A

PROJECT REPORT

ON

" Arduino based Robotic Car"

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C E R T I F I C A T E

This is to certify
that
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have successfully completed project entitled **"Arduino Based Robotic Car "** under my supervision, in the partial fulfilment of Bachelor of Engineering (Automobile) of University of Pune.

Date:
Place:

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This acknowledgement would remain incomplete if I do not thanks department staff of DYPSOEA, Ambi for their ever-helpful attitude towards making this project, a great success.

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Abstract

This project was developed in a way that the robot is controlled by voice commands.An android application with a microcontroller is used for required tasks. The connection between the android app and the vehicle is facilitated with Bluetooth technology. The robot is controlledby buttons on the application or by spoken commands of the user. The movement of the robot is facilitated by the two dc servo motors connected with microcontroller at the receiver side.

The commands from the application is converted in to digital signals by the Bluetooth RF transmitter for an appropriate range (about 100 meters) to the robot. At the receiver end the data gets decoded by the receiver and is fed to the microcontroller which drives the DC motorsfor the necessary work. The aim of Voice Controlled Robotic Vehicle is to perform the requiredtask by listening to the commands of the user. A prior preparatory session is needed for the smooth operation the robot by the user. For the same a code is used for giving instruction to the controller. Keywords: Robot, Design, Fabrication, Sensor, Automation.

The project aims is to design an android interface, Arduino bot and write program in to the arduino microprocessor. Arduino car contains Arduino microcontroller with basic mobility features. Arduino programs contains instructions mediating between android controller and Arduino car. Android mobile controller uses different mobile sensors to supervise motion. Anappropriate program in the arduino microprocessor to interact with the android controller has to be created. The program has been successfully complied through arduino IDE to the arduino microprocessor & loaded in to it after proper checking of logic to decrease any loss/damage of hardware. We have to create an android application that will provide user an interface to interact with the arduino powered car. The interface is easy to use and provide feedback from the arduino microprocessor through the Bluetooth after giving instruction to arduino for various actions through interface via Bluetooth module. The android application is to create with the help of android studio that provide us with more capability & stability. After doing all of this we have test this project thoroughly and find the maximum no. of error & wrong logic in the microprocessor program. After doing this only we can say that we have been able to create as per our goal described.

CHAPTER 1: INTRODUCTION

Our aim is to make a robot vehicle which can be controlled by the voice command of a person. Normally these types of systems are called as Speech Controlled Automation System (SCAS). Our design is a prototype of the above mentioned system. The idea is to create a sort ofrobot which going to be driven by voice commands. The robot is remotely controlled by a mobile phone; there are many articles that show the communication between a robot and smart phone. Smart phone is a very good interface for remotely automating the robot. It contains many features that can be helpful.

In this design, an android application with a micro controller is used for the required task. The connection between the application and the robot is facilitate with Bluetooth technology. The commands issued will be relayed over through the channel and will be receivedby the module. The objective of voice controlled robotic vehicle (VCRV) is to listen and act on the commands of the user. Here the system requires accent training, post which the device will start understanding the commands issued; and the commands have been added by codes.

1.1 Problem Statement

In current scenario vehicles are manually controlled and all are done by the person who is driving the vehicle. Every action like start and stop, applying brake, gear transmission, acceleration requires human effort. But nowadays new technologies have been developed that can be integrated with the conventional vehicles to new vehicle form. In the technology era, the space between the physical and the digital world is brought closer by the introduction of gesture concept. For all dangerous tasks, we prefer technology rather than people. Even though

these robots are being controlled manually in the early stages, these can now be controlled via voice and gestures. This technology of gesture and voice recognition can be defined by the interaction between the computer and the body language of human beings. This constructs thecommunication link between technology and mankind. The target of this work is to upgrade thecomplete security to the robot and to simplify the controlling mechanism . The voice directions are handled, utilizing an advanced mobile phone. The individual human right hand robot is created on a smaller scale controller based stage and can know about its present area. The viability of the voice control conveyed over a separation is estimated through numerous examinations. Execution assessment is completed with consequences of the underlying investigations. The developments to be forecasted are possibly referring to the applications in ventures, medical clinics and how, including the environmental laboratories .Providing human labor is the biggest problem all over the world. With the help of this device, they can move in a wheelchair on their own by just giving voice commands through Bluetooth. If any obstacle is detected while moving it informs the user and stops. It also detects if any fire and smoke occur due to emergency, detects and informs the prescribed number to get the requiredhelp. A prototype is developed by incorporating all the features in a single module.

1.2 Objective

a) The main motive to build a VCRV is to analyze the human voice and act accordingto the programmed commands. The most basic commands are backward, forward, right , left and also stop the robot.
b) The vehicle is to be controlled wirelessly with the use of android smartphone;our intention is to make a robotic vehicle with use of advanced smartphone technology in a very simple and economic way.
c) To make use of IOT in Automotives.

1.3Scope

- Autonomous vehicles can be used for more comfort
- IOT can be used in more than automotives, healthcare etc
- To make used of IOT and develop more comfort

1.4Methodology

A. Voice and Speech

Voice is a sound which is produced by living beings. Voice uses airflow that comes from lungs. Air makes pressure over vocal folds which vibrate. Normally speech produces a whisper in our throat by using neck, chest, and abdomen this whisper becomes our speech. Our speech is unique for every person and also it helps other people to understand each other's personality, mood and most importantly it helps people to communicate. Sounds propagate using mechanical waves for traveling around gases, liquids and solids. Mechanical waves transfer their energy from one medium to another medium while using vibration. Microphone is a hardware device which can convert analog input to a digital output. Digital data can be understood, modify and store by computers. Computers can recognize speech by using some complex algorithms and good dictionaries for these algorithms. Some systems use the Hidden Markov Model (HMM) and the Mel frequency cepstral coefficients (MFCC) techniques as well asthe techniques of frequency spectral decomposition to use these two algorithms.

B. Arduino Communication:

To communicate with Arduino we first need to install its free software from the internet and install. The software is very easy to use and installing it creates just one .uno files on the microprocessors these files confuse the user because there are many different files generating.After installing Arduino it is ready to usage including dictionaries using dictionaries is very easy on the Arduino and Arduino does not requires any configuration setting when programming.
User can use USB cable to connect Arduino and after that user can dump his code to Arduinofar more easily and quickly than micro-controller.

C. Bluetooth Communication:

Bluetooth is one of the popular devices to communicate in short range it is used on computers, cell phones, head phones and many other devices. Bluetooth devices use

2.4 to 2.5 GHz frequency to communicate with each other. Bluetooth standardized as IEEE 802.15.1 but then itchanged that 802.15.1 Bluetooth's range is 2400–2483.5 MHz approximately. Bluetooth devicesgenerally use frequency-hopping spread spectrum communication technique to communicate with each other.

CHAPTER 2: LITERATURE REVIEW

2.1: Background and Overview

In 2003, Worldwide speculation in modern robots up 19%. In 2004, orders for robots were up another 18% to the highest level ever recorded. Overall development in the period 2004-2007 conjecture at a normal yearly pace of about 7%. More than 600,000 family unit robots being usedseveral millions in the next few years. Various researches have been made by different researchers in developing this project. Be that as it may, they serve an alternate application and have various innovations actualized. Some of those papers are mentioned below stating their technology and application.

Robot Control Design Using Android Smartphone Authors: Mrumal K Pathak, Javed Khan, Aarushi Koul, Reshma Kalane Raunak Varshney The motivation behind this paper is to furnish amazing computational android stages with less difficult robot equipment design. This paper depicts how to control a robot utilizing portable through Bluetooth communication, a few highlights about Bluetooth innovation, segments of the versatile and robot. It present an audit of robots constrained by smart phone by means of moving the robot upward, reverse, left and right side by the android application, for example, Arduino, Bluetooth Smart Phone Controlled Robot Using ATMEGA328 Microcontroller. Authors : Aniket R. Yeole, Sapana M. Bramhankar, Monali D. Wani, Mukesh P. Mahajan. In this paper have structured a robot that can be controlled using an application runningon an android smartphone. It sends control order by means of Bluetooth which has certain highlights like controlling the speed of the engine, detecting and sharing the datawith telephone about the bearing and separation of the robot from the closest hindrance.

Android Controlled Bluetooth Robot Using 8051 Microcontroller. Authors : Ritika Pahuja, Narender Kumar. A robot is normally an electro-mechanical machine that is guided by PC and electronic programming. Numerous robots have been worked for producing reason and can be found in production lines around the globe. This paper build up the remote fastens in the android application which control the robot movement with them. What's more, in which Bluetooth communication is use to interface controller and

android. Controller is interfaced to the Bluetooth module however UART convention Robot Controlled Car Using Wi-Fi Module Authors : S R Madkar, Vipul Mehta, Nitin Bhuwania, Maitri Parida This paper, deliberate how to control robot controlled vehicle utilizing Wi-Fi module through android application of anandroid Smart Phone. It is additionally show that the apparatuses can be controlled even without an android telephone by sending an ordinary SMS. This task can be adjusted effectively to incorporate a covert agent camera too that can stream the recordings to the client over Wi-Fi. Sunlight based cells are rather than the customary lithiumion battery for the venture.

This paper describes Voice activation speaker recognition to regulate the Bioloid GP automaton by MFCC and DTW strategies is enforced well in automaton robots. The first step in the speech recognition process is feature extraction. In this paper, Mel Frequency Cepstrum Coefficient (MFCC) on the characteristic extraction process and Dynamic Time Warping (DTW) used have a feature matching technique [7]. It is to develop a robotic vehicle using Arduino and to controls the vehicle with the help of voice based information. The whole mechanism of the project is based upon the device namely Arduino. The feature of "hand gesture" helps it to move wirelessly depending upon the Radio Frequency, which is placed upon the hand of the user.

Joel Macwana, Chintan Patela, Nishant Doshi researched on this topic too. Early 21st century hurled the people in the middle of a transition era – the era of digitalization. This era, still in its
inception phase, is termed as 'Industry 4.0'. Industry 4.0, in simpler terms, is a step ahead in the fields of wireless
connectivity, cloud computing, Internet of Things (IoT), Cyber-Physical Systems (CPS),Artificial Intelligence,
Augmented Reality, Big Data Analytics, Autonomous Robotics, Industrial Internet of Cybersecurity [1]. Thus, Industry 4.0 is a hypernym of the aforementioned areas. Internet of Things forms the
backbone of Industry 4.0. All the sensors and devices are wirelessly connected through IoT. IoT has revolutionized
every industry [2]. One such industry is the automotive industry. IoT has made possible

the existence of autonomous
vehicles or smart vehicles.
In this paper, we present one such autonomous vehicle, which follows voice instructions given to it through
Google Assistant on the user's smartphone. The software and services used are Arduino IDE, Adafruit IO, Google
Assistant and If-This-Then-That (IFTTT).

Shiropa Chakraborty; Nilotpal De; Divine Marak; Mithu Borah; Sudip Paul in there paper Voice controlled Robotic Car Using Mobile Appllication writes Human Robotic Interface (HRI) is used by or with humans and is a field of research dedicated to understanding, evaluating and designing robotic system. There are different forms of human-robot communication and these forms are greatly influenced by the closeness of humans and robots. The robot car prototype is designed using Human Robot Interaction (HRI), which is controlled by user-specific commands provided by the robot user. The designed prototype uses voice recognition using Android phones. Convert them to a collection of digitally stored words. Human voice commands are performed by a robot with its own built-in microphone. The Bluetooth transceiver module also take decrees and ahead them to the robot's Arduino, as it controls his gesture according to the

orders he receives. Pause the robots "go forward", "go back", "go left", "go right"and "stop" and stop back and forth and left and right according to the voice command. This prototype is designed to overcome the problems of manual wheelchairs and provide a quality life individually for the physically handicapped.

Rubina Liyakat Khan; Deepa Priyanshu; Fatmah Saleh Alsulaiman writes in there paper Implementation of Human Voice Controlled Robotic Car that This study's objective is to ascertain out more about asystem that recognizes human voice instructions to operate a voice controlled car. The a voice-controlled car is only an example of how to exert control over the movement of a basic robot using commonly used spoken instructions . An android app is utilised in this system to transmit human instructions to the microcontroller. The UART protocolmay be used to connect a

controller to a Bluetooth module. The android app receives the speech and the voice module processes it. After then, the voice is transformed to text. This text will be further processed by the microcontroller, which is going to take appropriate step taken to control the avoice control roboticcar. The purpose of this system is to construct a robotic car that can be operatedwith a human voice for basic actions like going ahead and turning left or right.

The ATmega Arduino board is the Hardware Development board utilised in thisproject. The programme is written in the Embedded C/C++ is used by the Arduino IDE. The hardware has been set up , and software has been ported. Ingeneral, utilising some form of module to recognise human speech costs muchtoo much. We concluded that, indeed, there is a very basic and straightforwardsolution effective method for controlling robots using human voice after doing alarge number of tests on the subject. This is a simple robotic application approach.

Vaibhav Samant propose a system in his paper.

This project use an android smartphone as the transmitter to which commands arefed. Speech to text conversion takes place at this level using Google Speech to Text packageavailable on the android device itself. The smartphone communicates with the vehiclewithHC-05 bluetooth module which acts as an interface between the two. The HC-05 receivesthesignal and transmits it further to the arduino uno which is micro- controller based boardwhichfurther process the signal and using the driver code fed to it commands the motor controlleraccordingly which in turn drives the vehicle using the two DC motors on eachwheel providing the mechanical energy needed to do so. The following steps are involved: 1. Start. 2. Establish connection between the smartphone and the vehicle. 3. Check if connection established. 4. If connection established, user willspeak the predefined commands into the microphoneofthe smartphone. 5. Speech to Text conversion occurs and is further relayed. 6. Command is transmitted to the Bluetooth module. 7. It is further communicated with the Arduino Uno which further processes the command. 8. Arduino Uno commands the Motor Control IC. accordingly. 9. The Motor Controller in turn runs the two DC motors and vehicleexecutes the commandas per user’s desire. 10. Stop.

He also wrote about and existing system.

2.2 Existing System

Previously a many projects have ventured into the realm of vehicle which communicates withits operator using voice in one way or the other. These projects function around thebasictenet of voice recognition or speech to text, the difference arises in the implementationvis-a-vis driving code, sensor or mechanical part used. Some also include additional features likeobstacle detection, conformation on receiving command, automatic breaking andspeedlimiting system. The purpose is to make innovation in the field of vehicle automationsothat it caters to multi-dimensional requirements from critical applications space explorationandmilitary use to humanitarian innovation to helpthose with disabilities to drive themselves. Some the projects might require 'training' to better adapt to the voice of the user resultinginincreased accuracy. While those which do not require training are called speaker independent system. The voice commands can be a fixed set of commands (as in this project) whilemoreadvanced ones come with natural speech recognition which can process complete sentencesor phrases in multiple languages and accent of the speaker.

Jaramillo Pineda Victor Alfonso; Pineda Jhonatan; García Arias Luís Felipe write in there paper Design of an automatic voice controlled system and remotecontrol that

The Use of voice-controlled remote and automatic systems, is currently being implemented more frequently in the industrial sector in the management of variables in production processes and in the domestic sector for controlling of home automatic systems. This is because it allows more efficient processes, and substantially reduces execution times. The purpose of this work is to implement a voice commanded and remote control to manage a production system, in which routines are controlled without having to type parameters or physical modifications of the actuators, this also has a constant monitoring system of the processes that are running in real time, allowing continuous control of variables, the data is displayed on a mobile device, which provides versatility in handling and does not limit the user to be present to verify process. The electronic control is performed by an Arduino board due to its multiple applications and easy programming, data transfer between the mobile device and the physical control system was performed using a Wi-Fi module built in the Arduino board, and the process of Voice commands was performed with an application adapted to work with the whole integrated system such as actuators and sensors.

2.3 PROPOSED SYSTEM:

In this proposed device we perform a variety of research on control style variants for robots. It shows that it's feasible to study to successfully manipulate actual world objects with solely voice (human voice) as a control mechanism. The reason of this lookup is to provide simple robotic hardware architecture so that this shape can focal point on Bluetooth connection infrastructure. It is also beneficial for academic robotics due to the fact human beings can construct their personal robots with low cost. When the app is operating in the system, a microphone on the mobile is used to identify user voice commands. Commands are interpreted and the program utilizes Google's speech-recognition software to translate voice to text within the app. The text will then be sent with the aid of Bluetooth to the receiver part. The microcontroller Arduino UNO R3 has 32kB of ISP flash memory, 2kB of RAM and 1kB of EEPROM. The panel incorporates serial communication connectivity with UART, SPI and I2C. The MCU will operate at 16MHz clock speed. The digital Arduino I / O pins 3, 4, 5 and 6 are programmed as output pins in this design. For serial communication with the Bluetooth unit, pins 0 and 1 of Arduino are used. Text obtained with the aid of Bluetooth is forwarded to Arduino UNO microcontroller panel by the usage of UART serial conversation protocol.

Table displays the voice commands used to monitor the robots and their functions. Table :Voice command functions

Voice Command	**Function**
Forward	Bot moves forward
Backward	Bot moves backward
Stop	Bot stops moving

The voice commands to the robotic device are dispatched via Bluetooth with the aid of an Android device. These commands are received on the robotic device by using Bluetooth moduleset up on it. The motor driver circuit is used to manipulate the velocity of the car. The completecircuitry is powered by the usage of a 12V rechargeable battery hooked up on the system.

Chapter 3.Materials and Methods:

Modeling and designing of the VCRV was done by the following part available in the market and also the programming of the arduino was done and the app was developed by using app inventor on the internet.

3.1.1Chassis:

A chassis is the internal framework of the artificial object which support in its construction and use Direct inclusion in abstracting services.

Chassis for a car is analogous to the skeleton for a human body. Chassis, also known as 'Frame', is **the foundation structure of any car that supports it from underneath**. The purpose of the chassis is to bear the weight of the car in its idle and dynamic states

Figure 1. Shows chassis diagram

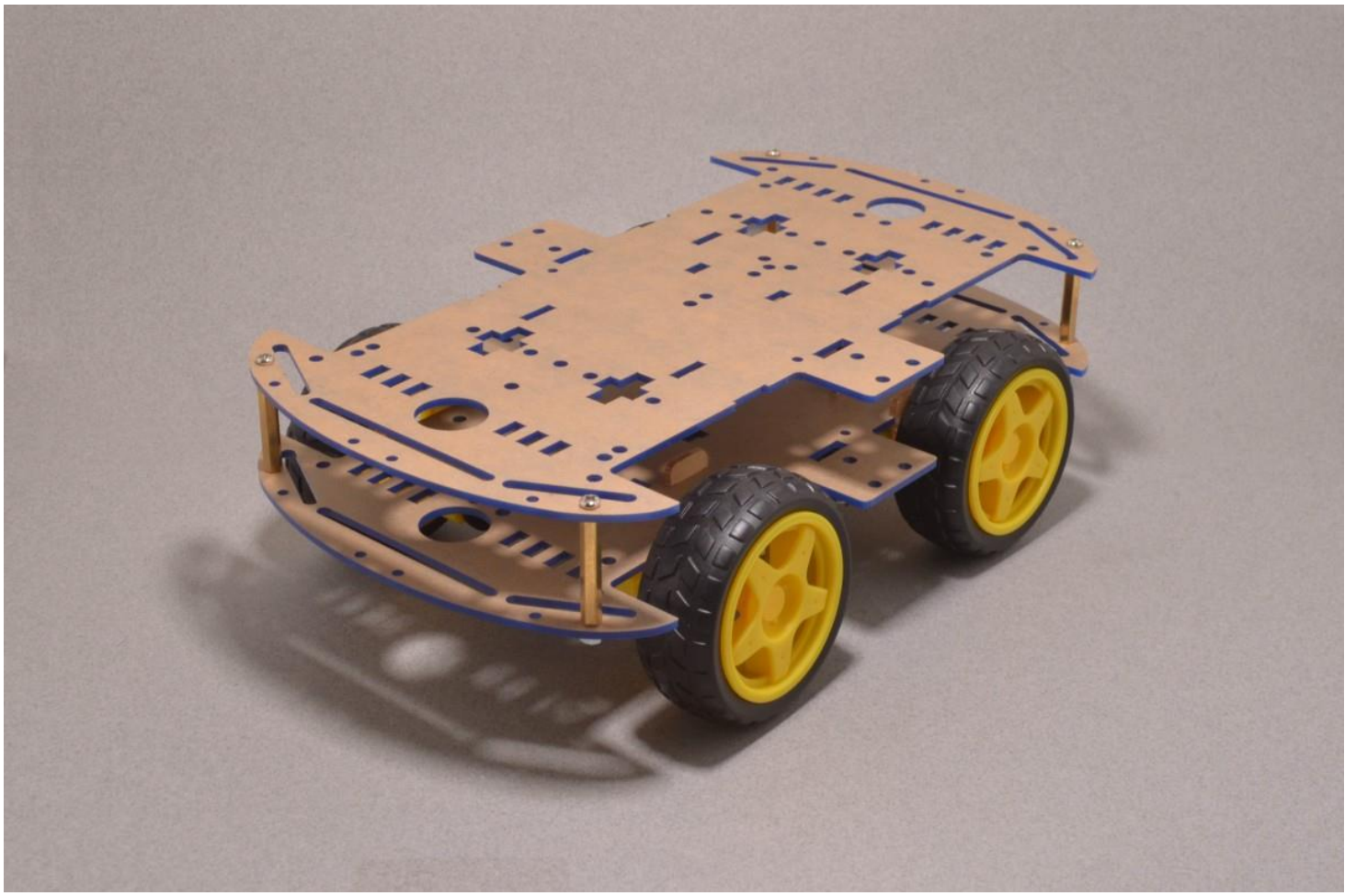


Fig 3.1- Chassis of car

3.1.2 Arduino

Arduino is an open source microcontroller which can be easily programmed, erased and reprogrammed at any instant of time. Introduced in 2005 the Arduino platform was designed to provide an inexpensive and easy way for hobbyists, students and professionals to create devices that interact with their environment using sensors and actuators. Based on simple microcontroller boards, it is an open source computing platform that is used for constructing and programming electronic devices. It is also capable of acting as a mini computer just like other microcontrollers by taking inputs and controlling the outputs for a variety of electronics devices. It is also capable of receiving and sending information over the internet with the help of various Arduino shields, which are discussed in this paper. Arduino uses a hardware known as the Arduino development board and software for developing the code known as the Arduino IDE (Integrated Development Environment). Built up with the 8-bit Atmel AVR microcontroller's that are manufactured by Atmel or a 32-bit Atmel ARM, these microcontrollers can be programmed easily using the C or C++ language in the Arduino IDE. Unlike the other microcontroller boards in India, the Arduino boards entered the electronic market only a coupleof years ago, and were restricted to small scale projects only. People associated with electronics are now gradually coming up and accepting the role of Arduino for their own projects. This development board can also be used to burn (upload) a new code to the board by simply using a USB cable to upload. The Arduino IDE provides a simplified integrated platform which can run on regular personal computers and allows users to write programs for Arduino using C or C++. International Journal of Control, Automation, Communication and Systems (IJCACS), Vol.1, No.2, April 2016 22 With so many Arduino boards available in the market, selecting a particular development board needs a variety of survey done with respect to their specifications and capabilities, which can be used for the project execution according to its specified applications.

3.1.3 NEED FOR ARDUINO:

Why is there a need to use Arduino in specific? or What makes it different from others?

Massimo Banzi, a Co-founder of Arduino mentions some very important reasons for this question.

1) Active User Community: A group of people using a similar product can hold posted message conversations and share their experiences or solve the problems of the other users in the communities with their own experiences [1]. "If you start charging for everything, everything dies very quickly." says Banzi, Arduino Cofounder.

2) Growth of Arduino: Arduino was developed with intent to provide an economical and trouble-free way for hobbyists, students and professionals to build devices that interact with their situation using sensors and actuators. This makes it perfect for newcomers to get started quickly [1].

3) Inexpensive Hardware: Since Arduino is an open source platform the software is not purchased and only the cost of buying the board or its parts is incurred, thus making it very cheap. The hardware designs are also available online for free from its official website [1].

4) Arduino Board as a Programmer: To make Arduino board function easy and also making it available everywhere these boards come with a USB cable for power requirements aswell as functioning as a programmer [1].

5) Multi-platform Environment:

The Arduino IDE is capable of running on a number of platforms including Microsoft, Linux andMac OS X making the user community even larger

3.2 TYPE OF ARDUINO BOARDS: Arduino boards are available with many different types of built-in modules in it. Boards such as Arduino BT come with a built-in Bluetooth module, for wireless communication. These built-in modules can also be available separately which can then be interfaced (mounted) to it. These modules are known as Shield. Some of the most commonly used Shields are: • Arduino Ethernet shield: It that allows an Arduino board to connect to the internet using the Ethernet library and to read and write an SD card using the SD library [2]. • Arduino Wireless shield: It allows your Arduino board to communicate wirelessly using Zigbee [2]. • Arduino Motor Driver Shield: It allows your Arduino boards to interface with driver of a motor etc. [2]. International Journal of Control, Automation, Communication and Systems (IJCACS), Vol.1, No.2, April 2016 23 Fig. 1.Arduino Shields – Ethernet, Wireless and Motor Driver. Here is a list of the different types of Arduino Boards available along with its

microcontroller type, crystal frequency and availabilities of auto reset facility:

Arduino Type	**Microcontroller**	**Clock Speed**
Arduino Uno	ATmega328	16 MHz with auto-reset
Arduino Duemilanove / ATmega328	ATmega328	16 MHz with auto-reset
Arduino Nano	ATmega328	16 MHz with auto-reset
Arduino Mega 2560 or MegaADK	ATmega2560	16 MHz with auto-reset
Arduino Leonardo	ATmega32u4	16 MHz with auto-reset
Arduino Mini w/ ATmega328	ATmega328	16 MHz with auto-reset
Arduino Ethernet	Equivalent to Arduino UNO withan Ethernet shield	Equivalent to Arduino UNO withan Ethernet shield
Arduino Fio.	ATmega328	8 MHz with auto-reset
Arduino BT w/ ATmega328	ATmega328	16 MHz with auto-reset
LilyPad Arduino w/ ATmega328	ATmga328	8 MHz (3.3V) with auto-reset

3.3 ELEMENTS OF ARDUINO BOARDS:

Elements of an Arduino Board can be done into two categories:

- *Hardware*
- *Software*

Hardware

The Arduino Development Board consists of many components that together makes it work. Here are some of those main component blocks that help in its functioning:

- **Microcontroller:** This is the heart of the development board, which works as a mini computer and can receive as well as send information or command to the peripheral devices connected to it. The microcontroller used differs from board to board; it also has its own various specifications.

- **External Power Supply:** This power supply is used to power the Arduino development board with a regulated voltage ranging from 9 – 12 volts. International Journal of Control, Automation, Communication and Systems (IJCACS), Vol.1, No.2, April 2016 24

- **USB plug:** This plug is a very important port in this board. It is used to upload (burn) a program to the microcontroller using a USB cable. It also has a regulated power of 5V which also powers the Arduino board in cases when the External Power Supply is absent.

- **Internal Programmer:** The developed software code can be uploaded to the microcontroller via USB port, without an external programmer.

- **Reset button:** This button is present on the board and can be used to resets the Arduino microcontroller.

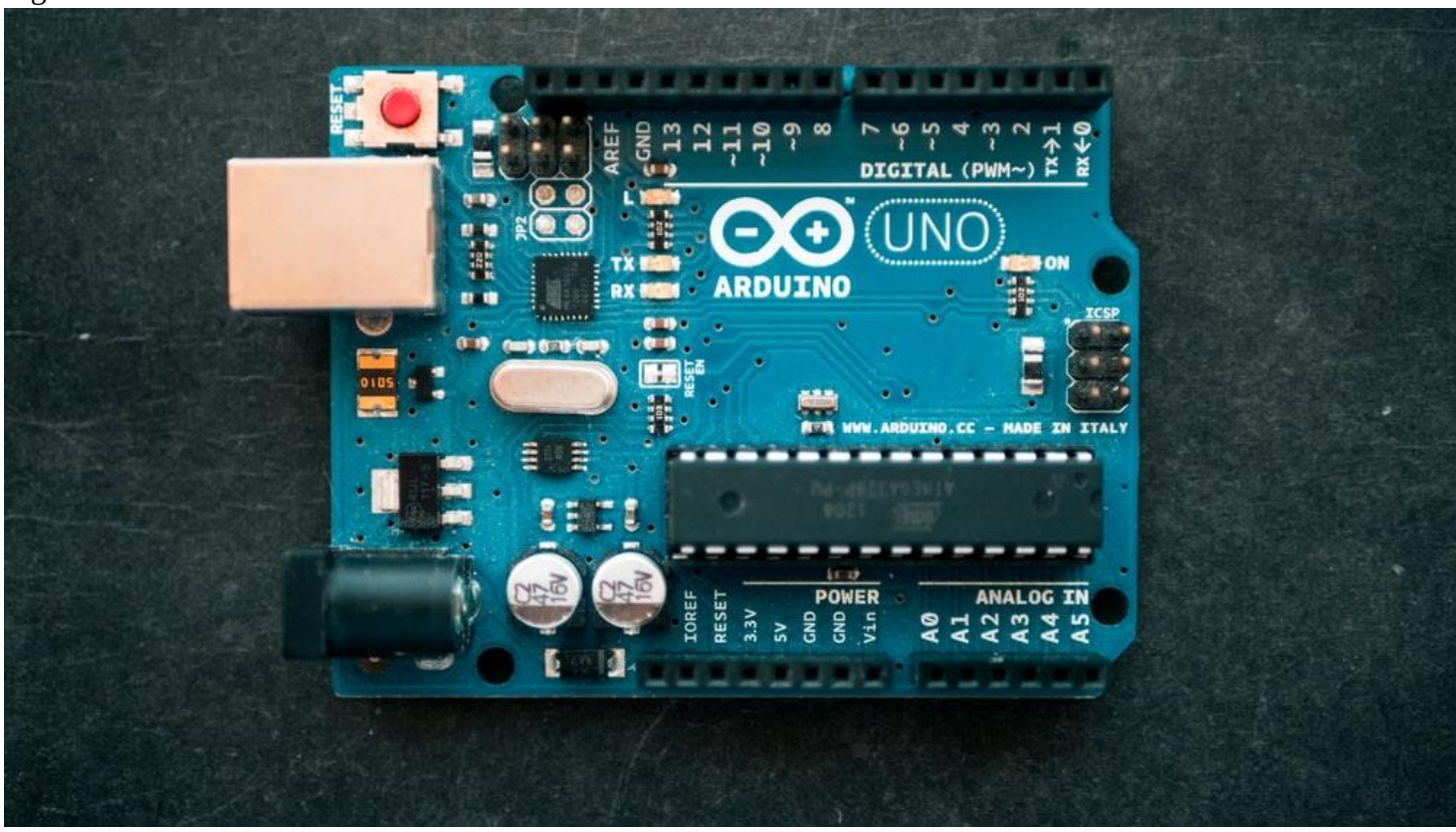
- **Analog Pins:** There are some analog input pins ranging from A0 – A7 (typical). These pins areused for the analog input / output. The no. of analog pins also varies from board to board.

- **Digital I/O Pins:** There are some digital input pins also ranging from 2 to 16 (typical).

These pins are used for the digital input / output. The no. of these digital pins also varies from boardto board.

- **Power and GND Pins:** There are pins on the development board that provide 3.3, 5 volts and ground through them.

Fig 3.2 Arduino Board



Chapter 4 Software, programming and equipments

The program code written for Arduino is known as a sketch. The software used for developing such sketches for an Arduino is commonly known as the Arduino IDE. This IDE contains the following parts in it:

- **Text editor:** This is where the simplified code can be written using a simplified version of C++programming language.

- **Message area:** It displays error and also gives a feedback on saving and exporting the code.

- **Text:** The console displays text output by the Arduino environment including complete error messages and other information

- **Console Toolbar:** This toolbar contains various buttons like Verify, Upload, New, Open, Save and Serial Monitor. On the bottom right hand corner of the window there displays the Development Board and the Serial Port in use.

4.2 Features of Arduino IDE

• The project file or the sketches for a project are saved with the file extension .ino

• Features such as cut / copy / paste are supported in this IDE.

• There also is a facility for finding a particular word and replacing it with another by pressing the Ctrl + F buttons on the keyboard

• The most basic part or the skeleton of all Arduino code will have two functions

4.3 PROGRAMMING BASICS

Now we'll discuss about the programming techniques of Arduino sketch in the Arduino IDE. There are two main parts every sketch will always have, they are:

• void setup ()

• void loop ()

1) void setup():

This is the first routine that begins when the Arduino starts functioning. This function is executed only once throughout the entire program functioning.

The setup function contains the initialization of every pin we intend use in our project for input or output. Here is an example of how it should be written:

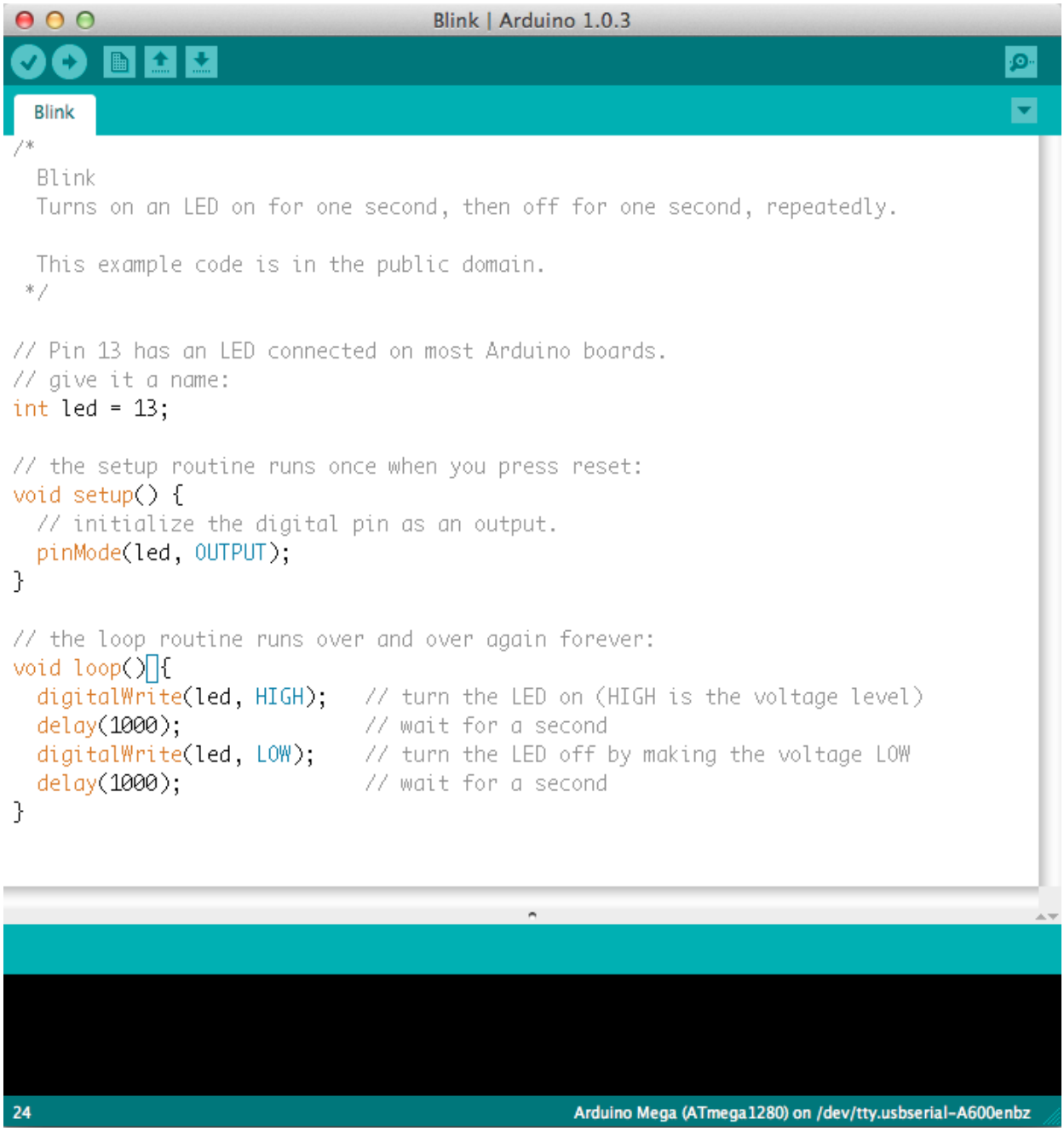


Fig 4.1 Arduino IDE

Here the pin is the no. of the pin that is to be defined. INPUT / OUPUT correspond to the mode in which the pin is to be used. It also contains the initialization of the Serial Monitor. A serial monitor is used to know the data that are being sent serially to any peripheral device.
Before using any variables for programming it is necessary to define them above the function "void setup()"

2) void loop():

This function is the next important function in the Sketch. It consists of that part of the code that needs to be continuously executed unlike the part of the code written in the setup function. An example of a void loop is as follows: International Journal of Control, Automation, Communication and Systems (IJCACS), Vol.1, No.2, April 2016 26 Here digital Write is a function that writes a high or a low value to a digital pin. If the pin has been configured as an OUTPUT with pin Mode(), its voltage will be set to the corresponding value: 5V (or 3.3V on 3.3V boards) for HIGH, 0V (ground) for LOW. Similarly if there is a need for delay in the sketch then there is another function that creates a delay in the execution of the code This creates a delay in the execution of the program for the time period specified (in milliseconds). Using the above two function lets create a pic.

4.4 APPLICATIONS

Arduino has endless applications as it has been used extensively for creating projects by hobbyist, amateurs and professional in various fields of engineering. Here are some of those amazing projects that have been developed on an Arduino platform:

1. **Arduino Satellite (ArduSat)**

   ArduSat is an open source satellite completely based on Arduino to create a stage for space discoveries. Built by Spire previously known as NanoSatisfi, ArduSat collects various types of information's from the space environment, with the help of numerous sensors that includes temperature sensors, pressure sensors, cameras, GPS, spectrometer, and magnetometer etc with its programmable Arduino processors [4]. This platform also allows common public to experiment their projects in space. ArduSat can be used for photography from space, making a spectrograph of the sun, detecting high energy radiation, compiling temperature readings and observing meteors etc. [5] [6].

2. **ArduPilot (ArduPilotMega - APM)**

   ArduPilot is an unmanned aerial vehicle (UAV) based on the open source platform and built using Aruino Mega which is able to control independent multicopters, fixed-wing aircraft, traditional helicopters and ground rovers. [3]

   It was created by the DIY Drones community in 2007 and was also an award winning platform of 2012 [3]. International Journal of Control, Automation, Communication and Systems (IJCACS), Vol.1, No.2, April 2012

3. **Lilypad Arduino**

   Just like the Google wearable's, Lilypad Arduino is a wearable version of Arduino developed and designed by Leah Buechley and SparkFun Electronics with the aim of

building interactive electronic textiles or e-textiles [10]. Fig. 6.Lily Arduino and so add-on components that can be sewn together and a Lilypad Arduino pillow. These designs involve use of a number of modules sewn on the cloth with conductive thread to give it the required electrical connections. [10] The microcontroller can be programmed just like the normal Arduino boards using the usb-to-serial connection. This is a perfect illustration of a user community determined project with the business version of the kit designed by Leah and SparkFun Electronics. This is an example of such designs, here is a jacket with turn signals that will let people know where you're going when on a bike.

5.1 JANALOG

Pin	Function	Type	Description
1	NC	NC	Not connected
2	IOREF	IOREF	Reference for digital logic V - connected to 5V
3	Reset	Reset	Reset
4	+3V3	Power	+3V3 Power Rail
5	+5V	Power	+5V Power Rail
6	GND	Power	Ground
7	GND	Power	Ground
8	VIN	Power	Voltage Input
9	A0	Analog/GPIO	Analog input 0 /GPIO
10	A1	Analog/GPIO	Analog input 1 /GPIO
11	A2	Analog/GPIO	Analog input 2 /GPIO
12	A3	Analog/GPIO	Analog input 3 /GPIO
13	A4/SDA	Analog input/I2C	Analog input 4/I2C Data line
14	A5/SCL	Analog input/I2C	Analog input 5/I2C Clock line

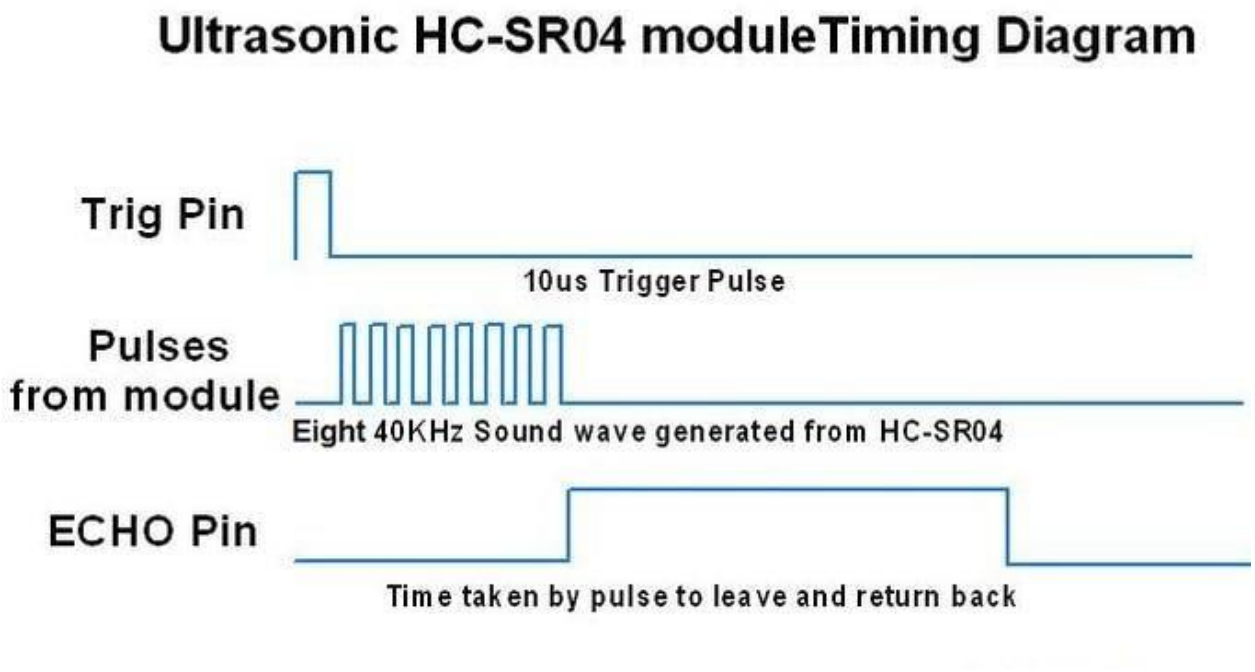
5.2 JDIGITAL

Pin	Function	Type	Description
1	D0	Digital/GPIO	Digital pin 0/GPIO
2	D1	Digital/GPIO	Digital pin 1/GPIO
3	D2	Digital/GPIO	Digital pin 2/GPIO
4	D3	Digital/GPIO	Digital pin 3/GPIO
5	D4	Digital/GPIO	Digital pin 4/GPIO
6	D5	Digital/GPIO	Digital pin 5/GPIO
7	D6	Digital/GPIO	Digital pin 6/GPIO
8	D7	Digital/GPIO	Digital pin 7/GPIO
9	D8	Digital/GPIO	Digital pin 8/GPIO
10	D9	Digital/GPIO	Digital pin 9/GPIO
11	SS	Digital	SPI Chip Select
12	MOSI	Digital	SPI1 Main Out Secondary In
13	MISO	Digital	SPI Main In Secondary Out
14	SCK	Digital	SPI serial clock output
15	GND	Power	Ground
16	AREF	Digital	Analog reference voltage
17	A4/SD4	Digital	Analog input 4/I2C Data line (duplicated)
18	A5/SD5	Digital	Analog input 5/I2C Clock line (duplicated)

Fig 4.2 Analog and Digital Pins chart

4.5 Ultrasonic Sensor:

Fig 4.3:



The HC-SR04 ultrasonic sensor uses SONAR to determine the distance of an object just like the bats do. It offers excellent non-contact range detection with high accuracy and stable readings in an easy-to-use package from 2 cm to 400 cm or 1" to 13 feet.

The operation is not affected by sunlight or black material, although acoustically, soft materials like cloth can be difficult to detect. It comes complete with ultrasonic transmitter and receiver module.

Technical Specifications

- Power Supply − +5V DC
- Quiescent Current − <2mA
- Working Current − 15mA
- Effectual Angle − <15°
- Ranging Distance − 2cm – 400 cm/1″ – 13ft
- Resolution − 0.3 cm

- Measuring Angle − 30 degree

For example, if the object is 20 cm away from the sensor, and the speed of the sound is 340 m/s or 0.034 cm/µs the sound wave will need to travel about 588 microseconds. But what you will get from the Echo pin will be double that number because the sound wave needs to travel forward and bounce backward. So in order to get the distance in cm we need to multiply the received travel time value from the echo pin by
0.034 and divide it by 2.

Fig 4.5 Ultrasonic Sensor

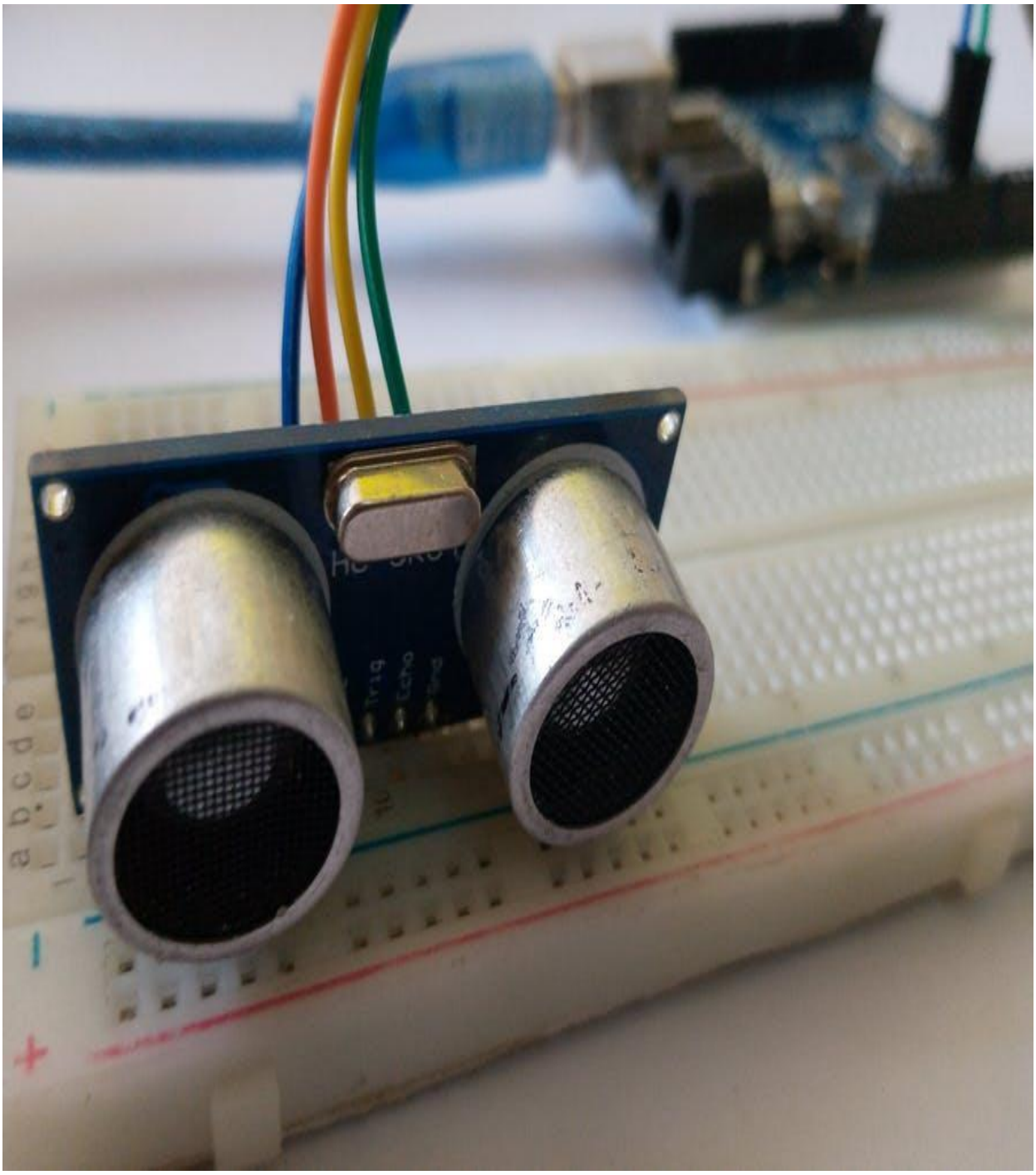


Fig 4.6 Ultrasonic Sensor Specifications:

4.5 HC05 Bluetooth module:

HC-05 is a Bluetooth device used for wireless communication with Bluetooth enabled devices (like smartphone). It communicates with microcontrollers using serial communication (USART).

Default settings of HC-05 Bluetooth module can be changed using certain AT commands.

As HC-05 Bluetooth module has 3.3 V level for RX/TX and microcontroller can detect 3.3 V level, so, there is no need to shift TX voltage level of HC-05 module. But we need to shift the transmit voltage level from microcontroller to RX of HC-05 module.

For more information about HC-05 Bluetooth module and how to use it, refer the topic HC-05 Bluetooth module in the sensors and modules section.

Example

Here, we will transmit data from Smartphone via Bluetooth to the Arduino Uno and display it on Serial Monitor of PC.

Download and install a **Bluetooth terminal** application on your phone and use it to connect to the HC-05 Bluetooth module.

Data is sent from the Smartphone using the **Bluetooth terminal** application.

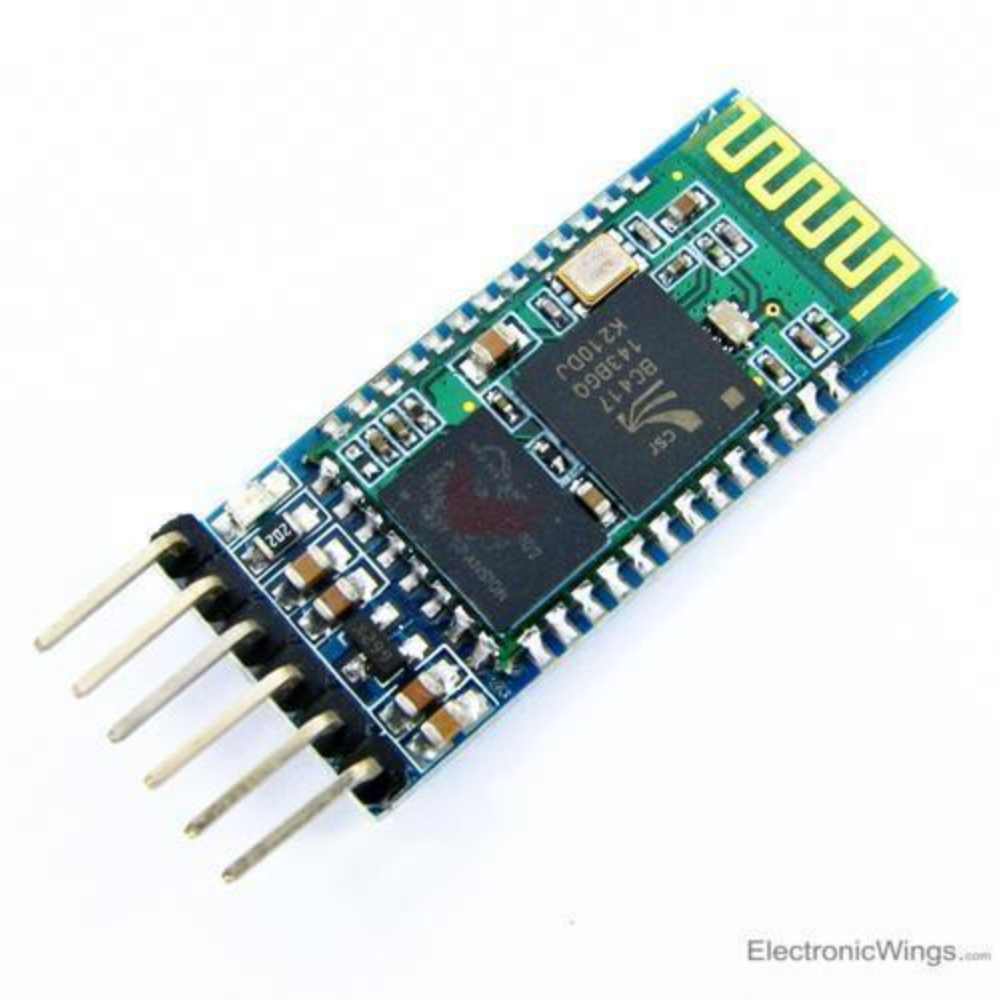


Fig 4.7 HC-05 Bluetooth Module

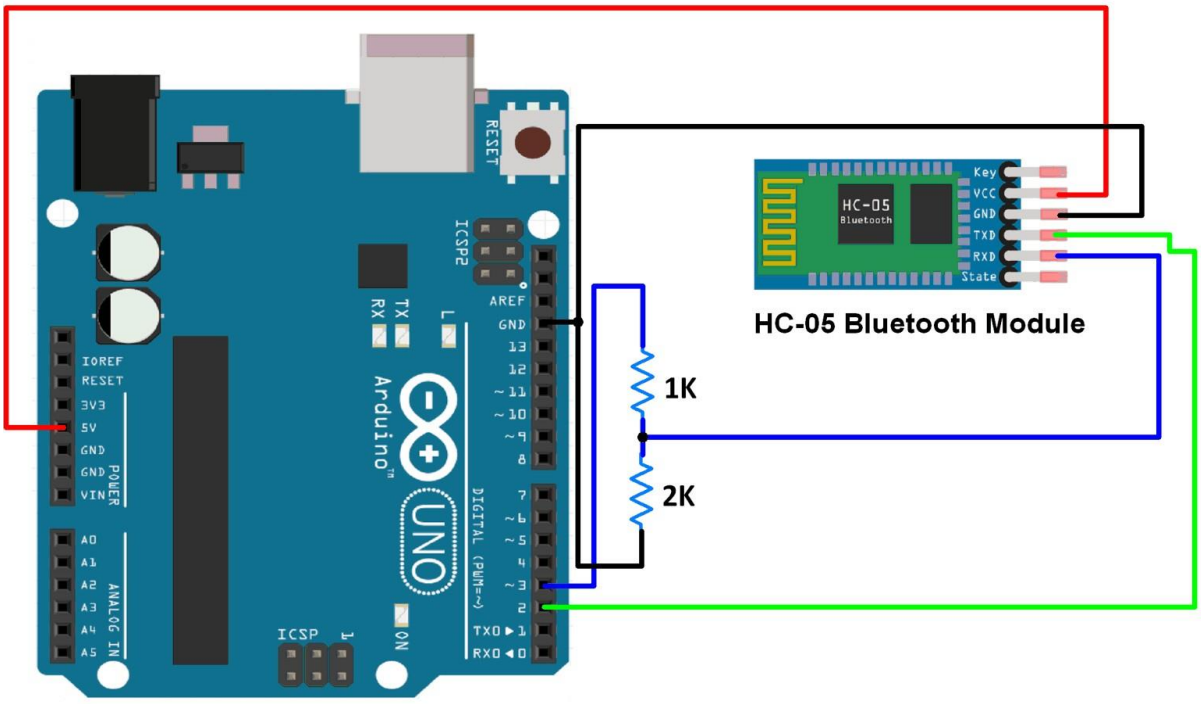


Fig 4.8 Arduino,HC-05 Connection

4.6 L293D Motor driver:

A motor driver is an integrated circuit chip which is usually used to control motors in autonomous robots. Motor driver act asan interface between Arduino and the motors . The most commonly used motor driver IC's are from the L293 series such as L293D, L293NE, etc. These ICs are designed to control 2 DC motors simultaneously. L293D consist of two H-bridge. H-bridge is the simplest circuit for controlling a low current rated motor.

We will be referring the motor driver IC as L293D only. L293Dhas 16 pins.

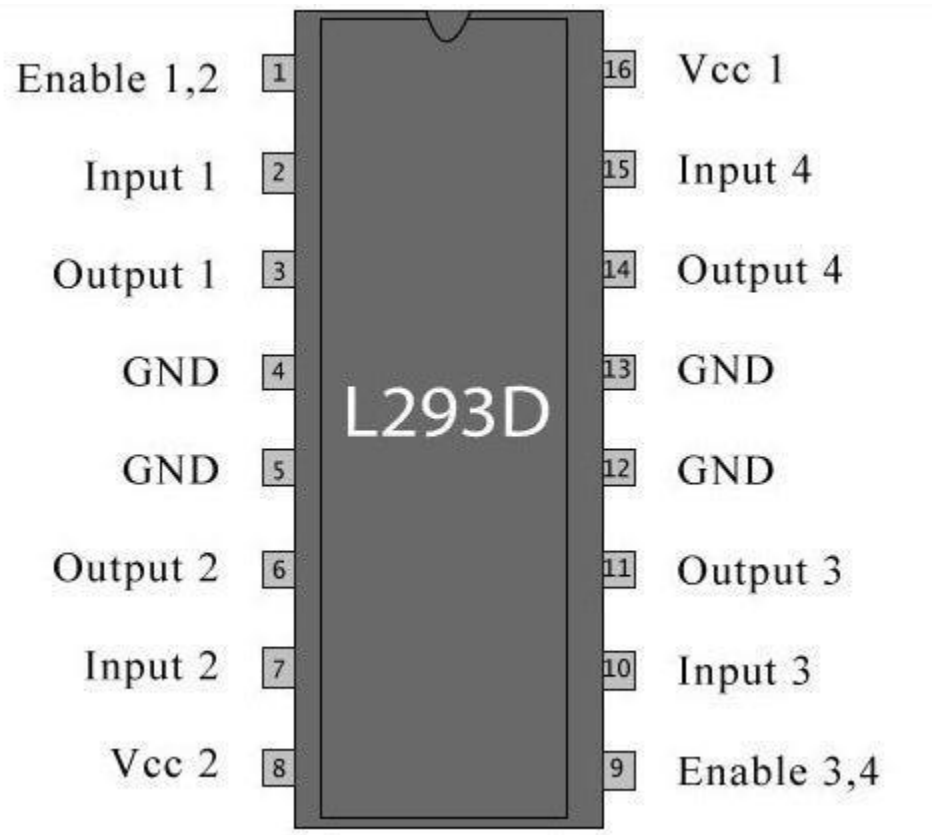


Fig 4.9 L293D Motor Driver

1) L293D IC

2) 4 1microfarad capacitor

3) 6 Header Male pins

4) 12 Volt battery or source

5) Wires or female sockets

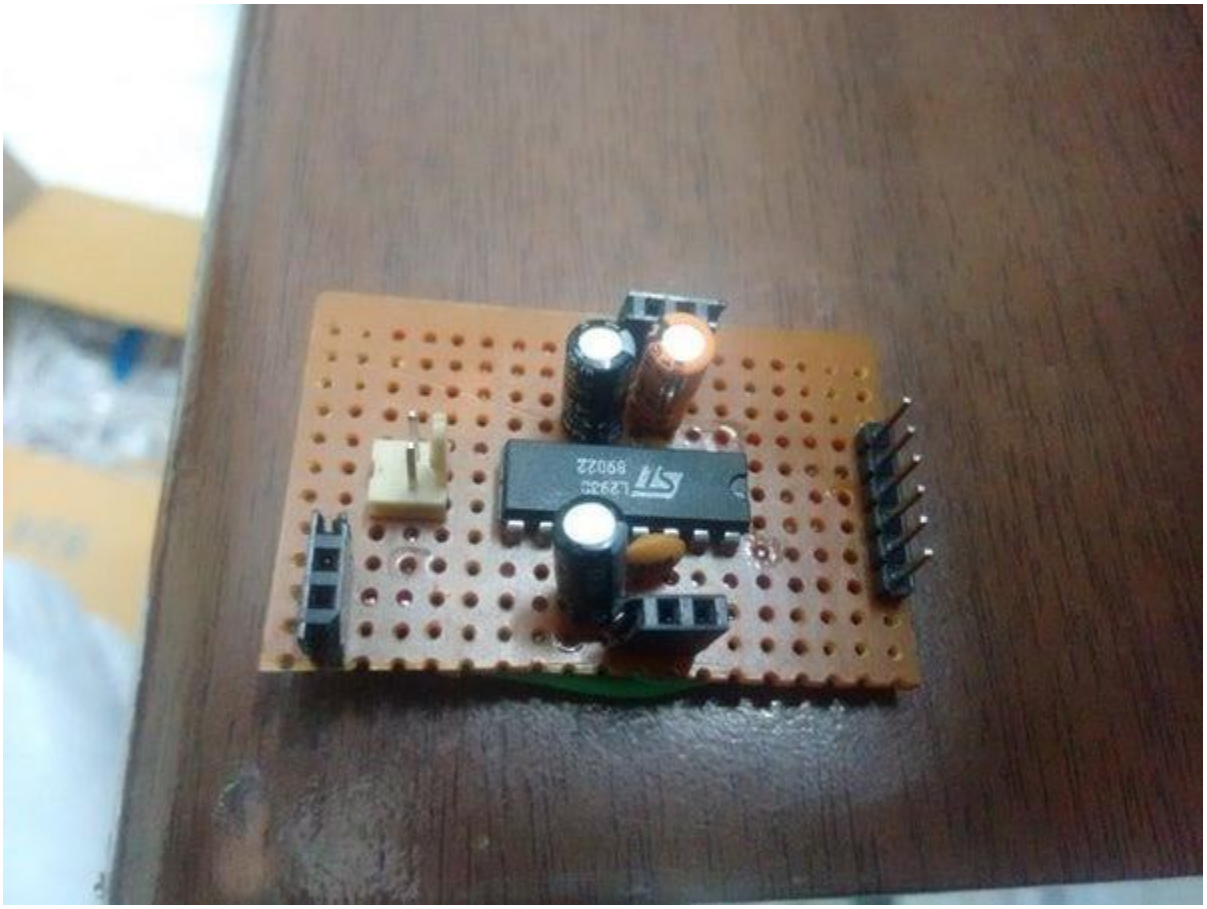
6) 2 Motors

7) Arduino (Any) to test the Driver

8) Computer with arduino IDE

9) Misc itmes like soldering iron , soldering Wire etc

Fig 4.10 Motor driver details



4.7 Servo Motor:

A Servo Motor is a small device that has an output shaft. This shaft can be positioned to specific angular positions by sending the servo a coded signal. As long asthe coded signal exists on the input line, the servo will maintain the angular position of the shaft. If the coded signal changes, the angular position of the shaft changes. In practice, servos are used in radio-controlled airplanes to position control surfaces like the elevators and rudders. They are also used in radio-controlled cars, puppets, and of course, robots.

Servos are extremely useful in robotics. The motors are small, have built-in control circuitry, and are extremely powerful for their size. A standard servo such as the Futaba S-148 has 42 oz/inches of torque, which is strong for its size. It also draws power proportional to the mechanical load. A lightly loaded servo, therefore, does not consumemuch energy.

The guts of a servo motor is shown in the following picture. You can see the control circuitry, the motor, a set of gears, and the case. You can also see the 3 wires that connect to the outside world. One is for power (+5volts), ground, and the white wire is the control wire.

4.7.1 Working of a Servo Motor

The servo motor has some control circuits and a potentiometer (a variable resistor, aka pot) connected to the output shaft. In the picture above, the pot can be seen on the rightside of the circuit board. This pot allows the control circuitry to monitor the current angle of the servo motor.

If the shaft is at the correct angle, then the motor shuts off. If the circuit finds that the angle is not correct, it will turn the motor until it is at a desired angle. The output shaft ofthe servo is capable of traveling somewhere around 180 degrees. Usually, it is somewhere in the 210-degree range, however, it varies depending on the manufacturer. A normal servo is used to control an angular motion of 0 to 180 degrees. It is mechanically not capable of turning any farther due to a mechanical stop built on to the main output gear.

The power applied to the motor is proportional to the distance it needs to travel. So, if the shaft

needs to turn a large distance, the motor will run at full speed. If it needs to turn only a small amount, the motor will run at a slower speed. This is called **proportional control**.

4.7.2 How Do You Communicate the Angle at Which the Servo Should Turn?

The control wire is used to communicate the angle. The angle is determined by the duration of a pulse that is applied to the control wire. This is called **Pulse Coded Modulation**. The servo expects to see a pulse every 20 milliseconds (.02 seconds). The length of the pulse will determine how far the motor turns. A 1.5 millisecond pulse, for example, will make the motor turn to the 90-degree position (often called as the neutral position). If the pulse is shorter than 1.5 milliseconds, then the motor will turn the shaft closer to 0 degrees. If the pulse is longer than 1.5 milliseconds, the shaft turns closer to 180 degrees.

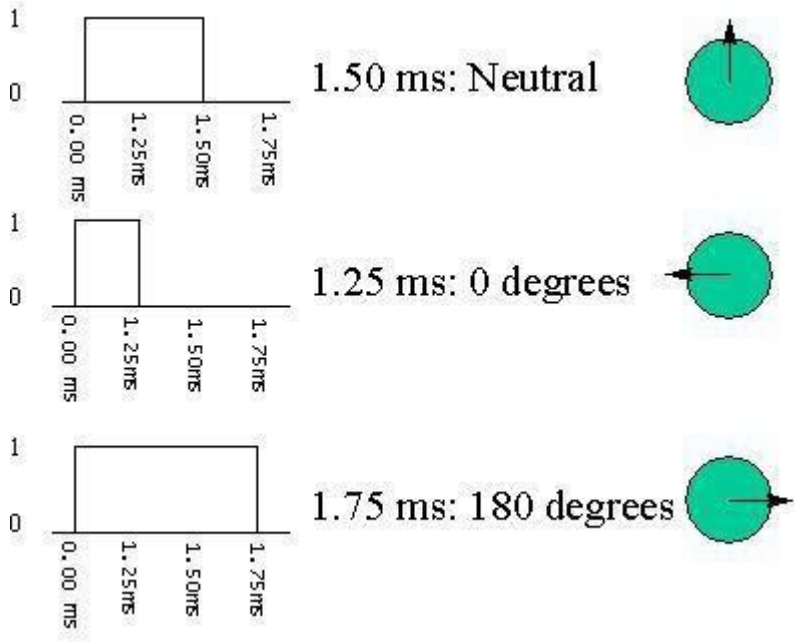


Fig 4.11 Servo Motor

Figure 3 - DC Gear Motor

Fig 4.12 Gear Motor details

4.8 Gear Motor:

If you work in electronics and robotics field, you have come across DC motors at least once. These motors are one of the most widely used elementsin electronics and robotics. These motors convert direct current electrical energy into mechanical energy.

An external source provides power for the stator of these motors. As a result, the current flowing through the stator creates a uniform field under the poles. Of course, permanent magnet can supply the stator field, too. If the armature is powered by an external source or stator, a field will also be created in the armature. As the stator and armature fields interact, motor begins to rotate.

These motors are made in various voltages and speeds. If you add a gearboxto these motors, the torque will increase by reducing its speed. Here are 3 ways to control the speed of DC motors:

- Voltage control
- Current Control
- Armature resistance

Fig 4.12- Single Gear Motor

4.9 Wheels

A wheel is circular block of durable and hard material which is placed in axil about whichthe wheel rotates when a moment is applied by torque or gravity, thereby making one of the simple machines. When placed under a load baring platform, the wheel turning on the horizontal axil makes it possible to transport heavy.

Fig 4.13 Wheels

4.10 Battery Holder:

A battery holder or a **battery mount** is an integrated or separate cavity to hold cells. If it is a separate compartment, it can be attached to a cell-powered device. It is used to hold the cells securely and power the device it is attached to.

Fig 4.14 Battery Holder

4.11 LI-ION Battery:

A **lithium-ion battery** or **Li-ion battery** is a type of rechargeable battery composed of cells in which lithium ions move from the negative electrode through an electrolyte to the positive electrode during discharge and back when charging. Li-ion cells use an intercalated lithium compound as the material at the positive electrode and typically graphite at the negative electrode. Li-ion batteries have a high energy density, no memory effect (other than LFP cells)[9] and low self-discharge. Cells can be manufactured to prioritize either energy or power density.[10] They can however be a safety hazard since they contain flammable electrolytes and if damaged or incorrectly charged can lead to explosions and fires.

Li-ion batteries have an unmatchable combination of high energy and power density, making it the technology of choice for portable electronics, power tools, and hybrid/full electric vehicles [1]. If electric vehicles (EVs) replace the majority of gasoline powered transportation, Li-ion batteries will significantly reduce greenhouse gas emissions [2]. The high energy efficiency of Li-ion batteries may also allow their use in various electric grid applications, including improving the quality of energy harvested from wind, solar, geo-thermal and other renewable sources, thus contributing to their more widespread use and building an energy-sustainable economy. Therefore Li-ion batteries are of intense interest from both industry and government funding agencies, and research in this field has abounded in the recent years.

Fig 4.15 Li-ion Battery

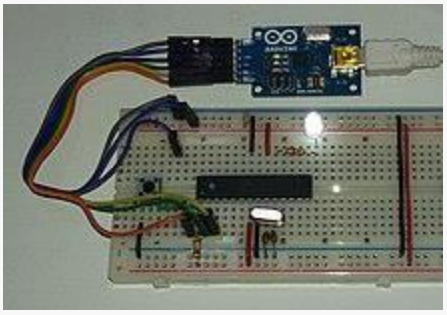
4.12 Jumper Wires:

A **jump wire** (also known as **jumper**, **jumper wire**, **DuPont wire**) is an electrical wire, or group of them in a cable, with a connector or pin at each end (or sometimes without them — simply "tinned"), which is normally used to interconnect the components of a breadboard or other prototype or test circuit, internally or with other equipment or components, without soldering.[1]

Individual jump wires are fitted by inserting their "end connectors" into the slots provided in a breadboard, the header connector of a circuit board, or a piece of test equipment.

Fig 4.16 Jumper wire with crocodile clips

Jumper wires with crocodile clips



Jump wires at the end of a multi-colored ribbon cable are used to connect the pin header at the left side of a blue USB2Serial board to a white breadboard below. Another jumper cable ending in a USB micro male connector mates to the right side of the USB2Serial board. Red and black tinned jump wires can be seen on the breadboard.

Types

There are different types of jumper wires. Some have the same type of electrical

connector at both ends, while others have different connectors. Some common connectors are:

- Solid tips — are used to connect on/with a breadboard or female header connector. The arrangement of the elements and ease of insertion on a breadboard allows increasing the mounting density of both components andjump wires without fear of short-circuits. The jump wires vary in size and colour to distinguish the different working signals.

- Crocodile clips – are used, among other applications, to temporarily bridge sensors, buttons and other elements of prototypes with components or equipment that have arbitrary connectors, wires, screw terminals, etc.
- Banana connectors – are commonly used on test equipment for DC and low-frequency AC signals.
- Registered jack (RJnn) – are commonly used in telephone (RJ11) and computer networking (RJ45).
- RCA connectors – are often used for audio, low-resolution composite video signals, or other low-frequency applications requiring a shielded cable.
- RF connectors – are used to carry radio frequency signals between circuits, test equipment, and antennas.
- RF jumper cables - Jumper cables is a smaller and more bendable corrugated cable which is used to connect antennas and other components tonetwork cabling. Jumpers are also used in base stations to connect antennas to radio units. Usually the most bendable jumper cable diameter is ½".

Fig 4.17 Jumper wires M-M,M-F,F-F

CHAPTER 5; CONSTRUCTION OF PROJECT

5.1 Procedure:

In this section we will explain step by step procedure how to make Arduino basedrobotic car.

Step1:

Take a stiff board and connect the four gear motor in the four end of the boardwe should connect the motor on the back side of the board and the distance between them should be proportional.

Step2:

After connecting the motor flip the board.Now we gotta connect the arduino and motor driver L293D and glue it to the board.Then make a opening in the board formotor wire to connect to motor driver.figure 1 is the circuit diagram for to understand the connnection.Connect all the motor wire to there allotted output.

Step3:

Now after connecting gear motor to the motor driver.We are going to connect the servo motor to the motor driver.After connecting servo motor placed ultrasonic sensor on top of it and glue them together now we gotta connect the sensor to motor driver with the help of jumper wires.The following are the connection between jumper wire and motor driver.First is for sensor and secondmotor driver 1] GND-->GND .2]Echo-->AO.3]Trig-->A1.4]VCC-->5v.In this way wehave connected sensor to motor driver.

Step4:

Now we gotta need connection between car and electronic device for this we are using bluetooth module HC-06.For connecting bluetooth to our motor driver we are going to use jumper wires.The following are the connection between HC-06 and motor driver.First is for HC-06 and second motor driver.1]RXD-->TX(D1).2]TXD-->RX(D0).3]GND-->GND.4]VCC-->5v.

Step5: Now glue battery holder to board and connnect it the black wire to GND of motordriver and yellow to +M of the motor driver.

Step6:

Now connect the arduino UNO to computer and upload the code of Obstacle Avoidance to arduino board.Now remove the RX and TX jumpers from bluetoothmodule and upload another code and connect the RX and TX again now our coding is complete.Connect the wheels to gear motor.Now put battery in holder for energy.Now the robot can work on both automatic and voice control for thatwe gotta make some minor changes in coding.

5.2 Testing

Upon successfully pairing the device, open the app on the smart phone and press on the Bluetooth textual and emblematic pushbutton. The number of associated gadgets will now be shown. Select HC-05 from the listing to join the smart phone with HC-05 Bluetooth module on the receiver side. After successful connection, 'connected' will be displayed on the primary screen of Voice control app. Press the pushbutton with microphone image and a prompt will show up asking for voice commands. ▪ When it appears, voice instructions are detected via the app, which converts them into textual content and sends it to the receiver aspect wirelessly by using Bluetooth. On the receiving side, Arduino tests the text. If it is a matching string, it controls the moves of the robot in accordance to the description. Figure 3.1.1: Flowchart of Voice controlled car

5.3 RESULTS

- Voice controlled car is working and all the functions are followed by the bot.

- Unlike DTMF robot, the car is connected to the mobile phone wirelessly making it comfortable to the user to control the car.

- The line follower robot moves only in a particular path, in case there is an obstacle in its pathit won't move unless the obstacle is removed.

CHAPTER 6 Conclusion:

The “Voice Controlled Robotic Vehicle” project has many applications and in present and future. The project can be made more effective by adding features to it in the future. The project has applications in wide variety of areas such as military, home security, rescue missions, industries, medical assistance etc. We were successful in implementing a simple model of voice controlled robotic vehicle using the available resources. The implementation of this project is easy, so this robot is beneficial for human life. The Voice Control Robot is useful for disable people and monitoring purpose. It works on simple voice command, so it is easy to use. It is useful for those areas where humans can’t reach. The size of this robot is small, so we can use this robot for spying purpose. It can be used for surveillance. We can implement web cam in this robot for security purpose. The voice recognition software has an accuracy and for identify a voice command and it is also highly sensitive to the surrounding noise.

In this project the voice control was designed for a hoe assistant robot. The order of speech signals is automatically transmitted via a wired network to the server. The car is built primarily on a platform based on a microcontroller. Evaluation of the output of the original tests is carried out with promising implications. Possible developments to feasible technologies in households, schools, vehicle networks and businesses are also addressed. Several areas that may additionally be discussed are the impact of noise on speech to textual content translation. The accent of the speaker no longer affects the robotic activity because speech commands are interpreted using a cloud-based server that works independentlyof the speaker accent. The use of renewable energy sources for robotic operation would not only increase the value of robotic energy, but would also be environmentally friendly. Solar cells can be a suitable power source to use. The design of the robotic assistant is ideal for applications ranging from chemical manufacturing to comfortable home circumstances. Accuracy of detecting a voice command correctly is found to be 75%.

In this paper, we have studied the working principle of Arduino, its hardware / software features and its applications as to where it is currently being used and where all it can be used. We have also learnt how to write sketches for Arduino in its own IDE (software). Developing new ideas with Arduino is endless, with the help of this paper we have learnt to build new devices of our own to create and implement innovative things. From wearable fashion to space research, the possibilities of using an Arduino to learnand develop new ideas is infinite. Though it does have

its own limitations, it is a great tool that can be used in learning

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