SMART WASTE MONITORING SYSTEM

DANIAL ADAM BIN AZMAN, MUHAMMAD HARITH BIN BOLHI

COLLEGE OF ELECTRICAL ENGINEERING

UNIVERSITI TEKNOLOGI MARA

40500 SHAH ALAM, SELANGOR

harithbolhi0@gmail.com

ABSTRACT – The purpose of this study is to create a waste monitoring system. The waste management system is very important nowadays. It is because waste nowadays have to manage properly to make sure outside the garbage bin is in a good condition. Sometimes there are an odd people like to throw their own waste in the garbage bin but it will affect the surrounding of the garbage bin and make it looks dirty and not good to see. Besides, it will make the area become smelly and disgusting. People have to realize that they should responsible on the environment condition to make sure the earth clean and human can live in society. A Smart Waste Monitoring System that operates via RFID card reader. Via Bluetooth, information is sent to the house management's mobile phone using a specific app via Arduino UNO and HC-05 as a platform or microcontroller. The design of the system is simple and can be applied to all garbage bin

Keywords – Ultrasonic Sensor, Bluetooth module

INTODUCTION

1.1 – Project Overview

Smart Waste Monitoring System is a revolutionary system that offers a simple and efficient way to assist in the recycling and composting process. This system will also help people to management their garbage bin area, and allows some people to use and responsible on their own garbage bin. In addition, by providing this Smart Waste Monitoring System, the community will have more fun throwing garbage in the garbage bin because they are no longer having to worry about the cleanliness around the garbage bin. Furthermore, by placing this Smart Waste Management System in the public places, it will attract more interest in the community to use Smart Waste Monitoring System because of its futuristic system.

1.2 – Problem statement

Nowadays, we are facing the problem of Environmental Pollution which can pollute the land, water, and air in some areas. This will cause the appearance of new various diseases to humans such as respiratory diseases, skin diseases, gastrointestinal diseases, and so on. Improper waste burning and composting systems can result in air pollution and water pollution. So, we need to overcome this problem of environmental pollution, by always throwing garbage in the right place and separating dry and wet garbage.

1.3 – Objectives

i. To design waste management system for preserving environment.
ii. To manage people to throw waste only in their area.
iii. To keep the cleanliness of the garbage bin from being polluted by wrong people.

1.4 – Scope of Project

In this project, we are using the Arduino Microcontroller as the main controller. The Moisture sensor be connected to the microcontroller, and it works to detect the condition of the waste that is to be disposed of, whether it is organic or inorganic waste. If the moisture sensor detects organic waste then the dc motor will move and put the waste into the organic waste container. If the waste is inorganic, then it will be placed in an inorganic waste container. The Ultrasonic sensors will be placed on the top of the garbage container to detect the volume of the garbage container, if the container is full, then it is ready to be recycled or composted.

METHODOLOGY

On this mini project we would use a couple of hardware and software. The software would help us in designing the project to communicate with the Arduino . Which help in getting the outcome that we want in the project. The hardware part is just buying the components and have better understanding on how to used it with the connection of the pin.

2.1 – Software

The software used called Smart Waste Monitoring System that focuses in monitoring the condition of the garbage bin especially the volume of the garbage bin. Once the garbage bin is empty or not fulfilled, it will turn green in the MIT Apps Inventor apps via mobile phones. If the garbage bin is full, the color will change to red and notify the house management about the condition of the garbage bin.

2.2 – Hardware

i. Arduino UNO

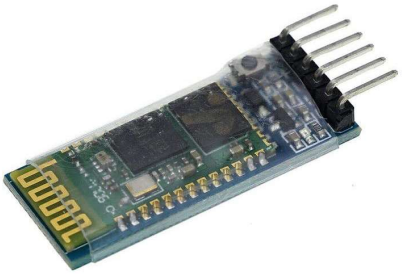
Arduino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller by connecting it to a computer with a USB cable or power it with a AC-

to-DC adapter or battery to operate. This microcontroller is used as the 'brain' of the system as it controls the output of the system such as Bluetooth module, buzzer and LEDs by the feedback of its input sensors.

ii. Ultrasonic Sensor

Ultrasonic sensor is an electronic device that used to measure distance of the object by emitting ultrasonic wave and convert the reflected sound into electrical signal. Ultrasonic wave is much faster than the speed of audible sound. It has two main component and that is the transmitter which produce sound using piezoelectric crystal and the receiver which receive the wave that had travelled to the measured object.

iii. HC-05 Bluetooth Module



HC-05 Bluetooth is a wireless communication protocol. It is used in two devices sending and receiving information wireless. For this project, this component is used to send information to the house management's smartphone in real- time alerting the house management. It is also used to inform and notified the house management that the garbage bin is fulfilled or ready to be used.

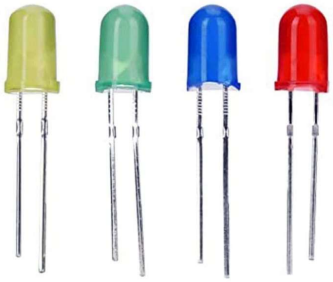
iv. SG90 Servo Motor

The RC522 RFID module is a wireless device that reads and writes data to RFID tags. It operates at 13.56 MHz, compliant with ISO/IEC 14443A, and is ideal for access control, inventory management, and contactless payments. For this project, this component is used to detect the presence of RFID card. The owner will be accepted, and it will send signal to the microcontroller.

v. Jumper Wire

Jumper wires are simply wires that have connector pins at each end, allowing them to be used to connect two points to each other without soldering. Jumper wires are typically used with breadboards.

vi. Light Emitting Diode

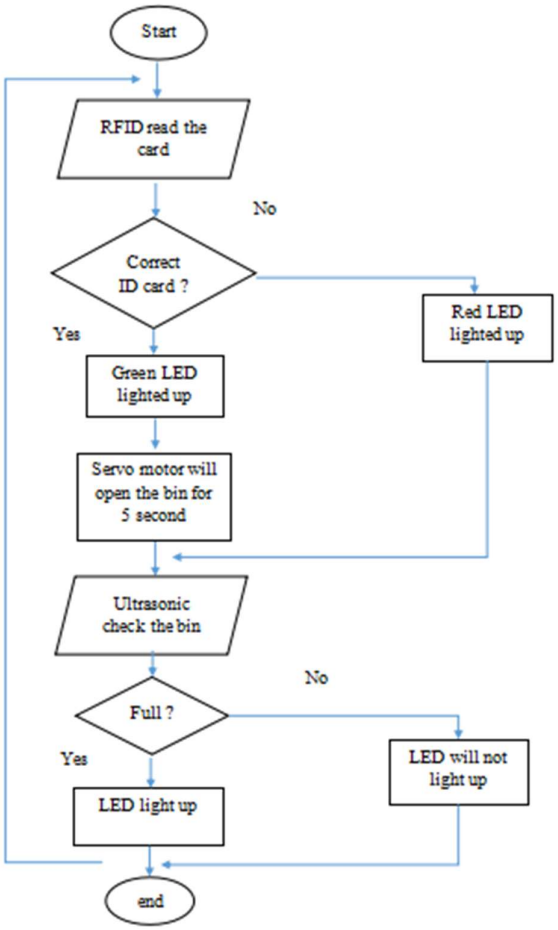


LEDs works as indicator in this Smart Waste Monitoring System. It gives the indicator for the presence of correct or wrong card. It is also indicates that the Garbage bin is fulfilled or empty.

2.3 – Algorithm

Step 1: Start
Step 2: The system initialize Bluetooth module
Step 3: The system initialize MIT Mobile Apps
Step 4: System read data from RFID reader
Step 5: If there are true card presence, the system send signal to Arduino UNO
Step 6: Arduino run the Servo Motor to rotate 180° counter clockwise
Step 7: In 10 second, the Servo Motor will rotate 180 clockwise
Step 8: System read data from ultrasonic sensor in
Step 9: If the ultrasonic sensor detect object in 5 cm, it send signal to Arduino UNO
Step 10: Arduino send signal to MIT Mobile Apps via Bluetooth Module
Step 11: Green color turn to red color in the MIT Mobile App
Step 12: End

2.4 – Flowchart



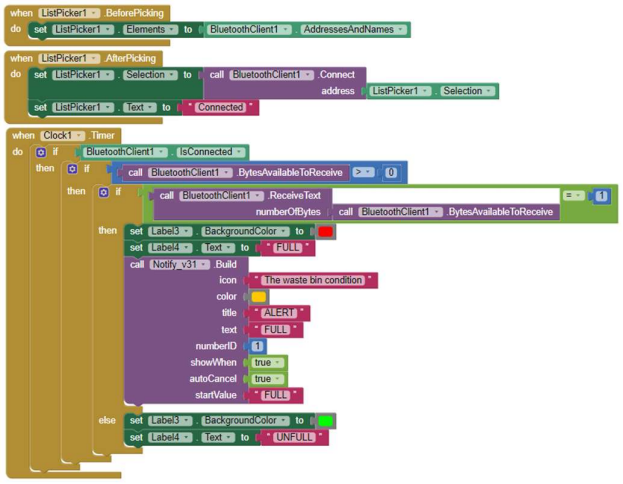
2.5 – Hardware coding

```
#include <SPI.h>
#include <MFRC522.h>
#include <Servo.h>
#include <SoftwareSerial.h>
SoftwareSerial mySerial(A0,A1);
#define SS_PIN 10
#define RST_PIN 9
#define LED_G 8
#define LED_R 7
MFRC522 mfrc522(SS_PIN, RST_PIN);
Servo myServo;
#define Trig_PIN 6
#define Echo_PIN 5

long duration;
int distance;
int safetyDistance;
int Incoming_value = 0;
```

```
void setup() {
  Serial.begin(9600);
  mySerial.begin(9600);
  SPI.begin();
  mfrc522.PCD_Init();
  myServo.attach(3);
  myServo.write(0);
  pinMode(LED_G, OUTPUT);
  pinMode(LED_R, OUTPUT);
  pinMode(Trig_PIN, OUTPUT);
  pinMode(Echo_PIN, INPUT);
  Serial.println("Put your card to the
reader...");
  Serial.println();
}

void loop() {
  digitalWrite(Trig_PIN, LOW);
  delay(2);

  digitalWrite(Trig_PIN, HIGH);
  delay(10);
  digitalWrite(Trig_PIN, LOW);

  duration = pulseIn(Echo_PIN, HIGH);
  distance= duration*0.034/2;

  safetyDistance = distance;
  if (safetyDistance <= 5){
    digitalWrite(LED_G, HIGH);
    Incoming_value = 1;
  }
  else{
    digitalWrite(LED_G, LOW);
    Incoming_value = 0;
  }
  mySerial.print(Incoming_value);
  delay (5000);

  Serial.print("Distance: ");
  Serial.println(distance);

  if ( !
mfrc522.PICC_IsNewCardPresent()) {
    return;
  }

  if ( ! mfrc522.PICC_ReadCardSerial())
  {
    return;
  }
```

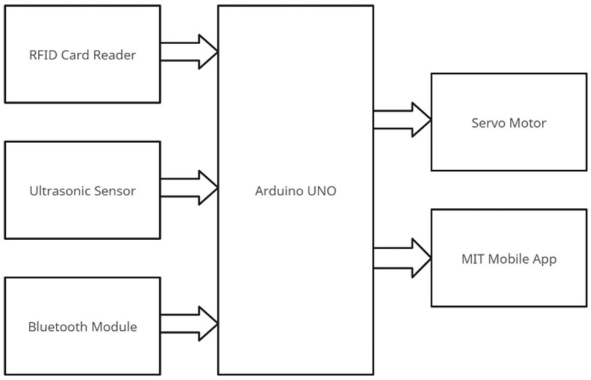
```
  Serial.print("UID tag :");
  String content= "";
  byte letter;
  for (byte i = 0; i < mfrc522.uid.size;
i++) {
     Serial.print(mfrc522.uid.uidByte[i]
< 0x10 ? " 0" : " ");
     Serial.print(mfrc522.uid.uidByte[i]
, HEX);
     content.concat(String(mfrc522.uid.u
idByte[i] < 0x10 ? " 0" : " "));
     content.concat(String(mfrc522.uid.u
idByte[i], HEX));
  }
  Serial.println();
  Serial.print("Message : ");
  content.toUpperCase();
  if (content.substring(1) == "83 23 38
BB" ||content.substring(1) == "AA 79 C2
8C") {
    Serial.println("Authorized access");
    Serial.println();
    delay(500);
    digitalWrite(LED_G, HIGH);
    delay(300);
    myServo.write(180);
    delay(5000);
    myServo.write(0);
    digitalWrite(LED_G, LOW);
  }

 else   {
    Serial.println(" Access denied");
    digitalWrite(LED_R, HIGH);
    delay(1000);
    digitalWrite(LED_R, LOW);

  }
  delay (5000);
}
```

Arduino UNO coding



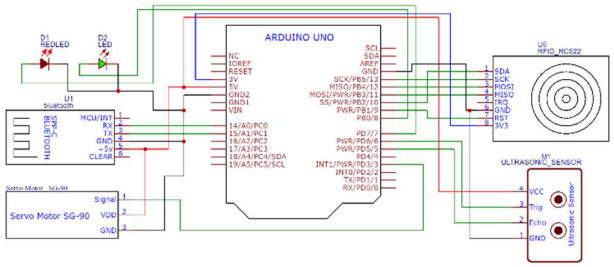
MIT Apps Inventor Coding

2.6 – Block Diagram



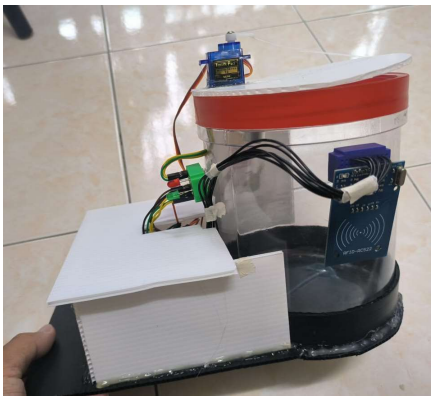
This project block diagram consists of three part which are input, microcontroller, and output. The input part consists of 3 components which is RFID Card Reader, Ultrasonic Sensor, and Bluetooth Module. The Arduino UNO as the microcontroller and at the output part consists of Servo Motor and MIT Mobile App

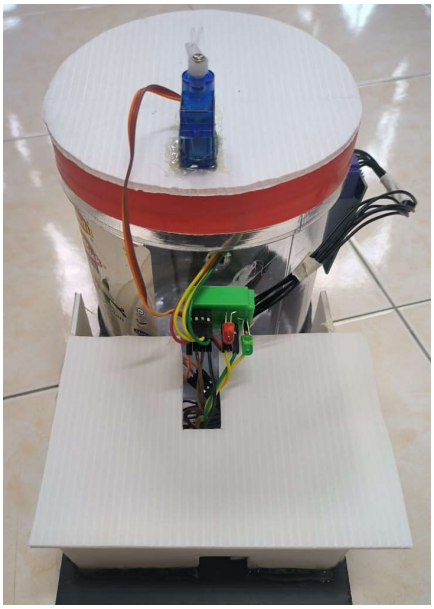
2.7 – Schematic Diagram



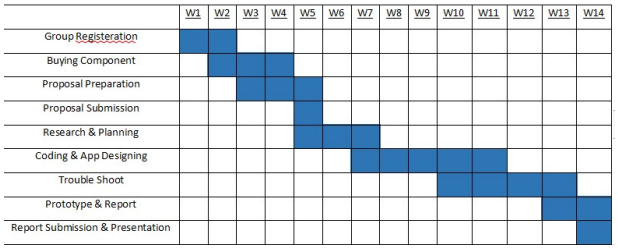
For schematic diagram above, the RC522 is connected to pin 10, pin 12, pin 13, pin 11, GND, pin 9 and 3V3 respectively. The green LED is connected to pin 8, red LED is connected to pin 7. The Ultrasonic Sensor is connected to 5V, pin 6, pin 5, and GND respectively. The Bluetooth module is connected to pin A0, pin A1, GND, and 5V, respectively. Lastly, SG90 is connected to pin 3, 5V, and GND respectively.

2.8 – Hardware Design





2.9 – Project Gantt Chart



The figure above shows the Gantt chart of the project planned to complete the prototype of the Smart Waste Monitoring System for Wheelchair Users. This includes the time period allocated for group selection and discussions, project research, hardware design, proposal design, proposal submission, components research, components buy & receive, coding inputs and outputs, prototype design, prototype assembly and troubleshooting, prototype presentation and report writing and submissions. The total time allocated to complete all task is 14 weeks.

RESULTS

The RFID card reader, Ultrasonic Sensor, and Bluetooth Module will be tested, troubleshoot ad installed into the prototype as an input part. For the output part Servo Motor and MIT Mobile App is installed to notify smartphone user.

As the supply is supplied to the Arduino UNO board, the prototype starts to operate. The Bluetooth Module and the smartphone is set to be connected successfully and the board start to fetch data from RFID card reader.

Firstly, when the card is touched to the RFID card reader, it will get the code from the card to be analyse and check whether it is synchronize with the code installed or not. If the code is matching, the LED will turn green and the Servo Motor will rotate 180° counter clockwise, and at the same time the garbage bin cover will open. In 10 seconds, the system has been coded to rotate back the Servo Motor 180° clockwise. But if the code is false and not matching, the LED red will turn on. Secondly, when the ultrasonic sensor is detect object in the range of 5 cm, it will send signal to the Arduino to notified MIT Mobile App via Bluetooth Module. At the same time the green color on the MIT Mobile App will turn to red, indicate that the garbage bit nearly or truly fulfilled.

CONCLUSION

In conclusion, this project is a success because each methodology has been achieved. The system can be using by the community or private for cleanliness purpose because every person involve in this system can feel good because the notification sends to the smartphone of the house management. Card holder can throw their waste their waste anytime without ask the house management which very convenience. However, each system that is success does not show that it is perfect. Some modification needs to add in order to fulfil the request from the consumers.

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embedded system design and interfacing as both a system engineer and an electrical engineer.

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