CHAPTER-1

OBJECTIVES AND INTRODUCTION

1.1 INTRODUCTION

Dustbin is the storage container used for disposing waste by each and every person in the world. The main thing they look in their surrounding for disposing waste is the Dustbin. Smart Dustbin is just a normal bin where everyone can dispose waste but integration of some hardware components is done for more efficient use of it. Smart Dustbin is integrated with some hardware components such as Arduino, Servo Motor, Ultrasonic sensors. These components help in opening the lid, on detection of human hand and waste. The code required to perform the above-mentioned operation is dumped in Arduino.

1.2 BACKGROUND

As we all know that the modern world is changing so drastically to machine level functioning .So we need to develop such a programs which will function as an machine but also they could understand the instruction given by us .So we have developed a smart dustbin as our project for the better understanding of the modernized world and to understand the machine language in deeper level.

1.3 PROBLEM STATEMENT

We have thought about developing this project in embedded system due to the emerging trend in modern world which uses the application for different purposes. Even though we have tried best to make the system error free but some errors may have crept into it. The limitation on the system is the lesson for us to improve it. During the procedure we have faced many problems in designing, coding, testing, debugging and implementation.

1.4 OBJECTIVES

Every project must have some objectives that lead to the development of the project. Our project also has some objectives that must be fulfilled by the project.

- To design and build a prototype for an automatic open dustbin that can automatically open the lid when it detects the people who want to throw out their trash.
- To get familiar with the Arduino and the respective sensor how to use them for a cause.
- To analysis the dustbin program and set it up according to the physical distance for best working.

1.5 PROPOSED WORK

We propose this integration of smart dustbin technology in the society. It solves the issue of waste management using smart dustbins. Screens in the past few years, have reached the pinnacle of popularity and have revolutionized the use of mobile technology in the automation of routine task in wireless environment.

CHAPTER-2

ANALYSIS

2.1 REQUIREMENT ANALYSIS

Regarding our project we need both hardware and software elements as our project is the embedded one. For the actual analysis of the requirements we went through several research papers that we found online.

2.1.1 HARDWARE REQUIREMENT

Fig 1: Arduino uno

Fig 2: 12 V Battery

Fig 3: Servo Motor

Fig 4: Ultrasonic Sensor

Fig 5: Jumping wires

Fig 6: Switch

1. ARDUINO UNO

In our project, we use Arduino uno as microcontroller. It helps to store the code that we had hard coded using Arduino uno software. It helps to receive command from Ultrasonic Sensor and transfer command to Servo Motor. Then, servo motor start to work according to command.

2. 12V BATTERY

12v Battery is used to supply power to ultrasonic sensor, Arduino uno and servo motor.

3. SERVO MOTOR

Servo motor helps in opening the lid of the dustbin. It include precise control of angular or linear position.

4. ULTRASONIC SENSOR

Ultrasonic sensor HC-SR04 is used to detect object in front. It sends the signals to Arduino Uno. The Arduino Uno understands the signals and sends a signal to the Servo motor which opens the lid on the top of the dustbin.

5. JUMPING WIRES

In our Smart Dustbin we use many types of jumper wire to connect Arduino Uno, Servo motor and Ultrasonic Sensor. We use different types of jumper wire. Specially, we use male to male and male to female jumpers.

6. SWITCH

Switch is used to control the power supply from battery to Arduino Uno.

2.1.2 SOFTWARE REQUIEMENT

ARDUINO IDE

The Arduino IDE is a cross-platform application that is written in functions from C and C++. Arduino IDE is an open source software that is mainly used for writing and compiling the code into Arduino module. In our project we used it to write the program to control the servo motor taking command coming through a ultrasonic sensor.

PROGRAM

We designed the program in such a way that it could take the command that is coming through ultrasonic sensor and give the control signals to the servo motor to open the lid of the dustbin.

The code part of the system is given below:

CODE :

```
#include <Servo.h> //servo library
Servo servo;
int trigPin = 5;
int echoPin = 6;
int servoPin = 7;
int led= 10;
long duration, dist, average;
long aver[3]; //array for average

void setup() {
Serial.begin(9600);
servo.attach(servoPin);
pinMode(trigPin, OUTPUT);
pinMode(echoPin, INPUT);
servo.write(0); //close cap on power on
delay(100);
servo.detach();
}

void measure() {
digitalWrite(10,HIGH);
digitalWrite(trigPin, LOW);
delayMicroseconds(5);
digitalWrite(trigPin, HIGH);
delayMicroseconds(15);
digitalWrite(trigPin, LOW);
```

```
pinMode(echoPin, INPUT);
duration = pulseIn(echoPin, HIGH);
dist = (duration/2) / 29.1; //obtain distance
}
void loop() {
for (int i=0;i<=2;i++) { //average distance
measure();

aver[i]=dist;
delay(10); //delay between measurements
}
dist=(aver[0]+aver[1]+aver[2])/3;

if ( dist<20 ) {
//Change distance as per your need
servo.attach(servoPin);
delay(1);
servo.write(0);
delay(3000);
servo.write(150);
delay(1000);
servo.detach();
}
Serial.print(dist);
}
```

2.2FEASIBILITY ANALYSIS

It is the process of measuring the feasibility of the project. In this phase we determine whether it is feasible to develop the system or not. We mainly focus on financial benefit and availability of appropriate setup for project development. The feasibility analysis is done with following ways:

- Technical Feasibility
- Economical Feasibility
- Schedule Feasibility

2.2.1 TECHNICAL FEASIBILITY

This assessment focuses on the technical resources available to the organization. It helps organizations determine whether the technical resources meet capacity and whether the technical team is capable of converting the ideas into working systems. Technical feasibility also involves evaluation of the hardware, software, and other technical requirements of the proposed system.

2.2.2 FINANCIAL FEASIBILITY

The hardware and software cost used in our project are as follows:

S.N.	Elements	Price (NRS)
1	Arduino uno	1700
2	HC-SR04 Ultrasonic Sensor	550
3	Servo Motor	450
4	Jumping Wires	250
5	Switch	50
6	Battery	650
7	Power Supply Connector	40
8	Dustbin	150
	Total	3840

Table 1: Financial Feasibility

2.2.3 SCHEDULE FEASIBILITY

Our project includes the following schedule task:

	2023.May 1st-16th	**2023.May** 16th-24th	**2023.June** 1st-16th	**2023.June** 17th-28th	**2023.july** 1st-13th	**2023.Aug** 1st-10th
Problem Identification						
Requirement Analysis						
System design and specification						
Coding & Verification						
Testing						
Implementation & Management Plan						
Maintenance & Documentation						

Table 2: Gantt chart

CHAPTER-3

DESIGN AND IMPLEMENTATION

3.1 HARDWARE DESIGN

We designed the hardware on the basis of the following circuit diagram and block diagram.

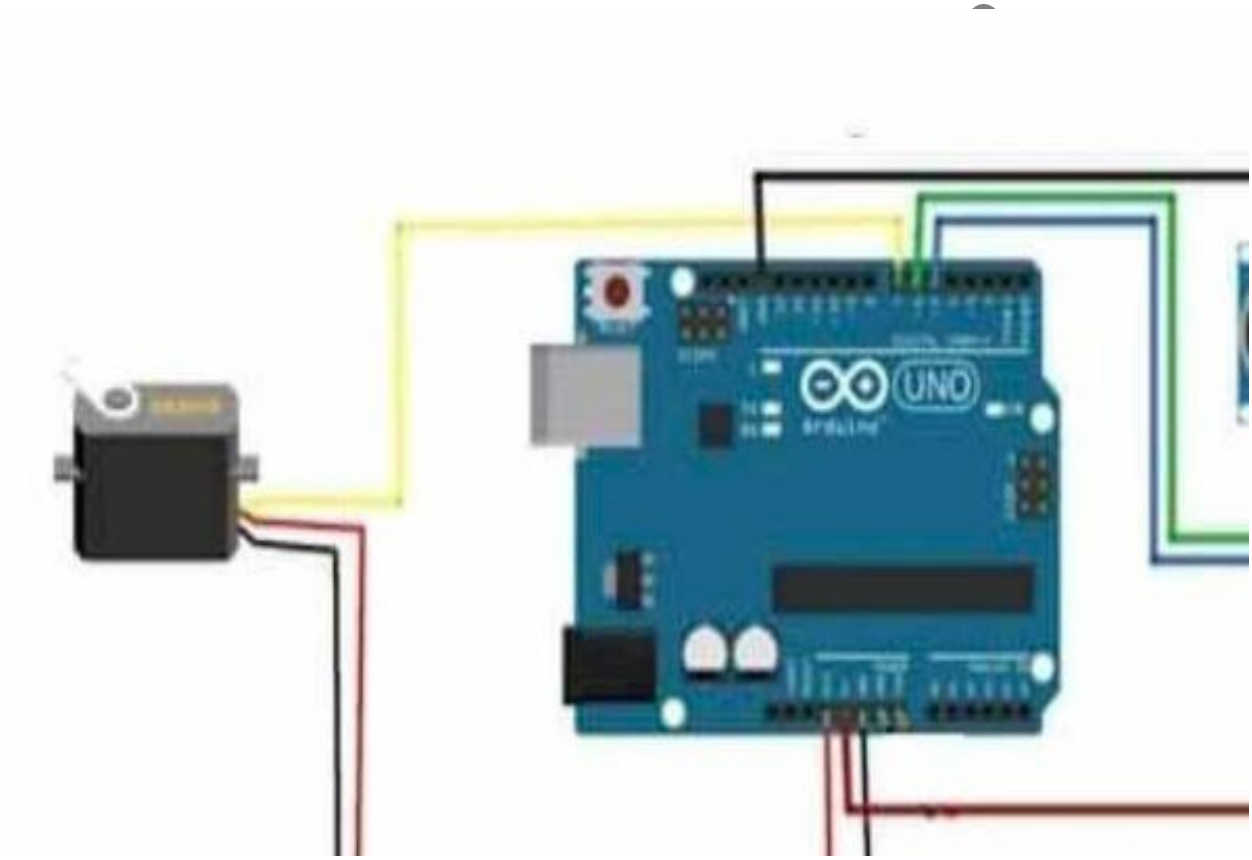


Fig: 7 Circuit Diagram

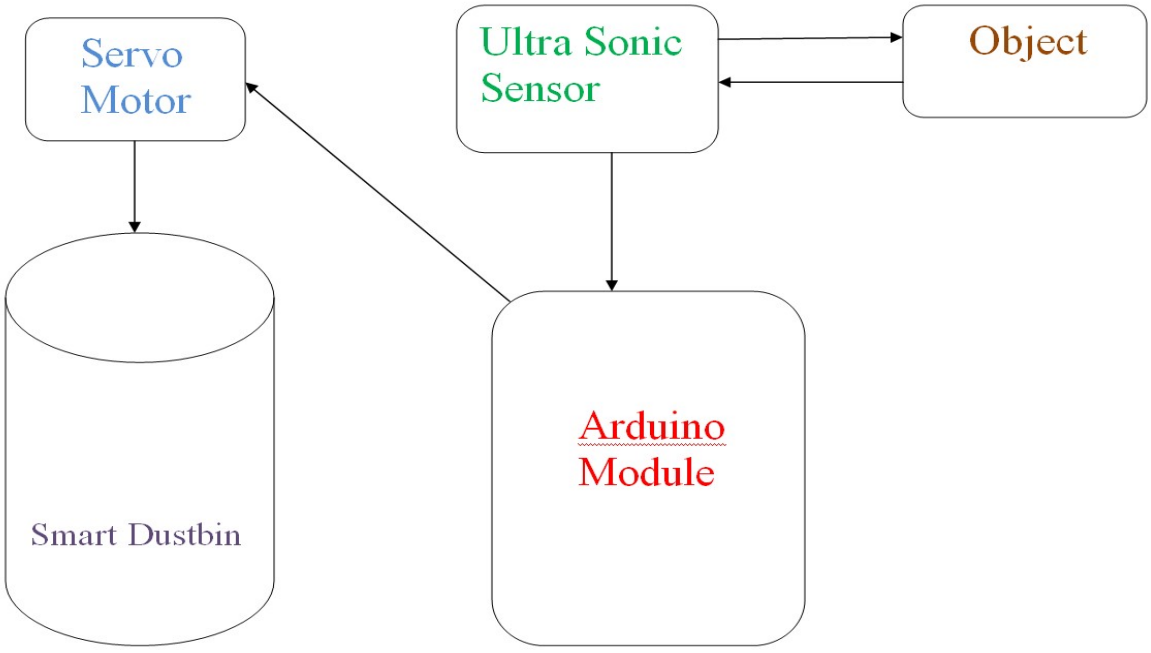


Fig: 8 Block Diagram

3.2HARDWARE INTERFACE

For a system to work properly there should be communication among all the components used in the system.In our system we are using components like Arduino, Ultrasonic sensor, Servo motor, Jumping wires, Battery and the switch. All these components are linked in some way, either it be by connectors. Hardware connections of the project can be explained as;

We have an Arduino which has the input as well as output ports. At the input port Ultrasonic Sensor is connected using some jumping wires and at the output port Servo motor is connected. Battery is used to power both Arduino and Servo motor and through motor driver motors get amplified power.

Connections of the Arduino and Ultrasonic Sensor is as follows;

- Vcc of the Ultrasonic Sensor is connected to the 5v output of the Arduino.
- GND of the Ultrasonic Sensor is connected to the GND of the Arduino,
- Trig pin of the Ultrasonic Sensor is connected to the pin 5 of the Arduino and
- Echo pin of the Ultrasonic Sensor is connected to the pin6 of the Arduino.

Connections of the Servo Motor and Arduino is as follows;

- Red pin of servo motor is connected to the 3.3v of the Arduino.
- Black pin of the servo motor is connected to the GND of the Arduino.
- Orange pin of the servo motor is connected to the pin7 of the Arduino.

3.3 SOFTWARE DESIGN

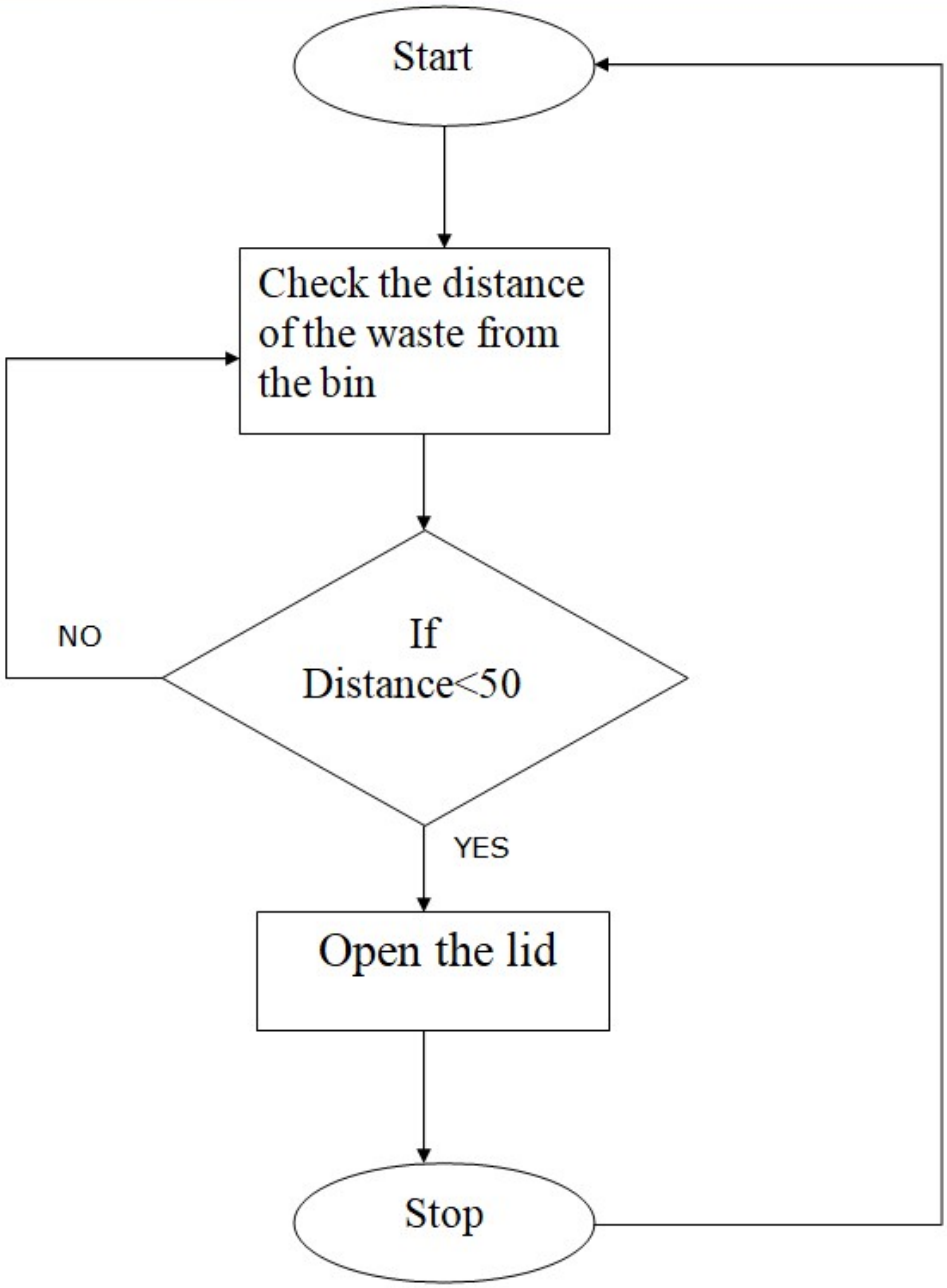
We have designed our program is such a way that it could take commands transmitted through the Ultrasonic sensor and provide control signals to the Servo motor to open the lid of the dustbin. To write the program we have used the Arduino IDE where we could use C and C++ as programming language. Some important things to look out for in an Arduino code are :

- An Arduino program is called a sketch.
- All lines of code in an Arduino sketch is processed from top to bottom.
- Arduino sketches are typically broken into five parts –

1. **Header:** Usually, the sketch starts with a header that explains what the sketch is doing, and the author.
2. **Global variables:** Next, global variables are defined. Often, this is where constant names are given to the different Arduino pins.
3. **Setup Routine:** After the initial variables are set, the Arduino begins the setup routine. In the setup function, we set initial conditions of variables when necessary, and run any preliminary code that we only want to run once.
4. **Loop:** From the setup function, we go to the loop routine. This is the main routine of the sketch. This is not only where your main code goes, but it will be executed over and over, so long as the sketch continues to run.
5. **Functions:** Below the loop routine, there are often other functions listed. These functions are user-defined and only activated when called in the setup and loop routine

3.4 IMPLEMENTATION

The working of the project can be explained through a flowchart:



(Fig 9 : Flow chart for Smart Dustbin)

3.5 WORKING

The smart dustbin uses an Ultrasonic Sensor HC-SR04 to detect object in front, It then sents the signals to Arduino Uno. The Arduino Uno understands the signal and send the signals to the servo motor which open the lid of the dustbin. Here we have program it to open the race for only 3 second after 3 second then the lid automatically closes.

CHAPTER-4

TESTING

4.1 TESTING

Testing is very important aspect for the success of any system. For the testing of our project, we tested every module and components while building and after the completion as well. We also took the technical reviews of every team member and our guide. While testing the system we faced many problems and solved them as well. Testing is basically done for following purpose.

- To uncover error in function and logic.
- To verify that the project under reviews meets its requirements.
- To ensure that the project has been represented according to predefined standards.
- To make project more manageable.

For testing there should be test plans as;

- The test plan for the project starts from unit testing and so on after that the units are integrated and tested then the validation test is done to ensure that the project we have developed is properly implemented and checks for another command. After that the system testing is done to get the result for which we are working on the project. Finally, the demo is performed.

CHAPTER-5

ADVANTAGE & FUTURE ENHANCEMENT

5.1 ADVANTAGE OF DEVELOPED SYSTEM

- Our system provides greater accessibility to the dustbin.
- It keeps the environment clean and fresh.
- It will save time using appropriate route planning.

5.2 FUTURE ENHANCEMENT

- Develop user-friendly interfaces, such as mobile apps, that allow users to receive notifications when the dustbin is full.
- Integrate GPS or other location based technologies to provide accurate location information for each smart dustbin.