.4.6 ARDUINO pH METER CIRCUIT DIAGRAM:

Circuit diagram for this Arduino pH meter project given below.

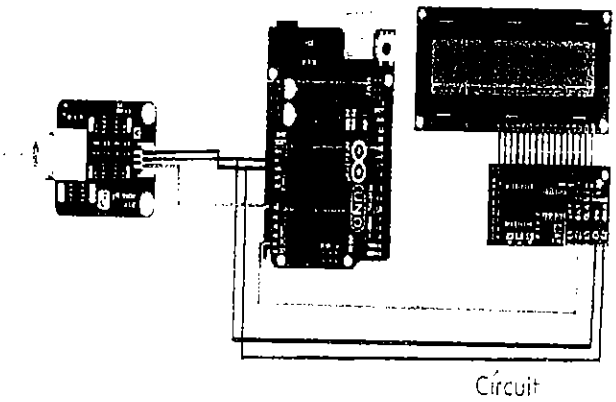


Figure 5.14: Arduino pH meter circuit diagram

5.4.7 CONNECTION OF pH SIGNAL CONVERSION BOARD WITH ARDUINO:

The connection between Arduino and pH signal conversion board is shown in the table below-

Arduino	pH sensor board
5V	V+
GND	G
AO	PO

Table 5.2: Connection between Arduino and pH Signal Conversion Board

5.4.8 PROGRAMMING ARDUINO FOR pH METER:

```
#include<Wire.h>
#include<LiquidCrystal_I2C.h>
Liquid Crystal_I2C lcd(0*27, 16, 2);
    calibration_value = 21.34;
  phval = 0;
                avgval;
  buffer_arr[10],temp;
   setup()
{
Serial.begin(9600);
```

```
lcd.init();
lcd.begin(16,2);
lcd.backlight();
lcd.setcursor(0,0);
lcd.print("Welcome to ");
lcd.setCursor(0,1);
lcd.print("Circuit Digest");
      (2000);
lcd.clear();
}
    loop()
{
   (int i=0;i<10;i++)
{
buffer_arr[i]=analogRead(A0);
delay(30);
}
   (int i=0; i<9; i++)
{
   (int j=i; j<10; j++)
{
  (buffer_arr[i]>buffer_arr[i])
{
temp=buffer_arr[i];
buffer_arr[i]=buffer_arr[j];
buffer_arr[j]=temp;
}
}
}

avgval=0;
  (int i=2;i<8; i++)
avgval+=buffer_arr[i];
      volt=(float)avgval*5.0/1024/6;
   ph_act=-5.70*volt+calibration_value;
lcd.setCursor(0,0);
lcd.print("pH val:");
lcd.setcursor(8,0);
lcd.print(ph_act);
delay(1000);
}
```

5.4.9 CALIBRATION OF pH ELECTRODE:

Calibration of the pH electrode is very important in this project. For this, we need to have a solution whose value is known to us. This can be taken as the reference solution for the calibration of the sensor.

Suppose, we have a solution whose pH value is 7 (distilled water). Now when the electrode is dipped in the reference solution and the pH value displayed on LCD is 6.5. Then to calibrate it, just add 7-6.5=0.5 in the calibration variable "Calibration Value" in the code. That is, make the value 21.34+0.5 21.85. After making these changes, again upload the code to Arduino and recheck the pH by dipping electrode in the reference solution. Now LCD should show the correct pH value that is 7 (little variations are considerable). Similarly, adjust this variable to calibrate the sensor.

5.5 ARDUINO UNO MICROCONTROLLER:

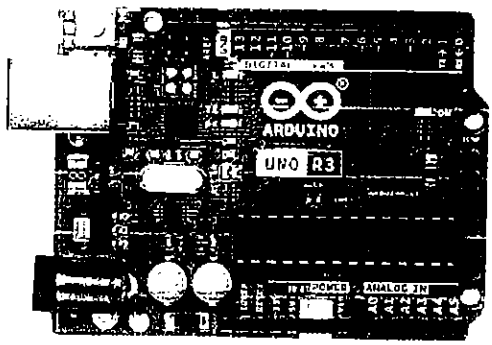


Figure 5.15: Arduino UNO Microcontroller

Arduino UNO is a microcontroller board on the ATmega328P (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16MHz ceramic resonator (CSTCE16M0V53-R0), a USB connection ,a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

"UNO" means one in Italian and was chosen to mark the release of Arduino software (IDE) 1.0. The UNO board and version 1.0 of Arduino Software(IDE) were the reference versions of Arduino, now evolved to newer releases. The UNO board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform; for an extensive list of current, past or outdated boards see the Arduino index of boards.

5.5.1 TECHNICAL SPECIFICATIONS:

MICROCONTROLLER	ATmega328P
OPERATING VOLTAGE	5V
INPUT VOLTAGE (RECOMMENDED)	7-12V
INPUT VOLTAGE(LIMIT)	6-20V
DIGITAL I/O PINS	14(of which 6 provide PWM output)
PWM DIGITAL I/O PINS	6
ANALOG INPUT PINS	6
DC CURRENT PER I/O PIN	20mA
DC CURRENT FOR 3.3V PIN	50mA
FLASH MEMORY	32KB (ATmega328P) of 0.5KB used by bootloader
SRAM	2KB (ATmega328P)
EEPROM	1KB (ATmega328P)
CLOCK SPEED	16 MHz
LED_BUILTIN	13
LENGTH	68.6mm
WIDTH	53.4mm
WEIGHT	25g

Table 5.3: Technical Specifications of pH sensor:

5.5.2 PINOUT DIAGRAM:

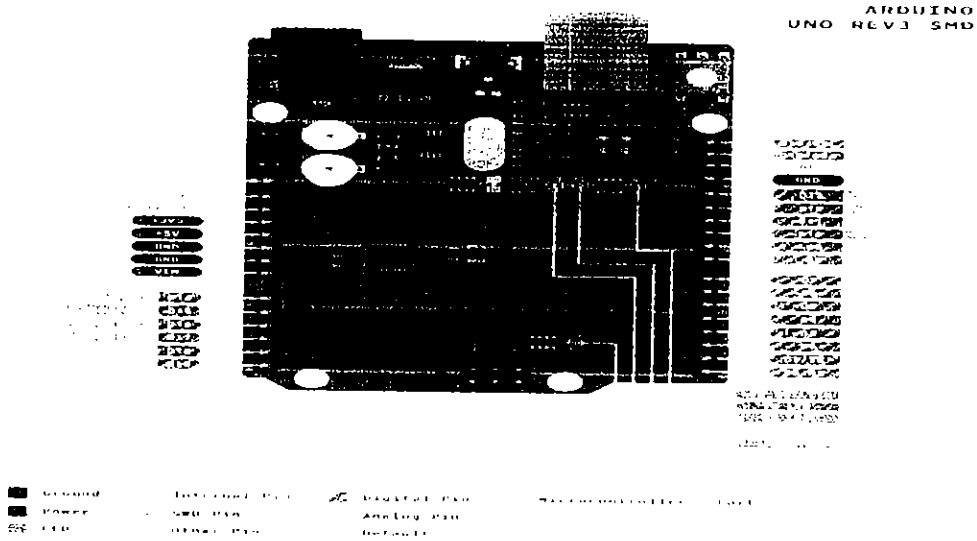


Figure 5.16: Pinout Diagram

The Arduino UNO can be programmed with the (Arduino Software (IDE)). Select "Arduino UNO from the tools>Board menu (according to the microcontroller on your board).

The ATmega328 on the Arduino comes preprogrammed with a boot ladder that allows you to upload new code to it without the use of an external hardware programmer. It the ATmega16U2 (or 8U2 in the rev1 and rev2 boards) firmware source code is available in the Arduino repository. The ATmega16U2/8U2 is loaded with a DFU bootloader, which can be activated by:

→ On Rev1 boards: Connecting the solder jumper on the back of the board (near the map of Italy) and then resetting the 8U2.
→ On Rev2 or later boards: there is a resistor that pulling the 8U2/16U2 HWB line to ground, making it easier to put into DFU mode.

5.5.3 POWER:

The Arduino UNO board can be powered via the USB connection or with an external power supply. The power source is selected automatically. External (non-USB) power can come either from an AC-to-DC adapter (wall-wart) or battery. The adapter can be connected by plugging a 2.1mm center-positive plug into the board's power jack. Leads from a battery can be inserted in the GND and Vin pin headers of the POWER connector.

The board can operate on an external supply from 6 to 20 volts. If supplied with less than 7V, however, the 5V pin may supply less than five volts and the board may become unstable. If using more than 12V, the voltage regulator may overheat and damage the board. The recommended range is 7 to 12 volts.

The power pins are as follows:

→ Vin. The input voltage to the Arduino board when it's using an external power source (as opposed to 5 volts from the USB connection or other regulated power source). You can supply voltage through this pin, or, if supplying voltage via the power jack, access it through this pin.
→ 5V. this pin outputs a regulated 5V from the regulator on the board. The board can ne supplied with power either from the DC power jack (7-12V), the USB connector (5V), or the VIN pin of the board (7-12V). Supplying voltage via the 5V or 3.3V pins bypasses the regulator, and can damage your board.
→ 3V 3A 3.3V supply generated by the on-board regulator. Maximum current drawn is 50mA.
→ GND. Ground pins.
→ IOREF. This pin on the Arduino board provides the voltage reference with which the microcontroller operates. A properly configured shied can read the IOREF pin voltage and select the appropriate power source or enable voltage translators on the outputs to work with 5V or 3.3V.

5.5.4 MEMORY:

The ATmega328 has 32KB (with 0.5KB occupied by the bootloader). It also has 2KB of SRAM and 1KB of EPROM (which can be read and written with the EEPROM library).

5.5.5 INPUT AND OUTPUT:

→ See the mapping between Arduino pins and ATmega328P ports. The mapping for the ATmega8, 168 and 328 is identical

Each of the 14 digital pins on the Uno can be used as an input or output, using pinMode (), digitalWrite () and digital Read () functions. They operate at 5 volts. Each pin can provide or receive 20mA as recommended operating conditions and has an internal pull-up resistor (disconnected by default) of 20-50kΩ. A maximum of 40mA is the value that must not be exceeded on any I/O pin to avoid permanent damage to the microcontroller.

In addition, some pins have specialized functions:

→ Serial: 0 (RX) and 1 (TX). Used to receive (RX) and transmit (TX) TTL serial data. These pins are connected to the corresponding pins of the ATmega8U2 USB-to-TTL Serial chip.

→ External interrupts: 2 and 3. These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value. See the attach interrupt () function for details.

→ PWM: 3, 5, 6, 9, 10 and 11. Provide 8-bit PWM output with the analog Write () functions.

→ SPI: 10 (SS), 11 (MOSI), 12 (MISO), 13 (SCK). These pins support SPI communication using the SPI library.

→ LED: 13. There is a built-in LED driven by digital pin 13. When the pin is HIGH value, then LED is on, when the pin is LOW, it"s off.

→ TWI: A4 or SDA pin and SCL pin. Support TWI communication using the wire library.

The UNO has 6 analog inputs, labeled A0 through A5, each of which provide 10 bits of resolution (i.e., 1024 different values). By default, they measure from ground to 5 volts, through is it possible to change the upper end of their range using the AREF pin and the analog Reference () function. There are a couple of other pins on the board.

→ AREF. Reference voltage for the analog inputs. Used with analog Reference ().

→ Reset. Bring this line LOW to reset the microcontroller. Typically used to add a reset button to shields which van block the one on the board.

AFFIDAVIT-8

AUTHERISATION OWNER OF THE INSTALLATION TO THE LICENCED ELECTRICAL CONTRACTOR (UNDER RULE 16)

(to be executed on stamp paper as per the Karnataka stamp act 1957)

I, **MUTTUVALLI MUSLIM SHADI MAHAL DOULATHPURA VILLAGE, SANDUR.,** do here by solemnly authorize the Licensed Electrical Contractor **VAZIR BASHA.L** Proprietor of **MOHAMMED ELECTRICALS** License Number: **1CL04898BLY** CLASS I. Valid Up to **30/04/2024** to carry out the Electrical Installation Work site at **DOULATHPURA VILLAGE, SANDUR.** On behalf of myself & my firm as per the agreement executed on **02/05/2023** as per the agreement executed by the undersigned with following conditions as marked.

1) The said electrical contractor is ONLY authorized to execute the electrical installation work and issue work completion report and other relevant as required for inspection and approval by the authorities concerned to the owner of electrical installation.
2) The said electrical contractor is authorized to execute the electrical installation work and to approach the Electrical Inspectorate/concerned authorities for obtaining Electrical Installation Drawing and commissioning approval of above said electrical installation.

I also state and solemnly affirm and state on oath as follows that whatever stated and furnished by me as above are true to the best of my knowledge, the breach of which may entail cancellation of agreement executed between the parties and termination of work order of electrical contractor and requesting the department pf Electrical Inspectorate to suspend/ cancellation of license.

Specimen Sign of LEC with firm seal and Address	Specimen Sign Owner of the Installation
1.	1.
2.	2.
3.	3.

SWORN TO BEFORE ME

5.5.6 COMMUNICATION:

The Arduino UNO has a number of facilities for communicating with a computer, another Arduino board, or other microcontrollers. The ATmega328 provides UART TTL (5V) serial communication, which is available on digital pins 0 (RX) and 1 (TX). An ATmega16U2 on the board channels this serial communication over USB and appears as a virtual com port to software on the computer. The 16U2 firmware uses the standard USB COM drivers, and no external driver is needed. The Arduino Software (IDE) includes a serial monitor which allows simple textual data to be sent to and from the board. The RX and TX LEDs on the board will flash when data is being transmitted via the USB-to-serial chip and USB connection to the computer (but not for serial communication on pins 0 and 1). A software serial library allows serial communication on any of the UNO"s digital pins.

The ATmega328 also supports I2C (TWI) and SPI communication. The Arduino software (IDE) includes a wire library to simplify use of the I2C bus; see the documentation for details. For SPI communication, we use SPI library.

5.5.7 AUTOMATIC(SOFTWARE) RESET:

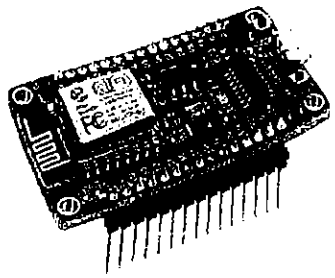
Rather than requiring a physical press of the reset button before an upload, the Arduino UNO board is designed in a way that allows it to be rest by software running on a connected computer. One of the hardware flow control lines (DTR) of ARmega8U2/16U2 is connected to the reset line of the ATmega328 via a 100 nano-farad capacitor. When this line is asserted (taken low), the reset line drops long enough to reset the chip. The Arduino Software (IDE) uses this capability to allow you to upload code by simply pressing the timeout, as the lowering of DTR can be well-coordinated with the start of the upload.

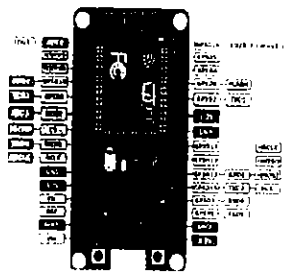
This setup has other implications, When the UNO is connected to either a computer running Mac OS X or Linux, it resets each time a connection is made to it from software (via USB). For the following half-second or so, the bootloader is running on the UNO. While it is programmed to ignore malformed data (i.e., anything besides an upload of new code), it will intercept the few bytes of data sent to the board after a connection is opened. If a sketch running on the board receives one-time configuration or other data when it first starts, make sure that the software with which it communicates waits a second after opening the communication and before sending this data.

The UNO board contains a trace that can be cut to disable the auto-reset. The pads on either side of the trace can be soldered together to re-enable it. It"s labeled "RESET-EN". We may also be able to disable the auto-reset by connecting a 110Ω resistor from 5V to the reset line.

5.6 NodeMCU ESP8266 WI-FI MODULE:

Node MCU is an open-source Lua based firmware and development board specially targeted for IoT based applications. It indicates firmware that runs on the ESP8266 Wi-Fi SoC from Express if systems, and hardware which is based on the ESP-12 module.





ESP8266NODEMCU

Figure 5.17: NodeMCU ESP8266 Wi-Fi Module

5.6.1 NodeMCU DEVELOPMENT BOARD PINOUT CONFIGURATION:

Pin Category	Name	Description
Power	Micro-USB, 3.3V,GND,Vin	Micro-USB; NodeMCU can be powered through the USB port. 3.3V: Regulated 3.3V can be supplied to ths pin to power the board. GND: Ground pins Vin: External Power Supply
Control Pins	EN, RST	The pin and the button resets the microcontroller.
Analog pin	A0	Used to measure analog voltage in the range of 0-3.3V
GPIO Pins	GPIO1 to GPIO16	NodeMCU has 16 general purpose input-output pins on its board.
SPI Pins	SD1, CMD, SD0,CLK	NodeMCU has four pins available for SPI communication.
UART Pins	TXD0, RXD0, TXD2,RXD2	NodeMCU has two UART interfaces, UART0 (RXD0 & TXD0) and UART1 (RXD1 & TXD1). UART1 is used to upload the firmware/program.
I2C Pins		NodeMCU has I2C functionality support but due to the internal functionality of these pins, you have to find which pin is I2C.

Table 5.4: NodeMCU Development Board Pinout Configuration.

5.6.2 NodeMCU ESP8266 Specifications and Features:

→ Microcontroller: Ten silica 32-bit RISC CPU Xtensa LX106
→ Operating voltage: 3.3V
→ Input Voltage: 7-12V
→ Digital I/O Pins: 16
→ Analog Input Pins (ADC): 1
→ UARTs: 1
→ SPIs: 1
→ I2Cs: 1
→ Flash Memory: 4MB
→ SRAM: 64KB
→ Clock Speed: 80MHz
→ USB-TTL based on CP2102 is included onboard, enabling plug n play
→ PCB Antenna
→ Small Sized module to fit smartly inside your IoT projects.

5.6.3 ABOUT NodeMCU ESP8266:

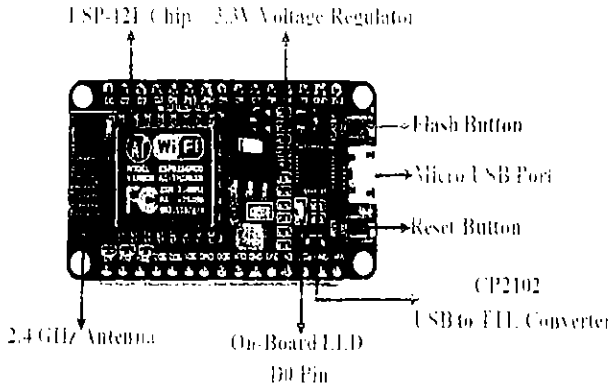


Figure 5.18: Pin Diagram of NodeMCU ESP8266.

The NodeMCU8266 development board comes with the ESP-12E module containing the ESP8266 chip having Ten silica Xtensa 32-bit LX106 RISC microprocessor. This microprocessor supports RTOS and operates at 80MHz to 160MHz adjustable clock frequency. NodeMCU has 128KB RAM and 4MB of flash memory to store data and programs. Its high processing power with in-built Wi-Fi/Bluetooth and Deep Sleep Operating features make it ideal for IoT projects.

NodeMCU can be powered using a Micro USB jack and VIN pin (External Supply Pin). It supports UART, SPI and I2C interface.

5.6.4 PROGRAMMING NodeMCU ESP8266 WITH ARDUINO IDE:

The NodeMCU Development Board can be easily programmed with Arduino IDE since it is easy to use. Programming NodeMCU with the Arduino IDE will hardly take 5-10 minutes. All you need is the Arduino IDE, a USB cable the NodeMCU board itself.

5.6.5 UPLOADING YOUR FIRST PROGRAM:

Once Arduino IDE is installed on the computer, connect the board with the computer using the USB cable. Now open Arduino IDE and choose the correct board by selecting Tools>Boards>NodeMCU1.0 (ESP-12E Module), and choose the correct port by selecting Tools>Port. To get it started with the NodeMCU board and blink the built-in LED, load the example code by selecting Files>Examples>Basics>Blink. Once the example code is loaded into your IDE, click on the „upload" button given on the top bar. Once the upload is finished, you should see the built-in LED of the board blinking.

5.6.6 APPLICATIONS:

→ Prototyping of IoT devices.
→ Low power battery operated applications.
→ Network projects.
→ Projects requiring multiple I/O interfaces with Wi-Fi and Bluetooth functionalities.

5.7 V-MODULE:

V-module is a system that converts a digital signal into an analog signal. There are several DAC for a particular application is determined by figures of merit including: resolution, maximum sampling frequency and others. Digital-to-analog conversion can degrade a signal, so a DAC should be specified that has insignificant errors in terms of the application. Due to the complexity and the need for precisely matched components, all but the most specialized DACs are implemented as integrated circuits (ICs). These typically take the form of metal-oxide-semiconductor (MOS) mixed-signal integrated circuit chips that integrate both analog and digital circuits.

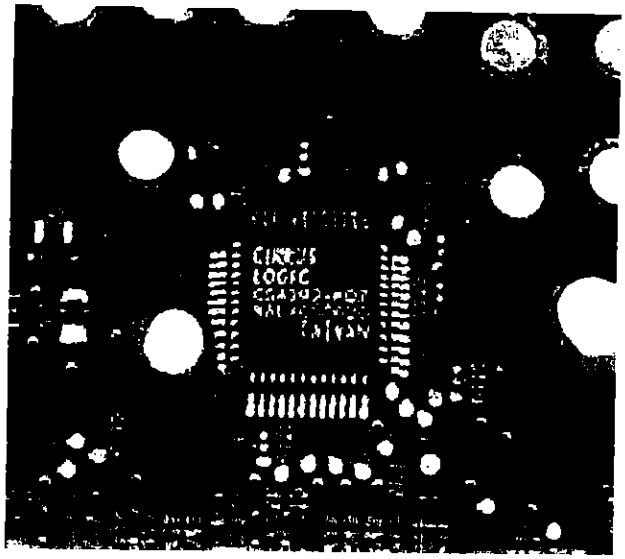


Figure 5.19: V-Module

DACs and ADCs are part of an enabling technology that has contributed greatly to the digital revolution. To illustrate, consider a typical long-distance telephone call. The caller's voice is converted into an analog electrical signal by a microphone, then the analog signal is converted to a digital stream by an ADC. The digital stream is then divided into network packets where it may be sent along with other digital data, not necessarily audio. The packets are then received at the destination, but each packet may take a completely different route and may not even arrive at the destination in the correct time order. The digital voice data is then extracted from the packets and assembled into a digital stream. An ADC converts this back into an analog electrical signal, which drives an audio amplifier, which in turn drives a loudspeaker, which finally produces sound.

4.7.1 PERFORMANCE:

The number of possible output levels the DAC is designed to reproduce. This is usually stated as the number of bits it uses, which is the binary logarithm of the number of levels. For instance, a 1-bit DAC is designed to reproduce 2(21)levels while a 8-bit DAC is designed for 256(28) levels. Resolution is related to the effective number of bits which is a measurement of the actual resolution attained by the DAC. Resolution determines color depth in video applications and audio bit depth in audio applications.

Maximum sampling rate:

The maximum speed at which the DACs circuitry can operate and still produce correct output. The Nyquist-Shannon sampling theorem defines a relationship between this and the bandwidth of the sampled signal.

Monotonicity:

The ability of a DACs analog output to move only in the direction that the digital input moves (i.e., if the input increases, the output doesn't dip before asserting the correct output). This characteristic is very important for DACs used as a low-frequency signal source or as a digitally programmable trim element.

Total harmonic distortion and noise:

A measurement of the distortion and noise introduced to the signal by the DAC. It is expressed as a percentage of the total power of unwanted harmonic distortion and noise that accompanies the desired signal.

Dynamic range:

A measurement of the difference between the largest and smallest signals the DAC can reproduce expressed in decibels. This is usually related to resolution and noise floor. Other measurements, such as phase distortion and jitter, can also be very important for some applications, some of which (e.g., wireless data transmission, composite video) may even rely on accurate production of phase-adjusted signals.

Non-linear PCM encodings (A-law, ADPCM, NICAM) attempt to improve their effective ranges by using logarithmic step sizes between the output signal strengths represented by each data bit. This trades greater qualification distortion of loud signals for better performance of quiet signals.

5.8 BUZZER:

A buzzer or beeper is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric (piezo for short). Typical uses of buzzers and beepers includes alarm devices, timers, train and confirmation of user input such as a mouse click or keystroke, piezoelectric buzzers, or piezo buzzers, as they are sometimes called, were invented by Japanese manufactures and fitted into a wide array of products during the 1970s to 1980s. This advancement mainly came about because of corporative efforts by Japanese manufacturing companies. In 1951, they established the barium Titanate Application Research Committee, which allowed the companies to be "competitively corporative" and bring about several piezoelectric innovations and inventions.

Early devices were based on an electromechanical system identical to an electric bell without the metal gong. Similarly, a relay may be connected to interrupt its own actuating current, causing the contacts to buzz (the contacts buzz at line frequency if powered by alternating current) often these were anchored to a wall or ceiling to use it as a sounding board. The word "buzzer" comes from the rasping noise that electromechanical buzzers made. A joy buzzer is an example of a purely mechanical buzzer and they require drivers. Other examples of them are doorbells. A piezoelectric element may be driven by an oscillating electronic circuit or a button has been presses are a button has been pressed are a click, a ring or a beep. A piezoelectric buzzer/beeper also depends on acoustic cavity resonance or Helmholtz resonance to produce an audible beep.

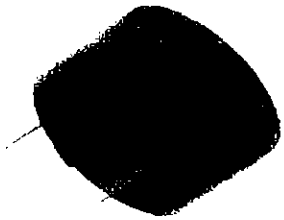


Figure 5.20: Buzzer

5.9 COMPUTER:

Computer includes measurement, reporting and verification (MVR) functions and aim to produce high-quality, reliable data on forests. It displays the outputs of all the sensors and it also displays pH meter. It also helps in monitoring of operating system in forest.

5.10 SMARTPHONE:

Smartphone is used for messaging and people do this for both business and leisure purposes. Here the NodeESP8266 Wi-Fi Module send the alerting message that is received from the sensors to the smartphone of forest officer in order to intimate the forest about the emergencies.

CHAPTER-06

ADVANTAGES, DISADVANTAGES AND APPLICATIONS

6.1 ADVANTAGES:

1. Assists smarter control for deforestation.
2. Reduces the requirements of man power.
3. More reliable than man.
4. Time saving and avoids illegal logging
5. Environmentally friendly and pollution free.

6.2 DISADVANTAGES:

1. Protection of sensors will be an issue.

6.3 APPLICATIONS:

1. Safeguarding of forest.
2. This project can be used in the forest to save the trees.
3. The concept can be used to save sandal.

CHAPTER-07

CONCLUSION

A system has been proposed for forest fire detection, tree cutting detection which overcomes the constraints of the existing technologies. The four major operations that are essential in monitoring the forest are developed in this work. This system helps in safeguarding the forest where it is most important to the world in terms of food and oxygen. There are many ways to protect the trees however a light procedure for inserting a few sensors around the trees with an Arduino has been done by this we can save our precious trees like sandalwood etc. this concept is developed using IOT technology.

CHAPTER-08

FUTURE SCOPE

Although it is claimed that a smart module is being developed to protect trees, future improvements are needed to make the system more simple. The unit/ Hardware/ Sensors should be hard. The fenced area should be made. The module should be located in an inaccessible area of trees, not easily accessible to tree destroyers. Forest official must be properly trained. In future, we will refresh the framework with additional features like interfacing vibration sensor for precise detection of tree cutting, expanding the scope of detecting of the fire sensor, and scanning of id for the authentication purpose so the illicit lumberjacks can be distinguished.

CHAPTER-09

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Automatic Monitoring of Deforestation using Arduino

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Abstract: *The manual monitoring of the forest to prevent unauthorized activities is practically difficult job The three major operations that are essential in monitoring the forest are developed in this work, namely tree cutting detection, fire detection and contaminated water detection using metal sensor, vibration sensor firesensor and pH sensor respectively. An Arduino Uno is used along with GSM to communicate to central server from remote place. The sensed data from sensors is collected and sent to the authorized person via GSM. In addition, this system uses Wi-Fi router module through which employee and forest officer can communicate with each other in case of network is disabled*

Keywords: Forest, Monitoring

I. INTRODUCTION

Forest is very important in our life: all the living creatures depend on forest for survival. Trees help the living organisms to breathe by pumping out the oxygen and absorbing the carbon dioxide. Therefore, vegetation is very important for removing the carbon dioxide from the air. But, over the past two decades, poaching and smuggling of trees as increased dramatically. The illegal activities along with the natural fire and the fire due to human being in forest has decreased the total area of forest from 45% to 28.95% on our planet. In order to reduce the deforestation, the system that detects the illegal activities and natural fire at their earlier stage has to be installed and it can be designed using the latest technologies with advanced components such as wireless sensor networks. Automatic monitoring is the solution for decreasing the deforestation. This project aims to maintain the forest by preventing the tree cut, fire prevention and detecting pH level of water in forest.

1.1 Objective

- Protection and conservation of flora, fauna, forest and wildlife.
- Protection of the environment in order to promote sustainable development.
- To promote and maintain long term forest.

II. LITERATURE SURVEY

Sr. No.	Paper Name	Author Name	Remarks
1	Wireless sensor based Conservation of illegal Logging of forest trees	L.K. HEMA, Dr. D. Murugar, R. Mohan Priya.	This system is suitable for large scale forest monitoring from illegal logging. Here the cluster of sensor nodes are used to monitor the cutting of tree.
2	GPS-Arduino based tracking and alarm system for protection of forest. Forest Fire monitoring system.	M. Gor, J. Vora, S. Tanwar, S. Tyagi	Location tracking system of fire accident and illegal logging of trees in the forest
3	Forest Fire monitoring system.	V. N. Vasyukov, A. Yu. Zaitseva	Detection of fire in the forest in order to minimize deforestation.
4	Smart pH sensor.	Pabitra Mohan Khilal, Rajesh Paul	Monitoring the quality of water in forests.

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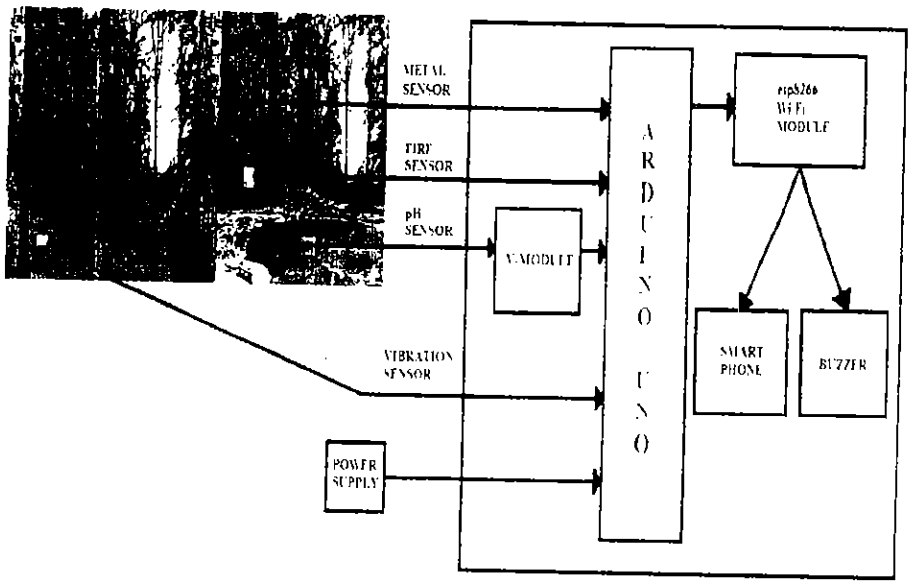
II. BLOCK DIAGRAM



III. COMPONENTS

- Fire sensor: A sensor used to detect the presence of fire which provides early warning notification to forest officer in order to prevent the fire accidents. The fire sensor goes ON when the temperature reaches 50 degree and above. This system can limit the emission of toxic products created by combustion.
- **Vibrator sensor:** Vibrator sensor is used to detect the vibration and send an alerting message to the employee when someone tries to cut the tree in a given particular area of the forest
- Metal sensor: Metal detector is an electronic device specially used to detect metal objects during logging of forest such as chainsaw, chopping Axe, crosscut saw, pruning saw etc
- pH sensor: pH sensor is used to determine the quality of water in forest which is very essential for trees and animals. It indicates the contamination of water by the pH meter
- Arduino Uno: An Arduino consists of analog and digital pins that are input and output ports which processes the data from sensors and sends the alerting message to forest officer and the same will be displayed on LCD (Liquid crystal display).
- GSM and GPS: GSM and GPs are the wireless sensor infrastructures. GSM is used to track the sensed region and the GPS provides the shorter way for the forest officer to reach the sensed region.
- Wi-Fi Router: Wi-fi router is a wireless technology used to send the alerting message to the officer which uses a radio frequency of the range 3GHz-30GHz when there is an network issue

IV. WORKING

n this project we are going to use a 4 wire less sensors which are placed in the different areas of the forest based on ne range of sensitivity. They are fire Sensor, metal Sensor, vibrator Sensor, pH Sensor. If a fire happens by high emperature or by human, fire sensor will detect that fire when the temperature reaches beyond 50°c and send the alerting ignal to the Arduino Uno, the program is written in the Arduino in such a way that there are two outputs from the rduino. One output is given to the LCD module placed in the control room of a forest office which displays the alerting iessage and the another output is sent as the alerting message to the forest officer smart phone through GSM module o that they can take necessary action immediately. If the network connectivity is disabled the Arduino sense the alerting iessage to the forest officer through Wi-Fi router. Hence, Wi-Fi router is considered as a backup protection system. the iPS is also provided with a system which tracks the sensed location and the Google map provides the shorter way to :ach location. If thief enters to a forest with a tree cut machine the metal sensor detects the metal and send signal to

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the Arduino Uno than it will send tree cut information to the and also it sends same information to GSM module, and it send alerting message to the forest officer and also location tracking system facility also provided to android application. So that they can take necessary action to prevent the tree cut

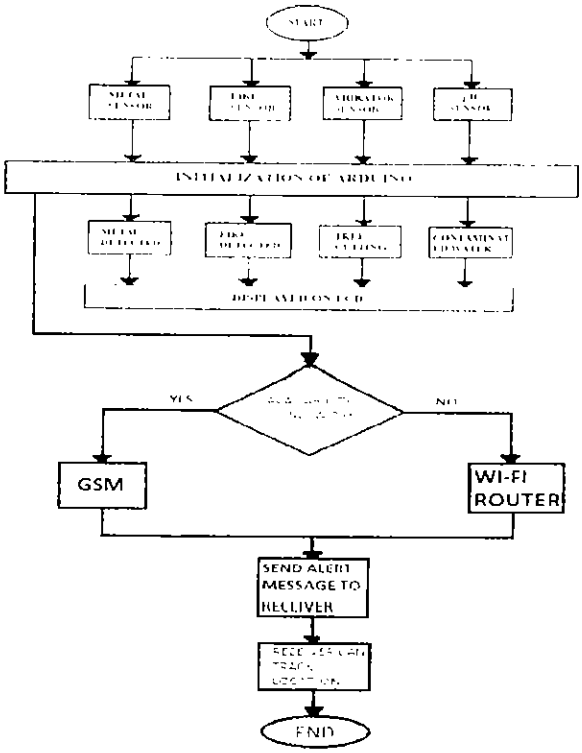

Fig: Flow Chart LCD module which is placed in control room of forest office

The roaming of human in the forest and also moving of heavy vehicles carrying illegal goods then the vibrator sensor will detect that vibration and send signal to the Arduino Uno. The Arduino will send the alerting message to the LCD module which is placed in the control room of a forest office and also alerting message to the forest officer through GSM module and forest officer can take necessary action to control the transport of illegal goods through forest. Here to measure the water quality of the forest we are going to use the Ph sensor if the Ph level is above 8 then it is good for animal, birds and aquatic organisms. If the Ph level is below 8 then the water is contaminated so the Ph sensor will the Ph level and send the signal to the Arduino. The Arduino will send the alerting message to the control room of the forest office and also the same message is sent to the forest officer through GSM module and the location can be tracked by the GPS and google map will show the direction to the forest officer so that he can take necessary action.

4.1 Applications

- Safeguarding of forest.

4.2 Advantages

- Assists smarter control for deforestation.
- Reduces the requirement of man power
- More reliable than man.
- Time saving and avoids illegal logging.
- Environmental friendly and pollution free.

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4.3 Disadvantages

- Protection of sensor will be an issue.

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Project Title: AUTO MATIC MONITORING OF DEFORESTATION USING ARDUINO

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PO 7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO 8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO 9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO 10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

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PO 12. **Life-long learning:** Recognize the need for, and have the preparation and ability to ngage in Independent and life-long learning in the broadest context of technological change.

COURSE OUTCOME 2021-2022

C413.A9.1	Identify the topics of relevance and carry out the literature survey on "Automatic Monitoring of Deforestation Using Arduino"
C413.A9.2	Design, develop and demonstrate feasible solution for the identified problem with good literature survey using modern tools & technology.
C413.A9.3	Prepare well-structured report of the project, communicate the same in different phases/journals/project exhibitions.
C413.A9.4	Coordinate and execute the assigned task and evaluate with the team members within the specified time in concern with the project guide.

CO-PO MAPPING MATRIX

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	POS1	POS2
C413.A9.1	3	3	2	2	3	3	2	3	3		3	3	3	2
C413.A9.2	3	3	3	3	3	3		3	3	3	3	3	3	3
C413.A9.3	3	3		3	3	3	3	3	3		2		2	2
C413.A9.4		2		2		2		3	3	3	3	3		
Average	3	2.75	2.5	3	3	2.75	2.5	3	3	3	2.75	3	2.6667	2.333

JUSTIFICATION WITH RESPECT TO CO-PO MAPPING

- C413.A9.1, C413.A9.2, C413.A9.3 and C413.A9.4 are mapped to PO2 (Problem Analysis) as 3,2,2 and 3 because relevancy is moderate.
- C413.A9.1, C413.A9.2 and C413.A9.3 is mapped to PO8 (Ethics) as 2,2 & 3 since report are written moderately ethical.
- C413.A9.2, C413.A9.3 and C413.A9.4 is mapped to PO9 (Individual and team work) as 3,3 & 3 as coordination among team mates was efficient
- C413.A9.2, C413.A9.3 and C413.A9.4 is mapped to PO10 (Communication) as 3,2 and 3 since oral communication was needed during demonstration of the project.
- C413.A9.2, C413.A9.3 and C413.A9.4 is mapped to PO11 (Project management and finance) as 3,2 and 1 because complication of the project was within the budget.
- C413.A9.1, C413.A9.2, C413.A9.3 and C413.A9.4 are mapped to PO12 (Lifelong learning) as 2,2,2 and 3 because it involves in continue learning.

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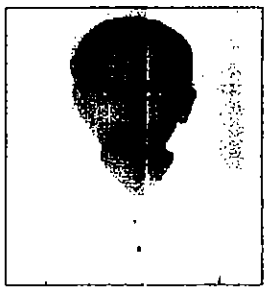	Name: Megana P L USN: 3VC18EE030 Email ID: meganapl.eee.rymec@gmail.com Mobile No: 9986239808

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

PROJECT REPORT

ON

"RFID BASED WOMEN SAFETY SYSTEM"

Submitted in the partial fulfilment of the requirement for the award of degree of Bachelor of Engineering during the Academic year 2020-21

PROJECT ASSOCIATES

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2.	M SHIVA SATISH	3VC18EE423
3.	C PRIYANKA	3VC17EE016
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Project Guide
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I would like to express our regards and acknowledgement to all those who helped in making this Project work possible.

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I would like to thank our guide, **Mrs.Deepa** BE, MTech **Asst Professor** Electrical & Electronics Engineering department for the constant guidance for the successful completion of project.

Finally, I would like to thank all the teaching and non-teaching staff members of Electrical and Electronics Engineering department for their guidance and support during my Bachelor's Degree. I am also thankful to my family members and friends for their extended support and encouragement.

Declaration

We hereby declare that the entire work embodied in this Project work entitled **"RFID BASED WOMEN SAFETY SYSTEM"** has been carried out by us under the guidance of **Mrs.Deepa B** BE, MTech at Electrical & Electronics Engineering Department, Rao Bahadur Y. Mahabaleswarappa Engineering College, Ballari affiliated to Visvesvaraya Technological University Belagavi.

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ABSTRACT

In recent years, acts of assault and violence against women are rising at a menacing rate. With escalation of female employees in industries and other sectors, it is now becoming a necessity for females to travel at late hours and visit distant and isolated locations as a part of their work regime. However, the exponential increase in assault, violence and attacks against women in the past few years, is posing a threat to the growth and development of women. Defense isn't the only measure that can suffice against this increasing abuse. A security solution that creates a sense of safety among women needs to be devised. In instances of attack, it is largely reported that women are immobilized. There is thus, a need of simpler safety solution that can be activated as simply via RFID and GSM and can instantly send out alerts to the near ones and to family members of the victim. The system can be implemented in the form of a partial wearable and partial portable system, the information is passed to RFID reader which communicates with Arduino microcontroller and through GSM the "help" message is sent to 2 predefined contacts (parents, police).

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CHAPTER 1

INTRODUCTION

Many unfortunate incidents have been taking place in woman's case. Problems may come from any direction such as women walking on the road after the work, going to super market or many other reasons for which they go alone. People at home are not sure of their return safely. There might be a situation in which the person has to travel alone a long distance at an odd hour and perhaps even by public transport and may face some danger. At such a time, a personal safety app might not only be wise to have easy access to, it might also give you a lot of confidence needed. There might be a situation that when women had an accident in the late night and there are no one to help and to take care of them. In such situations the person will not be able to tell the situation that he/she facing. And they do not know the basic first-aid details and to know the person where the incident has happened. To escape from the un-wanted meetings we do not know the way to escape from that meeting because we do not know the fake calls working. These are some of the problems that have taken place in the day-to-day life of women. The objective of research work is to create a safety system in the form of a portable safety device for a woman that does the following tasks:

- Alerts family and police and gives location coordinates of the woman being attacked.

In this application we are maintaining a switch. In the worst situation when we press switch at that time with location place will be sent to the android mobile which is enrolled in the memory IC should get a message like help needed. We are using LCD to display on the screen while sending message like (message sending to cell *********).

GPS gives only the longitude and latitude values but by using Android application in the mobile we can easily get the location name from where the message has been sent.

The controller takes the switch as its input i.e. when some threat has occurred one need to press that switch and the controller makes the GSM module to message to the pre-stored number. In this way the concerned person will know the location and they will be able to save the candidate. With a wide range of serial communications

interfaces, they are also very well suited for communication gateways, protocol converters and embedded soft modems as well as many other general-purpose applications.

This project uses regulated 5V, 500mA power supply. Unregulated 12V DC is used for relay. 7805 three terminal voltage regulator is used for voltage regulation. Bridge type full wave rectifier is used to rectify the ac output of secondary of 230/12V step down transformer.

1.1 Project Overview:

An embedded system is a combination of software and hardware to perform a dedicated task. Some of the main devices used in embedded products are Microprocessors and Microcontrollers.

Microprocessors are commonly referred to as general purpose processors as they simply accept the inputs, process it and give the output. In contrast, a microcontroller not only accepts the data as inputs but also manipulates it, interfaces thedata with various devices, controls the data and thus finally gives the result.

The GPS and GSM based women security system using Arduino Microcontroller is an exclusive project that can provide security for women according tothe instructions given by the above said microcontroller.

1.2 Introduction to Embedded Systems:

An embedded system is a computer system designed to perform one or a few dedicated functions often with real-time computing constraints. It is embedded as part of a complete device often including hardware and mechanical parts. By contrast, a general-purpose computer, such as a personal computer (PC), is designed to be flexible and to meet a wide range of end-user needs. Embedded systems control many devices in common use today. Embedded systems are controlled by one or more main processing cores that are typically either microcontrollers or digital signal processors (DSP). The key characteristic, however, is being dedicated to handle a particular task, which may require very powerful processors. For example, air traffic control systems may usefully be viewed as embedded, even though they involve mainframe computers and dedicated

regional and national networks between airports and radar sites. (Each radar probably includes one or more embedded systems of its own.)

A modern example of embedded system is shown in fig: 2.1. Labeled parts include microprocessor (4). RAM (6). flash memory (7). Embedded systems programming is not like normal PC programming. In many ways, programming for an embedded system is like programming PC 15 years ago.

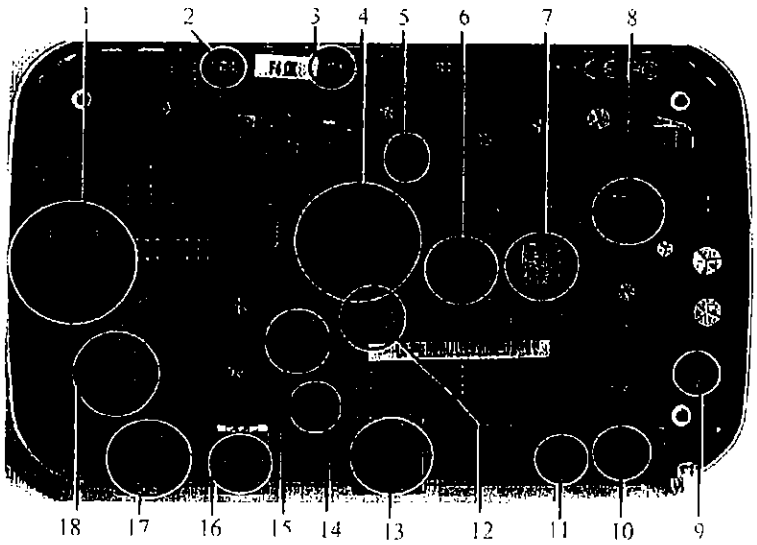


Fig 1.1.2: A modern example of embedded system

The hardware for the system is usually chosen to make the device as cheap as possible. Spending an extra dollar, a unit in order to make things easier to program can cost millions. Hiring a programmer for an extra month is cheap in comparison. This means the programmer must make do with slow processors and low memory, while at the same time battling a need for efficiency not seen in most PC applications. Below is a list of issues specific to the embedded field.

1.3 Need for Embedded Systems:

The uses of embedded systems are virtually limitless, because every day new products are introduced to the market that utilizes embedded computers in novel ways. In recent years, hardware such as microprocessors, microcontrollers, and FPGA chips have become much cheaper. So, when implementing a new form of control, it's wiser to just buy the generic chip and write your own custom software for it.

CHAPTER 2

LITERATURE SURVEY AND PROBLEM STATEMENT

2.1 LITERATURE SURVEY

This work [1] had proposed that it will intimate the parents and police about the current location of the women. A GPS system is employed to trace the present position of the victim and a GSM is employed to send the message to the pre-defined numbers This work [2] had proposed about that anytime a woman senses danger, so she has to turn ON the device. Once the device is activated, it tracks the current location of the women using GPS and sends emergency messages using GSM, to already register mobile number and the police control room. The pulse sensor checks the pulse of victimand in abnormal health situation the device also sends current GPS location to ambulance at every 10 sec in form of SMS. This work [3] had proposed about the violence against women (VAW) and also different health issues of women. We have designed and presented a skeleton of a user-friendly mobile application named Women Empowerment which can contain totally different laws associated with VAW and additionally contains different health tips for women, who can facilitate will help the rural as well as urban women. It includes emergency system, which will be active by thevictim woman once they area unit in peril. This work [4] had proposed about new modelfor women security, Once the switch is pressed the current location of women iscollected and sends through GMS to the numbers registered in the Arduino, This work

[5] had proposed in order to track the location and find the identity of the child a GPS module and a RFID card is used in the proposed system. The system uses Arduino Mega 2560 as main microcontroller.

2.2 PROBLEM STATEMENT

The main problem is to provide dual security for women as the crimeagainst women are prevalent these days. Today women are working during day andnight time as well; hence security has become the major concern. With the increase of crime against women like rape, theft, kidnap, domestic violence, dowry violence, honor

killing, acid throwing etc. Therefore, there is no security for women. Hence women security is a prime factor these days.

Therefore, the device basically deals with the safety of women during the adverse situations. So, we have come up with a novel device which uses two technologies inter connected via RFID.

Recently developed mobile applications for women safety in India survey shows 10 best mobile applications which ensure safety in case of emergencies listed below:

a) **FIGHT BACK:** Fight back, the women safety application, sends SOS alerts from your phone. Fight back uses GPS, SMS, location maps, GPRS, Email and your face book account to inform your loved ones in case you are in danger.

b) **GUARDLY:** This application places phone calls to the predefined contacts along with the name, real time location, type of emergencies and enables to identify different locations.

c) **ON WATCH:** This application is developed especially for college students. It allows the user to easily alert friends and emergency responders and police when needed with the GPS location.

d) **FAMILY LOCATOR:** This application notifies about the near and dear ones about the trouble. It provides the useful information about the criminals in the neighbor hood, tracking the most visited locations and so on. It also keeps connected with the family members with the support of GPS. It informs others about the exact location through messages, calls, Emails with the press of a button.

e) **SENTINEL:** It is a smart phone application used to serve as a virtual security guard for women. The users can press a button once they feel they are being stucked or harassed. It sends out instant alerts to let friends, family or police know about the trouble and save them.

f) **STREET SAFE:** This application has a feature called "walk with me" which gets the details of the situation and stays on line until they ensure the users gets back home safe. In case the call is cut, the safety advisor connects the user to the local police for further

help and guidance. In case of emergency situations, a feature called "silent alarm" enables to get local help from the real time location using the GPS and the physical description of the user.

g) **CIRCLE OF 6:** This application intends to add 6 members to your circle which is developed for college students which lets 6 friends know when you are facing a troublesome situation. With two taps, the app sends one out of three predeterminedalert messages to six contacts of your choice including a call for help connecting home that automatically includes the real-time location. The app also consists of pre- programmed hotline numbers and a local number that can be customized for police or 911.

h) **B SAFE:** The B Safe app works as a guardian that sends an emergency message to the chosen contacts with a push of a single button and its slogan is "never walk alone". This application offers two levels of safety; a risk mode with real time GPS which tracks the position and a timer mode with an automatic alarm activation. It's a user- friendly app which just needs a single tap to inform the chosen contacts.

i) **CAB 4 ME:** cab 4 me, as the name suggests, is a mobile cab finder app that helps get a cab anywhere at any time. It works based on the location. The phone's GPS shows the location on the map and one can choose the pickup destination or a nearby taxi stand based on the available stand. If in case the database has no cab company for the specific area, a local web search is performed to get a result.

j) **HOLLABACK:** "HOLLABACK! You have the power to end street harassment", is the tag line of this particular app. here the users can take a photo of the harasser and upload it as 'caught in the act' and submit their story on ihollaback.org. It signals the perpetrator that his photo is shared on the website as well as warns others from doing this act. The app encourages users to submit stories along with photographs of street harassment at every level from catcalls to strangers groping hands or even individuals exposing themselves in public roads.

CHAPTER 3

METHODOLOGY

The present and proposed work explains about an innovative idea for women security which has become mandatory now –a-days.

3.1 Hardware Description:

3.1.1 Introduction:

In this chapter the block diagram of the project and design aspect of independent modules are considered. Block diagram is shown in fig: 3.1:

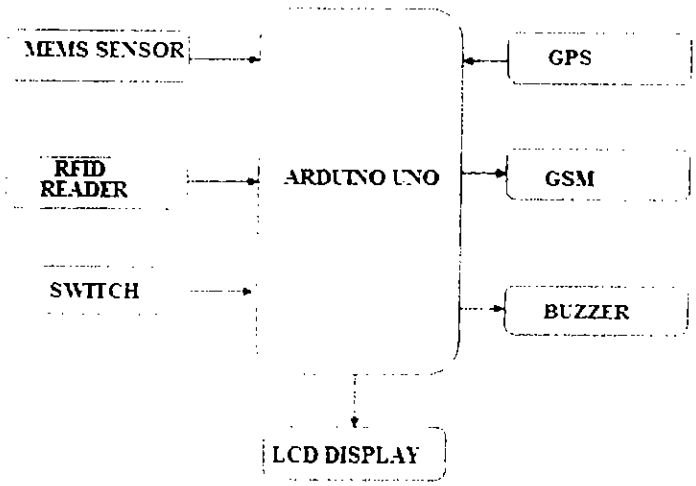


FIG 3.1.1: Block diagram

The main blocks of this project are:

1. Micro controller (Arduino Uno)
2. RFID Reader & Tags
3. Regulated power supply (RPS)
4. Mems Sensor
5. GSM modem
6. GPS module
7. LCD Display

3.2 MICROCONTROLLER:

Arduino Uno Board Description

The Arduino UNO is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The board has 14 Digital pins, 6 Analog pins, and programmable with the Arduino IDE (Integrated Development Environment) via a type B USB cable. It can be powered by a USB cable or by an external 9-volt battery. though it accepts voltages between 7 and 20 volts. It is also similar to the Arduino Nano and Leonardo. The hardware reference design is distributed under a Creative Commons Attribution Share-Alike 2.5 license and is available on the Arduino website.

Layout and production files for some versions of the hardware are also available. "Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases. The Uno board is the first in a series of USB Arduino boards and the reference model for the Arduinoplatfonn. The ATmega328 on the Arduino Uno comes preprogrammed with a boot loader that allows uploading new code to it without the use of an external hardware programmer. It communicates using the original STK500 protocol. The Uno also differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it uses the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter.

Arduino UNO Arduino is an open-source electronics platform based on easy-to-use hardware and software. It's intended for anyone making interactive projects. Arduino can take the input from many sensors attached to it & can give the output to many lights, motors, etc. There is no prerequisite knowledge of Advance electronics for operating Arduino. All you should know is basic electronics and C programming language. Arduino platform mainly contains a Hardware Board called Arduino Board & software Arduino IDE to program it. Other external hardware like Sensor Modules, Motors, lights, etc. could be attached with the board. ARDUINO BOARDS: - Arduino

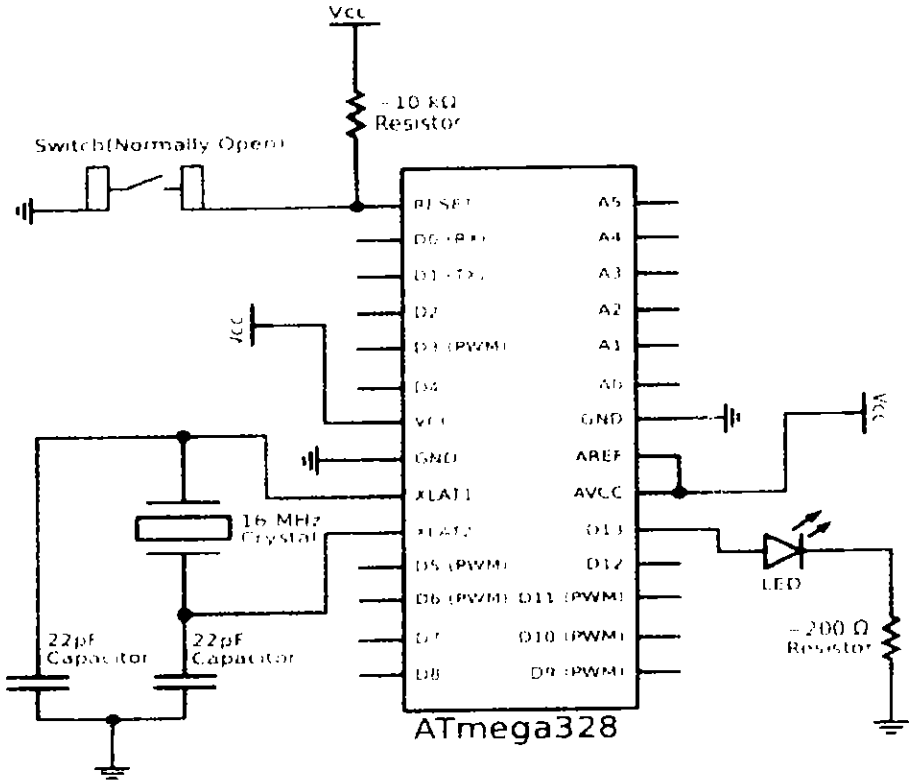
UNO. Arduino MEGA. Arduino MINI. Arduino DUE. Arduino YUN. Arduino Lily pad. The most common Board used is Arduino UNO. "UNO" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0.

The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases. Who created Arduino UNO? Arduino started in 2005 as a project for students at the Interaction Design Institute Ivrea in Ivrea, Italy. At that time program, students used a "BASIC Stamp" at a cost of $100, considered expensive for students. Massimo Banzi, one of the founders, taught at Ivrea. The name "Arduino" comes from a bar in Ivrea, where some of the founders of the project used to meet. The bar, in turn, has been named after Arduin of Ivrea, who was the margrave of Ivrea and king of Italy from 1002 to 1014. Colombian student Hernando Barragan created the Wiring development platform which served as the basis for Arduino. Following the completion of the Wiring platform, its lighter, less expensive versions were created and made available to the open-source community; associated researchers, including David Cuartielles, promoted the idea. The Arduino's initial core team consisted of Massimo Banzi, David Cuartielles, Tom Igoe, Gianluca Martino, and David Mellis.

Overview Arduino is an open-source computer hardware and software company, project, and user community that designs and manufactures microcontroller-based kits for building digital devices and interactive objects that can sense and control the physical world. The project is based on a family of microcontroller board designs manufactured primarily by Smart Projects in Italy, and also by several other vendors, using various 8-bit Atmel AVR microcontrollers or 32-bit Atmel ARDUINO UNO processors. These systems provide sets of digital and analog I/O pins that can be interfaced to various expansion boards ("shields") and other circuits. The boards feature serial communications interfaces, including USB on some models, for loading programs from personal computers. For programming, the microcontrollers, the Arduino platform provides an integrated development environment (IDE) based on the Processing project, which includes support for C, C++, and Java programming languages.

Arduino/Genuine Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started.

ATMEGA 328P:

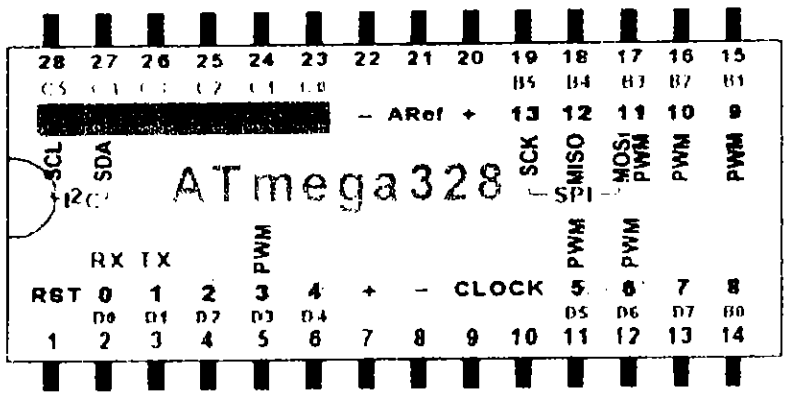


The ATmega48PA/88PA/168PA/328P is a low-power CMOS 8-bit microcontroller based on the AVR enhanced RISC architecture (RISC, or Reduced Instruction Set Computer. is a type of microprocessor architecture that utilizes a small, highly- optimized set of instructions) By executing powerful instructions in a single clock cycle, the ATmega48PA/88PA/168PA/328P achieves throughputs approaching 1 MIPS per MHz allowing the system designed to optimize power consumption versus processing speed. The AVR (Advanced Virtual RISC) core combines a rich instruction set with 32 general purpose working registers. All the 32 registers are directly connected

to the Arithmetic Logic Unit (ALU), allowing two independent registers to be accessed in one single instruction executed in one clock cycle.

The resulting architecture is more code efficient while achieving throughputs up to ten times faster than conventional CISC microcontrollers.

The ATmega48PA/88PA/168PA/328P provides the following features: 4/8/16/32K bytes of In System Programmable Flash with Read-While-Write capabilities, 256/512/512/1K bytes EEPROM, 512/1K/1K/2K bytes SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible Timer/Counters with comparemodes, internal and external interrupts, a serial programmable USART, a byte-oriented 2-wire Serial Interface, an SPI serial port, a 6-channel 10-bit ADC, a programmable Watchdog Timer with internal Oscillator, and five software selectable power saving modes. The Idle mode stops the CPU while allowing the SRAM, Timer/Count



The Idle mode stops the CPU while allowing the SRAM, Timer/Counters, USART, 2-wire Serial Interface, SPI port, and interrupt system to continue functioning. The Power-down mode saves the register contents but freezes the Oscillator, disabling all other chip functions until the next interrupt or hardware reset. In Power-save mode, the asynchronous timer continues to run, allowing the user to maintain a timer base while the rest of the device is sleeping. The ADC Noise Reduction mode stops the CPU and all I/O modules except asynchronous timer and ADC, to minimize switching noise during ADC conversions.

The Boot program can use any interface to download the application program in the Application Flash memory. Comparison between ATmega48PA, ATmega88PA,

ATmega168PA, and ATmega328P differ only in memory sizes, boot loader support, and interrupt vector sizes. Table summarizes the different memory and interrupts vector sizes for the three devices.

DEVICE	FLASH	EEPROM	RAM	INTERRUPT SIZE
ATmega48PA	4K Bytes	256 Bytes	512 Bytes	1 instruction word/vector
ATmega88PA	8K Bytes	512 Bytes	1K Bytes	1 instruction word/vector
ATmega168PA	16K Bytes	512 Bytes	1K Bytes	2 instruction word/vector
ATmega328P	32K Bytes	1K Bytes	2K Bytes	2 instruction word/vector

Internal Description Power the Arduino/Genuino Uno board can be powered via the USB connection or with an external power supply. The power source is selected automatically. External (non-USB) power can come either from an AC-to-DC adapter (wall-wart) or battery. The adapter can be connected by plugging a 2.1mm center- positive plug into the board's power jack.

Leads from a battery can be inserted in the GND and Vin pin headers of the POWER connector The board can operate on an external supply from 6 to 20 volts. If supplied with less than 7V, however, the 5V pin may supply less than five volts and the board may become unstable. If using more than 12V, the voltage regulator may overheat and damage the board. The recommended range is 7 to 12 volts. The power pins are as follows:

Vin - The input voltage to the Arduino/Genuine board when it's using an external power source (as opposed to 5 volts from the USB connection or other regulated powersource). You can supply voltage through this pin, or, if supplying voltage via the power jack, access it through this pin. 5V. This pin outputs a regulated 5V from the regulator on the board. The board can be supplied with power either from the DC power jack (7 - 12V), the USB connector (5V), or the VIN pin of the board (7-12V). Supplying voltage via the 5V or 3.3V pins bypasses the regulator, and can damage your board. We don't advise it. 3V3. A 3.3-volt supply generated by the on-board regulator. Maximum currentdraw is 50 mA.

GND - Ground pins.

IOREF - This pin on the Arduino/Genuine board provides the voltage reference with which the microcontroller operates. A properly configured shield can read the IOREF pin voltage and select the appropriate power source or enable voltage translators on the outputs to work with the 5V or 3.3V.

Memory - The ATmega328 has 32 KB (with 0.5 KB occupied by the boot loader). It also has 2 KB of SRAM and 1 KB of EEPROM (which can be read and written with the EEPROM library).

Input and Output each of the 14 digital pins on the Uno can be used as an input or output, using pin Mode (), digital Write (), and digital Read () functions. They operate at5 volts. Each pin can provide or receive 20 mA as recommended operating conditionand has an internal pull-up resistor (disconnected by default) of 20-50k ohm. A maximum of 40mA is the value that must not be exceeded on any I/O pin to avoid permanent damage to the microcontroller.

In addition, some pins have specialized functions:

Serial: 0 (RX) and 1 (TX). Used to receive (RX) and transmit (TX) TTL serial data. These pins are connected to the corresponding pins of the ATmega8U2 USB-to-TTL Serial chip.

External Interrupts 2 and 3 - These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value. See the attach Interrupt() function for details.

PWM: 3, 5, 6, 9, 10, and 11. Provide 8-bit PWM output with the analog Write () function.

SPI: 10 (SS), 11 (MOSI), 12 (MISO), 13 (SCK). These pins support SPI communication using the SPI library.

LED: 13. There is a built-in LED driven by digital pin 13. When the pin is HIGH value, the LED is on, when the pin is LOW, it's off.

TWI: A4 or SDA pin and A5 or SCL pin. Support TWI communication using the Wire library.

The Uno has 6 analog inputs, labeled A0 through A5, each of which provide 10 bits of resolution (i.e., 1024 different values). By default, they measure from ground to 5 volts, though is it possible to change the upper end of their range using the AREF pin and the analog Reference () function.

There are a couple of other pins on the board:

AREF. Reference voltage for the analog inputs. Used with analog Reference ().

RESET. Bring this line LOW to reset the microcontroller. Typically used to add a reset button to Shields which block the one on the board. Communication Arduino/Genuine Uno has a number of facilities for communicating with a computer, another Arduino/Genuine board, or other microcontrollers. The ATmega328 provides UART TTL (5V) serial communication, which is available on digital pins 0 (RX) and 1 (TX). An ATmega16U2 on the board channels this serial communication over USB and appears as a virtual com port to software on the computer.

TECHNICAL SPECIFICATIONS:

- Microcontroller: Microchip ATmega328P
- Operating Voltage: 5 Volts
- Input Voltage: 7 to 20 Volts
- Digital I/O Pins: 14 (of which 6 provide PWM output)
- Analog Input Pins: 6
- DC Current per I/O Pin: 20 mA
- DC Current for 3.3V Pin: 50 mA
- Flash Memory: 32 KB of which 0.5 KB used by boot loader
- SRAM: 2 KB
- EEPROM: 1 KB
- Clock Speed: 16 MHz
- Length: 68.6 mm
- Width: 53.4 mm

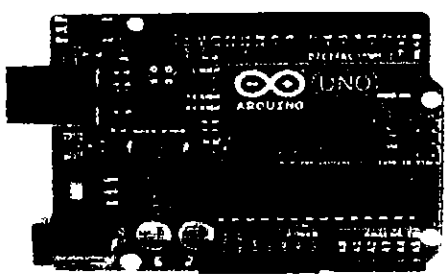
- Weight: 25 g

COMMUNICATION:

The Arduino/Genuine Uno has a number of facilities for communicating with a computer, another Arduino/Genuine board, or other microcontrollers. The ATmega328 provides UART TTL (5V) serial communication, which is available on digital pins 0 (RX) and 1 (TX). An ATmega16U2 on the board channels this serial communication over USB and appears as a virtual comport to software on the computer. The 16U2 firmware uses the standard USB COM drivers, and no external driver is needed. However, on Windows, an .in file is required. The Arduino Software (IDE) includes a serial monitor which allows simple textual data to be sent to and from the board. TheRX and TX LEDs on the board will flash when data is being transmitted via the USB- to-serial chip and USB connection to the computer (but not for serial communication onpins 0 and 1). A Software Serial library allows serial communication on any of theUno's digital pins.

AUTOMATIC (SOFTWARE) RESET:

Rather than requiring a physical press of the reset button before an upload, the Arduino/Genuine Uno board is designed in a way that allows it to be reset by software running on a connected computer. One of the hardware flow control lines (DTR) of the ATmega8U2/16U2 is connected to the reset line of the ATmega328 via a 100 nano- farad capacitor. When this line is asserted (taken low), the reset line drops long enough to reset the chip. This setup has other implications. When the Uno is connected to a computer running Mac OS X or Linux, it resets each time a connection is made to it from software (via USB). For the following half-second or so, the boot loader is runningon the Uno. While it is programmed to ignore malformed data (i.e., anything besides an upload of new code), it will intercept the first few bytes of data sent to the board.



Transformers:

A transformer is a device that transfers electrical energy from one circuit to another through inductively coupled conductors without changing its frequency. A varying current in the first or primary winding creates a varying magnetic flux in the transformer's core, and thus a varying magnetic field through the secondary winding. This varying magnetic field induces a varying electromotive force (EMF) or "voltage" in the secondary winding. This effect is called mutual induction.

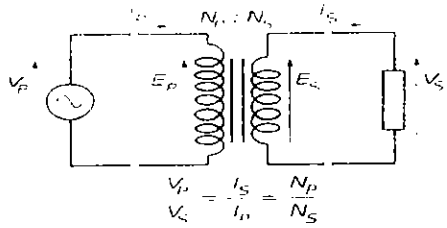


Fig 3.3.2: Step-Down Transformer

The voltage induced in the secondary is determined by the TURNS RATIO.

$$\frac{\text{primary voltage}}{\text{secondary voltage}} = \frac{\text{number of primary turns}}{\text{number of secondary turns}}$$

Battery power supply:

A battery is a type of linear power supply that offers benefits that traditional line-operated power supplies lack: mobility, portability and reliability. A battery consists of multiple electrochemical cells connected to provide the voltagedesired. Fig: 3.4.3 shows Hi-Watt 9V battery

Fig 3.3.3: Hi-Watt 9V Battery

The most commonly used dry-cell battery is the carbon-zinc dry cell battery. Dry-cell batteries are made by stacking a carbon plate, a layer of electrolyte paste, and a zinc plate alternately until the desired total voltage is achieved. The most common dry-cell batteries have one of the following voltages: 1.5, 3, 6, 9, 22.5, 45, and 90. During the discharge of a carbon-zinc battery, the zinc metal is converted to a zinc salt in the electrolyte, and magnesium dioxide is reduced at the carbon electrode. These actions establish a voltage of approximately 1.5 V.

A nickel-cadmium battery has become more popular in recent years. This battery cell is completely sealed and rechargeable. The electrolyte is not involved in the electrode reaction, making the voltage constant over the span of the batteries long service life. During the charging process, nickel oxide is oxidized to its higher oxidation state and cadmium oxide is reduced. The nickel-cadmium batteries have many benefits. They can be stored both charged and uncharged. Fig: 3.4.4 shows pencil battery of 1.5V.

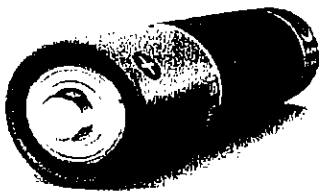


Fig 3.3.4: Pencil Battery of 1.5V

Step 2: Rectification

The process of converting an alternating current to a pulsating direct current is called as rectification. For rectification purpose we use rectifiers.

Rectifiers:

A rectifier is an electrical device that converts alternating current (AC) to direct current (DC), a process known as rectification. Rectifiers have many uses including as components of power supplies and as detectors of radio signals. Rectifiers may be made of solid-state diodes, vacuum tube diodes, mercury arc valves, and other

components. A device that it can perform the opposite function (converting DC to AC) is known as an inverter. When only one diode is used to rectify AC (by blocking the negative or positive portion of the waveform), the difference between the term diode and the term rectifier is merely one of usage, i.e., the term rectifier describes a diode that is being used to convert AC to DC.

Bridge full wave rectifier:

The Bridge rectifier circuit is one which converts an ac voltage to dc voltage using both half cycles of the input ac voltage. The circuit has four diodes connected to form a bridge. The ac input voltage is applied to the diagonally opposite ends of the bridge. For the positive half cycle of the input ac voltage, diodes D1 and D3 conduct, whereas diodes D2 and D4 remain in the OFF state. The conducting diodes will be in series with the load resistance R_L and hence the load current flows through R_L.

For the negative half cycle of the input ac voltage, diodes D2 and D4 conduct whereas, D1 and D3 remain OFF. The conducting diodes D2 and D4 will be in series with the load resistance R_L and hence the current flows through R_L in the same direction as in the previous half cycle. Thus, a bi-directional wave is converted into a unidirectional wave.

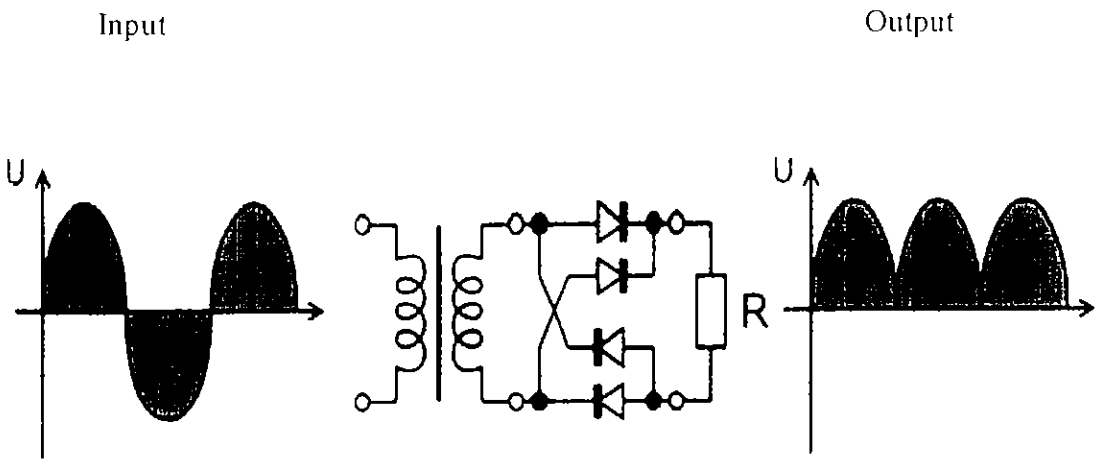


Fig 3.3.5: Bridge rectifier: a full-wave rectifier using 4 diodes

DB107:

Now-a-days Bridge rectifier is available in IC with a number of DB107. In our project we are using an IC in place of bridge rectifier. The picture of DB 107 is shown in fig: 3.4.6.

Features:

- Good for automation insertion
- Surge overload rating - 30 amperes peak
- Ideal for printed circuit board
- Reliable low-cost construction utilizing molded
- Glass passivated device
- Polarity symbols molded on body
- Mounting position: Any
- Weight: 1.0 gram

Fig 3.3.6: DB107

Step 3: Filtration

The process of converting a pulsating direct current to a pure direct current using filters is called as filtration.

Filters:

Electronic filters are electronic circuits, which perform signal-processing functions, specifically to remove unwanted frequency components from the signal, to enhance wanted ones.

Introduction to Capacitors:

The Capacitor or sometimes referred to as a Condenser is a passive device, and one which stores energy in the form of an electrostatic field which produces a potential (static voltage) across its plates. In its basic form a capacitor consists of two parallel conductive plates that are not connected but are electrically separated either by air or by an insulating material called the Dielectric. When a voltage is applied to these plates, a current flow charging up the plates with electrons giving one plate a positive charge and the other plate an equal and opposite negative charge this flow of electronsto the plates is known as the Charging Current and continues to flow until the voltage across the plates (and hence the capacitor) is equal to the applied voltage Vcc. At this point the capacitor is said to be fully charged and this is illustrated below. Theconstruction of capacitor and an electrolytic capacitor are shown in figures 3.4.7 and 3.4.8 respectively.

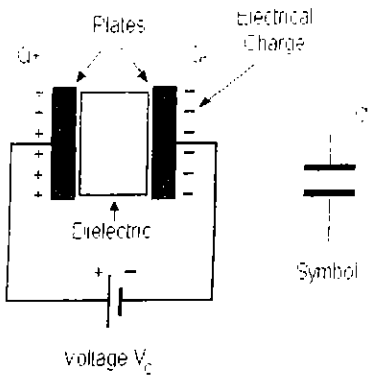


Fig 3.3.7: Construction of a Capacitor

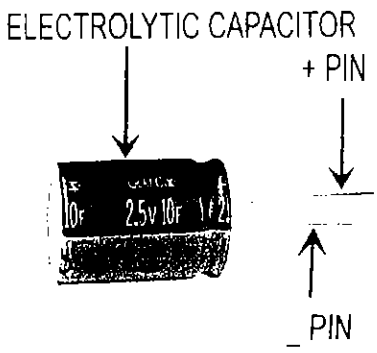


Fig 3.3.8: Electrolytic Capacitor

Step 4: Regulation

The process of converting a varying voltage to a constant regulatedvoltage is called as regulation. For the process of regulation, we use voltage regulators.

Voltage Regulator:

A voltage regulator (also called a 'regulator') with only three terminals appears to be a simple device, but it is in fact a very complex integrated circuit. It

converts a varying input voltage into a constant 'regulated' output voltage. Voltage Regulators are available in a variety of outputs like 5V, 6V, 9V, 12V and 15V. The LM78XX series of voltage regulators are designed for positive input. For applications requiring negative input, the LM79XX series is used. Using a pair of 'voltage-divider' resistors can increase the output voltage of a regulator circuit. It is not possible to obtain a voltage lower than the stated rating. You cannot use a 12V regulator to make a 5V power supply. The only way to destroy a regulator is to apply reverse voltage to itsinput. Reverse polarity destroys the regulator almost instantly. Fig: 3.4.9 shows voltage regulator.

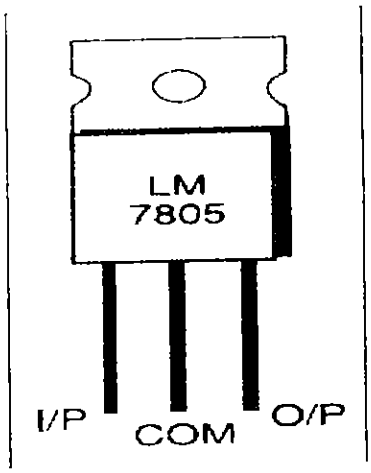


Fig 3.3.9: Voltage Regulator

Resistors:

A resistor is a two-terminal electronic component that produces a voltageacross its terminals that is proportional to the electric current passing through it in accordance with Ohm's law. Resistors are elements of electrical networks and electroniccircuits and are ubiquitous in most electronic equipment. Practical resistors can be madeof various compounds and films, as well as resistance wire (wire made of a high- resistivity alloy, such as nickel/chrome). Resistors can be made to control the flow of current, to work as Voltage dividers, to dissipate power and it can shape electricalwaves when used in combination of other components. Basic unit is ohms.

Power dissipation:

The power dissipated by a resistor (or the equivalent resistance of a resistor network) is calculated using the following:

$$P = I^2R = IV = \frac{V^2}{R}$$

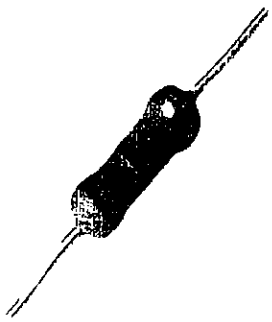


Fig 3.3.10: Resistor

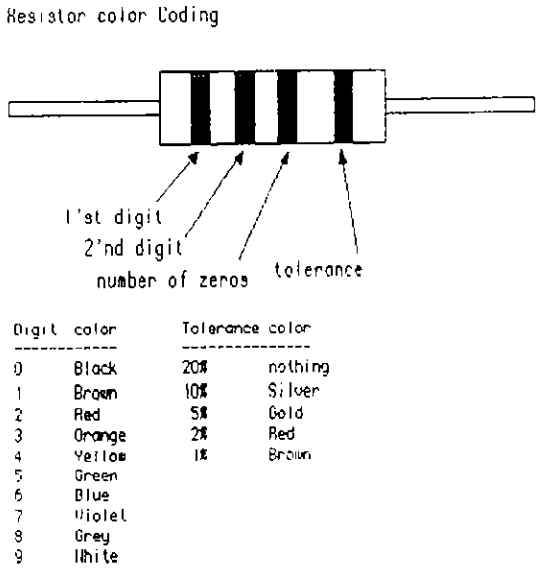


Fig 3.3.11: Color Bands In Resistor

3.4 LED:

A light-emitting diode (LED) is a semiconductor light source. LEDs are used as indicator lamps in many devices, and are increasingly used for lighting. Introduced as a practical electronic component in 1962, early LEDs emitted low- intensity red light, but modern versions are available across the visible, ultraviolet and infrared wavelengths, with very high brightness. The internal structure and parts of a led are shown below.

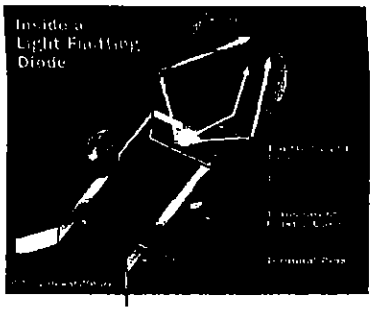


Fig 3.4.1: Inside a LED

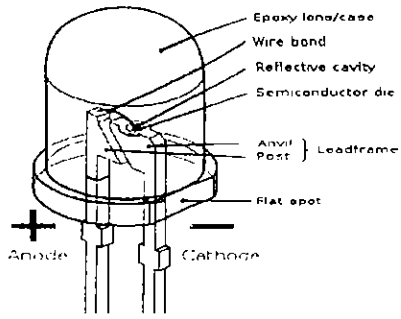


Fig 3.4.2: Parts of a LED

Working:

The structure of the LED light is completely different than that of the light bulb. Amazingly, the LED has a simple and strong structure. The light-emitting semiconductor material is what determines the LED's color. The LED is based on the semiconductor diode. When a diode is forward biased (switched on), electrons are able to recombine with holes within the device, releasing energy in the form of photons. This effect is called electroluminescence and the color of the light (corresponding to the energy of the photon) is determined by the energy gap of the semiconductor. An LED is usually small in area (less than 1 mm^2), and integrated optical components are used to shape its radiation pattern and assist in reflection. LEDs present many advantages over incandescent light sources including lower energy consumption, longer lifetime, improved robustness, smaller size, faster switching, and greater durability and reliability. The electrical symbol and polarities of led are shown in fig: 3.5.3.

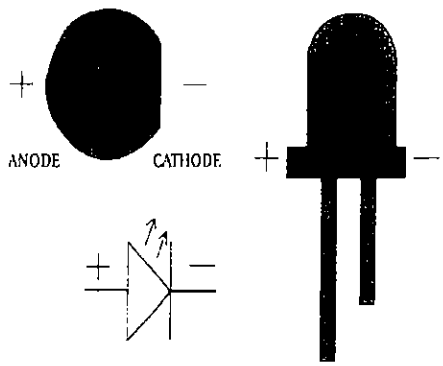


Fig 3.4.3: Electrical Symbol & Polarities of LED

LED lights have a variety of advantages over other light sources:

- High-efficiency
- Low-voltage and current requirements
- Low radiated heat
- High reliability (resistant to shock and vibration)
- Can be easily controlled and programmed

Applications of LED fall into three major categories:

- Visual signal application where the light goes more or less directly from the LED to the human eye, to convey a message or meaning.
- Generate light for measuring and interacting with processes that do not involve the human visual system.

3.5 GSM (Global System for Mobile Communication):

Definition:

GSM, which stands for Global System for Mobile communications, reigns (important) as the world's most widely used cell phone technology. Cell phones use a cell phone service carrier's GSM network by searching for cell phone towers in the nearby area. Global system for mobile communication (GSM) is a globally acceptedstandard for digital cellular communication. GSM is the name of a standardization groupestablished in 1982 to create a common European mobile telephone standard that would formulate specifications for a pan-European mobile cellular radio system operating at 900 MHz

Need of GSM:

- Improved spectrum efficiency.
- International roaming.
- Low-cost mobile sets and base stations (BS)
- High-quality speech

- Compatibility with Integrated Services Digital Network (ISDN) and other telephone company services.
- Support for new services.

3.5.1 GSM – Architecture:

A GSM network consists of several functional entities whose functionsand interfaces are defined. The GSM network can be divided into following broad parts.

1. The Mobile Station (MS)
2. The Base Station Subsystem (BSS)
3. The Network Switching Subsystem (NSS)
4. The Operation Support Subsystem (OSS)

Following fig shows the simple architecture diagram of GSM Network.

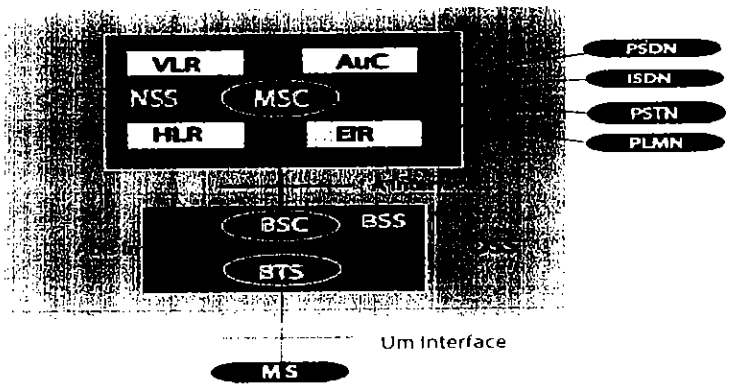


Fig 3.5.1: GSM Network.

The added components of the GSM architecture include the functions of the databases and messaging systems:

a. Home Location Register (HLR)
b. Visitor Location Register (VLR)
c. Equipment Identity Register (EIR)
d. Authentication Center (AuC)
e. SMS Serving Center (SMS SC)

f. Gateway MSC (GMSC)
g. Chargeback Center (CBC)
h. Transcoder and Adaptation Unit (TRAU)

Advantages of GSM:

1. GSM is already used worldwide with over 450 million subscribers.
2. International roaming permits subscribers to use one phone throughout Western Europe. CDMA will work in Asia, but not France, Germany, the U.K. and other popular European destinations.
3. The availability of Subscriber Identity Modules, which are smart cards that provide secure data encryption give GSM m-commerce advantages.

3.5.2 GSM commands:

Commands always start with AT (which means Attention) and finish with a <CR>character.

Information responses and result codes

Responses start and end with <CR><LF>, except for the ATV0 DCE response format) and the ATQ1 (result code suppression) commands.

- If command syntax is incorrect, an **ERROR** string is returned.
- If command syntax is correct but with some incorrect parameters, the **+CMEERROR:** <Err> or **+CMS ERROR:** <Sms Err> strings are returned with different error codes.
- if the command line has been performed successfully, an **OK** string is returned.

In some cases, such as "AT+CPIN?" or (unsolicited) incoming events, the product does not return the **OK** string as a response.

In the following examples <CR> and <CR><LF> are intentionally omitted.

1. Manufacturer identification +CGMI

2. Request model identification +CGMM

3. Request revision identification +CGMR

4. Product Serial Number +CGSN

5. Dial command D

ATD<nb> where <nb> is the destination phone number.

Please note that for an **international number**, the local international prefix does not need to be set (usually 00) but does need to be replaced by the '+' character.

Example: to set up a voice call to Wavecom offices from another country, the AT command is: "**ATD+33146290800;**"

Note that some countries may have specific numbering rules for their GSM handset numbering. The response to the ATD command is one of the following:

6. Hang-Up command H

Description: The ATH (or ATH0) command disconnects the remote user. In the case of multiple calls, all calls are released (active, on-hold and waiting calls). The specific Wavecom ATH1 command has been appended to disconnect the current outgoing call, only in dialing or alerting state (i.e., ATH1 can be used only after the ATD command, and before its terminal response (OK, NO CARRIER, ...). It can be useful in the case of multiple calls.

Command syntax: ATH

7. Answer a call A

Description: When the product receives a call, it sets the **RingInd** signal and sends the ASCII "**RING**" or "**+CRING: <type>**" string to the application (+CRING if the cellular result code +CRC is enabled). Then it waits for the application to accept the callwith the ATA command.

Command syntax: ATA

8. Redial last telephone number ATDL

Description: This command redials the last number used in the ATD command. The last number dialed is displayed followed by ";" for voice calls only

Command syntax: ATDL

9. Preferred Message Format +CMGF

Description: The message formats supported are text mode and PDU mode. In PDU mode, a complete SMS Message including all header information is given as a binary string (in hexadecimal format). Therefore, only the following set of characters is allowed: {'0','1','2','3','4','5','6','7','8','9', 'A', 'B','C','D','E','F'}. Each pair or characters are converted to a byte (e.g.: '41' is converted to the ASCII character 'A', whose ASCII code is 0x41 or 65). In Text mode, all commands and responses are in ASCII characters. The format selected is stored in EEPROM by the +CSAS command.

Command syntax: AT+CMGF

10. Read message +CMGR

Description: This command allows the application to read stored messages. The messages are read from the memory selected by **+CPMS** command.

Command syntax: AT+CMGR=<index>

11. Send message +CMGS

Description: The <address> field is the address of the terminal to which the message is sent. To send the message, simply type, <ctrl-Z> character (ASCII 26). The text can contain all existing characters except <ctrl-Z> and <ESC> (ASCII 27). This command can be aborted using the <ESC> character when entering text. In PDU mode, only hexadecimal characters are used ('0'...'9','A'...'F').

Syntax: AT+CMGS= <length> <CR>

PDU is entered <ctrl-Z / ESC >

12. Delete message +CMGD

Description: This command deletes one or several messages from preferred message storage ("BM" SMS CB 'RAM storage', "SM" SMSPP storage 'SIM storage' or "SR" SMS Status-Report storage).

Command syntax: AT+CMGD=<Index> [, <DelFalg>]

3.6 SIM 300 HARDWARE DESCRIPTIONS:

Designed for global market, SIM300 is a Tri-band GSM/GPRS enginethat works on frequencies EGSM 900 MHz, DCS 1800 MHz and PCS1900 MHz SIM300 provides GPRS multi-slot class 10 capabilities and support the GPRS coding schemes CS-1, CS-2, CS-3 and CS-4. With a tiny configuration of 40mm x 33mm x 2.85 mm, SIM300 can fit almost all the space requirement in your application, such as Smart phone, PDA phone and other mobile device. The physical interface to the mobile application is made through a 60 pins board-to-board connector, which provides all hardware interfaces between the module and customers' boards except the RF antenna interface.

- The keypad and SPI LCD interface will give you the flexibility to develop customized applications.
- Two serial ports can help you easily develop your applications.
- Two audio channels include two microphones inputs and two speaker outputs.

This can be easily configured by AT command. SIM300 provide RF antenna interface with two alternatives: antenna connector and antenna pad. The SIM300 is designed with power saving technique, the current consumption to as low as 2.5mA in SLEEP mode. The SIM300 is integrated with the TCP/IP protocol Extended TCP/IP AT commands are developed for customers to use the TCP/IP protocol easily, which is very useful for those data transfer applications.

3.6.1 SIM300 Hardware Interface Description:

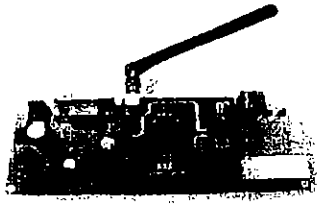


FIG 3.6.1: SIM300 Hardware Interface Description

Features of SIM300:

1. Power supply: Single supply voltage 3.4V – 4.5V

2. Power saving: typical power consumption in SLEEP mode to 2.5mA

3. Frequency bands: ⊓ SIM300 Tri-band: EGSM 900, DCS 1800, PCS 1900. The band can be set by AT COMMAND. and default band is EGSM 900 and DCS 1800.

4. SIM interface: Supported SIM card: 1.8V, 3V

5. External antenna: Connected via 50 Ohm antenna connector or antenna pad

The power supply of SIM300 is from a single voltage source of VBAT= 3.4V. 4.5V. In some case, the ripple in a transmit burst may cause voltage drops when current consumption rises to typical peaks of 2A, So the power supply must be able to provide sufficient current up to 2A. For the VBAT input, a local bypass capacitor is recommended. A capacitor (about 100μF, low ESR) is recommended.

SIM300 provides two unbalanced asynchronous serial ports. The GSM module is designed as a DCE (Data Communication Equipment), following the traditional DCE-DTE (Data Terminal Equipment) connection, the module and the client (DTE) are connected through the following signal (as following figure shows). Auto bauding supports baud rate from 1200 bps to 115200bps.

Serial port 1

- Port/TXD @ Client sends data to the RXD signal line of module
- Port/RXD @ Client receives data from the TXD signal line of module

Serial port 2

- Port/TXD @ Client sends data to the DGBRXD signal line of module
- Port/RXD @ Client receives data from the DGBTXD signal line of module

All pins of two serial ports have 8mA driver, the logic levels are described in following fig: 3.6.2.

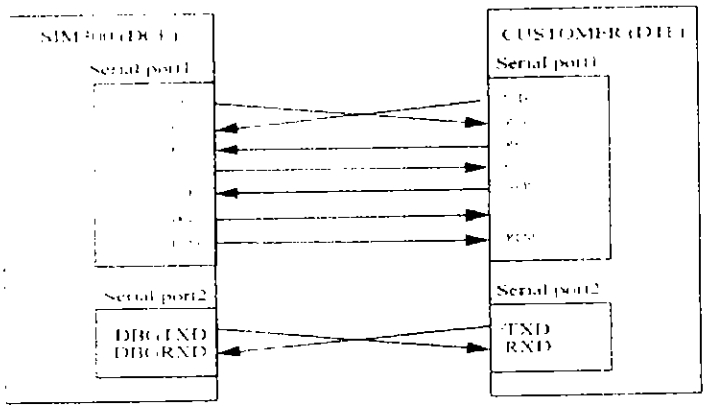


Fig: 3.6.2 Interconnection the PINs of serial port

3.7 FUNCTION OF SERIAL PORT 1 & 2 SUPPORTING:

Serial port 1:

1. Seven lines on Serial Port Interface
2. Contains Data lines /TXD and /RXD, State lines /RTS and /CTS, Control lines
3. /DTR, /DCD and RING;
4. Serial Port 1 can be used for CSD FAX, GPRS service and send AT command of controlling module. Serial Port 1 can use multiplexing function, but you cannot use the Serial Port 2 at the same time;
5. Serial Port 1 supports the communication rate as following: 1200, 2400, 4800, 9600, 19200, 38400, 57600, and 115200 Default as 115200bps.
6. Autobauding supports the communication rate as following: 1200, 2400, 4800, 9600, 19200, 38400, 57600, and 115200bps.

Serial port 2:

Two lines on Serial Port Interface

1. Only contains Data lines /TXD and /RXD
2. Serial Port 2 only used for transmitting AT command. It cannot be used for CSD call, FAX call. And the Serial port 2 cannot use multiplexing function;

3. Serial port 2 supports the communication rate of 9600, 19200, 38400, 57600, 115200

3.8 MODULE RECEIVE/TRANSMIT FREQUENCY:

Table 4.8.1 Receive/Transmit frequency ranges

SIM300 Receive/Transmit Frequency	Receive	Transmit
E-GSM900	925 - 960MHz	880 - 915MHz
DCS1800	1805 - 1880MHz	1710 - 1785MHz
PCS1900	1930 - 1990MHz	1850 - 1910MHz

3.9 SIM CARD INTERFACE:

You can use AT Command to get information in SIM card. The SIM interface supports the functionality of the GSM Phase 1 specification and also supports the functionality of the new GSM Phase 2+ specification for FAST 64 kbps SIM (intended for use with a SIM application Tool-kit). Both 1.8V and 3.0V SIM Cards are supported. The SIM interface is powered from an internal regulator in the module having nominal voltage 2.8V. All pins reset as outputs driving low.

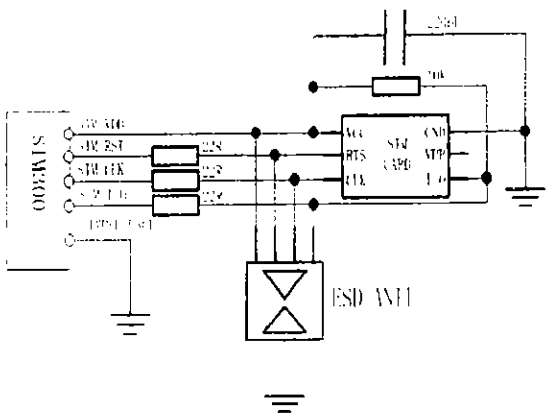


Fig 3.9.1: SIM interface reference circuit with 6 pins SIM card

3.10 LCD INTERFACE:

SIM300 provides a serial LCD display interface that supports serial communication with LCD device. These are composite pins that can be used as GPIO ports or LCD display interface according to your application. When use as LCD interface, the following table is the pin define. LCD interface timing should be united with the LCD device.

3.11 ADC:

SIM300 provides one auxiliary ADC (General purpose analog to digital converter.) as voltage input pin, which can be used to detect the values of some external items such as voltage, temperature etc. User can use AT command "AT+CADC" to read the voltage value added on ADC pin.

3.12 NETWORK STATUS INDICATION LED LAMP:

The PIN 30 on the board-to-board connector can be used to drive a network status indication LED lamp. The working state of this pin is listed in following table:

Table 4.12.1 Network Status Indication

Working state of network status indication LED pin State	SIM300 function
Off	SIM300 is not running
64ms on/ 800ms Off	SIM300 does not find the network
64ms on/ 3000ms Off	SIM300 find the network
64ms on/ 300ms Off	GPRS communication

3.13 Antenna interface:

The RF interface has an impedance of 50Ω. To suit the physical design of individual applications SIM300 offers two alternatives:

- Recommended approach: antenna connector on the component side of thePCB
- Antenna pad and grounding plane placed on the bottom side.
- GSM900<1dB
- DCS1800/PCS1900<1.5dB

3.13.1 Antenna connector

SIM300 use MURATA's MM9329-2700 RF connector on the module side, we recommend user use MURATA's MXTK92XXXXX as matching connector onthe application side. Please refer to appendix for detail info about MURATA`s MXTK92XXXXX.

3.13.2 Antenna pad

The antenna can be soldered to the pad, or attached via contact springs. To help you to ground the antenna, SIM300 comes with a grounding plane located closeto the antenna pad.

SIM300 material properties:

SIM300 PCB Material: FR4

Antenna pad: Gold plated pad

Antenna pad soldering temperature (fewer 10 seconds): 260°C

3.14 GLOBAL POSITIONING SYSTEM:

3.14.1 Introduction:

The Global Positioning System (GPS) is a burgeoning technology, which provides unequalled accuracy and flexibility of positioning for navigation, surveying and GIS data capture. The GPS NAVSTAR (Navigation Satellite timing and Ranging Global Positioning System) is a satellite-based navigation, timing and positioning

system. The GPS provides continuous three-dimensional positioning 24 hrs. a day throughout the world. The technology seems to be beneficiary to the GPS user community in terms of obtaining accurate data up to about 100 meters for navigation, meter-level for mapping, and down to millimeter level for geodetic positioning. The GPS technology has tremendous number of applications in GIS data collection, surveying, and mapping.

GPS provides accurate location and time information for an unlimited number of people in all weather, day and night, anywhere in the world. The Global Positioning System (GPS) is a satellite-based navigation system made up of a network of 24 satellites placed into orbit by the U.S. Department of Defense. GPS was originally intended for military applications, but in the 1980s, the government made the system available for civilian use. GPS works in any weather conditions, anywhere in the world, 24 hours a day. There are no subscription fees or setup charges to use GPS.

The GPS is made up of three parts: satellites orbiting the Earth; control and monitoring stations on Earth; and the GPS receivers owned by users. GPS satellites broadcast signals from space that are picked up and identified by GPS receivers. Each GPS receiver then provides three-dimensional location (latitude, longitude, and altitude) plus the time. Everyday activities such as banking, mobile phone operations, and even the control of power grids, are facilitated by the accurate timing provided by GPS. Farmers, surveyors, geologists and countless others perform their work more efficiently, safely, economically, and accurately using the free and open GPS signals.

3.14.2 GPS - Components and Basic Facts:

The GPS uses satellites and computers to compute positions anywhereon earth. The GPS is based on satellite ranging. That means the position on the earth is determined by measuring the distance from a group of satellites in space. The basic principles behind GPS are really simple, even though the system employs some of the most high-tech equipment ever developed. In order to understand GPS basics, thesystem can be categorized into 5 Logical steps.

3.14.3 Working of GPS:

GPS satellites circle the earth twice a day in a very precise orbit and transmit signal information to earth. GPS receivers take this information and use triangulation to calculate the user's exact location. Essentially, the GPS receiver compares the time a signal was transmitted by a satellite with the time it was received. The time difference tells the GPS receiver how far away the satellite is. Now, with distance measurements from a few more satellites, the receiver can determine the user's position and display it on the unit's electronic map.

Fig 3.14.1 GPS Working

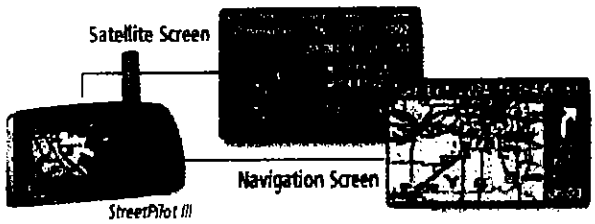


Fig: 3.14.2 GPS Locating

GPS receiver must be locked on to the signal of at least three satellites to calculate a 2D position (latitude and longitude) and track movement. With four or more satellites in view, the receiver can determine the user's 3D position (latitude, longitude and altitude). Once the user's position has been determined, the GPS unit can calculate other information, such as speed, bearing, track, trip distance, distance to destination, sunrise and sunset time and more.

3.14.4 The GPS satellite system:

The 24 satellites that make up the GPS space segment are orbiting the earth about 12,000 miles above us. They are constantly moving, making two complete orbits in less than 24 hours. These satellites are traveling at speeds of roughly 7,000 miles an hour. GPS satellites are powered by solar energy. They have backup batteries onboard to keep them running in the event of a solar eclipse, when there's no solar power. Small rocket boosters on each satellite keep them flying in the correct path.

Here are some other interesting facts about the GPS satellites (also called NAVSTAR, the official U.S. Department of Defense name for GPS):

- The first GPS satellite was launched in 1978.
- A full constellation of 24 satellites was achieved in 1994.
- Each satellite is built to last about 10 years. Replacements are constantly beingbuilt and launched into orbit.
- A GPS satellite weighs approximately 2,000 pounds and is about 17 feet acrosswith the solar panels extended.
- Transmitter power is only 50 watts or less.

3.14.5 GPS Positioning Types:

1) Absolute positioning:

The mode of positioning relies upon a single receiver station. It is also referred to as 'stand-alone' GPS, because, unlike differential positioning, ranging is carried out strictly between the satellite and the receiver station, not on a ground-based reference station that assists with the computation of error corrections. As a result, the positions derived in absolute mode are subject to the unmitigated errors inherent in satellite positioning. Overall accuracy of absolute positioning is considered to be no greater than 50 meters at best by Ackroyd and Lorimer and to be + 100-meter accuracy by the U.S. Army Corps of Engineers.

2) Differential Positioning:

Relative or Differential GPS carries the triangulation principles one step further. with a second receiver at a known reference point. To further facilitate determination of a point's position, relative to the known earth surface point, thisconfiguration demands collection of an error-correcting message from the reference receiver. Differential-mode positioning relies upon an established control point. The reference station is placed on the control point, a triangulated position, the control point coordinate.

3.14.6 Accuracy of GPS:

There are four basic levels of accuracy - or types of solutions - we can obtain with our real-time GPS mining system:

Table 3.14.1: Basic Levels of Accuracy

Autonomous	Accuracy	15 - 100 meters
Differential GPS (DGPS)	Accuracy	0.5 - 5 meters
Real-Time Kinematic (RTK Float)	Float Accuracy	20cm - 1 meter
Real-Time Kinematic (RTK Fixed)	Fixed Accuracy	1cm - 5 cm

GPS satellites broadcast on three different frequencies, and each frequency (or career wave) has some information or codes on it. We can think of it as three different radio stations broadcasting several different programs. The table below lists the signals and the contents:

Table 3.14.2 Signals and The Contents

L1 Career	L2 Career	L3 Career
19cm wavelength	24cm wavelength	
1575.42 M Hz	1227.6 M Hz	Data not available
C/A Code	P Code	
Navigation	Navigation Message	

- P Code: Reserved for direct use only by the military
- C/A Code: Used for rougher positioning
- For Single frequency use only L1 career is used
- For Double frequency, L1/L2/L3 career is used
- The navigation message (usually referred to as the ephemeris) tells us where the satellites are located, in a special coordinate system called WGS-84.If we know where the satellites are at any given time, then we can compute our location here on earth.

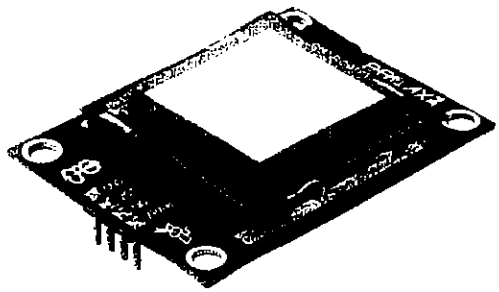


Fig 3.14.3 GPS circuit system

The SCYTEK Sky track 3000 GPS Vehicle Tracking System is theultimate GPS tracking system. It features unlimited real-time GPS tracking with user- friendly Internet software, notification alerts to cellular phone or e-mail address and an optional plug-in camera that takes pictures to display on a computer.

SCYTEK Sky track 3000 GPS Vehicle Tracking System:

- Unlimited real-time GPS tracking with user-friendly software
- Issues commands via computer or web-enabled cellular phone
- Door lock/unlock, remote start, starter enable/disable and flash horn
- Sends notification alerts to cellular phone or e-mail address
- Optional plug-in camera takes pictures to display on computer
- Unlimited $180 1-year airtime plan

Specifications:

Multi Pack Indicator:	No
Battery Type:	Does Not Contain a Battery
Model No.:	SKYTRACK 3000
Shipping Weight (in pounds):	1.0
Product in Inches (L x W x H):	7.2 x 5.3 x 4.9

3.14.7 Factors that affect GPS:

There are a number of potential error sources that affect either the GPSsignal directly or our ability to produce optimal results:

Number of satellites - minimum number required:

We must track at least four common satellites - the same four satellites.

Multi path - reflection of GPS signals near the antennae:

Multi path issimply reflection of signals similar to the phenomenon of ghosting.

Ionosphere - change in the travel time of the signal:

Before GPS signals reach our antenna on the earth they pass through a zone of charged particles called the ionosphere, which changes the speed of the signal.

Signal Strength - Quality of Signal:

The strength of the satellite signal depends on obstructions and the elevation of the satellites above the horizon.

Distance from the Reference Receiver:

The effective range of a rover from a reference station depends primarily on the type of accuracy we are trying to achieve.

Radio Frequency (RF) Interference: RF interference may sometimes be a problem both for our GPS reception and our radio system. Some sources of RF interference include:

- Radio towers
- Transmitters
- Satellite dishes
- Generators

One should be particularly careful of sources which transmit either near the GPS frequencies (1227 and 1575 MHz) or near harmonics (multiples) of these frequencies. One should also be aware of the RF generated by his own machines.

3.14.8 GPS Applications:

1. Surveying and Mapping:

The GPS is used to map cut blocks, road alignments, and environmental hazards such as landslides, forest fires, and oil spills. Continuous kinematic techniques can be used for topographic surveys and accurate linear mapping.

2. Navigation:

Navigation using GPS can save countless hours in the field. Any feature, even if it is under water, can be located up to one hundred meters simply by scaling coordinates from a map, entering waypoints, and going directly to the site.

3. Remote Sensing and GIS:

It is also possible to integrate GPS positioning into remote-sensing methods such as photo grammetry and aerial scanning, magnetometry, and video technology. GPS are becoming very effective tools for GIS data capture.

4. Military:

The GPS was primarily developed for real time military positioning. Military applications include airborne, marine, and land navigation.

3.14.8 Future of GPS Technology:

Barring significant new complications due to S/A (Selective Availability)from DOD, the GPS industry is likely to continue to develop in the civilian community. There are currently more than 50 manufacturers of GPs receivers, with the trend continuing to be towards smaller, less expensive, and more easily operated devices. While highly accurate, portable (hand-held) receivers are already available, currentspeculation envisions inexpensive and equally accurate 'wristwatch locators' and navigational guidance systems for automobiles. However, there is one future trend that will be very relevant to the GIS user community, namely, community base stations and regional receive networks, as GPS management and technological innovations that will make GPS surveying easier and more accurate.

RFID TECHNOLOGY

History of RFID:

In a very interesting article, the San Jose Mercury News tells us about **Charles Walton, the man behind the radio frequency identification technology (RFID).** Since his first patent about it in 1973, Walton, now 83 years old, collected about $3 million from royalties coming from his patents. Unfortunately for him, his latest patent about RFID expired in the mid-1990s. So he will not make any money from the billions of RFID tags that will appear in the years to come. But he continues to invent and his latest patent about a proximity card with incorporated PIN code protection was granted in June 2004.

What is RFID?

RFID is short for Radio Frequency Identification. Generally, a RFID system consists of 2 arts. A Reader, and one or more Transponders, also known as Tags. RFID systems evolved from barcode labels as a means to automatically identify and track products and people. You will be generally familiar with RFID systems as seen in:

- **Access Control.**

  RFID Readers placed at entrances that require a person to pass their proximity card (RF tag) to be "read' before the access can be made.

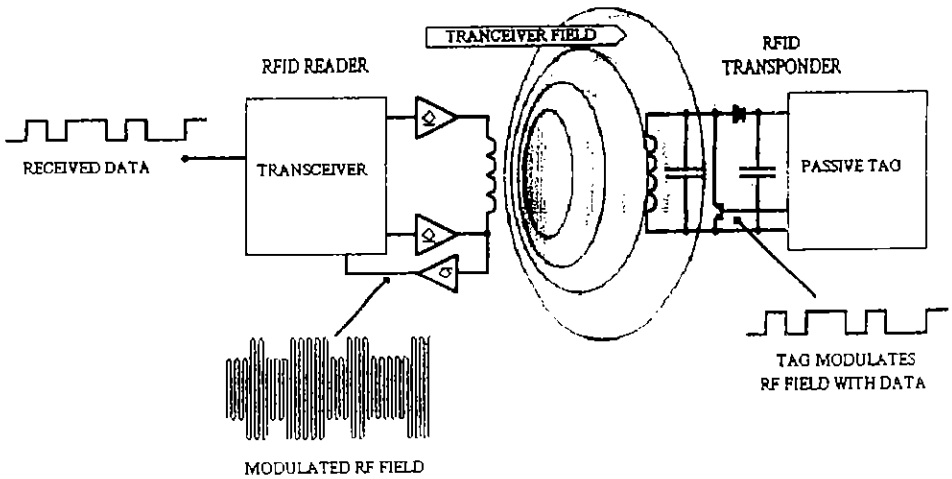
- **Contact less Payment Systems.**

  RFID tags used to carry payment information. RFIDs are particular suited to electronic Toll collection systems. Tags attached to vehicles, or carried by people transmit payment information to a fixed reader attached to a Toll station. Payments are then routinely deducted from a users account, or information is changed directly on the RFID tag.

- **Product Tracking and Inventory Control.** RFID systems are commonly used to track and record the movement of ordinary items such as library books, clothes, factory pallets, electrical goods and numerous items.

How do RFIDs work.

Shown below is a typical RFID system. In every RFID system the transponder Tags contain information. This information can be as little as a single binary bit, or be a large array of bits representing such things as an identity code, personal medical information, or literally any type of information that can be stored in digital binary format.



Shown is a RFID transceiver that communicates with a passive Tag. Passive tags have no power source of their own and instead derive power from the incident electromagnetic field. Commonly the heart of each tag is a microchip. When the Tag

enters the generated RF field it is able to draw enough power from the field to access its internal memory and transmit its stored information. When the transponder Tag draws power in this way the resultant interaction of the RF fields causes the voltage at the transceiver antenna to drop in value. This effect is utilized by the Tag to communicate its information to the reader. The Tag is able to control the amount of power drawn from the field and by doing so it can modulate the voltage sensed at the Transceiver according to the bit pattern it wishes to transmit.

COMPONENTS OF RFID

Basic RFID systems consist of three components:

- An antenna or coil
- A transceiver (with decoder)
- A transponder (RF tag) electronically programmed with unique information

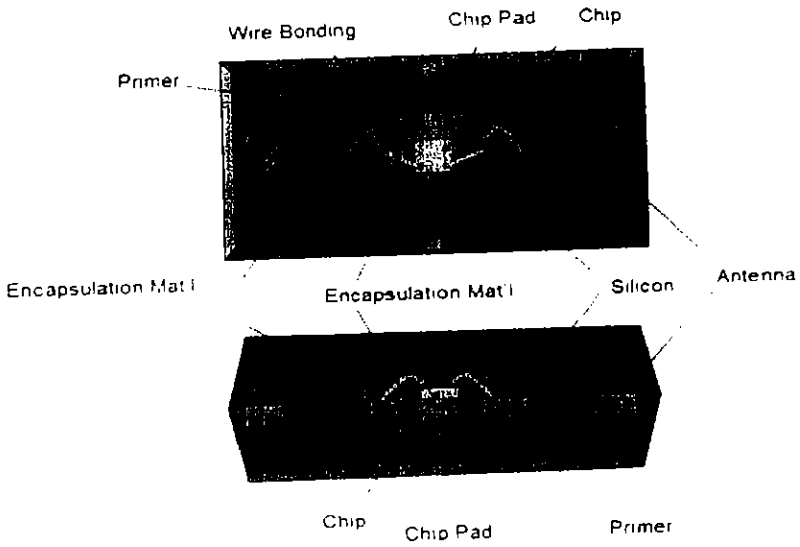
These are described below:

1. ANTENNA

The antenna emits radio signals to activate the tag and read and write data to it. Antennas are the conduits between the tag and the transceiver, which controls the system's data acquisition and communication. Antennas are available in a variety of shapes and sizes; they can be built into a door frame to receive tag data from persons or things passing through the door, or mounted on an interstate tollbooth to monitor traffic passing by on a freeway. The electromagnetic field produced by an antenna can be constantly present when multiple tags are expected continually. If constant interrogation is not required, a sensor device can activate the field.

Often the antenna is packaged with the transceiver and decoder to become a reader (a.k.a. interrogator), which can be configured either as a handheld or a fixed-mount device. The reader emits radio waves in ranges of anywhere from one inch to 100 feetor more, depending upon its power output and the radio frequency used. When an RFID tag passes through the electromagnetic zonPage | 47e, it detects the reader's activation signal. The

reader decodes the data encoded in the tag's integrated circuit (silicon chip) and the data is passed to the host computer for processing.



2. TAGS (Transponders)

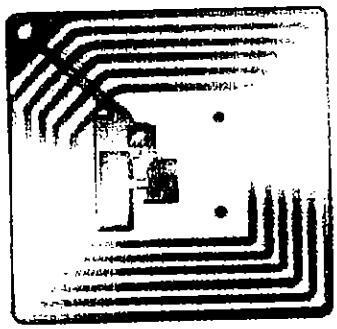
An RFID tag is comprised of a microchip containing identifying information and an antenna that transmits this data wirelessly to a reader. At its most basic, the chip will contain a serialized identifier, or license plate number, that uniquely identifies that item, Similar to the way many bar codes are used today. A key difference, however is that RFID tags have a higher data capacity than their bar code counterparts. This increases the options for the type of information that can be encoded on the tag, including the manufacturer, batch or lot number, weight, ownership, destination and history (such as the temperature range to which an item has been exposed). In fact, an unlimited list of other types of information can be stored on RFID tags, depending on application needs. An RFID tag can be placed on individual items, cases or pallets for identification purposes, as well as on fixed assets such as trailers, containers, totes, etc.

Tags come in a variety of types, with a variety of capabilities. Key variables include:

"Read-only" versus "read-write"

There are three options in terms of how data can be encoded on tags: (1) Read-only tags contain data such as a serialized tracking number, which is pre-written onto

them by the tag manufacturer or distributor. These are generally the least expensive tags because they cannot have any additional information included as they move throughout the supply chain. Any updates to that information would have to be maintained in the application software that tracks SKU movement and activity. (2) "Write once" tags enable a user to write data to the tag one time in production or distribution processes. Again, this may include a serial number, but perhaps other data such as a lot or batch number. (3) Full "read-write" tags allow new data to be written to the tag as needed—and even written over the original data. Examples for the latter capability might include the time and date of ownership transfer or updating the repair history of a fixed asset. While these are the most costly of the three tag types and are not practical for tracking inexpensive items, future standards for electronic product codes (EPC) appear to be headed in this direction.



RFID TAGS

Data capacity

The amount of data storage on a tag can vary, ranging from 16 bits on the low end to as much as several thousand bits on the high end. Of course, the greater the storage capacity, the higher the price per tag.

Form factor

The tag and antenna structure can come in a variety of physical form factors and can either be self-contained or embedded as part of a traditional label structure (i.e., the tag is inside what looks like a regular bar code label—this is termed a 'Smart Label')

companies must choose the appropriate form factors for the tag very carefully and should expect to use multiple form factors to suit the tagging needs of different physical products and units of measure.

Passive versus active

"Passive" tags have no battery and "broadcast" their data only when energized by a reader. That means they must be actively polled to send information. "Active" tags are capable of broadcasting their data using their own battery power. In general, this means that the read ranges are much greater for active tags than they are for passive tags—perhaps a read range of 100 feet or more, versus 15 feet or less for most passive tags.

Frequencies

Like all wireless communications, there are a variety of frequencies or spectra through which RFID tags can communicate with readers. Again, there are trade-offs among cost, performance and application requirements. For instance, low-frequency tags are cheaper than ultra-high-frequency (UHF) tags, use less power and are better able to penetrate non-metallic substances.

EPC Tags

EPC refers to "electronic product code," an emerging specification for RFID tags, readers and business applications first developed at the Auto-ID Center at the Massachusetts Institute of Technology. This organization has provided significant intellectual leadership toward the use and application of RFID technology.

3. RF Transceiver:

The RF transceiver is the source of the RF energy used to activate and power the passive RFID tags. The RF transceiver may be enclosed in the same cabinet as the reader or it may be a separate piece of equipment. When provided as a separate piece of equipment, the transceiver is commonly referred to as an RF module. The RF transceiver controls and modulates the radio frequencies that the antenna transmits and receives. The transceiver filters and amplifies the backscatter signal from a passiveRFID tag.

Typical Applications for RFID

- Automatic Vehicle identification
- Inventory Management
- Work-in-Process
- Container/ Yard Management
- Document/ Jewellery tracking
- Patient Monitoring

The Advantages of RFID Over Bar Coding

1. No "line of sight" requirements: Bar code reads can sometimes be limited or problematic due to the need to have a direct "line of sight" between a scanner and a bar code. RFID tags can be read through materials without line of sight.
2. More automated reading: RFID tags can be read automatically when a tagged product comes past or near a reader, reducing the labor required to scan product and allowing more proactive, real-time tracking.
3. Improved read rates: RFID tags ultimately offer the promise of higher read rates than bar codes, especially in high-speed operations such as carton sortation.
4. Greater data capacity: RFID tags can be easily encoded with item details such as lot and batch, weight, etc.
5. "Write" capabilities: Because RFID tags can be rewritten with new data as supply chain activities are completed, tagged products carry updated information as they move throughout the supply chain.

3.15 LCD DISPLAY

LCD Background:

One of the most common devices attached to a micro controller is an LCD display. Some of the most common LCDs connected to the many

microcontrollers are 16x2 and 20x2 displays. This means 16 characters per line by 2 lines and 20 characters per line by 2 lines, respectively.

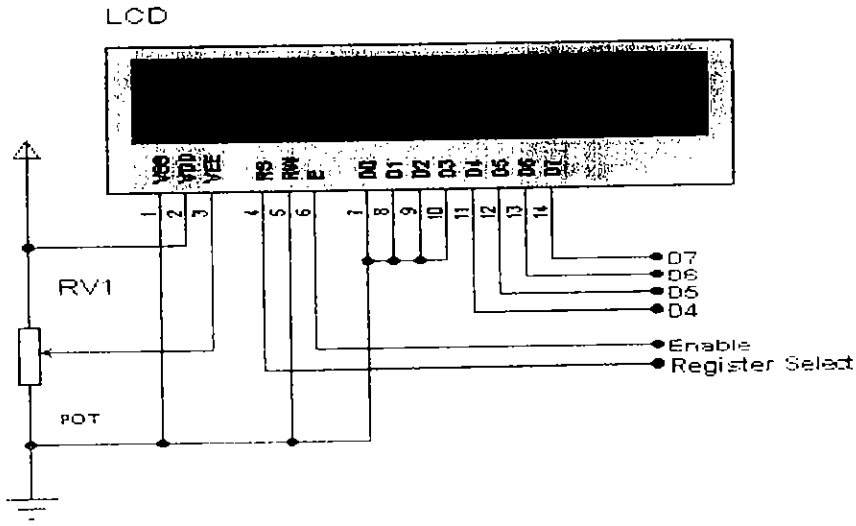


Fig 3.15.1: Basic 16x2 Characters LCD Pin Diagram

3.15.1 Pin description:

Table 4.15.1: Character LCD pins with Microcontroller

Pin No.	Name	Description
Pin no. 1	**VSS**	Power supply (GND)
Pin no. 2	**VCC**	Power supply (+5V)
Pin no. 3	**VEE**	Contrast adjust
Pin no. 4	**RS**	0 = Instruction input 1 = Data input
Pin no. 5	**R/W**	0 = Write to LCD module 1 = Read from LCD module
Pin no. 6	**EN**	Enable signal
Pin no. 7	**D0**	Data bus line 0 (LSB)
Pin no. 8	**D1**	Data bus line 1
Pin no. 9	**D2**	Data bus line 2

Pin no. 10	**D3**	Data bus line 3
Pin no. 11	**D4**	Data bus line 4
Pin no. 12	**D5**	Data bus line 5
Pin no. 13	**D6**	Data bus line 6
Pin no. 14	**D7**	Data bus line 7 (MSB)

The three control lines are referred to as **EN**, **RS**, and **RW**.

The **EN** line is called "Enable." This control line is used to tell the LCD that we are sending it data. To send data to the LCD, our program should make sure this line is low (0) and then set the other two control lines and/or put data on the data bus.

The **RS** line is the "Register Select" line. When RS is low (0), the data is to be treated as a command or special instruction (such as clear screen, position cursor, etc.). When RS is high (1), the data being sent is text data which should be displayed on the screen. For example, to display the letter "T" on the screen we would set RS high.

The **RW** line is the "Read/Write" control line. When RW is low (0), the information on the data bus is being written to the LCD. When RW is high (1), the program is effectively querying (or reading) the LCD. Only one instruction ("Get LCD status") is a read command. All others are write commands--so RW will almost always be low.

Finally, the data bus consists of 4 or 8 lines (depending on the mode of operation selected by the user). In the case of an 8-bit data bus, the lines are referred to as DB0, DB1, DB2, DB3, DB4, DB5, DB6, and DB7.

Applications:

- Medical equipment
- Electronic test equipment
- Industrial machinery Interface
- Restaurant ordering systems
- Gaming box

- Security systems

3.16 Software Description:

CREATING PROJECT IN ARDUINO 1.7.11 VERSION. Arduino Uno Installation

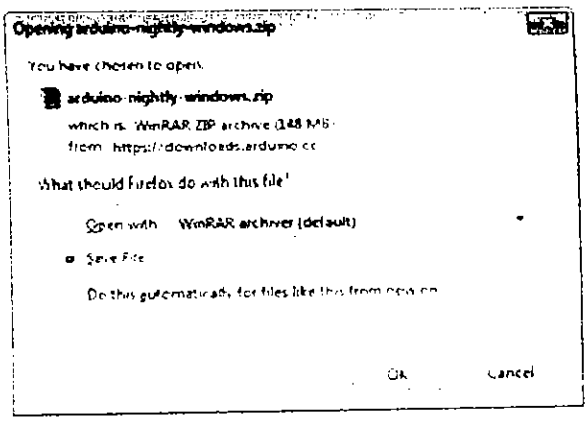
In this, we will get know of the process of installation of Arduino IDE and connecting Arduino Uno to Arduino IDE.

Step 1

First, we must have our Arduino board (we can choose our favorite board) and a USB cable. In case we use Arduino UNO, Arduino Duemilanove, Nano, Arduino Mega 2560, or Diecimila, we will need a standard USB cable (A plug to B plug), t

In case we use Arduino Nano, we will need an A to Mini-B cable.

Step 2 – Download Arduino IDE Software. We can get different versions of Arduino IDE from the Download page on the Arduino Official website. We must select were software, which is compatible with were operating system (Windows, IOS, or Linux). After where file download is complete, unzip the file.



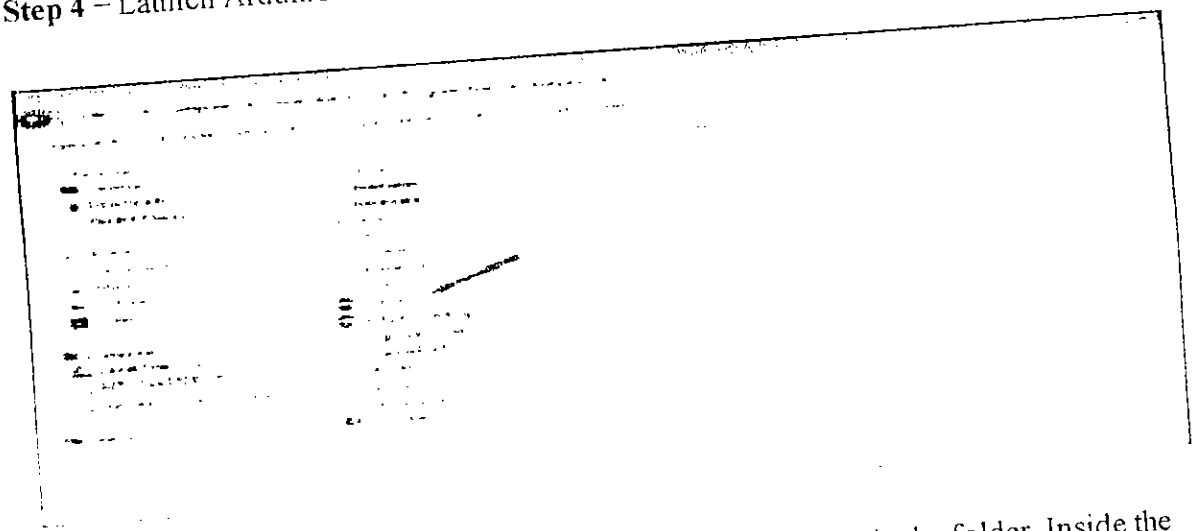
Step 3 – Power up our board.

The Arduino Uno, Mega, Duemilanove, and Arduino Nano automatically draw power from either, the USB connection to the computer or an external power supply. If we are using an Arduino Diecimila, we have to make sure that the board is configured to draw power from the USB connection. The power source is selected with a jumper, a small piece of plastic that fits onto two of the three pins between the USB and power jacks.

Check that it is on the two pins closest to the USB port.

Connect the Arduino board to were computer using the USB cable. The green powerLED (labeled PWR) should glow.

Step 4 – Launch Arduino IDE.

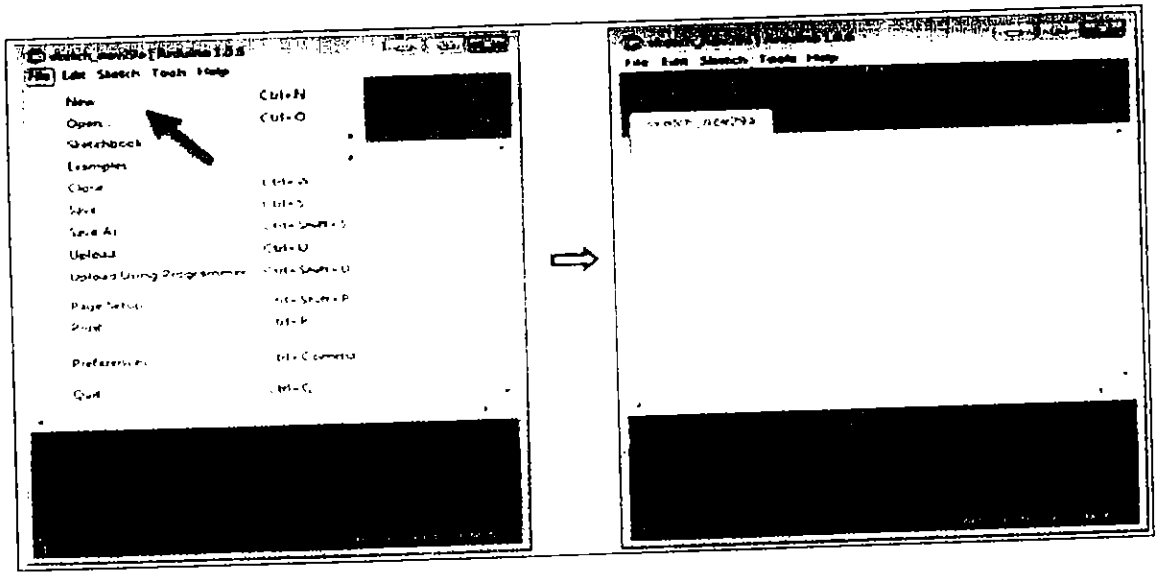


After our Arduino IDE software is downloaded, we need to unzip the folder. Inside the folder, we can find the application icon with an infinity label (application.exe). Double-click the icon to start the IDE.

Step 5 – Open our first project.

Once the software starts, we have two options

- Create a new project



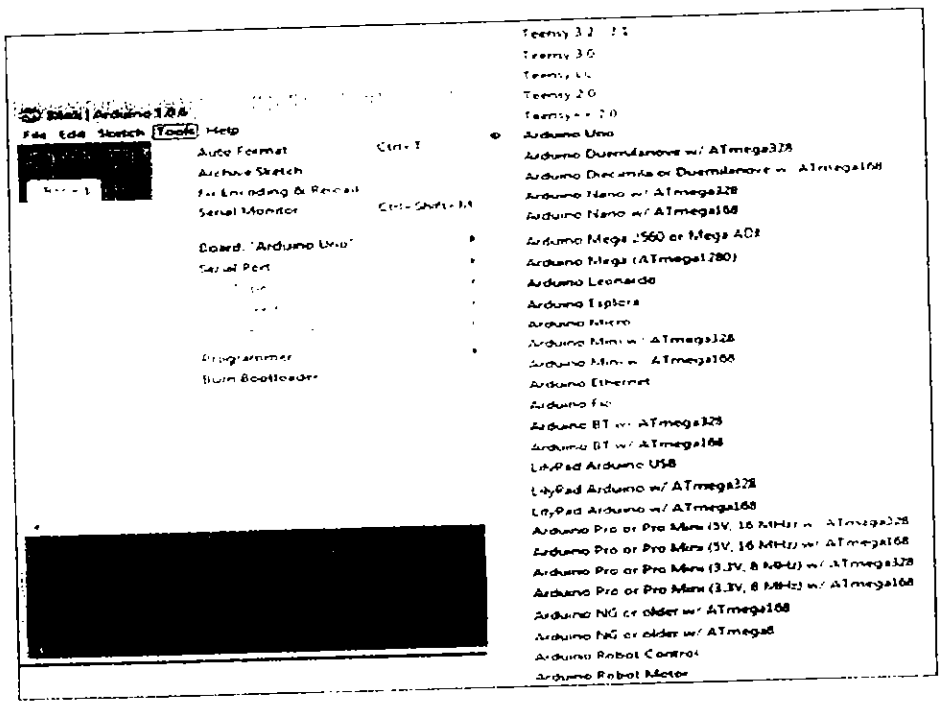
Open an existing project example.

To create a new project, select File → New.

To open an existing project example, select File → Example → Basics → Blink.

Here, we are selecting just one of the examples with the name Blink. It turns the LED on and off with some time delay. We can select any other example from the list.

Step 6 – Select our Arduino board.

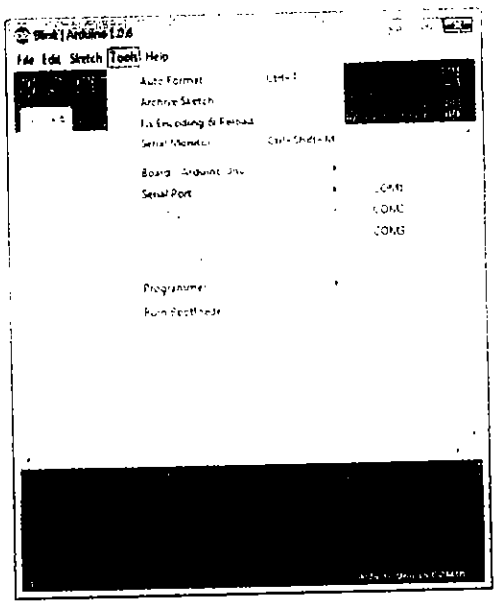


To avoid any error while uploading were program to the board, we must select thecorrect Arduino board name, which matches with the board connected to were computer.

Go to Tools → Board and select were board.

Here, we have selected Arduino Uno board according to our tutorial, but we must select the name matching the board that we are using

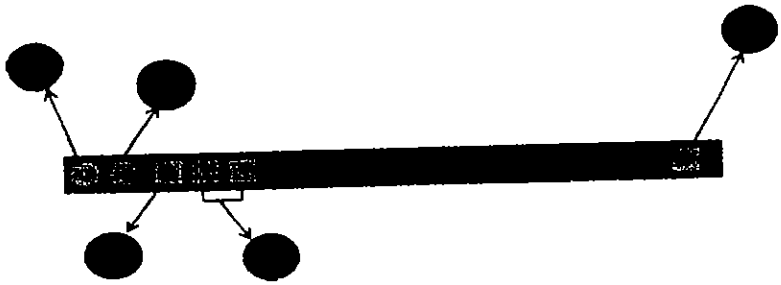
Step 7 – Select were serial port.



Select the serial device of the Arduino board. Go to Tools → Serial Port menu. This is likely to be COM3 or higher (COM1 and COM2 are usually reserved for hardware serial ports). To find out, we can disconnect were Arduino board and re-open the menu, the entry that disappears should be of the Arduino board. Reconnect the board and select that serial port.

Step 8 – Upload the program to were board.

Before explaining how we can upload our program to the board, we must demonstrate the function of each symbol appearing in the Arduino IDE toolbar.



A – Used to check if there is any compilation error.

B – Used to upload a program to the Arduino board.

C – Shortcut used to create a new sketch.

D – Used to directly open one of the example sketch.

E – Used to save were sketch.

F – Serial monitor used to receive serial data from the board and send the serial data to the board.

Now, simply click the "Upload" button in the environment. Wait a few seconds; we will see the RX and TX LEDs on the board, flashing. If the upload is successful, the message "Done uploading" will appear in the status bar.

Note – If we have an Arduino Mini, NG, or other board, we need to press the reset button physically on the board. immediately before clicking the upload button on the Arduino Software.

CHAPTER 4

ADVANTAGES, DISADVANTAGES AND APPLICTIONS

Advantages:

- It is safe and easy to use
- Low cost
- Less weight (Can be used by children, teenager girls, women, old age people)
- Easy coding & Maintenance (mobile number can be changed at any time)

Disadvantages:

- Interfacing of GSM modem to microcontroller is sensitive.
- When the power will turn OFF, and then the total system will turn OFF, sobattery is always required.

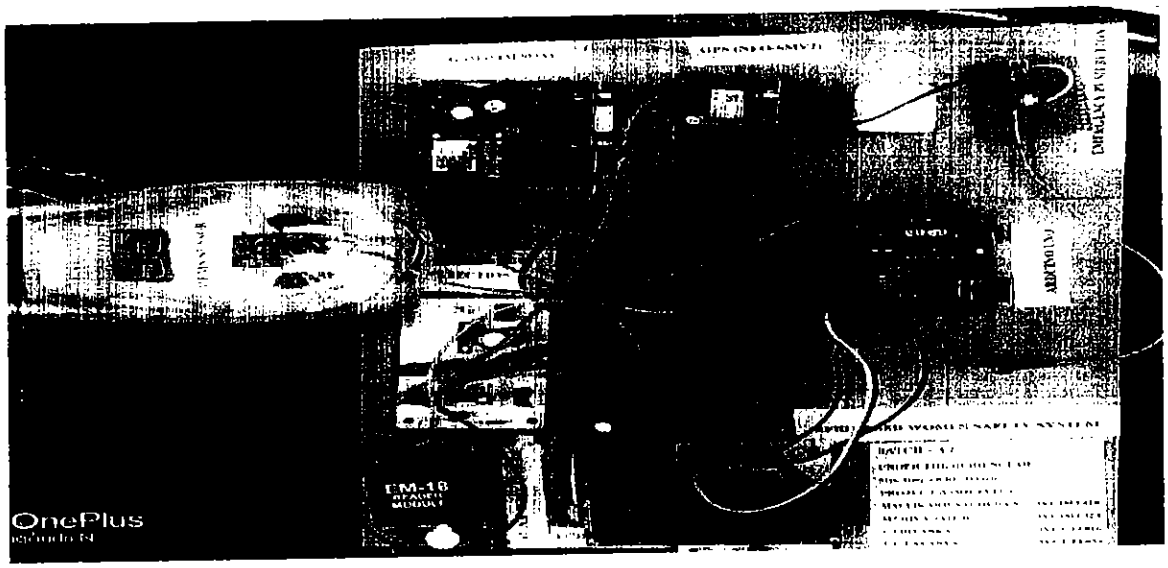
Applications:

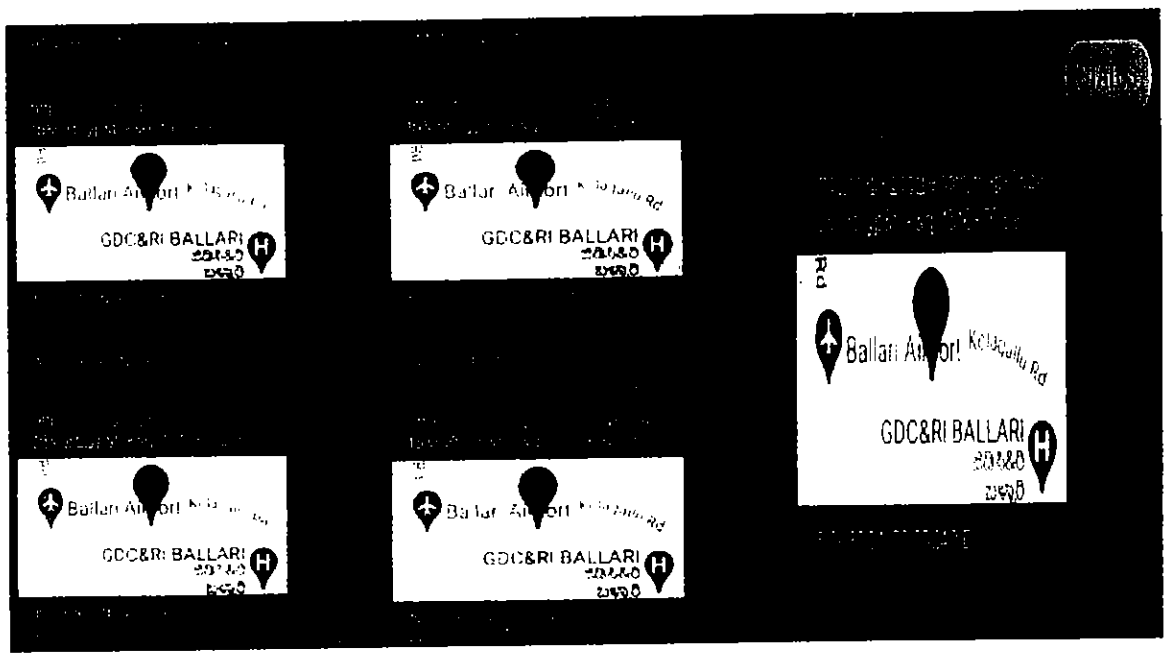
1. It can be used in banks, industries during nights.
2. This system can be implemented in apartments for security purpose.
3. Can be used in jails for security.

CHAPTER 5

EXPERIMENTAL RESULTS

In this proposal, we have proposed the designing and implementation of a safety system for women in the form of RFID card. Going serially as per the objectives mentioned, a location tracking subsystem was successfully implemented and the corresponding results were logged. It allows checking the location of the person using the Tag. The Reader which is embedded in each vehicle recognizes the details of the particular person. When the car picks up the person: he/she needs to swap the RFID card. The RFID card no with its database records and sends the person id & co-ordinatesto the unit via GSM module.





CHAPTER 6

FUTURE SCOPE AND CONCLUSION

6.1 Conclusion:

Integrating features of all the hardware components used have beendeveloped in it. Presence of every module has been reasoned out and placed carefully, thus contributing to the best working of the unit. Secondly, using highly advanced ICs with the help of growing technology, the project has been successfully implemented. Thus, the project has been successfully designed and tested.

6.2 Future Scope:

Our project "**RFID BASED WOMEN SAFETY SYSTEM**" is mainly intended for detection of burglar's. This project uses a Mems sensor which is capable of detecting human movements when they are harassed which are emitted by the microelectronic movement detection sensor, an appropriate electrical signal is given as input to microcontroller which in turn sends the alert message to the family/police through SMS with the help of GSM modem interfaced to the Micro Controller.

This project can be extended by using Fire sensor, IR sensor, IoT and 3G technologies. Fire sensor alerts in case of fire accidents. IR module ca also helps in alerting if any presence. Through IoT, we can monitor the women from anywhere in the world and 3G technologies can be used to view the person through video calling option.

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