Department of Electrical and Computer Engineering (ECE)

North South University

Junior Project Design

Smart Safety System for Industry

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AGREEMENT FORM

It is our great pleasure to submit our junior design project report on "Smart Safety System for Industry". This report is prepared as a requirement for semester long junior designing course EEE299. We hereby declare that this progress report is the result of our own work except as cited in the reference.

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We would like to request you to accept this report as a partial fulfillment of Bachelor of Science degree under Electrical and Computer Engineering Department of North South University.

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ABSTRACT

Technology is developing day by day and the use of technology is also increasing. Technology can be used for the good as well as for the bad purposes. Our goal is to build a system by using automated technology for out of human attention in industry.

In an industry there are many workers but all of them are busy about their individual work. Any accident can occur for mechanical malfunction there. With that in mind we have created the device so that it can predict accident.

Another feature of our system is RFID scanning device. So that staffs can punch their ID card to enter in workplace.

CHAPTER 1
OVERVIEW

1.1 Introduction:

In an industry there are many people such as workers and some stuffs. There are some common accident which are occurring in industry such as gas leakage, fire hazard and covering by smoke. We know industry is a combination of many kinds of machine. Actually the people of an industry are busy by their work. At the time of occurring accident they cannot make attention firstly. At the time when accident gone to danger then thy can notify the situation. So the main purpose of this system is make a notification at starting time for accident. Another thing of an industry workers and stuffs are registered for their work and they are working their daily work. There is possibility for outsider are likely to come in and enter. So we thought about an automatic door lock system for registered people.

1.2 Objective:

- To make a smart door lock system for registered staffs using RFID card so they can punch their card in door and pass that gate.
- To make a safety system using smoke, fire, gas and vibration sensor and this system will give us notification for any warning situation in that industry.

1.3 Project Definition:

The implementation of this system will provide safety for a specific industry. The main purpose of this system is to provide notification for some alarming condition such as gas leakage, fire hazard and covering by smoke. If any machine of industry is acting as abnormal then this system will provide notification also.

There is another feature of our system and which is automatic door lock system using RFID scanning device. All stuffs and workers of an industry can punch their RFID card by this device and thy can enter into the industry.

Chapter 2

Components and its description

2.1 Introduction:

For the implementation of the system we used different types of equipment. For choosing different types of component we have to think about some factors such as availability in market, usability, performance and reliability. After choosing components we successfully done our final implementation.

2.2 Component required:

- ARDUINO UNO
- RFID RC522 Module
- Really Module
- 12V solenoid lock
- Hall effect sensor
- 10K resistance
- Buzzer
- RFID card
- smoke sensor
- gas sensor
- fire detector
- vibration detector
- display
- PCB board
- cork sheet
- jumper wire

2.3 Component description:

1. **Arduino Uno:** The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The board has 14 digital I/O pins (six capable of PWM output), 6 analog I/O pins, and is programmable with the Arduino IDE

(Integrated Development Environment), via a type BUSB cable. It can be powered by the USB cable or by an external9-volt battery, though it accepts voltages between 7 and 20 volts.

In our system we used Arduino as a microcontroller and we used Arduino language for controlling our system.

Figure 1: Arduino Uno.

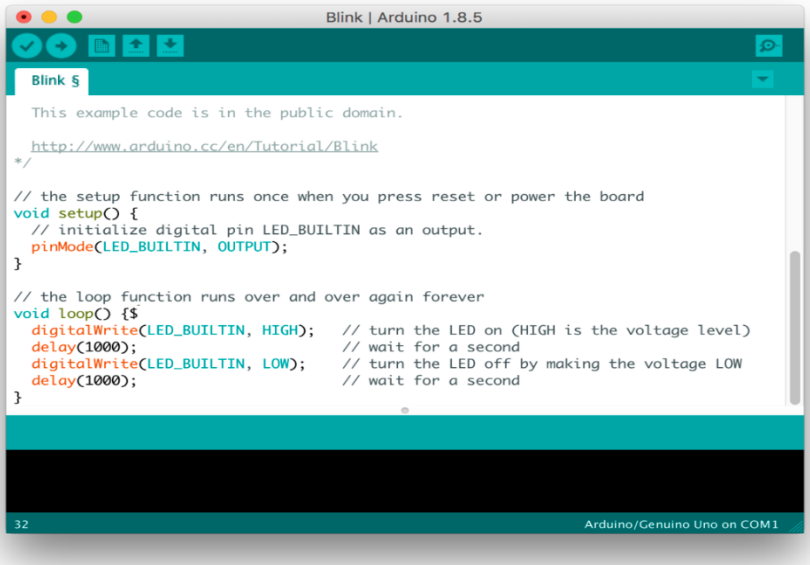


Figure 2: Arduino software user's interface.

2. **RFID RC522 Module:** RFID or Radio Frequency Identification system consists of two main components, a transponder/tag attached to an object to be identified, and a Transceiver also known as interrogator/Reader. A Reader consists of a Radio Frequency module and an antenna which generates high frequency electromagnetic field.
   RFID module works of some registered ID card. There is a specific code for every ID card and RFID module can detect the code. If ID's internal code and RFID module's code which saved in previous match with each other then RFID module will work.

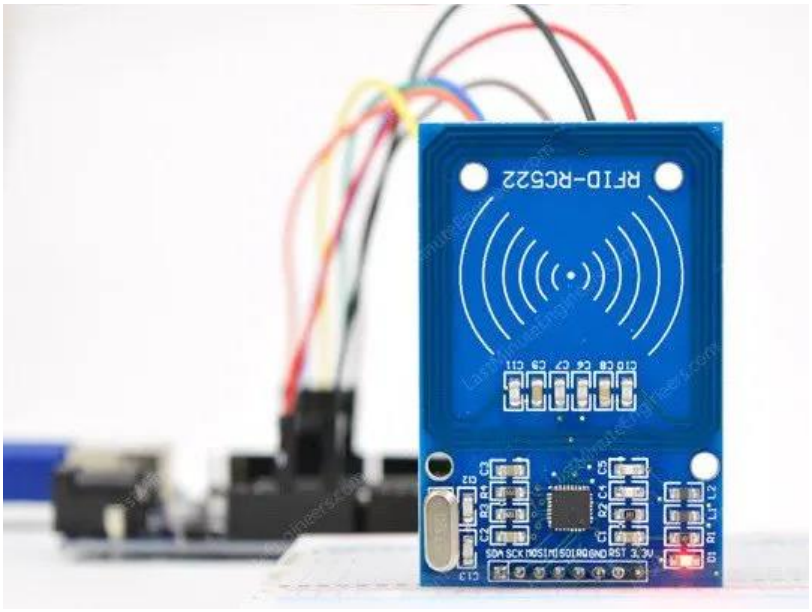


Figure 3: RFID module.

3. **Really Module:** The relay module is a separate hardware device used for remote device switching. With it anyone can remotely control devices over a network or the Internet. Devices can be remotely powered on or off with commands coming from Clock Watch Enterprise delivered over a local or wide area network. Anyone can control computers, peripherals or other powered devices from across the office or across the world.

Figure 4: RFID module.

4. **Solenoid lock:** A solenoid bolt is a type of electronic-mechanical locking mechanism. This type of lock is characterized by the use of a solenoid to throw the bolt. Sophisticated solenoid bolt locks may use microprocessors to perform voltage regulation, reduce power consumption, and/or provide access control. A solenoid bolt can be designed either to fail open (the lock opens on power loss) or to fail closed (the device is locked upon power loss). Some models may be suitable for high-security sites.

Figure 5: Solenoid lock.

5. **RFID card:** Radio-frequency identification (RFID) uses electromagnetic fields to automatically identify and track tags attached to objects. An RFID tag consists of a tiny radio transponder; a radio receiver and transmitter. When

triggered by an electromagnetic interrogation pulse from a nearby RFID reader device, the tag transmits digital data, usually an identifying inventory number, back to the reader. This number can be used to inventory goods. There are two types. Passive tags are powered by energy from the RFID reader's interrogating radio waves. Active tags are powered by a battery and thus can be read at a greater range from the RFID reader; up to hundreds of meters.

Figure 6: RFID card.

6. **Smoke sensor:** Smoke detector is a device that senses smoke, typically as an indicator of fire. Commercial security devices issue a signal to a fire alarm control panel as part of a fire alarm system, while household smoke detectors, also known as smoke alarms, generally issue a local audible or visual alarm from the detector itself or several detectors if there are multiple smoke detectors interlinked.

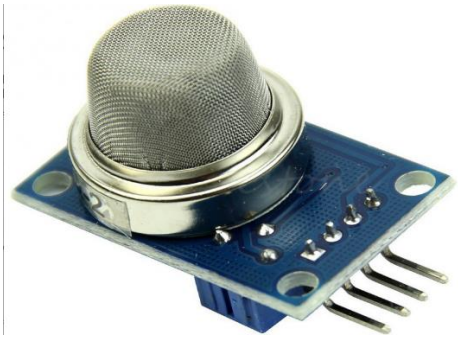


Figure 7: Smoke sensor.

7. **Gas sensor:** Gas sensors (also known as gas detectors) are electronic devices that detect and identify different types of gasses. They are commonly used to detect toxic or explosive gasses and measure gas concentration. Gas sensors are employed in factories and manufacturing facilities to identify gas leaks, and to detect smoke and carbon monoxide in homes. Gas sensors vary widely in size (portable and fixed), range, and sensing ability. They are often part of a larger embedded system, such as hazmat and security systems, and they are normally connected to an audible alarm or interface. Because gas sensors are constantly interacting with air and other gasses, they have to be calibrated more often than many other types of sensors.

Figure 8: Gas sensor.

8. **Fire detector:** A flame detector is a sensor designed to detect and respond to the presence of a flame or fire, allowing flame detection. Responses to a detected flame depend on the installation, but can include sounding an alarm, deactivating a fuel line (such as a propane or a natural gas line), and activating a fire suppression system.

Figure 9: flame sensor.

9. **Vibration Detector:** The vibration sensor is also called a piezoelectric sensor. These sensors are flexible devices which are used for measuring various processes. This sensor uses the piezoelectric effects while measuring the changes within acceleration, pressure, temperature, force otherwise strain by changing to an electrical charge. This sensor is also used for deciding fragrances within the air by immediately measuring capacitance as well as quality.

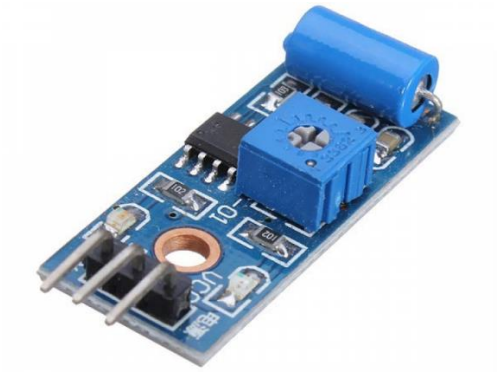


Figure 10: vibration sensor.

10. **LCD Display:** A liquid-crystal display (LCD) is a flat-panel display or other electronically modulated optical device that uses the light-modulating properties of liquid crystals combined with polarizers. Liquid crystals do not emit light directly, instead using a backlight or reflector to produce images in color or monochrome.

Figure 11: LCD display.

2.4 Cost of the equipment:

NUMBER	EQUPMENT	quantity	PRICE
1	ARIDUINO UNO	2	800
2	RFID RC522 Module	1	170
3	Really Module	1	129
4	12V solenoid lock	1	750
5	Hall effect sensor	1	70
6	10K resistance	2	5
7	Buzzer	3	45
8	RFID card	3	105
9	smoke sensor	1	155
10	gas sensor	1	190
11	fire detector	1	130
12	vibration detector	1	85
13	sonic sensor	4	360
14	display	1	273
15	PCB board	2	30
16	cork sheet		200
17	jumper wire		100
		total	3597

Chapter 3
Connections

3.1 Introduction:

Mainly there are two parts of our system. 1st one is automatic door lock system and another one is a device which detect some abnormal conditions. We build up our total system part by part. I this chapter we will discuss individual parts in briefly.

3.2 Automatic door lock system:

In this part there are mainly three components which we used to implement automatic door lock system. This thee components are Arduino Uno as a microcontroller, RFID module and solenoid lock.

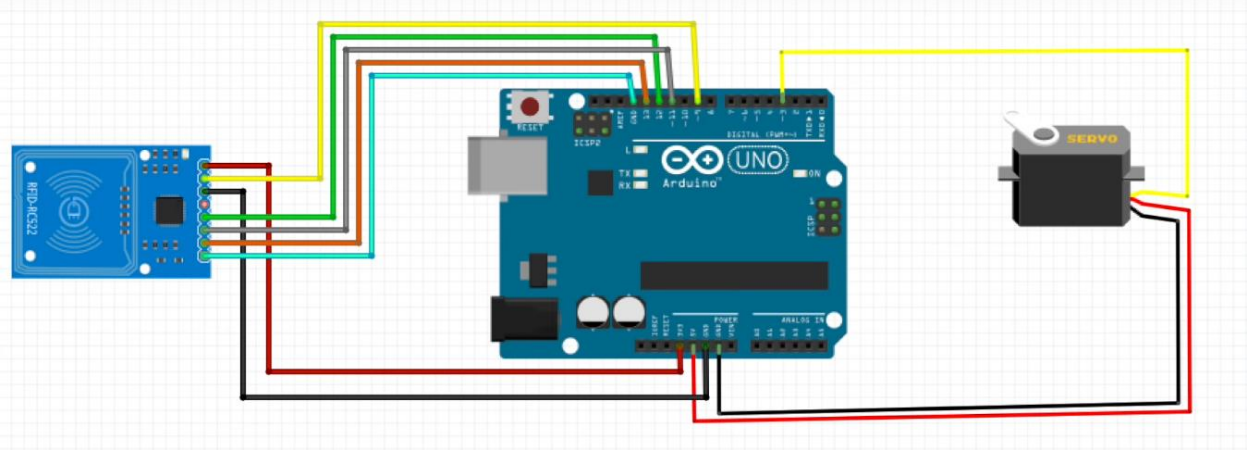


Figure 12: Circuit diagram for automatic door lock system.

3.3 Gas detector:

In this part we used Arduino Uno, gas sensor and buzzer. When gas sensor detect gas then microcontroller (Arduino) will activate buzzer.

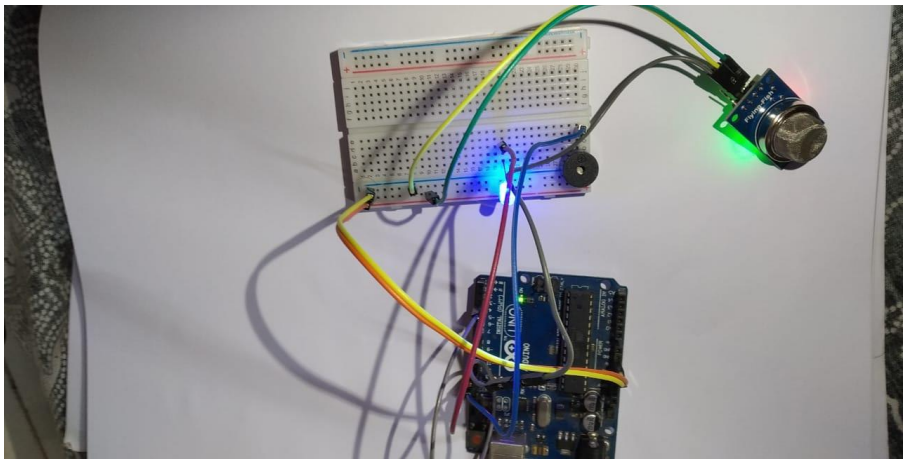


Figure 13: Circuit set up for gas sensor.

3.4 Fire detector:

In this part we used Arduino Uno, fire detector, led and buzzer. When fire detector detect fire in anywhere then microcontroller (Arduino) will activate buzzer and led.

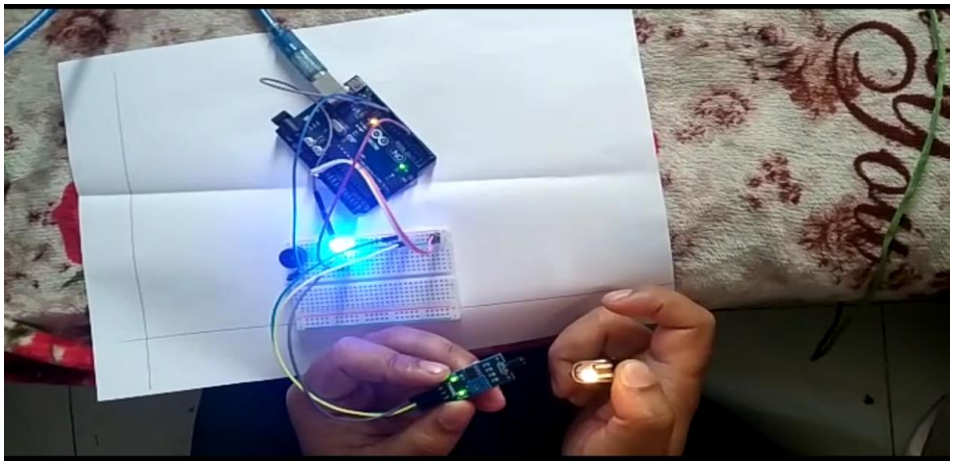


Figure 14: Circuit set up for fire detector.

3.5 Smoke detector:

In this part we used Arduino Uno, smoke sensor, led and buzzer. When smoke sensor detect any smoke then microcontroller (Arduino) will activate buzzer and led.

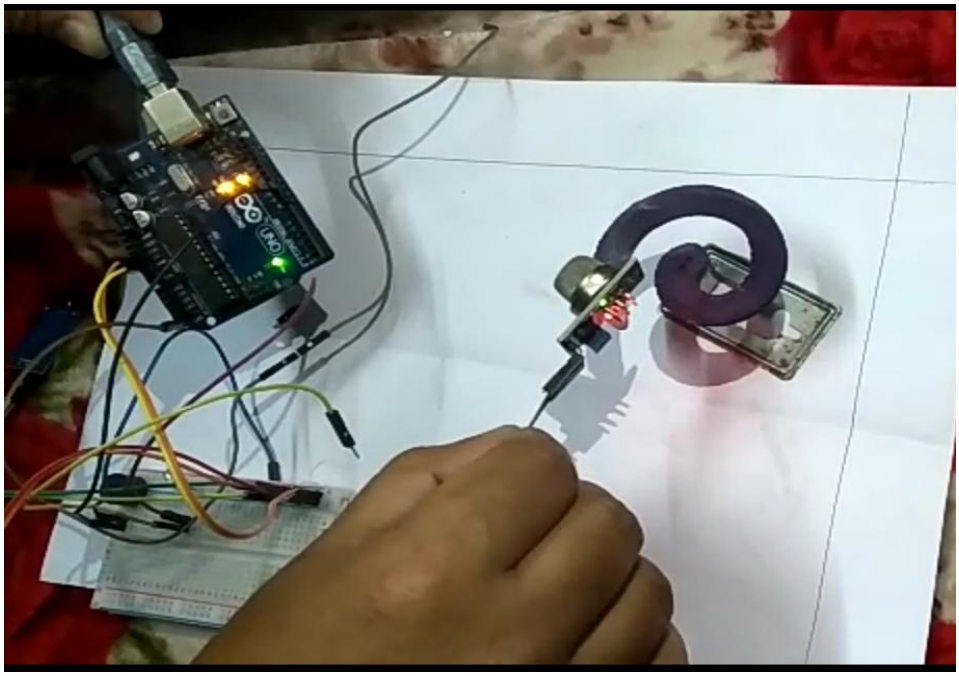


Figure 15: Circuit set up for smoke detector.

3.6 Vibration detector:

Vibration detector will detect when any machine vibrate as abnormal. In this part of the system we can record frequency of individual machine. When a machine vibrate too largely that means not like previous vibration then vibration detector will give us a notification. To implement this part use used Arduino Uno, vibration sensor, buzzer and led. When vibration sensor detect any machine vibrate with too large frequency then microcontroller (Arduino) will activate buzzer and led.

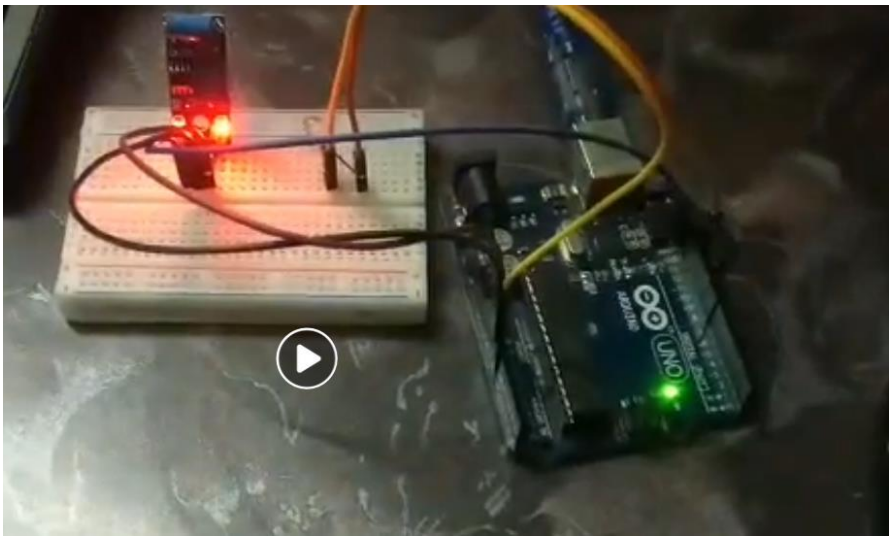


Figure 16: Circuit set up for vibration detector.

CHAPTER 4
DESCRIPTION AND LIMITATIONS

4.1 Description:

In final implementation of our system we used power bank which provide a constant power for Arduino Uno. We used two Arduinos for two parts of our system. We used one Arduino for detector system and another one for RFID scanning device. In detector system there are four sensor which are connected with microcontroller that means Arduino. There are a LED and a buzzer which are connected with Arduino. And another part of circuit is Display which is connected with Arduino. When Arduino detect any abnormal condition then make a signal by the help of buzzer, LED and display

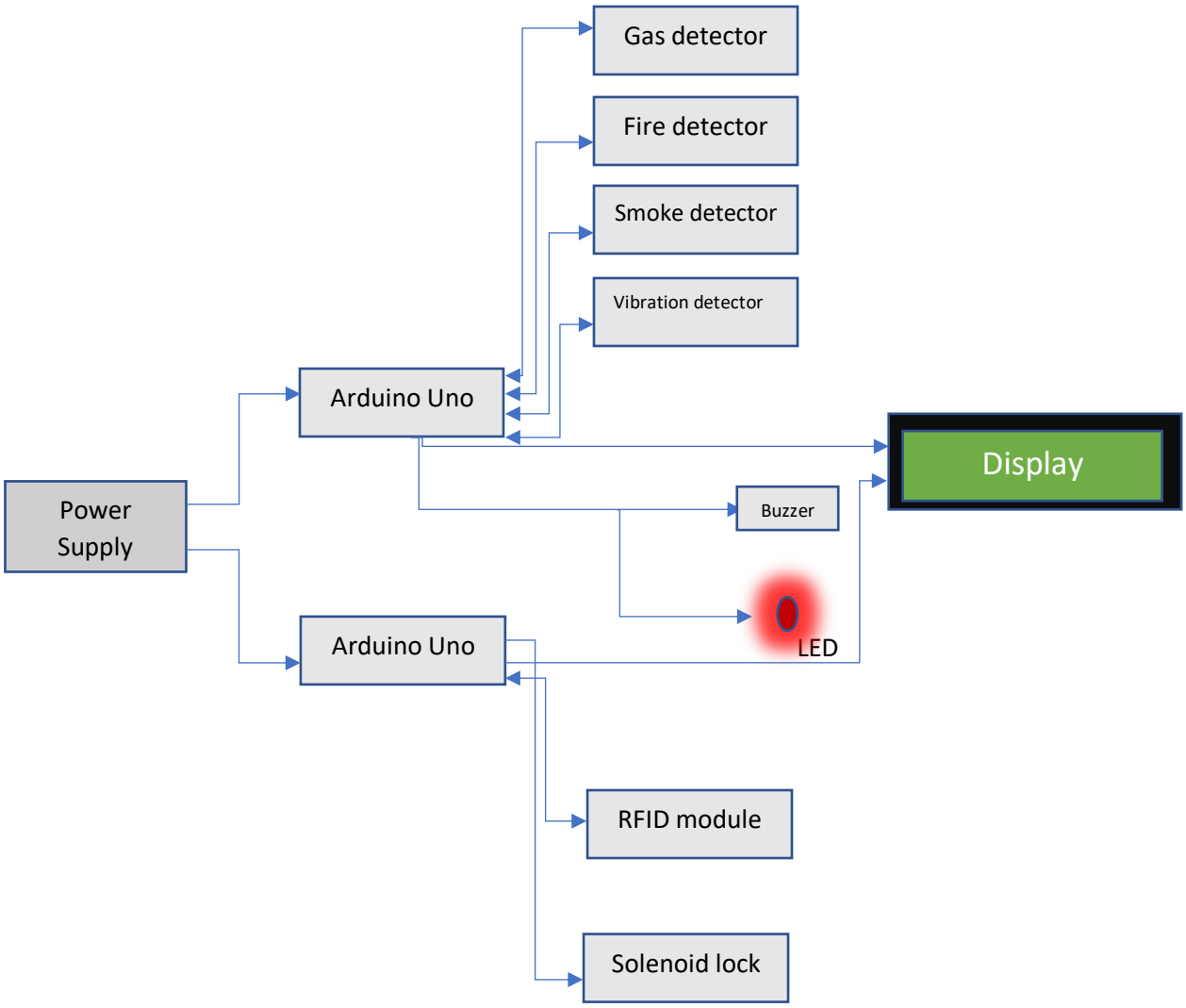
We used another Arduino for RFID scanning device. In this part an RF module are connected with Arduino and a solenoid lock also connected with Arduino. When anyone punch his/her ID card Arduino send a signal to solenoid lock and then lock open. Arduino can make signal by display when there exist like something else. Suppose anyone punch an unregistered ID then Arduino can show a notification that “Something else”.

There is a block diagram for whole system in next part.

4.2 Limitations:

In this system it only can make an alarm at accidental situation for take attention. But this can’t take the necessary steps to avoid an accident.

4.3 Block diagram for total system:



CHAPTER 5
PROGRAM CODE

5.1 Automatic door lock system:

```
#include <SPI.h>

#include <MFRC522.h>


#define SS_PIN 10

#define RST_PIN 9

#define LED_G 5 //define green LED pin

#define LED_R 4 //define red LED

#define RELAY 3 //relay pin

#define BUZZER 2 //buzzer pin

#define ACCESS_DELAY 2000

#define DENIED_DELAY 1000

MFRC522 mfrc522(SS_PIN, RST_PIN);   // Create MFRC522 instance.


void setup()

{

 Serial.begin(9600);   // Initiate a serial communication

 SPI.begin();         // Initiate  SPI bus

 mfrc522.PCD_Init();   // Initiate MFRC522

 pinMode(LED_G, OUTPUT);

 pinMode(LED_R, OUTPUT);

 pinMode(RELAY, OUTPUT);

 pinMode(BUZZER, OUTPUT);

 noTone(BUZZER);

 digitalWrite(RELAY, LOW);

 Serial.println("Put your card to the reader...");

 Serial.println();
```

```
}
void loop()
{
 // Look for new cards
 if ( ! mfrc522.PICC_IsNewCardPresent())
 {
  return;
 }
 // Select one of the cards
 if ( ! mfrc522.PICC_ReadCardSerial())
 {
  return;
 }
 //Show UID on serial monitor
 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.uidByte[i] < 0x10 ? " 0" : " "));
   content.concat(String(mfrc522.uid.uidByte[i], HEX));
 }
 Serial.println();
 Serial.print("Message : ");
```

```
  content.toUpperCase();
  if (content.substring(1) == "83 23 38 BB") //change here the UID of the card/cards that you want to give access
  {
    Serial.println("Authorized access");
    Serial.println();
    delay(500);
    digitalWrite(RELAY, HIGH);
    digitalWrite(LED_G, HIGH);
    delay(ACCESS_DELAY);
    digitalWrite(RELAY, LOW);
    digitalWrite(LED_G, LOW);
  }

 else   {
    Serial.println(" Access denied");
    digitalWrite(LED_R, HIGH);
    tone(BUZZER, 300);
    delay(DENIED_DELAY);
    digitalWrite(LED_R, LOW);
    noTone(BUZZER);
  }
}
```

5.2 Safety system:

```
int BUZZER=7;
```

```
//vibration
int ledPin = 13;
int EP = 9;

//smoke
int LED=8;
int Smoke=10;
int Smoke_detected;
int Smoke_sensor;

//gas
int LED1=12;
int LPG_sensor=3;
int LPG_detected;

//fire
const int ledpin1=4;
const int flamepin=11;
int flame=HIGH;
int redled= 5;
const int threshold=200;
int flamesensvalue=0;

void setup()
 {
   //vibration
 pinMode(ledPin, OUTPUT);
```

```
pinMode(EP, INPUT);
Serial.begin(9600);
Serial.println(" Vibration Demo ");

 //smoke
pinMode(LED,OUTPUT);
pinMode(BUZZER,OUTPUT);
pinMode(Smoke_sensor,INPUT);

 //gas
pinMode(LED1,OUTPUT);
pinMode(BUZZER,OUTPUT);
pinMode(LPG_sensor,INPUT);

//fire
pinMode(BUZZER,OUTPUT);
pinMode(redled,OUTPUT);
pinMode(flamepin,INPUT);
}

void loop()
 {
 long measurement = TP_init();
 delay(50);
 Serial.print("measurement= ");
 Serial.println(measurement);
 if (measurement>1000)
```

```
  {
  digitalWrite(ledPin, HIGH);
  }

  else
   {
   digitalWrite(ledPin, LOW);
   }

   Smoke_detected = digitalRead(Smoke_sensor);
 Serial.println(Smoke_detected);

//smoke
 if (Smoke_detected == 1)
 {
  Serial.println("Smoke_detected...! take action imediately.");
  digitalWrite(LED,HIGH);
  digitalWrite(BUZZER,HIGH);
 }

 else
 {
  Serial.println("No Smoke detected, stay cool");
  digitalWrite(LED,LOW);
  digitalWrite(BUZZER,LOW);

 }
```

```
delay (1000);

//gas
LPG_detected = digitalRead(LPG_sensor);
Serial.println(LPG_detected);

if (LPG_detected == 1)
{
  Serial.println("LPG_detected...! take action imediately.");
  digitalWrite(LED1,LOW);
  digitalWrite(BUZZER,LOW);
}

else
{
  Serial.println("No LPG detected, stay cool");
  digitalWrite(LED1,HIGH);
  digitalWrite(BUZZER,HIGH);

}

//fire
flame=digitalRead(flamepin);
if (flame==LOW)
{
  Serial.println("fire !!!!");
  digitalWrite(BUZZER,HIGH);
```

```
  digitalWrite(redled,HIGH);
}
else
{
Serial.println("NO Problem");
digitalWrite(BUZZER,LOW);
digitalWrite(redled,LOW);
}
 }

long TP_init(){
  delay(10);
  long measurement=pulseIn (EP, HIGH);
  return measurement;
  }
```

CHAPTER 6

IMPORTANCE OF SYSTEM & FUTURE PROGRESS

6.1 Introduction:

Industrial safety is important as it safeguards human life, especially in high risk areas such as nuclear, aircraft, chemical, oil and gases, and mining industries, where a fatal mistake can be catastrophic. Industrial Safety reduces risks to people, and processes. Process control and safety systems are usually merged. Maintaining a safe and healthy working environment is not only an important human resources issue, it's the law. Whether they're entry-level workers, seasoned veterans, supervisors, or plant managers, the employees need to understand health and safety risks, the steps they need to take to minimize those risks, and common safety standards and compliance procedures.

Another part of our system is RFID scanning device. RFID applications can automate the collection of information about the movement and location of assets, components, stock or other items; doing this more quickly, whilst reducing costs and with greater accuracy and reliability than is possible with manual methods and with more detail than can be obtained from techniques such as bar-coding. Data collection can be a by-product of other activities, eliminating the need for effort in form filling. Identifying products using RFID is quicker than barcode scanning or manual entry of product details.

Because RFID allows data to be captured in real-time as stock or assets are moved detailed, up-to-date, management information is available for planning and operational management purposes.

6.2 Further development:

The journey to the future is always a challenging thing to deal with. Every product has to face the competitive force to survive in the market. Research and development with the touch of continuous redesigning of the same product make it stronger and sustainable for the market for a long time. As redesigning is the key, we are committed to the future modification of the product to make it a selling product across the globe. There are some initial thoughts punched through the mind of our team and we are pretty much excited to work on it. Here are the things that we can add to increase the value of the system in the near future:

- We used RFID scanning device. Staffs can punch their ID to enter the gate. In future we can take attendance by improving the scanning device.
- We used four sensor and fire detector is one of them. Now in our system if detector can detect fire then it can give notification. In future we can improve the device so that after detecting fire device can take necessary steps to put out the fire.
- In our device vibration detector can detect a machine when it's frequency is higher then normal condition. In future we can improve the device so that after detecting abnormal condition it can shut down the machine automatically.

There can be more and more such things that we can add to the system if we can work under a supervisor who will guide us for such things. We are hopeful to get such an opportunity and flourish ourselves with full freedom.

CHAPTER 7
CONCLUTION

CONCLUTION

The success of any group work demands a bunch of dedicated people who are restless for achieving the desired goal. We were blessed with some group mates that never compromised a day off in any week's meeting. The group meeting was a part of our regular academic calendar throughout the semester where we broke the entire task in many small pieces and took one of them at a time. We decided on the number of meetings as per the importance of the task and hold many urgent meetings for urgent situations. The workload, as a result, could never be built on our shoulders.

The team needed working freedom which was a very important factor that helped us to flourish our thought process. We were never forced or pressurized by the supervisor to go in a particular way. It was due to that factor, we could spend our time to make changes according to our thinking. It was a great experience working under such a supervisor where we were guided but not forced.

The thing as we stated earlier, this system is a concept for the future. We had the responsibility to build a prototype that could help the internal environment which is out of human attention. This project thus promises for a day that will help save many lives from accents and save lives.

CHAPTER 8

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