Motion Based Message Conveyer For Paralytic/Disabled People

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Synopsis

Paralytic or disabled patients are not capable of full body movement and hence communication is a major issue for them. We propose to develop and implement a low cost dependable device which will help to establish communication between paralytic or disabled patients and a nurse. A patient can easily communicate with the medical personnel by just tilting an accelerometer which is connected to any body part capable of movement. Our proposed system interprets and processes the angle of tilt and transmits data accordingly which helps in communication between the patient and the medical personnel. We use RF transmitter and receiver to transmit encoded data which is then decoded before passing it to the microcontroller to process and respond to it. Messages can be displayed on the display. It also sounds a buzzer as soon as it receives the motion signal from the accelerometer to alert the nurse. Our project provides a reliable, effective and simple yet important solution to various issues faced by disabled patients in communicating with nurses about their needs.

Keywords:

Patient Communication, Accelerometer, RF Module, Arduino NANO, LCD Display

Motivation

The idea for this project was conceived while attending a lecture of Dr. Dhananjay V. Gadre, in that lecture sir showcased one of their interesting project that they did back then to tackle some problems faced by visually impaired people. The project "weighing machine with speech module", gave us a glimpse of how with the help of technology, one can solve many challenges faced by differently-abled people. This motivated us to choose such a project that can enhance our practical knowledge as well as was purpose driven to solve some real life problem through technology, and we decided to work on this project which can help to cater disabled/paralytic people in such a fashion that through slight movement of their moving body part with which the accelerometer circuit is attached, their message can be conveyed to a nurse/care taker of the person via LCD screen and a Peizoelectric buzzer through a RF module.

Block Diagrams

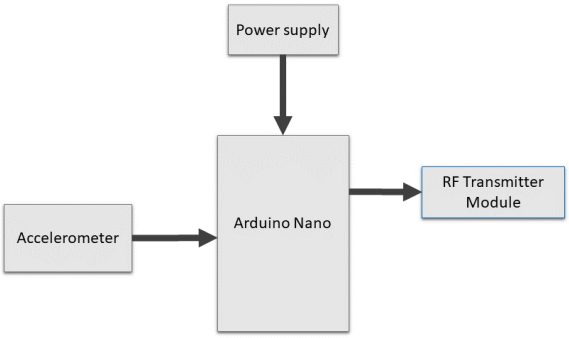

Figure 1: Transmitter circuit Block Diagram

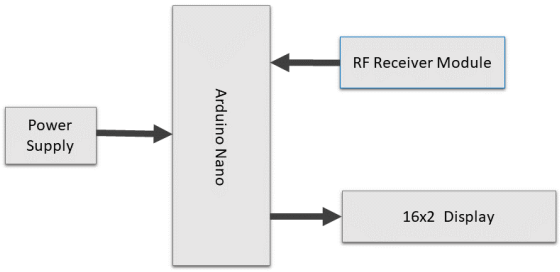

Figure 2: Receiver circuit Block Diagram

Flow Charts

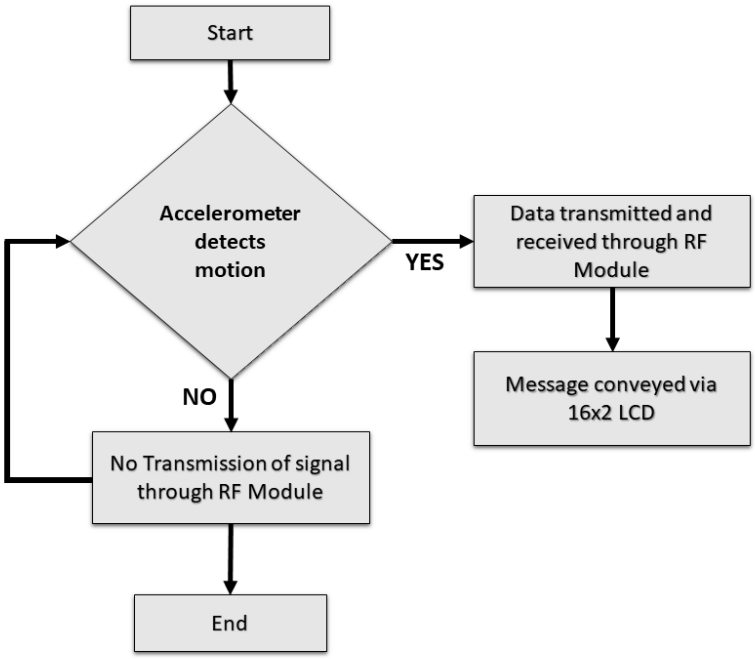

Figure 3: Flow Chart

Project Description

The following components will be used in our project:

1. Arduino NANO

The Arduino Nano is a small, complete, and breadboard-friendly board based on the ATmega328P released in 2008. It offers the same connectivity and specs of the Arduino Uno board in a smaller form factor.The Arduino Nano is equipped with 30 male I/O headers, in a DIP-30-like configuration, which can be programmed using the Arduino Software IDE, which is common to all Arduino boards and running both online and offline. The board can be powered through a type-B mini-USB cable or from a 9 V battery.

2. Accelerometer (MPU6050)

MPU6050 is a Micro Electro-mechanical system (MEMS), it consists of three-axis accelerometer and three-axis gyroscope. It helps us to measure velocity, orientation, acceleration, displacement and other motion like features. MPU6050 consists of Digital Motion Processor (DMP), which has property to solve complex calculations. MPU6050 consists of a 16-bit analog to digital converter hardware. Due to this feature, it captures three-dimension motion at the same time. This module has some famous features which are easily accessible, due to its easy availability it can be used with a famous microcontroller like Arduino. Friend if you are looking for a sensor to control a motion of your Drone, Self Balancing Robot, RC Cars and something like this, then MPU6050 will be a good choice for us.

3. 16x2 LCD

A 16x2 LCD will be used, 16X2 LCD means it can display 16 characters per row and there are 2 such rows.The instruction will be displayed on LCD.

4. RF Module

An RF module (radio frequency module) is a small electronic device used to transmit and/or receive radio signals between two devices. In an embedded system it is often desirable to communicate with another device wirelessly.

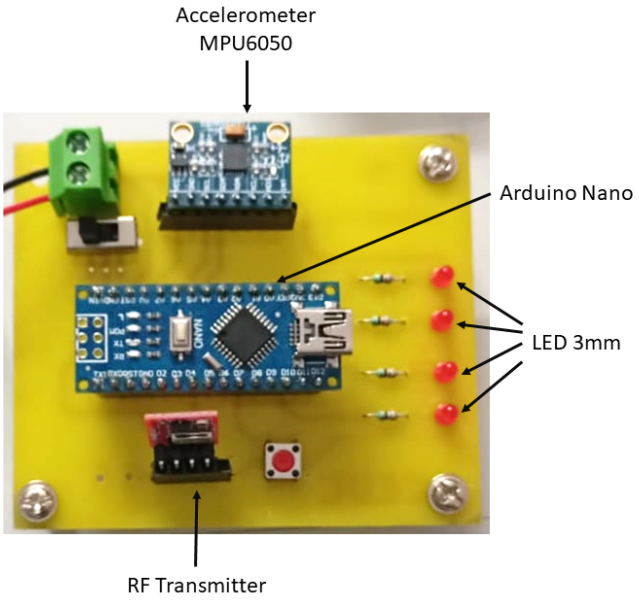

Figure 4: Transmitter Circuit
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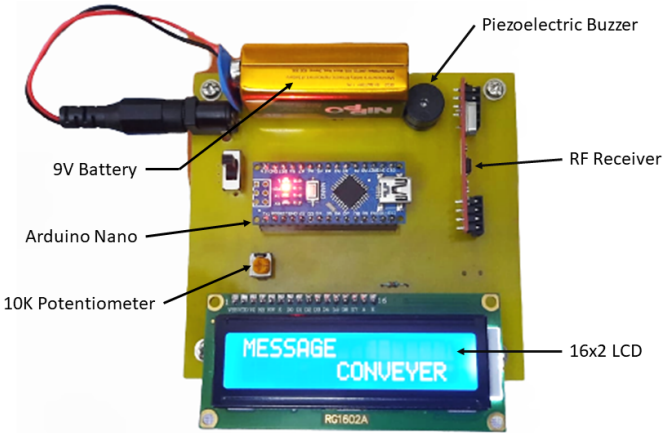

Figure 5: Receiver Circuit
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How does it work ?

After taking a glimpse of the project through synopsis, here lies the complete explanation of it's working :

Transmitter Circuit

The transmitter circuit consists of an Accelerometer(MPU6050) which tracks the angle of tilt of patient's hand movement, accelerometer sends this data to Arduino Nano which process the data and transmits it using a RF transmitter, 4 LEDs are soldered on PCB each for specific direction (forward, backward, right, left). movement in each direction corresponds to a unique message which is displayed on the Receiver circuit's LCD. Arduino Nano and LEDs are powered by 9V battery whereas MPU6050, RF transmitter are powered by Arduino's 5V pin.

Receiver Circuit

The Receiver circuit consists of RF receiver which receives the incoming RF signal and sends it to Arduino Nano which process the received data and sends corresponding signal to show a specific message on 16x2 LCD for a specific hand movement, also to a peizoelectric buzzer in order to enhance the functionality of the project (beeping sound of buzzer will alert the doctor/caretaker of the patient's needs), a 10KOhms potentiometer is soldered to adjust the contrast of the text displayed on the LCD. Arduino Nano is powered by a 9V battery and RF receiver, LCD and Buzzer are powered by Arduino Nano's 5V pin.

Schematic Diagram of Transmitter Circuit

The following schematic was prepared using EAGLE CAD:

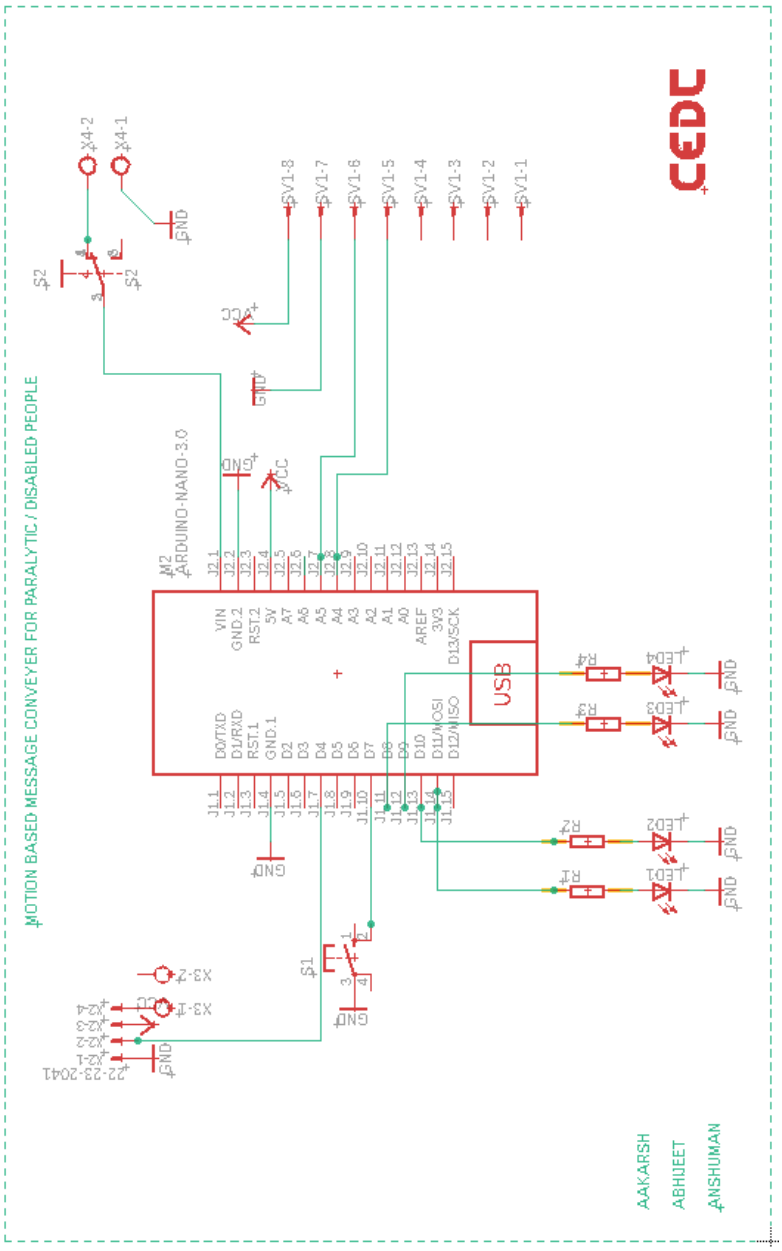

Figure 6: Transmitter Circuit

PCB layout of Transmitter Circuit

The following board layout was prepared using EAGLE CAD:

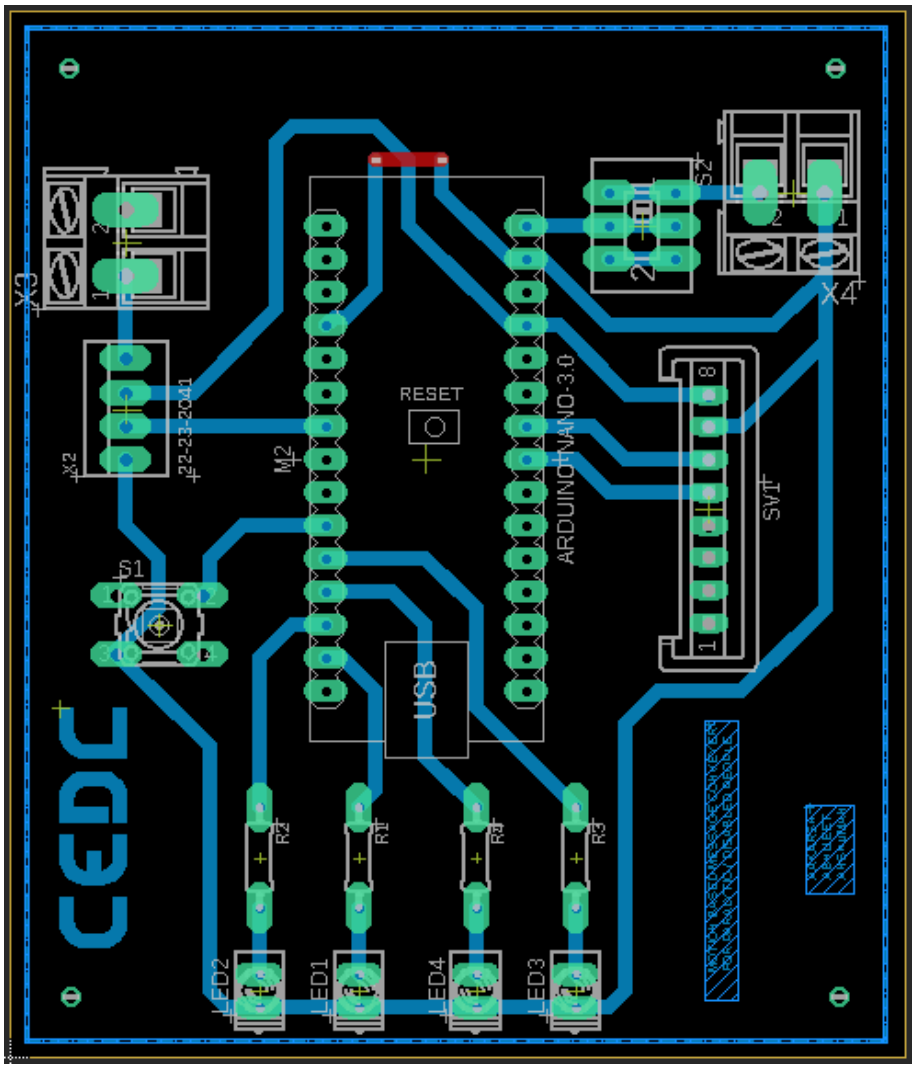

Figure 7: Transmitter Circuit

Schematic Diagram of Receiver Circuit

The following schematic was prepared using EAGLE CAD:

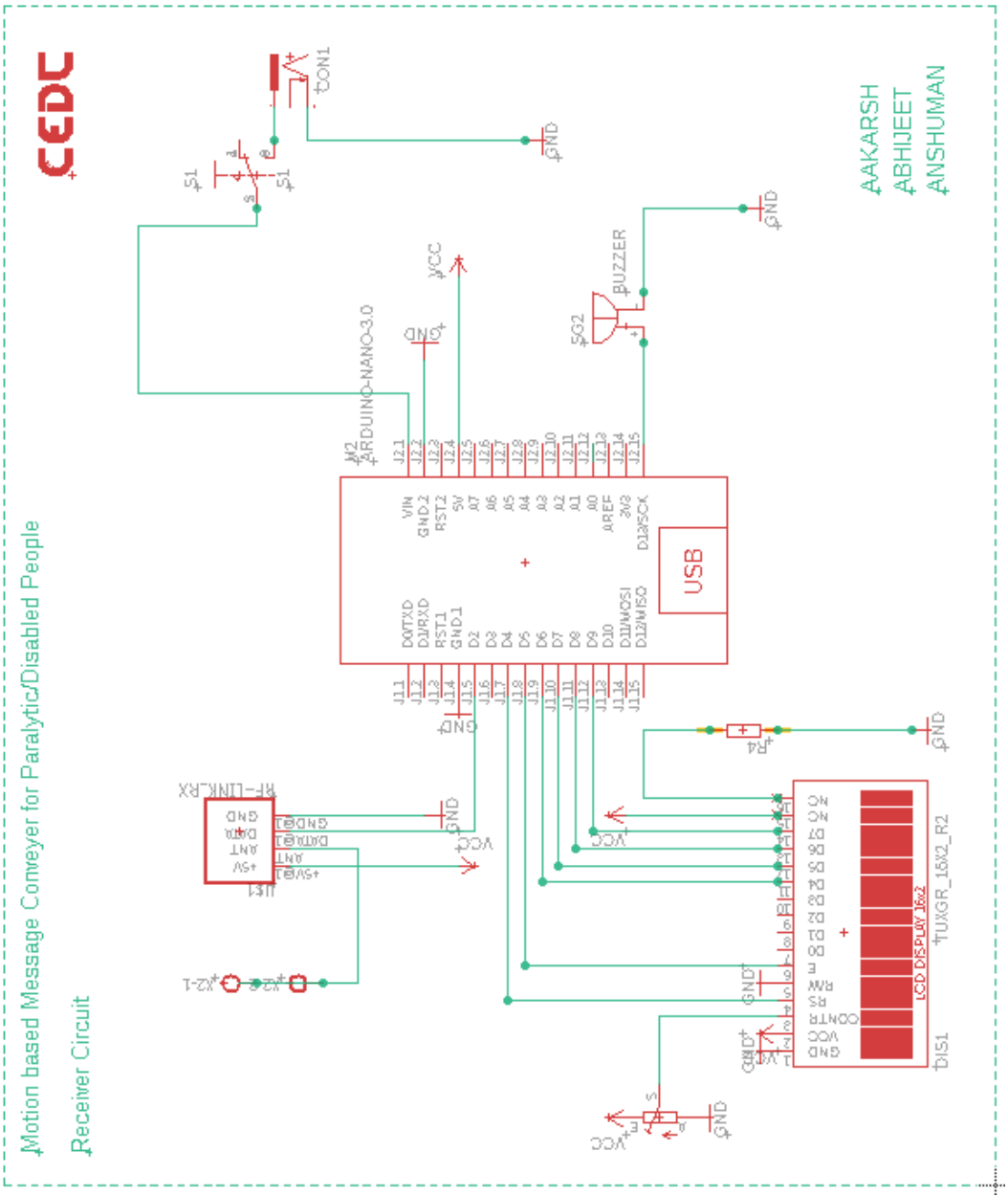

Figure 8: Receiver Circuit

PCB layout of Receiver Circuit

The following board layout was prepared using EAGLE CAD:

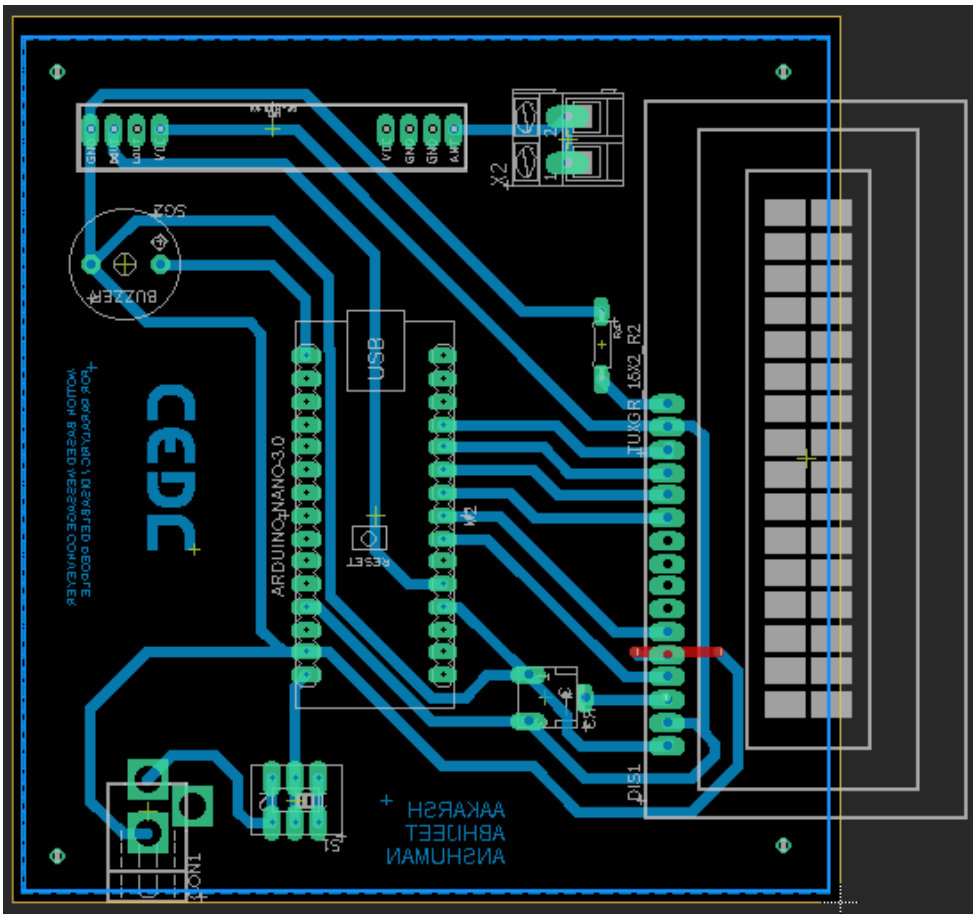

Figure 9: Receiver Circuit

Transmitter Code

Code written in Arduino IDE for transmitter circuit

FINAL_TRANSMITTER_C

```
#include <RCSwitch.h>
#include <Adafruit_MPU6050.h>
#include <Adafruit_Sensor.h>
#include <Wire.h>
#include <EEPROM.h>

RCSwitch mySwitch = RCSwitch();


int LED1 = 8;
int LED2 = 9;
int LED3 = 10;
int LED4 = 11;

float val1;
float val2;
float valX;
float valY;

Adafruit_MPU6050 mpu;

```

```
void setup(void) {
  Serial.begin(115200);

  mySwitch.enableTransmit(4);

  pinMode(LED1 , OUTPUT);
  pinMode(LED2 , OUTPUT);
  pinMode(LED3 , OUTPUT);
  pinMode(LED4 , OUTPUT);


  val1 = 0;
  val2 = 0;
  EEPROM.write(0, val1);
  EEPROM.write(1, val2);

  if (!mpu.begin()) {
    Serial.println("Failed to find MPU6050 chip");
    while (1) {
      delay(10);
    }
  }

```

```
45
46
47    Serial.println("MPU6050 Found!");
48
49
50    mpu.setAccelerometerRange(MPU6050_RANGE_8_G);
51
52    mpu.setGyroRange(MPU6050_RANGE_500_DEG);
53
54    mpu.setFilterBandwidth(MPU6050_BAND_21_HZ);
55
56    delay(100);
57  }
58
59  void loop() {
60
61    sensors_event_t a, g, temp;
62    mpu.getEvent(&a, &g, &temp);
63
64
65     valX = a.acceleration.x;
66     valY = a.acceleration.y;
67
68     if      ( EEPROM.read(0) + 8 < valX ) { digitalWrite(LED2,HIGH); mySwitch.send(1111, 24);}
69     else if ( EEPROM.read(0) - 8 > valX ) { digitalWrite(LED1,HIGH); mySwitch.send(2222, 24);}
70     else if ( EEPROM.read(1) + 8 < valY ) { digitalWrite(LED3,HIGH); mySwitch.send(3333, 24);}


71     else if ( EEPROM.read(1) - 8 > valY ) { digitalWrite(LED4,HIGH); mySwitch.send(4444, 24);}
72
73     else                                  { digitalWrite(LED1,LOW);
74                                             digitalWrite(LED2,LOW);
75                                             digitalWrite(LED3,LOW);
76                                             digitalWrite(LED4,LOW);
77
78                                            mySwitch.send(9999, 24); }
79
80
81
82     delay(300);
83
84
85  }
86
```

Receiver Code

Code written in Arduino IDE for receiver circuit

FINAL_RECIEVERCODE_(

```
#include <LiquidCrystal.h>
#include <RCSwitch.h>


LiquidCrystal lcd(4, 5, 6, 7, 8, 9);

RCSwitch mySwitch = RCSwitch();


int value;
int Buzzer = 13;


void setup(){
  Serial.begin(9600);
  mySwitch.enableReceive(0);
  delay(100);

  lcd.begin(16, 2);
  lcd.print("MESSAGE");
  lcd.setCursor(7,1);
  lcd.print("CONVEYER");
  delay(5000);
  lcd.clear();


  pinMode(Buzzer,OUTPUT);
}

void loop(){
  if (mySwitch.available()) {
    value = mySwitch.getReceivedValue();
    mySwitch.resetAvailable();

  }

  lcd.setCursor(0,0);
  lcd.clear();

  if     ( value == 1111){digitalWrite(Buzzer,HIGH); delay(200);lcd.print("NEED ASSISTANCE ");digitalWrite(Buzzer,LOW);delay(200);}
  else if( value == 2222){digitalWrite(Buzzer,HIGH); delay(200);lcd.print("I NEED WATER  ");digitalWrite(Buzzer,LOW);delay(200);}
  else if( value == 3333){digitalWrite(Buzzer,HIGH); delay(200);lcd.print("I AM HUNGRY   ");digitalWrite(Buzzer,LOW);delay(200);}
  else if( value == 4444){digitalWrite(Buzzer,HIGH); delay(50);lcd.print("EMERGENCY  ");digitalWrite(Buzzer,LOW);delay(50);}
  else if( value == 9999){lcd.print(" ALL GOOD ");digitalWrite(Buzzer,LOW);}
  else   (digitalWrite(Buzzer,LOW));
}
```

Bill of Components

COMPONENTS	QUANTITY	SPECIFICATION
Arduino Nano	2	Atmega 328P
Red LED	4	3mm
RF Receiver Module	1	433MHz
RF Transmitter Module	1	433MHz
LCD	1	16x2
Accelerometer	1	MPU6050
Buzzer	1	
Other Miscellaneous components		

Figure 10: Bill of Components

Gantt Chart

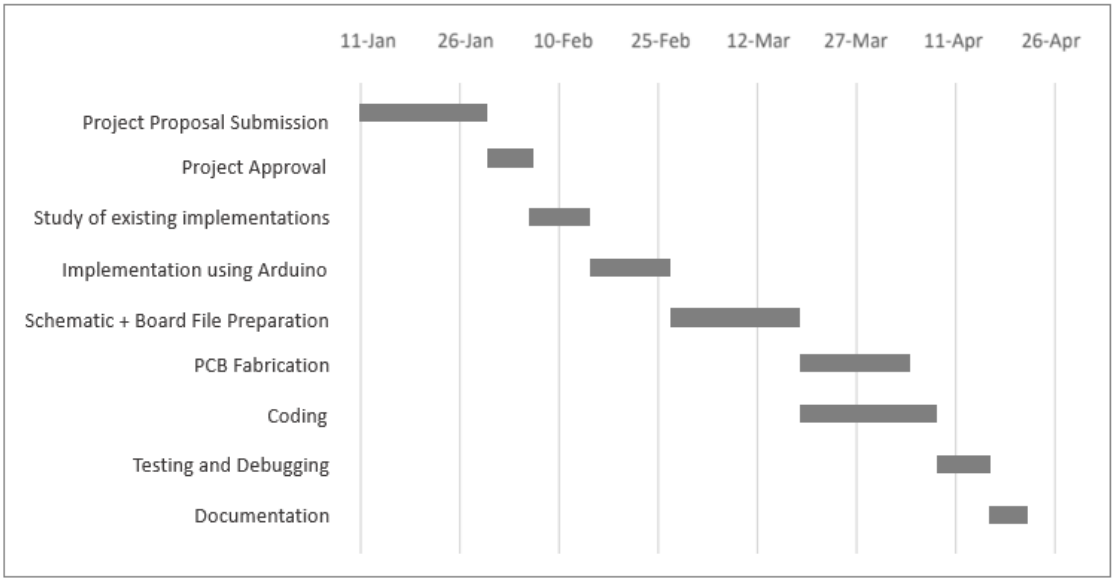

Figure 11: Gantt Chart

Bibliography

List of all of the sources we have used in the process of researching our project.

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