Faculty of Electrical and Electronic Engineering Technology

DESIGN AND DEVELOPMENT OF AN AUTOMATED RAILWAY GATE SYSTEM USING WIRELESS NOTIFICATION FOR OBSTACLES DETECTION

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Bachelor of Electronics Engineering Technology (Telecommunications) with Honours

2022

DESIGN AND DEVELOPMENT OF AN AUTOMATED RAILWAY GATE SYSTEM USING WIRELESS NOTIFICATION FOR OBSTACLES DETECTION

LOSHENE PRIYA RAJ A/P JUDE AMAL RAJ

A project report submitted
in partial fulfillment of the requirements for the degree of
Bachelor of Electronics Engineering Technology (Telecommunications) with Honours

Faculty of Electrical and Electronic Engineering Technology

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2022

DECLARATION

I declare that this project report entitled DESIGN AND DEVELOPMENT OF AN AUTOMATED RAILWAY GATE SYSTEM USING WIRELESS NOTIFICATION FOR OBSTACLES DETECTION is the result of my own research except as cited in the references. The project report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

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APPROVAL

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Date :

DEDICATION

To my beloved mother, Mrs Soorya Kala,
and father, Mr Jude Amal Raj,and
my siblings.

ABSTRACT

The railway system is the most commonly used transportation mode. More safety features should be added into the system to ensure less operation failures to happen in future. Railroad related accidents are more dangerous than other transportation accidents in terms of severity and death rate. In this project, IR sensors play the main role as the detection of incoming train in several places. Six IR sensors were used in terms to detect the incoming train. Those sensors are placed in various places where IR sensor 1 gives signal to change the level crossing signal and IR 2 gives the signal to close the gate in the level crossing. In addition, IR sensor 3 and 4 were placed at the level crossing to ensure obstacles to be detected and the gate opens when there are obstacles with a message through GSM modular to the train master telling the train to slow down. This procedure also follows with an emergency alarm buzzing while the message is being sent. Furthermore, there is two other sensors which is IR sensor 5 and IR sensor 6 which acts to close the gate back if there is no obstacles detected and the signal at the level crossing changes when the trains passes IR sensor 6. The overall system works is dual direction because in certain countries railway industries are still using single tracks for trains to move. This project ensures that the system works even when the train approaches in either direction.

ABSTRAK

Sistem kereta api adalah mod pengangkutan yang paling biasa digunakan. Lebih banyak ciri keselamatan harus ditambah ke dalam sistem untuk memastikan kurang kegagalan operasi berlaku pada masa hadapan. Kemalangan berkaitan kereta api adalah lebih berbahaya daripada kemalangan pengangkutan lain dari segi keterukan dan kadar kematian. Dalam projek ini, sensor IR memainkan peranan utama sebagai pengesanan kereta api yang masuk di beberapa tempat. Enam sensor IR digunakan dari segi untuk mengesan kereta api yang masuk. Sensor tersebut diletakkan di pelbagai tempat di mana sensor IR 1 memberi isyarat untuk menukar isyarat lintasan aras dan IR 2 memberi isyarat untuk menutup pintu di lintasan aras. Selain itu, sensor IR 3 dan 4 diletakkan di persimpangan aras untuk memastikan halangan dikesan dan pintu pagar terbuka apabila terdapat halangan dengan mesej melalui modular GSM kepada jurulatih kereta api yang memberitahu kereta api diperlahankan. Prosedur ini juga diikuti dengan penggera kecemasan berdengung semasa mesej dihantar. Tambahan pula, terdapat dua lagi sensor iaitu IR sensor 5 dan IR sensor 6 yang bertindak menutup kembali pintu pagar sekiranya tiada halangan dikesan dan isyarat di peringkat lintasan berubah apabila tren melepasi IR sensor 6. Keseluruhan sistem berfungsi adalan dua arah kerana negara tertentu industri kereta api masih menggunakan landasan tunggal untuk kereta api bergerak. Projek ini memastikan sistem berfungsi walaupun kereta api menghampiri kedua-dua arah.

ACKNOWLEDGEMENTS

First and foremost, I would like to express my gratitude to my supervisor, Ts Effendy Onn Bin Siam and for his precious guidance, words of wisdom and patient throughout this project.

I am also indebted to Universiti Teknikal Malaysia Melaka (UTeM) and my parents for the financial support throughout this journey which enables me to accomplish the project. Not forgetting my fellow friends for the willingness of sharing his thoughts and ideas regarding the project.

My highest appreciation goes to my parents, and family members for their love and prayer during the period of my study.

Finally, I would like to thank all the staffs at the UTeM, fellow colleagues and classmates, the faculty members, as well as other individuals who are not listed here for being co-operative and helpful.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF SYMBOLS

LIST OF ABBREVIATIONS

IR Sensor	Infrared sensor
GSM Modular	Global System for Mobile communication

LIST OF APPENDICES

CHAPTER 1

INTRODUCTION

1.1 Background

Railway system is commonly used transportation mode and which of those kinds of transportation that is affected by human mistake such as level crossing accidents and collisions [1]. The severity of railway accidents and death rate is higher compared to other transportation accidents. In many countries like Canada, India and Russia are still using the train as their primary transport. Those countries are still focusing on this transportation due to the high cost and the duration of journey time which necessitates greater initiative in improving the railway system.

The railway system needs accurate planning to offer a secure and accident-free ride. Since the advent of railway transportation system, many accidents have involved train and other vehicles such as cars, motorcycles and even accident between trains. A level crossing is an intersection where a railway line crosses a road. This level crossing is at risk of accidents and death. Human coordination in controlling the level crossing is very important. Failure to coordinate will result in disasters. The majority of level crossings in many countries are still regulated manually rather than automatically. Oversleeping, laziness, timing faults, and other human flaws all contribute to railway accidents.

Level crossings that are manually controlled by humans who operates the gates have a higher risk of accidents due to road users' negligence or time errors made by the gatekeepers [2]. If the gate operations are eventually automated based on sensors, the time taken to operate the system will be greatly decreased and so would the number of accidents caused by railway transit.

1.2 Problem Statement

In most instances, an incoming train requires human power to open and close the gate. To reduce delays in manual gate opening and closing, an automatic system must be used to prevent mishaps [3]. Moreover, if there are any obstacles stuck on the railway track, there will be a delay for the train master to receive information about the obstacles so a wireless message/notification need to be sent to the train master to inform the train to slow down or stop at the previous station [4]. Until the obstacles are removed the gate should be automatically opened when obstacles are detected [5]

1.3 Project Objective

a) To develop an automated railway gate system, automatic opening and closing of the gate when train is arriving and departing.

b) To detect obstacles and send notification to train master through wireless system

c) To develop an automated opening and closing of the gate when obstacles detected.

1.4 Scope of Project

The scope of this project are as follows:

a) IR sensors that limit the human power needed to open and close the gate manually

b) Reduce cost spend on paying people to work in opening and closing of the gate

c) IR sensor detecting the obstacles without human investigating

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The first section discusses how automated train system's mechanism works. Second section discusses the intelligent traffic light system and the usage in this project. The third section demonstrates these ideas by explaining and integrating the GSM module into this project.

2.2 Automatic Control of Railway Gates

In order to manage the railroad gate, the railway project uses two sets of IR sensors, with a couple of IR sensors situated near to the intersection level. The sensors are placed at a certain distance from one another. An upward sensor, for example detects the entry of the prepare. The drawback sensor is a sensor that detects the flight of prepare. Combining both the sensors and can be describe as drawback sensor. A transmitter and a recipient are included in each sensor combination [6]. The ideal gap which the sensors could be placed to identify the landing of the prepare is 5km from the level crossing and 1km of the takeoff and the doorway would be open for 8 minutes. This presents a framework that includes five sensors: IR one, IR two, IR three, IR four as well as a light dependent resistor (LDR), a laser source(L), a counter, and one signal (B1). The IR sensors are gradually placed on the track at a distance of 5km and 1km on both sides of the level intersection. To determine the proximity of a snag between the railroad gate, the LDR and laser source are used [7]. DC engines are used to control the operation of the doors in the system. The ringer is used to signal the train's arrival within a certain amount of time. The idea behind the automatic railroad entryway control framework is to reduce human involvement in closing and opening the railroad entrance gate which allows and prevents automobiles and people from colliding with railroad lines[8].

2.3 Sensor Automatic Railway Gate Control System

The ideal opportunity for which the entryway is shut is reduced because the entryway operations are mechanized in light of the sensors. The research intends to create a programmed railway track door control framework that is more solid and secure than the manual frameworks. A sensor-based railroad entryway mechanization framework has been developed to automate the process of opening and closing entryways at railroad level crossings [1]. This project's parameters include a base pulse, a most extreme pulse, and a redundancy rate. The servos are regulated by delivering them a variable-width pulse. This pulse is sent using the control wire. This pulse contains three parameters: a base pulse, a maximum pulse, and a redundancy rate. The landing and flight of the prepare are decided using an IR handset [9]. By utilizing an IR Transceiver, in which the distance between the prepare and the receiver is determined to be legitimate zero. The IR LED converts the IR radiations from the episode into an equal electric current, which when passed via a resistor result in a precise voltage drop. This voltage estimation will be based on the power of occurrence IR radiations or, there will be distance between the IR transmitter and the receiver [10]. The circuit is separated into three sections. The microcontroller comes first, followed by the IR sensor segment on a continuous rail, and finally the servo engine that operates the doorway.

2.4 Intelligent Traffic Control System

One of the most serious problems that large urban areas face is the problem of activity clogging. The line activity light concept is a result of research into movement building, in which vehicles touch base at a crossing point regulated by an activity light and shape a line [11]. Several research projects developed unique ways for assessing the lengths of the lines in each path on road width and the number of cars that are usual at a given time. This work demonstrated an innovative technique for the design and implementation of an intelligent movement lights control framework. The Structured System Analysis and Design Methodology (SSADM) and the Fuzzy Based Design Methodology were combined to create this technique [12].

2.5 Wireless Signal Automation in Railway

There are countless train accidents occurring at levels between railroad and interstate due to unresponsiveness and irresponsibility in manual operations or a lack of labourers. The MSP430 microcontroller is used as the main component in this system [4]. The framework is built around the MSP430 microcontroller. The main purpose of the android application is to communicate the Wireless flag to the Wi-Fi module. The android application features two catches that may be used to open the door and near to close it. The framework receives input from the vibration sensors in the unmanned mode and automatically closes the door. The yield displays on the LCD whether to open or close the door. Vibration sensor are sensors that measure the vibrations produced by the devices on display and break them down into direct speed, uprooting and proximity. Vibration sensors sense the vibration of a train approaching or passing by. The vibration sensors installed beneath the track provide input to the framework. The android versatile comes with an application that sends a message to the WIFI module. There are two options in the android application: open and close. When we select open or close, the WIFI module receives the flag and sends it to the microcontroller, causing the doorway to open or close naturally [2]. We can determine the current longitude and scope position of the prepare in caverns and high altitudes using an android application and a WIFI module. This system greatly improves the dependability of correspondence while also being a simple system. The DC engine entrance can work in a natural way.

Figure 2.1 explains the wireless signal automation for a railway with block diagram illustration

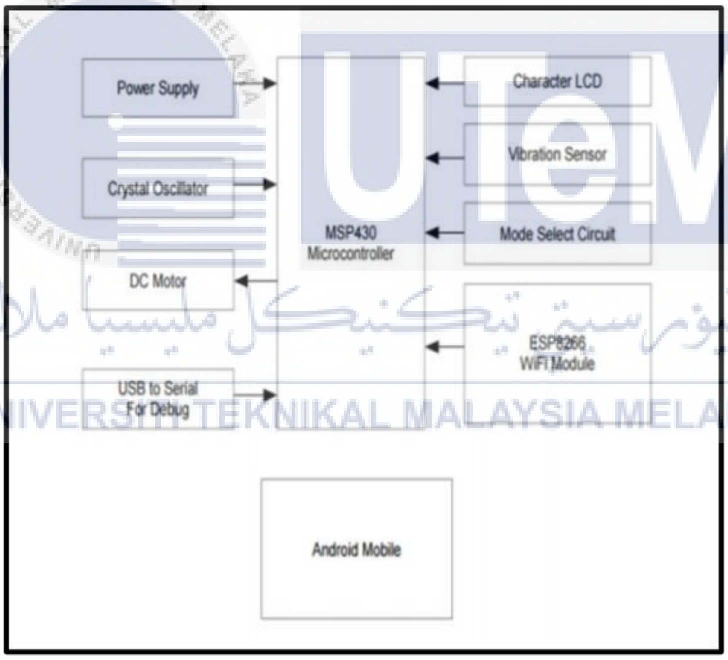

Figure 2.1: Operating system of wireless automation
(Source : www.ijircce.com)

2.6 Obstacles Detection Using GSM Modular

Microcontroller components with GSM and GPS interface are highlighted to improve the overall framework [14]. At each moment, the GPS gadget receives valid GPS signals from the satellite and sends the calculated longitude, scope, and speed of the car to the microcontroller. The microcontroller monitors the speed obtained from GPS on a regular basis, and if there is a large predefined difference between two consecutive GPS speed measurements, it is considered a mishap condition. For blockages, the discovering microcontroller will issue specific AT orders to the GSM modem interfaced to deliver content SMS to the designated proprietor's mobile number. The current scope and longitude obtained from the GPS receiver are included in this instant message. In the event of an impediment, sensors will detect any query or other vehicle in its railroad path, and any deterrent that detects this should naturally slow down the prepare pace by applying a smooth break. This zone is home to a large number of analysts. In a traditional framework, a microcontroller is used with a low-level computing architecture, however we have used a PIC Microcontroller with embedded C Language so that the coding is unrestricted [15]. The Microcontroller PIC18F26K22 is connected to a track sensor that continuously detects, tracks, and moves the vehicle. If the track sensor yield detects hard terrain, the Microcontroller immediately reduces vehicle speed and attempts to move the car back on the road using track sensor yield. Similarly, a Microcontroller interfaced with Ultrasonic sensors is being developed to detect any barrier in the vehicle's path. A microcontroller with GSM and GPS interface is also incorporated to enhance a huge system.

2.7 Summary

Various themes including a literature study of the automated railway gate controller with obstacles detection have been discussed in this chapter. The automated railway system was addressed in the first section, and the sensor-based automated railway system was examined in the second part. The intelligent traffic light control system was the subject of the third section. The fourth section also discussed the entire project's microcontroller-based traffic light system. The wireless signal automation in railways was addressed in the fifth section, and the barriers detection utilising GSM modular was covered in the last part.

CHAPTER 3

METHODOLOGY

3.1 Introduction

In this chapter a brief overview of the procedures that has been implemented for this project has been explained in detail to achieve the project's objectives.

3.2 Methodology

This chapter explains the method that was taken in light of the proposed design consideration. The method also integrated hardware and software in order to build an automated PIR-based surveillance system. The first section emphasizes the project's overall setup and operations, whereas Figure 3.1 depicts the overall operating system as a block diagram. In addition, the second part of this chapter covers the hardware and circuitry design, which includes all of the sections for opening and closing gates, detecting obstructions, and providing a wireless notification and security alarm system. The last part includes the programming implemented to run the whole system.

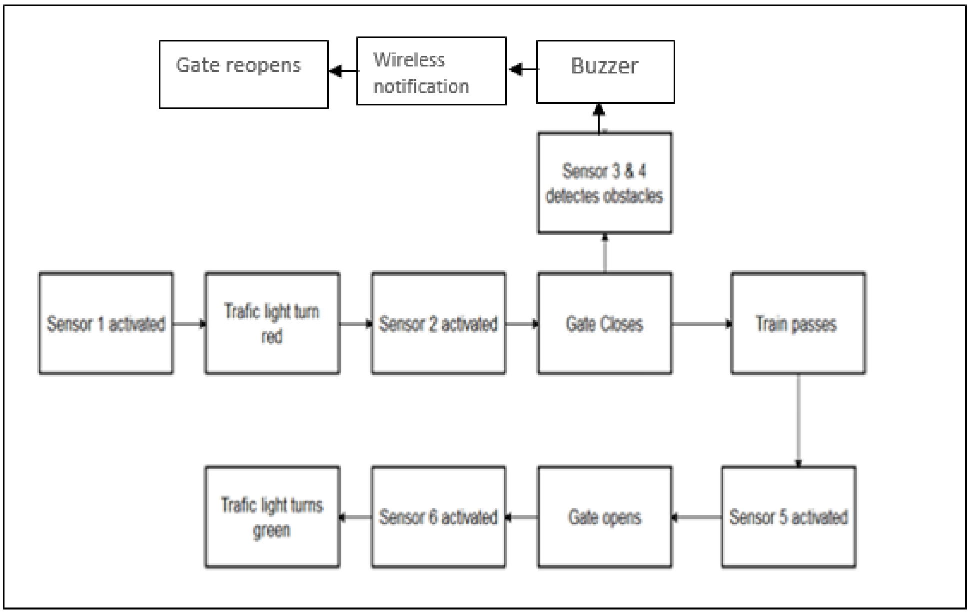

Figure 3.1 Block diagram of complete working system

3.3 Operating Principle of IR Sensor Automated System

Combining hardware and software to create an automated IR sensor-based automated system. The initial step is to detect an approaching train and activate the traffic light, turning it red. Next, the gate will close when the train reaches a particular distance. the IR sensor 1 and IR sensor 2 were positioned at the arriving side of the train, with IR sensor 1 controlling the traffic light and IR sensor 2 controlling the servo motor. The IR sensor 1 was set at a distance of about 10km, to determine the approaching train. IR sensor 2 was set after 2km of IR sensor 1 to initiate gate shutting, giving the train about 8km to slow down and stop in an event of emergency. The project's scale has been reduced from 10km to 10cm and 8km to 8cm. IR sensors 3 and 4 were placed on the road crossway to detect any obstacles once the gate was closed. The GSM module delivers a wireless notification to the train control station if obstacles was detected and a security siren will sound, assuring the train stops before it hits the gate. If no obstacles detected, the train will proceed like usual. IR sensors 5 and 6 were positioned after the gate at 2km and 4 km. The servo motor opens the gate after the train passes the IR sensor 5 and the traffic light turns green after the train passes IR sensor 6.

3.4 Project Design

3.4.1 Project's Framework

Figure 3.2 shows the complete design of the project with the distance covered by the IR sensors.

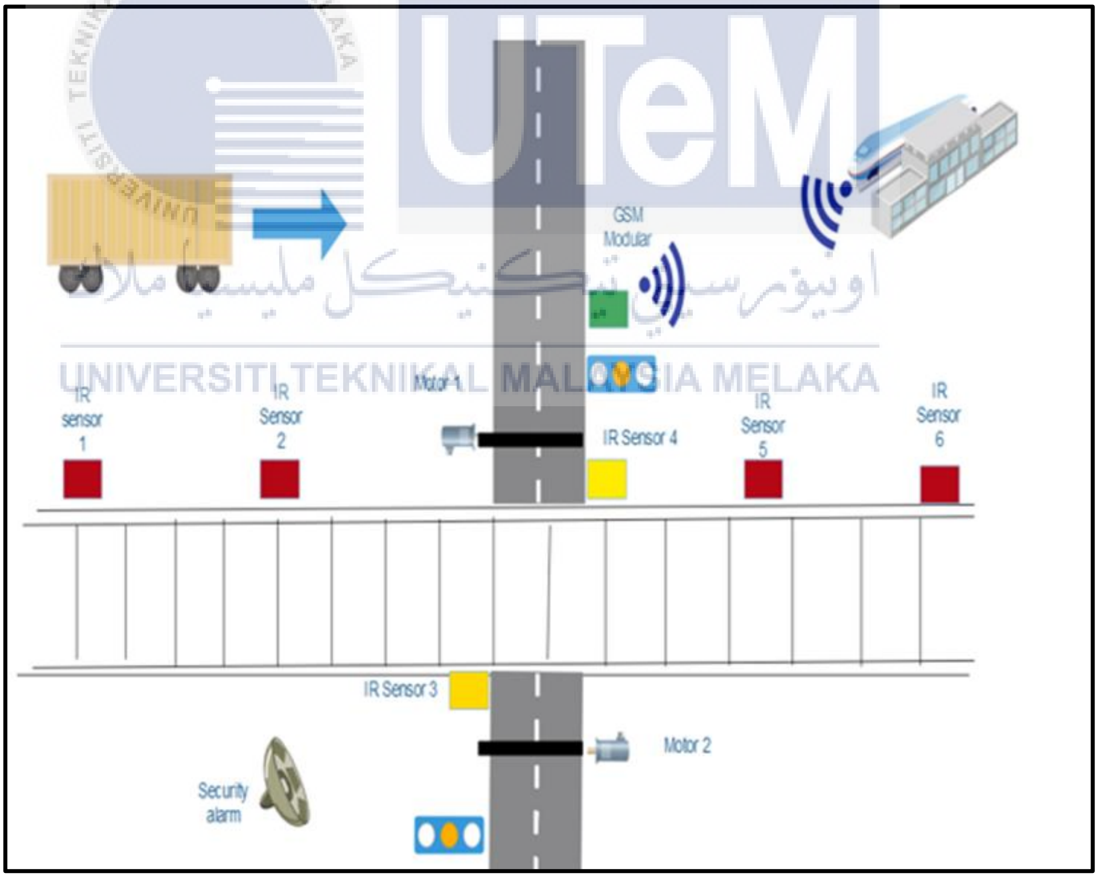

Figure 3.2: Framework of overall project

3.4.2 Flowchart of the Project

Figure 3.3 shows a flowchart of the gate closing and opening together with the obstacles detection process which was done in a few different steps

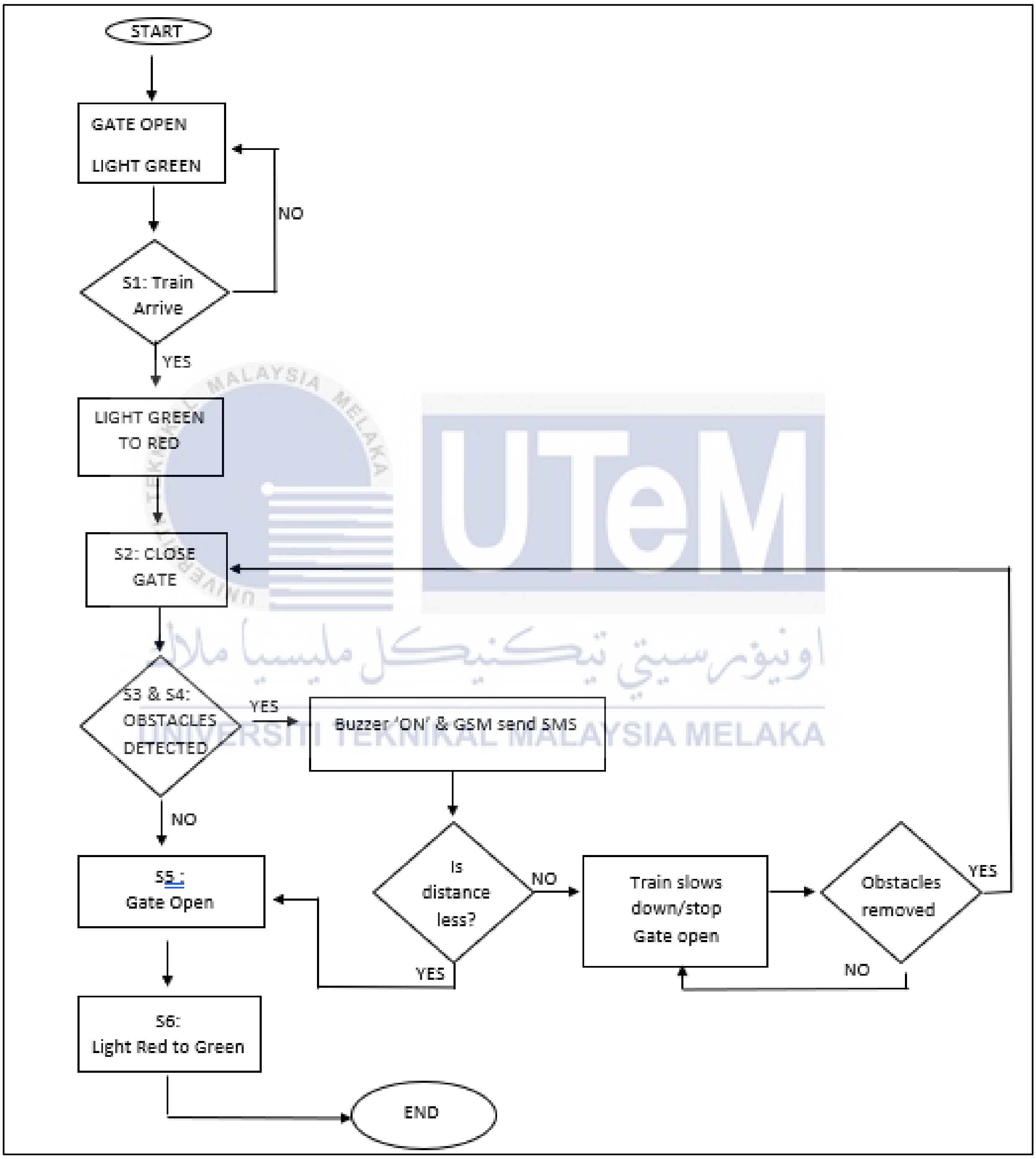

Figure 3.3: Flowchart of the project

3.4.3 General Block Diagram of the Project

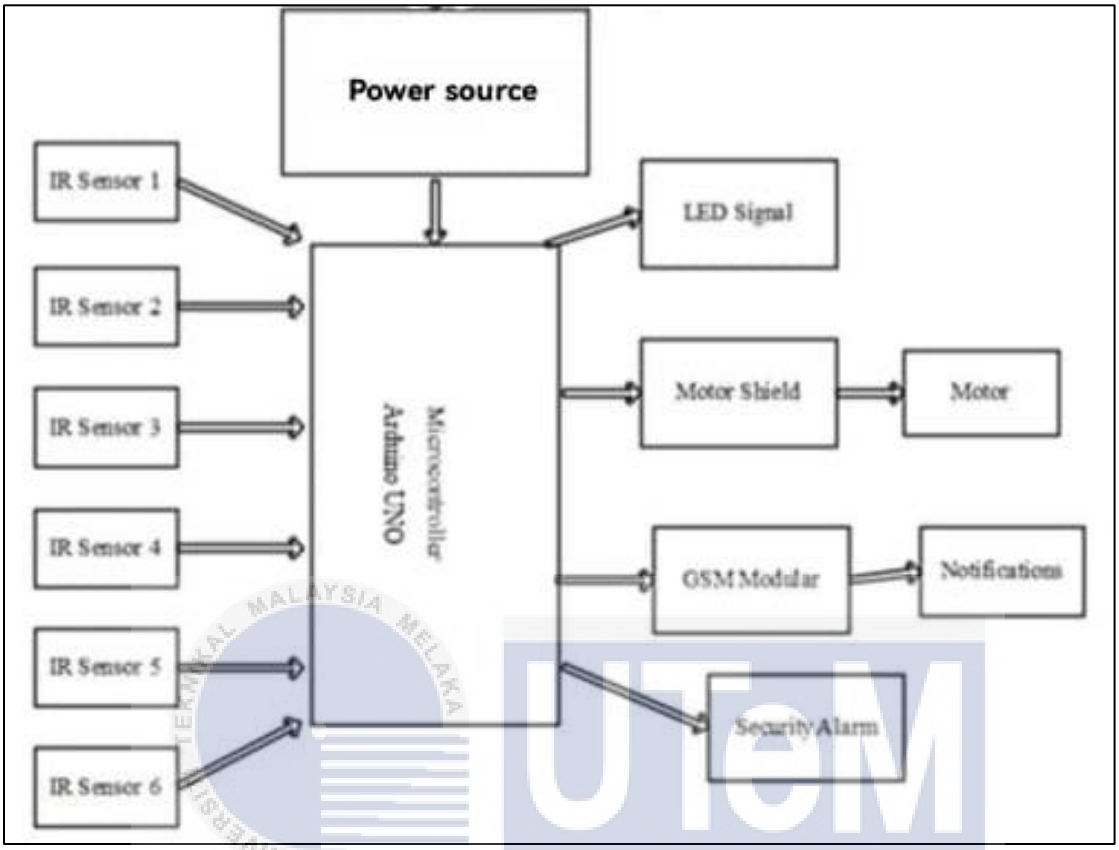

Figure 3.4: General Block Diagram

3.5 Schematic Diagram

3.5.1 Schematic Diagram of the Railway Track

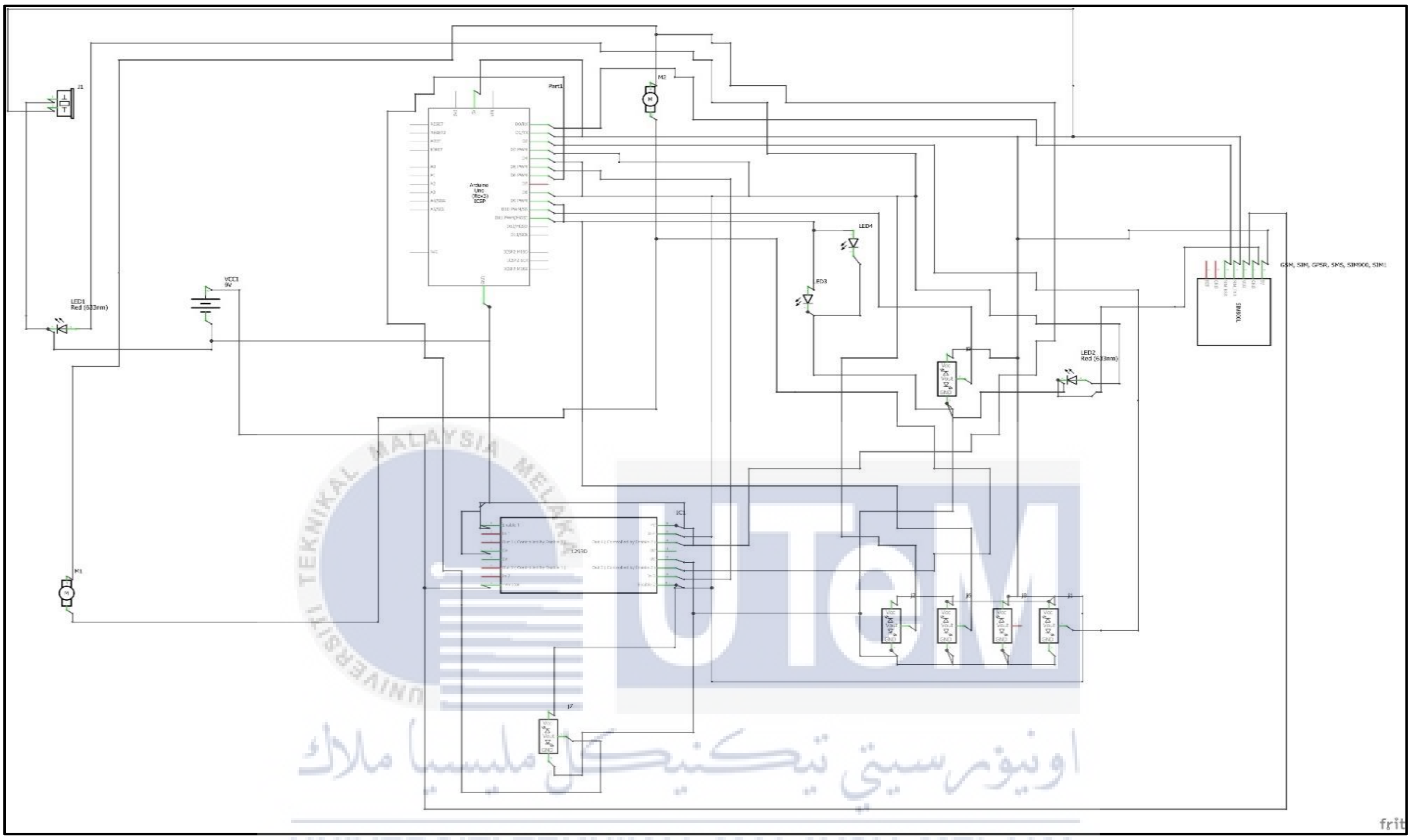

Figure 3.5: Schematic Diagram

3.6 Project's Logic Table Characteristics

Table 3.1: Logic table characteristics

High or Low	Traffic Signal 1	Servo Motor 1	Activates GSM Modular	Buzzer
0	Green	Open	No obstacles	No siren
1	Red	Close	Yes Obstacles	Yes siren

Table 3.2: Logic table of IR sensors when train arriving

	Traffic Signal 1	**Servo Motor 1**	**Activates GSM Modular**	**Buzzer**
IR Sensor 1	1	-	-	-
IR Sensor 2	-	1	-	-
IR Sensor 3	-	-	1	1
IR Sensor 4	-	-	1	1
IR Sensor 5	-	0	-	-
IR Sensor 6	0	-	-	-

Table 3.3: Logic table of IR sensors when train departs

	Traffic Signal 1	**Servo Motor 1**	**Activates GSM Modular**	**Buzzer**
IR Sensor 6	1	-	-	-
IR Sensor 5	-	1	-	-
IR Sensor 4	-	-	1	1
IR Sensor 3	-	-	1	1
IR Sensor 2	-	0	-	-
IR Sensor 1	0	-	-	-

3.7 Programming Part

This project has three aspects to it in terms of programming. The gate opening and shutting in two ways is the first portion that has to be programmed into the Arduino microcontroller. The second section is about adjusting the LED signal in two ways, which will be utilized to regulate traffic lights from red to green. The obstacle detection and GSM modular output are the final parts of the code.

3.7.1 Two Ways of Opening and Closing Gate

The gate opening and closing software is made up of two programs that required sensor 2 and sensor 5 input. Appendix B contains the programming instructions.

3.7.2 Changing LED Signal for Both Ways

Sensor 1 and sensor 6 outputs are used to change the LED signal from red to green and then back to red. Appendix C contains the programming instructions.

3.7.3 Obstacles Detection and GSM Modular

It uses the output from sensors 3 and 4 as well as the input from the GSM module to detect impediments. Appendix D contains the programming instructions.

3.7.4 Integrate All Three Programs

This program aids in the integration of the three programs discussed above. Appendix E contains a copy of the program.

3.8 Components and Budget

3.8.1 List of Components

Components	Model
Dc geared motor	30 RPM
IR sensor	Obstacles avoidance module
Connecting wires	Male and female
Microcontroller	Arduino Uno
GSM modular	Sim 900A
Railway track and train	Toy replica
LED	Red and Green
Buzzer	-

Table 3.4: Electrical and electronics components

3.8.2 List of Budget

Components	Units	Price per Unit (RM)	Price (RM)
DC geared motor	2	7	14
IR sensor	6	10	60
Connecting wires	2	12	24
Microcontroller	1	45	45
GSM modular	1	80	80
Railway track and train	1	120	120
Buzzer	1	5	5
Motor driver Shield	1	35	35
LED	6	1	6
Total	-	-	389

Table 3.5: Overall budget of this project

3.9 Limitation of proposed methodology

The project fell short of what was required due to the type of sensors employed. IR sensors with variable speeds of motion detection could be a serious problem because the project prototype was scaled down to 1:1000 so there will be some delay in the opening of the gate. The IR motion detector might be less sensitive in detecting fast moving object so different countries have to review in the speed of the moving train. Furthermore, due to interference or network problems the transmission of the notification via GSM may be delayed.

3.10 Summary

The working system of this project has been covered in this chapter. Furthermore, the automated system was explained using flowcharts and a truth table was done to explain the system's operation when implemented in microcontroller-based system. Moreover, the programming for each part of the project have been designed and modified according to the working system needed.

CHAPTER 4

RESULTS AND DISCUSSIONS

4.1 Introduction

In this chapter, the results have been included to demonstrate the findings, which are development of automatic railway gate and obstacles detection, interfacing of GSM and Arduino with IR sensors. The overall output from the project should based on the truth table.

4.2 Project Outcomes

The first outcome which was produced from the overall project includes when there is presence of train on the track at 10km which is scoped down to 10cm in the train model. The first IR sensor was detected and sent signal to the microcontroller to turn the LED signal from green to red in colour. Moreover, when the train passed the second IR sensor the sensor sent a signal to close the gate. Furthermore, when there were obstacles detected in between the IR sensor 3 and IR sensor 4 in the level crossing before the train arrived, the signal was automatically sent through the micro-controller to boot up the GSM modular and sends the message to the phone either to the train master or to the train driver. When there were no obstacles detected through the IR sensor 3 and 4 the train continuously moved towards the IR sensor five which re-opened the gate when it passes 2000m distance from the level crossing which is scoped down to 20 cm. In addition, the red signal also turned into green when the train passed the 6th IR sensor.

4.3 Outcomes of Detected Signal

4.3.1 Overall Circuit Design

This is the overall circuit design with all the 6 sensors, buzzer, motor, GSM module, Arduinos connected.

Figure 4.1: Design of the overall system.

4.3.2 First IR Sensor Detected

The first IR sensors is detected when the train arrives and the traffic light is turned from green to red, indicating the train is arrving and for the car to stop.

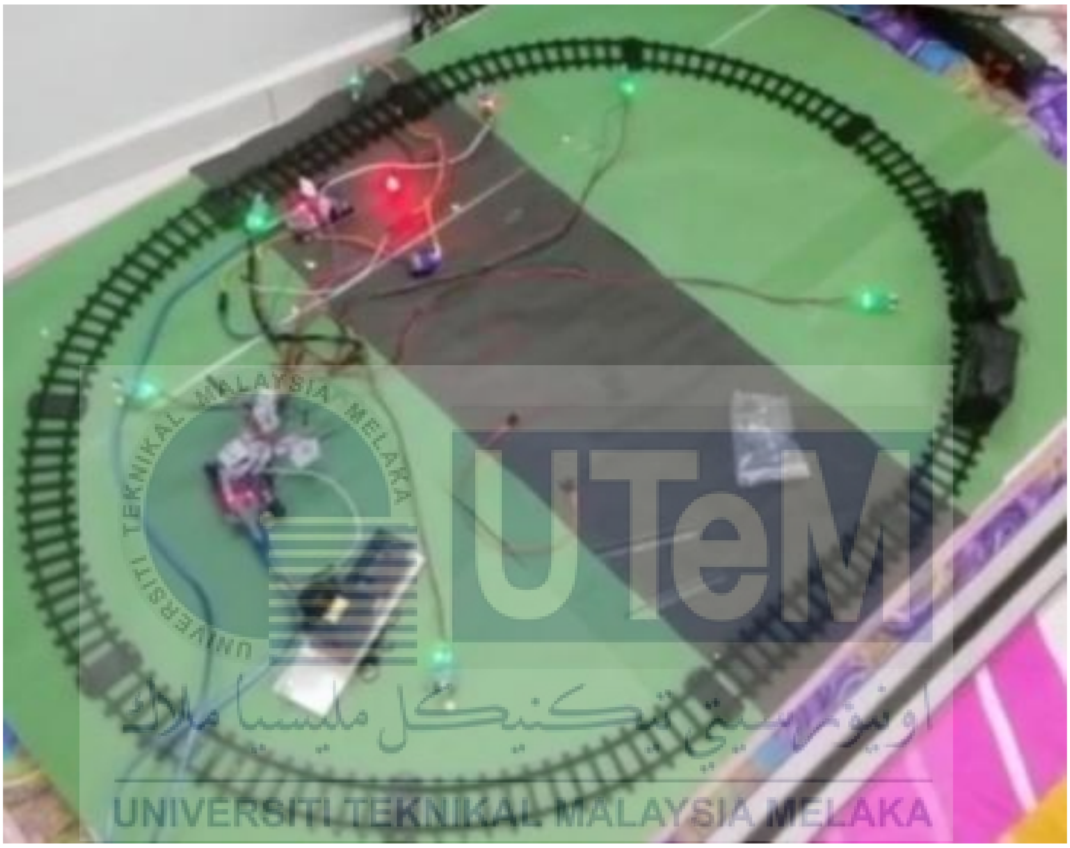

Figure 4.2: Traffic signal changes from green to red

4.3.3 Second IR Sensor Detected

When the second IR sensor was detected the gate closes indicating the train is nearing and cars cannot pass.

Figure 4.3: Closing of the gate

4.3.4 Third IR Sensor Detected

When the third and fourth IR sensors are detected for obstacles the gate open automatically where the train will stop and cars can pass until the obstacles were removed.

Figure 4.4: Gate re-open automatically

4.3.5 Fourth IR Sensor Detected

Once obstacles were detected the GSM modules sends notification through sms, informing the train master/ train operator to slow down and stop

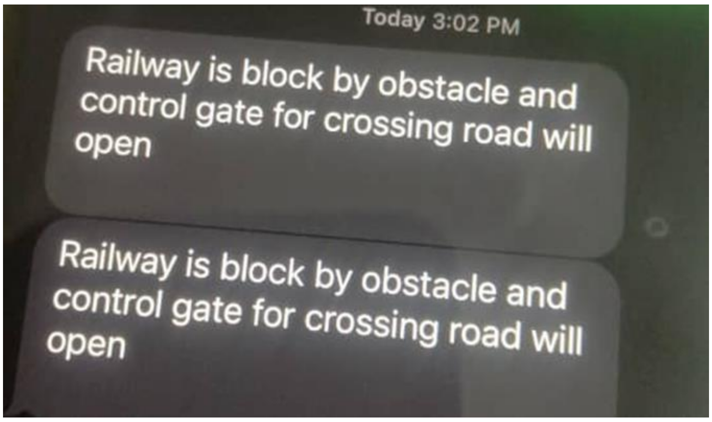

Figure 4.5: Message received when obstacles detected

4.3.6 Fifth IR Sensor Detected

When the fifth IR sensor was detected it indicates the train has passed few kilometers from the level crossing and the gate opens.

Figure 4.6: Gate opens

4.3.7 Sixth IR Sensor Detected

Once the sixth IR sensor was detects the train, the traffic light will change from red to green indicating the train has passed and safe for the cars to pass.

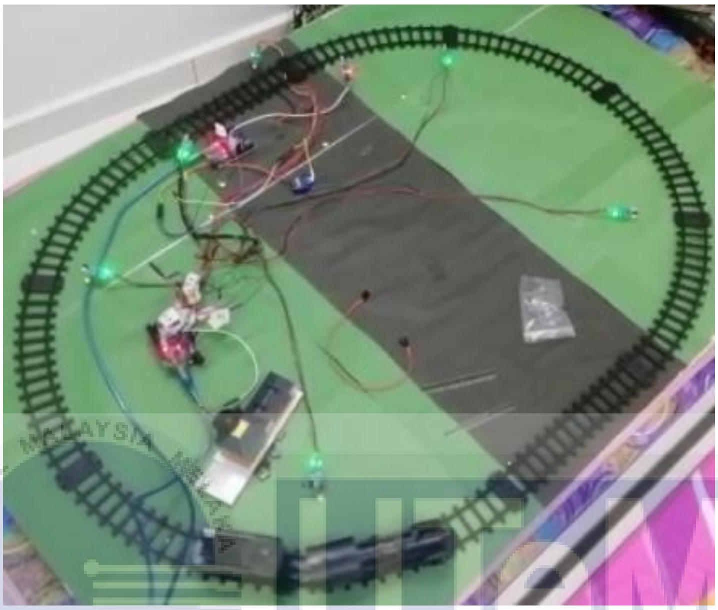

Figure 4.7: Traffic signal changes from red to green

4.4 Summary

As mentioned in the first objective, the first objective is to open and close the gate automatically at the level crossing. This objective was accomplished by connecting two IR sensors of IR sensor 2 and IR sensor 5 as shown in the design diagram. According to IR sensor 2 and 5 those sensors trigger the signal and acts as an on and off medium which helps to trigger the Arduino’s output. For example, after the IR sensor 2 gets triggered as either low or high, the signal will be sent to the Arduino. If the IR sensor 2 is low, the gate signal should be high. When the IR sensor 5 is low the then the program says that the gate signal should be low which closes the gate.

Moreover, the IR sensor 1 and 6 acts as a traffic signal. After being triggered, the IR sensor 1 signal changed the traffic signal from green to red and IR sensor 6 changed the traffic signal from red to green back. The results of this system can be verified as shown in Figure 4.1 and 4.6

Furthermore, the second and third objective stated that the project is also able to detect the obstacles in the train track and inform the train master via wireless. This objective is accomplished by IR sensor 3 and 4 because both sensors are placed at the level crossing of the train track. Before the approaching train reaches the level crossing, the IR sensor 3 and 4 detects the obstacles present in the level crossing and the signal of obstacles detected is sent to the GSM modular and a message is sent to the train master and the gate will open until the obstacles is removed. The respective result is shown in the Figure 4.3 and 4.4.

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

As a conclusion, the results obtained from the overall project are according to the objectives of this project and the proposed method. Automatic gate control framework offers a viable approach to lessen the event of railroad mishaps. This framework can contribute a great deal of advantage either to the street clients or to the railroad administration and reducing human involvement for closing and opening the railway gate which allows and prevents cars and human from crossing railway track. Since the plan is totally mechanized it can be utilized as a part of remote towns where no station aces or line man is available. The railroad sensors are set at two sides of entryway. It is utilized to detect the arrival and departure of the train.

In addition, the system can also generate buzzer and light indicators while the train passing through the level crossing. In this system, this is controlled by using microcontroller. Presently the programmed framework involves every single part of applications as it is solid and precise. Involvement of GSM modular is very helpful in detecting and sending messages even in remote area. This helps also in detecting obstacles on the railway track.

In general, this project is an improvement in the railway industry where it needs a train master to reduce the number of accidents happen throughout the year at the railway system. This project also focused on the safety and early preparation for the railway system.

Through this system railway accidents or mishaps may be reduced and deaths can be avoided to the maximum.

5.2 Future Works

For the future work scope, this project can be enhanced by implementing a solar system where it requires less power to boot up the system. Moreover, it can be used run the microcontroller unit, motor, and sensors. In addition, a solar power hybrid system can be built as well to prevent a power shortage during occurrence of power failure or blackout state. The solar power and a common power supply are hybridized to store energy in the power battery bank. The battery bank can supply enough power to withstand the system during power failure time.

5.3 Project Potential

Automatic railway gate system and obstacles detection is a simple hardware implementation and basic control scheme. Numerous railway accidents can be prevented without human error at level crossings with the help of this project.

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APPENDICES

Appendix A

BDP 1 GANTT CHART

	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	W13	W14
Background study: find For research papers related to the project														
Begin drafting the the report														
Produce a complete abstarct of the project														
Begin reporting according to the template given														
Complete chapter 1 and chapter 2 of report														
Progress chapter 3 (methodology)														
Submit 1st draft report to SV (Due 20/05/2022)														
Report alteration														
Prepare slide presentation. Mock presentation														
Submit Report To Panel Via ePSM (10/06/2022)														
BDP Presentation (13/06/2022)														
Submit final report via ePSM (08/07/2022)														

BDP 2 GANTT CHART

	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	W13	W14
Prototype Planning														
Prototype Designing														
Software Planning- Coding														
Hardware and Software Interface														
Assembling Hardwares														
Prototype testing														
Preparation of Chapter 4 & 5														
Submit 1st draft report to SV (Due 06/01/2023)														
Report alteration														
Video Planning-Recording														
Submit Thesis to SV &Panels														
BDP 2 Presentation (18/01/2023)														

Appendix B

```
intsensor1=2;
intsensor2=3;
intmotor1=4;
intmotor2=5;

voidsetup(){
pinMode(sensor1,INPUT);
pinMode(sensor2,INPUT);
pinMode(motor1,OUTPUT);
pinMode(motor2,OUTPUT);
}

void
loop(){
C:
if(sensor1==LOW){
digitalWrite(motor1,HIGH);
digitalWrite(motor2,LOW);
delay(500);
digitalWrite(motor1,HIGH);
digitalWrite(motor2,HIGH);
A:
if(sensor2==LOW){
digitalWrite(motor1,LOW);
digitalWrite(motor2,HIGH);
delay(500);
digitalWrite(motor1,HIGH);
digitalWrite(motor2,HIGH);
delay(1000);
gotoC;
}gotoA;
if(sensor2==LOW){
digitalWrite(motor1,HIGH);
digitalWrite(motor2,LOW);
delay(500);
digitalWrite(motor1,HIGH);
digitalWrite(motor2,HIGH);
B:
if(sensor1==LOW){
digitalWrite(motor1,LOW);
digitalWrite(motor2,HIGH);
delay(500);
digitalWrite(motor1,HIGH);
digitalWrite(motor2,HIGH);
delay(1000);
gotoC;
```

```
}
gotoB;
}
}
}
```

Appendix C

```
intsensor3=6;
intsensor4=7;
intled1=8;
intled2=9;

voidsetup(){
pinMode(sensor1,INPUT);
pinMode(sensor2,INPUT);
pinMode(led1,OUTPUT);
pinMode(led2,OUTPUT);
}

void loop(){
C:
if(sensor1==LOW){
digitalWrite(led1,LOW);
digitalWrite(led2,HIGH);
A:
if(sensor2==LOW){
digitalWrite(led1,HIGH);
digitalWrite(led2,LOW);
delay(1000);
goto C;
}goto A;
if(sensor2==LOW){
digitalWrite(led1,lOW);
digitalWrite(led2,HIGH);
B:
if(sensor1==LOW){
digitalWrite(led1,HIGH);
digitalWrite(led2,LOW);
goto C;
}
goto B;
}
}
```

Appendix D

```
// Include the GSM library
#include <GSM.h>


#define PINNUMBER ""


// initialize the library instance
GSM gsmAccess;
GSM_SMS sms;


void setup() {
// initialize serial communications and wait for port to open:
Serial.begin(9600);
while (!Serial) {
; // wait for serial port to connect. Needed for native USB port only
}


Serial.println("SMS Messages Sender");


// connection state
boolean notConnected = true;


// Start GSM shield
// If your SIM has PIN, pass it as a parameter of begin() in quotes
while (notConnected) {
```

Appendix E

```
#include <SoftwareSerial.h>
SoftwareSerial gsm(10,11); //GSM module RX, TX

#define DEBUG 2  //1-bluetooth, 2-GSM
// special character
#define  CTRL_Z      26 //CTRL-Z
#define  quoteKey   34 //
#define  endString   '\r' //catridge return
//
//-----------------------------------------------------------------
#define IR01 A0
#define IR02 A1
#define IR03 A2
#define IR04 A3
#define IR05 A4
#define IR06 A5
#define ledR01 4
#define ledG01 5
#define ledR02 6
#define ledG02 7
#define ML01 8
#define MR01 9
#define ML02 0
#define MR02 1
#define buzzer 12
#define gsmPwrKey 13    //gsm enable
//-----------------------------------------------------------------
const int gateOpenTime = 100; // 100 x 10ms = 1 seconds
const int gateCloseTime = 100; // 100 x 10ms = 1 seconds

const String contactNumber = "0103856463";
char serialdata[80];
String strBuf = "Railway is block by obstacle and control gate for crossing road will open";
// a string to hold incoming data

// CONTROL VARIABLE
int state = 0;
int prevState = 0;
int dir = 1;
bool isMessageSent = false;

void SerialDebug (String input)
{
  if (DEBUG)
```

```
  {
    Serial.print(input);
  }
}
/*
  Check IR sensor
*/
bool checkInfraRed(int input) {
  if (analogRead(input) > 512) {
    return false;
  }
  else {
    return true;
  }
}

/*
  Gate Control
*/
int gateControl( int ML, int MR, bool clockWise = true, int pwm = 100)
{
  for ( int i = 1; i <= 100; i++)
  {
    // Motor 1
    if (i <= pwm)
    {
      if (clockWise)
      {
        digitalWrite(ML, HIGH);   // turn on
        digitalWrite(MR, LOW);   // turn off
      }
      else
      {
        digitalWrite(ML, LOW);   // turn off
        digitalWrite(MR, HIGH);   // turn on
      }
    }
    else
    {
      digitalWrite(ML, HIGH);   // turn on
      digitalWrite(MR, HIGH);   // turn off
    }
    delayMicroseconds(100);
  }
  return 0;
}

void openGate01()
{
  for (int j = 1; j <= gateOpenTime; j++)
```

```
  {
    gateControl(ML01, MR01, true, 100);
  }
  SerialDebug("Open1");
}
void openGate02()
{
  for (int j = 1; j <= gateOpenTime; j++)
  {
    gateControl(ML01, MR01, true, 100);
  }
  SerialDebug("Open2");
}
void closeGate01()
{
  for (int j = 1; j <= gateCloseTime; j++)
  {
    gateControl(ML01, MR01, false, 100);
  }
  SerialDebug("Close1");
}
void closeGate02()
{
  for (int j = 1; j <= gateCloseTime; j++)
  {
    gateControl(ML01, MR01, false, 100);
  }
  SerialDebug("Close2");
}
/*
   Send SMS
*/
int sendSMS() {
  int returnMsg = 0;
  // set SMS
  if (DEBUG) {
    Serial.println("Initiate SMS mode");
    delay(1000);
  }
  gsm.setTimeout(1000);       // read feedback OK
  gsm.listen();
  gsm.print("AT+CMGF=1");
  gsm.write(endString);
  returnMsg = gsm.readBytesUntil('K', serialdata, 80); // detect CR, next line
  if (returnMsg > 0) {
    if (DEBUG) {
      Serial.println("SMS mode set success");
    }
  }
  else {
```

```
    if (DEBUG) {
      Serial.println("SMS mode set failed");
    }
  }
  // set recipient
  if (DEBUG) {
    Serial.print("Set Recipient=");
    Serial.println(contactNumber);
  }
  gsm.setTimeout(1000);       // read feedback OK
  gsm.listen();
  gsm.print("AT+CMGS=");
  gsm.write(quoteKey);
  gsm.print(contactNumber);
  gsm.write(quoteKey);
  gsm.write(endString);
  returnMsg = gsm.readBytesUntil('>', serialdata, 80); // detect CR, next line
  if (returnMsg > 0) {
    if (DEBUG) {
      Serial.println("sms text mode ready");
    }
  }
  else {
    if (DEBUG) {
      Serial.println("sms text mode not ready");
    }
  }
  // send out SMS
  if (DEBUG) {
    Serial.println("Send SMS");
  }
  gsm.setTimeout(3000);       // read feedback OK
  gsm.listen();
  gsm.println(strBuf);        // refer message from main
  gsm.write(endString);
  gsm.write(CTRL_Z);
  gsm.write(endString);
  returnMsg = gsm.readBytesUntil('K', serialdata, 80); // detect CR, next line
  if (returnMsg > 0) {
    Serial.print("sms sent success to");
    Serial.println(contactNumber);
  }
  else {
    Serial.println("sms sent failed");
  }
  return returnMsg;  // when all others fail, return this...
}

/*
   GSM Setup
```

```
*/
int setupGSM() {
  int returnMsg = 0;
  if (DEBUG) {
    Serial.println();
    Serial.println("mobile device");
    Serial.println("-------------------------");
    Serial.println("ATI - search GSM");
  }
  gsm.print("AT");
  gsm.write(endString);
  gsm.setTimeout(1000);       // read feedback OK
  gsm.listen();
  returnMsg = gsm.readBytesUntil('K', serialdata, 80); // detect CR, next line
  if (returnMsg > 0) {
    if (DEBUG) {
      Serial.println("GSM device connected");
    }
    delay(1000);
  }
  else {
    if (DEBUG) {
      Serial.println(returnMsg);
      Serial.println(serialdata);
      Serial.println("GSM device not connected");
    }
    delay(1000);
  }
  //
  return returnMsg;
}

int chkGsmStatus() {
  int ReturnMsg = 0;
  gsm.print("AT");
  gsm.write(endString);
  gsm.setTimeout(1000);       // read feedback OK
  gsm.listen();
  ReturnMsg = gsm.readBytesUntil('K', serialdata, 80); // detect CR, next line
  return ReturnMsg;
}

void writeGSM() {
  if (Serial.available()) {
    gsm.write(Serial.read());
  }
}

void readGSM() {
  if (gsm.available()) {
```

```
    char inChar = gsm.read();
    Serial.write(inChar);
  }
}
/*
   Traffic control for train
*/
void trafficRed() {
  digitalWrite(ledR01, HIGH);
  digitalWrite(ledR02, HIGH);
  digitalWrite(ledG01, LOW);
  digitalWrite(ledG02, LOW);
  if(DEBUG) Serial.print("traffic red");
}
void trafficGreen() {
  digitalWrite(ledR01, LOW);
  digitalWrite(ledR02, LOW);
  digitalWrite(ledG01, HIGH);
  digitalWrite(ledG02, HIGH);
  if(DEBUG) Serial.print("traffic green");
}

void onBuzzer() {
  digitalWrite(buzzer, HIGH);
  if(DEBUG) Serial.print("buzzer on");
}

void offBuzzer() {
  digitalWrite(buzzer, LOW);
  if(DEBUG) Serial.print("buzzer off");
}

void trafficControl() {
  if (state == 1 || state == 6) {
    // when train pass IR1 the traffic signal should change from green to red
    trafficRed();
    // when train pass IR5 gate should open
    if (prevState == 5 && dir == 1) {
      openGate01();
      openGate02();
    }
    if (prevState == 1 && dir == 0) {
      openGate01();
      openGate02();
    }
  }
  if (state == 2 && dir == 1) {
    // when the train pass IR2 the gate should close
    closeGate01();
    closeGate02();
```

```
  }
  if (state == 5 && dir == 0) {
    // when the train pass IR2 the gate should close
    closeGate01();
    closeGate02();
  }
  if (state == 0 || state == 7) {
    // when the train pass IR6 the traffic light should change from red to green back
    trafficGreen();
  }
}

void setup() {
  // Open serial communications and wait for port to open:
  Serial.begin(9600);
  Serial.println("Railway traffic control with GSM alert");
  // set the data rate for the SoftwareSerial port
  gsm.begin(9600);
  pinMode(gsmPwrKey, OUTPUT);
  pinMode(buzzer, OUTPUT);
  pinMode(MR01, OUTPUT);
  pinMode(MR02, OUTPUT);
  pinMode(ML01, OUTPUT);
  pinMode(ML02, OUTPUT);
  pinMode(ledR01, OUTPUT);
  pinMode(ledR02, OUTPUT);
  pinMode(ledG01, OUTPUT);
  pinMode(ledG02, OUTPUT);
  digitalWrite(gsmPwrKey, HIGH);
  digitalWrite(ledR01, LOW);
  digitalWrite(ledR02, LOW);
  digitalWrite(ledG01, HIGH);
  digitalWrite(ledG02, HIGH);
  setupGSM();
  state = 0;
  // assume gate is close initially
  openGate01();
  openGate02();
}

void loop() { // run over and over
  //AT command communication gsm
  if (DEBUG == 2) {
    gsm.listen();
    writeGSM();
    readGSM();
  }
  // DO SOMETHING HERE
  if (checkInfraRed(IR01) == HIGH) {
    prevState = state;
```

```
 state = 1;
}
else {
 if (prevState == 1 && dir == 0) {
   state = 0;
   isMessageSent = false;
 }
}
if (checkInfraRed(IR02) == HIGH) {
 prevState = state;
 if (prevState == 1 || prevState == 5) {
   state = 2;
   if (prevState == 1)
     dir = 1;
 }

}
// another side coming
if (checkInfraRed(IR06) == HIGH) {
 prevState = state;
 state = 6;
}
else {
 if (prevState == 6 && dir == 1) {
   state = 7;
   isMessageSent = false;
 }
}
if (checkInfraRed(IR05) == HIGH) {
 prevState = state;
 if (prevState == 6 || prevState == 2) {
   state = 5;
   if (prevState == 6)
     dir = 0;
 }
}
if(DEBUG){
 Serial.print("Dir");
 Serial.print(dir);
 Serial.print("State:");
 Serial.print(state);
 Serial.print(" Previous State:");
 Serial.println(prevState);
 delay(500);
}
// traffic control
trafficControl();
// obstacle
if (checkInfraRed(IR03) == HIGH || checkInfraRed(IR04) == HIGH) {
 // when the train passes if there is obstacle detected in the road by IR3 and IR4
```

```
    // GSM should send message to hp and
    // gate should open back and buzzer should ring
    if (state == 2 && dir == 1) {
      openGate01();
      openGate02();
    }
    if (state == 5 && dir == 0)
{
      openGate01();
      openGate02();
    }
    onBuzzer();
    if(!isMessageSent)
{
      sendSMS(); // if no sms sent before, trigger sms
    }
  }
  else
 {
    offBuzzer();
  }
  delay(1000);//take out this delay if you wanna skip the DEBUG
}
```