FABRICATION OF VOICE ASSITED AND HAND GESTURE CONTROLLED WHEELCHAIR

Submitted in partial fulfillment of the requirements for the award of
Bachelor of Engineering degree in Mechanical Engineering

By

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SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)
Accredited with Grade "A" by NAAC
JEPPIAAR NAGAR, RAJIV GANDHI SALAI, CHENNAI - 600 119

MARCH-2021

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BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of Yandamuri Urdhwa Srikiran (Reg. No. 37150224) and Vanga Mohan Krishna Reddy (Reg. No. 37150200) who carried out the project entitled **"Fabrication of voice assisted and hand gesture control wheelchair"** under my supervision from december (2020) to march (2021)

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DECLARATION

We Yandamuri Urdhwa Srikiran (Reg.No.37150224) and Vanga Mohan Krishna Reddy (Reg.No 37150200) hereby declare that the Project Report entitled "Fabrication Of Voice Assisted And Hand Gesture Controlled Wheelchair" done by us under the guidance of **Mr.V.Sriram,** Assistant Professor, at Sathyabama Institute of Science and Technology, Chennai is submitted in partial fulfilment of the requirements for the award of Bachelor of Engineering degree in Mechanical Engineering.

DATE: 30.03.2021

PLACE: CHENNAI　　　　1.

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ACKNOWLEDGEMENT

I am pleased to acknowledge my sincere thanks to Board of Management of **SATHYABAMA** for their kind encouragement in doing this project and for completing it successfully. I am grateful to them.

I convey my thanks to **Dr.S.PRAKASH, M.E., Ph.D.,** Dean, School of Mechanical Engineering and **Dr.G.ARUNKUMAR, M.E., Ph.D.,** Head of the Department, Dept. of Mechanical Engineering for providing me necessary support and details at the right time during the progressive reviews.

I would like to express my sincere and deep sense of gratitude to my Project Guide **Mr.V.SRIRAM, M.E., (Ph.D.)** Assistant Professor**,** for his valuable guidance, suggestions and constant encouragement paved way for the successful completion of my project work.

I wish to express my thanks to all Teaching and Non-teaching staff members of the Department of Mechanical Engineering, who were helpful in many ways for the completion of the project**.** Further I would like to express heartful thanks to **Mr.NIVIN JOY THYKATTUSSERRY, M.E., (Ph.D.),** Project Coordinator, Department of Mechanical Engineering for timely assisting and intimation of necessary information at right time.

ABSTRACT

• Generally, robots are modified to perform particular errands which people cannot. To increase the use of robots where conditions are not certain, robots can be made to follow the instruction of human operator and perform the task. In this way choices are taken agreeing to the working conditions by the administrator and the errand is performed by the robots. This paper describes about the voice assisted and hand gesture control wheelchair which can be controlled by your normal hand gesture and voice assistance.

• The gesture control consists of mainly two parts, one is transmitter part and another is receiver part. The transmitter will transmit the flag agreeing to the position of accelerometer and your hand signal and the recipient will get the flag and make the robot move in particular course. Here, the program is arranged by utilizing Arduino IDE.

• A voice controlled wheelchair model was created employing a commercially available manual wheelchair to help individuals with both upper and lower appendage inabilities. An Arduino microcontroller forms the voice command from the discourse acknowledgment module and controls the engine development of the wheelchair.

• The victory rate of the wheelchair to recognize the voice commands in English, Chinese and Malay was tall. The overall cost of the model was kept moo to form it affordable.

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LIST OF SYMBOLS AND ABBREVATIONS

V_c Cutting speed (mm/sec)

N   Spindle speed (rpm)

V_c Penetration rate (mm/sec)

F_n Feed per revolution (mm/rev)

MRR   Metal Removal Rate (Q)

M_c Torque (N/m)

T_c Machining Time (sec)

Ae   Axial depth of cut (mm)

Ap   Radial depth of cut (mm)

R_a surface roughness factor

L   length of cut (mm)

D   diameter (mm)

F_x Tangential Force (N)

F_t Thrust Force (N)

CHAPTER 1

INTRODUCTION

With the advancement in technology, home automation has made possible everywhere. Home automation is extremely useful for someone with disabilities in many aspects. Lots of individuals think that Home Automation could be a Luxury Thing. Home Automation isn't just a luxury one but, it's the way beyond. Physically paralyzed person is that the one who has lost his/her physical mobility. There are various sorts of paralysis. They are monoplegia (which effects just one arm or leg), hemiplegia (effects one arm and one leg on same side of body), paraplegia (effects both legs), quadriplegia(effects both arms and legs) . Such a physically paralyzed person wants to hunt other person's help even for his/her basic task like clothing, bathing, eating etc.. Things become even worse when there's no guardian to handle the care of such person. How such person would control the house appliances? And,there are more such questions. Many people would say they'll hire some people whose duty is to take care of such people but, it's not a reliable solution.How much a new person would care about all the items. So we want to design a system where a paralyzed person are often ready to operate devices with the assistance of some simple hand gestures and with some voice commands. The user can wear MEMS accelerometer on a hand, through gestures they'll control powered devices like fan, light, etc.,. With the assistance of arduino voice control application on android phone someone can control home appliances through voice commands.

1.1 OBJECTIVE

• Wheelchair is the best assistive device used by elder and disabled people.

 • The driving and controlling of traditional wheelchair are much harder task.

 • Our point is to construct a moo fetched and capable wheel chair which makes a difference the incapacitated individuals to travel without depending on others.

• We want to give the disabled person the sense of freedom where they can go on their own.

CHAPTER 2

LITERATURE SURVEY

2.1 Wireless Gesture Control Wheelchair

Author: Shanelle Fernandes, Rushia Fernandes, Jessica Kakkanad.

Wheelchairs have been used by patients who suffer from various physical disabilities to help them with locomotion and cater their day to day needs with ease. But there are some cases where the movement of a wheelchair is dependent on another individual as is the case with patients who lack the required arm strength and movement to properly push the wheels forward such as quadriplegics, paraplegics, stroke patients, elders etc. Joystick situated wheelchairs, thought to be a arrangement to those sorts of patients, can posture diverse issues because it requires basic shoulder development. It isn't continuously conceivable for the previously mentioned sorts of patients. In expansion, our arrangement doesn't have the positional constraints that a joystick wheelchair might have because it is remote and can be worn on either hand which permits the persistent to sit in their favored position for least discomfort. This project is an attempt to help the disabled move around independently. Thus, in this research work, we present a prototype of a wireless gesture-based wheelchair which can be controlled via hand gestures. The framework consists of a transmitter and a receiver that communicate with each other wirelessly. For wireless transmission, 433Mhz RF Transmitter and Receiver Unit has been used as it transmits data through an antenna at the speed of 1Kbps - 10Kbps and the range can be adjusted as required. The transmitter unit consists of an Arduino LilyPad microcontroller and an accelerometer that has been attached to a hand glove. The accelerometer sensor has been used to register the position of the hand while creating a gesture. This glove is supposed to be worn by the patient allowing them to move their hand conveniently, sending signals to the receiver unit connected to the wheelchair leading to the movement of the wheels in the desired direction. The receiver unit consist of motor drivers that convert the voltage as needed by the wheels. This paper presents an alternative to the commercial wheelchairs as it is cost effective, easy to control and efficient. The working and assembly of the system has been explained in the paper.

2.2. Hand Gesture Controlled Wheelchair with Emergency Alert System and Obstacle Detection

Author: Siddhi Chokshi (1), Kritika Kotian (2), Meena Ugale (3).

This paper presents a basic but successful strategy for actualizing hand motion acknowledgment that gives a stage for individuals with physical disabilities.Using these signals, the wheelchair can be worked in an productive way that's typical and helpful not at all like a machine. The wheelchair comprises of an accelerometer sensor that faculties the hand developments and sends the yield to the microcontroller. Depending on the signals recognized by the accelerometer, the wheelchair will move in forward, in reverse, right and cleared out bearings. Impediments can be identified utilizing ultrasonic sensor, sparing the client from hazard. In case of any crisis the client can fair press the button given which sends the caution messages to the doctors/relatives with the assistance of GSM module.

2.3. Voice and Hand Gesture based Home Automation for Physically Challenged

Author: G. Bhaskar Phani Ram 1, P. Girish Kumar 2, G. Sai Bhargav 3, K. Rohith 4, S. Dolly Sree 5, | May 2020

Physical inabilities for instance, paralysis, paraplegia, quadriplegia and Parkinson'sillness, can incredibly constrain the self-governance of patients as for home living. Rehabilitation engineering is that the application of engineering sciences and technology to boost the standard of life for physically challenged people. A tool is intended for the physically challenged people to assist them in operating the house appliances individually. This Paper presents a framework for voice and hand signal controlled program. This proposed framework points to control diverse domestic machines. In this system MEMS accelerometer sensor is employed to detect hand motion and bluetooth module is employed to detect voice commands from the user and transmitted to microcontroller. This paper presents a low-cost voice and hand gesture based system to control the house Electronic devices using PICmicrocontroller.PIC acts as the main part of gesture identification and speech recognition. The MEMS sensor which is associated to hand may be a xyz-axis accelerometer which faculties the motion of the hand and bluetooth module HC05 faculties the voice commands through which the house electrical apparatuses are controlled utilizing PIC16F877A controller.

2.4. HAND GESTURE BASED HOME AUTOMATION FOR VISUALLY CHALLENGED

Author: Smitha.M, T. Ayesha Rumana, Sutha.P, APR.-2015

Rehabilitation building is the application of designing sciences and innovation to make strides the quality of life for the individuals with incapacities. A gadget is planned for the outwardly challenged individuals to help them in working the domestic machines exclusively. A Microelectromechanical Frameworks (MEMS) accelerometer is utilized to sense the increasing velocities of a hand in movement in three opposite headings that's (x, y, z) and transmitted to remote convention utilizing Radio Recurrence (RF). The RF signals transmission recurrence is 2.25 GHz. The motion code layouts are already put away within the microcontroller at the recipient area. The gotten motions and the hand motion appeared by the outwardly challenged is recognized and compared with the formats put away within the collector. On the off chance that the layouts coordinate the put away layouts, at that point appropriately the domestic appliances are controlled.

2.5. Hand Gesture Based Home Automation

Author: Abhijit M.1, Anjana Nair2, Jikhil John3, ShabasBasheer4, Munna Basil Mathai5 Controlling the domestic apparatuses and electronic contraptions through an infrared inaccessible control is presently in common. But the same controlling errands can be done more effortlessly. The essential rationale of proposing the modern framework of hand signal inaccessible control is to expel the have to be see into the handheld inaccessible and to seek for a particular key for particular work. An accelerometer, spinner and magnetometer is utilized to recognize the hand motions in 3 opposite headings and transmitted through remote convention utilizing radio recurrence. The information is gotten by the center segment which controls the domestic apparatuses concurring to the choices made. This venture proposes a straightforward and simple way of controlling the home appliances.

2.6 EXISTING SYSTEM:

This report proposes a model for Hand Gesture Controlled and Voice assisted Wheelchair, which is able to control some of the overall disadvantages of the other strategies commonly used by providing a gesture controlled wheel chair. This gives the client freedom and a mental advantage of being autonomous. To maintain a strategic distance from physical hardship, a client can utilize the accelerometer to the protect as with the slight bend often hand the client gets the capacity and flexibility to turn the wheelchair into the specified direction. Also, the obstacle sensor detects the obstacle, turns on the buzzer and stops the wheelchair because change of direction may be dangerous. The user can then give another alternate direction to move. During an emergency, the user presses the button placed on the wheelchair and the GSM module sends the recorded alert message to the relative/doctor.

2.7 PROPOSED SYSTEM:

In proposed framework we are getting to screen the elderly individuals controlling wheelchair by utilizing hand signal and voice commands. Conjointly screen debilitated individuals controlling wheelchair and the working of cautions framework to their caretakers.

CHAPTER 3
AIM AND SCOPE

3.1 AIM

☐ The main aim of Voice Helped and Hand Motion Controlled Wheelchair extend is prescribed to control a wheel chair by utilizing discourse acknowledgment module and motion controlled module.

☐ The system is designed to control a wheel chair using the voice of person and his hand gestures.

☐ The objective of this project is to fascilate the movement of people who are disable or handicapped and elderly people who are not able to move well.

☐ The objective of this framework will permit certain individuals to live a life with less reliance on others for their development as a every day require.

3.2 SCOPE

Speech recognition innovation and Motion control innovation could be a key innovation which can give a other way of human interaction with machine or instruments. Subsequently the problems that they confront can be fathomed by utilizing discourse acknowledgment innovation for the development of wheel chair. This will be realized and optimized with utilize the savvy phone gadget as an mediator or interface. In this venture interfacing has been outlined in this manner to develop a program for recognize discourse moreover controls the development of chair and an application which can handle or oversee the graphical commands.

Easy to operate, since this wheelchair can be worked for the clients who are neck down paralyzed and are having a troublesome time whereas driving a reliable life with no sense of freedom.

CHAPTER 4
MATERIALS AND METHODS

4.1 MATERIALS

Arduino Nano with shield

Arduino Uno

Accelerometer

Bluetooth pair for voice controlling

ZigBee pair for gesture controlling

Ultrasonic sensor

Relay Motor driver

Motor

Power supply (batteries)

Glove Module

Gyroscope Sensor

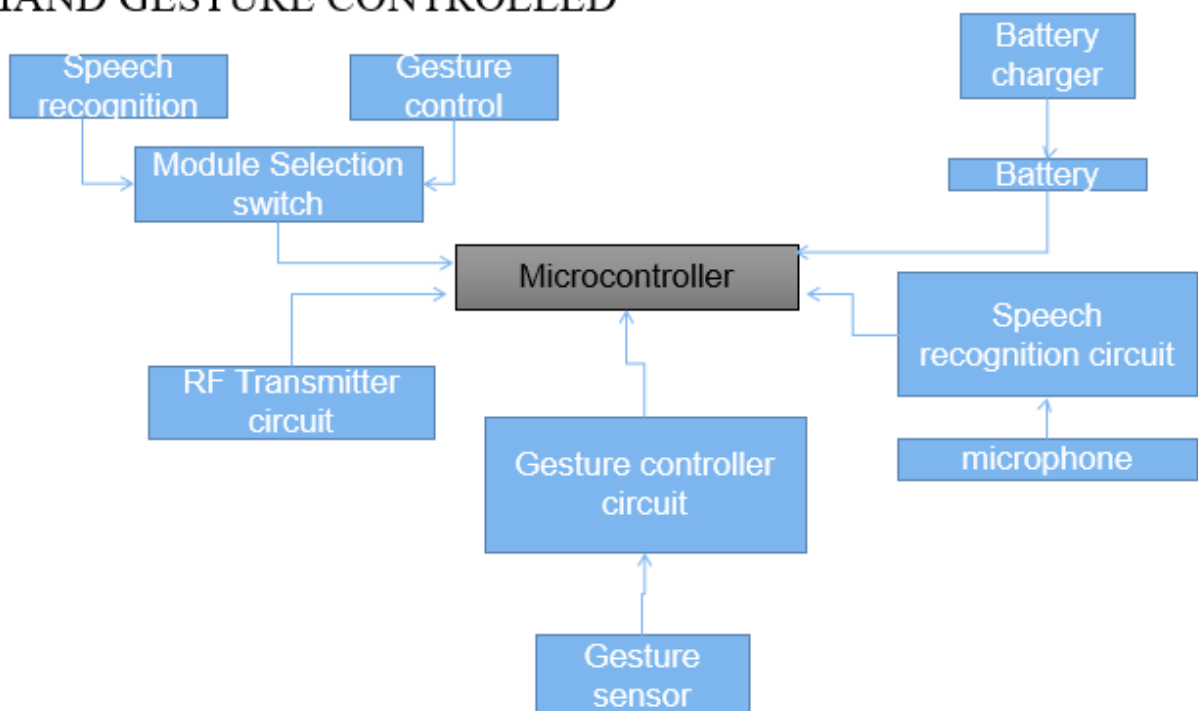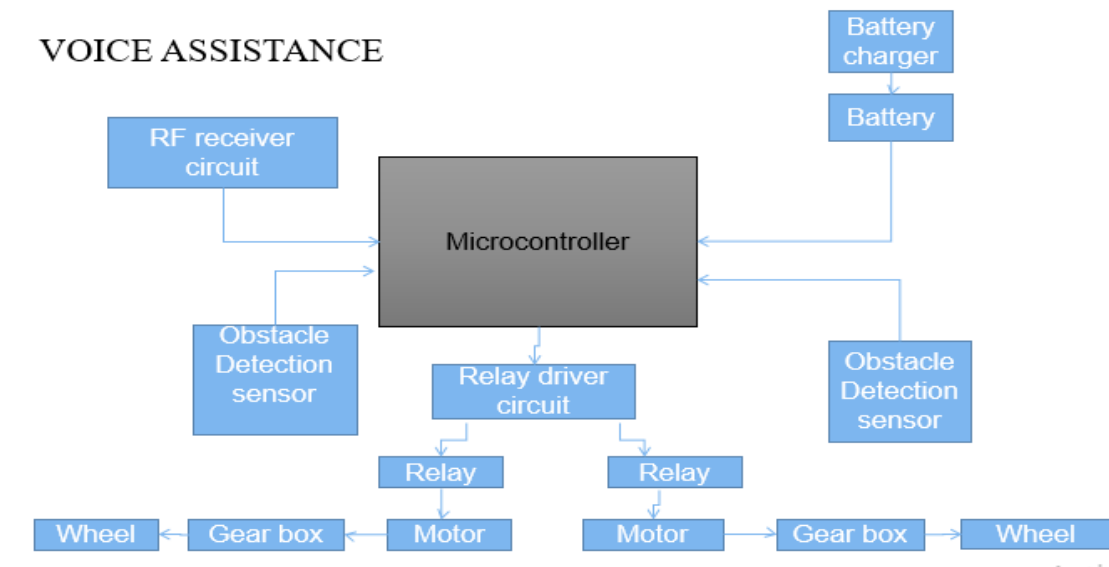## 4.2 MATERIAL IMPLEMENTATIONS

Fig4.2.1

Fig4.2.2

4.2.1 Embedded Systems

4.2.1.1 Overview of embedded systems

An embedded system could be a special-purpose computer system planned to perform one or some committed capacities, frequently with real-time computing limitations. It is more often than not inserted as portion of a total gadget counting equipment and mechanical parts. In differentiate, a general-purpose computer, such as a individual computer, can do numerous distinctive errands depending on programming. Implanted frameworks have gotten to be exceptionally vital nowadays as they control numerous of the common devices we use.

Since the implanted framework is committed to particular errands, plan engineers can optimize it, decreasing the measure and taken a toll of the item, or expanding the unwavering quality and execution. A few inserted frameworks are mass-produced, profiting from economies of scale. Physically, implanted frameworks run from convenient gadgets such as computerized observes and MP3 players, to expansive stationary establishments like activity lights, plant controllers, or the frameworks controlling atomic control plants. Complexity changes from moo, with a single microcontroller chip, to exceptionally tall with numerous units, peripherals and

systems mounted interior a expansive chassis or walled in area. In common, "implanted framework" isn't an precisely characterized term, as numerous frameworks have a few component of programmability. For illustration, Handheld computers share a few components with inserted frameworks — such as the working frameworks and chip which control them — but are not really implanted frameworks, since they allow particular applications to be stacked and peripherals to be associated. In common, "inserted framework" isn't an precisely characterized term, as numerous frameworks have a few component of programmability. For case, Handheld computers share a few components with implanted frameworks — such as the working frameworks and chip which control them — but are not really implanted frameworks, since they permit distinctive applications to be stacked and peripherals to be associated. Embedded systems provide several functions

• Monitor the environment; inserted frameworks studied information from input sensors. This information is at that point handled and the comes about shown in a few organize to a client or users.

● Control the environment; embedded systems generate and transmit commands for actuators.

● Transform the data; inserted frameworks change the information collected in a few significant way, such as information compression/decompression

Although interaction with the outside world through sensors and actuators is an imperative angle of inserted frameworks, these frameworks moreover give usefulness particular to their applications. Implanted frameworks ordinarily execute applications such as control laws, limited state machines, and flag preparing calculations. These frameworks must too identify and respond to issues in both the inner computing environment as well as the encompassing electromechanical frameworks.

There are numerous categories of inserted frameworks, from communication devices to domestic apparatuses to control systems. Examples include;

☐ Communication devices

e.g.: modems, cellular phones

☐ Home Appliances

e.g.: CD player, VCR, microwave oven

☐   Control Systems

e.g.: Automobile anti-lock braking systems, robotics, satellite control

4.2.1.2 Block diagram of an embedded system:

An embedded system as a rule contains an inserted processor. Numerous apparatuses that have a computerized interface -- microwaves, VCRs, cars -- utilize inserted frameworks. A few implanted frameworks incorporate an working framework. Others are exceptionally specialized coming about within the whole rationale being executed as a single program. These frameworks are inserted into a few gadget for a few specific purpose other than to supply common reason computing . A typical embedded system is appeared in Fig 1.1
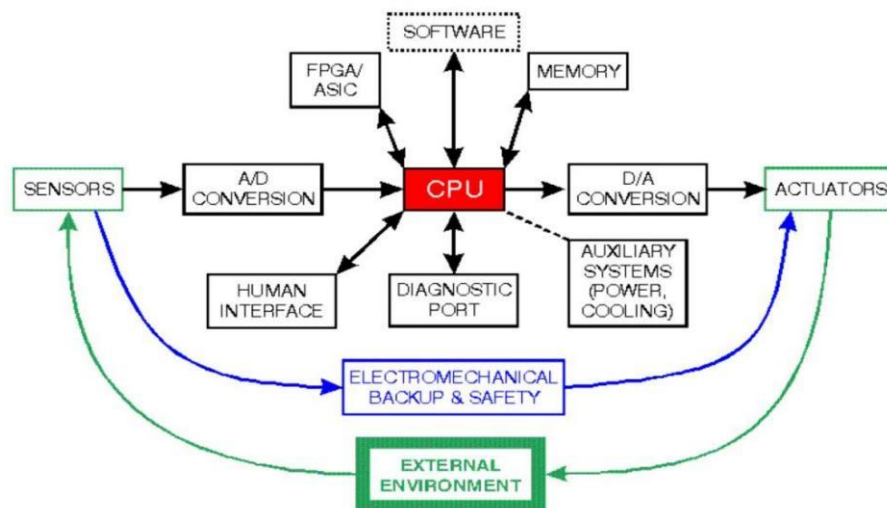
Fig 4.2.1.2 Block diagram of a typical embedded system

4.2.1.3 Characteristics of embedded systems

Embedded systems are characterized by a one of a kind set of characteristics. Each of these characteristics forced a particular set of plan limitations on implanted frameworks creators. The challenge to planning inserted frameworks is to comply to the particular set of imperatives for the application.

Application Specific Systems:

Embedded systems are not general-purpose computers. Implanted framework plans are optimized for a particular application. Numerous of the work characteristics are known some time recently the equipment is outlined. This permits the architect to center on the particular plan imperatives of a well-defined application. As such, there's restricted client reconstruct capacity. A few inserted frameworks, be that as it may, require the adaptability of reconstruct capacity. Programmable DSPs are common for such applications.

Reactive Systems

As mentioned prior, a ordinary implanted frameworks demonstrate reacts to the environment by means of sensors and control the environment utilizing actuators. This requires inserted frameworks to run at the speed of the environment. This characteristic of inserted framework is called "reactive". Responsive computation implies that the framework (essentially the program component) executes in reaction to outside occasions. Outside occasions can be either intermittent or aperiodic. Occasional occasions make it simpler to plan handling to ensure execution. Aperiodic occasions are harder to plan. The most extreme occasion entry rate must be evaluated in arrange to oblige most exceedingly bad case circumstances. Most inserted frameworks have a critical reactive component. One of the biggest challenges for inserted framework architects is performing an precise most exceedingly bad case plan examination on frameworks with factual execution characteristics (e.g., cache memory on a DSP or other implanted processor). Genuine time framework operation implies that the rightness of a computation depends, in portion, on the time at which it is conveyed. Frameworks with this necessity must regularly plan to most exceedingly bad case execution. But precisely anticipating the most noticeably awful case may be troublesome on complicated structures. This frequently leads to excessively critical gauges failing on the side of caution. Numerous implanted frameworks have a critical necessity for genuine time operation in arrange to meet outside I/O and control solidness necessities. Numerous real-time frameworks are too reactive systems.

Distributed Systems

A common characteristic of an inserted framework is one that comprises of communicating forms executing on a few CPUs or ASICs which are associated by communication joins. The reason for this is often economy. Conservative 4 8-bit microcontrollers may be cheaper than a 32-bit processors. Indeed after including the

fetched of the communication joins, this approach may be best. In this approach, numerous processors are as a rule required to handle numerous time-critical assignments. Gadgets beneath control of inserted frameworks may too be physically distributed.

Heterogeneous Architectures

Embedded systems regularly are composed of heterogeneous designs (Fig 1.2). They may contain distinctive processors within the same framework arrangement. They may too be blended flag frameworks. The combination of I/O interfacing, neighborhood and inaccessible recollections, and sensors and actuators makes implanted framework plan really special. Implanted frameworks moreover have tight plan limitations, and heterogeneity gives superior plan flexibility.
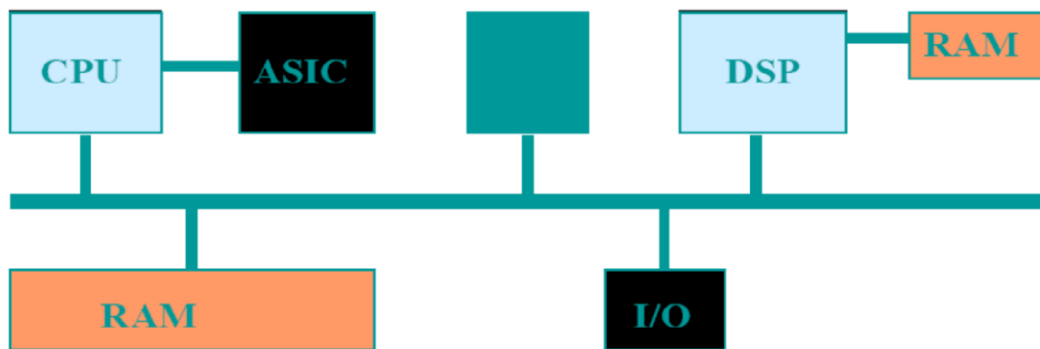
Fig 4.2.1.3 Embedded Systems having Heterogeneous Architectures

Harsh environment

Many embedded systems do not work in a controlled environment. Expect warm is as often as possible a issue, especially in applications counting combustion (e.g., various transportation applications). Additional issues can be caused for embedded computing by a require for security from vibration, shock, lightning, control supply changes, water, disintegration, fire, and common physical abuse.

System safety and reliability

As embedded system complexity and computing control proceed to grow, they are beginning to control increasingly of the security viewpoints of the in general framework. These security measures may be inside the outline of program as well as gear control. Mechanical security fortifications are routinely sanctioned when the computer system loses control in orchestrate to safely closed down system operation. Program security and immovable quality may well be a more prominent issue. Program doesn't

commonly "break" within the sense of gear. Be that because it may program may be so complex that a set of startling circumstances can cause program disappointments driving to dangerous circumstances. Discourse of this theme is exterior the scope of this book, but the challenges for embedded creators incorporate planning dependable program and building cheap, accessible frameworks utilizing questionable components. The most challenge for inserted framework creators is to get low-cost unwavering quality with negligible repetition.

Control of physical systems

One of the main reasons for inserting a computer is to interact with the environment. Typically frequently done by checking and controlling outside apparatus. Implanted computers change the analog signals from sensors into computerized shape for preparing. Yields must be changed back to analog signal levels. When controlling physical hardware, huge current loads may got to be exchanged in arrange to function engines and other actuators. To meet these needs, inserted frameworks may require expansive computer circuit sheets with numerous non-digital components. Embedded framework architects must carefully adjust framework tradeoffs among analog components, control, mechanical, arrange, and computerized equipment with comparing computer program.

Small and low weight

Many embedded computers are physically found inside a few bigger framework. The frame calculate for the inserted framework may be managed by aesthetics. For case, the frame calculate for a rocket may ought to fit interior the nose of the rocket. One of the challenges for implanted frameworks originators is to create non-rectangular geometries for certain arrangements. Weight can moreover be a basic limitation. Inserted car control frameworks, for case, must be light weight for fuel economy. Versatile CD players must be light weight for portability purposes.

Cost sensitivity

Cost is an issue in most systems, but the affectability to taken a toll changes can change drastically in implanted frameworks. This is often basically due to the impact of

computer costs have on productivity and is more a work of the proportion of fetched changes compared to the entire system cost.

Power management

Embedded frameworks have strict imperatives on control. Given the movability prerequisites of numerous implanted frameworks, the have to be preserve control is critical to preserve battery life as long as conceivable. Minimization of warm generation is another self-evident concern for embedded frameworks.

4.2.2 POWER SUPPLY

All electronic circuits works as it were in moo DC voltage, so we require a control supply unit to supply the fitting voltage supply for their legitimate working .This unit comprises of transformer, rectifier, channel & controller. AC voltage of regularly 230volts rms is associated to a transformer voltage down to the level to the specified ac voltage. A diode rectifier that gives the complete wave amended voltage that's at first sifted by a straightforward capacitor channel to create a dc voltage. This coming about dc voltage usually has a few swell or ac voltage variety . A controller circuit can utilize this dc input to supply dc voltage that not as it were has much less swell voltage but too remains the same dc esteem indeed the dc voltage changes a few what, or the stack associated to the yield dc voltages changes.
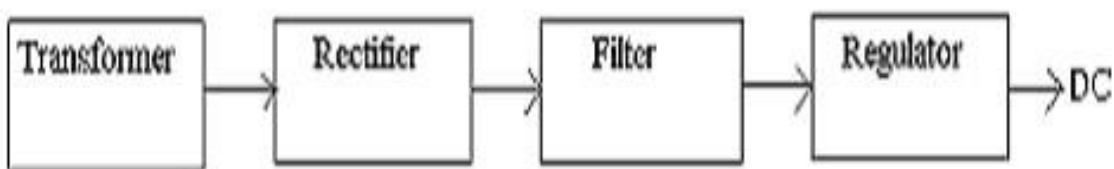

Fig 4.2.2 General Block Of Power Supply Unit

4.2.3 TRANSFORMER:

A transformer may be a inactive piece of which electric control in one circuit is changed into electric control of same recurrence in another circuit. It can raise or lower the voltage within the circuit, but with a comparing diminish or increment in current. It

works with the rule of common acceptance. In our venture we are employing a step down transformer to giving a fundamental supply for the electronic circuits. Here we step down a 230volts ac into 12volts ac.

4.2.4 RECTIFIER:

A dc level gotten from a sinusoidal input can be moved forward 100% employing a handle called full wave correction. Here in our venture for full wave correction we use bridge rectifier. From the fundamental bridge arrangement we see that two diodes(say D2 & D3) are conducting whereas the other two diodes (D1 & D4) are in off state amid the period t = to T/2.Accordingly for the negative cycle of the input the conducting diodes are D1 & D4 .Hence the extremity over the stack is the same.

In the bridge rectifier the diodes may be of variable types like 1N4001, 1N4003, 1N4004, 1N4005, IN4007 etc.… can be used. But here we utilize 1N4007, since it can withstand up to 1000v.

4.2.5 FILTERS:

In order to get a dc voltage of Hz, we need to utilize a moo pass channel. So that a capacitive channel circuit is utilized where a capacitor is associated at the rectifier yield& a dc is gotten over it. The sifted waveform is basically a dc voltage with irrelevant swells & it is eventually fed to the load.

4.2.6 REGISTERS:

The controller IC has two 8 bit registers, an instruction register (IR) and a data register (DR). The IR stores the instruction codes and address data for show information Slam (DD Slam) and character generator Smash (CG Smash). The IR can be composed, but not studied by the MPU. The DR transiently stores information to be composed to /studied from the DD Slam or CG Slam. The information composed to DR by the MPU, is naturally composed to the DD Slam or CG Slam as an inner operation.

When an address code is composed to IR, the information is consequently exchanged from the DD Slam or CG Slam to the DR. information exchange between the MPU is at that point completed when the MPU peruses the DR. moreover, for the another MPU

examined of the DR, information in DD Smash or CG Slam at the address is sent to the DR consequently. Additionally, for the MPU compose of the DR, the following DD Slam or CG Slam address is chosen for the type in operation. The dot-matrix fluid precious stone show controller and driver LSI shows alphanumeric, Japanese kana characters, and images. It can be arranged to drive a dot-matrix fluid precious stone show beneath the control of a 4- or 8-bit microprocessor. Since all the capacities such as show Slam, character generator, and fluid gem driver, required for driving a dot-matrix fluid precious stone show are inside given on one chip, a negligible framework can be interfaces with this controller/driver

4.2.7 REGULATORS:

The output voltage from the capacitor is more sifted & at long last controlled. The voltage controller may be a gadget, which keeps up the yield voltage consistent independent of the alter in supply varieties, stack varieties & temperature changes. Here we utilize fixed voltage regulator specifically LM7805.The IC LM7805 could be a +5v controller which is utilized for microcontroller.

4.2.8 FEATURES AND DESCRIPTION OF REGULATORS

- Output Current up to 1A

- Output Voltages of 5, 6, 8, 9, 10, 12, 15, 18, 24V

- Thermal Overload Protection

- Short Circuit Protection

- Output Transistor Safe Operating Area Protection

4.2.9 ARDUINO UNO AND ITS PROGRAMMING

Arduino could be a apparatus for making computers that can sense and control more of the physical world than your desktop computer. It's an open-source physical computing organize based on a clear microcontroller board, and a enhancement environment for composing program for the board.

Arduino can be utilized to create intelligently objects, taking inputs from a combination of switches or sensors, and controlling a grouping of lights, motors, and other physical yields. Arduino wanders can be stand-alone, or they can be communicate with computer program running on your computer. The sheets can be amassed by hand or obtained preassembled; the open-source IDE can be downloaded for free.

The Arduino programming dialect is an execution of Wiring, a comparable physical computing stage, which is based on the Preparing interactive media programming environment.

Arduino Uno:
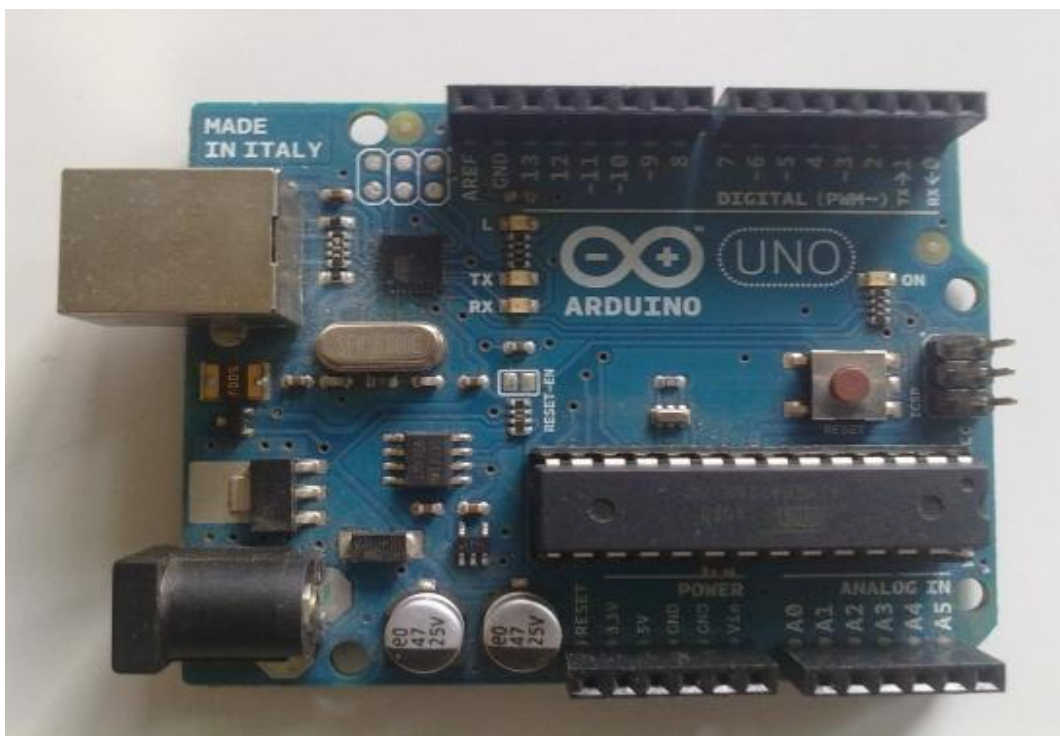
Fig 4.2.9 ARDUINO UNO

4.2.9.1 Overview

The Arduino microcontroller is a straightforward to utilize however capable single board computer that has picked up significant footing within the hobby and proficient advertise. The Arduino is open-source, which suggests equipment is sensibly estimated and advancement program is free. This direct is for students in ME 2011, or understudies anyplace who are going up against the Arduino for the primary time. For progressed Arduino clients, lurk the net; there are parts of assets.

This guide covers the Arduino Uno board (Start fun DEV-09950, $29.95), a great choice for understudies and teachers. With the Arduino board, you'll compose programs and make interface circuits to studied switches and other sensors, and to control engines and lights with exceptionally small exertion. Numerous of the pictures and drawings in this direct were taken from the documentation on the

This is what the Arduino board looks like.

Fig 4.2.9.1

The Duemilanove board highlights an Atmel ATmega328 microcontroller working at 5 V with 2 Kb of Pummel, 32 Kb of streak memory for putting absent programs and 1 Kb of EEPROM for putting absent parameters. The clock speed is 16 MHz, which deciphers to nearly executing nearly 300,000 lines of C source code per minute. The board has 14 computerized I/O pins and 6 analog input pins. There's a USB connector for talking to the have computer and a DC control jack for meddle an exterior 6-20 V control source, for outline a 9 V battery, when running a program while not related to the have computer. Headers are given for intrude to the I/O pins utilizing 22 g solid wire or header connectors.

The Arduino programming dialect may be a disentangled form of C/C++. In case you know C, programming the Arduino will be recognizable. In case you are doing not know C, no have to be worry as only a number of commands are required to perform useful functions. An critical include of the Arduino is that you just can make a control program on the have PC, download it to the Arduino and it'll run naturally. Remove the USB cable association to the PC, and the program will still run from the top each

time you thrust the reset button. Expel the battery and put the Arduino board in a closet for six months. Once you reconnect the battery, the final program you put away will run. This implies that you just interface the board to the have PC to create and investigate your program, but once that's done, you now not require the PC to run the program.

The Arduino Uno may be a microcontroller board based on the ATmega328.It has 14 computerized input/output pins (of which 6 can be utilized as PWM yields), 6 analog inputs, a 16 MHz ceramic resonator, a USB affiliation, a control jack, an ICSP header, and a reset button. It contains everything required to support the microcontroller; fundamentally interface it to a computer with a USB cable or control it with a AC-to-DC connector or battery to encourage begun. The Uno contrasts from all going some time recently sheets in that it does not utilize the FTDI USB-to-serial driver chip. Instep, it highlights the Atmega16U2 (Atmega8U2 up to create R2) altered as a USB-to-serial converter.

4.2.9.2 Summary:

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

4.2.9.3 Pin Configuration

The Arduino Uno can be fueled by implies of the USB affiliation or with an exterior control supply. The control source is chosen naturally. Outside (non-USB) control can come either from an AC-to-DC connector (divider- wart) or battery. The connector can be related by ceasing a 2.1mm center-positive plug into the board's control jack. Leads from a battery can be implanted inside the Gnd and Vin adhere headers of the Control connector. The board can work on an exterior supply of 6 to 20 volts. On the off chance that given with less than 7V, be that because it may, the 5V adhere may supply less than five volts and the board may be insecure. In case utilizing more than 12V, the voltage controller may overheat and hurt the board. The recommended run is 7 to 12 volts.

- The control pins are as follows: • VIN. The input voltage to the Arduino board when it's utilizing an exterior control source (as negated to 5 volts from the USB affiliation or other controlled control source). You'll supply voltage through this adhere, or, within the occasion that giving voltage through the control jack, get to it through this stick.

-

- • 5V. this stick yields a coordinated 5V from the controller on the board. The board can be given with control either from the DC control jack (7 - 12V), the USB connector (5V), or the VIN adhere of the board (7-12V). Giving voltage by implies of the 5V or 3.3V pins bypasses the controller, and can hurt your board.

-

• • 3V3. A 3.3 volt supply produced by the on-board controller. Greatest current draw is 50 mA.

• GND. Ground pins.

• IOREF. This adhere on the Arduino board gives the voltage reference with which the microcontroller works. A fittingly organized shield can look at the IOREF adhere voltage and select the reasonable control source or engage voltage mediators on the yields for working with the 5V or 3.3V.

Memory

The ATmega328 has 32 KB (with 0.5 KB utilized for the bootloader). It too has 2 KB of SRAM and 1 KB of EEPROM**.**

 Input and Output

Each of the 14 computerized pins on the Uno can be utilized as an input or abdicate, utilizing pinMode(), computerized Sort in( ), and computerized Scrutinized( ) capacities. They work at 5 volts. Each adhere can deliver or get a most prominent of 40 mA and has an internal drag- up resistor (segregated by default) of 20-50 kohms. In extension, a couple of pins have specialized capacities:

• **Serial: 0 (RX) and 1 (TX). Used to receive (RX) and Trans mit (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's a built- in Driven associated
  to computerized adhere 13. When the adhere
  is Tall regard, the Driven is on, when the
  adhere is Moo, it's off. The Uno has 6 analog
  inputs, labeled A0 through A5, each of which
  grant 10 bits of assurance (i.e. 1024 different
  values). By default they degree from ground to
  5 volts, in show disdain toward of the truth
  that's it conceivable to modify the upper
  conclusion of their run utilizing the AREF
  adhere and the analog Reference () work. Also,
  some pins have specialized functionality:
- • **TWI: A4 or SDA pin and A5 or SCL pin.**
  Support TWI communication using the Wire
  library.

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.

4.2.9.4 Communication
Microcontrollers depend on a have computer for
creating and compiling programs. The computer
program utilized on the have computer is known as an
coordinates improvement environment, or IDE. For the

Arduino, the advancement environment is based on the open source Handling stage (www.processing.org) which is portrayed by its makers as a "programming dialect and environment for individuals who need to program pictures, movement, and interactions." The Arduino programming dialect leverages an open source extend known as Wiring (wiring.org.co). The Arduino dialect is based on great ancient- molded C. On the off chance that you're new with this dialect, don't stress; it's not difficult to memorize, and the Arduino IDE gives a few input after you make botches in your programs.

The Arduino Uno highlights a number of workplaces for communicating with a computer, another Arduino, or other microcontrollers. The ATmega328 gives UART TTL (5V) serial communication, which is open on computerized pins (RX) and 1 (TX). An ATmega16U2 on the board channels this serial communication over USB and appears up as a virtual com harbor to program on the computer. The '16U2 firmware livelihoods the standard USB COM drivers, and no exterior driver is required. In any case, on Windows, a inf record is required. The Arduino program joins a serial screen which licenses clear printed data to be sent to and from the Arduino board. The RX and TX LEDs on the board will streak when data is being transmitted through the USB-to-serial chip and USB affiliation to the computer (but not for serial communication on pins and 1). A Program Serial library grants for serial communication on any of the Uno's computerized pins. The ATmega328 besides supports I2C (TWI) and SPI communication. The Arduino computer program incorporates a a Wire

library to rearrange utilize of the I2C transport; see the documentation for subtle elements. For SPI communication, utilize the SPI library.

As you go through the list of programming articulations accessible within the Arduino IDE (select Help->Reference), you might think there isn't much control for doing t hings like running servos, working stepper motors, scrutinizing potentiometers, or appearing substance on an LCD. Like most any tongue based on C, the Arduino supports the thought of "libraries" code.

Repositories that amplify center programming usefulness. Libraries let you re- utilize code without having to physically duplicate and glue it into all your programs. The standard Arduino computer program establishment comes with a few libraries you'll utilize, and you'll download others from the Arduino bolster pages and from third-party websites that distribute Arduino library code. A great illustration of a library you'll utilize with the Robot and likely many other robot ventures is Servo. This library permits you to put through one or more pastime R/C servos to the Arduino's computerized I/O pins. The Servo library comes with the standard Arduino establishment bundle Library->Servo. This adds the line

#include <Servo.h>

Which tells the Arduino IDE that you just wish to incorporate the Servo library in your portray. With the usefulness of the library presently accessible to you, you'll be able use its different capacities to control one or more servos. For case, you'll utilize the type in work to turn a servo to a particular position, from to 180

degrees. The taking after code
myServo.write(90);

Moves a servo to its midpoint, or 90 degree position. Fundamentally, Arduino portrays are exceptionally clear and are lovely simple to perused and get it. The Arduino program contains two primary parts: setup () and circle (). These are programming capacities that do what their names recommend: setup () sets up the Arduino equipment, such as indicating which I/O lines you arrange to utilize, and whether They are inputs or yields. The circle () work is rehashed perpetually when the Arduino is operating. Arduino IDE (Coordinates improvement environment) is utilized to compose the program and dump into the Arduino board

4.2.9.5 ARDUINO SOFTWARE:
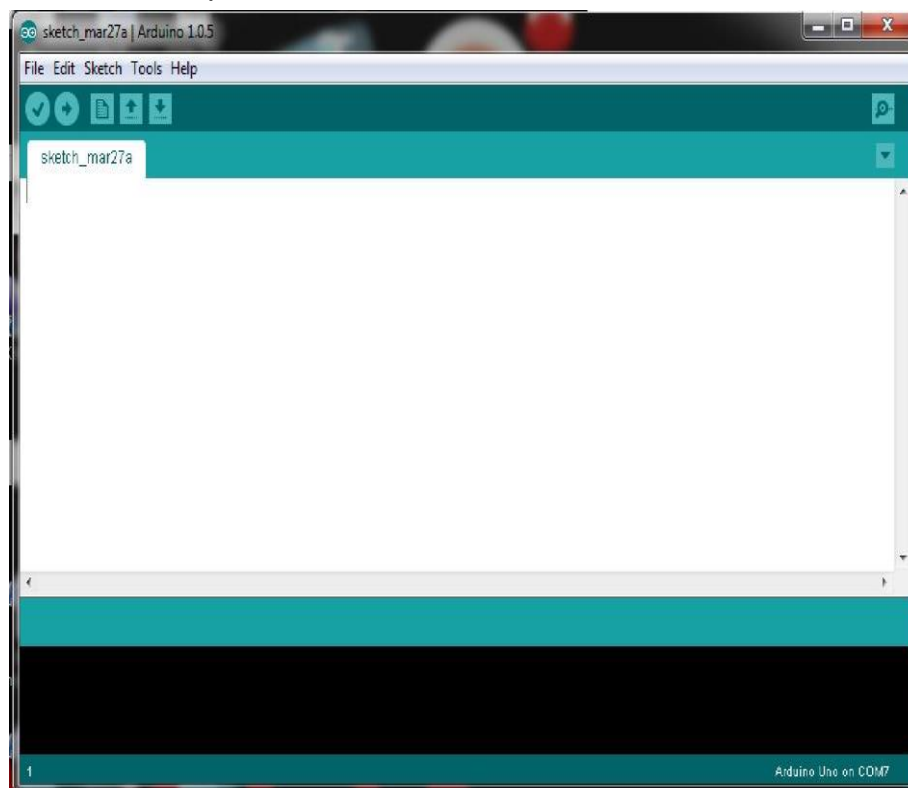1. Open Arduino IDE as shown below

Open Arduino IDE

Fig 4.2.9.5.1

2. Select the COM Port from tool

Select the COM Port
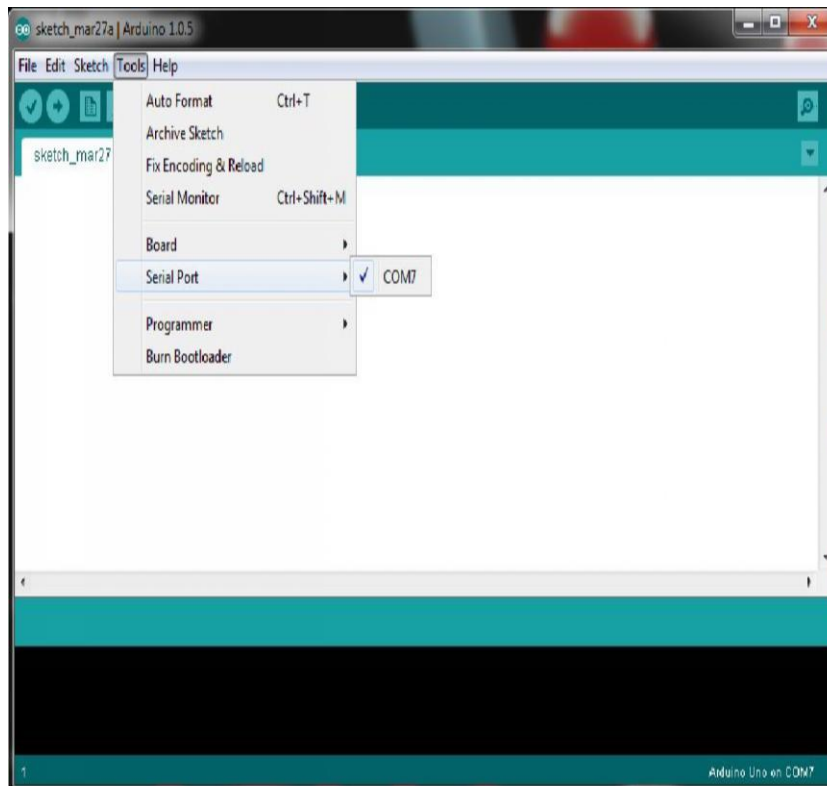
Fig 4.2.9.5.2

3. Select the required Arduino board from Tools as shown below

Select the required Arduino board
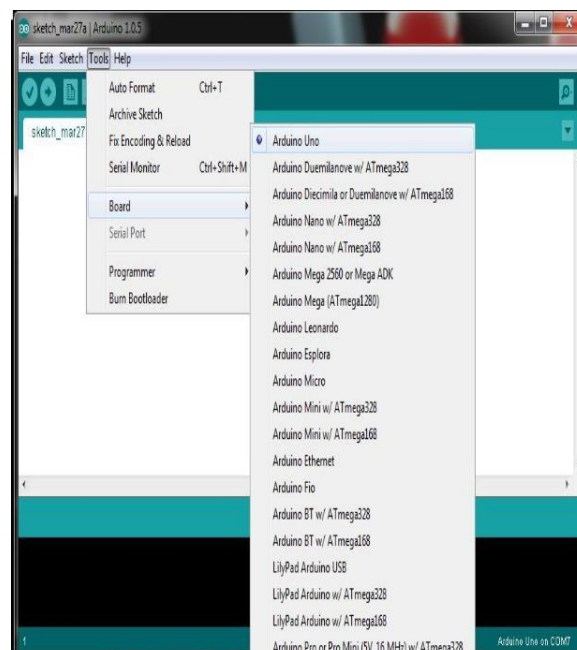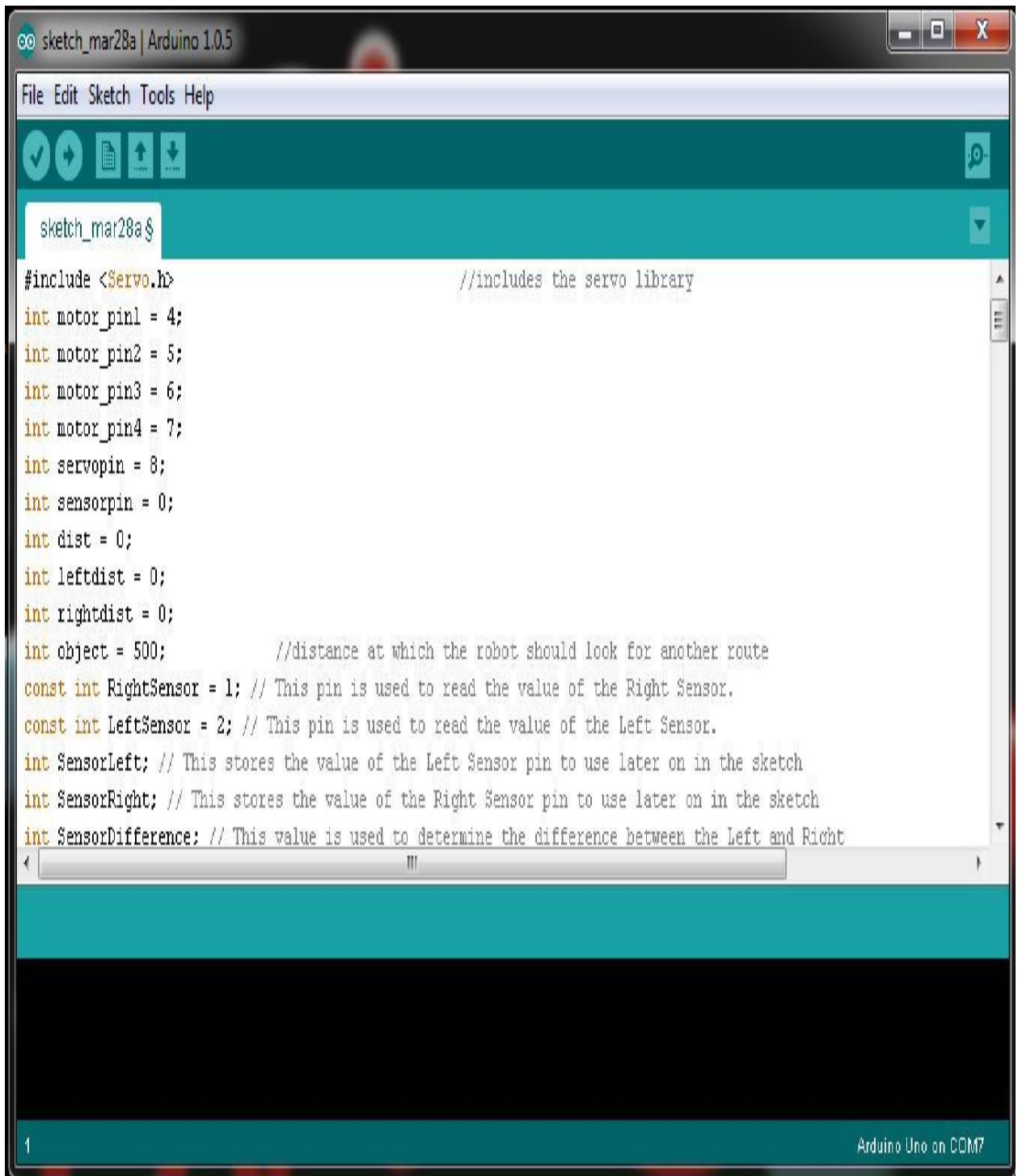
Fig 4.2.9.5.3

4. Write the sketch in Arduino IDE

Sketch in Arduino IDE


```
sketch_mar28a | Arduino 1.0.5

File Edit Sketch Tools Help

sketch_mar28a§

#include <Servo.h>                    //includes the servo library
int motor_pin1 = 4;
int motor_pin2 = 5;
int motor_pin3 = 6;
int motor_pin4 = 7;
int servopin = 8;
int sensorpin = 0;
int dist = 0;
int leftdist = 0;
int rightdist = 0;
int object = 500;          //distance at which the robot should look for another route
const int RightSensor = 1; // This pin is used to read the value of the Right Sensor.
const int LeftSensor = 2; // This pin is used to read the value of the Left Sensor.
int SensorLeft; // This stores the value of the Left Sensor pin to use later on in the sketch
int SensorRight; // This stores the value of the Right Sensor pin to use later on in the sketch
int SensorDifference; // This value is used to determine the difference between the Left and Right

1                                                          Arduino Uno on COM7
```

Fig 4.2.9.5.4

5. Compile and upload the Sketch to Arduino board upload the Sketch to Arduino board

Fig 4.2.9.5.5

4.2.10 ARDUINO NANO:

Arduino may be a instrument for making computers that can sense and control more of the physical world than your desktop computer. It's an open-source physical computing arrange based on a direct microcontroller board, and a enhancement environment for composing software for the board.

Arduino can be utilized to form naturally objects, taking inputs from a grouping of switches or sensors, and controlling a grouping of lights, motors, and other physical yields.

Arduino wanders can be stand-alone, or they can be communicate with program running on your computer. The sheets can be amassed by hand or obtained preassembled; the open-source IDE can be downloaded for free. The Arduino programming dialect is an execution of Wiring, a comparable physical computing stage, which is based on the Preparing mixed media programming environment.

Arduino nano:
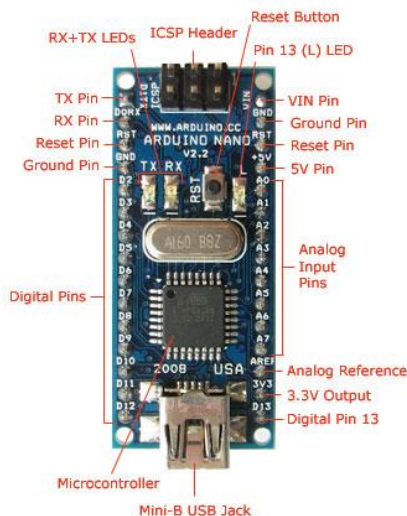
Fig 4.2.10 (1)
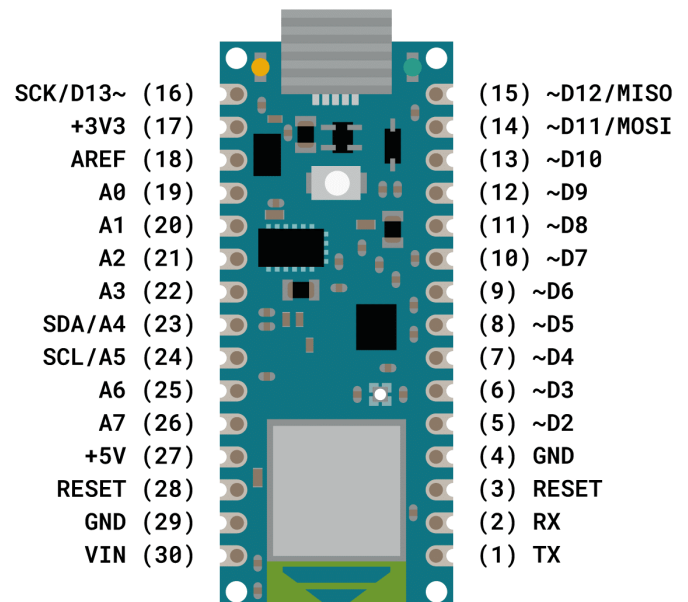
Fig 4.2.10 (2)

4.2.10.1 Overview

The Arduino microcontroller could be a basic to utilize in any case compelling single board computer that has picked up noteworthy balance inside the pastime and capable promote. The Arduino is open-source, which suggests gear is sensibly assessed and headway program is free. This coordinate is for understudies in ME 2011, or understudies wherever who are standing up to the Arduino for the essential time. For advanced Arduino clients, sneak the web; there are packages of assets.

This direct covers the Arduino Uno board (Begin fun DEV-09950, $29.95), a incredible choice for understudies and instructors. With the Arduino board, you will be able compose programs and make interface circuits to inspected switches and other sensors, and to control motors and lights with uncommonly little effort. Various of the pictures and drawings in this coordinate were taken from the documentation on Ordinarily what the Arduino board looks like.
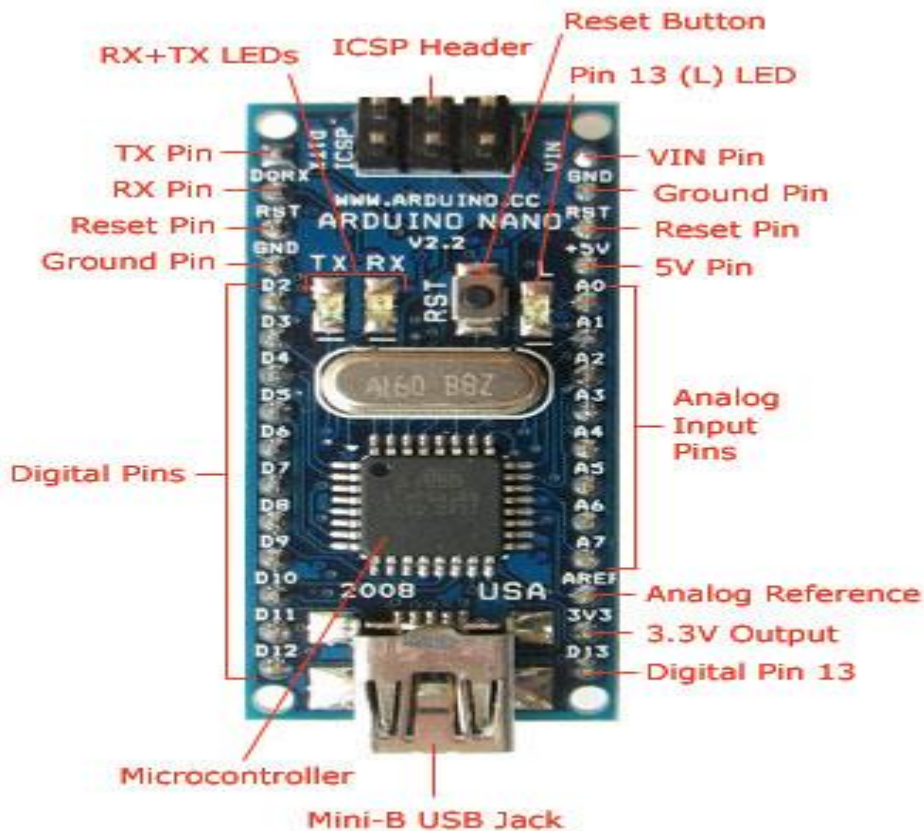
Fig 4.2.10.1 (1)

The Duemilanove board highlights an Atmel ATmega328 microcontroller working at 5 V with 2 Kb of Crush, 32 Kb of streak memory for putting absent programs and 1 Kb of EEPROM for putting absent parameters. The clock speed is 16 MHz, which deciphers to around executing around 300,000 lines of C source code per minute. The board has 14 progressed I/O pins and 6 analog input pins. There's a USB connector for talking to the have computer and a DC control jack for meddle an exterior 6-20 V control source, for outline a 9 V battery, when running a program while not related to the have computer. Headers are given for intrude to the I/O pins utilizing 22 g solid wire or header connectors. The Arduino programming lingo can be a streamlined adjustment of C/C++. In case you know C, programming the Arduino will be recognizable. On the off chance merely are doing not know C, no need to stress as because it were numerous commands are required to perform valuable capacities.

The Arduino programming lingo can be a streamlined adjustment of C/C++. In case you know C, programming the Arduino will be recognizable. On the off chance merely are doing not know C, no need to stress as because itAn basic incorporate of the Arduino is that you just basically can make a control program on the have PC, download it to the Arduino and it'll run actually. Evacuate the USB cable affiliation to the PC, and the program will still run from the beat each time you pushed the reset button. Oust the battery and put the Arduino board in a closet for six months. After you reconnect the battery, the ultimate program you put absent will run. This suggests that you just basically interface the board to the have PC to make and explore your program, but once that's done, you not require the PC to run the program were numerous commands are required to perform valuable capacities.

The Arduino Uno can be a microcontroller board based on the ATmega328.It has 14 computerized input/output pins (of which 6 can be utilized as PWM yields), 6 analog inputs, a 16 MHz ceramic resonator, a USB affiliation, a control jack, an ICSP header, and a reset button. It contains everything required to back the microcontroller; fundamentally interface it to a computer with a USB cable or control it with a AC-to-

DC connector or battery to induce begun.

The Uno contrasts from all going before sheets in that it does not utilize the FTDI USB-to-serial driver chip. Instep, it highlights the Atmega16U2 (Atmega8U2 up to form R2) modified as a USB-to-serial converter.

4.2.10.2 Summary:

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

4.2.10.3 Pin Configuration
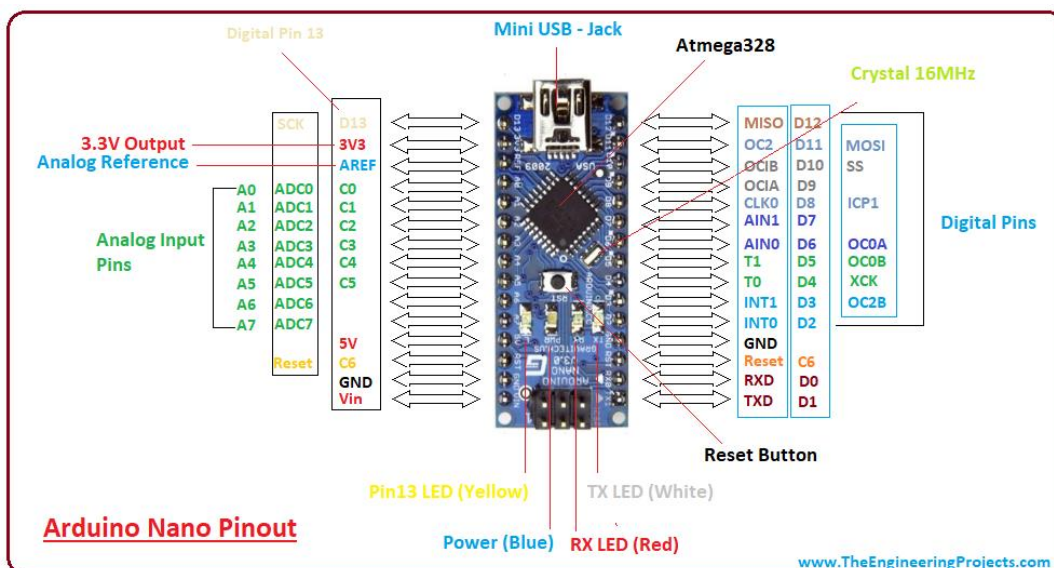
Fig 4.2.10.3

- •The Arduino Uno can be fueled through the USB affiliation or with an exterior control supply. The control source is chosen naturally. Outside (non-USB) control can come either from an AC-to-DC connector (divider- wart) or battery. The connector can be related by halting a 2.1mm center-positive plug into the board's control jack. Leads from a battery can be inserted inside the Gnd and Vin adhere headers of the Control connector.

- The board can work on an exterior supply of 6 to 20 volts. On the off chance that given with less than 7V, in any case, the 5V adhere may supply less than five volts and the board may be shaky. In case utilizing more than 12V, the voltage controller may overheat and hurt the board. The endorsed run is 7 to 12 volts.

- The power pins are as follows:

• VIN. The input voltage to the Arduino board when it's utilizing an exterior control source (as negated to 5 volts from the USB affiliation or other coordinated control source). You'll supply voltage through this adhere, or, on the off chance that giving voltage through the control jack, get to it through this adhere.

• 5V.this stick yields a coordinated 5V from the controller on the board. The board can be given with control either from the DC control jack (7 - 12V), the USB connector (5V), or the VIN adhere of the board (7-12V). Giving voltage by implies of the 5V or 3.3V pins bypasses the controller, and can hurt your board.

• 3V3. A 3.3 volt supply delivered by the on-board controller. Most extraordinary current draw is 50 mA.

• **GND**. Ground pins.

- **IOREF.** This pin on the Arduino board gives the voltage reference with which the microcontroller works. A legitimately arranged shield can examine the IOREF stick voltage and select the suitable control source or empower voltage interpreters on the yields for working with the 5V or 3.3V.

Memory

The ATmega328 has 32 KB (with 0.5 KB used for the bootloader). It also has 2 KB of SRAM and 1 KB of EEPROM.

Input and Output

Each of the 14 advanced pins on the Uno can be utilized as an input or abdicate, utilizing pinMode(), computerized Compose( ), and computerized Considered( ) capacities. They work at 5 volts.
 Each adhere can give or get a most prominent of 40 mA and has an interior drag- up resistor (separated by default) of 20-50 kohms. In extension, a couple of pins have specialized capacities:
• **Serial: 0 (RX) and 1 (TX). Used to receive (RX) and Trans mit (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 connected to digital pin 13. When the pin is HIGH value, the LED is on, when the pin is LOW, it's off.

The Uno has 6 analog inputs, labeled A0 through A5, each of which donate 10 bits of assurance (i.e. 1024 differing values). By default they degree from ground to 5 volts, in show disdain toward of the truth that's it conceivable to modify the upper conclusion of their run utilizing the AREF adhere and the analog Reference () work. Additionally, some pins have specialized value:

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

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.

4.2.10.4 Communication

Microcontrollers depend on a have computer for creating and compiling programs. The program utilized on the have computer is known as an coordinates advancement environment, or IDE. For the Arduino, the improvement environment is based on the open source Handling stage (www.processing.org) which is portrayed by its makers as a "programming dialect and environment for individuals who need to program pictures, movement, and interactions." The Arduino programming dialect leverages an open source extend known as Wiring (wiring.org.co). The Arduino dialect is based on great ancient- designed C. On the off chance that you're new with this dialect, don't stress; it's not difficult to memorize, and the Arduino IDE gives a few input once you make botches in your programs.

The Arduino Uno highlights a number of workplaces for communicating with a computer, another Arduino, or other microcontrollers. The ATmega328 gives UART TTL (5V) serial communication, which is open on computerized pins (RX) and 1 (TX). An ATmega16U2 on the board channels this serial communication over USB and appears up as a virtual com harbor to computer program on the computer.

The '16U2 firmware livelihoods the standard USB COM drivers, and no exterior driver is required. Be that because it may, on Windows, a inf record is required. The Arduino computer program consolidates a serial screen which licenses fundamental printed data to be sent to and from the Arduino board. The RX and TX LEDs on the board will streak when data is being transmitted by implies of the USB-to-serial chip and USB affiliation to the computer (but not for serial communication on pins and 1).

A Computer program Serial library grants for serial communication on any of the Uno's computerized pins. The ATmega328 additionally supports I2C (TWI) and SPI communication. The Arduino computer program consolidates a Wire library to modify utilize of the I2C transport; see the documentation for focuses of intrigued. For SPI communication, utilize the SPI library.

As you go through the list of programming explanations accessible within the Arduino IDE (select Help->Reference), you might think there isn't much control for doing t hings like running servos, working stepper engines, perusing potentiometers, or showing content on an LCD. Like most any dialect based on C, the Arduino underpins the idea of "libraries" code

Storehouses that expand center programming usefulness. Libraries let you re-utilize code without having to physically duplicate and glue it into all your programs. The standard Arduino program establishment comes with a few libraries you will utilize, and you'll download others from the Arduino back pages and from third-party websites that distribute Arduino library code. A great case of a library you'll utilize with the Robot and likely many other robot projects is Servo.

This library permits you to associate one or more pastime R/C servos to the Arduino's advanced I/O pins. The Servo library comes with the standard Arduino establishment bundle Library->Servo. This includes the line #include
Which tells the Arduino IDE that you wish to include the Servo library in your sketch. With the functionality of the library now available to you, you can use its various functions to control one or more servos. For example, you can use the

write function to rotate a servo to a specific position, from 0 to 180 degrees. The following code

myServo.write(90);

Moves a servo to its midpoint, or 90 degree position. Basically, Arduino outlines are exceptionally direct and are lovely simple to examined and get it. The Arduino program contains two fundamental parts: setup () and circle (). These are programming capacities that do what their names recommend: setup () sets up the Arduino equipment, such as indicating which I/O lines you arrange to utilize, and whether

They are inputs or yields. The circle () work is rehashed unendingly when the Arduino is operating.

Arduino IDE (Coordinates advancement environment) is utilized to compose the program and dump into the Arduino board.

4.2.11 ULTRASONIC SENSOR:

Ultrasonic (UV) Sensors or Ultrasound Sensors Bats are superb animals. Daze from the eyes and however a vision so exact that seem recognize between a moth and a broken leaf indeed when flying at full speed. No question the vision is more honed than our own and is much past human capabilities of seeing, but is certainly not past our understanding. Ultrasonic extending is the strategy utilized by bats and numerous other animals of the creature kingdom for navigational purposes. In a offered to mimic the ways of nature to get an edge over everything, we people have not as it were caught on
it but have effectively imitated a few of these signs and tackled their potential to the most prominent extent.

History

Ultrasonic Transducers: Historical Perspective

1880	1915
The Discovery of piezoelectricity	Electrostatic transducers considered
By Curie Brothers	for the ultrasonic submarine detector
1917	by P. Langevin
The ultrasonic submarine detector	
By P. Langevin	
1940	1970-1990
Piezoelectric ceramics	Advances in microelectronics
1969	1994
A piezoelectric polymer: PVDF	Micromachined electrostatic
1980	transducers by M. Haller and
Piezocomposites	B.T.Khuri-Yakub

Fig 4.2.11 (1)

The history dates back to 1790, when Lazzaro Spallanzani to begin with found that bats maneuvered in flight utilizing their hearing instead of locate. Jean-Daniel Colladon in 1826 found sonography utilizing an submerged chime, effectively and precisely deciding the speed of sound in water. From that point, the ponder and investigate work in this field went on gradually until 1881 when Pierre Curie's disclosure set the arrange for advanced ultrasound transducers. He found out the relationship between electrical voltage and weight on crystalline fabric. The sad Titanic mischance impelled thorough intrigued into this field as a result of which Paul Langevin concocted the hydrophone to detect icebergs. It was the primary ultrasonic transducer. The hydrophone seem send and get low frequency sound waves and was later utilized within the location of submarines within the World War 1.

On a note parallel to the SONAR, restorative inquire about moreover begun taking intrigued in ultrasonics. In late 1930's Dr. Karl Dussik utilized a strategy called hyperphonography which recorded echoes of ultrasonic waves on a delicate paper. This method was utilized to deliver ultrasound pictures of the brain to assist identify tumors and checked the birth of ultrasound imaging. After that, numerous researchers like Ian Donald, Douglas Howry, Joseph Holmes, John Wild and John Reid progressed upon the different aspects of ultrasonic sensors within the restorative field

which empowered conclusion of stomach cancers, ovarian sores, discovery of twin pregnancies, tumors etc. Industry as well did not squander time in bouncing on to the temporary fad and before long created procedures like ultrasonic welding and non damaging testing at the start of the 1960s. How Ultrasonic Sensors work?

Ultrasonic sensors are gadgets that utilize electrical–mechanical vitality change, the mechanical vitality being within the shape of ultrasonic waves, to degree separate from the sensor to the target protest. Ultrasonic waves are longitudinal mechanical waves which travel as a progression of compressions and rarefactions along the course of wave proliferation through the medium. Any sound wave over the human sound-related run of 20,000 Hz is called ultrasound. Depending on the sort of application, the extend of frequencies has been broadly categorized as appeared within the figure underneath:

The Frequency Ranges of the Sound

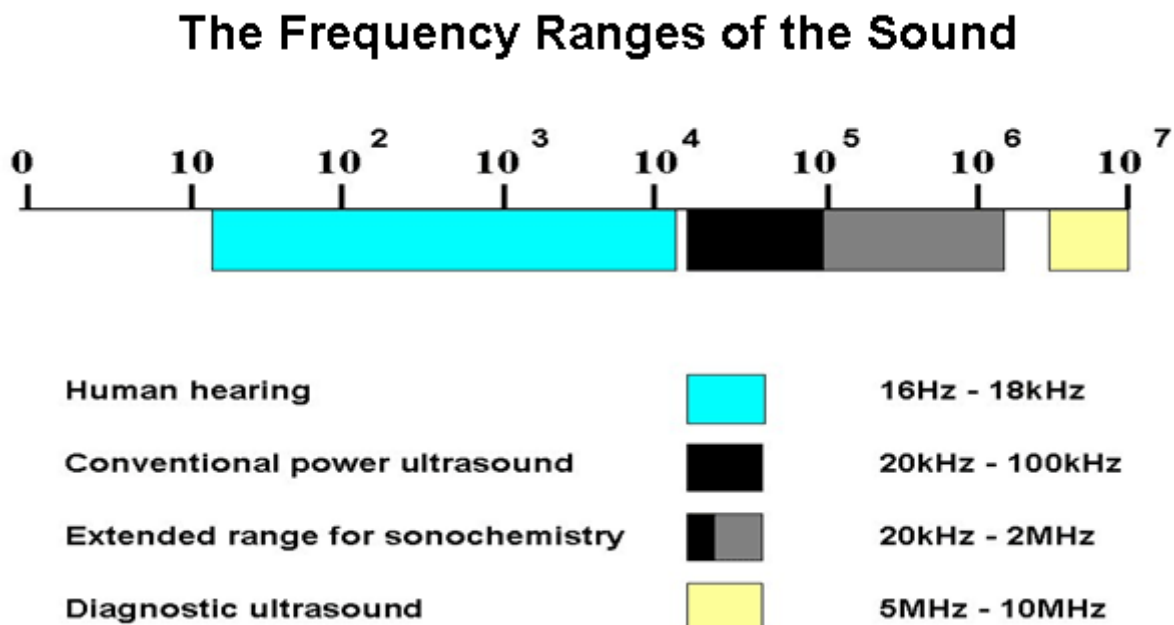| | Human hearing | 16Hz – 18kHz |
	Conventional power ultrasound	20kHz – 100kHz
	Extended range for sonochemistry	20kHz – 2MHz
	Diagnostic ultrasound	5MHz – 10MHz

Fig 4.2.11 (2)

When ultrasonic waves are occurrence on an question, diffused reflection of the vitality takes put over a wide strong point which may well be as tall as 180 degrees. In this way a few division of the incident energy is reflected back to the transducer within the frame of echoes and is recognized. The separate to the protest (L) can at that

point be calculated through the speed of ultrasonic waves (v) within the medium by the connection

$$L = \frac{v \, t \cos\theta}{2}$$
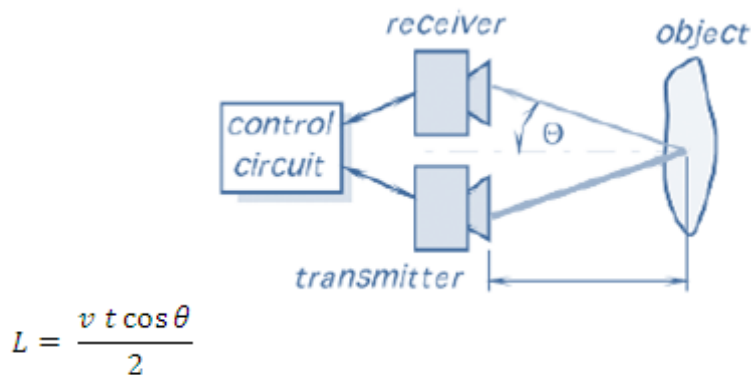
Fig 4.2.11 (3)

Where 't' is the time taken by the wave to reach back to the sensor and ' ' is the point between the even and the way taken as appeared within the figure. In the event that the protest is in movement, disobedient based on Doppler move are utilized. Get all the points of interest almost inside structure and working of an ultrsound sensor at Insight-How Ultrasonic Sensors Work.

Generating Ultrasonic Waves

For the generation of such mechanical waves, development of a few surface like a stomach is required which can at that point initiate the movement to the medium before it within the frame of compression and rarefaction. Piezoelectric materials working within the engine mode and magnetostrictive materials have been broadly utilized within the era of ultrasonic waves at recurrence ranges of 1-20 MHz and 20-40 kHz separately. The sensors utilize piezoelectric ceramic transducers which flex when an electric flag is connected to them.These are connected to an electronic oscillator whose yield creates the wavering voltages at the specified recurrence. Materials like Lead Zirconate Titanate are well known piezoelectric materials utilized in therapeutic ultrasound imaging. For best comes about, the recurrence of the connected motions must be rise to to the normal recurrence of the ceramic, which produces motions promptly through reverberation. It offers greatest affectability and productivity when worked at resonance.

Piezoelectricity being a reversible marvel produces electrical voltages when ultrasonic waves reflect back from the target and encroach upon the ceramic structure. In this way, a transducer may work both as a transmitter and a recipient in beat mode. When persistent estimation of separations is required, isolated transducers may be utilized for transmission and gathering. The sensors when utilized in industry are for the most part utilized in clusters which may be mechanical clusters comprising of swaying or turning sensors, or electronic clusters which may be straight, bended or staged. To imagine the yield of an ultrasonic sensor, shows of distinctive kind are utilized whose shape depends on the sort of transducer cluster utilized and the work. A sectored Field of See is created by mechanical clusters and bended and staged electronic clusters, whereas a straight field is produced by direct clusters. The show modes may be straight graphical plotting with adequacy on y-axis and time on x-axis called Plentifulness mode or A-mode, or concentrated balanced B-scans where the brightness of a spot shows the adequacy of reflected waves. Other modes incorporate M-mode, Doppler (D) Mode etc.

The parameterization of these sensors is for the most part done by checking the reflected and transmitted signals from the horizontal an pivotal movement of transducer whereas keeping the target settled in a particular medium (water in common). The sound bar veers quickly, thus care is taken that the transducer produces the littlest conceivable bars. The smaller the bar design, the more touchy the sensor is. Be that as it may, the point conceivable between the transducer and the surface increments with the bar width. The bar designs of the kind appeared underneath are observed:

Fig4.2.11(4)

Fig 4.2.11 (5)

Axial and Cross Sectional beam profiles

The parameters on which the execution of an ultrasonic sensor is measured incorporate transmission capacity, constriction, energetic run and determination like grayscale, hub and sidelong determination. Other parameters are Ostensible Recurrence, Crest Recurrence, Transmission capacity center Recurrence, Beat Width, affectability and Flag to Clamor Proportion (SNR).

Importance of Ultrasonic Sensors

There are a assortment of sensors based on other physical transduction standards just like the optical run finding sensors and the microwave based gadgets as well. At that point why should one utilize ultrasonic transducers within the to begin with put, given that the speed of sound is exceptionally moderate than the speed of electromagnetic waves? The reply lies within the address itself. Since the EM waves based gadgets are as well quick. Being slower that the EM waves, the time taken by ultrasonic waves is much longer than that taken by the last mentioned and thus its estimation can be done more effectively and less extravagantly. Since these are based on sound waves instead of EM waves, these would work in places where the last mentioned would not.

For example, within the case of clear question discovery and estimation of fluid levels or tall glare situations, light based sensors would endure significantly since of the

transmittance of the target or the translucence of the engendering media. Ultrasonic gadgets being based upon sound proliferation

 would stay essentially unaffected. These moreover work well in damp situations where optical pillars may endure from refraction from the water beads within the environment. On account of run and precision, the ultrasonic sensors may lie in between two EM wave based sensors, the Infrared rangefinders on the lower conclusion and the LIDARs on the upper conclusion. Not as exact or long separate as the LIDARs, the Ultrasonic rangefinders passage way better than the IR rangefinders which are profoundly helpless to surrounding conditions and require recalibration when environment changes. Assist these gadgets offer advantage in therapeutic imaging as compared to MRI or X-Ray looks due to inexpensiveness and compactness. No harmful effects of ultrasonic waves at the intensity levels used have been detected in contrast to X-rays or radioactivity based methods and is particularly suited for imaging soft tissues.

Problems & Concerns

However, Ultrasonic sensors as well aren't free of all the issues. The speed of sound in a medium increments as the temperature of the medium increments. In this way indeed when the target has remained within the same put, it may presently appear that it has moved to a put closer to the sensor. Discuss streams due to changed reasons may aggravate the way of the wave which may lead to 'Missed Detection' or a off-base measurement.

Acoustic commotion like tall pitched sounds made due to shrieking or murmuring of valves and pneumatic gadgets at the recurrence near to the working recurrence may meddled with the yield of the sensor. Electrical clamor too influences the execution

 of the sensor. These may produce artifacts which are not a genuine representation of the imaged question. A bit like the vision begins to obscure when the separate of the question from the eye gets as well little for the eyes to see it, ultrasonic gadgets too have a 'dead zone' where the sensor cannot dependably make estimations. This happens due to a marvel called ringing which is the persistent vibration of the

transducer after emanating the beat. Hence when the remove is as well little, the transducer has not yet come to rest to be able to distinguish between the vibration due to the occurrence radiation or the swaying from the electrical excitation. The dangers of Ultrasonic waves are also well founded. If the intensity is too high, it can cause human tissues to heat and may cause ruptures in people exposed to it. Ethical issues like fetus identification and resulting abortions in medical field are also a widespread concern.

Applications

The applications of ultrasonic sensors can be classified on the basis of the property that they exploit. These can be summarized as:

Domain	Parameter	Applications
Time	Tile-of-Flight, Velocity	Density, Thickness, Flaw Detection, Anisotropy, Robotics, Remote Sensing etc.
Attenuation	Fluctuations in reflected and Transmitted Signals	Defect characterization, microstructures, interface analysis
Frequency	Ultrasonic Spectroscopy	Microstructure, grain size, porosity, phase analysis.
Image	Time-of-Flight, velocity, attenuation mapping in Raster C-Scan or SARs	Surface and internal Defect imaging, density, velocity, 2D and 3D imaging.

Table no: 4.2.11

Investigate has been going on to overcome the issues of ultrasonic sensors, especially in restorative imaging where it is known as ultrasound. The artifacts of

ultrasonic sensors like Acoustic shadowing and Acoustic Improvement are being misused to characterize tissues which permit the separation between strong and cystic tissues. The industry as well has procured the benefits from ultrasonic sensors in applications like plastic welding, gems cleaning, farther detecting and telemetry, helped stopping frameworks etc. Mechanical autonomy has been known to utilize ultrasonic rangefinders as a favorite apparatus for separate extending and mapping. Indeed the mold industry is utilizing ultrasonic sensors in hair styling like hair expansion   inserts.
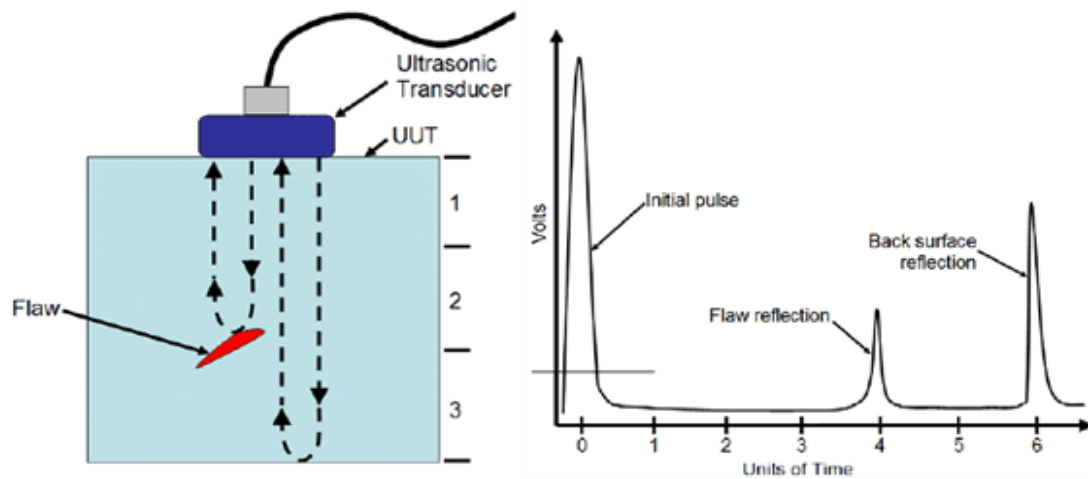

Fig 4.2.11 (6)

Flaw Detection Using Ultrasonic Sensors

Future

Non damaging testing and blemish discovery employments ultrasonic waves in different modes just like the Longitudinal (L-wave) mode and the Shear (S-wave) mode to distinguish blemishes in materials. With the progresses in Science, modern materials advertising increased performance at lower voltages just like the capacitive micromachined ultrasonic transducers (CMUTs) are being created which are anticipated to have higher transfer speed and more noteworthy potential for integration with electronic circuits.

These gadgets give non-invasive measures for the discovery of issues in all sorts of materials, be it a living tissue or non-living made merchandise. With a sound history of being able to identify numerous issues which something else cleared out the specialists disoriented and the issue untreated, ultrasonic sensors do offer a part of guarantee indeed within the coming times. The natural and mental impacts of introduction to EM-radiation being thoroughly being put beneath the scanner, ultrasonic applications are anticipated to flourish and offer a considerable elective to the modern technologies.

4.2.12 Engine driver:

The L293D may be a prevalent 16-Pin Engine Driver IC. As the title proposes it is basically utilized to drive engines. A single L293D IC is competent of running two DC engines at the same time; too the course of these two motors can be controlled freely. So on the off chance that you have got engines which has working voltage less than 36V and working current less than 600mA, which are to be controlled by computerized circuits like Op-Amp, 555 clocks, advanced doors or even Micron rollers like Arduino, PIC, ARM etc.. This IC will be the correct choice for you. Using this L293D engine driver IC is exceptionally basic. The IC works on the guideline of Half H-Bridge, let us not go as well profound into what H-Bridge implies, but for presently fair know that H bridge could be a setup which is utilized to run engines both in clock wise and anti-clockwise heading. As said prior this IC is competent of running two engines at the any course at the same time, the circuit to realize the same is appeared below.
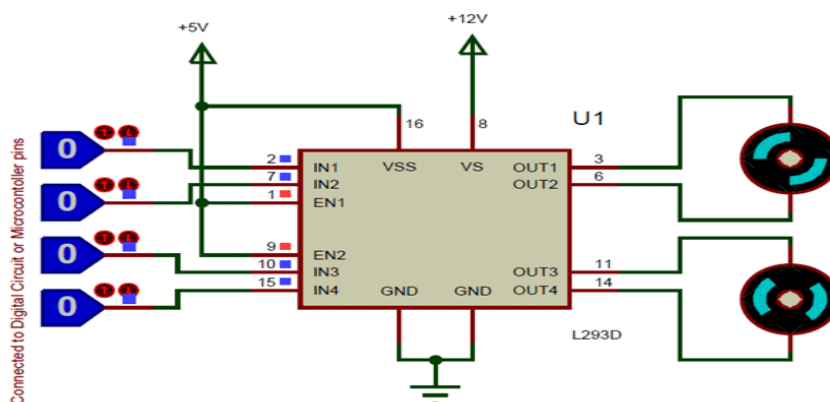

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Fig 4.2.12

All the Ground pins ought to be grounded. There are two control pins for this IC, one is the Vss(Vcc1) which gives the voltage for the IC to work, this must be associated to +5V. The other is Vs (Vcc2) which gives voltage for the engines to run, based on the determination of your engine you'll interface this stick to anyplace between 4.5V to 36V, here I have associated to +12V.

The Empower pins (Empower 1, 2 and Empower 3, 4) are utilized to Empower Input pins for Engine 1 and Engine 2 separately. Since in most cases we'll be utilizing both the engines both the pins are held tall by default by interfacing to +5V supply. The input pins Input 1, 2 are utilized to control the engine 1 and Input pins 3, 4 are utilized to control the Engine 2. The input pins are associated to the any Computerized circuit or microcontroller to control the speed and direction of the engine. You'll be able flip the input pins based on the taking after table to control your motor.

Applications

- Used to drive high current Motors using Digital Circuits
- Can be used to drive Stepper motors
- High current LED's can be driven
- Relay Driver module (Latching Relay is possible)

L298n **vs** L293d

Enable 1,2	1		16	Vcc 1
Input 1	2		15	Input 4
Output 1	3		14	Output 4
GND	4	L293D	13	GND
GND	5		12	GND
Output 2	6		11	Output 3
Input 2	7		10	Input 3
Vcc 2	8		9	Enable 3,4

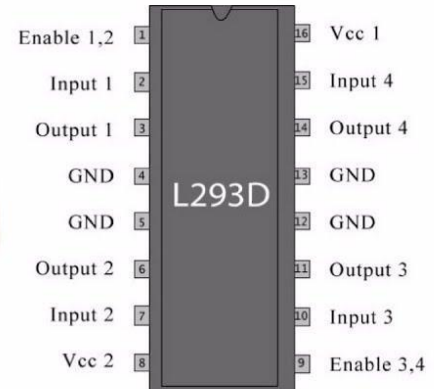Fig 4.2.12(1)   Fig 4.2.12 (2)

4.2.13 Relay:

A transfer is an electrically worked switch. Current spilling through the coil of the exchange makes a alluring field which pulls in a lever and changes the switch contacts. The coil current can be on or off so exchanges have two switch positions and they are twofold hurl (changeover) switches. Transfers permit one circuit to switch a moment circuit which can be totally isolated from the primary. For illustration a moo voltage battery circuit can utilize a hand-off to switch a 230V AC mains circuit. There's no electrical association interior the hand-off between the two circuits; the connect is attractive and mechanical.

The coil of a hand-off passes a generally huge current, regularly 30mA for a 12V transfer, but it can be as much as 100mA for transfers outlined to function from lower voltages. Most ICs (chips) cannot give this current and a transistor is more often than not utilized to open up the little IC current to the bigger esteem required for the hand-off coil. The most extreme yield current for the well known 555 clock IC is 200mA so these gadgets can supply hand-off coils specifically without amplification.

Fig 4.2.13 (1)   Fig 4.2.13 (2)

Relays are more often than not SPDT or DPDT but they can have numerous more sets of switch contacts, for illustration transfers with 4 sets of changeover contacts are promptly accessible. Most transfers are outlined for PCB mounting but you'll patch wires directly to the pins giving you pay attention to maintain a strategic distance from dissolving the plastic case of the transfer. The vivified picture appears a working exchange with its coil and switch contacts. You'll see a lever on the cleared out being pulled in by fascination when the coil is traded on. This lever moves the switch contacts. There's one set of contacts (SPDT) inside the frontal region and another behind them, making the hand-off DPDT.
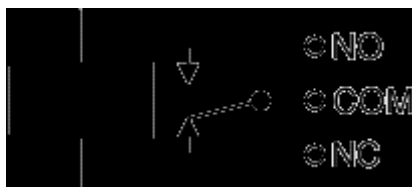

Fig 4.2.13. (3)

The relay's switch connections are usually labeled 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** = Normally Open, COM is connected to this when the relay coil is **on**.

Acceleration sensor:

An inertial estimation unit, or IMU, is an electronic gadget that measures and reports on a craft's speed, introduction, and gravitational powers, employing a combination of accelerometers and spinners. IMUs are ordinarily utilized to move air ship, counting UAVs, among numerous others, and shuttle, counting transports, satellites and landers.

The IMU is the most component of inertial route frameworks utilized in air ship, shuttle, watercraft and guided rockets among others. In this capacity, the information collected from the
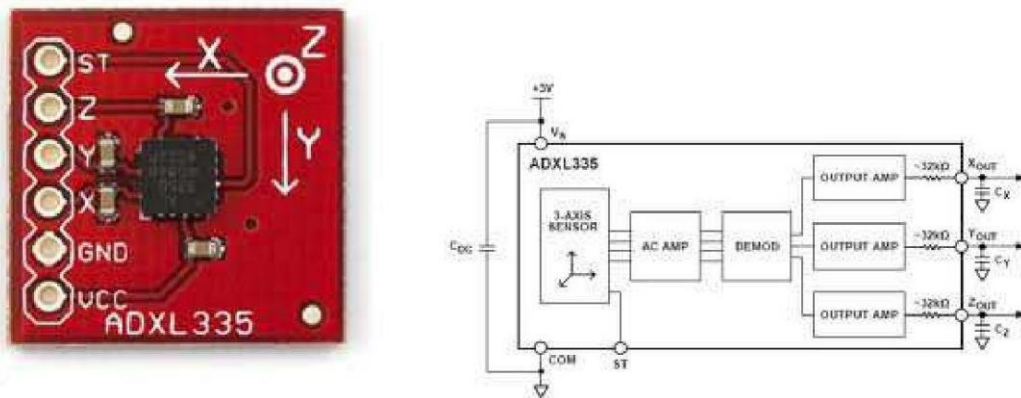

Fig 4.4.1: Inertial Measurement Unit (ADXL-335)

IMU's sensors allow a computer to track a craft's position, using a method known as dead reckoning.

An IMU works by recognizing the current rate of increasing speed utilizing one or more accelerometers, and identifies changes in rotational qualities like pitch, roll and yaw utilizing one or more gyroscopes. IMUs can, other than navigational purposes, serve as introduction sensors within the human field of movement. They are regularly utilized for sports innovation (strategy preparing), and liveliness applications. They are a competing innovation for utilize in movement capture innovation.

The ADXL335 may be a little, lean, moo control, total 3-axis accelerometer with flag conditioned voltage yields. The item measures increasing speed with a least full-scale extend of ±3 g. It can degree the inactive speeding up of gravity in tilt-sensing

applications, as well as energetic increasing speed coming about from movement, stun, or vibration. The client chooses the transmission capacity of the accelerometer utilizing the CX, CY, and CZ capacitors at the XOUT, YOUT, and ZOUT pins. Transmission capacities can be chosen to suit the application, with a extend of 0.5 Hz to 1600 Hz for the X and Y tomahawks, and a run of 0.5 Hz to 550 Hz for the Z pivot.

THEORY OF OPERATION:-

The ADXL335 could be a complete 3-axis speeding up estimation framework. The ADXL335 contains a estimation extend of ±3 g least. It contains a poly silicon surface-micro machined sensor and flag conditioning circuitry to execute open-loop speeding up estimation engineering. The yield signals are analog voltages that are corresponding to increasing speed. The accelerometer can degree the inactive increasing speed of gravity in tilt-sensing applications as well as energetic increasing speed coming about from movement, stun, or vibration.

The sensor could be a polysilicon surface-micro machined structure built on beat of a silicon wafer. Polysilicon springs suspend the structure over the surface of the wafer and give a resistance against speeding up forces. Deflection of the structure is measured employing a differential capacitor that comprises of autonomous settled plates and plates connected to the moving mass. The settled plates are driven by 180° ou t-of-phase square waves. Increasing speed Diverts the moving mass and unbalances the differential capacitor coming about in a sensor yield whose sufficiency is corresponding to increasing speed. Phase-sensitive demodulation strategies are at that point utilized to decide the size and heading of the increasing speed. The demodulator yield is increased and brought off-chip through a 32 kΩ resistor. The client at that point sets the flag transfer speed of the gadget by including a capacitor. This sifting progresses estimation determination and makes a difference anticipate aliasing.

4.2.14 ZIGBEE

ZigBee Physical Layer

ZigBee may be a remote innovation created as an open worldwide standard to address the special needs of low-cost, low-power remote M2M systems. The ZigBee standard works on the IEEE 802.15.4 physical radio detail and works in unlicensed groups counting 2.4 GHz, 900 MHz and 868 MHz.

The 802.15.4 determination upon which the ZigBee stack works picked up confirmation by the Founded of Electrical and Electronics Engineers (IEEE) in 2003. The detail may be a packet-based radio convention expecting for low-cost, battery-operated gadgets. The convention permits gadgets to communicate in a assortment of organize topologies and can have battery life enduring a few years.

The ZigBee Protocol

The ZigBee convention has been made and confirmed by part companies of the ZigBee Collusion . Over 300 driving semiconductor producers, innovation firms, OEMs and benefit companies contain the ZigBee Organization together participation. The ZigBee convention was outlined to supply an easy-to-use remote information arrangement characterized by secure, solid remote arrange models.

The ZigBee Advantage

The ZigBee protocol is designed to communicate data through hostile RF environments that are common in commercial and industrial applications.
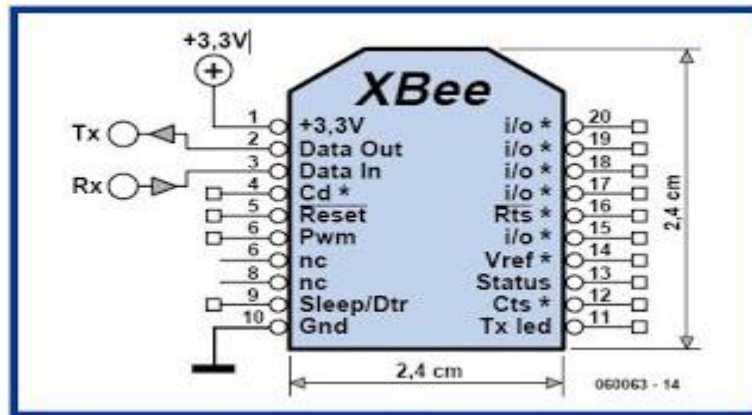
Fig. 4.2.14 (1)

ZigBee may be a determination for a suite of high-level communication conventions utilized to make individual region systems built from little, low-power advanced radios. ZigBee is based on an IEEE 802.15.4 standard. In spite of the fact that its moo control utilization limits transmission separations to 10–100 meters line-of-sight, depending on control yield and natural characteristics,[1] ZigBee gadgets can transmit information over long separations by passing information through a work organize of middle gadgets to reach more removed ones. ZigBee is regularly utilized in moo information rate applications that require long battery life and secure networking (ZigBee systems are secured by 128 bit symmetric encryptionkeys.) ZigBee incorporates a characterized rate of 250 kbit/s, best suited for discontinuous information transmissions from a sensor or input gadget. Applications incorporate remote light switches, electrical meters with in-home-displays, activity administration frameworks, and other shopper and mechanical hardware that requires short-range low-rate remote information exchange. The innovation characterized by the ZigBee determination is planning

to be easier and less costly than other remote individual region systems (WPANs), such as Bluetooth or Wi-Fi.

Zigbee convention highlights incorporate ;

• Support for numerous organize topologies such as point-to-point, point-to-multipoint and work networks

• Low obligation cycle – gives long battery life

• Low latency

• Direct Arrangement Spread Range (DSSS)

• Up to 65,000 hubs per network

• 128-bit AES encryption for secure information connections

• Collision shirking, retries and acknowledgements

Mesh Networks

A key component of the ZigBee convention is the capacity to back work organizing. In a work organize, hubs are interconnected with other hubs so that different pathways interface each hub. Associations between hubs are powerfully overhauled and optimized through advanced, built-in work steering table. Mesh systems are decentralized in nature; each hub is competent of self-discovery on the arrange. Moreover, as hubs take off the organize, the work topology permits the hubs to reconfigure steering ways based on the modern arrange structure. The characteristics of work topology and ad-hoc steering give more noteworthy soundness in changing conditions or disappointment at single node.

ZigBee Applications

ZigBee empowers broad-based sending of remote systems with low-cost, low-power arrangements. It gives the capacity to run for a long time on cheap batteries for a

have of observing and control applications. Keen energy/smart network, AMR (Programmed Meter Perusing), lighting controls, building computerization frameworks, tank observing, HVAC control, restorative gadgets and armada applications are fair a few of the numerous spaces where ZigBee innovation is making critical progressions.

Digi ZigBee Technology

Digi could be a part of the ZigBee Collusion and has created a wide extend of organizing arrangements based on the ZigBee convention. XBee and XBee-PRO modules and other XBee-enabled gadgets provide an easy-to-implement arrangement that gives usefulness to associate to a wide assortment of gadgets.

Bluetooth Module HC-05

Introduction

•   It is utilized for numerous applications like remote headset, diversion controllers, remote mouse, remote console and numerous more customer applications.

• It has run up to <100m which depends upon transmitter and recipient, air, geographic & urban conditions.

 • It is IEEE 802.15.1 standardized convention, through which one can construct remote Individual Zone Organize (Container). It employments frequency-hopping spread range (FHSS) radio innovation to send information over discuss.

• It employments serial communication to communicate with gadgets. It communicates with microcontroller utilizing serial harbour (USART). HC-05 Bluetooth Module

• HC-05 may be a Bluetooth module which is planned for remote communication.
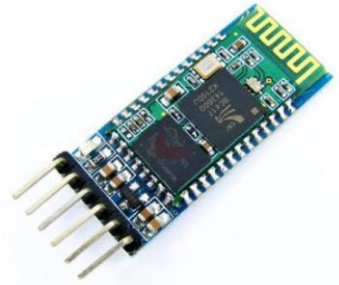
This module can be utilized in a ace or slave arrangement.

Fig. 4.2.14 (2)

Pin Description

Fig 4.2.14 (3)

Bluetooth serial modules permit all serial empowered gadgets to communicate with each other utilizing Bluetooth.

It has 6 pins,

1. Key/EN: It is utilized to bring Bluetooth module in AT commands mode. In case Key/EN adhere is set to tall, at that point this module will work in command mode. Something else by default it is in data mode. The default baud rate of HC-05 in command mode is 38400bps and 9600 in data mode.

HC-05 module has two modes,

1. Information mode: Trade of information between devices.

2. Command mode: It employments AT commands which are utilized to alter setting of HC-05. To send these commands to module serial (USART) harbour is utilized.

2. VCC: Interface 5 V or 3.3 V to this Pin.

3. GND: Ground Stick of module.

4. TXD: Transmit Serial information (wirelessly gotten information by Bluetooth module transmitted out serially on TXD pin)

5. RXD: Get information serially (gotten information will be transmitted wirelessly by Bluetooth module).

6. State: It tells whether module is associated or not.

HC-05 module Information

- • HC-05 has ruddy Driven which demonstrates association status, whether the Bluetooth is associated or not. Some time recently interfacing to HC-05 module this ruddy Driven squints ceaselessly in a intermittent way. When it gets associated to any other Bluetooth gadget, its flickering moderates down to two seconds.
- • This module works on 3.3 V. We are able interface 5V supply voltage as well since the module has on board 5 to 3.3 V regulator.
- • As HC-05 Bluetooth module has 3.3 V level for RX/TX and microcontroller can identify 3.3 V level, so, no ought to move transmit level of HC-05 module. But we have to be move the transmit voltage level from microcontroller to RX of HC-05 module.

Bluetooth communication between Devices

E.g. Send information from Smartphone terminal to HC-05 Bluetooth module and see this information on PC serial terminal and bad habit versa. To communicate smartphone with HC-05 Bluetooth module, smartphone requires Bluetooth terminal

application for transmitting and getting data. You'll find Bluetooth terminal applications for android and windows in specific app. store
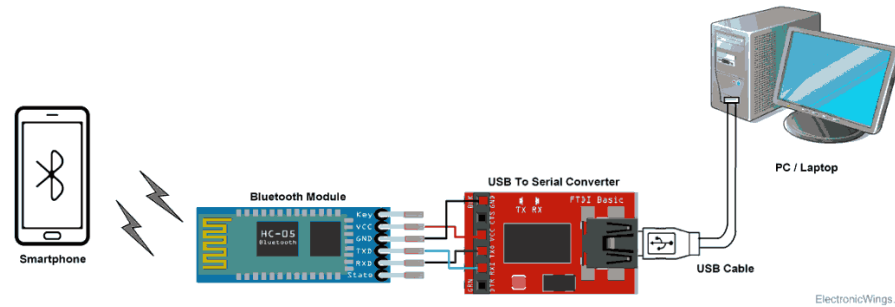

Fig. 4.2.14 (4)

So, when we ought to communicate through smartphone with HC-05 Bluetooth module, interface this HC-05 module to the PC by implies of serial to USB converter. Some time recently

setting up communication between two Bluetooth contraptions, 1st we need to match HC-05 module to smartphone for communication. Pair HC-05 and smartphone: 1. Search for modern Bluetooth gadget from your phone. You may discover Bluetooth gadget with "HC-05" name. 2. Click on connect/pair gadget alternative; default stick for HC-05 is 1234 or 0000. After coordinating two Bluetooth contraptions, open terminal program (e.g. Teraterm, Realterm etc.) in PC, and select the harbor where we have related USB to serial module. As well select default baud rate of 9600 bps. In canny phone, open Bluetooth terminal application and interface to coordinated contraption HC-05.

It is essential to communicate, we reasonable have to be be sort inside the Bluetooth terminal application of smartphone. Characters will get sent wirelessly to Bluetooth module HC-05. HC-05 will actually transmit it serially to the PC, which is able appear up on terminal. Same way prepared to send data from PC to smartphone.

Command Mode

- • When we need to alter settings of HC-05 Bluetooth module like alter secret word for association, baud rate, Bluetooth device's title etc.

- • To do this, HC-05 has AT commands.
- • To utilize HC-05 Bluetooth module in AT command mode, interface "Key" stick to Tall (VCC).
- • Default Baud rate of HC-05 in command mode is 38400bps.
- • Following are a few AT command by and large utilized to alter setting of Bluetooth module.
- • To send these commands, we have to be interface HC-05 Bluetooth module to the PC through serial to USB converter and transmit these command through serial terminal of PC.

Command	Description	Response
AT	Checking communication	OK
AT+PSWD=XXXX	Set Password e.g. AT+PSWD=4567	OK
AT+NAME=XXXX	Set Bluetooth Device Name e.g. AT+NAME=MyHC-05	OK
AT+UART=Baud rate, stop bit, parity bit	Change Baud rate e.g. AT+UART=9600,1,0	OK
AT+VERSION?	Respond version no. of Bluetooth module	+Version: XX OK e.g. +Version: 2.0 20130107 OK
AT+ORGL	Send detail of setting done by manufacturer	Parameters: device type, module mode, serial parameter, passkey, etc.

Table no: 4.2.14

CHAPTER 5
RESULTS

5.1 The Source Code Of Voice Assistance: The source code of the voice help is the programming dialect we utilize for voice control work within the wheelchair by which the development in our model happens as we command, we utilized aurdino computer program to total the extend.

```
#include <SoftwareSerial.h>
SoftwareSerial mySerial(14, 12);
int i=0;
int j=0;
#include "Ubidots.h"

const char* UBIDOTS_TOKEN = "BBFF-J3tPATQHMcsKhleotzFO8D3p0dlRUO";  //
Put here your Ubidots TOKEN
const char* WIFI_SSID = "wheelchair";     // Put here your Wi-Fi SSID
const char* WIFI_PASS = "12345678";     // Put here your Wi-Fi password
Ubidots ubidots(UBIDOTS_TOKEN, UBI_HTTP);

void setup() {
  Serial.begin(9600);
  mySerial.begin(9600);
  pinMode(D0,OUTPUT);
  pinMode(D1,OUTPUT);
  pinMode(D2,OUTPUT);
  pinMode(D3,OUTPUT);
  pinMode(D4,OUTPUT);
  digitalWrite(D0,HIGH);
  digitalWrite(D1,HIGH);
  digitalWrite(D2,HIGH);
  digitalWrite(D3,HIGH);

  ubidots.wifiConnect(WIFI_SSID, WIFI_PASS);
  digitalWrite(D4,HIGH);
```

```
  delay(250);
  digitalWrite(D4,LOW);
  delay(250);
  digitalWrite(D4,HIGH);
  delay(250);
  digitalWrite(D4,LOW);
  delay(250);
  digitalWrite(D4,HIGH);
  delay(250);
  digitalWrite(D4,LOW);
  delay(250);
  digitalWrite(D4,HIGH);
  delay(250);
  digitalWrite(D4,LOW);
  delay(250);
}

void loop() {
  if (Serial.available() > 0)
  {
    String b = Serial.readString();
    Serial.println(b);
    if (b.indexOf("s") != -1) i=1;
    while (i=1)
    {
      if (Serial.available() > 0)
       {
         String a = Serial.readString();
         Serial.println(a);
         if (a.indexOf("a") != -1)      stop1();
         else if (a.indexOf("I") != -1)  forward();
```

```
      else if (a.indexOf("r") != -1)  backward();
      else if (a.indexOf("f") != -1)  left();
      else if (a.indexOf("b") != -1)  right();
      else if (a.indexOf("c") != -1)  stop1();
      else if (a.indexOf("z") != -1)  {i=0; stop1(); break;}
    }
  }


}
 if (mySerial.available() > 0)
 {
   String a = mySerial.readString();
   Serial.println(a);
   if (a.indexOf("a") != -1)       stop1();
   else if (a.indexOf("l") != -1)  forward();
   else if (a.indexOf("r") != -1)  backward();
   else if (a.indexOf("f") != -1)  left();
   else if (a.indexOf("b") != -1)  right();
   else if (a.indexOf("c") != -1)
   {
     j=1;
     ubidots.add("Fall State", j);
     bool bufferSent = false;
     bufferSent = ubidots.send();  // Will send data to a device label that matches the
device Id

     if (bufferSent) {
      // Do something if values were sent properly
      Serial.println("Values sent by the device");
     }
     delay(5000);
```

```
    j=0;
  }
 }
}

int forward()
{
  digitalWrite(D0,HIGH);
  digitalWrite(D1,LOW);
  digitalWrite(D2,HIGH);
  digitalWrite(D3,LOW);
}

int backward()
{
  digitalWrite(D0,LOW);
  digitalWrite(D1,HIGH);
  digitalWrite(D2,LOW);
  digitalWrite(D3,HIGH);
}

int left()
{
  digitalWrite(D0,LOW);
  digitalWrite(D1,HIGH);
  digitalWrite(D2,HIGH);
  digitalWrite(D3,LOW);
//  delay(1000);
//  digitalWrite(D0,HIGH);
//  digitalWrite(D1,HIGH);
//  digitalWrite(D2,HIGH);
```

```
//  digitalWrite(D3,HIGH);
}


int right()
{
  digitalWrite(D0,HIGH);
  digitalWrite(D1,LOW);
  digitalWrite(D2,LOW);
  digitalWrite(D3,HIGH);
//  delay(1000);
//  digitalWrite(D0,HIGH);
//  digitalWrite(D1,HIGH);
//  digitalWrite(D2,HIGH);
//  digitalWrite(D3,HIGH);

}


int stop1()
{
  digitalWrite(D0,HIGH);
  digitalWrite(D1,HIGH);
  digitalWrite(D2,HIGH);
  digitalWrite(D3,HIGH);
}
```

5.2 The Source Code Of Hand Gesture Control: The source code of the hand signal control is the programming dialect we utilize for signal control work within the

wheelchair by which the development in our model happens as we command, we utilized aurdino program to total the venture.

```
int sensorValue1;
int sensorValue2;
int sensorValue3;

int l1=170;
int l2=200;

int a1=230;
int a2=270;

int m1=300;
int m2=350;

int b1=380;
int b2=410;

int u1=430;
int u2=470;

void setup() {
  Serial.begin(9600);
  pinMode(sensorValue1,INPUT);
  pinMode(sensorValue2,INPUT);
  pinMode(sensorValue3,INPUT);
}

void loop() {
  int sensorValue1 = analogRead(A5);
```

```
  int sensorValue2 = analogRead(A6);
  int sensorValue3 = analogRead(A7);

  Serial.print("S1 : ");
  Serial.print(sensorValue1);
  Serial.print("\t S2 : ");
  Serial.print(sensorValue2);
  Serial.print("\t S3 : ");
  Serial.println(sensorValue3);

  if (sensorValue1 > m1 && sensorValue1 < m2 && sensorValue2 > u1 &&
sensorValue2 < u2 && sensorValue3 > m1 && sensorValue3 < m2)
  {
    Serial.println("a");
    delay(3000);
  }
  else if (sensorValue1 > m1 && sensorValue1 < m2 && sensorValue2 > l1 &&
sensorValue2 < l2 && sensorValue3 > m1 && sensorValue3 < m2)
  {
    Serial.println("b");
    delay(3000);
  }
  else if (sensorValue1 > u1 && sensorValue1 < u2 && sensorValue2 > m1 &&
sensorValue2 < m2 && sensorValue3 > m1 && sensorValue3 < m2)
  {
    Serial.println("c");
    delay(3000);
  }
  else if (sensorValue1 > m1 && sensorValue1 < m2 && sensorValue2 > m1 &&
sensorValue2 < m2 && sensorValue3 > a1 && sensorValue3 < a2)
  {
```

```
    Serial.println("d");
    delay(3000);
  }
  else if (sensorValue1 > m1 && sensorValue1 < m2 && sensorValue2 > l1 &&
sensorValue2 < l2 && sensorValue3 > b1 && sensorValue3 < b2)
  {
    Serial.println("e");
    delay(3000);
  }
  else if (sensorValue1 > a1 && sensorValue1 < a2 && sensorValue2 > m1 &&
sensorValue2 < m2 && sensorValue3 > m1 && sensorValue3 < m2)
  {
    Serial.println("f");
    delay(3000);
  }
  else if (sensorValue1 > b1 && sensorValue1 < b2 && sensorValue2 > m1 &&
sensorValue2 < m2 && sensorValue3 > m1 && sensorValue3 < m2)
  {
    Serial.println("g");
    delay(3000);
  }
  else if (sensorValue1 > m1 && sensorValue1 < m2 && sensorValue2 > a1 &&
sensorValue2 < a2 && sensorValue3 > m1 && sensorValue3 < m2)
  {
    Serial.println("h");
    delay(3000);
  }
  else if (sensorValue1 > m1 && sensorValue1 < m2 && sensorValue2 > b1 &&
sensorValue2 < b2 && sensorValue3 > m1 && sensorValue3 < m2)
  {
    Serial.println("i");
```

```
    delay(3000);
  }
  else if (sensorValue1 > l1 && sensorValue1 < l2 && sensorValue2 > m1 &&
sensorValue2 < m2 && sensorValue3 > a1 && sensorValue3 < a2)
  {
    Serial.println("j");
    delay(3000);
  }
  if (sensorValue2 > 170 && sensorValue2 < 200)
  {
    Serial.println("k");
    delay(3000);
  }
  else if (sensorValue2 > 170 && sensorValue2 < 200)
  {
    Serial.println("l");
    delay(3000);
  }
  else if (sensorValue2 > 200 && sensorValue2 < 230)
  {
    Serial.println("m");
    delay(3000);
  }
  else if (sensorValue2 > 230 && sensorValue2 < 260)
  {
    Serial.println("n");
    delay(3000);
  }
  else if (sensorValue2 > 260 && sensorValue2 < 290)
  {
    Serial.println("o");
```

```
    delay(3000);

  }

  else if (sensorValue2 > 290 && sensorValue2 < 320)

  {

    Serial.println("p");

    delay(3000);

  }

  else if (sensorValue2 > 320 && sensorValue2 < 350)

  {

    Serial.println("Q");

    delay(3000);

  }

  else if (sensorValue2 > 350 && sensorValue2 < 380)

  {

    Serial.println("R");

    delay(3000);

  }

  else if (sensorValue2 > 380 && sensorValue2 < 410)

  {

    Serial.println("S");

    delay(3000);

  }

}
```

5.3THE FINAL PRODUCT:

5.3.1 Side view

Fig.5.3.1

5.3.2 Top view

Fig.5.3.2

5.3.3 Front view

Fig.5.3.3

5.3.4 Rear view

Fig.5.3.4

5.4 PERFORMANCE ANALYSIS

Comparing to the past wheelchair models our wheelchair is having distant better;a much better;a higher;a stronger;an improved">a distant better torque and rpm over "300" as we are utilizing two electric bike engines over here instep on one wheelchair engine conjointly the feature of SOS highlights our wheelchair when compared to the existing variations show within the showcase. There's a speedy reaction from both the voice control and the signal control with prompt activity taking put for the wheelchair at any certain point of time.

CHAPTER 6
SUMMARY AND CONCLUSION

6.1 SUMMARY

Working in this extend is both challenging and curiously, as the venture is so striking and having a expanded field we experienced both the mechanical and electrical areas of building. The mechanical portion of joining the circuits within the most attainable way for the client and the fastest way for the prompt reaction to the machine and the electrical portion of connecting the circuits and coding the aurdino computer program for both the voice help and the hand signal was lovely curiously. The utilize of accelerometer and the gyroscopic tech within the mobiles made it easy for us whereas building the SOS highlight within the last yield of our Voice Helped and Hand Motion Controlled Wheelchair.

6.2 CONCLUSION

The objective of this extend was to discover an elective arrangement for the wheelchairs display within the advertise and to do so by making an reasonable show. This observational consider appears how such a wheelchair show benefits from the utilize of diverse remote innovations. The proposed framework "Wireless Signal Control Wheelchair" and "voice controlled wheelchair" was planned to cater patients with different sorts of physical incapacities. Since the wheelchair moves agreeing to particular hand signals each comparing to its claim heading; total ease of the understanding has been kept in intellect whereas making the framework. We imagined this system can be distant better;a much better;a higher;a stronger;an improved">a much better elective to the joy-stick wheelchair demonstrate. As for future work, a measurable examination of the model and its capacities to distinguish deviations in hand developments in numerous natural settings is arranged.

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