SMART DEVELOPMENT OF A HUMANOID ROBOT

A Project and Thesis submitted in partial fulfillment of the requirements for the Award of Degree of
Bachelor of Science in Electrical and Electronic Engineering

BY

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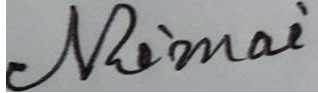
FACULTY OF ENGINEERING

DAFFODIL INTERNATIONAL UNIVERSITY

December 2018

Certification

This is to certify that this project and thesis entitled "**Smart Development of A Humanoid Robot**" is done by the following student under my direct supervision and this work has been carried out by him in the laboratories of the Department of Electrical and Electronic Engineering under the Faculty of Engineering of Daffodil International University in partial fulfillment of the requirements for the degree of Bachelor of Science in Electrical and Electronic Engineering. The presentation of the work was held on 10 December 2018.
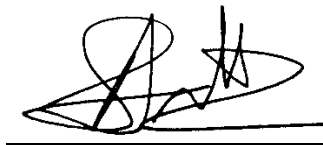
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DEDICATED TO
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ABSTRACT

A humanoid robot is a robot with its body shape. The Design can be for functional purposes, such as interacting with human tools and environments, for experimental purposes, Robotics is seen to be one of the most dominant aspects in several areas of interest by the humanworld, and one special type of them are humanoids, which are of an important use nowadays to ease the way of our life .This project is about building a humanoid robot, and applying a control system to its so that it can talking, moving, shake hand and interact with human voice. Two main parts is required to implement this project, the construction part, and the control part. First, the construction part, which is about a suitable design for the humanoid robot, and Building the right model this part was handled as follows, Designing the mechanical structure of the humanoid robot and all its parts, and set the layout of its parts (i) modeling the parts using (0.5mm) Pvc board (ii) based on the total design, we assembled the robot by adding the essential actuators and the needed controller. Second, the control part, which is the robot walk properly We made use of the static walk approach for this task; that is maintaining the robot statically stable during both phases of its walking sequence, the double support phase, and the single support phase. This is achieved by keeping the robot's center of within the support area. To conclude, this project is about using static walking mechanism to make the humanoid the robot walks on a flat surface, in hopes of further improvements in the future

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LIST OF ABBREVIATIONS

Tx	Transmitter
Rx	Receiver
Mosi	Master out slave in
Miso	Master in slave out
SCK	Serial clock
SS	Slave select
SD	Storage device
LCD	Liquid crystal display
AVR	Automatic voltage regulation
IC	Internal circuit
USB	Universal Serial Bus
PWM	Pulse width modulation
AC	Alternating current
DC	Direct current
ICSP	In circuit serial programming
I/O	Input output
SRAM	Static Random access memory
EEPROM	Electrical erasable read only memory
UART	universal asynchronous receiver-transmitter
SPI	Serial peripheral interface
TTL	Transistor –Transistor logic
SCA	Sensor chip assembly
TWI	Two way interface
IDE	Integrated development environment
MBPS	Megabyte per second
GPS	Global positioning system
IR	Inferred
LED	Light emitting diode
FPV	First person view
SMPS	switched-mode power supply

List of Symbols

λ	Wavelength
λ_B	Bragg wavelength
n_{eff}	Effective index
z	Position along the grating
n	Mode index
f	Fundamental Frequency
ω	Angular frequency
M	Modulation Index
T	Fundamental Time Period

ACKNOWLEDGEMENT

CHAPTER 1

INTRODUCTION

1.1 Introduction

Humanoid robots, particularly those with AI algorithms, can be helpful for future dangerous and / or distant space exploration missions, with none need to turn around and come to Earth. during this project the target of our work is to design, model, implement and control a humanoid robot, and add some options and this work are going to be a start line for us to develop additional complicated humanoids and integrate with human purpose use and our lifestyle.in this chapter we have a tendency to are about to analyze the talking and moving mechanism of the robot robot exploitation Arduino mega that could be a microcontroller with this controller unit we have a tendency to are going presents our project "smart development of a humanoid robot" operating and with totally different options of the project .
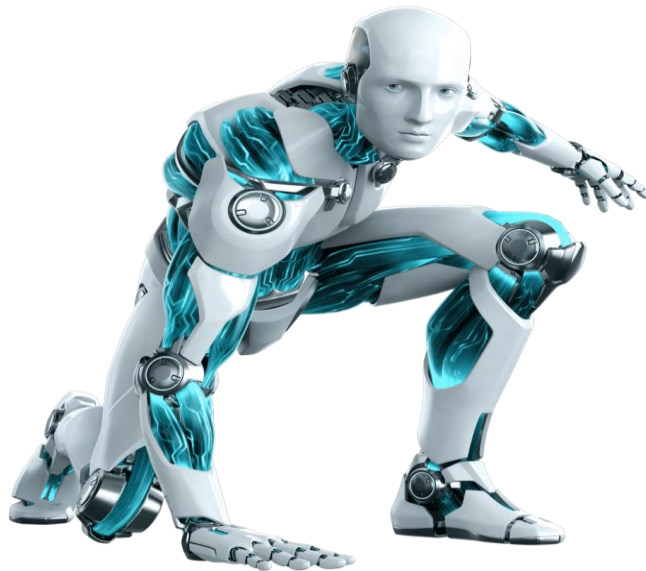
Fig: 1.1 Humanoid Robot

1.1.1: History of Humanoid Robot

In 1495, famed inventor Leonardo da Vinci designed a suit of armor that moved as if there was a real person inside. It was operated by a series of pulleys and cables, and could stand, sit, move its arms, and even raise its visor to reveal nothing inside. The goal was simply amused by the Milanese royalty, but the modern recreations of the device showed that it was fully functional.

Fig: 1.2 LeonardoRobot

1.1.2: Three Law of Robot

I.   : A robot may not injure a human (or humanity), or, through inaction, allow a human (or Humanity) to come to damage

II.   : A robot must obey orders given by human beings, except where such orders will conflict with a higher order law

III.   : A robot must protect its own existence, as long as such protection does not conflict with a higher order law

A zeroth law was added after stating that a robot may not injure a human being, or, through inaction, when a person is allowed to come to harm

1.2 Problem Statement

Humanoid robots are still a young technology with several analysis challenges. Just some robot robots are presently commercially offered, typically at high prices. Physical The prototypes of robots are necessary to investigate to research to analyze the advanced interactions between robots and human and to integrate and validate analysis results from the various research fields concerned in robot artificial intelligence the event of a robot mechanism platform per a Special target system at the start overwhelming hindrance during this article a method for robot mechanism systems is conferred The goal of this method is to attenuate robot robot platforms by together with the expertise and information gained within the development of robot robot parts within the cooperative research.in this project the main target is to interact robot with human like how human talk.

1.3: Aim of the Project

Humanoid robots are now used as a research tool in several scientific areas

- To understand the human body structure and behavior to build and study humanoid robots.
- learn how to robot talking and act as like human
- learn how to robot moving/walking like human
- On the opposite aspect, the conceive to the simulation of the body ends up in an improved understanding of it.
- Human noises could be a field of study that is targeted on however humans learn from sensory data so as to accumulate sensory activity and motor skills.
- used robot to replace human in industry for completing various task
- Utilizing of humanoid robot in education, entertainment, house, medical and welfare, receptions of multinational company, restaurant.
- search and rescue in danger

1.4 Scopes

- A humanoid robot is built for interact with human and its behavior
- To increase the flexibility with human and robot
- can be used commercially in industry, restaurant for serve to human work
- robot can be socialized
- can be used in teaching purpose
- we can use robot in our military system
- humanoid robot can be your best assistant
- by using humanoid robot in danger many precise lives will be saved
- And as well as we know finally humanoid robot will be do which we want.

1.5 Methodology

The smart development of a humanoid robot is that robot who can talking, moving, shake hand, and rotate head with human voice command and will be many for in future development. The methodology of the proposed robot is mainly divided into the many step .in the initial step an android application interface with the Bluetooth module .after that the second step microcontroller receive the signal which has been send by Bluetooth module. Then microcontroller send the signal to the actuator and speaker then the actuator or motor will receive the signal and activate the system to execute the command from the stores data .the above system can run our smart development of a humanoid robot.

1.6 Organization of the Report

This project report has seven chapters in total. The first chapter describes an idea about our project "Smart Development of a Humanoid Robot", 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 five hardware implementation. Then chapter six describes result & discussion properly. Finally, chapter seven gives the concluding remarks, limitation of our system and suggestion for the future works.

CHAPTER 2
LITERATURE REVIEW

2.1: Introduction

"Only if a robot is able to move freely in our environment, he will one day be able to be a real help for human being and carry the name humanoid robot" The smart development of a humanoid robot is an experimental humanoid robot which can talk, move and lots of feature with given voice command through an android apps which already store in the robot by coding. We can remove the abstract with human and robot.in this chapter we are going to discuss about the robot functionality. Its block diagram, circuit diagram, android application, Bluetooth communication, and the working process of the circuit diagram. List of component we used in our robot.

2.2: Block Diagram
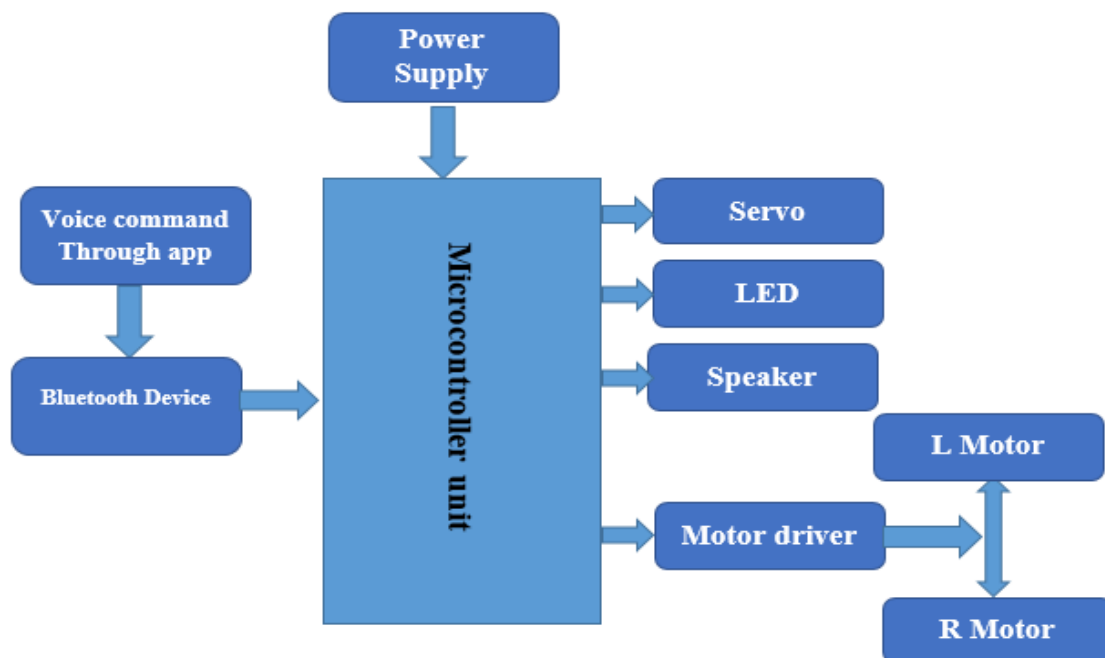
Fig: 2.1 System Block Diagram

2.3: Circuit Diagram
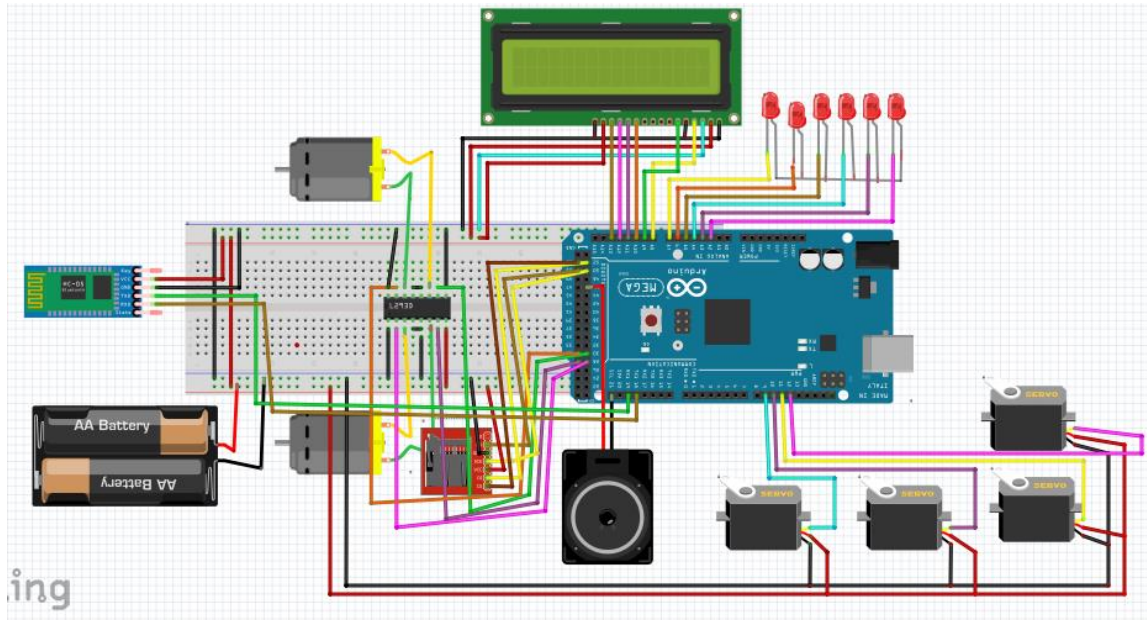
Fig: 2.2 System Circuit Diagram

2.4: Working Process of System Circuit

In this article we will describe how the circuit diagram working.in our first of we have to give power supply of 12 volt to active the circuit. Then we have to pair the Bluetooth device with an android apps to give voice command the Bluetooth module send the data to the microcontroller unit after the controller unit execute the data and send the data to the specific module. Here we have Bluetooth module HC-05 which have 4 pin VccGnd will be the 5 volt positive and negative, Tx, Rx will be the arduino Rx, Tx. The servo motor and the gear motor of the system connect the same way signal pin to the microcontroller the connection is shown in above. The SD card pin MISO, MOSI, SCK, CS will be connected respectively the pin of arduino mega 50,51,52,53. The speaker pin positive connected the 46 of mega and negative to the (-5 volt). The lcd pin connected to the arduino mega analog pin for print the executable command and relative text.as the same way light emitting diode connect the negative pin to the (-5 volt) and positive pin will be arduino mega output pin as shown in above circuit diagram

2.5 Flow Chart of Our System

Fig: 2.3Flow Chart of Our System

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2.6 Flow Chart Diagram of Android Apps

START

Mobile device support Bluetooth

yes

Mobile Device Bluetooth is on

No → Request to switch on user bluetooth

yes

HC pair

HC-05 pair

No → Scan BT device → HC-05 found — yes → HC pair / No → HC turn on

yes

Connect HC-05

Send Signal

Send signal true or false

STOP

NO
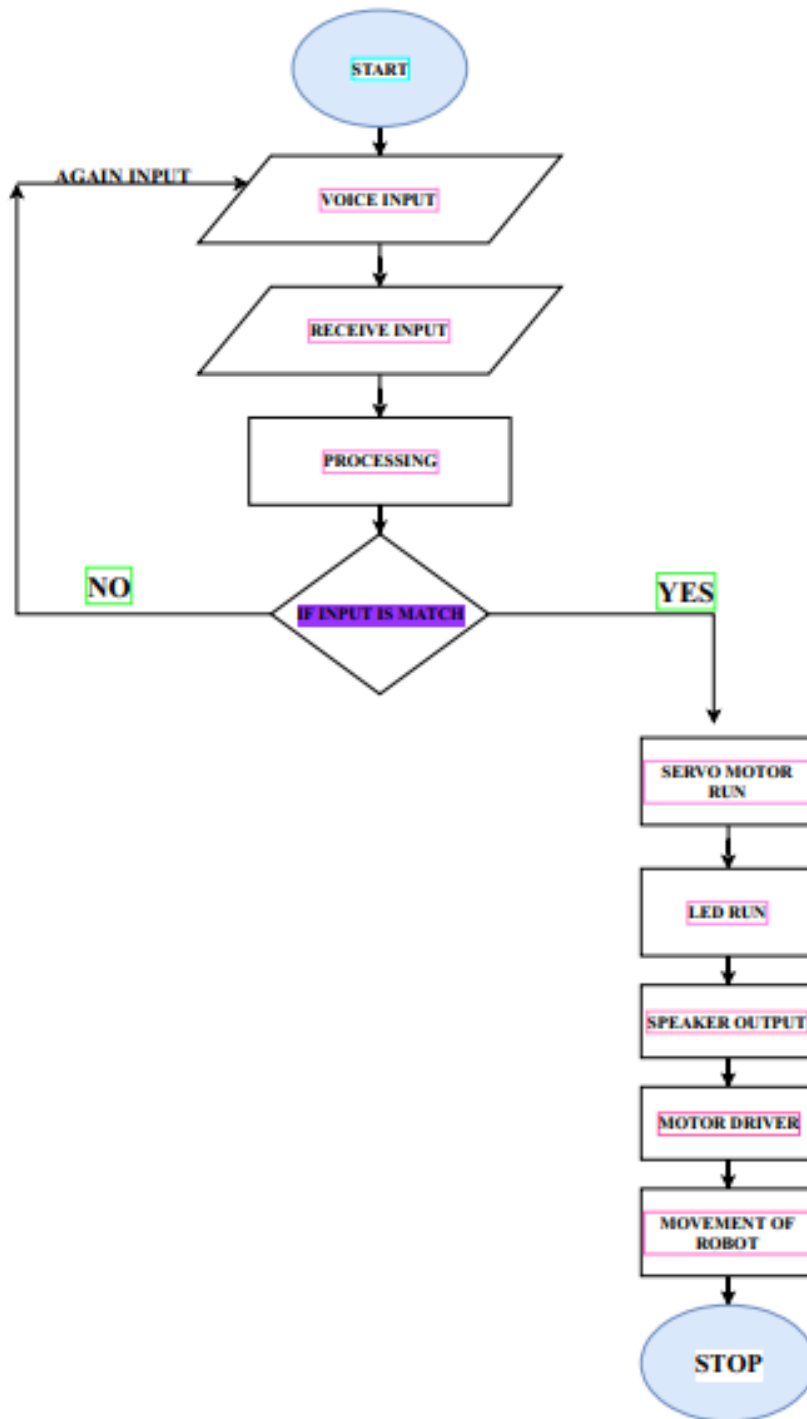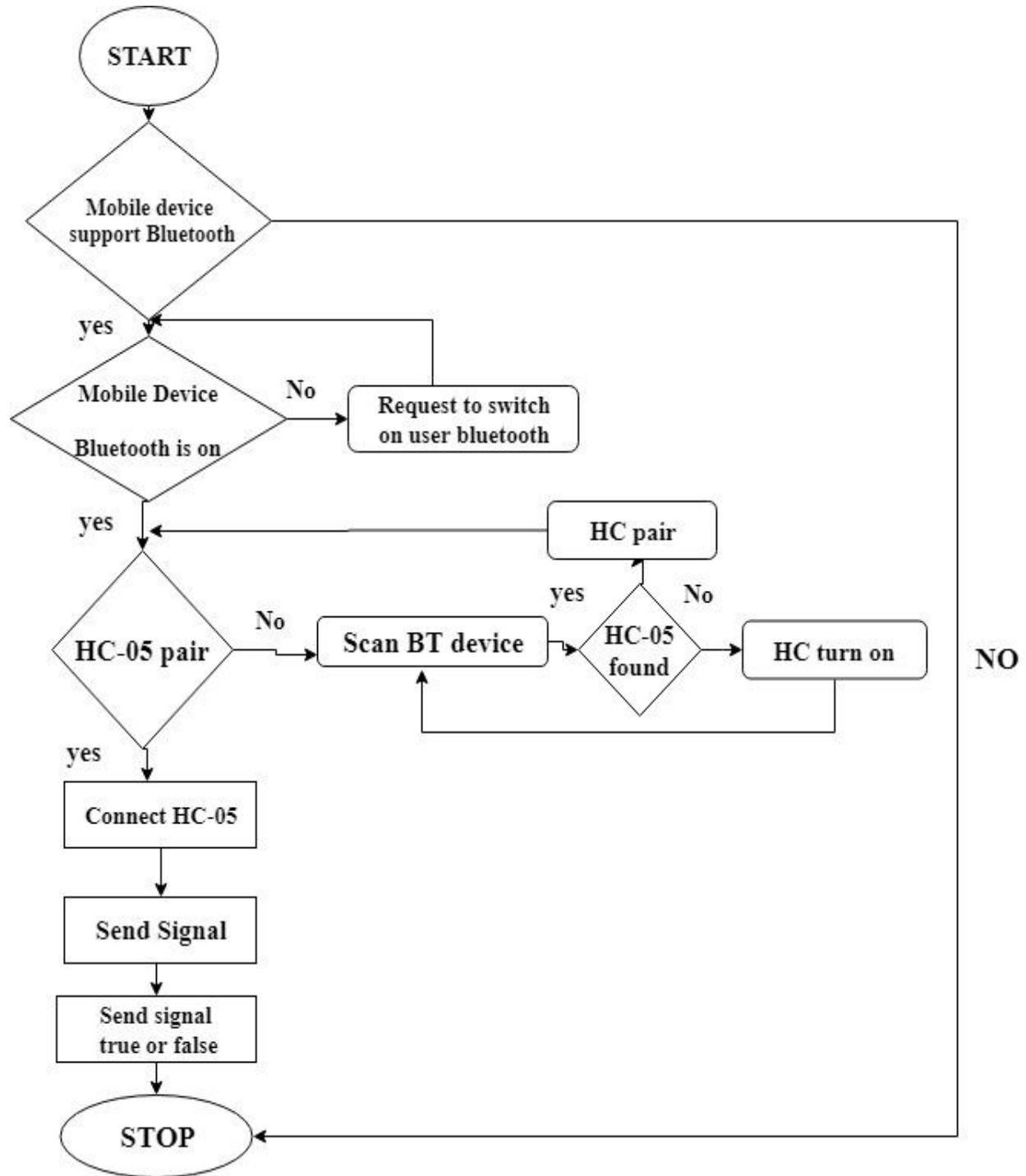
Fig: 2.4 Flow Chart Diagram of android application

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2.7 Flow Chart Diagram of Robot Movement
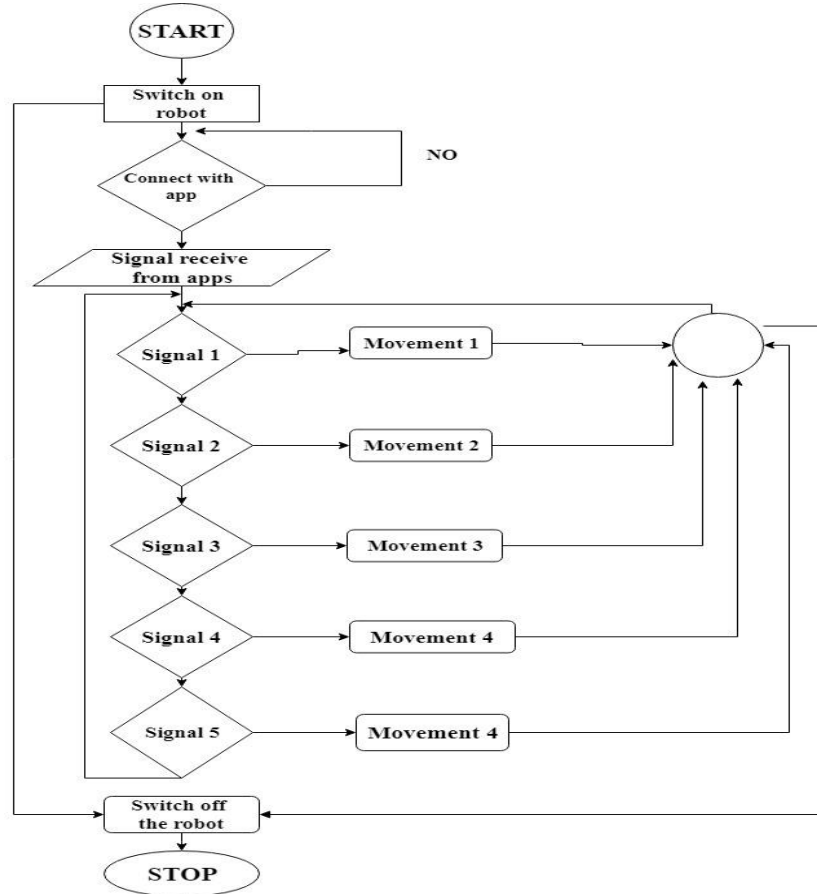
Fig: 2.5 Robot Movement Flow Chart

2.8: List of Component Used In Circuit

NO	Component name	quantity	Used
01	Arduino mega	01	As a controller
02	Bluetooth module	01	For wireless communication
03	Servo motor	05	Movement for head, hand
04	Buck converter	02	For power supply regulate
05	Servo channel	01	For motor control
06	Dc gear motor	02	For movement of robot body
07	Wheel	02	Attached with gear motor
08	L298N	01	For motor control

09	Speaker	01	Voice output
10	wires	10+	Built connection
11	12 volt power supply	01	Support power supply
12	charger	01	Charging battery
13	PVC board	10 feet	Making robot body
14	Light emitting diode	20+	Fabrication
15	Sonar sensor	01	Consider as robot eye
16	Many related tools		

Table: 2.1 Parts Used In Circuit

2.9: Conclusion

In this chapter of system review we show all of the system circuit diagram, Block diagram component list and flow chart of the included system. How the smart development of a robot will be run successfully.

CHAPTER 3
ANALYSIS AND SIMULATION

3.1: Introduction

In the previous chapter many points wherever created clear, like the robot's design, the fabric utilized in the modeling of the robot, and also the actuators providing the specified force to move the various components of the robot. Though these points are adequate to make a biped robot, they're not enough, as a result of the robot must move, that is why we have a tendency to be progressing to analyze the required aspects of the robot mechanism. during this chapter, we are discuss about some sorts of simulation of robot how we decide the component and how it's make easy to our project.

3.2 Motor/ Actuator

In this section we will discuss about our motor which is producing motion or action to move our robot head and two hand. Here is the servo motor rotate angle and simulation result
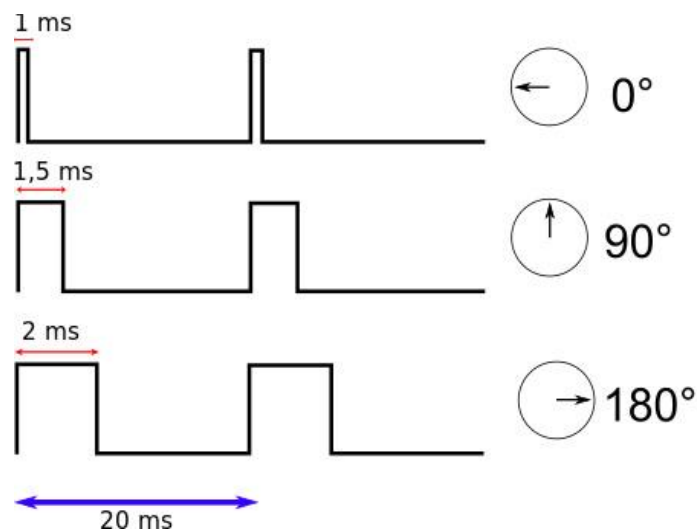
Fig: 3.1Motor Position Angle with Time

The Figure above shows, how the set point is set. You can see, that the value is sent via a 50Hz signal. The actual value for the angle is the time of the logic HIGH impulse. Most servos work with exactly that timing protocol

3.3: Speaker

LTK5203 is a dual channel audio amplifier .which amplify the low audio signal to high pass signal to get better audio output with speaker .LTK5203 is pass the 8bit 16kHz mono audio to the speaker the below Figure is its output simulation .
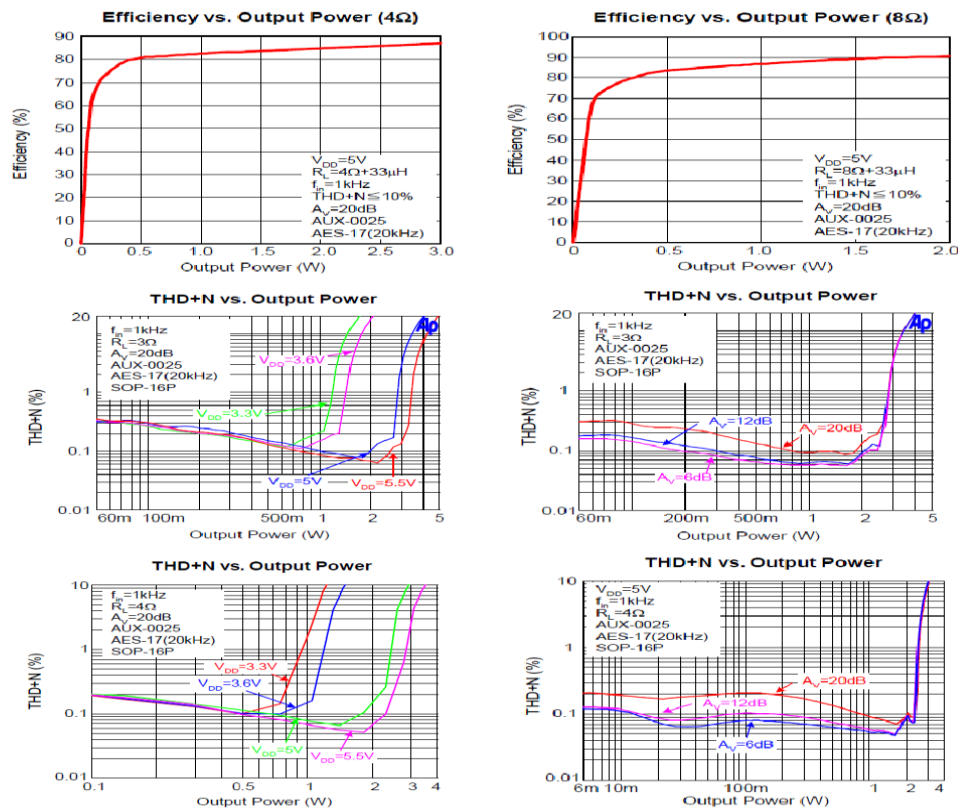
Fig: 3.2 Output Wave Form of LTK5203 Speaker

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3.3.1 Output Audio Signal

in our robot we use 8 bit, 16 sampling rate mono audio output for the system response. Below graph is the audio output signal simulation
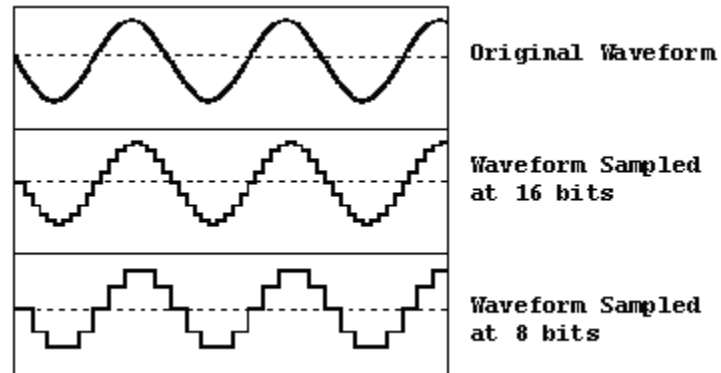
Fig3.3: Output Signal of Audio

3.4: Conclusion

In this chapter we show the simulation part of our component which we used in our circuit. The producing motion and get voice from our robot we complete thus process.

CHAPTER 4
HARDWARE DEVELOPMENT

4.1: Introduction

In this section, we will discuss elaborately about our hardware design of "smart development of a humanoid robot" and the component description, features, working procedure and cost analysis of our all equipment. the system hardware fabricate composed of microcontroller unit, servo motor, dc gear motor, buck converter, 16 channel servo module, Bluetooth module, speaker, led, SD card reader module and many more related component.

4.2 Basic Description of Controller Unit

In the controller unit, we tend to are exploitation Arduino hardware board (with AVR microcontroller). With the assistance of Arduino1.6.8 computer code plate type we will simply program AVR IC, as our demand. Arduino is AN ASCII text file natural philosophy prototyping platform supported versatile, easy-to-use hardware and computer code. It's meant for artists, designers, hobbyists, and anyone inquisitive about making interactive objects or environments. The microcontroller on the board is programmed exploitation the Arduino programing language (based on Wiring) and also the Arduino development atmosphere (based on Processing). The Arduino mega could be a microcontroller board supported the ATmega2560. Its fifty four digital input/output pins (of that fifteen will be used as PWM outputs), sixteen analog inputs, a sixteen megacycle ceramic resonator, a USB affiliation, an influence jack, AN ICSP header, and a push. It contains everything required to support the microcontroller; merely connect it to a pc with a USB cable or power it with AC-to-DC adapter or battery to induce started.

4.2.1 Specification Arduino Mega:

Microcontroller	ATmega2560
Operating Voltage	5V
Input Voltage (recommended)	7-12V

Input Voltage (limits)	6-20V
Digital I/O Pins	54 (of which 15 provide PWM output)
Analog Input Pins	16
DC Current per I/O Pin	20 MA
DC Current for 3.3V Pin	50 MA
Flash Memory	256 KB (ATmega2560) which 8 KB used by boot loader
SRAM	8 KB (ATmega328)
EEPROM	4 KB (ATmega328)
Clock Speed	16 MHz

Table: 4.1 Specification of Arduino Mega

Fig: 4.1 Arduino Mega Microcontroller Unit

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4.2.2 Description of Microcontroller: ATmega2560:
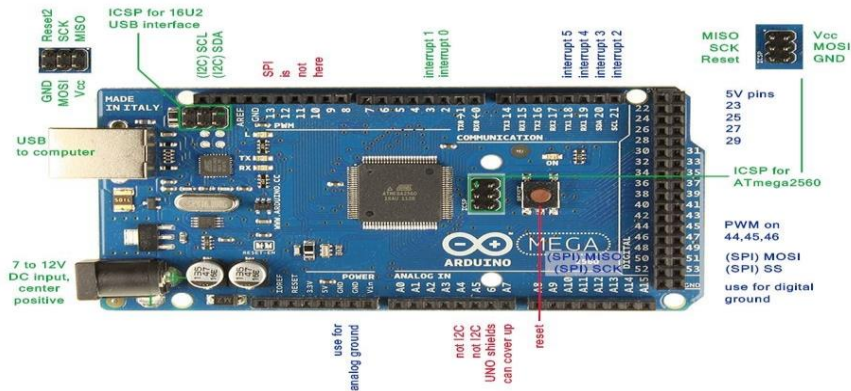
Fig: 4.2 Arduino Mega2560

The Arduino Mega 2560 may be a microcontroller board supported the ATmega2560 (datasheet). It's fifty four digital input/output pins (of that fourteen is used as PWM outputs), sixteen analog inputs, four UARTs (hardware serial ports), a sixteen megacycle per second oscillator, a USB association, an influence jack, associate ICSP header and a push button. It contains everything required to support the microcontroller; merely connect it to a pc with a USB cable or power it with an AC-to-DC adapter or battery to urge started. The Mega is compatible with most shields designed for the Arduino Duemilanove or Diecimila.

4.2.3 Block Diagram of Microcontroller – (ATmega2560):

Fig. 4.3: Block Diagram of Microcontroller – (Atmega2560)

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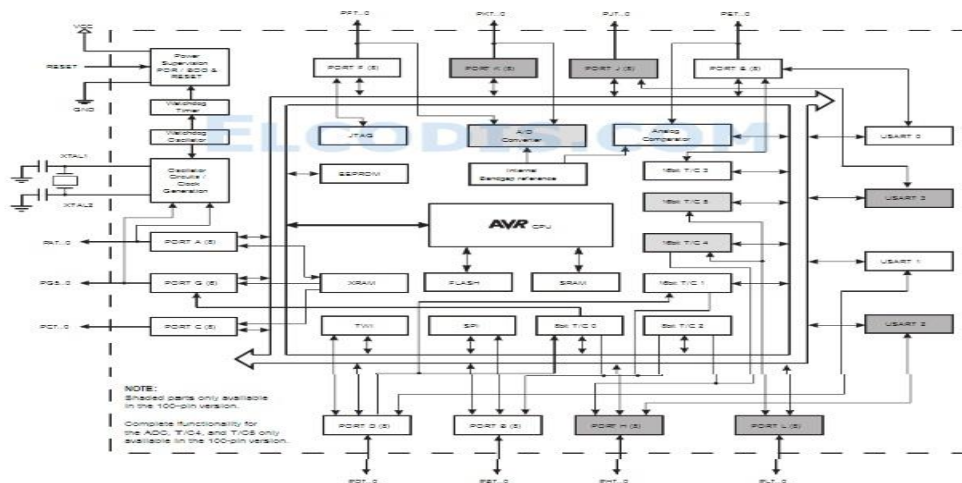
4.2.4 Pin Configurations of Microcontroller – (ATmega2560):
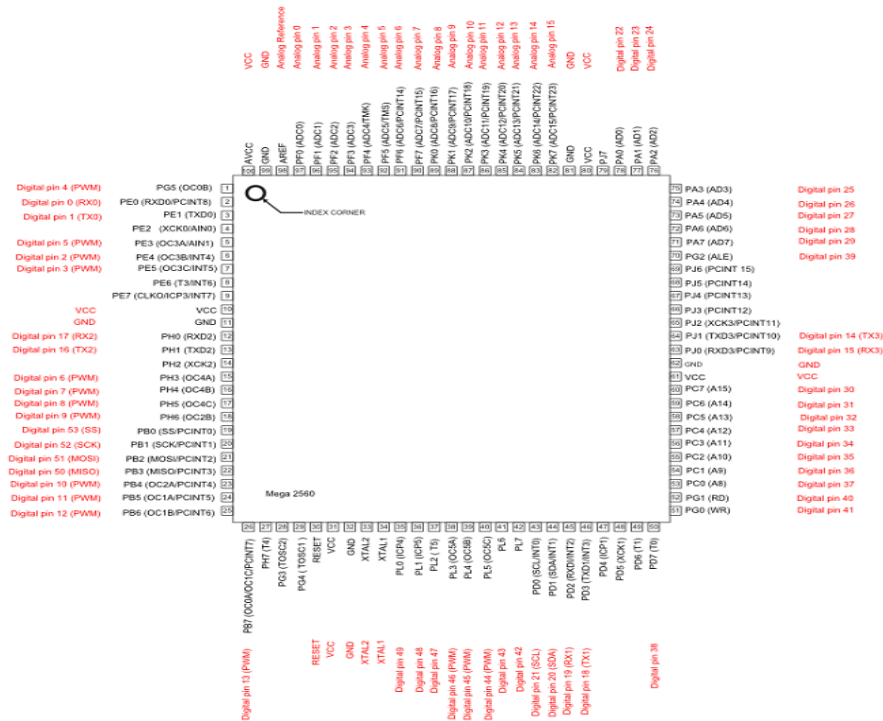
Fig. 4.4: Pin Configurations Of Microcontroller –(Atmega2560)

4.2.5 Pin Descriptions:

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

The power pins are as follows:

- VIN: The input voltage to the Arduino board once its mistreatment associate degree external power supply (as critical five volts from the USB affiliation or different regulated power source). You'll be able to offer voltage through this pin, or, if supply voltage via the facility jack, access it through this pin.

- 5V: The regulated power offer accustomed power the microcontroller and different elements on the board. This may return either from VIN via associate degree on-board regulator, or be provided by USB or another regulated 5V offer.

- 3V3: A 3.3 potential unit offer generated by the on-board regulator. Most current draw is fifty mA.GND: Ground pins.

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Input & Output of Arduino Mega:

Each of the fifty four digital pins on the Mega may be used as associate degree input or output, victimization pin Mode, digitalWrite, and digitalRead functions. They operate at five volts. Every pin will offer or receive a most of forty mA and has an enclosed pull-up resistance (disconnected by default) of 20-50 khoums. Additionally, some pins have specialized functions:

In addition, some pins have specialized functions:

- Serial: 0 (RX) and 1 (TX); Serial 1: 19 (RX) and 18 (TX); Serial 2: 17 (RX) and 16 (TX); Serial 3: 15 (RX) and 14 (TX). Used to receive (RX) and transmit (TX) TTL serial data. Pins 0 and 1 are also connected to the pins of the ATmega8U2 USB-to-TTL Serial chip

- External Interrupts: 2 (interrupt 0), 3 (interrupt 1), 19 (interrupt 4), 20 (interrupt 3), and 21 (interrupt 2). These pins can be configured on a low value, a rising or falling edge, or a change in value. See the attachInterrupt function for details.

- PWM: 0 to 13. Provide 8-bit PWM output with the analog Write function.

- SPI: 50 (MISO), 51 (MOSI), 52 (SCK), 53 (SS). These pins support SPI communication, which, although provided by the underlying hardware, is not currently included in the Arduino language. The SPI pins are also broken out on the ICSP header, which is physically compatible with the Duemilanove and Diecimila.

- 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). Support I2C (TWI) communication using the wire library (documentation on the Wiring website). Note that these pins are not the same location as the I2C pins on the Duemilanove. The Mega2560 has 16 analog inputs, each of which provides 10 bits of resolution (i.e. 1024 different values). By default they measure from ground to 5 volts, though is it

- 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 shieldsMemory: The ATmega2560 has 256 KB of flash memory for storing code (of which 8 KB is used for the boot loader), 8 KB of SRAM and 4 KB of EEPROM (which can be read and written with the EEPROM library.

VIN: The input voltage to the Arduino board when it's using an external power source (as opposed to 5 volts from the USB connection or other regulated power source). You can supply voltage through this pin, or, if supplying voltage via the power jack, access it through this pin.

5V:. This pin outputs a regulated 5V from the regulator on the board. The board can be supplied with power either from the DC power jack (7 - 12V), the USB connector (5V), or the VIN pin of the board (7-12V). Supplying voltage via the 5V or 3.3V pins bypasses the regulator, and can damage your board we do not advise it.

4.3 Servo Motor

A servomotor is a rotary actuator or a linear actuator that allows for precise control of angular or linear position, velocity and acceleration. It consists of a suitable motor coupled to a sensor for position feedback. It also requires a relatively sophisticated controller Servomotors are not a specific class of motor, although the term servomotor is often used to refer to a motor-friendly use in a closed-loop control system. Servomotors were used in applications such as robotics, CNC machinery or automated manufacturing.

Fig: 4.5 Servo Motor

4.3.1 How is the servo controlled?

Serves are controlled by causing AN electrical pulse of variable dimension or pulse width modulation (PWM), through the management wire. There's a minimum pulse, a most pulse, and a repetition rate. A servo motor will typically simply flip ninety in either direction for a complete of one hundred eighty ° movement. The motor's neutral position is outlined because the position wherever the servo has an equivalent quantity of potential rotation within the each dextrorotary and counter-clockwise direction. The PWM sent to the motor determines the position of the shaft, and supported the heartbeat sent via management wire; the rotor can communicate the specified position. As an example, a 1.5ms pulse can build the motor communicate the ninety ° position. Shorter than one.5ms moves it within the counterclockwise direction toward the zero ° position, and any more than one.5ms can flip the servo during a dextrorotary direction toward the one hundred eighty ° position
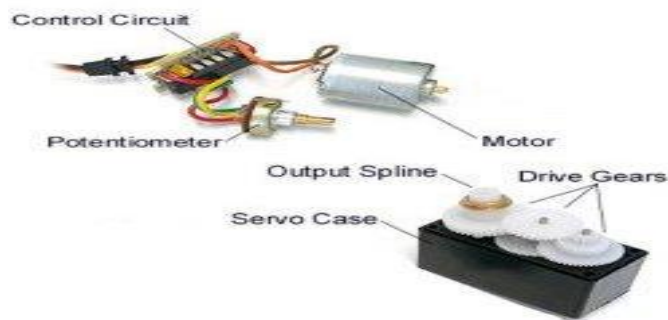
Fig: 4.6:Inside Outlook of Servo Motor

4.3.2 Servo Motor Applications

Servos were utilized in guided airplanes to position control surfaces like elevators, rudders, walking an automaton, or operative grippers. Servo motors are tiny, have constitutional management electronic equipment and have smart power for his or her size. In food services and prescribed drugs, the tools square measure to be utilized in harsher environments, wherever hot temperatures and high temperature

Fig: 4.7 Application of Servo in Robotic Hand

4.4: SD Card Module

The SD Card Module may be a straightforward resolution for transferring information to and from a regular sd card. The pin out is additionally compatible with Arduino, however also can be used with alternative microcontrollers. This module has SPI interface that is compatible with any SD card and it uses 5V or three.3V power provide that is Arduino UNO / Mega.SD module has totally different applications like information feller, audio, video, graphics
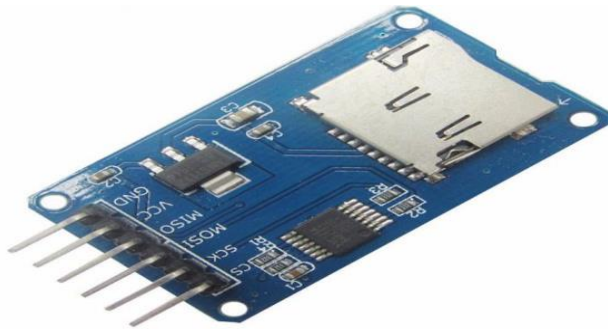
Fig: 4.8 SD Card Module

4.4.1: Specifications

- Operating voltage 5 v

- Speech Communication Method

- Saddle Card Socket

- Supper's crevice 16 and fat 32

- Support 2 GB is 4 times

4.4.2: Pin Outs of SD Card Module

Fig: 4.9: SD Card Pin Out

Hardware and Software Required

SD Card Module

Arduino Uno

Arduino IDE

Hardware Connections

The SD Card Module should be connected to Arduino mega has follows:

- Vcc - 5V
- Gnd - Gnd
- MOSI - pin 48
- MISO - pin 49
- CLK - pin 50
- CS - pin 51
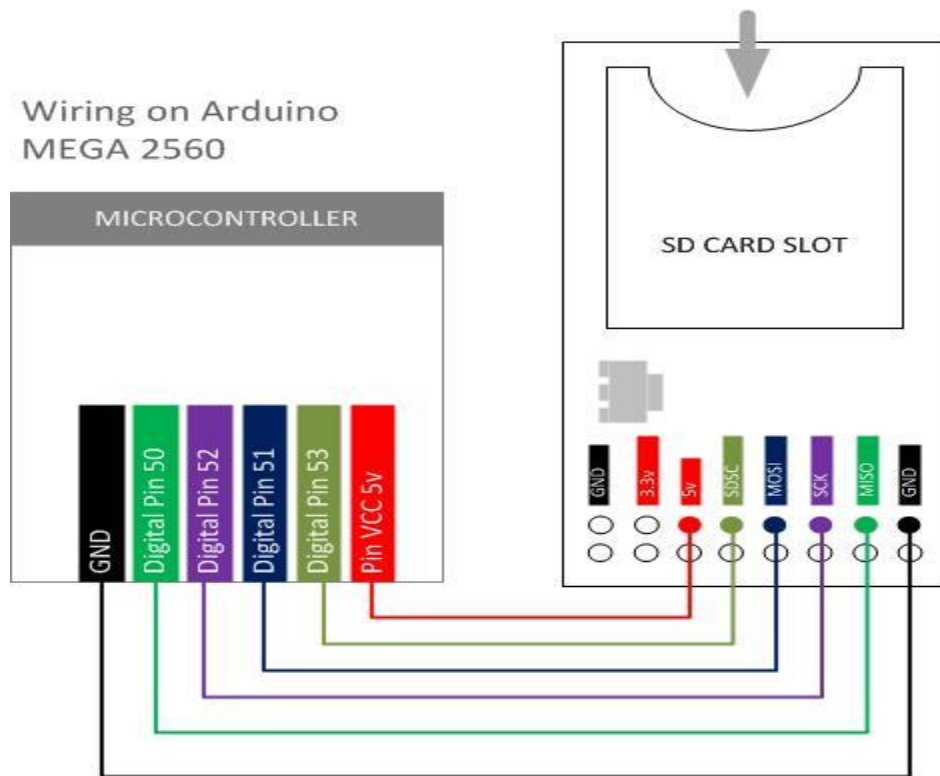
Fig: 4.10:Connection of Arduino Mega And SD Card Module

4.5: Description of Display

Display is interfaced with controller. In this project 16*2 LCD (Liquid Crystal Display) is used, 16*2 mean that, 16 columns and 2 rows. Liquid crystal display LCD digital display alphanumeric display} (Liquid Crystal Display) screen is an electronic display module and finds a large vary of applications. A 16*2 liquid crystal display LCD digital display alphanumeric display display is that the terribly basic module and is extremely usually utilized in numerous devices and circuits. These modules area unit most popular over seven segments and different multi-segment LEDs. The explanations being: LCDs area unit economical; simply programmable; haven't any limitation of displaying special & even custom characters (unlike in seven segments), animations and then on.LCD will show sixteen characters per line and there are a unit two such lines. During this liquid crystal display every character is displayed within the 5x7 element matrix. This liquid crystal display has 2 registers, namely, Command and information. The command register stores the command directions given to the liquid crystal display. A command is Associate in Nursing

Fig: 4.11 Liquid Crystal Display

4.5.1: Pin Diagram:
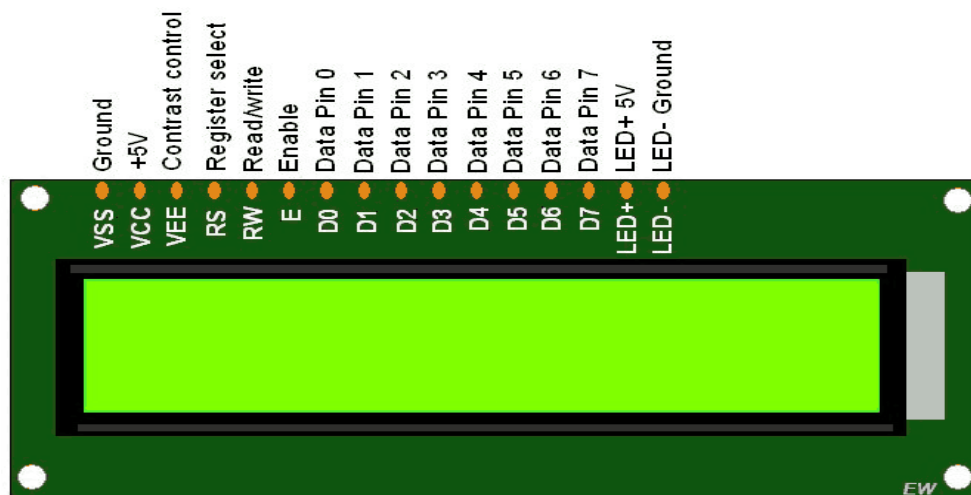
Fig. 4.12: Pin Diagram of LCD

PIN DESCRIPTION:

1. GND (Ground)

2. Vcc (Supply Voltage)

3. Vee (Contrast Voltage)

4. R/S (Instruction/Register Select)

5. R/W (Read/Write)

6. E (Clock)

7. D0 (Data0)

8. D1 (Data1)

9. D2 (Data2)

10. D3 (Data3)

11. D4 (Data4)

12. D5 (Data5)

13. D6 (Data6)

14. D7 (Data7)

4.6: Description of Bluetooth Module HC-05

HC-05 module is a simple to use Bluetooth SPP (Serial Port Protocol) module, designed for clear wireless serial association setup. The HC-05 Bluetooth Module may be utilized in a Master or Slave configuration, creating it a good resolution for wireless communication. This interface Bluetooth module is absolutely qualified Bluetooth V2.0+EDR (Enhanced information Rate) 3Mbps Modulation with complete two.4GHz radio transceiver and baseband. It uses CSR Blue core 04-External single chip Bluetooth system with CMOS technology and with AFH (Adaptive Frequency Hopping Feature). The Bluetooth module HC-05 could be a MASTER/SLAVE module. By default the works setting is SLAVE. The Role of the module (Master or Slave) may be organized solely by AT COMMANDS. The slave modules willnot initiate an association to a different Bluetooth device however can settle for connections. The master module will initiate an association to different devices. The user will use it merely for an interface replacement to ascertain the association between MCU and GPS, computer to your embedded project

4.6.1: Hardware and Software Specification

Hardware Features

- Typical -80dBm sensitivity.

- Up to +4dBm RF transmit power.

- 3.3 to 5 V I/O.

- PIO (Programmable Input/Output) control.

- UART interface with programmable baud rate.

- 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.

- Auto-pairing PINCODE:"1234" as default.

4.6.2: Pin Diagramand Description for HC-05
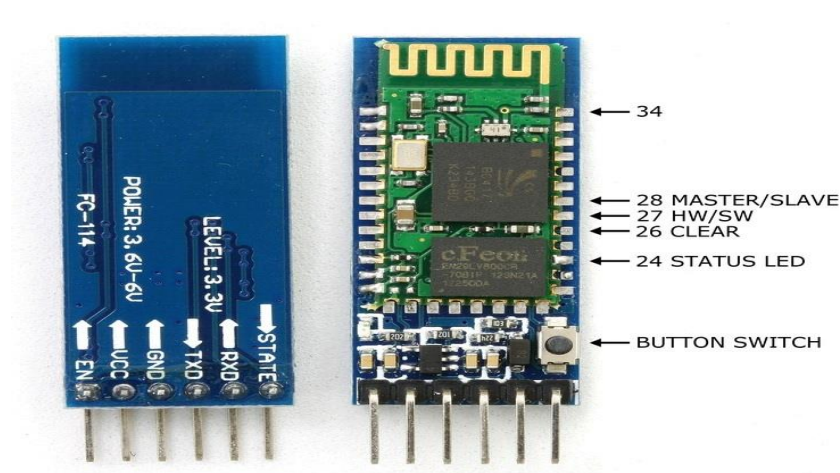
Fig: 4.13 Pin Diagram of HC-05

The HC-05 Bluetooth Module has 6pins. They are as follows:

Enable: When modify is force LOW, the module is disabled which implies the module won't activate and it fails to speak. Once modify is left open or connected to three.3V, the module is enabled i.e the module remains on and communication conjointly takes place.

Vcc:

Supply Voltage 3.3V to 5V

GND:

Ground pin

TXD & RXD:

These two pins acts as an UART interface for communication

State:

It acts as a standing indicator. Once the module isn't connected to / paired with the other Bluetooth device, signal goes Low. At this low state, the crystal rectifier flashes endlessly that denotes that the module isn't paired with different device. Once this module is connected to/paired with the other Bluetooth device, the signal goes high. At this high state, the crystal rectifier blinks with a relentless delay say as an example 2s delay that indicates that the module is paired.

Button Switch:

This is accustomed switch the module into AT command mode. To change AT command mode, press the button switch for a second. With the assistance of AT commands, the user will modification the parameters of this module however only if the module isn't paired with the other BT device. If the module is connected to the other Bluetooth device, it starts to speak therewith device and fails to figure in AT command mode.

4.6.3 Connection of Bluetooth Module and Arduino Mega
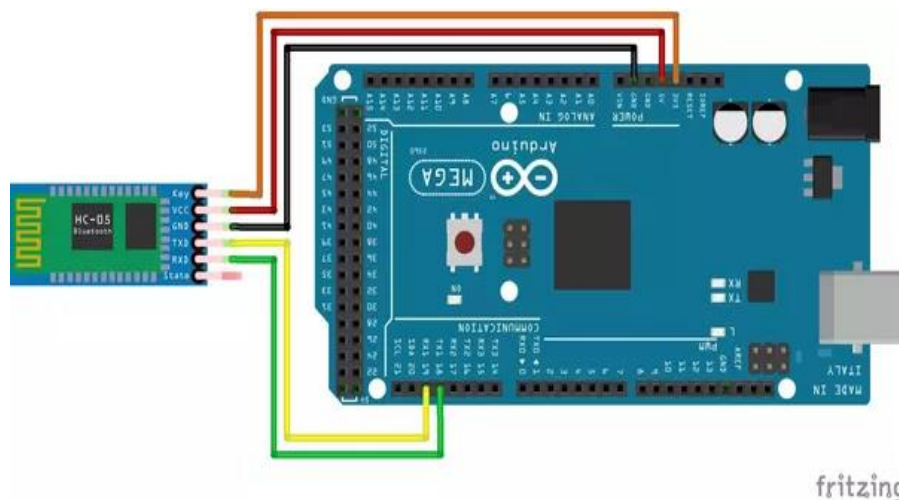
Fig: 4.14: Connection of HC-05 with Arduino Mega

4.7: L298n Motor Driver

L298N could be a twin H-bridge motor driver. Motor drivers act as current amplifiers since they take a low-current management signal and supply a higher-current signal. This higher current signal is employed to drive the motors. L2938 contains 2 constitutional H-bridge driver circuits.

In its common mode of operation, 2 DC motors is driven at the same time, each in forward and reverse direction. The motor operations of 2 motors is controlled by input logic at pins two and ten . Input logic 00 or 11 can stop the corresponding motor. Logic 01 and 10 will rotate it in clockwise and anticlockwise directions, respectively.
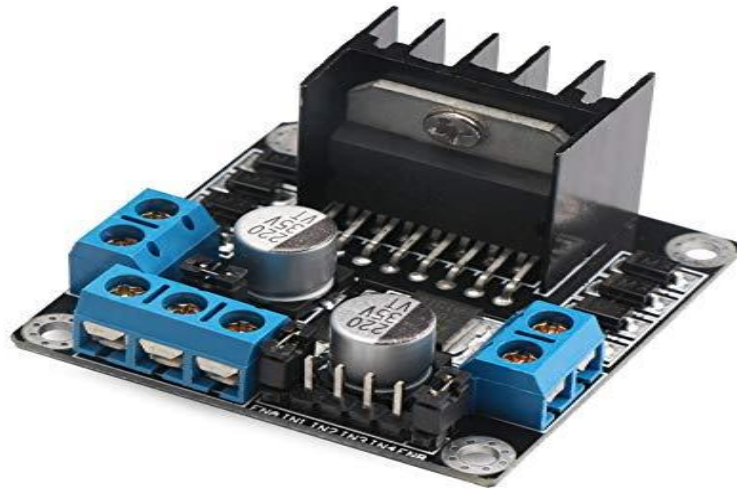
Fig 4.15: L298N Motor Driver

Enable pins ENA and ENB (corresponding to the 2 motors) should be high for motors to begin operative. Once Associate in Nursing alter input is high, the associated driver gets enabled. As a result, the outputs become active and add section with their inputs. Similarly, once the alter input is low, that driver is disabled, and their outputs square measure off and within the high-impedance state.L298N may be a twin H-Bridge motor driver, A simple schematic for interfacing a DC motor using L298N is shown below.
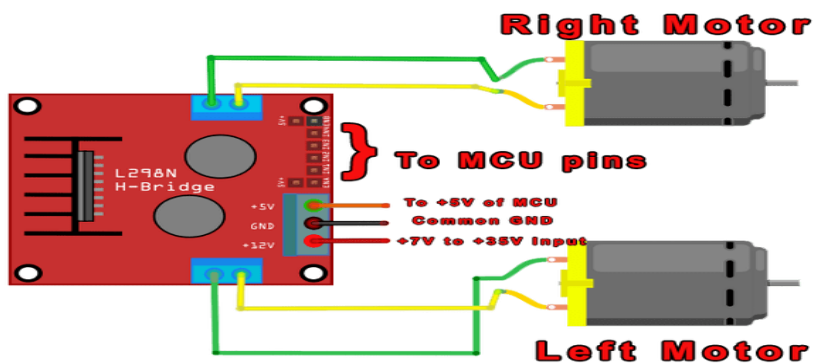
Fig 4.16: Schematic Interfacing of the L298N.

4.7.1 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. A 100nF 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 4.2 L298N Driver Pin Specification

4.7.2 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

Table4.3 L298N Driver Voltage Specification

4.8 Speaker

In our project "Smart development of a humanoid robot" we use a speaker which we get in the local market with USB and 3.5mm audio jack. The reason of use this speaker is high audio volume with built in amplifier which can pass low voltage signal into high for audio output of 8 bit, 16 sampling rate mono audio file.

Fig: 4.17Used Speaker in Our System

4.9Resistance

Resistance is that the opposition of a fabric to this. It's measured in Ohms (Ω). All conductors represent an explicit quantity of resistance, since no conductor is 100 percent economical. To manage the lepton flow (current) during a predictable manner, we have a tendency to use resistors. Electronic circuits use tag lumped resistance to manage the flow of current. Generally, electrical device is divided into 2 teams viz. fastened & adjustable (variable) resistors. In fastened resistors, the worth is fastened varied. In variable resistors, the resistance worth is varied by a claim agent knob. It is divided into

(a) Carbon composition

(b) Wire wound

(c) Special type.

The most common variety of resistors utilized in our comes is carbon sort. The resistance worth is often indicated by color bands. every resistance has four colours, one in every of the band on

either facet are gold or silver, this is often known as fourth band and indicates the tolerance, others 3 band can provide the worth of resistance (see table). As an example if an electrical device has the subsequent marking on that say red, violet, and gold. Comparison these colored rings with the color code, its value is 27000 ohms or 27 kilo ohms and its tolerance is ±5%.Resistor comes in various sizes (Power rating). The bigger, the size, the more power rating of 1/4 watts
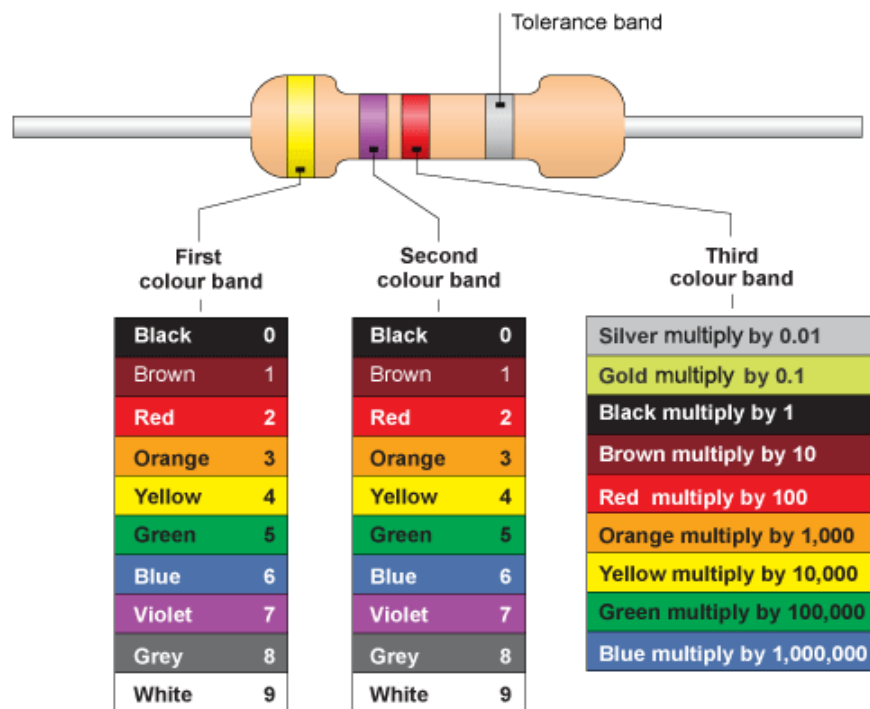
Fig: 4.18 Sample of Resistance and Color Code

4.10: Light Emitting Diode (LED)

A crystal rectifier (LED) could be a semiconductor that emits visible radiation once an electrical current passes through it. The sunshine isn't significantly bright, however in most LEDs it's monochromatic, occurring at one wavelength. The output from a diode will vary from red (at a wavelength of roughly 700 nanometers) to blue-violet (about four hundred nanometers). Some LEDs emit infrared (IR) energy (830 nanometers or longer); such a tool is understood as AN infrared-emitting diode (IRED).An diode or IRED consists of 2 parts of processed material referred to as P-type semiconductors and N-type semiconductors. These 2 parts area unit placed

in direct contact, forming a locality referred to as the contact. During this respect, the diode or IRED resembles most alternative diode varieties, however there are a unit necessary variations. The diode or IRED features a clear package, permitting visible or IR energy to go through. Also, the diode or IRED features a massive PN-junction space whose form is customized to the applying. Edges of LEDs and IREDs, compared with incandescent and fluorescent illuminating devices, include: Low power requirement: Most varieties is operated with battery power provides.
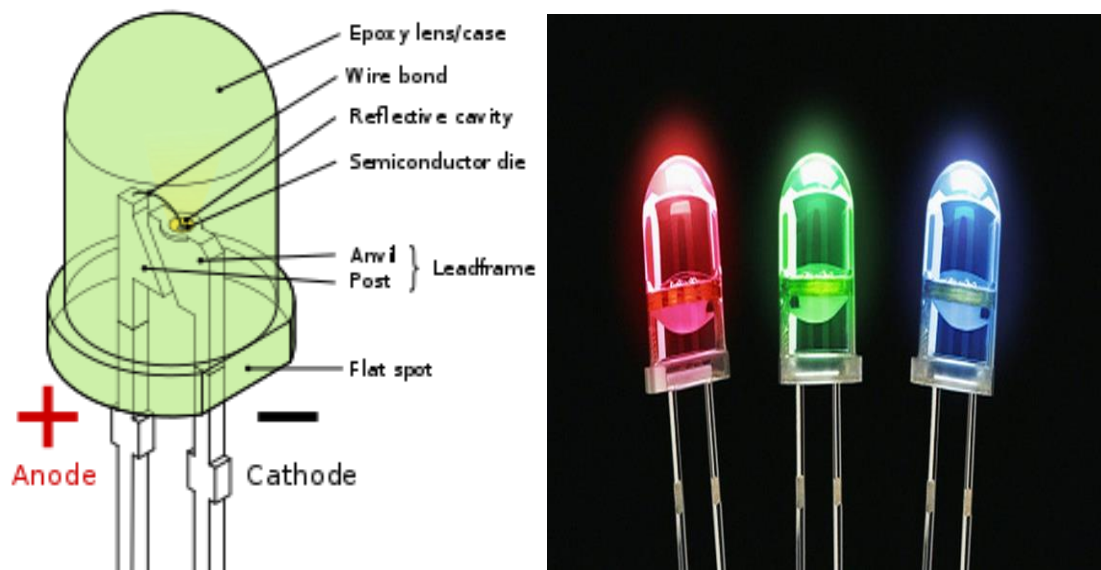
Fig: 4.19 Light Emitting Diode

4.11 Wires

In this project we need couples of Female to Male and Male to Male jumper wire. That is for connecting Bluetooth module and motor driver and all connecting device to the Arduino mega board.
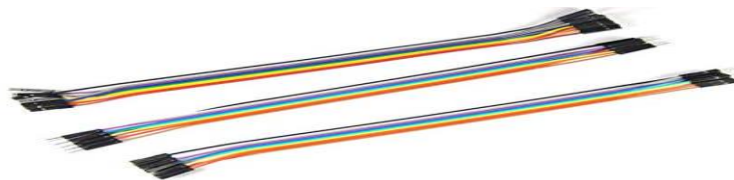
Fig: 4.20 Jumper wires

4.12: Power Supply 12 Volt

In this section we will describe about power supply for our robot. We need high power supply with several voltage and current ampere for our system that's why we select multi-star lipo battery which is provide 12 volt 5.2A and we use buck converter for several power supply. We will discuss in below section.

Fig: 4.21: 12 volt battery

Features:

• Ultra high capacity LiPoly batteries

• Similar size / weight as batteries of much less capacity, making it a direct drop-in upgrade for most multi-rotor aircraft

• Provides increased flight times of up to 20% or more when compared to standard LiPoly batteries of the same weight

• Ideal for use with aerial video and FPV multi-rotor aircract

Specifications:

Minimum Capacity: 5200mAh

Configuration: 3S1P / 11.1V / 3Cell

Constant Discharge: 10C

Peak Discharge (10sec): 20C

Pack Weight: 331g

Pack Size: 142 x 49 x 22mm

Charge Plug: JST-XH

Discharge Plug: XT60

4.12.1: Buck Converter

A buck converter (step-down device) could be a DC-to-DC power converter that steps down current from its output (load) to its input (load). it's a category of switched-mode power offer (SMPS) usually containing a minimum of 2 semiconductors (a diode and a semiconductor device, though fashionable buck converters usually replace the diode with a second semiconductor device used for synchronous rectification) and a minimum of one energy storage component , a condenser, inductor, or the 2 together to scale back voltage ripple, the filter manufactured from capacitors (sometimes together with inductors) is sometimes such a converter's output (load-side filter) and input (supply-side filter)
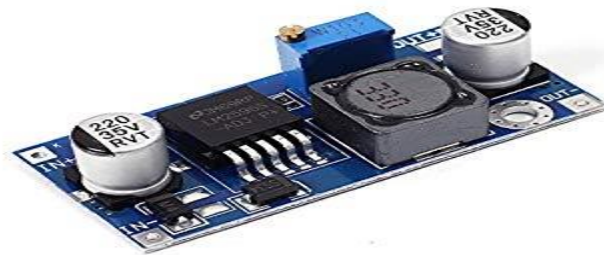
Fig: 4.22Buck Converter

4.12.2: Buck Converter Operation

When the switch within the buck regulator is on, the voltage that seems across the electrical device is VIN - Vout. victimization the electrical device equations, this within the electrical device can rise at a rate of (Vin-Vout) / L At now the diode D is reverse biased and doesn't conduct. Once the switch opens, current ought to still flow because the electrical device works to

stay identical current flowing. As a result current flows through the electrical device and within the load. The diode, D then forms the core path with a current diode. With the switch open, the polarity of the voltage across the electrical device has reversed and so this through the electrical device decreases with a slope capable -Vout / L
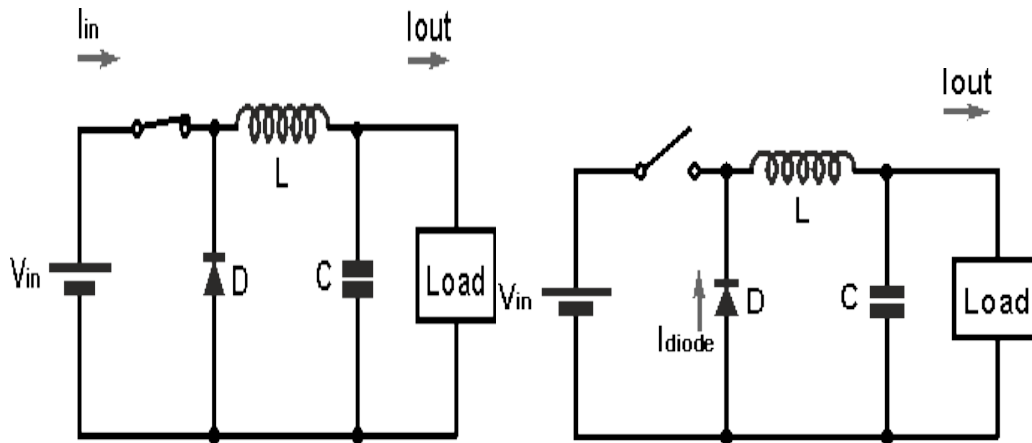
Fig: 4.23: Circuit Diagram Of Buck Converter Operations

4.13 Cost Analysis

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

4.13.1 Cost Sheet:

No	Component Name	Quantity	Purchase Price (TK)
01	Arduino mega	1	960.00
02	Bluetooth module	1	300.00
03	Servo motor	5	2750.00
04	Buck converter	2	480.00
05	Servo channel	1	440.00

06	Dc gear motor	3	1000.00
07	Wheel	1	300.00
09	L298N	8	240.00
10	Speaker	1	650
1 1	wires	10+	500.00
12	12 volt power supply	1	3500.00
13	charger	1	3000.00
14	PVC board	1	1000.00
15	Light emitting diode	50	50.00
16	Sonar sensor	1	160.00
17	Related tools		3000.00
	Total Cost		**=18330.00**

Table 4.4 Cost Sheet

4.14 Conclusion

Five main Component & some tools are used in this system (Smart development of a humanoid robot) to makes it .This robot is used to the several application. Our all component are very simple &available in our country market. A Smart development of a humanoid robot which used in many applications because of its desirable properties like homes, hostels, industries, and also teaching purpose.So we can use this robot formany application of our daily life. The cost involved in developing the system is significantly low and is much less than the cost of commercially available in the market.

CHAPTER 5

SOFTWARE ANALYSIS

5.1 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.

Fig:5.1 Software Logo

5.2: Description of our Software

Arduino is the world's leading open-source hardware and software ecosystem. The Company offers a range of software tools, hardware platforms and documentation enabling. Arduino is a popular tool for IoT product development as well as one of the most successful tools for STEM / STEAM education. Hundreds of thousands of designers, engineers, students, developers and makers around the world are using Arduino to innovate in music, games, toys, smart homes, farming, autonomous vehicles, robot and more.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 is shown below…

Fig: 5.2Arduino Software

It is conjointly capable of assembling and uploading programs to the board with one click. There's generally no got to edit make files or run programs on the command-line interface. Though building on command-line is feasible if needed with some third-party tools like Ino.

The Arduino IDE comes with a C/C++ library known as "Wiring" (from the project of a similar name), that makes several common input/output operations a lot of easier. Arduino programs square measure written in C/C++, though users solely got to outline 2 functions to create 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

5.2.1Program Explanation:

1. Important Initialization & Setup:-

- Software Serial Communication is used with PWM pin of Arduino.

<SoftwareSerial.h> - Header library is made us of!

- Sensor speaker pin is assigned to pin 46 using Variable "sensor"
- "Sensor " – Configured as Input
- "speaker" – Configured as Output
- "SD card" –Configured as input
- "motor" –Configured as output

5.3 Bluetooth Control System with an Android Phone:

I use this to connect the micro controller with the Android or any other Bluetooth device.
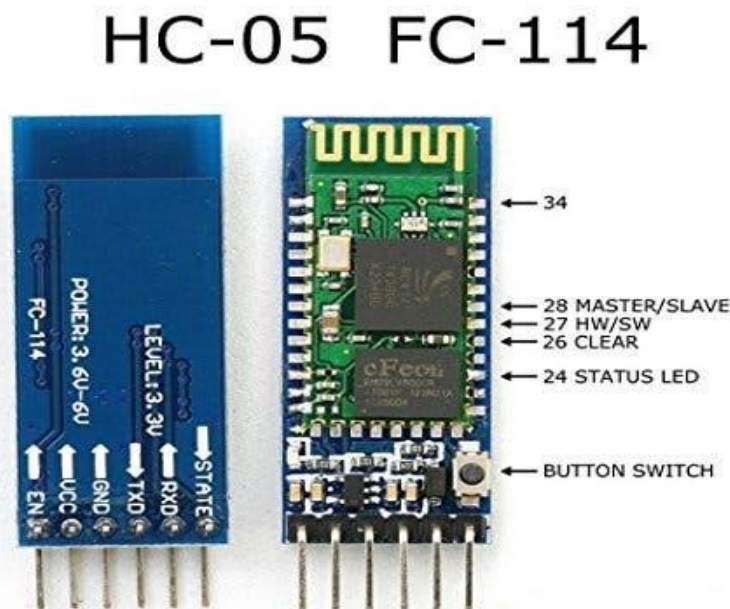
Fig 5.3: Bluetooth System.

Fig 5.4: Android Apps Amr Voice

5.4: Fritzing Software:

Fritzing is AN open supply initiative to develop amateur or hobby CAD code for the planning of natural philosophy hardware, to support designers and artists able to move from experimenting with a epitome to putting together a lot of permanent circuit. It absolutely was developed at the University Of Applied Sciences Of Potsdam. The code is made within the spirit of the process artificial language and also the Arduino microcontroller and permits a designer, artist, researcher, or amateur to document their Arduino-based epitome and make a PCB layout for producing. The associated web site helps users share and discuss drafts and experiences yet on scale back producing prices. By this code we tend to draw our circuit diagram with graphics interfaces.
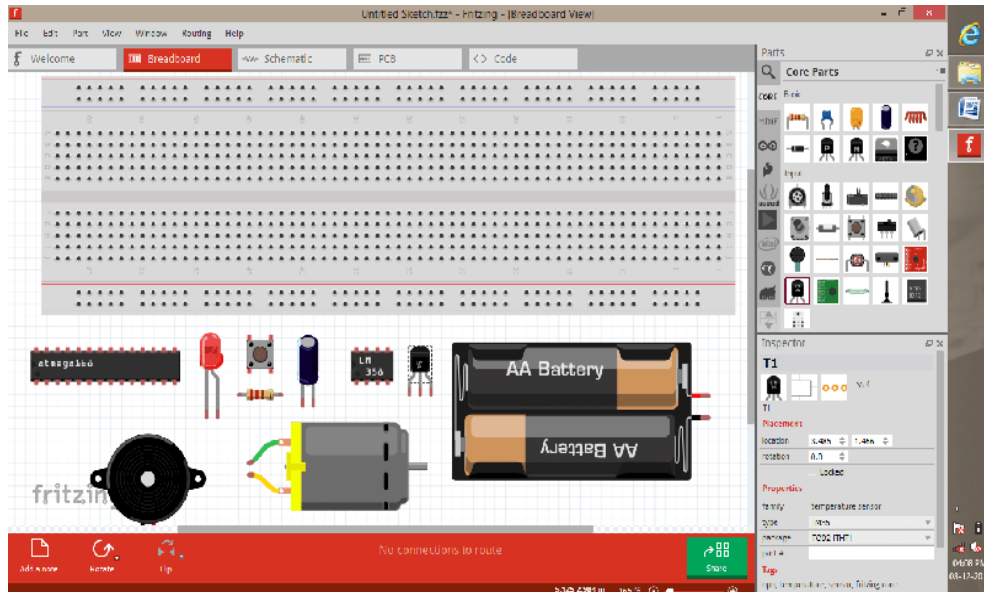
Fig:5.5Fritzing software

5.5: Conclusion

In this chapter we discussed about the software we use for our smart development of a robot. Here we use couple of software for programming, compiling, executing command for robot response and drawing circuit diagram for our robot and setup wireless communication between robot hardware .thus software are free and open source that's why it's reliable to us for making project or prototypes project. 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 6

RESULTS AND DISCUSSIONS

6.1 Introduction

The system proposed consists of five major modules namely, servo motor/ actuator, Bluetooth module, SD card module, Speaker and microcontroller, Display unit and led. It uses ATmage2596, which is an 8 bit microcontroller. It finds wide application due to its features and low power.in our smart development of a humanoid robot. Firstly we give the command through voice control app which is communicate with Bluetooth module and command execute in microcontroller unit and we get the output of our system. We use built in amplifier which come with speaker in market as a USB dual channel speaker it provide us good sound quality in 8 bit microcontroller which pass signal to amplifier for get output voice .And servo change its position which is coded in controller unit and run as we want to move the robot hand, head and other section.as usually other function will execute as the system was composed for development of a robot like human. LCD display show the command execution and different text to perception of robot.

6.2 Experimental Setup

In this project we experiment all the robot part are separately. The experiment of getting sound as an output of the robot is quite low and then we select a built in speaker which is buy from market. The servo is quite good during experiment. We do all of the part of robot is step by step it's become easier to us to reduce the circuit complexity and taking minimum time to stand the experimental setup.

6.2.1 Robot Hand
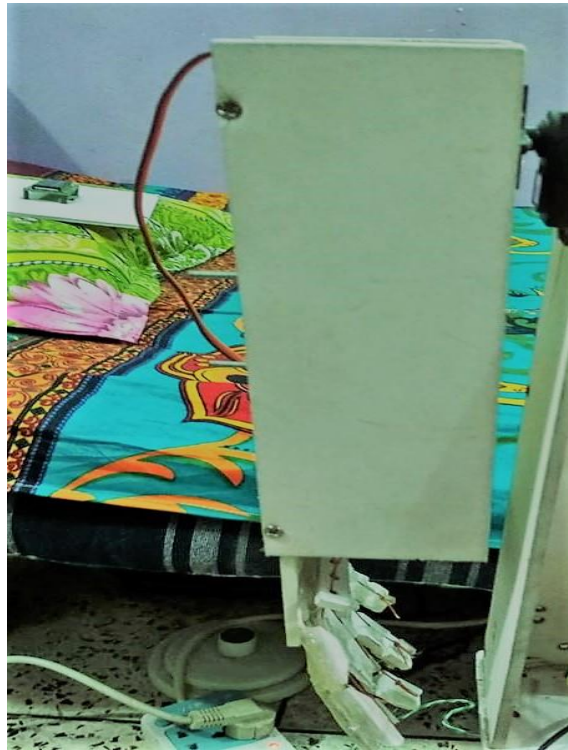
Fig: 6.1 Robot Hand Setup

6.2.2 Robot Head

Fig: 6.2 Head Setup

6.3 Testing of Our Project

After developing the circuit on the board, then complete are designing the full system. We can be seen that output.

Display Test

We are using 16*2 LCD display in this project. This following figure 6.3 shows the status massage commands to LCD module.
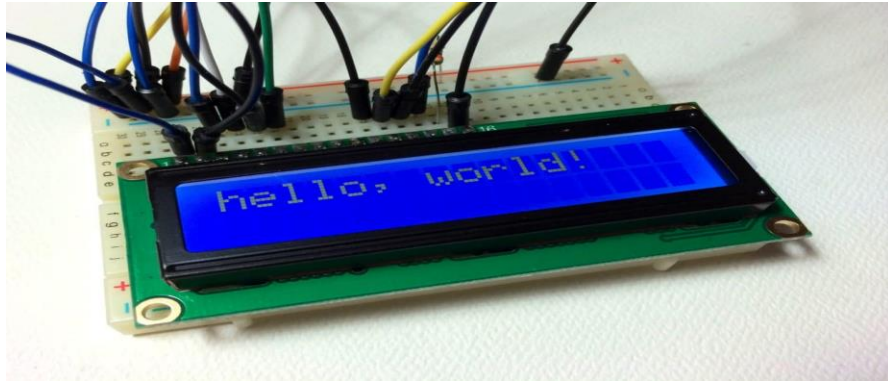
Fig 6.3: Display Output of Our System

Head test
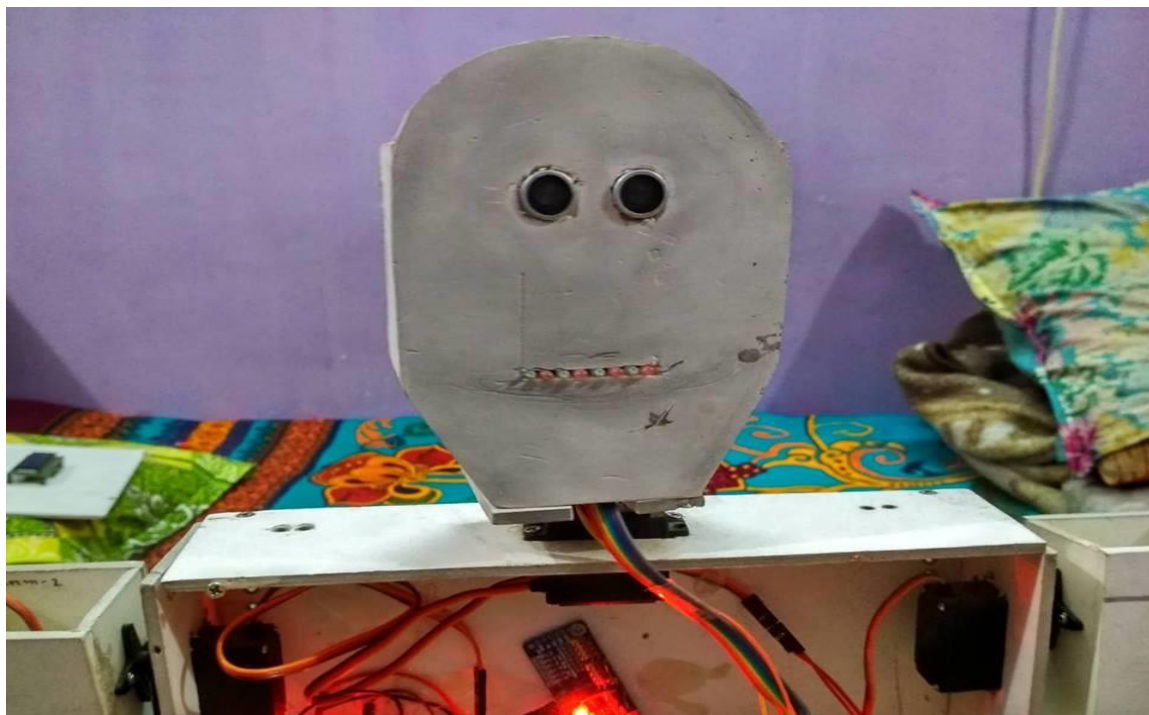
Fig: 6.4 Head Movement

Hand test
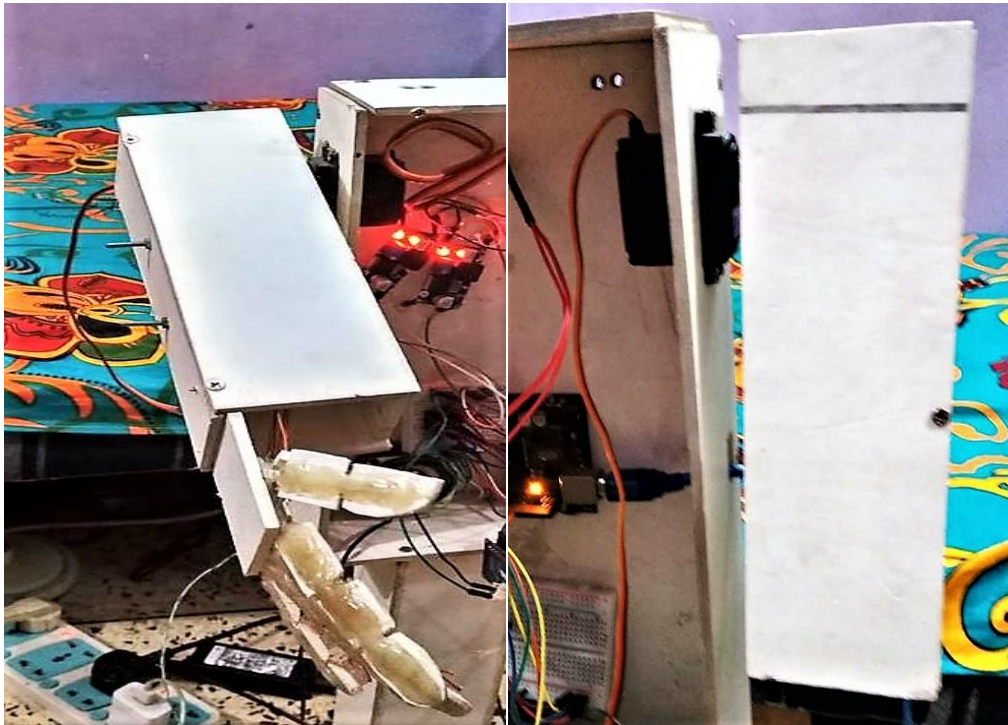
Fig: 6.5 Hand Movement

Body moving

Fig: 6.6 Whole Body Movement

6.4 Advantage:

i. we can use this type of robot for our education sector

ii. The robot can easily interface with voice command

iii. we can use this robot in industry for reduce human work load

iv. this robot can use in customer caring service company

v. also used in restaurant

vi. manage multiple simultaneous task

vii. repeatable

viii. moveable

ix. robot can be used in medical service

x. can be our assistant

As you all are aware of how can we utilize the robot in our daily life for complete the multiple task. This robot also be the part of that one.

6.5 Disadvantage

i. limit to simple procedures

ii. Construction and debug is hard

iii. Expensive

iv. Need a skill full operator in the relevant field for maintains the robot

v. take huge time to build such robot

vi. if the robot will be crush isn't recoverable

vii. very hard to program for a robot

6.6 Result

The smart development of a humanoid robot. In this project we get the output of the robot hand, Head, and moving part of the robot. the robot is response very well by giving the command and the result of command we get the hand shake movement of robot and head rotate during the shake hand and also rotate the head during the command execute in different command and blink led which setup in mouth for giving the shape of mouth during the robot talking and to take the necessary action and display the message on LCD display. Our project's is completed a

successful implementation & testing. It can be seen that output clearly. So we said that our smart development of a humanoid robot was effective fast response most response of the certain command and easy to interface with human voice

6.7 Conclusion

We tested our robot & it's worked properly. As beginning of the code section we use unit testing. When we made our modules we test it by unit testing. After complete development process of our full robot, we test it by integration testing system. In every test section we found some problems and we solve those problems as soon as possible. After completing all process including testing we are assuring that now the smart talking robot is such a robot which we can be introduce in the market and it can be ready for commercial use.

CHAPTER 7
CONCLUSION

7.1 Conclusion

The smart talking robot is a microcontroller base robot. The robot can talking, moving, shake hand, rotate head with the mentor who give the command to complete the specific task. The command execution show in display unit and blink led for the specific command. We hope that this type of robot take the remark of the robotics industry.In this project we have designed a humanoid robot by servo motor as its main motion provider & lithium polymer battery as its main source of power. PVC sheets have been used as a building block or body of the robotwe have finally succeeded in making the"Smart development of a humanoid robot" Satisfactorily. More knowledge is gained and more experiences are faced lot of information's are collected ultimately, we have concluded with a great pleasure for achieving our aim. We have planned to fulfill my technical requirements. The knowledge we have attained with this project really would follow till the end of our career.

7.2 Applications

Humanoid robots are now used as research tools in several scientific areas. Researchers study the human body structure and behavior (biomechanics) to build humanoid robots. On the other side, the attempt to simulate the human body leads to a better understanding of it. Human cognition is a field of study which is focused on how humans learn from sensory information in order to acquire perceptual and motor skills. This knowledge is used to develop computational models of human behavior and it has been improving over time.Besides the research.

- Humanoid robots ar being developed to perform human tasks like personal help, through that they ought to be ready to assist the sick and senior, and dirty or dangerous jobs.
- Humanoids also are appropriate for a few procedurally-based vocations, like reception-desk directors and automotive producing line employees.

- In essence, since they'll use tools and operate instrumentation and vehicles designed for the human kind, humanoids may in theory perform any task a person's being will, goodbye as they need the right code. However, the complexness of doing therefore is large.
- They also are turning into more and more standard as entertainers
- Large industries that use as their production.
- This project may be used as a system in applications like homes, hostels, industries.

7.3 Limitations of the Work

During experiment this robot we face a couple of limitation which is! in the controller unit the controller have very little flash memory which is 32 kilo bytes only so we cannot programed it above mentioned memory. Another is Bluetooth communication which interference with an android apps some time it will not take the command and disconnect the communication .in this project most of the sensory parts or device operate only 5 volt dc power supply if the power source is exceed 5 volt the sensory device is crushed or damage and it will not recoverable. If the speaker is burn or damage or don't get sufficient power it will not work that's the big issue during this project.

7.4 Future Scope

Robotics contains a terribly crucial & wide scope within the future because the technology is foreplay advancement each single moment to form our life higher. artificial intelligence is that the gift science, a humanoid robot have their own importance as a result of square measure they're style to perform all the task of a human being however during an additional precise manner they'll perform the task that area unit nearly not possible for human hands or their strength & speed permits them to perform the task of ten to twelve humans single handily & that's why their bodies are style on the idea of a form of a human body.

7.4.1 Artificial Intelligence in Upcoming Humanoid Robots

Artificial intelligence (AI) is intelligence exhibited by machines. In computer science, the field of AI research defines itself as the study of "intelligent agents": any device that perceives its environment and takes actions that maximize its chance of success at some goal. Colloquially, the term "artificial intelligence" is applied when a machine mimics "cognitive" functions that humans associate with other human minds, such as "learning" and "problem solving" (known as machine learning). As machines become increasingly capable, mental facilities once thought to require intelligence are removed from the definition. For instance, optical character recognition is no longer perceived as an example of "artificial intelligence", having become a routine technology.

Fig: 7.1 (Imaginable artificial circuitry)

7.4.2: Person Recognition

In the field of AI person recognition may be a hot topic. Person recognition technology applies to learning deep learning algorithms. The data that's generated with this identification may be accustomed improve the potency and so the business from each business is to start out the business in our mechanism next development are same like that

Fig: 7.2 Person Recognition

7.4.3: Text Reading and Speech Output

Text-to-speech functionality allows our characters to speak any text dynamically, in real time with correct lip-synching. Special effects can also be applied to the audio, including emotive cues and expressions. This functionality will be come as an alternative or compliment to a real human voices, TTS will be available in English languages. Thus features can help us many way of our daily life and hope that we can use this service in our learning platform.

The End

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[5]   https://www.hackster.io/ashwini-kumar-sinha/humaniod-a-i-talking-robot-with-arduino-433972
[6]   https://www.youtube.com/watch?v=BfMfysmfoNM
[7]   https://www.youtube.com/watch?v=QjX4JKU_I9M&vl=en
[8]   https://www.instructables.com/id/How-to-make-a-voice-control-direction-control-remo/
[9]   http://microcontrollerslab.com/voice-controlled-robot-arduino/
[10]   https://www.irjet.net/archives/V2/i1/Irjet-v2i109.pdf
[11]   https://www.youtube.com/watch?v=5w8G_OGzjD8
[12]   https://www.allaboutcircuits.com/projects/reading-and-writing-files-from-an-sd-card-with-an-arduino/
[13]   https://www.youtube.com/watch?v=YWY_Is0L7fE
[14]   https://www.youtube.com/watch?v=dyZolgNOomk
[15]   https://en.wikipedia.org/wiki/Humanoid_robot
[16]   http://www.ieee-ras.org/humanoid-robotics
[17]   https://www.youtube.com/watch?v=9LmaLemfSNw

Appendix A

The below code is for led of used in robot

```
int
led=2,
led1=3,
led2=4,
led3=5,
led4=6,
led5=7,
led6=8,
led7=9;
void setup() {
  // put your setup code here, to run once:
pinMode(led,OUTPUT);
pinMode(led1,OUTPUT);
pinMode(led2,OUTPUT);
pinMode(led3,OUTPUT);
pinMode(led4,OUTPUT);
pinMode(led5,OUTPUT);
pinMode(led6,OUTPUT);
pinMode(led7,OUTPUT);
}
void loop() {
  // put your main code here, to run repeatedly:
digitalWrite(led,1);
delay(10);
digitalWrite(led,0);
delay(50);
digitalWrite(led1,1);
delay(10);
digitalWrite(led1,0);
delay(50);
digitalWrite(led2,1);
delay(10);
digitalWrite(led2,0);
delay(50);
digitalWrite(led3,1);
delay(10);
digitalWrite(led3,0);
delay(50);
digitalWrite(led4,1);
```

```
delay(10);
digitalWrite(led4,0);
delay(50);
digitalWrite(led5,1);
delay(10);
digitalWrite(led5,0);
delay(50);
digitalWrite(led6,1);
delay(10);
digitalWrite(led6,0);
delay(50);
digitalWrite(led7,1);
delay(10);
digitalWrite(led7,0);
delay(50);
}
```

Appendix B

```
The below code for servo position of the robot
#include "ServoTimer2.h"
ServoTimer2 head;         //declare Head servo followed by left right hand servos
ServoTimer2 rightHand;
ServoTimer2 leftHand;
intpos=750;
int pos1=920;
void setup() {
head.attach(10);
rightHand.attach(9);
leftHand.attach(11);
// put your setup code here, to run once:
head.write(750);
rightHand.write(920);
}
void loop() {
for(pos=750; pos<=1750; pos+=1){
head.write(pos);
delay(5);
}
for (pos=1750;pos>=750; pos -=1){
head.write(pos);
delay(5);
head.write(1310);
}
for (pos1=920;pos1<=1500; pos1 +=1){
rightHand.write(pos1);
```

```
delay(5);
}
for (pos1=1500; pos1>=920;pos1 -=1){
rightHand.write(pos1);
delay(5);
}
// put your main code here, to run repeatedly:

}
```

Appendix C

The below code is used for the robot voice command and user need to install the library which mention in the code .the format is #include<libraryName.h>

```
#include <LiquidCrystal.h>
#include "SD.h"
#define SD_ChipSelectPin 10
#include "TMRpcm.h"
#include "SPI.h>
TMRpcmtmrpcm;
#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

//-------------------------Call A Function-----------------------------//
constintrs = A5, en = A4, d4 = A3, d5 = A2, d6 = A1, d7 = A0;
LiquidCrystallcd(rs, en, d4, d5, d6, d7);

inti = 0;
intpos;
Servo myServo;
void setup() {
//  Serial.begin(9600);
//  lcd.begin(16, 2);
//  myServo.attach(8); //edit for audio
//   myServo.write(90);
//  pinMode(in1, OUTPUT);
//  pinMode(in2, OUTPUT);
//  pinMode(in3, OUTPUT);
//  pinMode(in4, OUTPUT);
```

```
/////lcd print///
//  lcd.setCursor(0,0);
//  lcd.print("Welcome to");
//  delay(1000);
//  lcd.setCursor(1,0);
//  lcd.print("Project Solution");
//  delay(1000);
//  lcd.clear();
///////// audio setup/////
tmrpcm.speakerPin=9;
Serial.begin(9600);
if(!SD.begin(SD_ChipSelectPin))
{
Serial.println("SD fail");
return;
}
}
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 == "*Hello"){
say_hello();
}
else if(voice == "*how are you"){
replay();
}
else if(voice == "*who are you") {
i_am();
}
else if(voice == "*who build you") {
DIURC();
}
else if(voice == "*what about diu") {
about_diu();
}

voice=""; //Reset the variable after initiating
}
}
```

```
void say_hello()
{
tmrpcm.setVolume(6);
tmrpcm.play("robo.wav");
}
void replay()
{
tmrpcm.setVolume(6);
tmrpcm.play("robo.wav");
}
void i_am()
{
myServo.write(0);
delay(1000);
}
void DIURC()
{
tmrpcm.setVolume(6);
tmrpcm.play("robo.wav");
}
void about_diu()
{
tmrpcm.setVolume(6);
tmrpcm.play("robo.wav");
}
```