VISVESVARAYA TECHNOLOGICAL UNIVERSITY Jnana Sangama, Belagavi- 590018

A Project Report on

"VOICE AND GESTURE CONTROLLED SMART VEHICLE FOR PHYSICALLY CHALLENGED INTEGRATED WITH HOME AUTOMATION"

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A dissertation submitted in the partial fulfillment of the requirement for the Award of Degree of

BACHELOR OF ENGINEERING
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Submitted by

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CERTIFICATE

Certified that the Project Work entitled **"VOICE AND GESTURE CONTROLLED SMART VEHICLE FOR PHYSICALLY CHALLENGED INTEGRATED WITH HOME AUTOMATION"** is a bonafide work carried out by **Ms. ANISHA (3VC17EC003), Mr. ASIF AHMED (3VC17EC005), Ms. SREELAKSHMI DESAI (3VC17EC072), Ms. VIDYASHREE (3VC17EC080)** in partial fulfillment for the Award of Bachelor of Engineering in Electronics & Communication Engineering of Visvesvaraya Technological University, Belagavi during the year 2020-2021. It is certified that all corrections/suggestions indicated for Internal Assessment have been incorporated in the report deposited in the departmental library. The project report has been approved as it satisfies the academic requirements in respect of project work prescribed for the said Degree.

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1.	20/8/21
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DECLARATION

We, **ANISHA, ASIF AHMED, SREELAKSHMI DESAI, VIDYASHREE** students of Eight semester BE, in the Department of Electronics and Communication Engineering, RYMEC, Ballari declare that the Project entitle **"VOICE AND GESTURE CONTROLLED SMART VEHICLE FOR PHYSICALLY CHALLENGED INTEGRATED WITH HOME AUTOMATION"** has been carried out by us at **Dept of ECE RYMEC Ballari,** and submitted in partial fulfillment of the course requirements for the award of degree in **Bachelor of Engineering in Electronics & Communication Engineering**, of Visvesvaraya Technological University, Belagavi during the year 2020-2021. Project Associates

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ABSTRACT

A voice and touch controlled wheelchair prototype was developed using a commercially available manual wheelchair to assist people with both upper and lower limb disabilities. An Arduino microcontroller processes the voice command as well touch based from the speech recognition process and controls the motor movement of the wheelchair. Bluetooth module was also used to do away with messy wiring and an optional hand gesture command was also incorporated into the prototype design. The Bluetooth module of the wheelchair will recognize the voice commands in English. The overall cost of the prototype was kept low to make it affordable. With these modules we can also make basic home automation like controlling lights and fan with voice.

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INTRODUCTION

"World report on disability" (2011) jointly presented by World Health Organization (WHO) and World Bank says that there are 70 million people are handicapped in the world. Unfortunately, day by day the number of handicapped people is going on increasing due to road accidents as well as the disease which leading paralysis. Among people with disabilities, percentage of physically handicapped person is most. If a person is handicapped, he is dependent on other person for his day to day work like transport, food, orientation etc [1]. Despite the widespread use of smart vehicles, majority of the people be it physically challenged or people in their old age find it extremely difficult or impossible to use a wheelchair for necessary daily activities and the major difficulty is with steering tasks.

What will happen if wheelchair starts moving with audio input like forward, backward, left and right? The disabled person can move anywhere they want without the help of second person and independently. There will be no need to use hands for moving the wheelchair. We are trying to implement this concept through our project "Smart Vehicle". The name itself indicates the meaning which is intelligent. The idea of using voice activated technology for controlling the motion of the smart vehicle and home automation are to prove that it can be a unique concept that would stand apart from the rest of the average papers. The need of this new technology in conjunction with a mechanical system in order to simplify everyday life and it would spark interest in an ever growing modern society. The main target of the human smart vehicle interface is to allow the user to control the mobility of the chair in less effort and more robustness and safety. While the needs of many individuals with disabilities can be satisfied with power wheelchairs, some members of the disabled community find it is difficult or impossible to operate a standard power wheelchair. This paper could be part of an assisting technology. It is for more independent, productive and enjoyable living. [2]

CHAPTER-2

LITERATURE SURVEY

There are many researches done in the field of smart vehicles to impart the independent living and mobility to its users. But due to sophisticated signal processing algorithms and powerful computers and components available, computer based speech processing systems nowadays have reached high accuracy with complex structure. The challenge is to maintain the standard performance while using limited computation and memory resources. Researches in the area of smart vehicle control system are still going on. Many people with disabilities do not have the skill as required to control a basic smart vehicle. This can become a great drawback for the users who are permanently unable to move. The need of this new technology in conjunction with a mechanical system in order to simplify everyday life and it would spark interest in an ever growing modern society.

Keeping mind the needs of such type of people this smart vehicle which can be controlled either by voice or by using hand gesture operations was designed thus providing the independency and self satisfaction of disabled or aged people. After several studies and survey around the world it has shown that both children and adults benefit substantially from access to a means of independently move freely. Though many disabled people can be satisfied with traditional manual or powered smart vehicles, there is a category of disabled community which find it difficult or impossible to use assistive devices independently. Many researchers have used several technologies to make a smart vehicle accessible to use for this population. Several wheelchairs have been developed with several control devices. The brain signal interfaces, vision based, head gesture based and many more controlled devices have been developed. The proposed work is to design and develop a smart wheelchair using a voice recognition and hand gesture control system integrated with home automation. It can be used efficiently with less effort by the users so that they can use it independently and easily.

2.1 PROBLEM STATEMENT

Though the recent developments of science and technology has drastically changed the way a normal person lives his life, There are certain groups of people who have not been able to benefit from this development. On this note majorly handicapped people with limited mobility are still living a miserably life. Irrespective of the area the smart vehicle can be used by people of any age groups who are dependent on others for their mobility. The voice and gesture controlled smart vehicle can provide easy access for physically disabled person who cannot control their movements especially hands. Our project of smart vehicle aims at providing these physically challenged people with some sort of mobility which would greatly help them.

2.2 OBJECTIVE

The main objective of smart vehicle system project is recommended to control a vehicle by using speech recognition or gesture recognition module. The objective of this project is to facilitate the movement of people who are disabled or handicapped and elderly people who are not able to move well. Providing independent, productive and enjoyable living for physically challenged people by the use of voice and gesture operated smart vehicle. It can be a unique concept that would stand apart from the rest of the average projects. The need of this new technology in conjunction with a mechanical system in order to simplify everyday life and it would spark interest in an ever growing modern society.

2.3 PROPOSED SYSTEM

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. Producing a custom-made chip to handle a particular task or set of tasks costs far more time and money. Many embedded computers even come with extensive libraries, so that "writing your own software" becomes a very trivial task indeed. From an implementation viewpoint, there is a major difference between a computer and an embedded system. Embedded systems are often required to provide Real-Time response. The main elements that make embedded systems unique are its reliability and ease in debugging.

Today a lot of industries are using embedded systems for process control. In industries we design the embedded systems to perform a specific operation like monitoring temperature, pressure, humidity ,voltage, current etc.., and basing on these monitored levels we do control other devices, we can send information to a centralized monitoring station. Embedded systems often reside in machines that are expected to run continuously for years without errors and in some cases recover by themselves if an error occurs. Therefore the software is usually developed and tested more carefully than that for personal computers, and unreliable mechanical moving parts such as disk drives, switches or buttons are avoided.

CHAPTER-3

DESIGN AND IMPLEMENTATION OF THE PROPOSED WORK

3.1 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).

Since the embedded system is dedicated to specific tasks, design engineers can optimize it to reduce the size and cost of the product and increase the reliability and performance. Some embedded systems are mass-produced, benefiting from economies of scale.

Physically embedded systems range from portable devices such as digital watches and MP3 players, to large stationary installations like traffic lights, factory controllers, or the systems controlling nuclear power plants. Complexity varies from low, with a single microcontroller chip, to very high with multiple units, peripherals and networks mounted inside a large chassis or enclosure.

In general, "embedded system" is not a strictly definable term, as most systems have some element of extensibility or programmability. For example, handheld computers share some elements with embedded systems such as the operating systems and microprocessors which power them, but they allow different applications to be loaded and peripherals to be connected. Moreover, even systems which don't expose programmability as a primary feature generally need to support software updates. On a continuum from "general purpose" to "embedded", large application systems will have subcomponents at most points even if the system as a whole is "designed to perform one or a few dedicated functions", and is thus appropriate to call "embedded". A modern example of embedded system is shown in fig: 1.1.

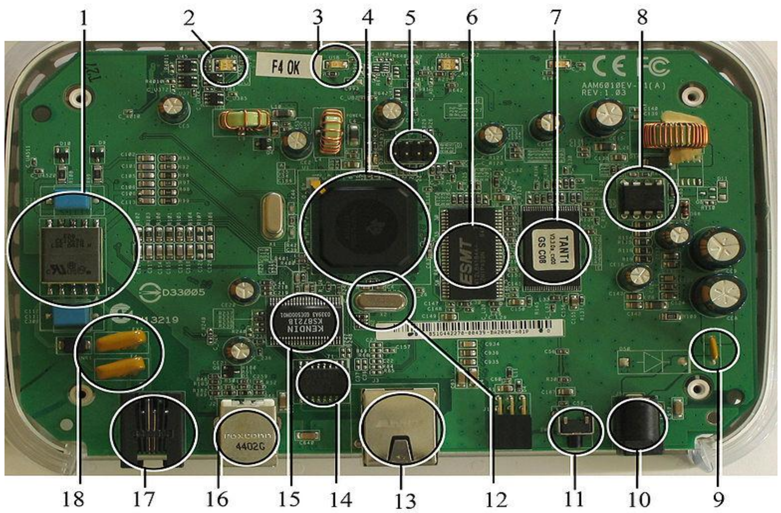


Fig 3.1 A modern example of embedded system

Fig 3.1 shows the Labeled parts that 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. 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.

3.1.1 HISTORY:

In the earliest years of computers in the 1930–40s, computers were sometimes dedicated to a single task, but were far too large and expensive for most kinds of tasks performed by embedded computers of today. Over time however, the concept of programmable controllers evolved from traditional electromechanical sequencers, via solid state devices, to the use of computer technology.

One of the first recognizably modern embedded systems was the Apollo Guidance Computer, developed by Charles Stark Draper at the MIT Instrumentation Laboratory. At the project's inception, the Apollo guidance computer was considered the riskiest item in the Apollo project as it employed the then newly developed monolithic integrated circuits to reduce the size and weight. An early mass-produced embedded system was the Autonetics D-17 guidance computer for the Minuteman missile, released in 1961. It was built from transistor logic and had a hard disk for main memory. When the Minuteman II went into production in 1966, the D-17 was replaced with a new computer that was the first high-volume use of integrated circuits.

3.1.2 TOOLS:

Embedded development makes up a small fraction of total programming. There's also a large number of embedded architectures, unlike the PC world where 1 instruction set rules, and the Unix world where there's only 3 or 4 major ones. This means that the tools are more expensive. It also means that they're lower featured, and less developed. On a major embedded project, at some point you will almost always find a compiler bug of some sort.

Debugging tools are another issue. Since you can't always run general programs on your embedded processor, you can't always run a debugger on it. This makes fixing your program difficult. Special hardware such as JTAG ports can overcome this issue in part. However, if you stop on a breakpoint when your system is controlling real world hardware (such as a motor), permanent equipment damage can occur. As a result, people doing embedded programming quickly become masters at using serial IO channels and error message style debugging.

3.1.3 RESOURCES:

To save costs, embedded systems frequently have the cheapest processors that can do the job. This means your programs need to be written as efficiently as possible. When dealing with large data sets, issues like memory cache misses that never matter in PC programming can hurt you. Luckily, this won't happen too often- use reasonably efficient algorithms to start, and optimize only when necessary. Of course, normal profilers won't work well, due to the same reason debuggers don't work well.

Memory is also an issue. For the same cost savings reasons, embedded systems usually have the least memory they can get away with. That means their algorithms must be memory efficient (unlike in PC programs, you will frequently sacrifice processor time for memory, rather than the reverse). It also means you can't afford to leak memory. Embedded applications generally use deterministic memory techniques and avoid the default "new" and "malloc" functions, so that leaks can be found and eliminated more easily. Other resources programmers expect may not even exist. For example, most embedded processors do not have hardware FPUs (Floating-Point Processing Unit). These resources either need to be emulated in software, or avoided altogether.

3.1.4 REAL TIME ISSUES:

Embedded systems frequently control hardware, and must be able to respond to them in real time. Failure to do so could cause inaccuracy in measurements, or even damage hardware such as motors. This is made even more difficult by the lack of resources available. Almost all embedded systems need to be able to prioritize some tasks over others, and to be able to put off/skip low priority tasks such as UI in favor of high priority tasks like hardware control.

3.2 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. Producing a custom-made chip to handle a particular task or set of tasks costs far more time and money. Many embedded computers even come with extensive libraries, so that "writing your own software" becomes a very trivial task indeed. From an implementation viewpoint, there is a major difference between a computer and an embedded system. Embedded systems are often required to provide Real-Time response. The main elements that make embedded systems unique are its reliability and ease in debugging.

3.2.1 DEBUGGING:

Embedded debugging may be performed at different levels, depending on the facilities available. From simplest to most sophisticate they can be roughly grouped into the following areas:

- Interactive resident debugging, using the simple shell provided by the embedded operating system (e.g. Forth and Basic)
- External debugging using logging or serial port output to trace operation using either a monitor in flash or using a debug server like the Remedy Debugger which even works for heterogeneous multi core systems.
- An in-circuit debugger (ICD), a hardware device that connects to the microprocessor via a JTAG or Nexus interface. This allows the operation of the microprocessor to be controlled externally, but is typically restricted to specific debugging capabilities in the processor.
- An in-circuit emulator replaces the microprocessor with a simulated equivalent, providing full control over all aspects of the microprocessor.
- A complete emulator provides a simulation of all aspects of the hardware, allowing all of it to be controlled and modified and allowing debugging on a normal PC.
- Unless restricted to external debugging, the programmer can typically load and run software through the tools, view the code running in the processor, and start or stop its operation. The view of the code may be as assembly code or source-code.

Because an embedded system is often composed of a wide variety of elements, the debugging strategy may vary. For instance, debugging a software(and microprocessor) centric embedded system is different from debugging an embedded system where most of the processing is performed by peripherals (DSP, FPGA, co-processor). An increasing number of embedded systems today use more than one single processor core. A common problem with multi-core development is the proper synchronization of software execution. In such a case, the embedded system design may wish to check the data traffic on the busses between the processor cores, which requires very low-level debugging, at signal/bus level, with a logic analyzer, for instance.

3.2.2 RELIABILITY:

Embedded systems often reside in machines that are expected to run continuously for years without errors and in some cases recover by themselves if an error occurs. Therefore the software is usually developed and tested more carefully than that for personal computers, and unreliable mechanical moving parts such as disk drives, switches or buttons are avoided.

Specific reliability issues may include:

- The system cannot safely be shut down for repair, or it is too inaccessible to repair. Examples include space systems, undersea cables, navigational beacons, bore-hole systems, and automobiles.
- The system must be kept running for safety reasons. "Limp modes" are less tolerable. Often backups are selected by an operator. Examples include aircraft navigation, reactor control systems, safety-critical chemical factory controls, train signals, engines on single-engine aircraft.
- The system will lose large amounts of money when shut down: Telephone switches, factory controls, bridge and elevator controls, funds transfer and market making, automated sales and service.

A variety of techniques are used, sometimes in combination, to recover from errors—both software bugs such as memory leaks, and also soft errors in the hardware:

- Watchdog timer that resets the computer unless the software periodically notifies the watchdog
- Subsystems with redundant spares that can be switched over to
- software "limp modes" that provide partial function
- Designing with a Trusted Computing Base (TCB) architecture[6] ensures a highly secure & reliable system environment
- An Embedded Hypervisor is able to provide secure encapsulation for any subsystem component, so that a compromised software component cannot interfere with other subsystems, or privileged-level system software. This encapsulation keeps faults from propagating from one subsystem to another, improving reliability. This may also allow a subsystem to be automatically shut down and restarted on fault detection.
- Immunity Aware Programming

3.3 EXPLANATION OF EMBEDDED SYSTEMS

3.3.1 SOFTWARE ARCHITECTURE:

There are several different types of software architecture in common use.

- Simple Control Loop:

In this design, the software simply has a loop. The loop calls subroutines, each of which manages a part of the hardware or software.

- Interrupt Controlled System:

Some embedded systems are predominantly interrupting controlled. This means that tasks performed by the system are triggered by different kinds of events. An interrupt could be generated for example by a timer in a predefined frequency, or by a serial port controller receiving a byte. These kinds of systems are used if event handlers need low latency and the event handlers are short and simple.

Usually these kinds of systems run a simple task in a main loop also, but this task is not very sensitive to unexpected delays. Sometimes the interrupt handler will add longer tasks to a queue structure. Later, after the interrupt handler has finished, these tasks are executed by the main loop. This method brings the system close to a multitasking kernel with discrete processes.

- Cooperative Multitasking:

A non-preemptive multitasking system is very similar to the simple control loop scheme, except that the loop is hidden in an API. The programmer defines a series of tasks, and each task gets its own environment to “run” in. When a task is idle, it calls an idle routine, usually called “pause”, “wait”, “yield”, “nop” (stands for no operation), etc.The advantages and disadvantages are very similar to the control loop, except that adding new software is easier, by simply writing a new task, or adding to the queue-interpreter.

- Primitive Multitasking:

In this type of system, a low-level piece of code switches between tasks or threads based on a timer (connected to an interrupt). This is the level at which the system is generally considered to have an "operating system" kernel. Depending on how much functionality is required, it introduces more or less of the complexities of managing multiple tasks running conceptually in parallel.

As any code can potentially damage the data of another task (except in larger systems using an MMU) programs must be carefully designed and tested, and access to shared data must be controlled by some synchronization strategy, such as message queues, semaphores or a non-blocking synchronization scheme.

Because of these complexities, it is common for organizations to buy a real-time operating system, allowing the application programmers to concentrate on device functionality rather than operating system services, at least for large systems; smaller systems often cannot afford the overhead associated with a generic real time system, due to limitations regarding memory size, performance, and/or battery life.

- Microkernels And Exokernels:

A microkernel is a logical step up from a real-time OS. The usual arrangement is that the operating system kernel allocates memory and switches the CPU to different threads of execution. User mode processes implement major functions such as file systems, network interfaces, etc.

In general, microkernels succeed when the task switching and intertask communication is fast, and fail when they are slow. Exokernels communicate efficiently by normal subroutine calls. The hardware and all the software in the system are available to, and extensible by application programmers. Based on performance, functionality, requirement the embedded systems are divided into three categories.

3.3.2 STAND ALONE EMBEDDED SYSTEM:

These systems takes the input in the form of electrical signals from transducers or commands from human beings such as pressing of a button etc.., process them and produces desired output. This entire process of taking input, processing it and giving output is done in standalone mode. Such embedded systems comes under stand alone embedded systems

Eg: microwave oven, air conditioner etc..

3.3.3 REAL-TIME EMBEDDED SYSTEMS:

Embedded systems which are used to perform a specific task or operation in a specific time period those systems are called as real-time embedded systems. There are two types of real-time embedded systems.

- Hard Real-time embedded systems:

These embedded systems follow an absolute dead line time period i.e.., if the tasking is not done in a particular time period then there is a cause of damage to the entire equipment.

Eg: consider a system in which we have to open a valve within 30 milliseconds. If this valve is not opened in 30 ms this may cause damage to the entire equipment. So in such cases we use embedded systems for doing automatic operations.

- Soft Real Time embedded systems:

These embedded systems follow a relative dead line time period i.e.., if the task is not done in a particular time that will not cause damage to the equipment.

Eg: Consider a TV remote control system ,if the remote control takes a few milliseconds delay it will not cause damage either to the TV or to the remote control. These systems which will not cause damage when they are not operated at considerable time period those systems comes under soft real-time embedded systems.

3.3.4 NETWORK COMMUNICATION EMBEDDED SYSTEMS:

A wide range network interfacing communication is provided by using embedded systems as given in the figure 3.2

Example

- Consider a web camera that is connected to the computer with internet can be used to spread communication like sending pictures, images, videos etc.., to another computer with internet connection throughout anywhere in the world.

- Consider a web camera that is connected at the door lock.

Whenever a person comes near the door, it captures the image of a person and sends to the desktop of your computer which is connected to internet. This gives an alerting message with image on to the desktop of your computer, and then you can open the door lock just by clicking the mouse.

Fig 3.2 Network communication embedded systems

3.3.5 DIFFERENT TYPES OF PROCESSING UNITS:

The central processing unit (c.p.u) can be any one of the following microprocessor, microcontroller, digital signal processing.

- Among these Microcontroller is of low cost processor and one of the main advantage of microcontrollers is, the components such as memory, serial communication interfaces, analog to digital converters etc.., all these are built on a single chip. The numbers of external components that are connected to it are very less according to the application.

- Microprocessors are more powerful than microcontrollers. They are used in major applications with a number of tasking requirements. But the microprocessor requires many external components like memory, serial communication, hard disk, input output ports etc.., so the power consumption is also very high when compared to microcontrollers.

- Digital signal processing is used mainly for the applications that particularly involved with processing of signals

3.4 APPLICATIONS OF EMBEDDED SYSTEMS

3.4.1 CONSUMER APPLICATIONS:

At home we use a number of embedded systems which include microwave oven, remote control, vcd players, dvd players, camera etc. one such example is show in the fig 3.3

Fig:3.3 Automatic coffee makes equipment

3.4.2 OFFICE AUTOMATION:

We use systems like fax machine, modem, printer etc as shown in the figures 3.4 & 3.5

Fig:3.4 Fax machine

Fig:3.5 Printing machine

3.4.3 INDUSTRIAL AUTOMATION:

Today a lot of industries are using embedded systems for process control. In industries we design the embedded systems to perform a specific operation like monitoring temperature, pressure, humidity ,voltage, current etc.., and basing on these monitored levels we do control other devices, we can send information to a centralized monitoring station.

Fig: 3.6 Robot

Fig 3.6 describes the use of robot In critical industries where human presence is avoided there we can use robot**s** which are programmed to do a specific operation.

3.4.4 COMPUTER NETWORKING:

The figure 3.7 shows the use of Embedded systems as bridges routers

Fig:3.7 Computer networking

3.4.5 TELE COMMUNICATIONS:

Cell phones, web cameras the examples of tele communications are shown in figures 3.8 & 3.9 respectively.

Fig: 3.8 Cell Phone

Fig: 3.9 Web camera

3.4 BLOCK DIAGRAM

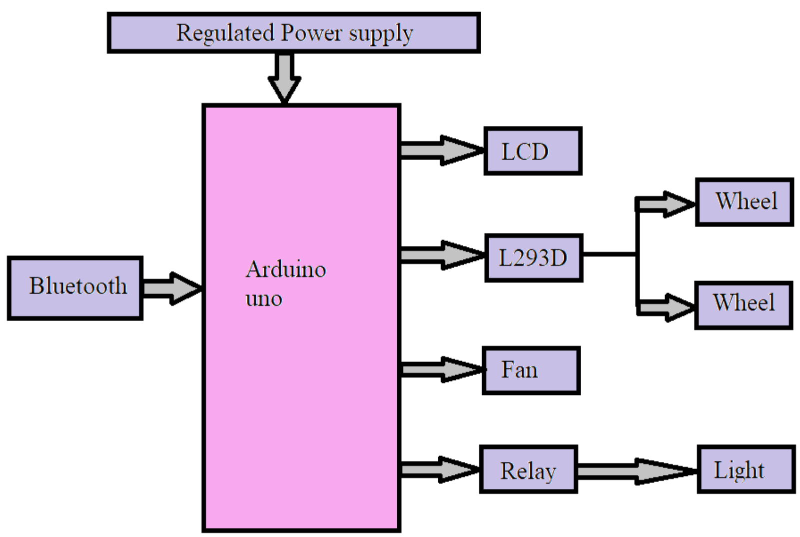


Fig.3.10 Block Diagram

The above Figure 3.10 Shows the block diagram of the system unit. The system has two parts, namely; hardware and software. The hardware architecture consists of an embedded system that is based on Arduino Uno board, a Bluetooth Module, Motor Driver and an Android phone. The Bluetooth Module provides the communication media between the user through the android phone and the system by means of voice command given to the android phone. The user speaks the desired command to the "BT Voice Control for Arduino voice (AMR Voice Application)" software application installed in the android phone that is connected through Bluetooth with Bluetooth Module SR-04. The voice command is converted to an array of string and the string is passed to Arduino Uno connected to it. Once the Bluetooth Module receives the message, the command sent will be extracted and executed by the microcontroller attached to it and depending on the commands fed to the Motor Driver, the motors will function accordingly. The system will interpret the commands and control the Wheelchair accordingly via android application. Meanwhile, the ultrasonic sensor works while the circuit is on and makes sure the path has no obstacle and if any obstacle occurs it notifies the Arduino and stops wheelchair till further command is obtained from the user [3]. The optimum distance for the Bluetooth communication with the wheelchair was tested to be 10 m with response delay of 0.47 seconds, beyond which the connection becomes unstable. The IR detectors were tested to be capable of detecting obstacles between 10 cm to 80 cm. This system operation is divided in two parts we use the AVR microcontroller Atmega328 with the help of Arduino complier to performing overall function of the circuit. First is to control the movement of smart vehicle. For controlling we receive the signals coming from a mobile application through Bluetooth Module to control the movement of the wheelchair by using DC motors Second part is to control home appliances for that we use remote sensor to ON or OFF the device[2].

The hardware components used in this are as follows:

- **Arduino UNO Board**

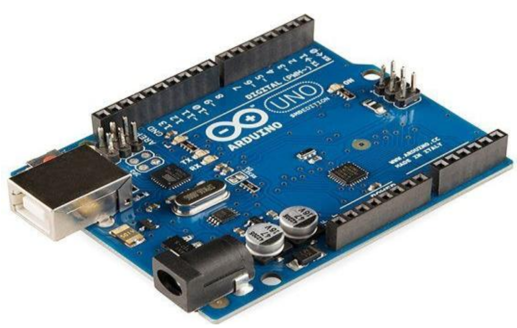


Fig 3.11 Arduino UNO board

Arduino is a device that takes the input from various sensors and performs the operation at output pot of the board. It is a microcontroller development board for writing software for the hardware circuitry. It consists of an AVR microcontroller Atmega328 IC. The Atmel Atmega328 is a low-power CMOS 8-bit microcontroller based on AVR enhanced RISC architecture. It has 14digital input/output pins, 6 analog inputs, a 16 MHz crystal oscillator, 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.

- **Bluetooth Module HC-05**

Fig:3.12 HC05 – Bluetooth module

Bluetooth is an open wireless technology standard for exchanging data over short distances (using short wavelength radio transmissions) from fixed and mobile devices, creating personal area networks (PANs) with high levels of security. HC-05 module is an easy to use Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup. Serial port Bluetooth module is fully qualified Bluetooth V2.0+EDR (Enhanced Data Rate) 3Mbps Modulation with complete 2.4GHz radio transceiver and baseband. It uses CSR Blue core 04-External single chip. Bluetooth system with CMOS technology and with AFH (Adaptive Frequency Hopping Feature). It has the footprint as small as 12.7mmx27mm. Hope it will simplify your overall design/development cycle. This Bluetooth module is interfaced with the Arduino board which receives the signal coming from the mobile application and send to the any Arduino board pin. It performs the operation according to the signal and activates the motors for movement

- **MotorDriverL293D**

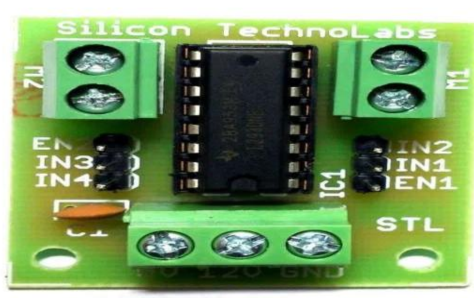


Fig: 3.13 Motor driver l293d

The DC motor is used in the robot applications. Here we can use L293D driver motor for control the rotation of the motor. The L293D motor driver is used to control the motors in both directions. The left and right side motors are used to drive the motor to turn left and turn right. This system is used to move wheelchair safely. It also used for activating the relay to the load for activating the home appliances. Which ON or OFF the devices.

Microcontroller is of low cost processor and one of the main advantage of microcontrollers is, the components such as memory, serial communication interfaces, analog to digital converters etc.., all these are built on a single chip. The numbers of external components that are connected to it are very less according to the application.

Bluetooth is an open wireless technology standard for exchanging data over short distances (using short wavelength radio transmissions) from fixed and mobile devices, creating personal area networks (PANs) with high levels of security. Created by telecoms vendor Ericsson in 1994 it was originally conceived as a wireless alternative to RS-232 data cables. It can connect several devices, overcoming problems of synchronization. Bluetooth is a short-range radio link intended to replace the cable(s) connecting portable and/or fixed electronic devices. Key features are robustness, low complexity, low power and low cost. There are already similar standards in this market, such as IrDA, Home RF and IEEE 802.11 family. Bluetooth is designed to offer some unique advantages that none of the others can provide.

Bluetooth technology is designed for and optimized for use in mobile devices. Mobile computers, cellular handsets, network access points, printers, PDA's, desktops, keyboards, joysticks and virtually any other device can have short range. An AVR Microcontroller Atmega 328, arduino and dc motors are 3used to create movement in a vehicle with the help of mobile application which involves several essential steps,

- A Smartphone Bluetooth paired with the HC05 Bluetooth device picks up the signal of the speech to be recognized.
- First make sure Bluetooth module is paired with the android mobile. The default password for pairing is "1234" or "0000".
- This HC05 module will be used to communicate with mobile which has the speed of approximately 2.4Ghz.

- An corresponding supporting application is to be installed in the smartphone to drive the vehicle.
- The operator gives voice as input in order to drive the smart vehicle to the desired position. Microphone which converts the voice signal to the electric signal and the signal is transferred to the microcontroller.
- The microcontroller that is ATMEGA328 will take the decision to move forward or backward or left or right with help of relay switching unit.
- A relay is a electrically operated mechanical switch which performs open loop and closed loop functions is used in the proposed system.
- Two DC Motors are used which helps in the movement of the smart vehicle
- In a similar fashion, the hand movements given on the mobile application can control the smart vehicle in a desired way. Thus allowing the user to operate the vehicle in any desired way.
- The user can operate fan& light as per the requirement with help of relay switching unit.

Common words	*Operation*
GO	Moves Forward
BACK	Moves Backward
LEFT	Moves Left
RIGHT	Moves Right
STOP	Stops Moving

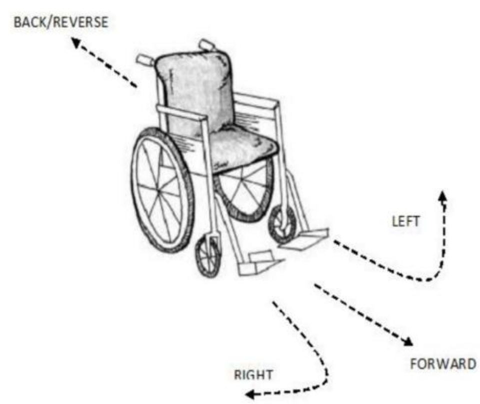


Fig:3.14 Shows the Vehicle movement paths

- The GO command given makes the vehicle move in forward direction, Back instruction makes it move back, left command will make the vehicle move in left direction, right command given will drive the vehicle right, stop command makes the vehicle from moving ahead. These instructions are preset or predefined in the mobile application. The table given below easily summarizes the movement paths of vehicle.

- Click on “DISCONNECT” icon to disconnect the paired Bluetooth module.

3.5 DC MOTOR

Fig:3.15 DC motor

The fig 3.15 shows the DC motors which can be configured in many types and sizes, including brush less, servo, and gear motor types. A motor consists of a rotor and a permanent magnetic field stator. The magnetic field is maintained using either permanent magnets or electromagnetic windings. DC motors are most commonly used in variable speed and torque.

Motion and controls cover a wide range of components that in some way are used to generate and/or control motion. Areas within this category include bearings and bushings, clutches and brakes, controls and drives, drive components, encoders and resolves, Integrated motion control, limit switches, linear actuators, linear and rotary motion components, linear position sensing, motors (both AC and DC motors), orientation position sensing, pneumatics and pneumatic components, positioning stages, slides and guides, power transmission (mechanical), seals, slip rings, solenoids, springs.

Motors are the devices that provide the actual speed and torque in a drive system. This family includes AC motor types (single and multiphase motors, universal, servo motors, induction, synchronous, and gear motor) and DC motors (brush less, servo motor, and gear motor) as well as linear, stepper and air motors, and motor contactors and starters.

In any electric motor, operation is based on simple electromagnetism. A current-carrying conductor generates a magnetic field; when this is then placed in an external magnetic field, it will experience a force proportional to the current in the conductor, and to the strength of the external magnetic field. As you are well aware of from playing with magnets as a kid, opposite (North and South) polarities attract, while like polarities (North and North, South and South) repel. The internal configuration of a DC motor is designed to harness the magnetic interaction between a current-carrying conductor and an external magnetic field to generate rotational motion.

Let's start by looking at a simple 2-pole DC electric motor as shown in the fig 3.16 (here red represents a magnet or winding with a "North" polarization, while green represents a magnet or winding with a "South" polarization).

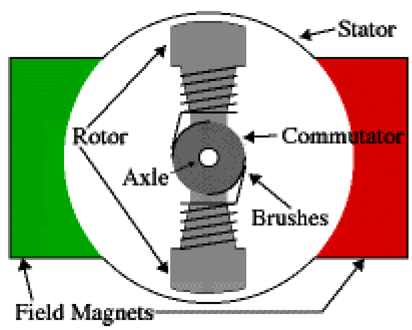


Fig: 3.16 Motor rotor

Every DC motor has six basic parts -- axle, rotor (a.k.a., armature), stator, commutator, field magnet(s), and brushes. In most common DC motors (and all that Beamers will see), the external magnetic field is produced by high-strength permanent magnets1. The stator is the stationary part of the motor -- this includes the motor casing, as well as two or more permanent magnet pole pieces. The rotor (together with the axle and attached commutator) rotates with respect to the stator. The rotor consists of windings (generally on a core), the windings being electrically connected to the commutator. The above diagram shows a common motor layout -- with the rotor inside the stator (field) magnets.

The geometry of the brushes, commutator contacts, and rotor windings are such that when power is applied, the polarities of the energized winding and the stator magnet(s) are misaligned, and the rotor will rotate until it is almost aligned with the stator's field magnets. As the rotor reaches alignment, the brushes move to the next commutator contacts, and energize the next winding. Given our example two-pole motor, the rotation reverses the direction of current through the rotor winding, leading to a "flip" of the rotor's magnetic field, and driving it to continue rotating.

In real life, though, DC motors will always have more than two poles (three is a very common number). In particular, this avoids "dead spots" in the commutator. You can imagine how with our example two-pole motor, if the rotor is exactly at the middle of its rotation (perfectly aligned with the field magnets), it will get "stuck" there. Meanwhile, with a two-pole motor, there is a moment where the commutator shorts out the power supply (i.e., both brushes touch both commutator contacts simultaneously). This would be bad for the power supply, waste energy, and damage motor components as well. Yet another disadvantage of such a simple motor is that it would exhibit a high amount of torque” ripple" (the amount of torque it could produce is cyclic with the position of the rotor).

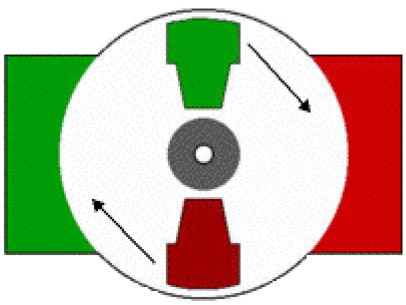


Fig: 3.17 Motor pole

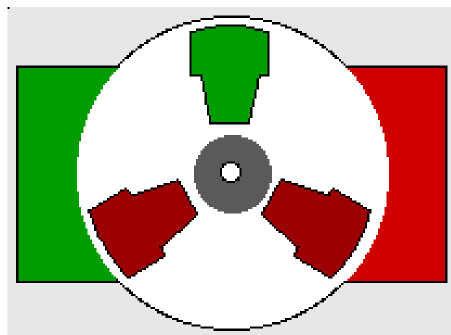


Fig: 3.18 Motor three pole

From fig 3.17 & 3.18 You'll notice a few things from this -- namely, one pole is fully energized at a time (but two others are "partially" energized). As each brush transitions from one commutator contact to the next, one coil's field will rapidly collapse, as the next coil's field will rapidly charge up (this occurs within a few microsecond). We'll see more about the effects of this later, but in the meantime you can see that this is a direct result of the coil windings' series wiring

There's probably no better way to see how an average dc motor is put together, than by just opening one up. Unfortunately this is tedious work, as well as requiring the destruction of a perfectly good motor

3.6 BLUE TOOTH

Fig: 3.19 Bluetooth device

The fig 3.19 shows Bluetooth it is an open wireless technology standard for exchanging data over short distances (using short wavelength radio transmissions) from fixed and mobile devices, creating personal area networks (PANs) with high levels of security. Created by telecoms vendor Ericsson in 1994 it was originally conceived as a wireless alternative to RS-232 data cables. It can connect several devices, overcoming problems of synchronization.

Bluetooth Overview

Why Bluetooth?

Bluetooth is a short-range radio link intended to replace the cable(s) connecting portable and/or fixed electronic devices. Key features are robustness, low complexity, low power and low cost. There are already similar standards in this market, such as IrDA, Home RF and IEEE 802.11 family. Bluetooth is designed to offer some unique advantages that none of the others can provide.

For example, IrDA uses infrared as medium, so its range is limited to around 1 meter, and it requires a line-of-sight communication. In comparison, Bluetooth can operate at a range up to 10 meters, or even 100 meters with enhanced transmitters. RF signals goes through walls, so a Bluetooth network can span several rooms.

Compared with Home RF and IEEE 802.11 family, Bluetooth has much lower data rate and transmission range (10 meter). While Home RF supports 1.6 ~ 10 Mbps data rate and IEEE 802.11a/b supports 54/11 Mbps, Bluetooth supports only 780 Kbps, which can be used for 721 kbps downstream and 57.6 kbps upstream asymmetric data transfer, or 432.6 kbps symmetric data transfer. Both Home RF and IEEE 802.11 operate at 100 meter range, while Bluetooth operates at up to 10 meter.

However, as a result of the lower data rate and transmission range, Bluetooth offers much lower cost per node (approximately 5 ~ 10% of Home RF and IEEE 802.11). So it is more suitable for applications involving low data rate (data and voice), small number of devices (8 at maximum), low power consumption and short range (up to 10 meter), such as PC-to-peripheral networking, home networking, hidden computing, data synchronization (such as between PC and PDA), mobile phone devices, and future smart devices or entertainment equipment.

3.6.1 BLUETOOTH ARCHITECTURE

The Bluetooth architecture and its mapping to OSI model. Bluetooth communication occurs between a master radio and a slave radio. Bluetooth radios are symmetric in that the same device may operate as a master and also the slave. Each radio has a 48-bit unique device address (BD_ADDR) that is fixed.

Two or more radio devices together form ad-hoc networks called pioneers. All units within a pioneer share the same channel. Each pioneer has one master device and one or more slaves. There may be up to seven active slaves at a time within a pioneer. Thus, each active device within a pioneer is identifiable by a 3-bit active device address. Inactive slaves in unconnected modes may continue to reside within the pioneer.

A master is the only one that may initiate a Bluetooth communication link. However, once a link is established, the slave may request a master/slave switch to become the master. Slaves are not allowed to talk to each other directly. All communication occurs within the slave and the master. Slaves within a pioneer must also synchronize their internal clocks and frequency hops with that of the master. Each pioneer uses a different frequency hopping sequence. Radio devices used Time Division Multiplexing

(TDM). A master device in a pioneer transmits on even numbered slots and the slaves may transmit on odd numbered slots.

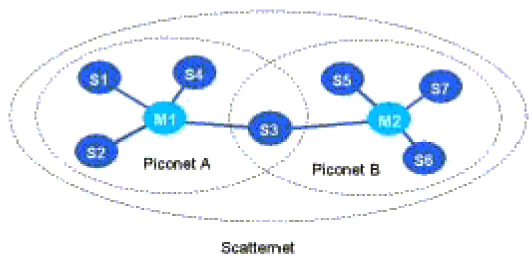


Fig: 3.20 Bluetooth Scatter nets and Pico nets

Fig 3.20 shows the Multiple pioneers with overlapping coverage areas form a scatter net. Each pioneer may have only one master, but slaves may participate in different pioneers on a time-division multiplex basis. A device may be a master in one pioneer and a slave in another or a slave in more than one pioneer.

Bluetooth technology is designed for and optimized for use in mobile devices. Mobile computers, cellular handsets, network access points, printers, PDA's, desktops, keyboards, joysticks and virtually any other device can have short range Bluetooth radios operating in the free 2.4GHz Industrial-Scientific-Medical (ISM) band integrated into them (single chip). It uses Frequency Hop (FH) spread spectrum, which divides the frequency band into a number of hop channels. Bluetooth radios use tiny radio-frequency transmitters, no larger than 1.0 by 0.5 inches, that can run off a watch battery for months. Power considerations are always important for battery-powered mobile devices, and Bluetooth's low power modes meet those requirements with less than 0.1 W active power. And since Bluetooth is designed for both computing and communications applications, it is designed to support high quality simultaneous voice and data, with robust data transfer rates of up to 721 Kbps. IT supports both synchronous and asynchronous services and easy integration of TCP/IP for networking purposes.

The fig 6.3 describes the complete Bluetooth protocol stack has been designed to include the existing protocols as much as possible (like TCP, UDP, OBEX) as well as Bluetooth specific protocols like LMP and L2CAP. The protocol reuse ensures smooth interoperability between existing applications and hardware. The Specification is also open, thereby allowing vendors to build proprietary applications.

Although different applications may run over different protocol stacks, they all use the Bluetooth data link and physical layers. The Applications layer lies on top of the vCard (internal object representation convention) layer.

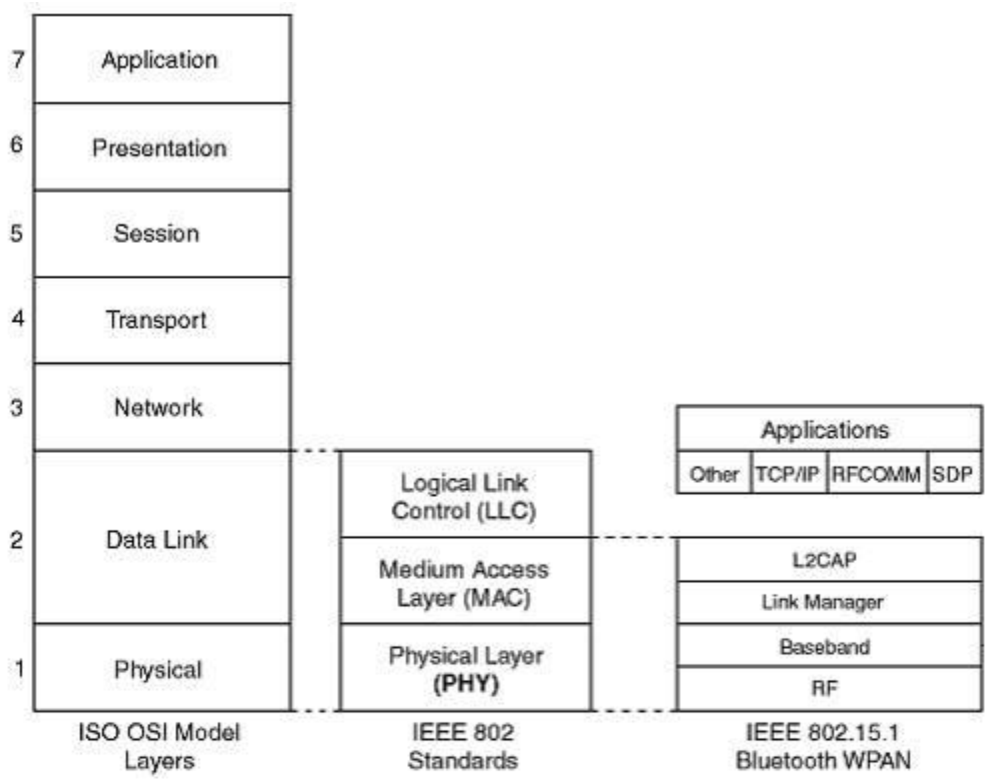


Fig:3.21 TCP/IP Protocol

3.6.2 APPLICATIONS OF BLUETOOTH

Mobile computers

Cellular handsets

Network access points

Printers, PDA's, desktops, keyboards, joysticks

3.6.3 BLUETOOTH DONGLE

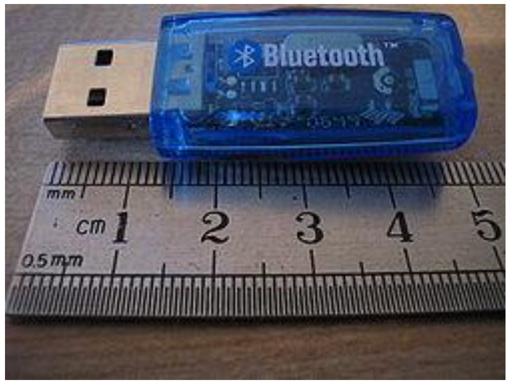


Fig:3.22 Bluetooth dongle

Fig 3.22 shows a Bluetooth dongle wherein **Bluetooth** is an open wireless technology standard for exchanging data over short distances (using short wavelength radio transmissions) from fixed and mobile devices, creating personal area networks (PANs) with high levels of security. Created by telecoms vendor Ericsson in 1994,[1] it was originally conceived as a wireless alternative to RS-232 data cables. It can connect several devices, overcoming problems of synchronization. Today Bluetooth is managed by the Bluetooth Special Interest Group.

3.7 PIN CONFIGURATION OF ATMEGA328P

ARDUINO UNO

The most common version of Arduino is the Arduino Uno. This board is what most people are talking about when they refer to an Arduino. The Uno is one of the more popular boards in the Arduino family and a great choice for beginners. There are different revisions of Arduino Uno, below detail is the most recent revision (Rev3 or R3). The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, 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. The fig 7.1 shows the pin representation and the configuration for the same is as below:

Microcontroller	:	ATmega328
Operating Voltage	:	5V
Input Voltage (recommended)	:	7-12V
Input Voltage (limits)	:	6-20V
Digital I/O Pins	:	14 (of which 6 provide PWM output)
Analog Input Pins	:	6
DC Current per I/O Pin	:	40 mA
DC Current for 3.3V Pin	:	50 mA
Flash Memory	:	32 KB (ATmega328) of which 0.5 KB used by bootloader
SRAM	:	2 KB (ATmega328)
EEPROM	:	1 KB (ATmega328)
Clock Speed	:	16 MHz
Length	:	68.6 mm
Width	:	53.4 mm

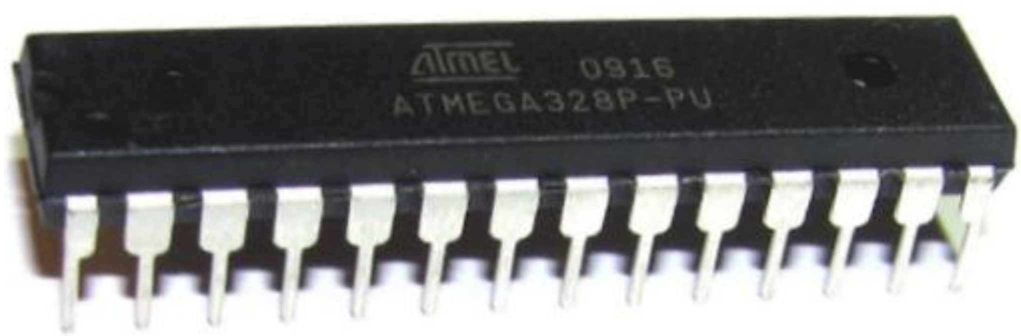


Fig:3.23 Representation of a pin

In this, we will go over the pinout of the Atmega328 chip. TheThe Atmega328 is a very popular microcontroller chip produced by Atmel. It is an 8-bit microcontroller that has 32K of flash memory, 1K of EEPROM, and 2K of internal SRAM.

The Atmega328 is one of the microcontroller chips that are used with the popular Arduino Duemilanove boards. The Arduino Duemilanove board comes with either 1 of 2 microcontroller chips, the Atmega168 or the Atmega328. Of these 2, the Atmega328 is the upgraded, more advanced chip. Unlike the Atmega168 which has 16K of flash program memory and 512 bytes of internal SRAM, the Atmega328 has 32K of flash program memory and 2K of Internal SRAM.

The Atmega328 has 28 pins. It has 14 digital I/O pins, of which 6 can be used as PWM outputs and 6 analog input pins. These I/O pins account for 20 of the pins.

The Pin Configuration for the Atmega328 is shown below in the fig:3.24

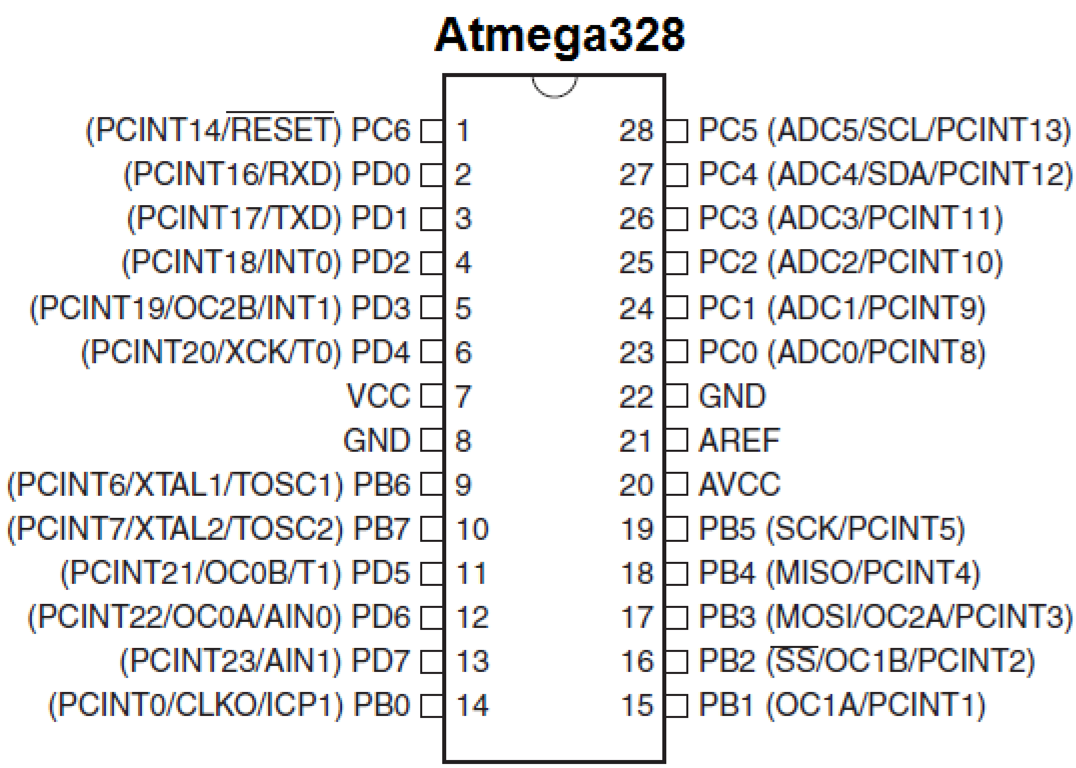


Fig: 3.24 Pin Configuration of ATMEGA 328

The table below gives a description for each of the pins, along with their function.

Pin Number	Description	Function
1	PC6	Reset
2	PD0	Digital Pin (RX)
3	PD1	Digital Pin (TX)
4	PD2	Digital Pin
5	PD3	Digital Pin (PWM)
6	PD4	Digital Pin
7	Vcc	Positive Voltage (Power)
8	GND	Ground
9	XTAL 1	Crystal Oscillator
10	XTAL 2	Crystal Oscillator
11	PD5	Digital Pin (PWM)
12	PD6	Digital Pin (PWM)
13	PD7	Digital Pin
14	PB0	Digital Pin
15	PB1	Digital Pin (PWM)
16	PB2	Digital Pin (PWM)
17	PB3	Digital Pin (PWM)
18	PB4	Digital Pin
19	PB5	Digital Pin
20	AVCC	Positive voltage for ADC (power)
21	AREF	Reference Voltage
22	GND	Ground
23	PC0	Analog Input
24	PC1	Analog Input
25	PC2	Analog Input
26	PC3	Analog Input
27	PC4	Analog Input
28	PC5	Analog Input

As stated before, 20 of the pins function as I/O ports. This means they can function as an input to the circuit or as output. Whether they are input or output is set in the software. 14 of the pins are digital pins, of which 6 can function to give PWM output. 6 of the pins are for analog input/output.

2 of the pins are for the crystal oscillator. This is to provide a clock pulse for the Atmega chip. A clock pulse is needed for synchronization so that communication can occur in synchrony between the Atmega chip and a device that it is connected to. The chip needs power so 2 of the pins, Vcc and GND, provide it power so that it can operate. The Atmega328 is a low-power chip, so it only needs between 1.8-5.5V of power to operate.

The Atmega328 chip has an analog-to-digital converter (ADC) inside of it. This must be or else the Atmega328 wouldn't be capable of interpreting analog signals. Because there is an ADC, the chip can interpret analog input, which is why the chip has 6 pins for analog input. The ADC has 3 pins set aside for it to function- AVCC, AREF, and GND. AVCC is the power supply, positive voltage, that for the ADC. The ADC needs its own power supply in order to work. GND is the power supply ground. AREF is the reference voltage that the ADC uses to convert an analog signal to its corresponding digital value. Analog voltages higher than the reference voltage will be assigned to a digital value of 1, while analog voltages below the reference voltage will be assigned the digital value of 0. Since the ADC for the Atmega328 is a 10-bit ADC, meaning it produces a 10-bit digital value, it converts an analog signal to its digital value, with the AREF value being a reference for which digital values are high or low. Thus, a portrait of an analog signal is shown by this digital value; thus, it is its digital correspondent value.The last pin is the RESET pin. This allows a program to be rerun and start over. And this sums up the pinout of an Atmega328 chip.

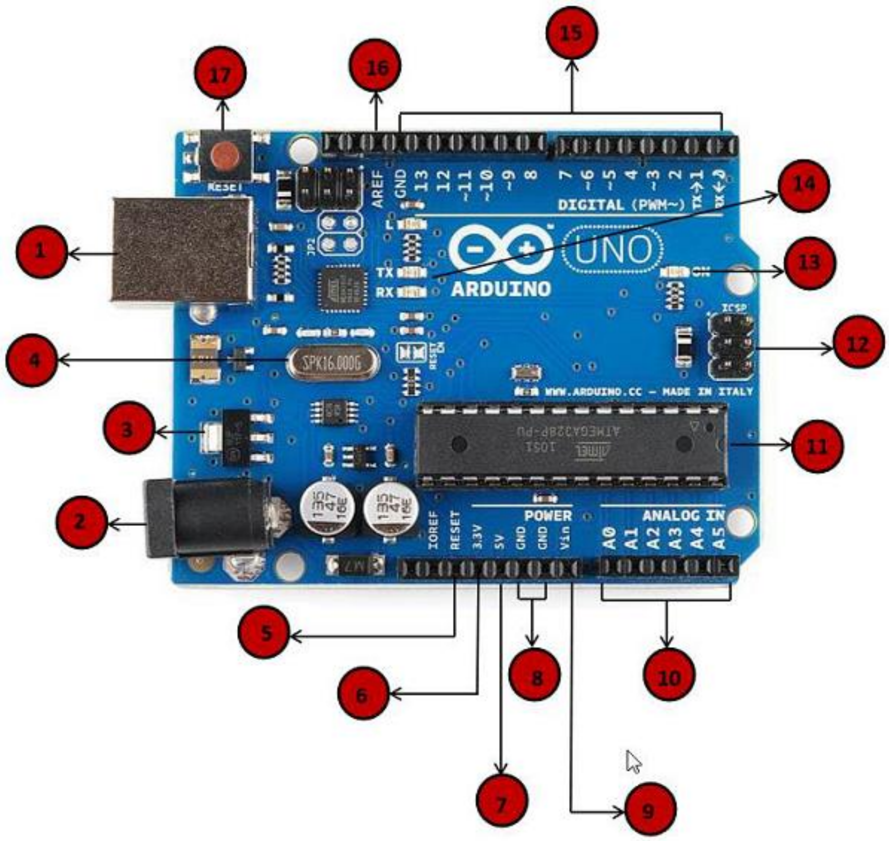


Fig:3.25 Configuration of ARDUINO UNO

Fig 3.25 shows the configuration of Arduino uno board the configuration is as shown below

1	**Power USB** Arduino board can be powered by using the USB cable from your computer. All you need to do is connect the USB cable to the USB connection (1).
2	**Power (Barrel Jack)** Arduino boards can be powered directly from the AC mains power supply by connecting it to the Barrel Jack (2).
3	**Voltage Regulator** The function of the voltage regulator is to control the voltage given to the

	Arduino board and stabilize the DC voltages used by the processor and other elements.
4	**Crystal Oscillator** The crystal oscillator helps Arduino in dealing with time issues. How does Arduino calculate time? The answer is, by using the crystal oscillator. The number printed on top of the Arduino crystal is 16.000H9H. It tells us that the frequency is 16,000,000 Hertz or 16 MHz.
5,17	**Arduino Reset** You can reset your Arduino board, i.e., start your program from the beginning. You can reset the UNO board in two ways. First, by using the reset button (17) on the board. Second, you can connect an external reset button to the Arduino pin labelled RESET (5).
6,7 8,9	**Pins (3.3, 5, GND, Vin)** • 3.3V (6) − Supply 3.3 output volt • 5V (7) − Supply 5 output volt • Most of the components used with Arduino board works fine with 3.3 volt and 5 volt. • GND (8)(Ground) − There are several GND pins on the Arduino, any of which can be used to ground your circuit. • Vin (9) − This pin also can be used to power the Arduino board from an external power source, like AC mains power supply.
10	**Analog pins** The Arduino UNO board has five analog input pins A0 through A5. These pins

	can read the signal from an analog sensor like the humidity sensor or temperature sensor and convert it into a digital value that can be read by the microprocessor.
11	**Main microcontroller** Each Arduino board has its own microcontroller (11). You can assume it as the brain of your board. The main IC (integrated circuit) on the Arduino is slightly different from board to board. The microcontrollers are usually of the ATMEL Company. You must know what IC your board has before loading up a new program from the Arduino IDE. This information is available on the top of the IC. For more details about the IC construction and functions, you can refer to the data sheet.
12	**ICSP pin** Mostly, ICSP (12) is an AVR, a tiny programming header for the Arduino consisting of MOSI, MISO, SCK, RESET, VCC, and GND. It is often referred to as an SPI (Serial Peripheral Interface), which could be considered as an "expansion" of the output. Actually, you are slaving the output device to the master of the SPI bus.
13	**Power LED indicator** This LED should light up when you plug your Arduino into a power source to indicate that your board is powered up correctly. If this light does not turn on, then there is something wrong with the connection.
14	**TX and RX LEDs** On your board, you will find two labels: TX (transmit) and RX (receive). They appear in two places on the Arduino UNO board. First, at the digital pins 0 and

	1, to indicate the pins responsible for serial communication. Second, the TX and RX led (13). The TX led flashes with different speed while sending the serial data. The speed of flashing depends on the baud rate used by the board. RX flashes during the receiving process.
15	**Digital I/O** The Arduino UNO board has 14 digital I/O pins (15) (of which 6 provide PWM (Pulse Width Modulation) output. These pins can be configured to work as input digital pins to read logic values (0 or 1) or as digital output pins to drive different modules like LEDs, relays, etc. The pins labeled “~” can be used to generate PWM.
16	**AREF** AREF stands for Analog Reference. It is sometimes, used to set an external reference voltage (between 0 and 5 Volts) as the upper limit for the analog input pins.

3.8 SOFTWARE

Software introduction:

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

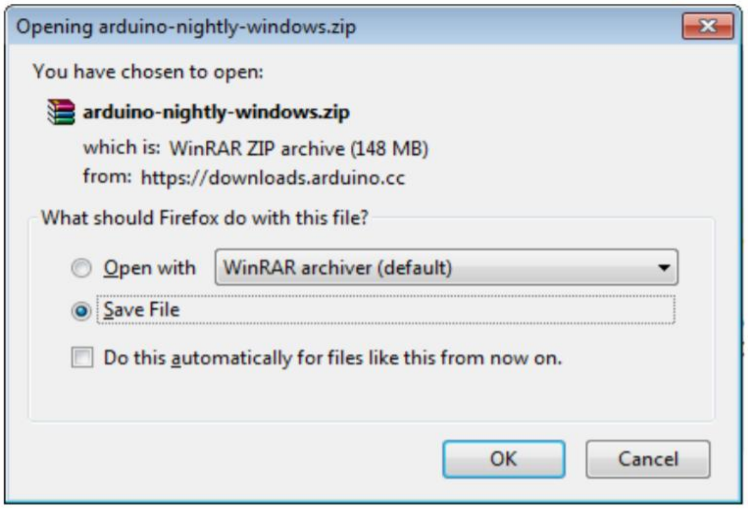


Fig: 3.26 Arduino IDE downloaded file

Launch Arduino IDE. After your Arduino IDE software is downloaded, you need to unzip the folder. Inside the folder, you can find the application icon with an infinity label (application.exe). Doubleclick the icon to start the IDE.

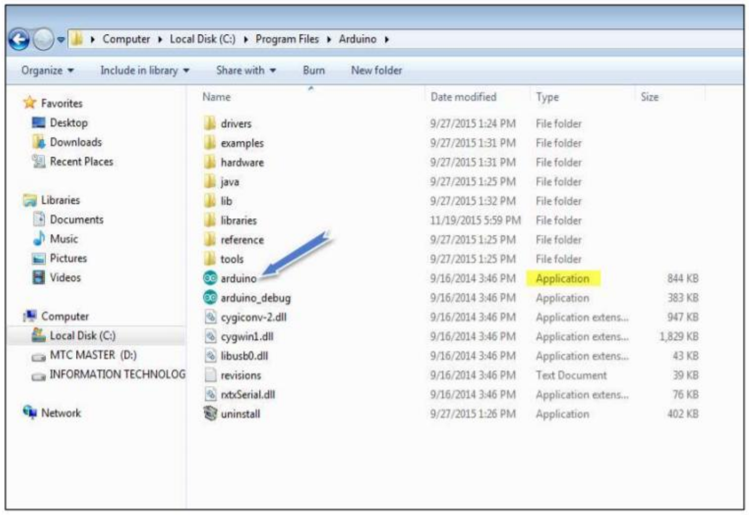


Fig: 3.27 Arduino IDE in the downloaded files

Open your first project. Once the software starts, you have two options:

• Create a new project.

• Open an existing project example.

To create a new project, select File --> New

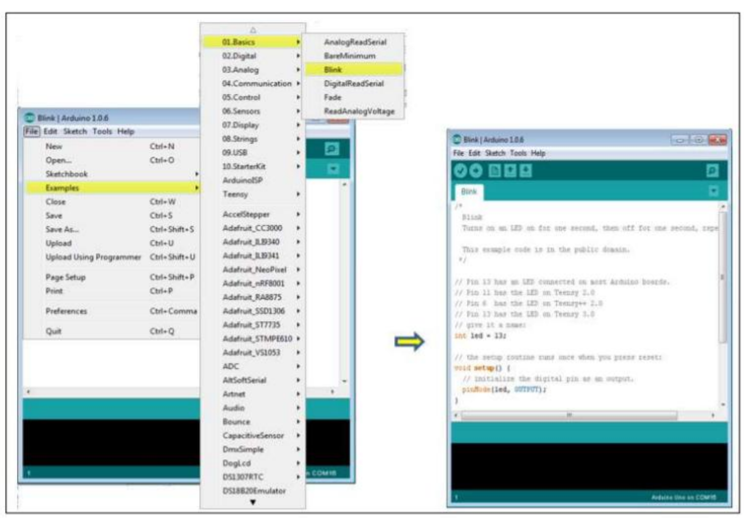


Fig:3.28 Blink as an example

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

Select your 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, you can disconnect your 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.

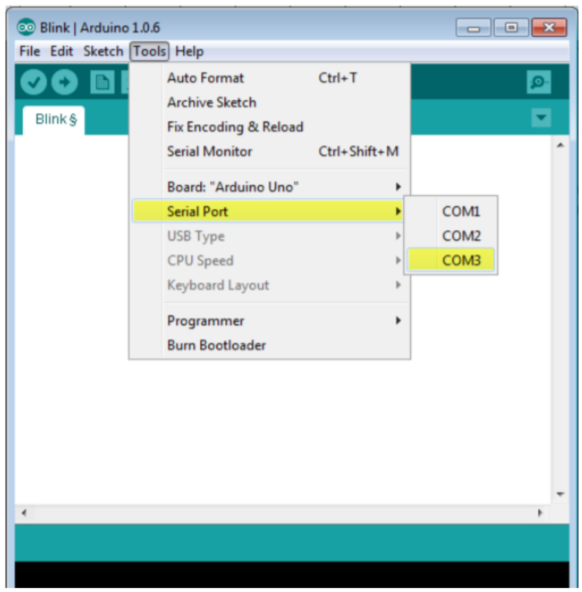


Fig: 3.29 Selection of Serial Port

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 your 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; you 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.

In this chapter, we will study in depth, the Arduino program structure and we will learn more new terminologies used in the Arduino world. The Arduino software is open-source. The source code for the Java environment is released under the GPL and the C/C++ microcontroller libraries are under the LGPL. Sketch: The first new terminology is the Arduino program called "sketch". Structure Arduino programs can be divided in three main parts: Structure, Values (variables and constants), and Functions. In this tutorial, we will learn about the Arduino software program, step by step, and how we can write the program without any syntax or compilation error. Let us start with the Structure. Software structure consist of two main functions:

- Setup( ) function
- Loop( ) function

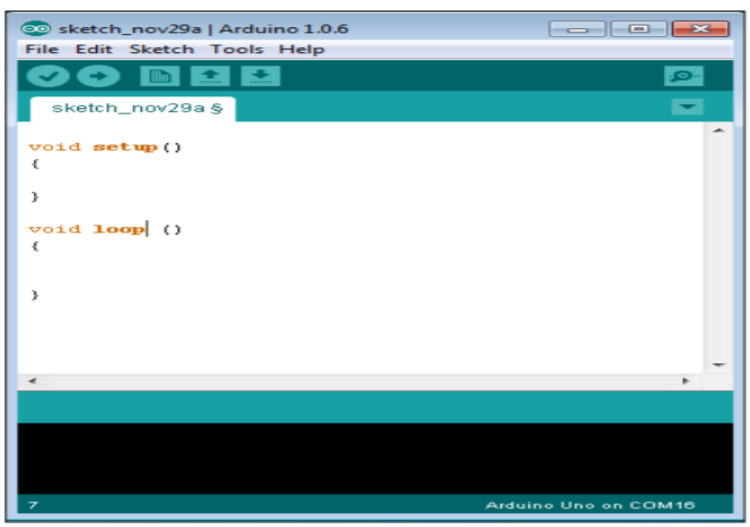


Fig: 3.30 The two main functions Setup() & Loop()

Example Programming:

```
#define led8 7

String voice;

int

led1 = 2, //Connect LED 1 To Pin #2

led2 = 3, //Connect LED 2 To Pin #3

led3 = 4, //Connect LED 3 To Pin #4

led4 = 5, //Connect LED 4 To Pin #5

led5 = 8, //Connect LED 5 To Pin #6

led6=7;

//--------------------------Call A Function-------------------------------//

void allon(){

    digitalWrite(led1, HIGH);

    digitalWrite(led2, HIGH);

    digitalWrite(led3, HIGH);

    digitalWrite(led4, HIGH);

    digitalWrite(led5, HIGH);

}

void alloff(){

    digitalWrite(led1, LOW);

    digitalWrite(led2, LOW);
```

```
    digitalWrite(led3, LOW);
    digitalWrite(led4, LOW);
    digitalWrite(led5, LOW);
}
//----------------------------------------------------------------------//
void setup() {
  Serial.begin(9600);
  pinMode(led1, OUTPUT);
  pinMode(led2, OUTPUT);
  pinMode(led3, OUTPUT);
  pinMode(led4, OUTPUT);
  pinMode(led5, OUTPUT);
  pinMode(led6, OUTPUT);
}
void loop() {
  while (Serial.available()){  //Check if there is an available byte to read
  delay(10); //Delay added to make thing stable
  char c = Serial.read(); //Conduct a serial read
  if (c == '#') {break;} //Exit the loop when the # is detected after the word
  voice += c; //Shorthand for voice = voice + c
  }
```

```
  if (voice.length() > 0) {
    Serial.println(voice);
//-----------------------------------------------------------------------//
  //----------Control Multiple Pins/ LEDs----------//
       if(voice == "all on") {allon();}  //Turn Off All Pins (Call Function)
  else if(voice == "all of"){alloff();} //Turn On  All Pins (Call Function)


  //----------Turn On One-By-One----------//
  else if(voice == "up")
  {alloff();delay(300);digitalWrite(led1, HIGH);digitalWrite(led2,LOW);digitalWrite(led3,
HIGH);digitalWrite(led4,LOW);}
  else if(voice == "down")
  {alloff();delay(300);digitalWrite(led1, LOW);digitalWrite(led2,HIGH);digitalWrite(led3,
LOW);digitalWrite(led4,HIGH);}
  else if(voice == "stop")
  {digitalWrite(led1, LOW);digitalWrite(led2,LOW);digitalWrite(led3,
LOW);digitalWrite(led4,LOW);}
  else if(voice == "left")
  {alloff();delay(300);digitalWrite(led1, LOW);digitalWrite(led2,LOW);digitalWrite(led3,
HIGH);digitalWrite(led4,LOW);}
  else if(voice == "right")
```

```
  {alloff();delay(300);digitalWrite(led1, HIGH);digitalWrite(led2,LOW);digitalWrite(led3,
LOW);digitalWrite(led4,LOW);}

  /*else if(voice == "check")

  {while(digitalRead(led6)==0){digitalWrite(led5,
HIGH);delay(1000);digitalWrite(led5,LOW);delay(1000);digitalWrite(led5,
HIGH);delay(1000);digitalWrite(led5,LOW);delay(1000);}}*/

  //----------Turn Off One-By-One----------//

  else if(voice == "light off") {digitalWrite(led5, LOW);}

  else if(voice == "light on") {digitalWrite(led5, HIGH);}

  else if(voice == "fan on") {digitalWrite(led6, HIGH);}

  else if(voice == "fan off") {digitalWrite(led6, LOW);}

  else if(voice == "bathroom lights off") {digitalWrite(led5, LOW);}

voice="";}}
```

CHAPTER-4

RESULTS AND DISCUSSIONS

The Arduino based voice controlled wheelchair prototype was successfully built and tested to respond to voice commands. It will greatly improve the quality of life for those with severe disabilities. The cost has also been kept low by adding the design to any manual wheelchair. Irrespective of the area the smart wheelchair can be used by people of any age groups who are dependent on others for their mobility. People residing at Villages to people at Metropolitan areas can have access to this smart vehicle. From people who are physically challenged to aged people who are dependent on their workers for their movements can be beneficial from this idea.

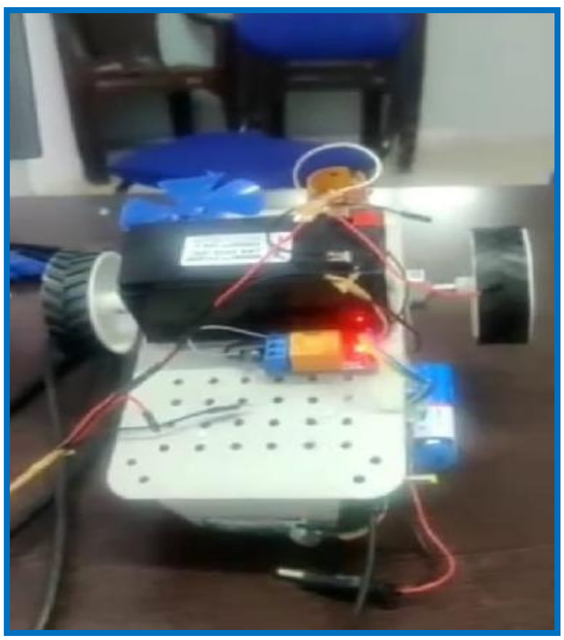


Fig: 4.1 Movement in the Left wheel

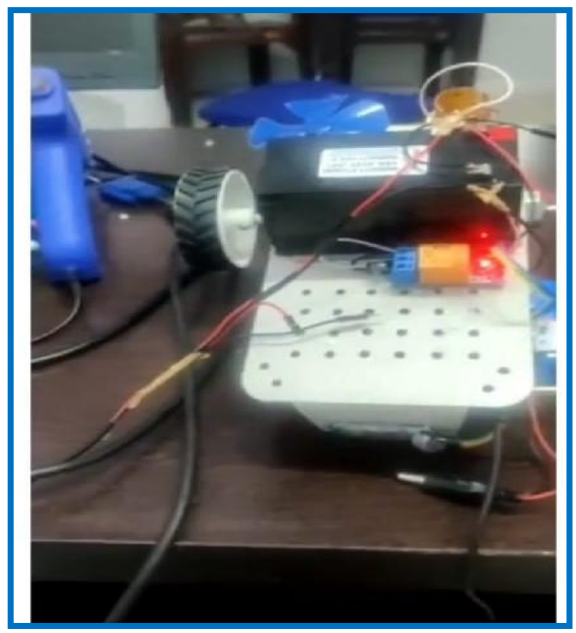
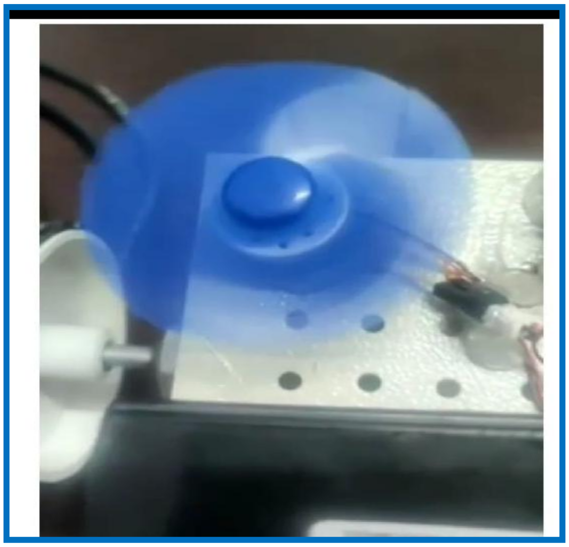
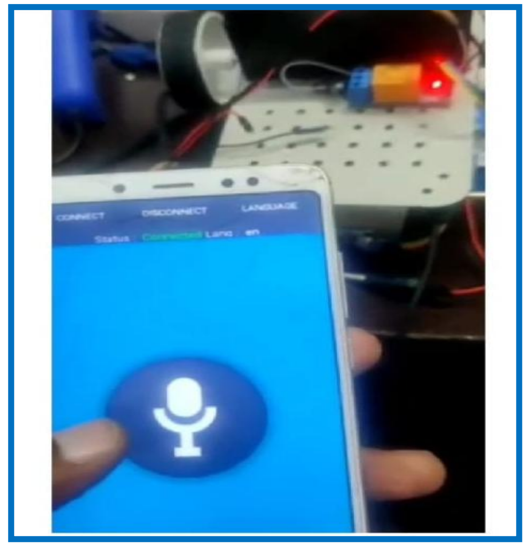


Fig:4.2 Movement in Right wheel

The command of left and right is given respectively via a mobile phone that is paored with bluetoth HC05 module the wheels start to rotate in the given direction. The movement of the wheels can be observed ftrom the above figures.





Fig;4.3 Rotation of fan **Fig:4.4 Communication via bluetooth**

As an example of home automation, a fan is operated via the voice commands or hand gesture opeartion of the user that is communicated through a bluetooth paired smart phine. Once the predefined commands are recognised that particular action is performed by the vehicle. The figures above show the rotation of a fan and the communication made through the bluetooth.

CHAPTER-5

APPLICATIONS ADVANTAGES AND DISADVANTAGES

5.1 APPLICATIONS:

1) Used in Hospitals and different health care centers
2) Can be operated by blind people.
3) Used in Old age homes

System can be switched into manual mode

5.2 ADVANTAGES:

4) Highly Sensitive, Low cost and Reliable circuit.
5) Works according to the soil condition.
6) Complete elimination of manpower.
7) Can handle heavy loads up to 7A.
8) System can be switched into manual mode when even required.

5.3 DISADVANTAGES:

1) It may be difficult to operate in noisy areas
2) Batteries need to be recharged periodically.

CHAPTER-6

CONCLUSION AND FUTURE SCOPE

6.1 CONCLUSION:

Our proposed smart vehicle provides a safe and reliable system with the presence of line follower and obstacle detector. It provides an easily accessible and a variety of functionalities. In this paper, we developed a smart vehicle system which includes ultrasonic and infrared sensors to automatically track the paths provided and also detects the obstacles in between the track along with a little intelligence of taking proper care to avoid the accidental mishaps, where we got the desired results. Thus, the disabled persons can be self reliable, safe and independent with the help of this easily controllable smart vehicle..

6.2 FUTURE SCOPE:

Despite the widespread use of smart vehicle, Majority of the people be it physically challenged or people in the old age find it extremely difficult or impossible for their movements for necessary daily activities. But our smart vehicle is boon to people with impaired sight, hemi spatial neglect or paralysis, old age people, significant cognitive impairment, as well as with younger age group that is children with disabilities, those with spinal cord injury or amputations. From people who are physically challenged to aged people who are dependent on their workers for their locomotion can be beneficial from this idea.

REFERENCE :

[1]Apsana.S, Renjitha G Nair, “**Voice Controlled Wheelchair Using Arduino**”, International Advanced Research Journal in Science, Engineering and Technology(IARJSET), Volume:03 Issue:03, August 2016.

[2]Shardul S. Kulkarni , Atul B. Dhembare, Pratik D. Deshmukh, **“Home automation by smart wheelchair for the physically handicapped person using Arduino”,** International Journal of Advance Research, ideas And Innovations In Technology(IJARIIT), Volume:04, Issue:02, December 2018.

[3] Deepak Kumar Lodhi, Prakashi Vats, Prashanth Solanki, “**Smart Electronic Wheelchair using Arduino and Bluetooth Module”**, International journal of Computer science and Mobile Computing(IJCSMC),Volume:05,May 2016.

[4] Tan Kian Hou,Yagsena and Chelladurai, **“Arduino based voice controlled wheelchair**”, Journal of Physics(ICE4CT),Volume:02,Issue:02, April 2019.

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CERTIFICATE OF PARTICIPATION

This is to Certify that Anisha Bearing USN 3VC17EC003 From Rymec Has Participated in "PROJECT EXHIBITION & COMPETITION 2021" Organised by Department of Electronics & Communication Engineering, RYMEC, Ballari on 3rd August 2021.

DR. T. HANUMANTHA REDDY	DR. SAVITA SONOLI	MR. L VIRUPAKSHAPPA	DR. S PRABHAVATHI	MR. T NAGARAJU
Principal	Vice Principal & HOD-ECE	VAsst. General Manager(Retired) BSNL, Ballari	Professor Dept. of ECE	Asst. General Manager, Airport Authority of India, Ballari

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Department of Electronics & Communication Engineering

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Rao Bahadur Y. Mahabaleswarappa
Engineering College, Ballari.

Department of Electronics & Communication Engineering

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Dr. T. Hanumanth Reddy	**Dr. Savita Sonoli**	**Dr. Prabhavathi S**	**Mr. Rudra B. Satpathy**
Patron | ICFTEN 2021	Conference Chair | ICFTEN 2021	Convenor | ICFTEN 2021	CEO & Founder
Principal	Vice Principal & HOD (E&CE)	Professor (E&CE)	Institute For Engineering Research
RYMEC, Ballari	RYMEC, Ballari	RYMEC, Ballari	and Publication (IFERP)

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION

VISION, MISSION, PROGRAM EDUCATIONAL OBJECTIVES and PROGRAM SPECIFIC OUTCOMES (PSO)

VISION OF THE INSTITUTION

To Produce Professionally Excellent, Knowledgeable, Globally Competitive and Socially Responsible Engineers and Entrepreneurs.

MISSION OF THE INSTITUTION

M1	To provide quality education in Engineering and Management.
M2	To establish a continuous industry-institute interaction, participation and collaboration to contribute skilled Engineers.
M3	To develop human values, social values, entrepreneurship skills and professional ethics among the technocrats.
M4	To focus on innovation and development of technologies by engaging in cutting edge research areas.

VISION OF THE DEPARTMENT

To Produce Professionally Excellent, Knowledgeable, Globally Competitive, Socially Responsible Electronics and Communication Engineers and Entrepreneurs.

MISSION OF THE DEPARTMENT

M1	To provide quality education in Electronics and Communication Engineering.
M2	To establish a continuous industry-institute interaction, participation and collaboration to contribute skilled Electronics and Communication Engineers.
M3	To develop human values, social values, entrepreneurship skills and professional ethics among the technocrats.
M4	To focus on innovation and development of technologies by engaging in Electronics and Communication Research areas.

Criteria I coordinator NBA coordinator HOD, ECE

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1	Graduates of Electronics & Communication Engineering course will have successful professional career.
PEO2	Graduates of Electronics & Communication Engineering course will pursue higher education or to become an Entrepreneur.
PEO3	Graduates of Electronics & Communication Engineering course will have ability for lifelong learning and to serve the society.

PROGRAM SPECIFIC OUTCOMES (PSO)

PSO 1	Ability to Design, Develop and Test the Electronics Circuits & Communication Systems.
PSO 2	Ability to Develop Excellent Programming and Problem Solving skills in the field of Embedded System.

Criteria 1 coordinator **NBA coordinator** **HOD, ECE**

PROGRAM OUTCOMES (POS)

Engineering Graduates will be able to:

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis**: Identify, formulate, review research literature, and analyze complexengineering 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 investigations 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 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.

PROJECT WORK 2020-21

COURSE OUTCOMES (CO's) Of PROJECT TITLED:

____

CO	PROJECT OUTCOMES
C413.1	Identify and Analyze Problem through Literature Survey in the Field of Engineering and Technology.
C413.2	Design and Develop Prototype for Identified Problem using Modern Tools.
C413.3	Analyze, Interpret Data to Asses Social, Health & Safety Issues to Provide Valid Conclusion.
C413.4	Develop Communication, Documentation, Presentation Skills and Demonstrate it as a Team.
C413.5	Apply for Project Funding, Exhibition, Paper Presentation in Conference and Publishing in Journals for lifelong learning.

CO-PO/PSO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
413.1	2	2					3							
413.2			3		3							3	3	3
413.3				3		3							3	
413.4							3	3	3	3	3	3		
413.5								2	2	2	2	3		
AVG	**2**	**2**	**3**	**3**	**3**	**3**	**3**	**2.5**	**2.5**	**2.5**	**2.5**	**3**	**3**	**3**

PROJECT EVALUATION RUBRICS-2020-21

RUBRICS: Rubrics are scoring or grading tools used to measure a student's performance and learning across a set of criteria and objectives.

Component	Marks[M]	Criteria	Exceptionally Well Executed [M>90%]	Good with room for improvement [70%<M<90%]	Meets minimum requirement [M<70%]	Course Outcome Mapping	PO Mapping	BTL Mapping
Literature Survey &Problem Identification	20	Refer	Refer more number of standard research papers & understand the technology.	Refer more number of research papers & understand the technology.	Refer research papers & understand the technology.	CO1	1,2,7	L2,L4
		Sustainability	Identify a problem integrating and balancing economic, environmental and social factors.	Identify a problem in which one factor out of three is missing.	Identify a problem in which more than two factors out of three are missing.			
		Ethics	Identify a unique problem.	Identify an existing problem to be extended.	Identify a very poor existing problem.			
Synopsis	20	Synopsis	Synopsis submitted with well and clearly identified problem and very good literature survey.	Synopsis with a problem identified and a literature survey.	Synopsis with poor problem and literature survey of few papers.	CO2	7,8,9,10,11 12	L3, L5
Objective & Methodology	20	Goal	Well defined Objective to meet the problem Identified.	Defined Objective nearly meets the problem Identified.	Objectives are poorly defined to meet the problem Identified.	CO1	1,2,7	L2, L4
		Functionality	Problem is broken into well thought out elements with good length, reusability and efficiency.	Problem is broken into elements. Length, reusability and efficiency need to be taken care.	Problem elements exist, no reusability and efficiency.			
		Use of Modern Technologies	Most recent and efficient technologies are used.	New technologies but not efficient technologies are used.	Old technologies and platform are used.			
Seminar on Synopsis	40	Demonstration	Team members were very well balanced and had clear articulation and power point presentation was excellent.	Team members are audible and fluent. Presentation was good.	Team members were inaudible but fluent. Poor presentation.	CO2	7,8,9,10,11 , 12	L3,L5

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Component	Marks[M]	Criteria	Exceptionally Well Executed [M>90%]	Good with room for improvement [70%<M<90%]	Meets minimum requirement [M<70%]	Course Outcome Mapping	PO Mapping	BTL Mapping
Experimental observation	30	Validation	Hardware Program handles erroneous or unexpected input. Meets all requirements.	All error conditions are checked. May not meet all the requirements.	Some error conditions are checked does not meet all specified requirements.	CO2,CO3	3,5,12,PSO 1, PSO2	L3,L4, L5,L6
		Testing	Hardware Program / Testing is complete without being redundant..	All key items are tested, but testing may be redundant.	Testing was done, but is not sufficiently complete.			
Documentation	20	Thesis	The thesis is clearly stated with good flow and adequate content.	The thesis is clearly stated with adequate content. Flow was little difficult to follow.	The thesis is not clearly stated with inadequate content. Flow was little difficult to follow.	CO4	7,8,9,10,11 , 12	L3,L5
Demonstration Presentation & Discussion	30	Demonstration	Team members were very well balanced and had clear articulation and power point presentation was excellent.	Team members are audible and fluent. Presentation was good.	Team members were inaudible but fluent. Poor presentation.	CO4	7,8,9,10,11 , 12	L3,L5
Paper Presentation/ Project Exhibition	10	Paper Presentation/ Project Exhibition	Paper was presented in a very good conference or journal with good impact factor./ Participated in project Exhibition and won prizes	Paper was presented in a conference./ Participated in project Exhibition and not won prizes	Paper was presented in conference with no relevant data./ Not Participated in project Exhibition	CO5	8,9,10,11, 12	L4
Team Work	10	Time Management	No adjustments of deadlines. Ensured timely productions. Routinely met the guide.	Usually uses time well. Had to adjust deadlines.	Rarely gets things done by deadlines. Rarely meet the guide.	CO4, CO5	7,8,9,10,11 , 12	L3,L4, L5
		Team Work	Team worked with unity and mutual respect. Each member contributed well.	Team worked well with unity most of the times. Each member contributed to the project.	Team did not work well with unity and mutual respect. Contribution from few of the members was lacking.			

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Rao Bahadur Y Mahabaleswarappa Engineering College,Bailari
Dept. of Electronics & Communication Engineering
Project Evalation sheet -2020-21 Phase2

Sem:8 **Sec:A &B**

Batch	Names	USN	DOMAINS	TITTLE	Experimental Observation (30M)	Documentation (20M)	Demonstration, E-Presentation & Discussion (30M)	Paper Presentation / Project Exhibition (10M)	Team Work (10M)	Total (100M)	GUIDE
1	Seema P	3VC17EC062	EMBEDDED / COMMUNICATION	Design And Fabrication Of Low Cost Mems Based Smart Electronic Listening Device For Hearing Impairment People	30	20	29	10	10	99	Dr Savita Sonoli
	Triveni	3VC17EC078			30	20	28	10	10	98	
	K Swetha	3VC17EC025			30	20	29	10	10	99	
	Sonia S	3VC17EC069			30	20	28	10	10	98	
2	B Manasa	3VC17EC031	IOT / COMMUNICATION	Raitha Bandava-An Autonomous Iot Agrobot Controlled Over A Google Assistant With Solar Powered Agricultural Machine	29	20	30	10	10	99	Rakhee Patil
	Chetana Gumaste Desai	3VC17EC015			29	20	30	10	10	99	
	K M Anjum	3VC17EC004			29	20	29	10	10	98	
	N Sowbhagya Shree	3VC17EC036			29	20	29	10	10	98	
3	Balaji.B	3VC17EC008	IOT / COMMUNICATION	ToI Stereopticon for Rural E-Learning Education System	30	20	30	10	9	99	Prashanth keni
	C.Ruchitha	3VC17EC011			30	20	30	9	10	99	
	G.S.Tanuja	3VC17EC017			30	20	29	10	10	99	
4	Vidyashree	3VC17EC080	IOT / COMMUNICATION	Smart vehicle with voice and gesture controlled for physically challenged integrated with home automation	30	20	30	10	9	99	Dr Prabhavathi S
	Sreelakshmi Desai	3VC17EC072			30	20	30	9	9	98	
	Asif Ayodhi	3VC17EC005			30	20	30	9	9	98	
	Anisha	3VC17EC003			30	20	30	9	9	98	

co-ordinator

HOD

Head of the Department, ... Communication En... ...Engineering College, (Formerly Vijayanagar Engg. College) BELLARY 583 104.

Rao Bahadur Y Mahabaleswarappa Engineering College,Ballari
Dept. of Electronics & Communication Engineering
Project Evalation sheet -2020-21 Phase1

Sem:7 Sec:A &B

Sl.no	Names	USN	DOMAINS	TITTLE	Literature Survey &Problem Identification(20M)	Objective &Methodology(20M)	Synopsis(20M)	Seminar on Synopsis(40M)	Total	GUIDE
1	Seema P	3VC17EC062	EMBEDDED / COMMUNICATION	Design And Fabrication Of Low Cost Mems Based Smart Electronic Listening Device For Hearing Impairment People	20	20	20	39	99	Dr Savita Sonoli
	Triveni	3VC17EC078			20	20	20	37	97	
	K Swetha	3VC17EC025			20	20	20	37	97	
	Sonia S	3VC17EC069			20	20	20	37	97	
2	B Manasa	3VC17EC031	IOT / COMMUNICATION	Raitha Bandava-An Autonomous Iot Agrobot Controlled Over A Google Assistant With Solar Powered Agricultural Machine	20	20	20	39	99	Rakhee Patil
	Chetana Gumaste Desai	3VC17EC015			20	20	20	39	99	
	K M Anjum	3VC17EC004			20	20	20	39	99	
	N Sowbhagya Shree	3VC17EC036			20	20	20	39	99	
3	Balaji.B	3VC17EC008	IOT / COMMUNICATION	ToI Stereopticon for Rural E-Learning Education System	19	20	20	40	99	Prashanth keni
	C.Ruchitha	3VC17EC011			19	20	20	40	99	
	G.S.Tanuja	3VC17EC017			19	20	20	40	99	
4	Vidyashree	3VC17EC080	IOT / COMMUNICATION	Smart vehicle with voice and gesture controlled for physically challenged integrated with home automation	20	20	20	37	97	Dr Prabhavathi S
	Sreelakshmi Desai	3VC17EC072			20	20	20	39	99	
	Asif Ayodhi	3VC17EC005			20	20	20	39	99	
	Anisha	3VC17EC003			20	20	20	36	96	

co-ordinator

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