

# FARBOT

(Voice Command Humanoid Robot)

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A project submitted in partial fulfillment for the degree of Bachelor of  
Science in the Department of Computer Science and Engineering  
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**December, 2017**

## Declarations

The project has been submitted to the Department of the Computer Science & Engineering, East West University in the partial fulfillment of the requirement for the degree of Bachelor of Science in Computer Science & Engineering. We hereby, declare that this project has not been submitted elsewhere for the requirement of any degree or diploma or any other purposes.

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## Letter of Acceptance

This project is entitled “FARBOT(Voice Command Humanoid Robot)” submitted by: A S Fardin Ahmed ID:2012-2-60-043 and Marjan Islam Preom ID:2012-2-60-030 to the department of Computer Science & Engineering, East West University, Dhaka, Bangladesh is accepted as satisfactory for partial fulfillment of the requirement for the degree of Bachelor of Science in Computer Science & Engineering on December 2017.

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## **Acknowledgement**

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## **Abstract**

In today's world there is an increasing need to create artificial robots for different inhuman situations where human interaction is difficult or impossible. In this book, we proposed to design technology to build a voice controlled humanoid robot. This project is implemented in Arduino Mega ATmega2560(M 2560) device along with ultrasonic sensors and Bluetooth modules. The programming part is completed by Arduino IDE(1.8.3). By voice command, the designed robot can move four direction forward, backward, left and right, can lift its arm to catch and hold any object as well as discharge the object by down its arm gently. This robot can sense and interact with human being over a range of 30-90 cm within 180 degree angular movement. The robot is also designed to perform certain arithmetic operation through random voice command.

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# Chapter 1 Introduction

## 1.1 Background

The term 'robot' was first introduced in a play called "Rossum's universal robots" by the Czech writer Karel Capek. In that play man makes robots then robots killed man. Many movies continue to follow the idea of harmful robots. However, robots of present world are not as intelligent, walking, talking machines like the story or in a movies. Today we will find out robots working for people in an industry, warehouse or laboratory. But in robots may seem up in street, home, and school or even in our bodies. Fully functioning robots are many years away due to the many problems must be solved. But real working, sophisticated robots are in use in the industry and are really computer controlled 'arms'. Robots can change our way of thinking, our living standards and the world which we live in. Each new use brings new hopes and possibilities. There is a famous quote stated by Robot Institute of America in 1979:

*"A reprogrammable, multifunctional manipulator designed to move material, parts, tools, or specialized devices through various programmed motions for the performance of a variety of tasks.[1]"*

## 1.2 Motivation

Robots are cheaper often used them over human beings and easier for robots to do some jobs than humans and sometimes only possible for robot to do that work. Robot can explore inside gas tanks, inside volcanos, travel the surface of Mars and other places too dangerous for humans. Robot can also do the same thing over again and again. They never late for work like humans, they never skip their work and they always get the best result. That's why we tried to develop a robot which can do some of human jobs easily over again and again like moving an object from one place to another. We can place this robot at industry or medical hospitals for carrying an object.

## 1.3 Problem Statement

On November 15, 2017 Bangladesh's first-ever robot restaurant was launched in Dhaka, [2]. The launching ceremony for Mexwel Robot Restaurant was arranged jointly by the restaurant authorities and China-based robot-manufacturing organization HZX Electronic Technology Company. But this is just a line following robot and this robot can't place the menu to the table. By better budget and support we can build these robot. We don't need to export such

robot. We proposed our robot can perform these tasks like serving food to customers in a restaurant, carrying a heavy metal in an industry and so many things.



**Figure 1.1:** First Robot Restaurant in Dhaka

#### **1.4 Objectives**

The aim of this project is to design a humanoid robot using Arduino, Ultrasonic sensors, Bluetooth module and develop a robot that can be control by the voice. In this regard, the objectives under scrutiny are:

- 1) To design and built a voice controlled humanoid robot using microcontroller and sensors.
- 2) To make the designed system optimally applicable for movement, hand lifting and interaction with humans.

With the above project aims, the proposed design and matching techniques are applied to design the desired robot

#### **1.5 Organization of the book**

The outline of the report is structured as follows.

**Chapter 2** presents the literature review where all the previous works related to this project are described.

**Chapter 3** briefly describes the model of the robot. Later the design procedure and experimental set-up are explained in details here.

**Chapter 4** analysis and discuss the results through Arduino IDE (1.8.3).

**Chapter 5** outlines the remarks of conclusion of this project precisely and also describes the scope of future work by using the proposed robot.

## Chapter 2 Literature Review

### 2.1 Previous works

It may seem that the phenomenon of robots took root in recent years but the fact is, the robot devices have roots as far back as ancient Greece and in early Chinese dynasties. Greek Aristttotle made this famous quote:

*“If every tool, when ordered, or even of its own accord, could do the work that benefits it...then there would be no need either of apprentices for the master workers or of slaves for the lords [3]”.*

In 1495, Leonardo da Vinci designed a complex humanoid sketch, could perform human-like motions such as sitting up, moving its arms and twisting its head and neck. There are numerous examples of automated machines and robotic development in both ancient and more recent history, but the first truly modern robot to be added to the history of robots was invented by George C. Devol in 1954. This robot was called Unimate. In 1961, Unimate became the first industrial robot to work at the assembly line of a New Jersey. Up to 1970, the term artificial intelligence was in its infancy. Android robots were designed to absorb every detail and carry out mathematical operation to analyze what they see. In the 1990s, a turning point occurred in the study of the AI. Many robots have since delighted humans and helped make their lives easier. There is Robonaut, a humanoid robot operated from the Dexterous Robotics Laboratory at Nasa’s Johnson Space Center in Houston, Texas. This robot could manipulate space tools with its hands and could work in the environment suited to astronauts. Robonaut 2 will be the first humanoid robot that will become a permanent resident of the International Space Station. Then there is ASIMO, a 51 inch humanoid robot created at Honda’s Research & Development Center in Japan in Japan. ASIMO can walk or run, can detect multiple objects, assess distance and direction and can greet a person. But we are developing a humanoid robot that can be controlled by the voice. By voice control, this robot can be moved, can carry an object, can place an object, can discharge the object and can sense the human being in a fixed range. This robot can also perform random arithmetic operation by given random voice command. Sophia was created using breakthrough robotics and artificial intelligence. The developers proposed, Sophia isn’t just technology but real. Sophia appeared in several interviews and sung a song in a concert[4].

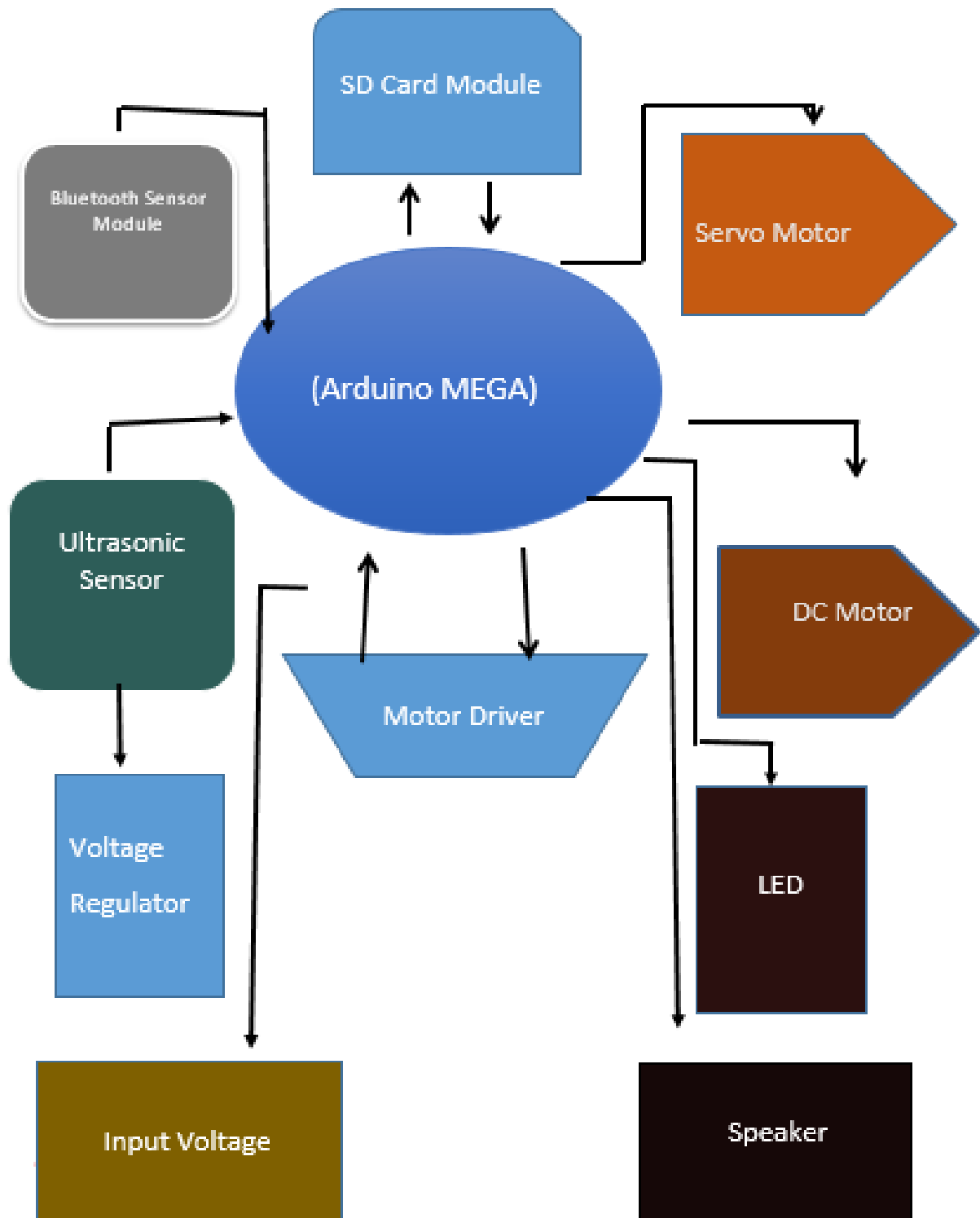
In Bangladesh, many organizations are trying to develop new project on robotics. BRAC University had sent a robot called CHONDROBOT-2 for competing NASA Lunabotics

Mining Competition on 2012. CHONDROBOT-2 was successful to collect samples in mining stage and also discharge those in the designated place[5].

In the year 2016, a total 11 member of the organization “ROBO SUST” of Shahjalal University of Science & Technology, produced the robot named ‘RIBO’[6]. This robot can speak ‘Bengali’ and able to move hands up and down and can dance. This robot can response to some certain call. This robot is used to call Social robot. They used voice recognition module to response to any voice command. But we proposed to design a robot that not only can move its hand as well as catch and hold an object. This robot can sense a human being in the range of 30-90 cm and can interact with that human being. In these project, voice command system works through an Android mobile that takes the voice as input and send it to Google and receives a feedback string. Mobile sends the string to the Arduino Bluetooth module through its built in Bluetooth function. Then Arduino filter the string and check with its functions and produce a signal.

## Chapter 3 Design and Methodology

### 3.1 System Overview



**Figure 3.1:** Block diagram

There are mainly three different parts of block diagram and these are Micro-controller, input/output and voltage source.

### **3.1.1 Micro-controller**

In this project, Arduino Mega 2560 is used which is controlling all operations and creating signals for the modules and sensor. The block diagram shows the left side of the microcontroller is for input operation and right side is showing the output operation.

### **3.1.2 Input/output**

There are three types of input output device for this project.

1. Bluetooth module and Ultrasonic sensors is used only for input (left side of the diagram green type color block).
2. Servo motor , DC motor, LED and Speaker are used only for output (Right side of the Block Diagram red type color block)
3. SD card module and motor driver are set in middle part of the block diagram (Blue type color block) are showing the input and output component.

On the other hand, the input/output device can be divide into two parts.

- A. Sensor is use to take data in various environments. In this project we use mainly ultrasonic sensor. Bluetooth is in fact a module which is connecting with two or more device but is sense the text from the phone to Micro-controller.
- B. Actuator works as the output provider of a device. LED, DC Motors, Speaker are the output provider of the project.

### **3.1.3 Power Supply**

There are two category of voltage source in this project.

LIPO battery (1500 mAh \* 3) are the main voltage / power source in this project, is shown in the bottom of the block diagram.

Voltage Regulator is the basic distributed voltage source of this project. Without this, Microcontroller and Motor Driver are also works distributed power source. Microcontroller can provide 3.3V and 5V and the motor driver can provide 12V and 5V power output which is gotten directly from the battery or other power source.

### 3.2 Circuit Diagram

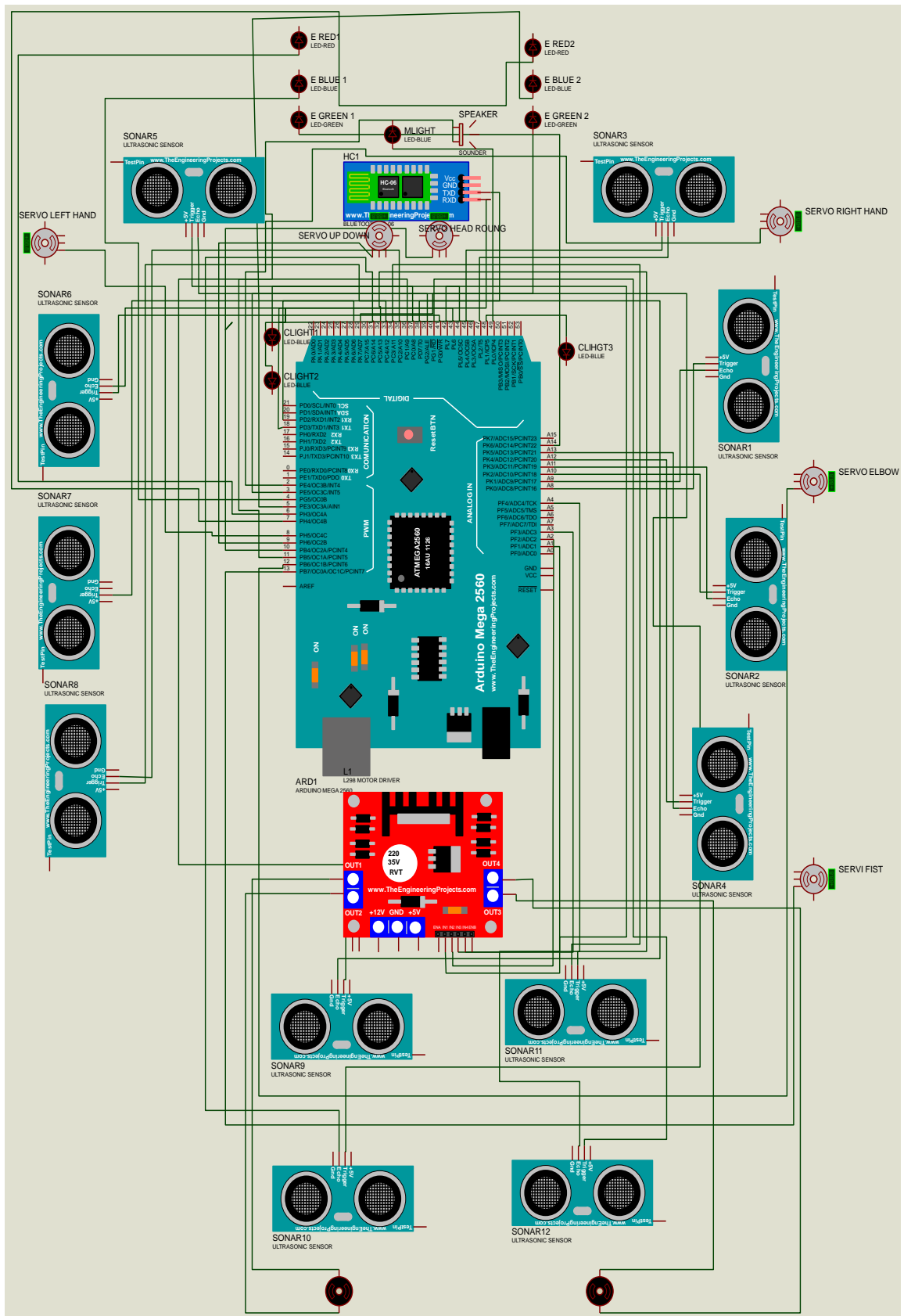


Figure 3.2: Circuit diagram



### **3.2.1 Description of Circuit Diagram**

The circuit diagram of the robot consists of sensors, one main power/voltage source and three types distributed- power source and four types actuators and the most important part of the project and that is Micro-controller.

All the input and out signal is connected directly or indirectly with the Micro-controller.

Arduino MEGA 2560 has mainly four different types of pin. These types of pin can provide or accept various types of signals.

### **3.2.2 Connection Establishment with Microcontroller:**

1. PWM pins can be used for increasing/decreasing the intensity of the Digital signals. So All the Servo motors are connected respectively pin (8,9,10,12,13 & 2) the Eyes LEDs are connected with respectively pin (3,4,5,6,7,) for reaction because PWM intensity changing can make reaction and the Speaker is connected with pin 11 for better voice signal.
2. Most of the ultrasonic sensors are connected with these Digital pins respectively (pin 28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,45,47) are used for ultrasonic sensors and (pin 44,46,48,49) are used for chest and mouth led. SD card module is connected with pin (50,51,52,53).
3. These pins are made for communication with other devices. Bluetooth Module has been connected with serial 1pin number (18,19).
4. Analog pins are used for analog signals. Motor Driver is connected with (A1,A2,A3,A4) and Ultrasonic sensor number (1,2,4) are connected with pin(A8,A9,A10,A11,A12,A13). And an eye LED is connected with analog A14 replacing by Servomotor pin 2.

### **3.2.3 Connection Establishment with Voltage/Power source:**

There are three battery which is using for power supply. These batteries are connected with three bread-board (+ve) and (-ve) connection. The breadboard common power lines (+ve) and common ground lines are providing the all power directly motor driver, Arduino, and voltage regulator. Voltage regulator are absorbing the direct 11.1V/12V from battery and providing 5V and 8V.

All the Servo Motors are connected with the 8V voltage regulators and all the ultrasonic sensor are connected with 5v voltage regulator. The number of voltage regulator is 12, that is use in the circuit and every single 5v voltage regulator is connected with 2 pieces ultrasonic sensor.

### 3.2.4 Connection Establishment with common basement:

All tools of this project are connected in a common base or common ground otherwise the circuit may be damaged. All component have a common path where these are directly or indirectly with connected the microcontroller that means a common ground connection.

### 3.2.5 Connection details

The following table shows the whole connection of the component

**Table 3.1:** Connection details

<u>Components Name</u>	<u>Component type</u>	<u>Connection pin</u>	<u>Required voltage/power</u>	<u>Component task</u>
<u>Microcontroller</u>	Input/output, signal generation, power supplier etc.	BUS Connector and has own 54 digital and 16 analog pins.	Operating Voltage (5V) Input voltage (7-12)V Limit (6-20)V	Signal generation, providing I/O, operating system, Powersupply, Storing data and code and logic.
<u>Bluetooth Module</u>	Input/output	Pin (18, 19)	5V	Receiving signals from other devices and transferring signals to Arduino in this project.
<u>Micro SD card Module</u>	Input /Output	Pin (50,51,52,53)	5V	Taking instruction and request for audio and supply

				these when microcontroller needs.
<b><u>Motor Driver</u></b>	Input /Output	Pin (A1,A2,A3,A4)	12V	Taking low signals from Arduino and amplifying the signals as the need of the DC motor.
<b><u>DC Motor</u></b>	Output	OUT1, OUT2, OUT3,OUT4	12V	Rotating Motor as the amplified signal of Motor driver from Arduino.
<b><u>Servo Motor</u></b>	Output	Digital PWM pin (8,9,10,12,13)	8V	Works as the Arduino signal which is written in angle position
<b><u>LED</u></b>	Output	Digital PWM pin (3,4,5,6,7) For eyes pin (44,46,48,49) for chest and mouth	5V	Blink as the signal
<b><u>Speaker</u></b>	Output	Pin (11)	5V	Voice Output

<b><u>Ultrasonic Sensor</u></b>	Input	For Sensor No:(3-12) except 4  pin (28,29,30,31, 32, 33,34,35,36,37, 38,39, 40,41,42,43,45,47)  For Sensor No.(1-4) except 3 pin(A8,A9,A10, A11,A12,A13).	5V	Take input From Environment and measured distance
<b><u>Power Source (Battery)</u></b>	Power Output	Breadboard (+ve) and (-ve)	( 11.1V -12 V)	Providing all power to components.
<b><u>Voltage Regulator</u></b>	Power input and output	Breadboard (+ve) and (-ve)	5V and 8V	

### 3.3 Component List

The following table shows the components details used in the designed project:

**Table 3.2:** Component list

<b>Name</b>	<b>Model Number/Type</b>	<b>Quantity</b>
<b>Arduino Mega</b>	ATmega2560(M 2560)	1
<b>Bluetooth module</b>	HC-06 FC114	1
<b>Ultrasonic sensor</b>	HC-SR04	12
<b>Servo motor</b>	MG995, MG996R, CYS-S8503	1, 4, 1
<b>Motor driver</b>	L298N	1
<b>DC Motor</b>		2
<b>Micro SD TF Module</b>		1
<b>Voltage Regulator</b>	L7808CV, L7805CV	12
<b>LIPO Battery</b>	12V	3
<b>LED</b>	R, G, B	10
<b>Jumper</b>	M-M, M-F, F-F	300-350
<b>Speaker</b>	Cell phone speaker	1
<b>Wheel</b>	Blue	2
<b>Breadboard</b>	White	3

### 3.4 Hardware design with pictures

The following pictures show the hardware in different scenario



**Figure 3.3:** Controller Circuit of the system



**Figure 3.4:** Closer view of the circuit



**Figure 3.5:** Ultrasonic sensor back view



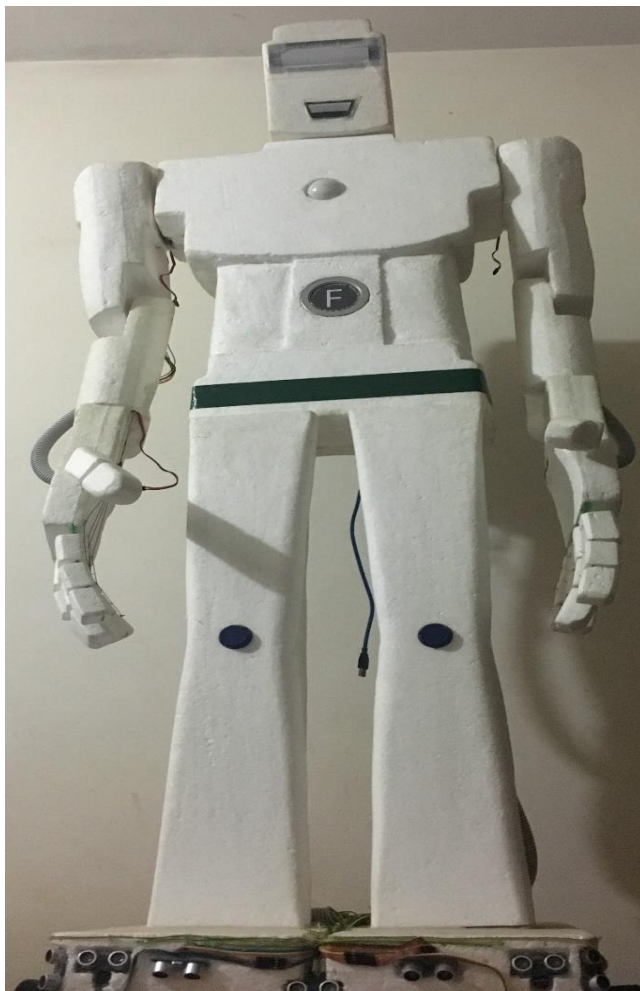
**Figure 3.6:** Ultrasonic sensor front view



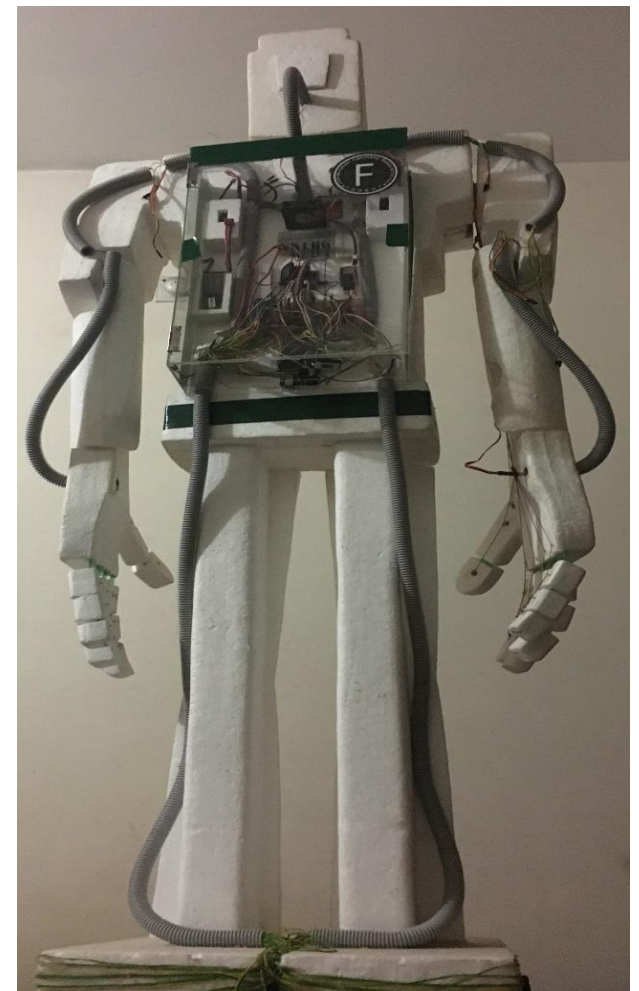
**Figure 3.7:** Ultrasonic sensor left view



**Figure 3.8:** Ultrasonic sensor right view



**Figure 3.9:** Front view of the robot



**Figure 3.10:** Back view of the robot

### 3.5 Software setup

#### 3.5.1 Platform and device

This project is handled by Arduino IDE (version 1.8.3) software which is used for hardware types programming and the device that is used in this project, is Arduino MEGA 2560, processor ATmega2560(Mega2560) and programmer board “AVRISP mkII”.

#### 3.5.2 Algorithm

##### 3.5.2.1 Algorithmic flowchart

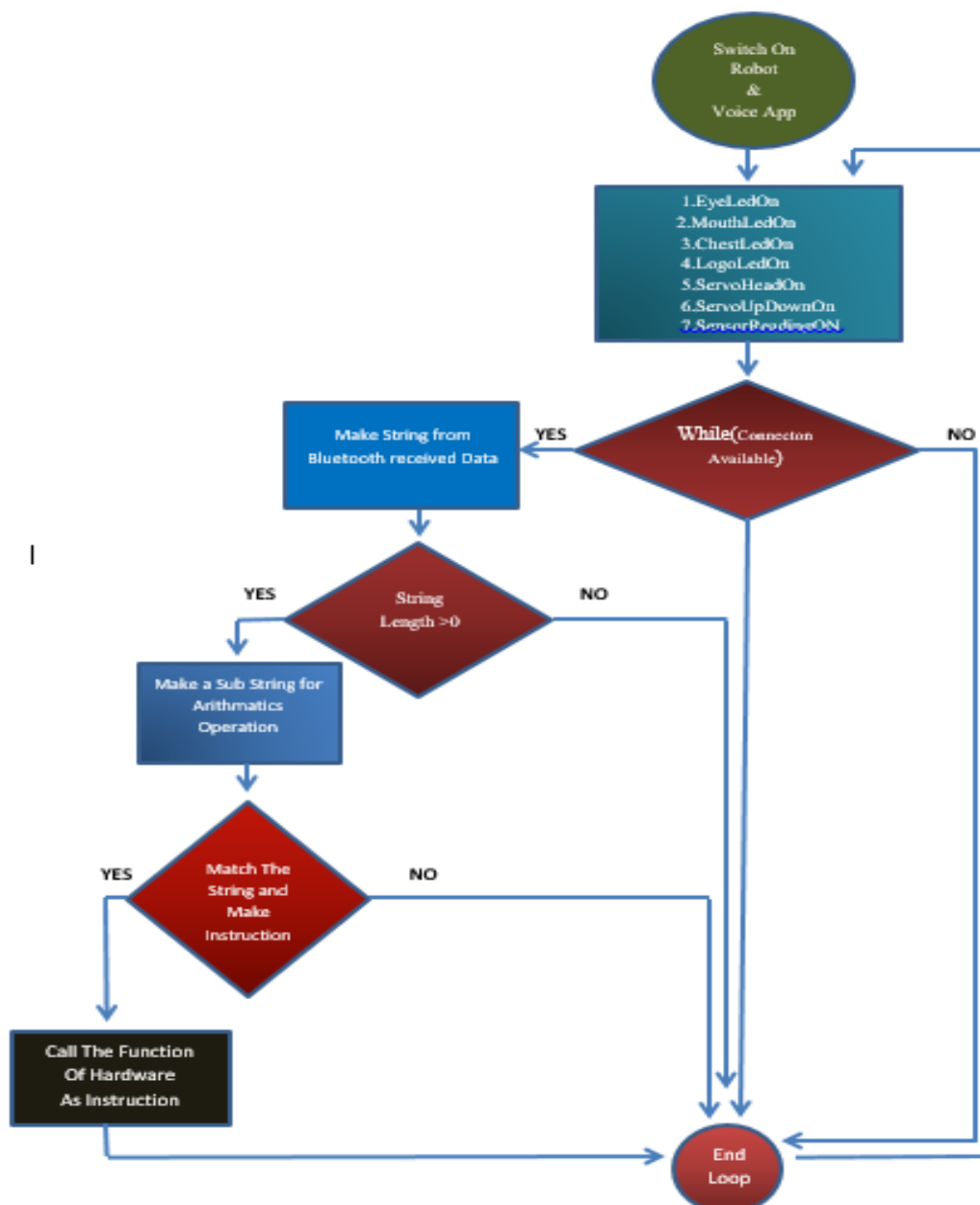
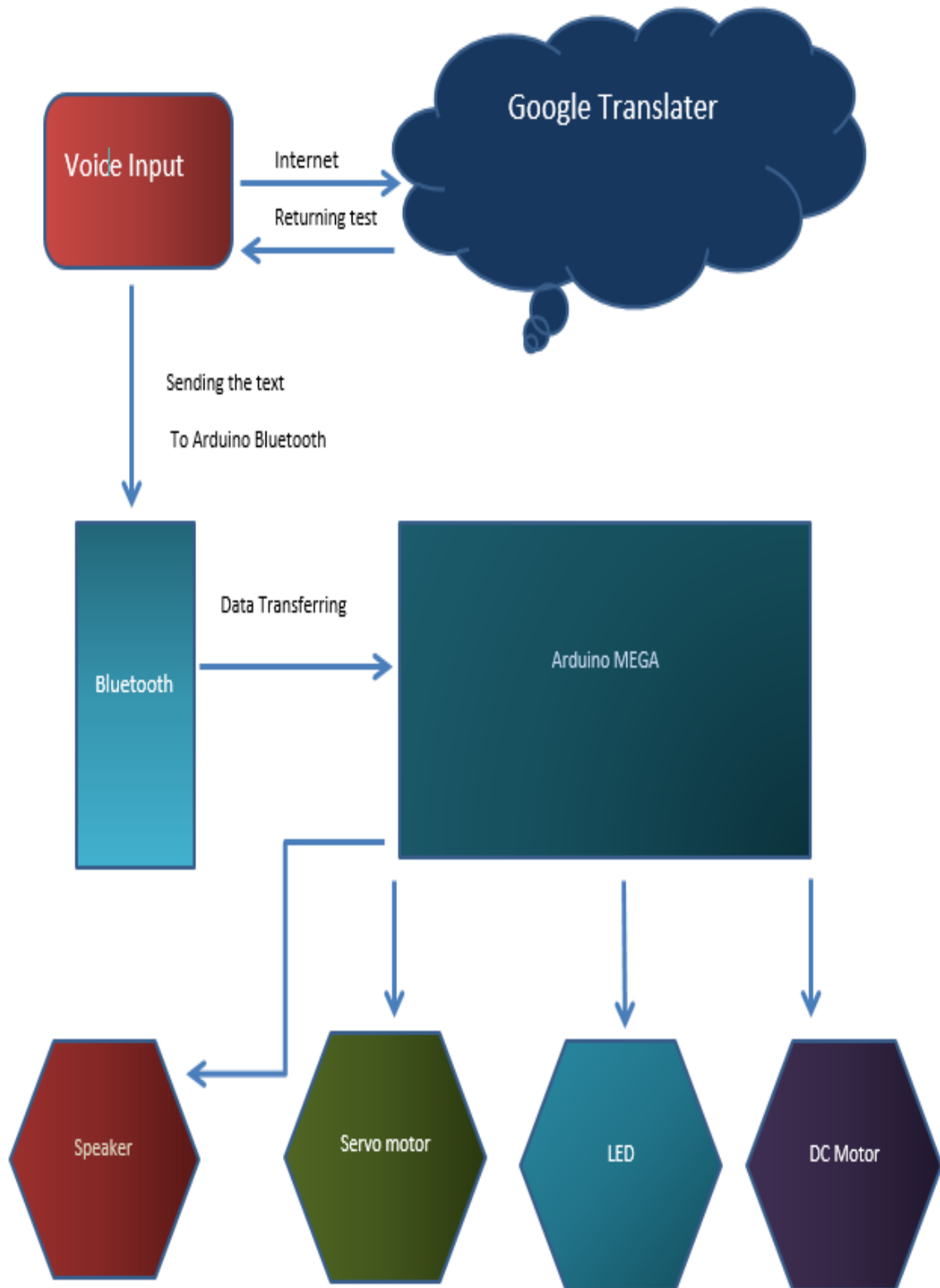


Figure 3.11: Algorithmic flowchart

The Algorithmic flowchart shows the interaction between hardware and software. When the switch or power is on, the robot become active hardly. Before connecting between two Bluetooth one is mobile Bluetooth and another is Arduino Bluetooth , ServoMotors and LED function starts and it can detect human movement and follow the movement by rounding its' neck as well as show the eyes reactions. After creating the connection between two Bluetooth theRobot can take the voice from the mobile via app and the voice data is translated into text by Google and returned as text into mobile. The phone transfer the data into Arduino Bluetooth, Arduino received the data from Bluetooth and make is as a string by adding the character one by one and get a length, if the length is 0 then round the main loop and wait for another voice data. When the length is more than 0 then it make a sub string only for mathematical operation and check all the command that is keep into logical operation. If a string is matched then it calls the hardware function as machine instruction for activating another part of the robot body like hand movement, handshake, go forward,backward, left, right or reply answer by its speaker.



### 3.5.2.2 Functional flowchart



**Figure 3.12:** Functional flowchart

The function flowchart show the main function of the robot. After voice input and translating in Google, it returns the Microcontroller and microcontroller process the voice and activate four major tasks, and these are speaker, servomotor, led, and DC motor and the component make a human behavior as Arduino instructional code.

### 3.5.3 Implementation of hardware

The main device is Arduino MEGA of this project. It creates digital and analog signal as the written program.

Firstly, Ultrasonic sensors are used for input. There are total four pins Vcc, ground,echo and trig pin and two parts for taking input. One is Trig and another is Echo component. Trig component throws a wave in front of this device and the wave are reflected by any obstacle. The sensor provide a value of time  $t$  and Arduino calculate distance value in cm unit. Here  $t$  is considered as one half time, because Echo pin gets a reflected value of  $t$  that is  $t_{\text{sensor}} = (T_{\text{original wave}} + T_{\text{reflected wave}})$  and  $t_{\text{calculate}} = t_{\text{sensor}} / 2$  and another factor is velocity of sound in air .the time and velocity provides the distance of the obstacle. The number of voltage regulator is twelve that is attached in the footer of the robot for getting better result and for avoiding the height of factor(human). These sensor are set in different angle in the footer and sensor 3 and 5 are used for the height of path. If it gives bigger height the robot will understand that there are hindrance in front of the robot and stop to go ahead.

Secondly, Bluetooth Module is the most important factor for voice input and output of the Robot. Except Ground and Vcc pin the two pin is most important part of Bluetooth and that is Tx for transfer the data and Rx if for received the data. The Tx pin of Bluetooth will be connected with Arduino receiver pin and Bluetooth Rx pin will be connected with ArduinoTx pin because what is transferred by Bluetooth module , that is received for Arduino. The mobile gives a voice data to voice app and the voice app sends it Google via internet for translating in Goggle. After translation, Google back the data as a text Bluetooth module sends the text data to Arduino, and Arduino makes the text data as a sting which is contain a “\*” in front of the string.

Thirdly, after receiving the string, Arduino filter the string by the processor which have a complete ALU / IO system and can compile like a computer. Microcontroller make decision for the string and if it is not a mathematical operation the other hardware or component work by the instruction of Arduino. Arduino makes the different signal for different operation.

Moreover, Servo motor is another important part for this Project. There are six servo motors in the body and most of these are 8-10kg torque servo and the right hand servo is about 28-33kg torque servo. The servo motor creates the angle for different instructions. All the servo angle range is 0 to 180 degree. The servo motors are fit in different position and angle considering the structure of the robot structure. The servo has three pins Vcc, Ground And signal. When servo gets an instruction from Microcontroller it write the position of angle and that is consider as the response or gesture to another.

For movement, two DC Motors are used in the footer of the robot. Though there is two motors but it actually work as four motor because when it move forward the two motors rotate clockwise and for coming back these rotate anti clockwise. The motors get signal from motor driver. The motor driver gets signal directly from Arduino. It gets a weak signal from motor Microcontroller and amplify the signal by using its internal component and additional power suppliers. The four input pins pass the amplified signals through the four output pins as well as these output pins get connection directly with the DC motors.

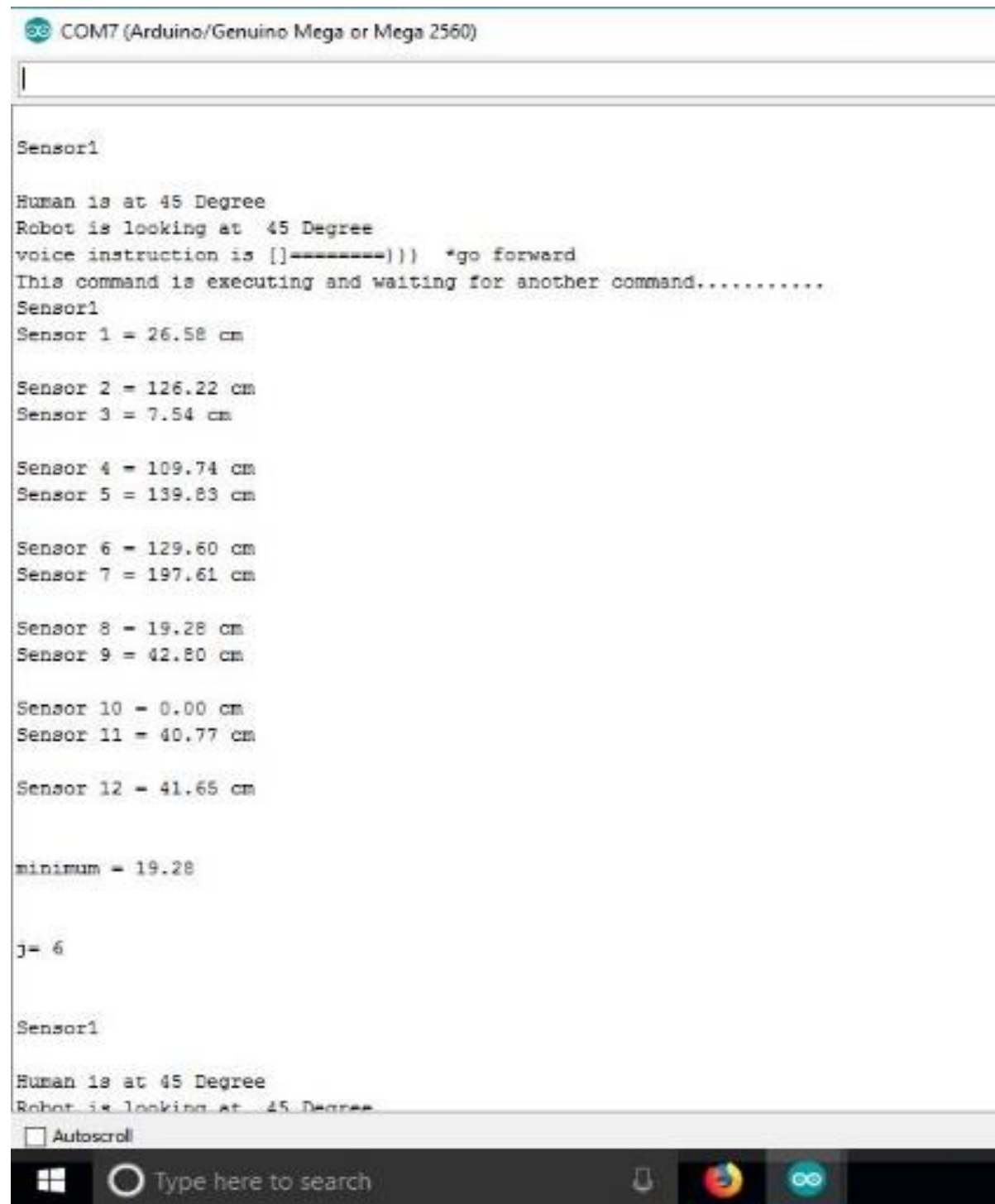
Arduino pins 50,51,52,53 connect the SD card module which is used for voice output from robot. SD card module needs 3.3 or 5 volt for operating the internal operation. This is the main storage for the voice output and secondary storage for the whole project. A chip selector pin must need for voice output and that is connected in 53 number digital pin. All audio files keep in Micro SD card in the SD card module and these files must be converted as wave type audio, unsigned 8 bit, frequency 16000Hz, mono speaker mode by converting online audio converter. Arduino support less than or equal 2 GB Micro SD card and less than or equal 16 GB for Normal SD card. Before keeping all audio files the micro SD card is formatted because if there any virus or malware in SD card the audio files will not be play. There must be needed two Header files <SD.h> and<TMRpcm.h> for hardware adjustment with the files and playing audio. Speaker is used for voice output. PWM pin number 11 is fixed for speaker. A mobile speaker are used for voice output and the assistant speaker or mic speaker is used for amplifying the sound of the mobile speaker.

Total 12 pieces voltage regulators are used for secondary power source. Lipo battery provides 11.1V - 12V and that can damage the little device like ultrasonic sensors, SD card module even servo motors. So total 6 pieces of 5V voltage regulator are used for 12 pieces of Ultrasonic sensor and other 6 pieces of 8V voltage regulator are used for servomotors. Voltage regulator convert the higher voltage to lower voltage according to its range.

LED are used for reaction or mode of the robot. Total 3 colors LED is used in the robot for different reaction. There will be three modes of robot, Normal mode, Friend mode and enemy mode. Green eyes LEDs are for Friend mode, red for enemy mode and blue for normal mode/command mode. Chest and mouth LEDs are blue for showing the active mode or alive mode of the robot.

## Chapter 4 Results and Discussion

### 4.1 Hardware output



The screenshot shows the Arduino IDE terminal window for COM7 (Arduino/Genuino Mega or Mega 2560). The terminal output is as follows:

```
Sensor1
Human is at 45 Degree
Robot is looking at 45 Degree
voice instruction is [ ]-----)) *go forward
This command is executing and waiting for another command,.....
Sensor1
Sensor 1 = 26.58 cm

Sensor 2 = 126.22 cm
Sensor 3 = 7.54 cm

Sensor 4 = 109.74 cm
Sensor 5 = 139.83 cm

Sensor 6 = 129.60 cm
Sensor 7 = 197.61 cm

Sensor 8 = 19.28 cm
Sensor 9 = 42.80 cm

Sensor 10 = 0.00 cm
Sensor 11 = 40.77 cm

Sensor 12 = 41.65 cm

minimum = 19.28

j= 6

Sensor1
Human is at 45 Degree
Robot is looking at 45 Degree
```

At the bottom of the terminal window, there is an "Autoscroll" checkbox which is currently unchecked. The Windows taskbar is visible at the bottom of the image, showing the Start button, a search bar with the text "Type here to search", and several application icons including the Arduino IDE icon.

**Figure 4.1:** Output of sensor data and non-arithmetic command

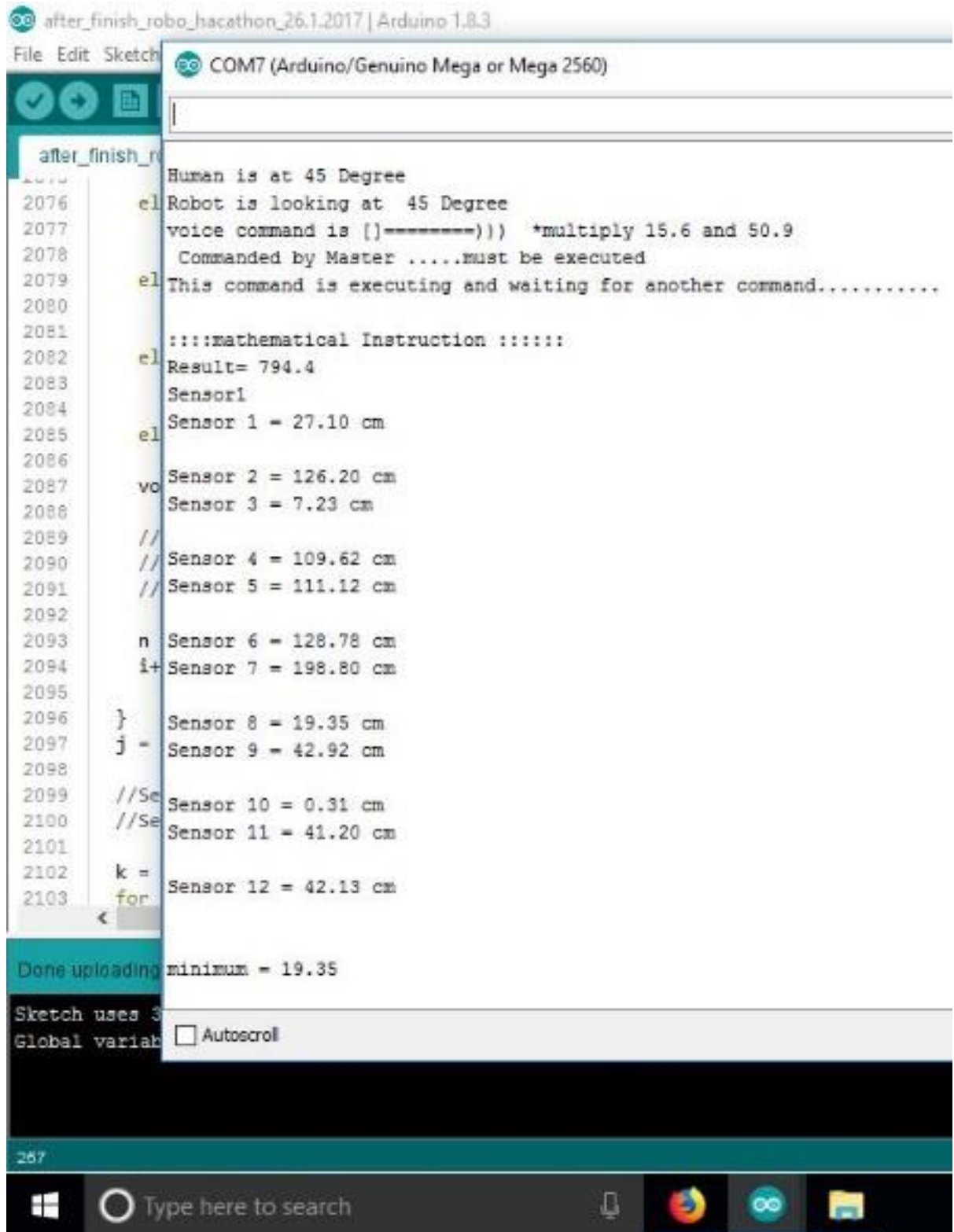


Figure 4.2: Output of Non-arithmetic command

```
Sensor1  
  
Human is at 45 Degree  
Robot is looking at 45 Degree  
voice instruction is [ ]=====)) *add 2.6 and 5.6  
This command is executing and waiting for another command.....  
Result= 8.19  
Sensor1  
Sensor 1 = 26.75 cm  
  
Sensor 2 = 126.48 cm  
Sensor 3 = 7.75 cm  
  
Sensor 4 = 109.88 cm  
Sensor 5 = 360.40 cm  
  
Sensor 6 = 130.81 cm  
Sensor 7 = 196.41 cm  
  
Sensor 8 = 18.28 cm  
Sensor 9 = 41.87 cm  
  
Sensor 10 = 0.07 cm  
Sensor 11 = 42.63 cm  
  
Sensor 12 = 42.13 cm  
  
minimum = 18.28  
  
j= 6  
  
Sensor1  
  
Human is at 45 Degree  
Robot is looking at 45 Degree
```

Autoscroll



Figure 4.3: Output of arithmetic command

## 4.2 Analysis of extracted data

There are mainly two types of data, voice data and sensor data. Voice data is used for command and sensor data is used for reaction. The voice data is remote communication mechanism and this mechanism is control by Bluetooth sensor. That mechanism is described in chapter 3 [Implementation of hardware 3.5]. The sensor data is collected by Ultrasonic sensor in centimeter. The data are analyses by Arduino and it's controlling the gesture and movement. The range of this input 30-90 centimeters. For gesture Arduino takes nearest input and if there is multiple object, then it gives response to all. Result analysis of Ultrasonic sensors given in following table:

**Table 4.1:** Ultrasonic sensor results

Name	Angle
Ultrasonic sensor 1	45 degree
Ultrasonic sensor 2	60 degree
Ultrasonic sensor 4	90 degree
Ultrasonic sensor 6	120 degree
Ultrasonic sensor 7	135 degree
Ultrasonic sensor 8	150 degree
Ultrasonic sensor 9	180 degree
Ultrasonic sensor 11	0 degree
Ultrasonic sensor 12	30 degree

According to this table, the head of the robot responses following degree. Here the range of the servo motor is 0-180 degree. 90 degree is the static position of the servo that means its, neutral position head like human. Straight right-side position is 0 degree that means when sensor 11 gets find the object or human and sensor 9 s' value indicatethe right most position of head.The following table shows the movement of the head according to distance:

**Table 4.2:** Ultrasonic sensor result by distance

Name	Distance(cm)	Position(Head up-down)
Ultrasonic sensor 4	5-20	50 degree
	21-50	60 degree
	51-60	65 degree
	61-70	70 degree
	71-90	77 degree
	➤ 90	82 degree



This table indicates the Up-Down position of head of the robot. The neutral position of head is 82 degree and the lower position of the head is 50 degree. This is one of the important for part for show reaction of robot.

### **4.3 Discussion**

All the function of this project is written after setting each component. When the text data comes from Bluetooth it send a letter at a time. These letters is added in string variable and that is “voice”. For non-mathematical command, “voice” variable is match with the conditional string value. But for mathematical term, another string value is created for verifying the arithmetical command that is “sub voice”. If it is a mathematical command, firstly, it makes two strings which contain only 0-9 characters including point (.)from the “voice” string two string are again converted into two float number by another user defined function. After finishing the arithmetic’s operation by a function it return a float data for the previous function. Then the data are again converted into string by another user defined function. After making a string, the string letter is check one by one with 0-9 including point (.). When it gets match with character, Micro-controller request for the audio file which is store for playing the audio to Micro-SD card Module. SD card module return audio file to Microcontroller and it play the audio. There is used a certain amount of delay equal to voice length for playing perfectly the audio sound. Moreover, before playing an audio, there is a led effect on mouth and after changing the position of the head the eyes led use PWM blink and that react as human eyes reaction. Before activating all circuit connection all programming id done parallel. Sometimes many built in functions cannot work perfectly because Arduino is an 8 bits microcontroller and some arithmetic’s result can be increase or decrease in a little amount for over flow of data as it is an 8 bits microcontroller.

All component is connected with a common ground where Arduino ground is connected directly. There is used 3 battery for supplying power in the whole circuit. If the battery power is low, the sensor value may be change for irregular power consuming. For protecting the little component, voltage regulator is used and as the SD card module very power sensitive module, so it is connected directly with Arduino. The right hand of the robot is active for lifting the object. There are used a high torque Servo motor. Although the servo is a high torque servo, there is needed to attach some mass upper positionof the servo for balancing.

Another fact is speaker adjustment. As it is an unsigned 8-bit microprocessor, so the speaker selection is much more important because if the speaker frequency does not match with the power supply or, a little noise creates for the frequency.

Servo motor creates some problem to up hand. The right hand elbow servo motor is written one by one degree and try to reach the expected position, the servo efficiency may decrease because when after reaching a certain position (angle), it cannot up any more. So servo motor position is written directly instead of increasing one by one degree gradually. But we decrease gradually the angle of the elbow servo when we down the arm.

## **Chapter 5 Conclusion and future work**

### **5.1 Conclusion**

Robots offer benefits to workers, industries and countries. If introduced correctly, robots can improve the quality of life by doing dirty, dangerous, heavy and repeated works. We proposed to design a humanoid robot that can be used for better life. This robot can be controlled easily. This robot can move easily, lift its arm, catch and hold an object and discharge the object gently. This robot can sense the human being in a fixed distance. This robot can perform specific arithmetic operation.

### **5.2 Future work**

The use of robots increasing day by day in real world. As time passing by people are depending on the machine rather than human being for their reliability, work skills, maximum result and saving time. In future, we plan to add IoT to this robot to control it from maximum distance. We plan to make this robot more user friendly so that this robot can be used for educational and industrial purpose. In industrial or medical organization this robot will provide maximum assistance by doing dangerous, dirty, heavy and repeated work.

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