DESIGN & CONSTRUCTION OF VOICE CONTROLLED ROBOT

A Project and Thesis proposed in some achievement of the Requirements for the Award of Degree of Bachelor of Science in Electrical and Electronic Engineering

Submitted By
Md.Sohan Rana
ID:143-33-2281
Absar Habib
ID: 143-33-2278

Supervised By
Mr. Md. Mahmudur Rahman
Assistant Professor, Faculty of Engineering
Department of EEE

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING
FACULTY OF ENGINEERING
DAFFODIL INTERNATIONAL UNIVERSITY

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TO

OUR BELOVED PARENTS

&

HONOURABLE SUPERVISER

Mr. Md. Mahmudur Rahman

Certification

This is to certify that this project and thesis entitled "Construction of Voice Control Robot System" is committed under the following students by my direct review and this action has been rowed out under them in the Department of Electrical and Electronic Engineering below the Faculty of Engineering of Daffodil International University in some fruition of the requirements for the degree of Bachelor of Science in Electrical and Electronic Engineering. The presentation which was held on December 2018.

Signature of the candidate

Name: Md.Sohan Rana
ID:143-33-2281

Name:Absar Habib
ID:143-33-2278

Signature of the supervisor

Mr.Md.Mahmudur Rahman
Assistant professor, Faculty of Engineering
Department of EEE

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ABBREVIATIONS		
CPU	--	Central Processing Unit
SRC	--	Speech-recognition Circuit
APP	--	Application

RAM	--	Random Access Memory
ROM	--	Read only Memory
DSP	--	Digital Signal Processor
CMOS	--	Complementary Metal Oxide Semiconductor
RPS	--	Regulated Power Supply
AC	--	Alternate Current
DC	--	Direct Current
USB	--	Universal Serial Bus
LED	--	Light Emitting Diode
LCD	--	Liquid Crystal Display
ALU	--	Arthematic Logic Unit
IC	--	Integrated Circuit
ISP	--	In-System Programmable
UART	--	Universal Asynchronous Receiver and Transmitter
GND	--	Ground
TTL	--	Transistor Logic
RST	--	Reset
ALE	--	Address Latch Enable
PC	--	Program Counter
SFR	--	Special Function Registers
PAN	--	Personal Area Networks
GFSK	--	Gaussian frequency shift keying
SIG	--	Special Interest Group
ISM	--	Industrial, scientific and medical Band
EDR	--	- Enhanced Data Rate
AMR	--	Android meets robot

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ABSTRACT

Most of simulated Intelligence will eventually command to robotics. Most neural networking, phusical language processing, idol recognition, oratory recognition/synthesis research goal at eventually league their technology into the summary of robotics - the source of a fully humanoid robot. The field of artificial intelligence has been around nearly as long as AI - however the sector has created very little progress. This is often solely natural, since the sector not solely makes an attempt to beat intelligence, however additionally the body that embodies it - a formidable task. Robotics, though, isn't regarding almost about|around as regards to close to concerning|near to on the subject of regardingwith reference to with regards to} humanoid robots; however additionally about their business applications in producing, safety and many different fields. It's solely comparatively recently that robots have begun to use a degree of computing in their work - several robots needed human operators, or precise steering throughout their missions. Slowly, robots have become additional and additional autonomous. Artificial intelligence is Associate in nursing fully fascinating field that interests most of the people. Robot is a system that contains sensors, control systems, manipulators, power supplies and software all working together to perform a task. Robot should have Sensing, Movement, Energy and Intelligence characteristics. This project deals with one of the application of vehicles. In this project, one moving object is developed such it's stirred as per commands area unit given by the voice recognition app which command is received by the microcontroller mistreatment wireless communication. This project is provided with DC motor, Voice Recognition module, Microcontroller at the side of the facility offer unit. Vehicle finds it applications within the time period.

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

Mainly it behaves to been a fancy soul to raise about machine which believe like as humans. Recognizing the speech and respondent consequently may be a crucial a part of this fancy. Inclding the enhancements of the terminology and exploration on spurious rational, this fancy turn real comparatively. This project aim get a important role for contribute the fancy. Dominant the device and atmosphere incluing oration create mortal life easiest and lightest. The project may be a easy shaping of this refuge. Those voice is received by the amr which processes and send to the robot for final output. Basically speech used to way of the communicate to people. Under the developments of communicate technologies within the last period,that the speech begin to be a important for many ways. More than used raised finally dseveral interfaces, speech is simply to communication with computers. This project, it's aimed to control a robot with speech commands. Robot is able to for spoken commands to move correctly. Get the output value input the specific commands in ANDROID phone. Basically android system recognizes the command by speech system.

1.2 AIM OF THE PROJECT

Robots are Fundamental in different manufacturing industries. Because is that cost per hour to contol a robot is a fracture of the cost of the human labor needed to perform the dentical deed. Over this, at one time programmed, robots often acts as duty including a sublime validity that conquer which the foremost knowledgeable mortal operator. Nowadays maximum moving robots can forced be “dinosaurs.”The robots are in the infancy stage to their evolution,that;s the

robot they are going to be a lots of versatile,emulating the human capability and abilities to exchange jobs task easily.Whatever the owner computer has been create an indelible mark on society. Robots need a mix of components to be effective. While not risking human life or limb, robots will exchange mortal.

Whatever dangerous labor work. Robots will perform in every kinds of impure environments, chemical likewise as nuclear. They also perform so dangerous which an bounded mortal will be soon died.

1.3 SCOPES

1. Robot used in industry system project to make easy daily life works through robot.

2. It can be used commercially in industries.

3. Portable android application to use it frequently in hand.

4. Nowadays bluetooth technologies that's can be used in without wire connection for cellular phones and used in this project technology. This technology gives us in different efficient for controlled robot simply

1.4 METHODOLOGY

This system is used to control all the robot hardware that connected to the microcontroller. The methodology of the proposed system is mainly divided into the three steps. In the initial step an android application interfaces with the Bluetooth module. After that in second step microcontroller receives the signal which has been send by the Bluetooth module. Then microcontroller sends the activation signal to the motor driver module. In the last step driver module switches the devices that connected to the robot

1.5 ORGANIZATIONOFTHEREPORT

This project report has seven chapters in total. The first chapter describes an idea about our project“Bluetooth Control Home Automation”, Brief description of the project, scopes and methodology. The second chapter about history, block diagram, circuit diagram, list of components. The chapter third about component description, cost analysis of our system.The chapter fourth software analysis &program explanation. The chapter fivehardware implementation. Then chaptersix describes result & discussion properly. Finally, chapter seven gives the concluding remarks, limitation of our systemand suggestion for the future works.

CHAPTER 2

SYSTEM REVIEW

2.1 INTRODUCTION

The voice control robot system allows people to control robot by using a smart phone application. It is necessary to look on hardware and user's smart phone software for developing a voice control robot. The can deal with many application such as industry, automation house, restaurant security, and toy for kids etc.In this chapter we will discuss about Bluetooth module (HC-05), and Arduino UNO, ‘voice control robot system’ apps, Arduino compiler, Block diagram & circuit diagram of our System.

2.2 BLOCK DIAGRAM

The block diagram is a way in which the principle parts are presented under blocks connect with the lines which showed the relationship of these waysThese are deeply used in engineering whole world it’s hardware graph,electronic design,software dgraph and diagram. The block iagrams rely on the ethics of the black box which the article are mystic from sight either to eliminate being distracted by the details are not well known.Also know that which goes inand goes out but we cannot see how does it work.

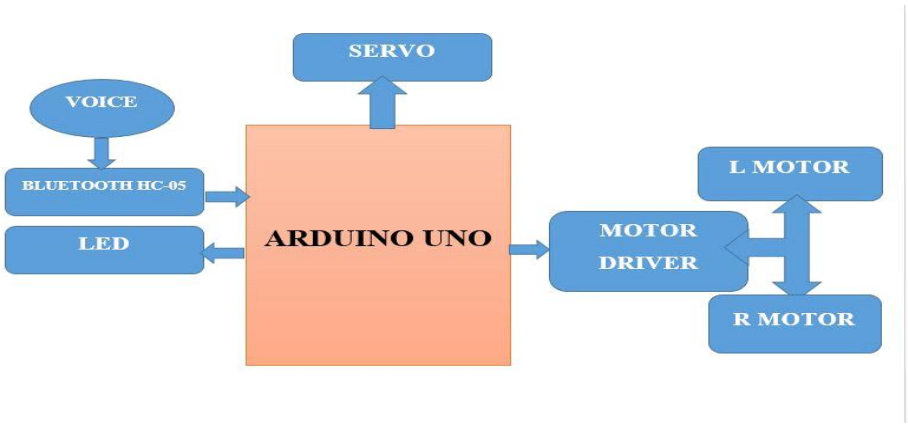

Fig 2.1: Block diagram of voice control robot

2.3 MICROPROCESSORS vs MICROCONTROLLERS:

- Microproprocessor which contains ALU(Arithmetic Logic Unit).
- Other hand Microcontroller contains ALU(Arithmetic Logic Unit), CU(Central Unit) and registers.
- Microprocessor has no internal memory otherwise microcontroller contains internal memory.
- Microprocessors used for purpose applications but Microcontroller used for specific purpose applications.
- Microprocessor which no circuits,timer and counters but Microcontroller which contains interfacing circuits ,timer and counters.
- Applications: Microprocessors square measure unremarkably used as a mainframe in computers whereas microcontrollers are found in little, minimum part designs performing arts control oriented activities. Microprocessor instruction sets are processing Intensive.

2.4 BASIC DESCRIPTION OF CONTROLLER UNIT:

In using controller unit we used Arduino hardware board with the AVR microcontroller.Basically it will be a single chip of microcontroller which include all components of microcontroller.Across the aiding of arduino 1.6.8 software chip form we performance freely ordered for AVR-IC. Arduino which is an open-source electronics prototyping stage based on supple, glib-to-conduct hardware and software. It's intended for mechanic, planner, hobbyists, and anyone loving in forming interactive purpose or environments. Using The microcontroller on these board is programmed behave the Arduino programming language (based on Wiring) and the Arduino development environment (based on Processing).The Arduino Uno is a microcontroller board based on the ATmega328. Mainly it has 14 digital input/output pins of which 6 can be used as PWM, 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a pour jack, an ICSP header, and a reset button. It stands the requirements instruments which needed in a microcontroller, usually it will be connect to computer USB cable with AC-DC adapter or battery to get started.

2.5 BLOCK DIAGRAM DESCRIPTION:

The block diagram of voice control robot system as shown in fig.2.1, using the Arduino UNO, we can operate the Bluetooth module, motor driver. When the dedicated command is available, then Bluetooth module (HC-05) sends a digital output to control unit. At this time the control units (Arduino UNO) will send commands to motor driver to move robot with desire programming.

2.6 CIRCUIT DIAGRAM

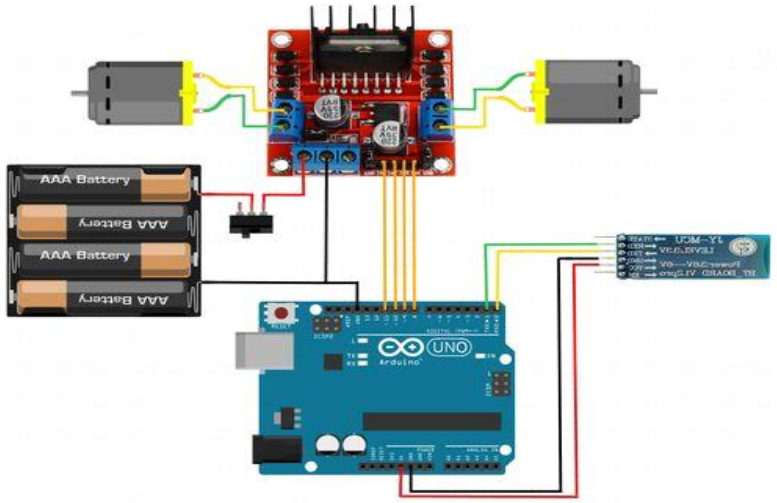

Fig.2.2:Circuit diagram

2.7 WORKING PROCESSOF OUR CIRCUIT:

This project the Bluetooth control voice activated robot project which called voice controlled robot. These application mainly controls the specific commands to preared to our robot. In time when toggle buttons are pressed these specific commands are passed by the voice apps and that's command we get a execute output for robot.The software arduino which finds out the signal was sent and compares it to the predefined for signal assigned for all application. Then it looking for active the motor from identifies that signal which passing by 5v.Then the motor driver is on and from specific command the motor driver is turned to move the robot.

2.8 LIST OF COMPONENTS USED IN CIRCUIT:

No	Component Name	Quantity	Used
01	Bluetooth Module (HC-05)	**01**	To direct communication.
02	Microcontroller:- ATmega328P(Arduino UNO)	**01**	To Control the System.
03	Motor driver	**01**	To run robot
04	Arduino compiler		To compile code.

04	Amr voice Apps	**01**	To giving command.
06	12v battery	**02**	Power Supply
07	Wires	**19**	To connection.
09	Led	**03**	Fabrication
10	Servo & sonar sensor	**1+1**	Rotate head
11	Sonar sensor	**1**	Giving eye shape

2.9 CONCLUSION:

The voice control robot which used in many applications because of its desirable properties like homes, hostels, industries, vehicles, toy for children, playing device for mature kids. Open source robot practice and many more

CHAPTER 3

COMPONENT DESCRIPTION

3.1 INTRODUCTION

System hardware design composed of Arduino Uno, L298N motor driver module, Servo motor sg90, ultrasonic sensor for fabrication,16x2 lcd,display, DC motor Bluetooth Module (HC-05),Some Wires, Arduino compiler, Android apps and obviously with power supply. In this chapter we will discuss about component description, features, working procedure and cost analysis of our all component.

3.2 DESCRIPTION OF BLUETOOTH MODULE (HC-05)

Recently everything goes to wireless such as phones computers,game controller,cosoles and many other.Without wire technologieshas allowed us to use electronic device with unbounded freedom to use without many others problem. Nowadays there are many types of wireless connetivity like as Wi-Fi,cetlular information,Zigbee and the most well –liked and wide used wireless ptocols using bluetooth.The 5 standard Bluetooth was announced the year in 2016 and looking the Bluetooth 4.2 standard is commonly used this moment..

In our project using HC-05 model of Bluetooth module which is easy to use and setup. The HC-05 which is used in a master of of salve configuration to do great solution and grat a smooth output for a great communication.

Fig. 3.1.1: Bluetooth Module (HC-05)

3.2.1 FEATURES OF BLUETOOTH MODULE (HC-05):

Hardware Features

- Typical 80dBm sensitivity.
- Up to +4dBm RF transmit poour.
- 3.3 to 5v I-O.
- PIO that's means Programmable I-O Control.
- With integrated antenna.
- With edge connector.

Software Features

- Slave default Baud rate: 9600, Data bits: 8, Stop bit: 1, Parity: No parity.
- Auto-connect to the last device on power as default.
- Permit pairing device to connect as default.

3.2.2 PIN DESCRIPTIONOF HC-05:

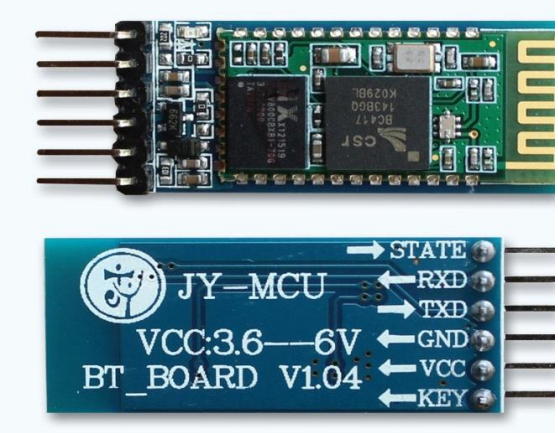

Fig 3.1.2: Pins of HC-05

Sl.		Pin Name	Description
1.		+5V or 3.3V	+5V supply or Power Pin.
2.		TX	The Data/Command to be transmitted is sent through this pin.
3.		RX	The Received data is read from this pin.
4.		KEY/EN	Input pin, which alters module between the Data mode and the AT Command mode.
5.		STATE	Output pin, the state of the module is indicated through this pin.
6.		GROUND	0V / GND or Power Pin

Table: 3.1.3: HC-05 pin description

3.2.3 SUMMARY:

In the end this is a very good device to use in home or industry. This is a low cost project so that it is very cost effective and efficient. In short term uses of communication it is better than other wireless communication.

3.3 BASIC DESCRIPTION OF ANDROID APPLICATION:

An Android app is a software application running on the Android platform. Because the Android platform is built for mobile devices, a typical Android app is designed for a smartphone or a tablet PC running on the Android OS. Although an android app are often made on the market by developers through their websites, most android apps are uploaded and published on the android Market, an internet store dedicated to those applications. The android Market features each free and priced apps. Android apps are written in the Java programming language and use Java core libraries. They're 1st compiled to Dalvik feasible to run on the Dalvik virtual machine, which may be a virtual machine specially designed for mobile devices. Developers might transfer the android software package development kit (SDK) from the android web site. The SDK includes tools, sample code and relevant documents for creating Android apps.

3.3.1 VOICE APPLICATION:

Fig 3.2: amr voice Android Apps.

3.4 BASIC DESCRIPTION OF CONTROLLER UNIT:

The controlled we are used in ardino hardware board with AVR microcontroller.This time with the help of arduino 1.6.8 plate from we can easily create a programAVR IC,arduino is an open source electronic platform based on flexible which to easy hardware software. The arduino UNO is mainly a microcontroller single chip which has 14 digital input output pin tha's contains 6 PWM and 6 are analog pins,All are requirements instruments are involved the arduino which are controlled a microcontroller. There are also a USB connector and a reset button and 6 MHz oscillator a power jacker all are include it..

3.4.1 TECHNICALSPECIFICATION ARDUINOUNO

Fig 3.3: Arduino UNO.

Microcontroller	ATmega328
Operating Voltage	5V
Supply Voltage (recommended)	7-12V
Maximum supply voltage (not recommended)	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 boot loader

SRAM	2 KB (ATmega328)

Table 3.2 Arduino Short Description

3.4.2 DESCRIPTION OF MICROCONTROLLER: ATMEGA328:

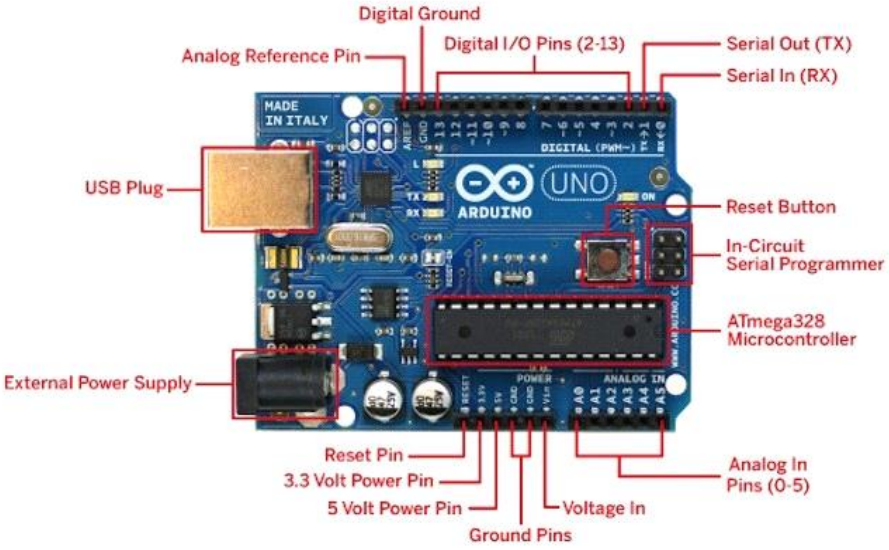

Fig 3.3(b): Arduino UNO

The Arduino Uno is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega8U2 programmed as a USB-to-serial converter. "Uno" means "One" in Italian and is named to mark the upcoming release of Arduino 1.0. The Uno and version 1.0 will be the reference versions of Arduino, moving forward. The Uno is the latest in a series of USB Arduino boards, and the reference model for the Arduino platform; for a comparison with previous versions, see the index of Arduino boards.

3.4.3 BLOCK DIAGRAM OF MICROCONTROLLER – (ATMEGA328):

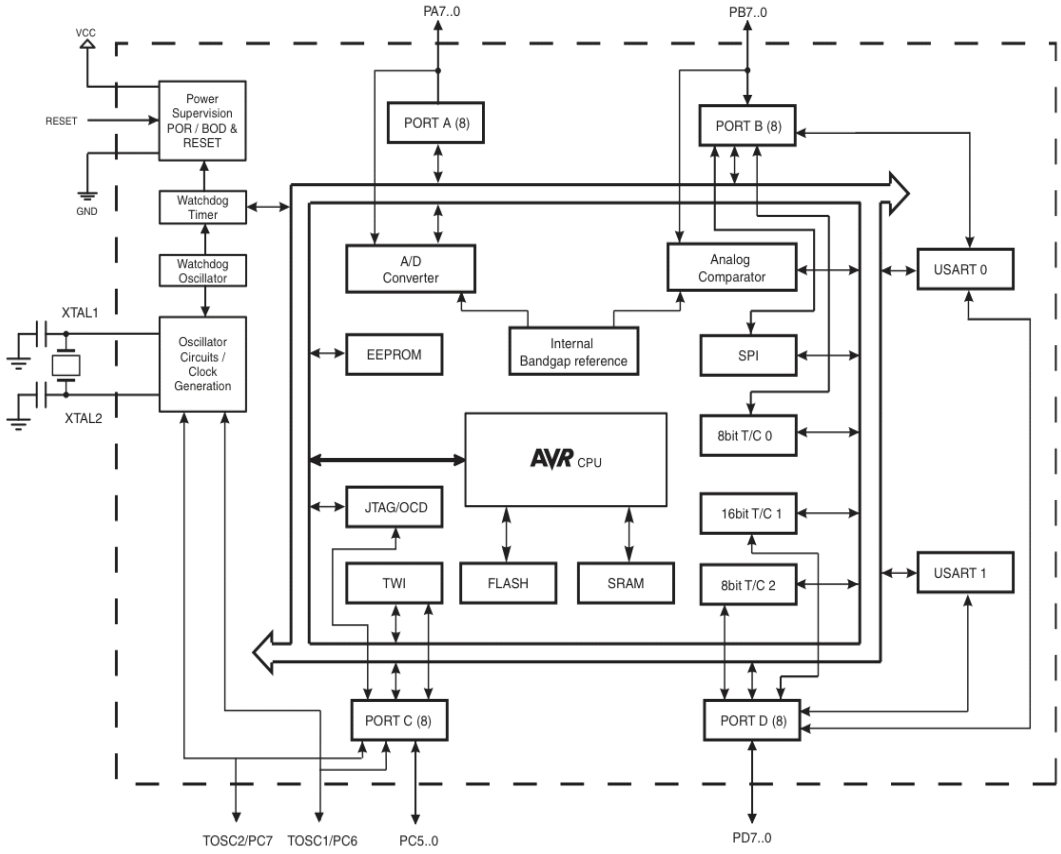

Fig. 3.3.1:Block Diagram ofMicrocontroller – (Atmega328)

3.4.4 PIN CONFIGURATIONS OF MICROCONTROLLER – (ATMEGA328):

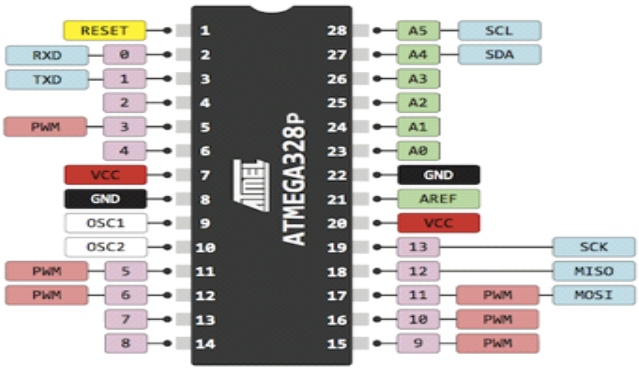

Fig. 3.3.2: Pin Configurations Of Microcontroller –(Atmega328)

3.4.5 PIN DESCRIPTIONS:

The below gives a description for each of the pins, along with their function:-

These pins are as follows:

• **VIN:**This pin basically input voltage to the arduino board when it is using an external power source.

• **5V:** This time used power supply to the microcontroller and other components in these board.

• **3V3:**The 3.3 voltage supplies generate under the on-board regulator.This time maximum 50mA current flowed.

• **GND:**Ground pins generated.

Input & Output of Arduino UNO:

Each of the 14 digital pins on the Mega can be used as an input or output, using pin Mode, digitalWrite, and digitalRead functions. They operate at 5 volts. Each pin can provide or receive a maximum of 40 mA and has an internal pull-up resistor (disconnected by default) of 20-50 kOhms. In addition, some pins have specialized functions:

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

• **External Interrupts:** 2 and 3. These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value.

• **PWM:**3, 5, 6, 9, 10, and 11. Provide 8-bit PWM output with the analogWrite() 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.

• **I 2C: 20 (SDA) and 21 (SCL).** The ATmega328 also supports I2C (TWI) and SPI communication. The Arduino Software (IDE) includes a Wire library to simplify use of the I2C bus.

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.

Memory: The Atmega 328 has 32 Kb of flash memory for storing code which 0.5 KB is used for the bootloader and 2 KB of SRAM and 1 KB of EEPROM which also be read and written with the EEPROM library.

3.5 L298N MOTOR DRIVER

L298N is a dual H-bridge motor driver. Motor drivers act as current amplifiers since they take a low-current control signal and supply a higher-current signal. This higher current signal is employed to drive the motors. L2938 contains 2 inherent H-bridge driver circuits. In its common mode of operation, 2 DC motors can be driven at the same time, each in forward and reverse direction. The motor operations of two motors can be controlled by input logic at pins 2 & 7 and

10 & 15. Input logic 00 or 11 will stop the corresponding motor. Logic 01 and 10 will rotate it in clockwise and anticlockwise directions, respectively.

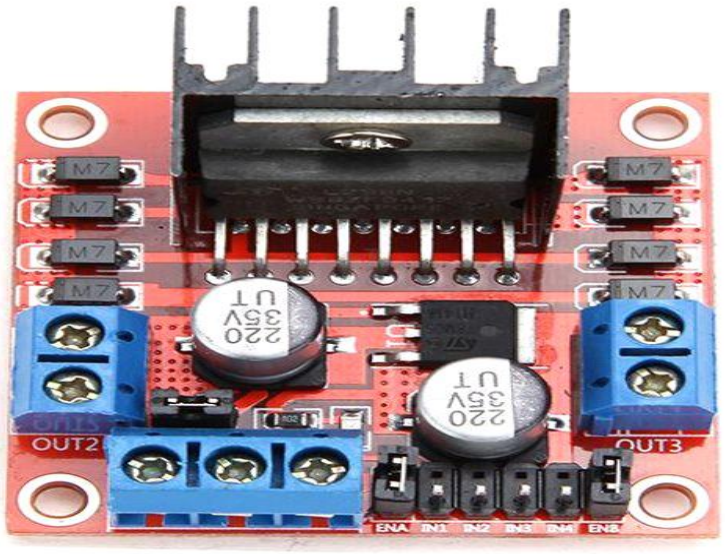

Fig 3.4: L298N Motor Driver

Enable pins ENA and ENB (corresponding to the two motors) must be high for motors to start operating. When an enable input is high, the associated driver gets enabled. As a result, the outputs become active and work in phase with their inputs. Similarly, when the enable input is low, that driver is disabled, and their outputs are off and in the high-impedance state.

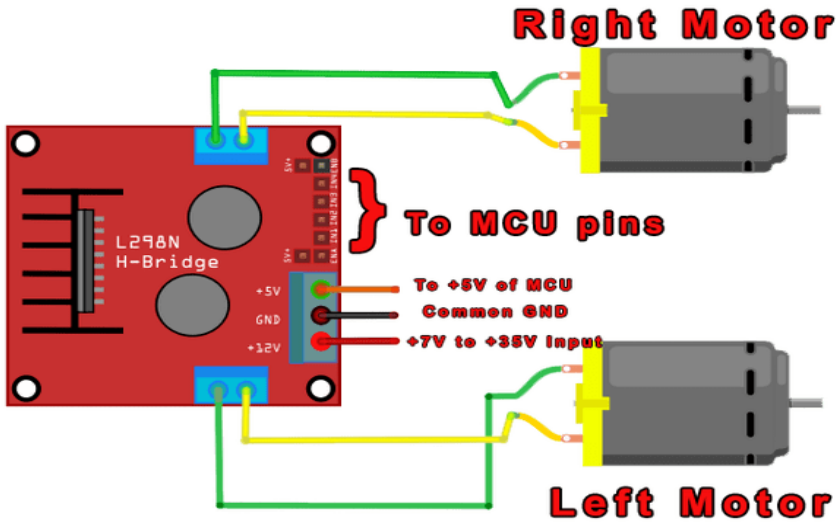

Fig 3.5:Schematic Interfacing of the L298N.

3.5.1 L298N CONNECTIONS

The circuit shown to the right is the most basic implementation of L298N motor driver. If we see the L298N motor driver pins and we have to understand the functionality of each pin before implementing this in a circuit.

MW.15	PowerSO	Name	Function
1;15	2;19	Sense A; Sense B	Between this pin and ground is connected the sense resistor to control the current of the load.
2;3	4;5	Out 1; Out 2	Outputs of the Bridge A; the current that flows through the load connected between these two pins is monitored at pin 1.
4	6	V_S	Supply Voltage for the Power Output Stages. A non-inductive 100nF capacitor must be connected between this pin and ground.
5;7	7;9	Input 1; Input 2	TTL Compatible Inputs of the Bridge A.
6;11	8;14	Enable A; Enable B	TTL Compatible Enable Input: the L state disables the bridge A (enable A) and/or the bridge B (enable B).
8	1,10,11,20	GND	Ground.
9	12	VSS	Supply Voltage for the Logic Blocks. A100nF capacitor must be connected between this pin and ground.
10; 12	13;15	Input 3; Input 4	TTL Compatible Inputs of the Bridge B.
13; 14	16;17	Out 3; Out 4	Outputs of the Bridge B. The current that flows through the load connected between these two pins is monitored at pin 15.
–	3;18	N.C.	Not Connected

Table 3.3 L298N driver pin specification

3.5.2 VOLTAGE SPECIFICATION

Symbol	Parameter	Value	Unit
V_S	Power Supply	50	V
V_{SS}	Logic Supply Voltage	7	V
V_I,V_{en}	Input and Enable Voltage	–0.3 to 7	V
I_O	Peak Output Current (each Channel) – Non Repetitive (t = 100µs) –Repetitive (80% on –20% off; t_{on} = 10ms) –DC Operation	 3 2.5 2	 A A A
V_{sens}	Sensing Voltage	–1 to 2.3	V
P_{tot}	Total Power Dissipation (T_{case} = 75°C)	25	W
T_{op}	Junction Operating Temperature	–25 to 130	°C
T_{stg}, T_j	Storage and Junction Temperature	–40 to 150	°C

Table 3.4 L298N driver voltage specification

3.6: DESCRIPTION OF LCD DISPLAY 16x2

Using the LCD(Liquid Crystal Display) is a thin which is flat and made of any number of color or monochrome pixelsin front of a source of light or reflector. Every pixel consists of a column of liquid crystal molecules suspended between two transparent electrodes, and two polarizing filters, the axes of polarity of which are perpendicular to each other. LCD display is not enabled, data lines are tri-state and they do not interfere with the operation of the microcontroller. Data can be placed at any location on the LCD. For 16×1 LCD, the address locations are:

POSITION		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
ADDRESS	LINE1	00	01	02	03	04	05	06	07	40	41	42	43	44	45	46	47

Table 3.5: Address locations for a 1x16 line LCD

3.6.1 SHAPES AND SIZES:

Even limited to character based modules, there is still a wide variety of shapes and sizes available. Line lengths of 8, 16,20,24,32 and 40 characters are all standard, in one, two and four line versions.

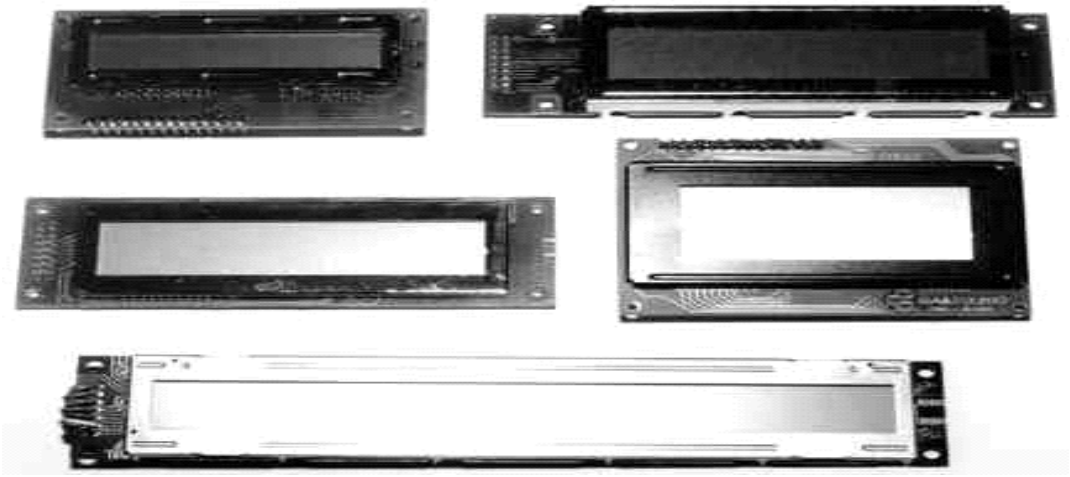

Fig 3.6: LCD Different Models.

Several different LC technologies exist. “Supertwist” types, for example, offer improved contrast and viewing angle over the older “twisted nematic” types. Some modules are available with back lighting, so so that they can be viewed in dimly-lit conditions.

3.6.2 PIN DESCRIPTION:

Most LCDs with 1 controller has 14 Pins and LCDs with 2 controller has 16 Pins (two pins are extra in both for back-light LED connections).

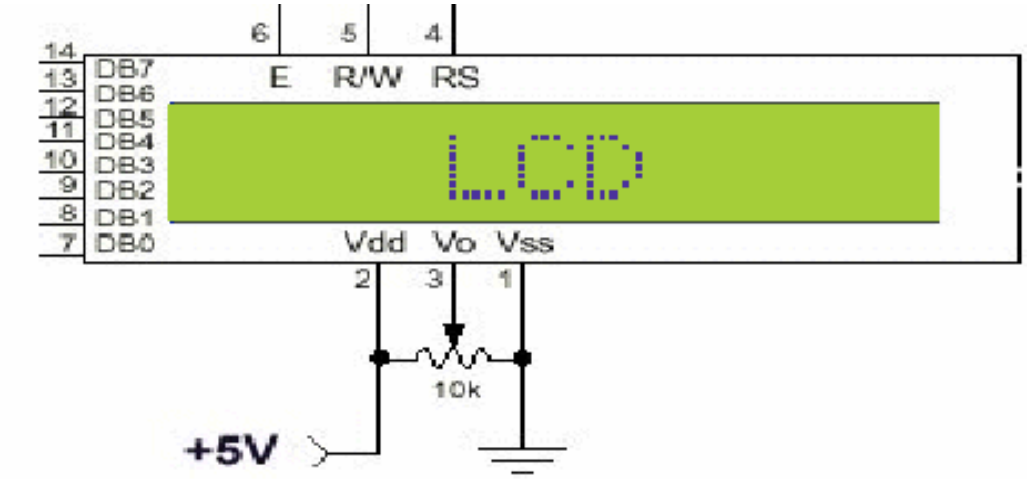

Fig 3.7: Pin Diagram of 1x16 lines LCD

PIN	SYMBOL	FUNCTION
1	Vss	Power Supply(GND)
2	Vdd	Power Supply(+5V)
3	Vo	Contrast Adjust
4	RS	Instruction/Data Register Select
5	R/W	Data Bus Line
6	E	Enable Signal
7-14	DB0-DB7	Data Bus Line
15	A	Power Supply for LED B/L(+)
16	K	Power Supply for LED B/L(-)

Table 3.6: Pin Description of LCD

3.6.3 CONTROL LINES:

EN: Line is called "Enable." This control line is used to tell the LCD that you are sending it data. To send data to the LCD, your program should make sure this line is low (0) and then set the other two control lines and/or put data on the data bus. When the other lines are completely ready, bring EN high (1) and wait for the minimum amount of time required by the LCD datasheet (this varies from LCD to LCD), and end by bringing it low (0) again.

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

RW: Line is the "Read/Write" control line. When RW is low (0), the information on the data bus is being written to the LCD. When RW is high (1), the program is effectively querying (or reading) the LCD. Only one instruction ("Get LCD status") is a read command. All others are write commands, so RW will almost always be low.Finally, the data bus consists of 4 or 8 lines (depending on the mode of operation selected by the user). In the case of an 8-bit data bus, the lines are referred to as DB0, DB1, DB2, DB3, DB4, DB5, DB6, and DB7.

3.6.4. INITIALIZATION BY INSTRUCTIONS:

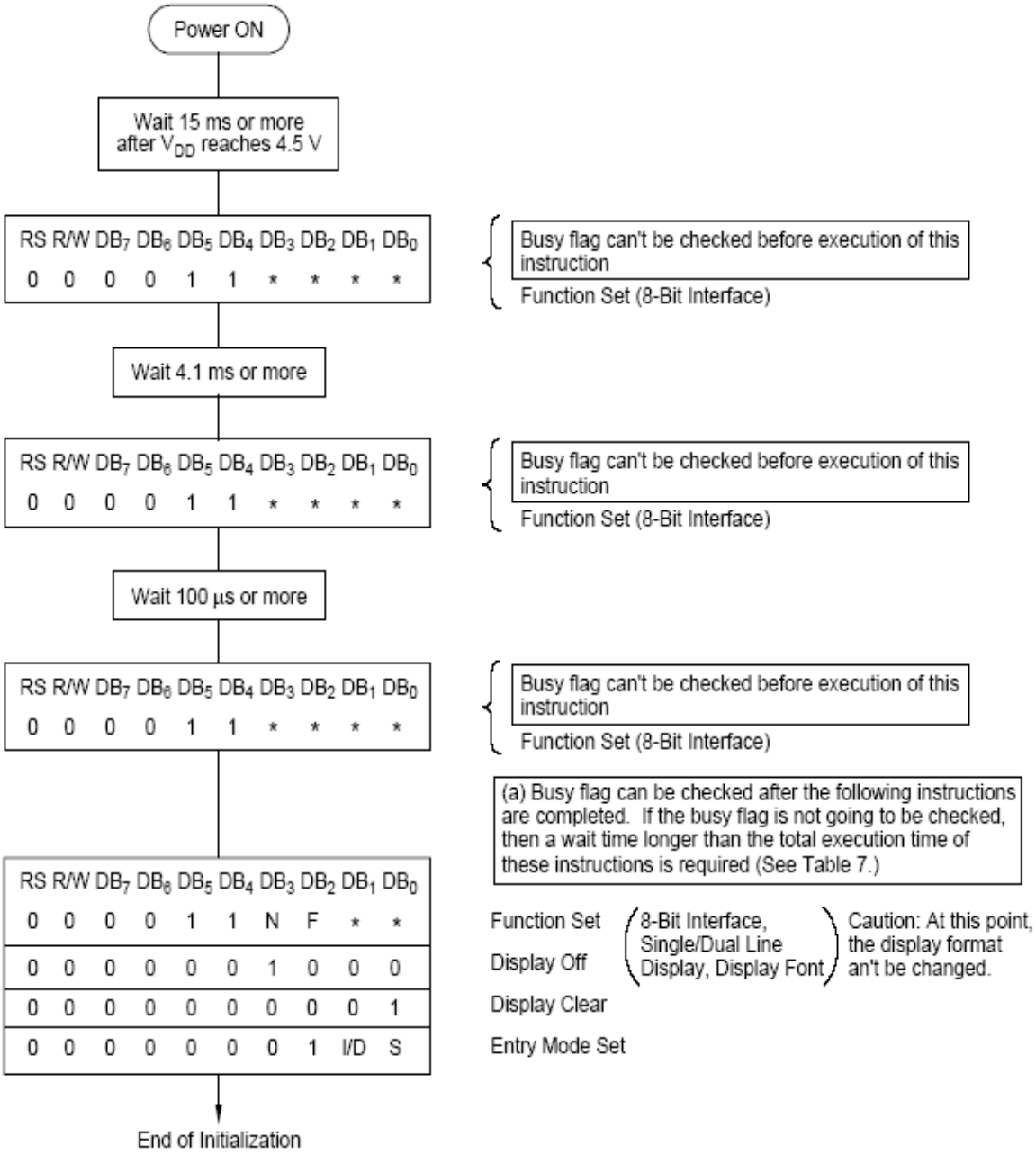

Fig 3.8.: Flow Chart of Installation

3.7 DC MOTOR

A DC motor is designed to run on DC electric power. Two examples of pure DC designs are Michael Faraday's homopolar motor (which is uncommon), and the ball bear in motor, which is (so far) a novelty. By far the most common DC motor types are the brushed and brushless types, which use internal and external commutation respectively to create an oscillating AC current from the DC source -- so they are not purely DC machines in a strict sense.

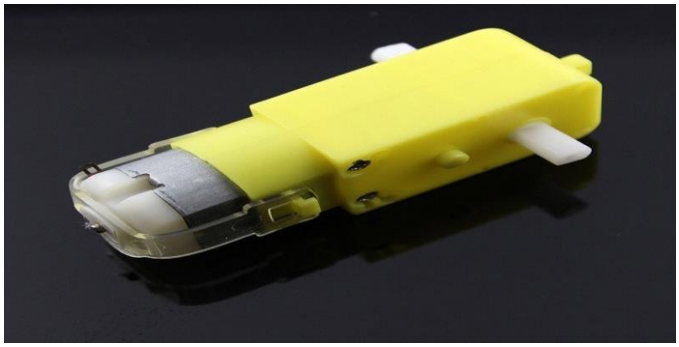

Fig 3.9: DC Motor.

3.7.1 TYPES OF DCMOTORS

- Brushed DC Motors
- Brushless DC motors
- Coreless DC motors

3.7.2 WORKING OR OPERATING PRINCIPLE OF DC MOTOR

A DC motor in simple words is a device that converts direct current (electrical energy) into mechanical energy. It's of vital importance for the industry today, and is equally important for engineers to look into the working principle of DC motor in details that has been discussed in this article. In order to understand the operating principle of dc motor we need to first look into its constructional feature. The very basic construction contains a current carrying armature which is connected to the supply end through commutator segments and brushes and placed within the north south poles of a permanent or an electro-magnet as shown in the diagram below.

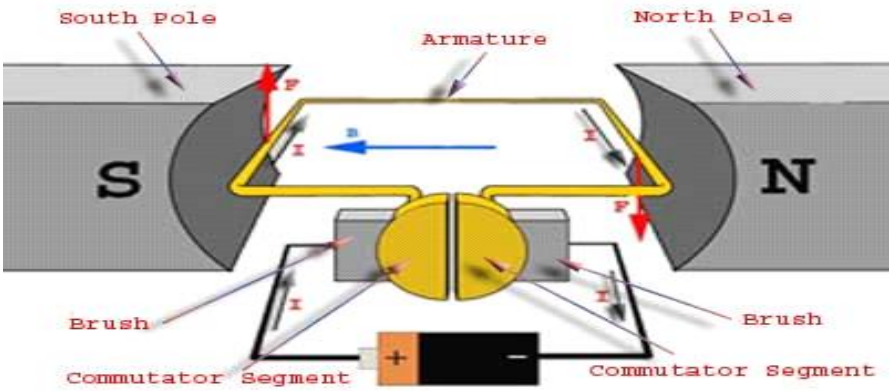

Fig 3.10: Operation of DC Motor.

For clear understanding the principle of DC motor we have to determine the magnitude of the force, by considering the diagram below.

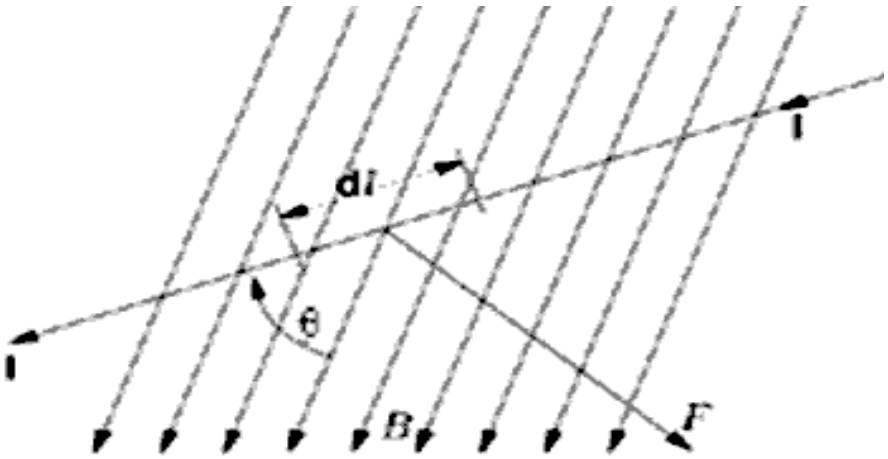

Fig 3.11: Magnitude of the force for DC Motor.

We know that when an infinitely small charge dq is made to flow at a velocity 'v' under the influence of an electric field E, and a magnetic field B, then the Lorentz Force dF experienced by the charge

3.8 BASIC ARDUINO SOFTWARE:

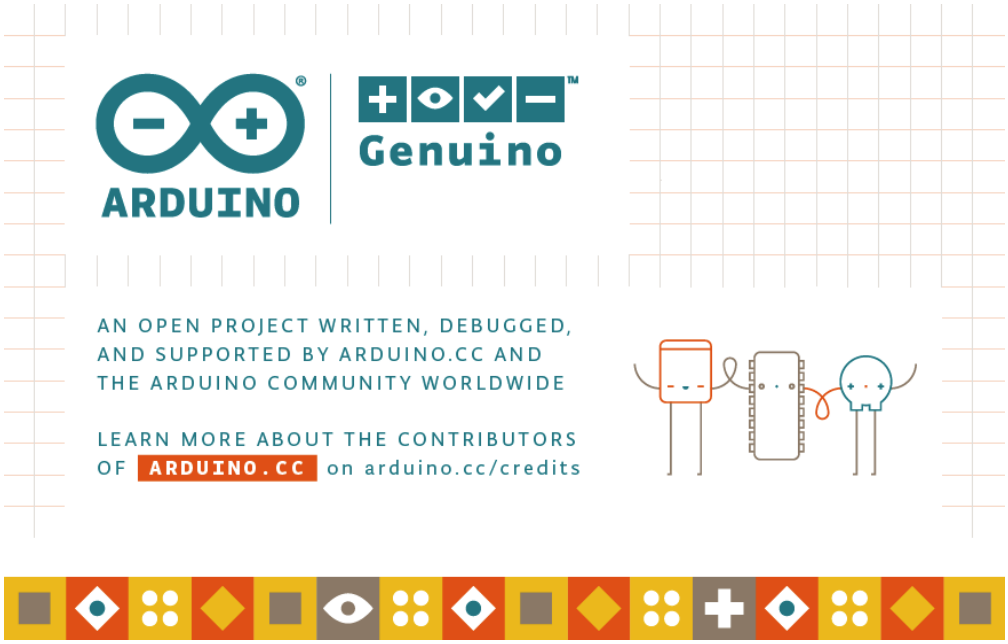

Fig 3.12: Arduino Software

The Arduino software is published as open source tools, available for extension by experienced programmers. The language can be expanded through C++ libraries, and people wanting to understand the technical details can make the leap from Arduino to the AVR C programming language on which it's based. Similarly, we can add AVR-C code directly into our Arduino programs if we want to.

3.8.1 FEATURES OF ARDUINO SOFTWARE:

- File
- Edit
- Sketch
- Tools
- Help

Sketchbook

The Arduino Software (IDE) uses the concept of a sketchbook a standard place to store our programs (or sketches). The sketches in our sketchbook can be opened from the **File** > **Sketchbook** menu or from the **Open** button on the toolbar. The first time we run the Arduino software, it will automatically create a directory for our sketchbook. We can view or change the location of the sketchbook location from with the **Preferences** dialog.

Beginning with version 1.0, files are saved with a .ino file extension. Previous versions use the .pde extension. We may still open .pde named files in version 1.0 and later, the software will automatically rename the extension to .ino.

Tabs, Multiple Files, and Compilation

Preferences

Some preferences can be set in the preferences dialog (found under the **Arduino** menu on the Mac, or **File** on Windows and Linux). The rest can be found in the preferences file, whose location is shown in the preference dialog.

3.9 WIRES:

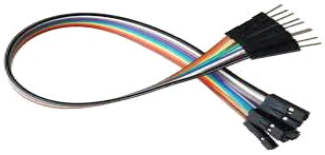

Fig 3.12(a): Female to Male Jumper Wire. Fig 3.12(b): Male to Male jumper

3.10 POWER SUPPLY 12V:

The robot are powered from 12v lipo battery. The internal circuitry of an external power supply is very similar to the design that would be used for a built-in or internal supply. External power supplies are used both with equipment with no other source of power and with battery-powered equipment, where the supply, when plugged in, can sometimes charge the battery in addition to powering the equipment. Use of an external power supply allows portability of equipment.

Fig 3.13: 12v Power supply

3.10.1 SPECIFICATIONS:

- Capacity: 1100mAh
- Voltage: 11.1V (3S)
- Discharge Rating: 30C
- Charge Rate: 2C
- Dimensions: 138x46x35.5mm
- Weight: 300g

3.11 COST ANALYSIS

In this section we will show cost of our project that means cost sheet representation of our project.

3.11.1 COST SHEET:

No	Component Name	Quantity	Purchase Price (TK)
01	Bluetooth Module(HC-05)	1	350.00
02	Arduino UNO	1	450.00
03	L298N motor driver	1	400.00
06	Amr voice app	1	Free
07	Battery and charger	1	1900.00
08	Arduino Software	1	Free
09	Wires	8	100.00
10	Pvc board	1	200
11	Servo motor	1	180

12	Others		500
	Total Cost		**=4080.00**

Comparison:-

Our all components are available in market. We get all components are very reasonable price. So that we make this project more cost efficient.

3.12 CONCLUSION

Five main Component & some tools are used in this system to makes it .This Project is used to control the house appliances. Our all component are very simple &available in our country market.

CHAPTER 4

SOFTWARE ANALYSIS

4.1 INTRODUCTION

In this chapter the software used and the language in which the program code is defined is mentioned and the program code dumping tools are explained. The chapter also documents the development of the program for the application.

4.2 DESCRIPTION OF OUR SOFTWARE

The open-source Arduino environment makes it easy to write code and upload it to the I/O board. It runs on Windows, Mac OS X, and Linux. The environment is written in Java and based on Processing, avr-gcc, and other open source software. The screen shot of Arduino 1.6.8 is shown below…

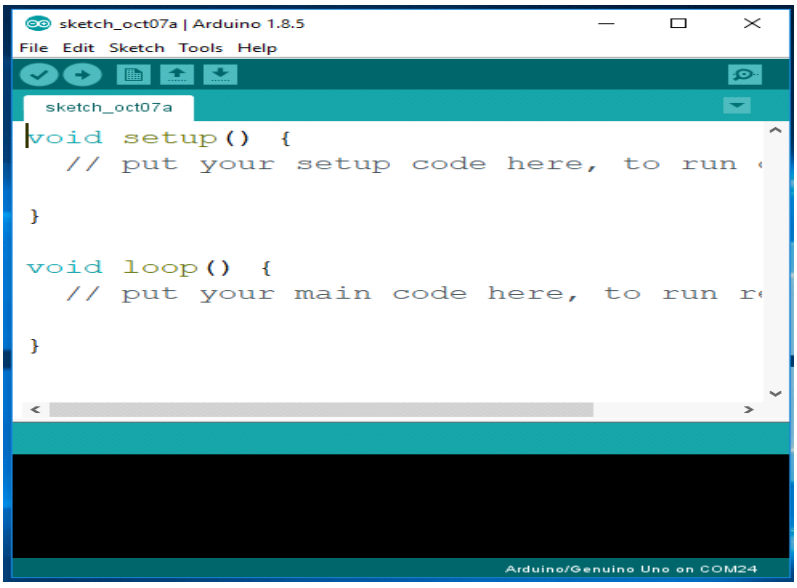

Fig. 4.1: Software Platform

It is also capable of compiling and uploading programs to the board with a single click. There is typically no need to edit make files or run programs on a command-line interface. Although building on command-line is possible if required with some third-party tools such as Ino.The

Arduino IDE comes with a C/C++ library called "Wiring" (from the project of the same name), which makes many common input/output operations much easier. Arduino programs are written in C/C++, although users only need define two functions to make a runnable program:

setup() – a function run once at the start of a program that can initialize settings

loop() – a function called repeatedly until the board powers off

The compiled window of our code is shown below.

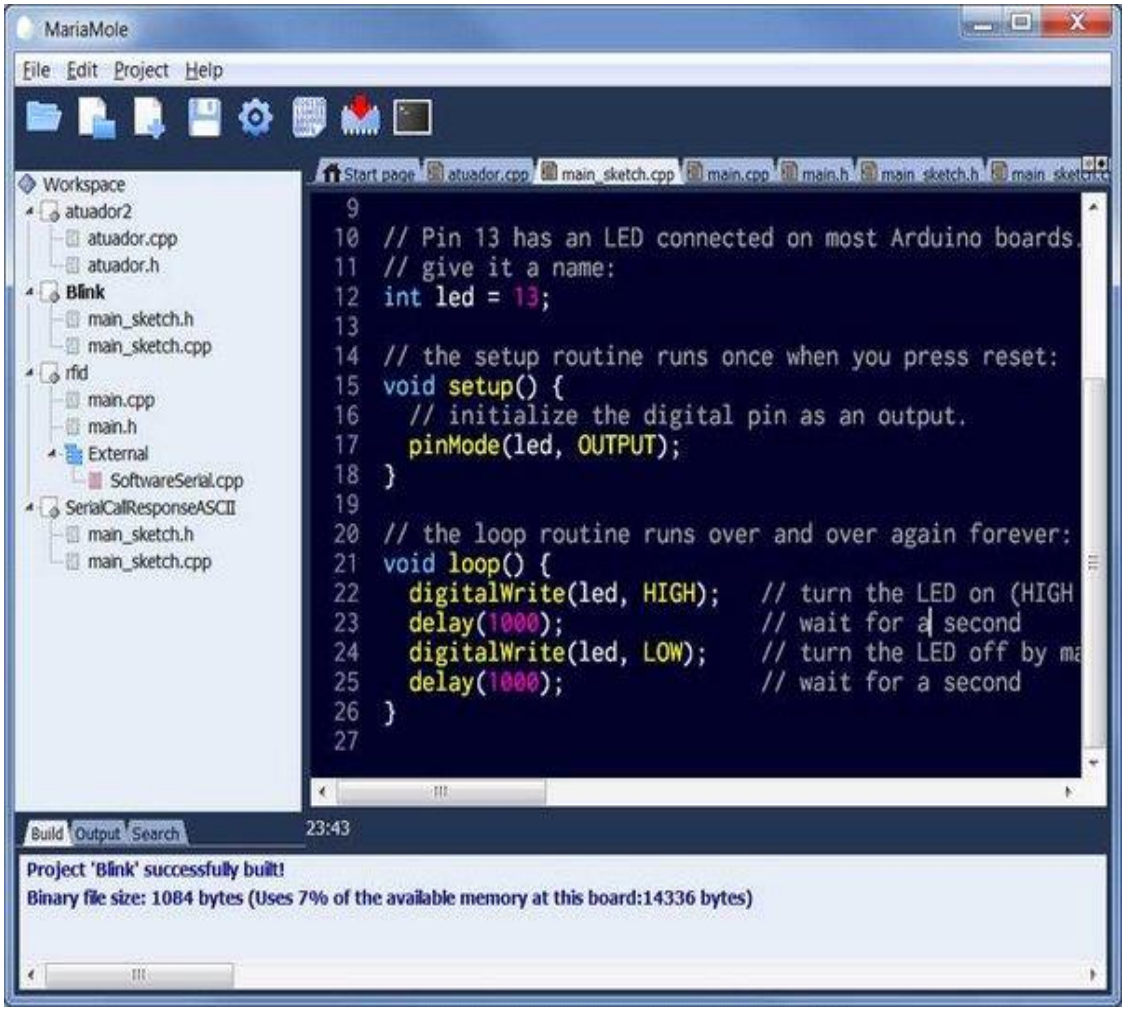

Fig. 4.2: Compiling window

4.3 Flow Chart Diagram

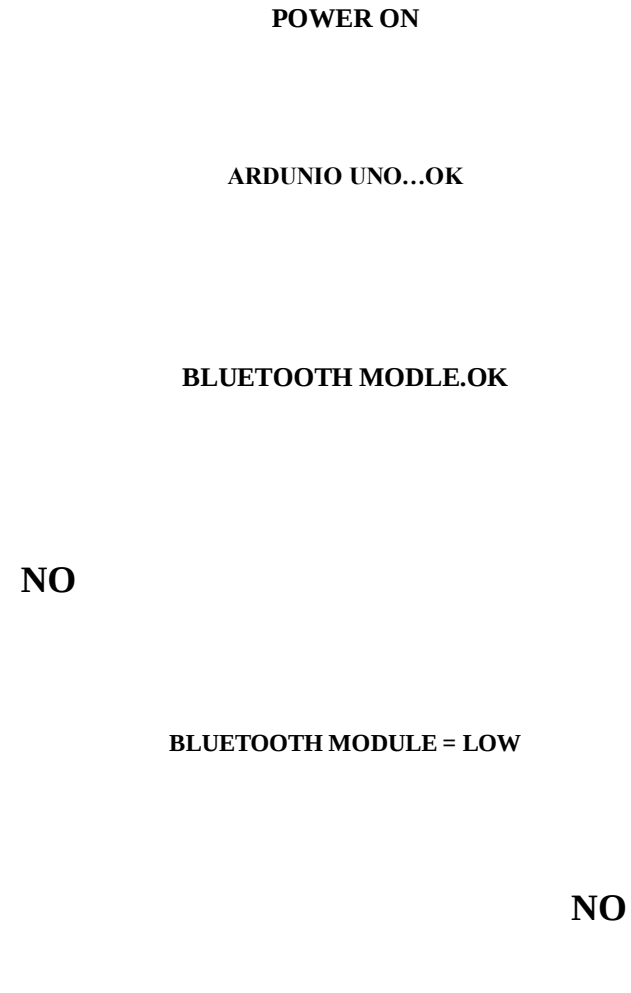

Fig. 4.3: Flow chart of our system

4.4 CONCLUSION

The system software developed in Embedded C, C++ language which has the ability of receiving the data from sensor and transmitting the data, and controls all the Robot that connected. Because of its low power consumption, easy usage, reliability it is used in other fields. Software analysis is a very important part of our system. A Software analysis makes sure good design. A proper Software analysis and its burn into arduino Uno the project to a smooth end.

CHAPTER 5

SCHEMATICREPRESENTATION

5.1 INTRODUCTION

A schematic, or schematic diagram, is an illustration of the elements of a system using abstract, graphic symbols instead of realistic pictures. A schematic sometimes omits all details that aren't relevant to the knowledge the schematic is intended to convey, and will add unrealistic parts that aid comprehension. For example, a subway map intended for riders may represent a subway station with a dot; the dot doesn't resemble the actual station at all but gives the viewer information without unnecessary visual clutter. A schematic diagram of a chemical process uses symbols to represent the vessels, piping, valves, pumps, and other equipment of the system, emphasizing their interconnection paths and suppressing physical details. In an electronic circuit diagram, the layout of the symbols may not resemble the layout in the physical circuit. In the schematic diagram, the symbolic elements are arranged to be more easily interpreted by the viewer. A circuit diagram (also known as an electrical diagram, elementary diagram, or electronic schematic) is a simplified conventional graphical representation of an electrical circuit. A pictorial circuit diagram uses simple images of components, while a schematic diagram shows the components of the circuit as simplified standard symbols; both types show the connections between the devices, including power and signal connections. Arrangement of the components interconnections on the diagram does not correspond to their physical locations in the finished device.

5.2 SCHEMATIC DIAGRAM

In the previous chapters we got an idea about project block diagram and functions of each block in detail. In this chapter we seen schematic representation of the project and various components what are involved in this project. The below figure shows the schematic representation of the project.

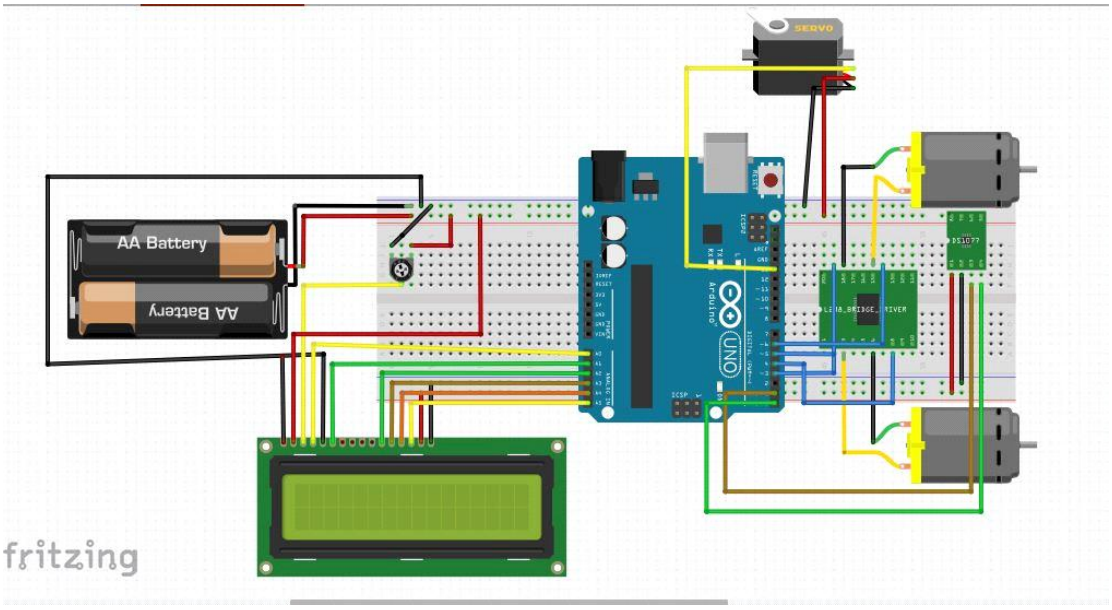

Fig 5.1: Circuit Diagram

After seen the above diagram we have an idea about each and every pin connection of microcontroller involves in the project. The wire connections in the project are very important.

The various components involved in this project are:

- CRYSTAL OSCILATOR
- RESISTORS
- SWITCHES
- MOTORS
- WHEELS

- PVC BOARD
- SONAR
- SERVO
- LCD
- MICROCONTROLLER
- DRIVER MODULE
- REGULATOR
- CONNECTIG WIRES
- BATTERY AND CHARGER

5.2.1 CRYSTAL OSCILLATOR

It is an electronic circuit that uses the mechanical resonance of a moving crystal of piezoelectric material to make an electrical signal with a awfully precise frequency. This frequency is often accustomed keep track of your time (as in quartz wristwatches), to supply a stable clock signal for digital integrated circuits, and to stabilize frequencies for radio transmitters. Using an amplifier and feedback, it is an especially accurate form of an electronic oscillator. In this project crystal oscillator frequency is 11.0592 MHz. The below figure shows the crystal oscillator.

Fig 5.2: Crystal Oscillator

5.2.2 RESISTOR

The resistor is a passive electrical component which create resistance for flowing electric current .Almost all are electrical networks and electronic circuits which can be found .The resistance in measuren in ohms, an ohms is the resistance tat occurs when a current of one ampere passes through a resistor within one voltage drop across it's terminals.Basically resistor are used in many purpose ssuch as current ,voltage division heat generation, matching and loading circuits.

5.2.3 SWITCHES

In engineering switch plays a important role that can break an electrical circuit delivering one conductor to another conductor.The most identical to manually controlled to electromechanical device eith one or more sets of electrical external circuits.Each contacts can be two states one is open and another is closed. Open means contacts are separate and switch is no conducting and closed means contacts are touching and electricity flow between them.Switches are the depends upon the closed conduct and open conduct

5.2.4 MOTORS

A DC motor is an electric motor which runs that an direct electric power. Mainly any electric motor operation depends upon the electromagnetism. A current carrying conductor produces a magnetic field and torque when it is placed in an external magnetic field. Examples of pure DC are Michael Faraday's homo polar motor (which is uncommon), and the ball bear in motor, By far the most common DC motor types are the brushed and brushless types. In any electric motor, operation is based on simple electromagnetism. Mainly it converts electrical energy to mechanical energy.

5.2.5 LCD

LCD means liquid crystal display is a flat display made up of colour or pixels front of a light source .It;s the common that an LCD disply controlled a attached device.Every pixels consist of a column of liquid crystal display between two transparent electrodes. The LCD which connected to the controller 16X1 and two polarizing filters. The specific given commands output will show the display.It depends upon the execute program.

5.2.6 MICROCONTROLLER

The true computer on a chip is nothing but a microcontroller. The design incorporates all of the features found in a microprocessor CPU, ALU, PC, SP and registers. It also had added the other features needed to make a complete computer. ROM, R AM, parallel I/O, serial I/O, Counters and a clock circuits.In this project we used Atmel 328**µC**. The Atmel 328 is a low-power, high-performance 8-bitmicrocontroller with 32K bytes of in-system programmable Flash memory. It is a Atmel microcontroller family.

5.2.7 DRIVER MODULE

L298N is a dual H-bridge motor driver module. Motor drivers act as current amplifiers since they take a low-current control signal and provide a higher-current signal. This higher current signal is used to drive the motors. L298N is a dual H-Bridge motor driver, So with one motor driver we can interface two DC motors which can be controlled in both clockwise and counter clockwise direction and if you have motor with fix direction of motion the you can make use of all the four I/O s to connect up to four DC motors.

5.2.8 CHARGED BATTERIES

Batteries are used to give a electric supply to run the electronic devices,machines,to run the vehicles.Batteries are also helpful in storage purpose. When power supply is not available then we will follow the storage batteries or batteries. Batteries are low cost, can be rechargeable. No expansive.

5.2.9 REGULATOR

A voltage regulator is an electrical regulator designed to automatically maintain a constant voltage level. Electronic voltage regulators are found in devices such as computer power supplies where they stabilize the DC voltages used by the processor and other elements. In automobile alternators and central power station generator plants, voltage regulators control the

output of the plant. In an electric power distribution system, voltage regulators may be installed at a substation or along distribution lines so that all customers receive steady voltage independent of how much power is drawn from the line

5.2.10 CONNECTING WIRES

A wire is a single, usually cylindrical, flexible strand or rod of metal. Wires are used to bear mechanical loads or electricity and telecommunications signals. Wire is commonly formed by drawing the metal through a hole in a die or draw plate. Wire gauges come in various standard sizes, as expressed in terms of a gauge number. The term *wire* is also used more loosely to refer to a bundle of such strands, as in 'multistranded wire', which is more correctly termed a wire rope in mechanics, or a cable in electricity.

5.3 CONCLUSION

From this chapter we conclude that schematic, or schematic diagram, is a representation of the elements of a system using abstract, graphic symbols rather than realistic pictures. A schematic usually omits all details that are not relevant to the information the schematic is intended to convey. Fig 6.1 shows the schematic diagram of voice control robot through android. This fig shows the overall project representation of the project and we are able to know in which way every pin of the microcontroller involves in this project. And also we are discussed about each component in this project. Fig 6.1 shows the schematic diagram of voice control robot through android. This fig shows the overall project representation of the project and we are able to know in which way every pin of the microcontroller involves in this project. And also we are discussed about each component in this project.

CHAPTER 6

RESULT AND DISCUSSION

6.1 INTRODUCTUION

In this chapter we'll discuss regarding the assembling process of voice control robot through android and assembling method. During this we'll additionally discuss regarding android, android applications. However the humanoid are going to be helpful during this project. That android applications are utilized in this project? Within the android applications however the commands are used to control the robots and additionally during this chapter we'll discuss regarding robot's operating mechanism. They're briefly explained below.

6.2 ASSEMBLING THE BOARD

The chassis used for this thesis is hand made in home with pvc board with relatively use in making Chassis, which is widely used for robotics project. It is a very simple robot platform which consists of four gear motors and wheels and many constructing elements like screws.

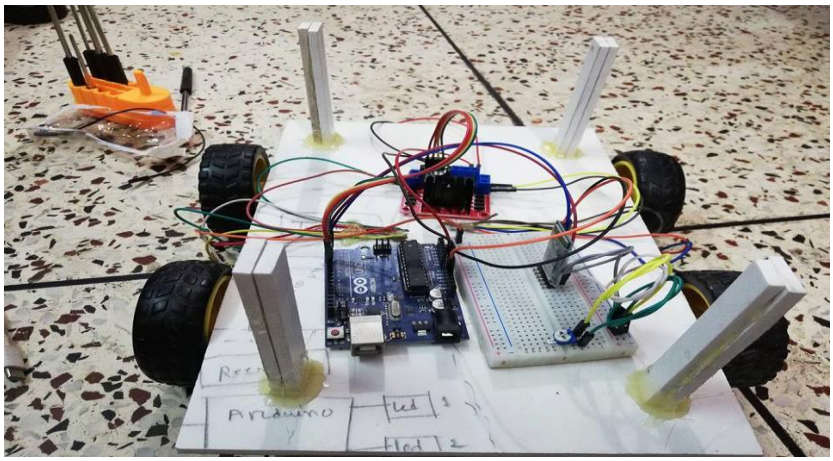

Fig 6.1: Hardware board

6.2.1 ASSEMBLING PROCESS

Assembling the chassis may take some time but it comes with detailed information so it is not difficult to assemble the parts. There are numbered screws and the plates have numbered mounting holes for the equivalent screws. The figures below show the process of assembling.

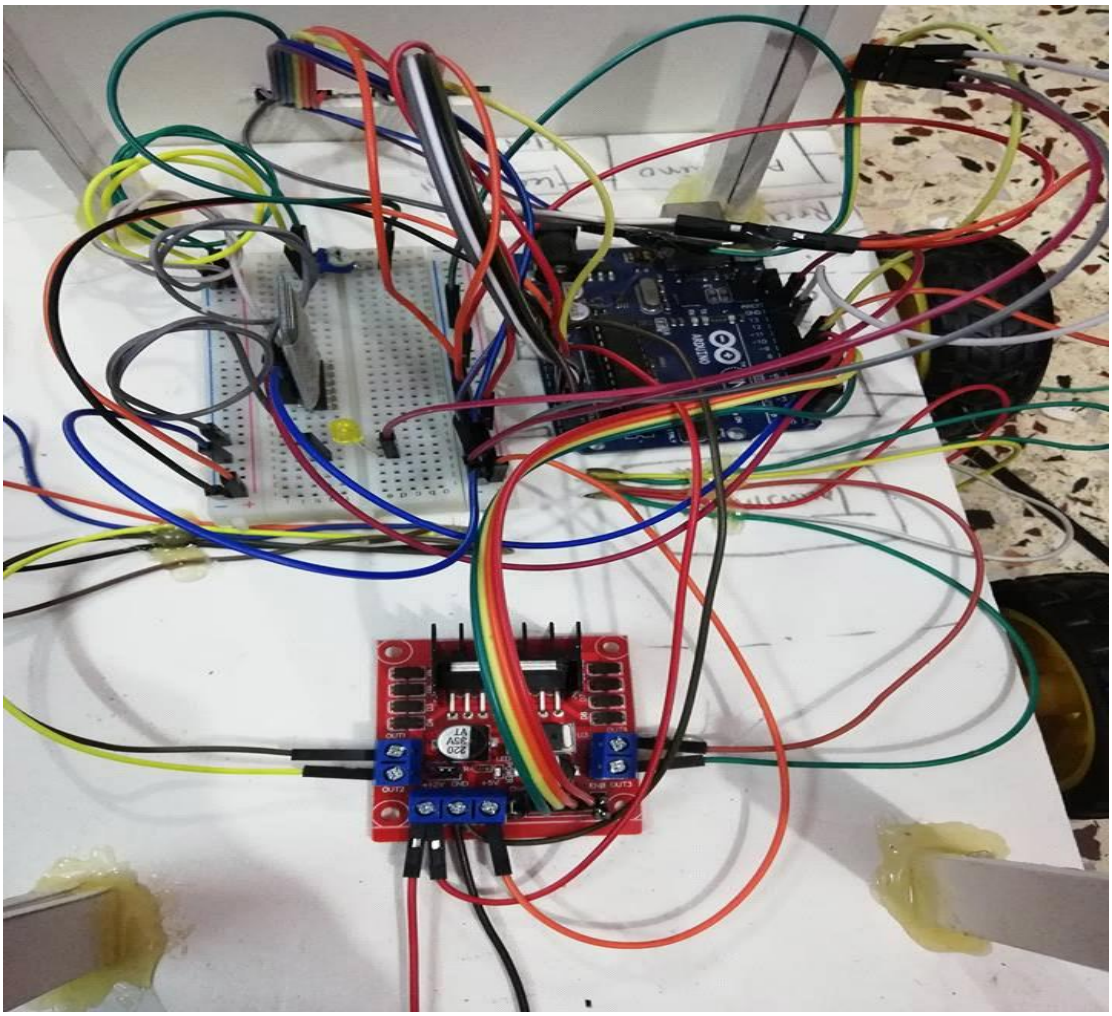

Fig 6.2: Circuit Board

6.2.2 COMPLETION OF ASSEMBLING PROCESS

The final product on the picture below is the framework for the robot movement which can gain the momentum if connected to the power source. But for certain control of the momentum it needs different elements. Thus, the elements required for the control are explained in part two.

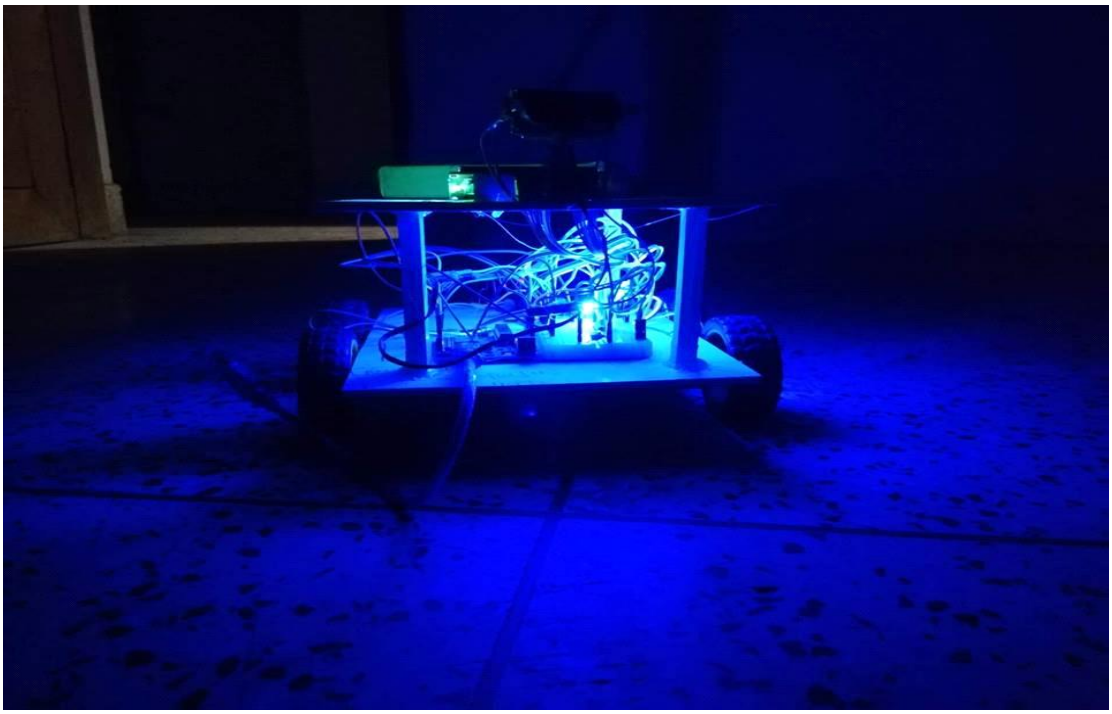

Fig: 6.2.1 Our Project

6.3 ANDROID APPLICATIONS

The android application designed for this thesis. It was designed through App Inventor. The basic function of the application is to control the robot (created with Arduino and Magician Chassis).these android applications are used to design. They are given as follows

- Bluetooth spp test. ii) BluetoothAMR (Android meets robot)

6.3.1 BLUETOOTH SPP TEST

Bluetooth SPP test is a android application to move robot.It is also available in Google play store. In this applications we will run the robot by using a commands like 2,4,6,8,5.in this application 2 is used to move the robo forward,4 is to move left side,6 is used to move right

side,8 is used to move backward.5 is used to STOP. These are the commands used for moving robot.

6.3.2 BLUETOOTH AMR (ANDROID MEETS ROBOT).

It is also a android application to move robo.It is also available in Google play store. Inthis application we will run the roboby using a voice commands. By using this applicationwe will give voice commands only. In this application we will not give typing commands.

6.4 ROBOT'S WORKING MECHANISM

The working mechanism of the robot is based on the information passed from the android mobile phone via Bluetooth connection to the robot using a Bluetooth modem and vice versa. When will give a commands by android phone that will transmitt and receive the information signals.by giving a commands it will move in the given command direction.here is the power supply is given to robot by eco friendly solar panel and storage batteries.by using both solar panel and batteries we are capable to run the robo. If there is no power or no light energy then power supply is used as vice versa.

6.5 TESTING

From the following commands our robot will be follows. The following commands are same as both android apps. What we given to robot via android whther it is voice command or touch command the following commands are same for the robot movement.

COMMAND	ROBOT MOVEMENT
Go back	BACKWARD
Turn left	LEFT
Stop	STOP

Turn right	RIGHT
Go ahead	FORWARD

Table 6.1: Testing Result

6.6 CONCLUSION

In this chapter we were discussed about the assembling process of voice control robot. In this chapter we were discussed about android, android applications. How the android applications are used in this project. In this chapter we will discuss about robot's working mechanism.

CHAPTER 7

CONCLUSION

7.1 APPLICATIONS:

Certainly we believed that a system would be find wide varite of applicable.Many driver systems like as toys specially household applications like as washing machine, microwaven and pagers and mobile many other form which will controlled by voice android apps in next.

7.1.1 HOME AUTOMATION

Nowadays due to much highest affordable and simplicity through out smartphones and tab connectivity respectively.Recently the popularities of the home automation increasing greatly in recent years.

7.1.2 WHEELCHAIRS:

Mainly to operate our project the robot is controlled by a giving a specific commands in amr voice apps. From giving the commands the robot will be move or stop.

Fig 7.1: Wheelchair Applications

7.1.3 SURVEILLANCE DEVICE:

Surveillance is the monitoring of the behavior, activities, or other changing information, usually of people for the purpose of influencing, managing, directing, or protecting them. This can include observation from a distance by means of electronic equipment (such as CCTV cameras).

7.1.4 MILITARY APPLICATIONS:

Our robot is mobile robot which plays an important role in military matters.With the suitable sensor and smooth camera these robots are operated. All the work will be the firms are getting easily from the mobile robot.

Fig 7.2: Military Applications

7.1.5 INDUSTRIAL PURPOSE

Material handling is the most popular application with 38% of operational stock of industrial robots worldwide. This includes machine tending, palatalizing and various operations for metal machining and plastic mounding.In cement industries machines are operated by robos. To reduce the useof labors robots are used in loading purpose.

7.2 ADVANTAGES

- Using this robot we can controlled live video feed under giving specific commands.
- It can also be used to known any multiple ways such as clockwise, anticlockwise, forward and backward direction.
- In industries purpose we contolled many oter machine by it.
- This robot is used in hazardous place.
- Execute can program make them to do exactly what I want to do something.
- You can send them to very dangerous places.
- They can do well something for job sectors..
- They can perform task faster than human beingso it will be worked any place.
- We send it a dangerous place where are people are not reached.
- They can also used in physically treatment person for helping moving.
- They can reduce the labor work in industry by it portable takes the load from one place to another place. They able to work always 24x7.

7.3 DISADVANTAGES

It will be very expensive to do better fabrication.

- For produce it exact material that's the demerit also.
- Execute this project very hard to program.
- You need highly trained people to make them.
- People can lose jobs in factories.
- It needs maintenance to keep it running.

7.4 FUTURE SCOPE:

The main object such robot system is to assist individuals with motor disabilitiesit controlling completely.In future time we use a secured wireless channel using secret writing and cryptography.There are many scope will be held in future such as AI movements speech to text translation and lots of additional.It also be in agricultural scope to additionally developed under artificial intelligence.In future larger bandwidth systel will be developed by this project. There are a number of interfacing applications might be created for home applications. In future industries, home automobile machine, agriculture is additionally developed by artificial intelligence.

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- **https://www.robotshop.com/community/robots/show/voice-control-arduino-robot**
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- **https://components101.com/wireless/hc-05-bluetooth-module**
- **https://amr-voice.en.aptoide.com/**
- **Scribd.com, the world's largest online library. URL:http://www.scribd.com**
- **Encyclopedia of regulators, capacitors, diodes, resistors**
- **http://www.morldtechgossips.com simple way of understand**
- **Other websites**
- **http://www.elprocus.com/solar-panel-facts/**
- **http://org.ntnu.no/solarcells/pages/introduction.php**
- **http://www.facstaff.bucknell.edu**
- **http://hyperphysics.phy-astr.gsu.edu/hbase/electronic/leds.html**
- **www.national.com**
- **www.atmel.com**
- **www.microsoftsearch.com**
- **www.geocities.com**

APPENDIX A

```
#include <LiquidCrystal.h>
#include <Servo.h>
String voice;
int
in1 = 2, //MORTORPIN 1 To Pin #2
in2 = 3, //MOTORPIN 2 To Pin #3
in3 = 4, //MOTORPIN 3 To Pin #4
in4 = 5, //MOTORPIN 4 To Pin #5
IN5 = 6, // RED LED
IN6 = 7; // GREEB LED
```

```
//-------------------------Call A Function------------------------------//
const int rs = A5, en = A4, d4 = A3, d5 = A2, d6 = A1, d7 = A0;
LiquidCrystal lcd(rs, en, d4, d5, d6, d7);
int i = 0;
int pos;
Servo myServo;
void setup() {
  Serial.begin(9600);
  lcd.begin(16, 2);
  myServo.attach(10);
  myServo.write(90);
  pinMode(in1, OUTPUT);
  pinMode(in2, OUTPUT);
  pinMode(in3, OUTPUT);
  pinMode(in4, OUTPUT);
  pinMode(IN5, OUTPUT); //A0 is output pin
  pinMode(IN6, OUTPUT); //A1 is output pin
  ////lcd print///
  lcd.setCursor(0, 0);
  lcd.print(" Welcome to our   ");
  delay(1000);
  lcd.clear();
  lcd.setCursor(1, 0);
  lcd.print("  Project ");
  delay(1000);
  lcd.clear();
}
```

```
void loop()
{
  while (Serial.available()) { //Check if there is an available byte to read
    delay(10); //Delay added to make thing stable
    char c = Serial.read(); //Conduct a serial read
    if (c == '#') {
      break; //Exit the loop when the # is detected after the word
    }
    voice += c; //Shorthand for voice = voice + c
  }
  if (voice.length() > 0) {
    if (voice == "*go ahead") {
      forward_car();
    }
    else if (voice == "*go back") {
      back_car();
    }
    else if (voice == "*turn right") {
      right_car();
    }
    else if (voice == "*turn left") {
      left_car();
    }
    else if (voice == "*stop") {
      stop_car();
    }
    voice = ""; //Reset the variable after initiating
```

```
  }
  digitalWrite(IN5, HIGH);
  delay(500);
  digitalWrite(IN5, LOW);
  delay(500);
  digitalWrite(IN6, HIGH);
  delay(500);
  digitalWrite(IN6, LOW);
  delay(500);
}
void forward_car()
{
  digitalWrite(in2, LOW);
  digitalWrite(in4, LOW);
  digitalWrite(in1, HIGH);
  digitalWrite(in3, HIGH);
  delay(1000);
  lcd.setCursor(0, 0);
  lcd.print("GOING Forward");
  delay(1500);
  lcd.setCursor(0, 1);
  lcd.print("NeXT COMMAND");
  delay(800);
  lcd.clear();
  digitalWrite(IN5, HIGH);
  delay(500);
  digitalWrite(IN5, LOW);
```

```
  delay(500);
  digitalWrite(IN6, HIGH);
  delay(500);
  digitalWrite(IN6, LOW);
  delay(500)
}
void back_car()
{
  digitalWrite(in1, LOW);
  digitalWrite(in3, LOW);
  digitalWrite(in2, HIGH);
  digitalWrite(in4, HIGH);
  delay(1000);
  lcd.setCursor(0, 0);
  lcd.print("GOING BACKWARD");
  delay(1500);
  lcd.setCursor(0, 1);
  lcd.print("NeXT COMMAND");
  delay(800);
  lcd.clear();
  digitalWrite(IN5, HIGH);
  delay(500);
  digitalWrite(IN5, LOW);
  delay(500);
  digitalWrite(IN6, HIGH);
  delay(500);
  digitalWrite(IN6, LOW);
```

```
  delay(500);
}
void right_car()
{
  myServo.write(0);
  delay(1000);
  myServo.write(90);
  delay(1000);
  digitalWrite(in1, LOW);
  digitalWrite(in3, HIGH);
  digitalWrite(in2, LOW);
  digitalWrite(in4, LOW);
  delay(800);
  lcd.setCursor(0, 0);
  lcd.print("GOING RIGHT");
  delay(1500);
  lcd.setCursor(0, 1);
  lcd.print("NeXT COMMAND");
  delay(800);
  lcd.clear();
  digitalWrite(IN5, HIGH);
  delay(500);
  digitalWrite(IN5, LOW);
  delay(500);
  digitalWrite(IN6, HIGH);
  delay(500);
  digitalWrite(IN6, LOW);
```

```
  delay(500);
}
void left_car()
{
  myServo.write(180);
  delay(1000);
  myServo.write(90);
  delay(1000);
  digitalWrite(in2, LOW);
  digitalWrite(in4, LOW);
  digitalWrite(in1, HIGH);
  digitalWrite(in3, LOW);
  delay(500);
  lcd.setCursor(0, 0);
  lcd.print("GOING LEFT");
  delay(1500);
  lcd.setCursor(0, 1);
  lcd.print("NeXT COMMAND");
  delay(800);
  lcd.clear();
  digitalWrite(IN5, HIGH);
  delay(500);
  digitalWrite(IN5, LOW);
  delay(500);
  digitalWrite(IN6, HIGH);
  delay(500);
  digitalWrite(IN6, LOW);
```

```
  delay(500);
}
void stop_car()
{
  digitalWrite(in1, LOW);
  digitalWrite(in3, LOW);
  digitalWrite(in2, LOW);
  digitalWrite(in4, LOW);
  lcd.setCursor(0, 0);
  lcd.print("CAR STOP");
  delay(1500);
  lcd.setCursor(0, 1);
  lcd.print("THANKS");
  delay(800);
  lcd.clear();
  digitalWrite(IN5, HIGH);
  delay(500);
  digitalWrite(IN6, HIGH);
  delay(500);
}
```