VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI-590018

S.J.P.N. Trust's

HIRASUGAR INSTITUTE OF TECHNOLOGY NIDASOSHI-591236

Academic year:2023-24

Accredited at 'A' Grade by NAAC

Programmes Accredited by NBA: CSE, ECE

MINI-PROJECT REOPRT ON

"Train Accident Prevention Using IOT"

SUBMITTED BY

1. Miss. Jaine Shah — USN: 2HN21EC019
2. Miss. Shreya D Yamakanmarde — USN: 2HN21EC038
3. Miss. Sindhu M Todakar — USN: 2HN21EC041
4. Miss. Namrata D Belgali — USN: 2HN22EC408

UNDER THE GUIDANCE OF

Prof. S. S. Malaj

DEPARTMENTOF ELECTRONICS & COMMUNICATION ENGINEERING

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI–590018

HIRASUGAR INSTITUTE OF TECHNOLOGY, NIDASOSHI-591236

Accredited at 'A' Grade by NAAC and Recognized under section 2(f) of UGC Act,1956

Programmes Accredited by NBA: CSE, ECE

DEPARTMENT OF ELECTONICS & COMMUNICATION ENGINEERING

CERTIFICATE

Certified that the Mini-Project entitled **"Train Accident Prevention Using IOT"** carried out by **Miss. Jaine shah (2HN21EC019), Miss. Shreya Dadasaheb Yamakanmarde (2HN21EC038), Miss. Sindhu M Todakar (2HN21EC041) and Miss. Namrata D Belgali (2HN22EC408)** are Bonafide students of **HIRASUGAR INSTITUTE OF TECHNOLOGY, NIDASOSHI.** It is certified thatall corrections/suggestions indicated have been incorporated in the report. The mini project report has been approved as it satisfiesthe academic requirements in respect of mini project work prescribed for the said degree.

Prof. S. S. Malaj	**Dr. M. C. Sarsamba**	**Dr. S. C. Kamate**
GUIDE	**H.O. D**	**PRINCIPAL**

DECLARATION

We hereby declare that the work presented in this report entitled "**TRAIN ACCIDENT PREVENTION USING IOT**" being submitted by me to the Visvesvaraya Technological University, Belagavi.

We also declare that the mini project work carried out/published by various workers/authors referred in this mini project has been listed in the list of references. I also declare that the mini project work claimed as own contribution in this dissertation is not duplicated from any other published works.

Place:

Date:

Project Associates:

1. Miss. Jaine shah
2. Miss. Shreya Dadasaheb Yamakanmarde
3. Miss. Sindhu M Todakar
4. Miss. Namrata D Belgali

ACKNOWLEDGEMENT

It is our proud privilege and duty to acknowledge the kind help and guidance received from several persons in preparation of this report. It would not have been possible to prepare this report in this form without their valuable help, cooperation and guidance.

First, our sincere thanks to **Dr. M. C. Sarsamba** Head of the Department of Electronics and Communication Engineering, HIT for valuable suggestions and guidance through the period of preparation of this report.

We express our sincere gratitude to our project guide, **Prof. S. S. Malaj**, Asst. Professor in the Department of Electronics & Communication Engineering in H.S.I.T., Nidasoshi, for guiding us in investigations for this project and in carrying out analytical / experimental work. Our sincere thanks to Mini-Project Coordinator **Prof. D. B. Madihalli** for help in choosing the topic of this mini-project work.

My friends particularly deserve my sincere thanks for sparing time to discuss several aspects of this mini-project and for helping in preparation of this report.

Place:

Date:

Project Associates:

1. Miss. Jaine shah
2. Miss. Shreya Dadasaheb Yamakanmarde
3. Miss. Sindhu M Todakar
4. Miss. Namrata D Belgali

ABSTRACT

Railway Transport is indispensable in modern day life, both for business and private users. But nowadays, it is not that much safer as lot of accidents occur due to improper communication among the network like wrong signaling, worst weather condition, immediate route change, etc.,

Train accidents, to enhance railway safety, we have developed a comprehensive system that uses advanced sensor technologies to address two critical issues:

1) Alerting humans and animals on tracks.
2) Preventing collisions between trains.

Ultrasonic sensors are installed along the tracks to detect the presence of humans and animals, triggering loud auditory alarms and flashing lights to warn them of approaching trains, while also sending real-time alerts to train operators.

We propose this system to avoid train collision by using IR sensors Additionally, infrared (IR) sensors are strategically placed to continuously monitor train positions. A central control unit processes data from these sensors, ensuring that if two trains are detected on the same track segment within a safe distance, automatic braking systems are activated to prevent collisions. This integrated approach aims to public education campaigns about railway safety and strict enforcement of regulations further enhance the protection of both people and animals, ensuring safer railways for all.

The proposed system leverages Arduino and Automated technology to create an intelligent and automated safety solution that monitors and controls train movements, thereby reducing the risk of train accident.

Tables of Contents

CONTENTS **PAGE NO**

CHAPTER-01

INTRODUCTION

1.1 INTRODUCTION:

Railway Transport is indispensable in modern day life, both for business and private users. Nowadays, rail networks across the world are getting busier with trains travelling at higher speeds and carrying more passengers and heavier axle loads than ever before. The combination of these factors has put considerable pressure on the existing infrastructure, leading to increased demands in inspection and maintenance of rail assets.

Our project focuses on improving railway safety by alerting humans and animals on train tracks and preventing train collisions. These measures aim to reduce accidents, ensuring a safer railway environment and saving lives.

- **Alerting humans and animals on tracks.**

Railway tracks are crucial for transportation but pose safety hazards due to human and animal presence. Effective alert systems are essential to prevent accidents and ensure smooth operations. Ultrasonic sensors are installed along the tracks to detect the presence of train, triggering loud auditory alarms and flashing lights to warn them of approaching trains.

Beside shown Image-1.1 (accident areas of populated and forest area.)

Image-1.1.1

- **Preventing collisions between trains**.

Nowadays, lot of accidents occur due to improper communication among the network like wrong signalling, worst weather condition, immediate route change, etc., The train driver doesn't get proper information on time and before time so that the hazardous condition can occur. We propose this system to avoid train collision by using IR Sensors to provide communication between trains and to avoid same track collisions.

Beside shown Image-1.2 (accident areas of train collision)

Image-1.1.2

This integrated approach aims to public education campaigns about railway safety and strict enforcement of regulations further enhance the protection of both people and animals, ensuring safer railways for all and reducing the risk of train collision.

CHAPTER-02

HARDWARE & SOFTWARE REQUIREMENTS

Here, in this project we need both Hardware and Software requirements to Implement effective circuit of project.

2.1 HARDWARE REQUIREMENTS:

❖ **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; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. You can tinker with your UNO without worrying too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again

Image-2.1.1

❖ **Ultrasonic sensor**

As the name indicates, ultrasonic sensors measure distance by using ultrasonic waves. The sensor head emits an ultrasonic wave and receives the wave reflected back from the target. Ultrasonic Sensors measure the distance to the target by measuring the time between the emission and reception.

Image-2.1.2

❖ **IR sensor**

An infrared sensor is an electronic device that emits in order to sense some aspects of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. These types of sensors measure only infrared radiation, rather than emitting it that is called a passive IR sensor. Usually, in the infrared spectrum, all the objects radiate some form of thermal radiation.

Image-2.1.3

❖ **N 20 gear motor**

The N20 gearmotor is a compact, high-performance motor and gearbox combo ideal for robotics projects. It offers high torque for heavy lifting and continuous rotation, slow speed for precise control, and a durable metal gearbox. Its compact size makes it perfect for small projects, and its reliability and ease of integration make it a popular choice among robotics enthusiasts and DIY electronics hobbyists.

Image-2.1.4

❖ **Relay**

A Relay is a simple electromechanical switch. While we use normal switches to close or open a circuit manually, a Relay is also a switch that connects or disconnects two circuits. But instead of a manual operation, a relay uses an electrical signal to control an electromagnet, which in turn connects or disconnects another circuit.

Image-2.1.5

❖ **Other components**

LED, Buzzer, Battery, Switch &wires

Image-2.1.6

2.2 SOFTWARE:

❖ Arduino IDE (2. 0. 9):

- **IDE:** Utilize the Arduino IDE for code development.
- **Language:** Write code in C/C++.
- **Libraries:** Incorporate sensor libraries for interfacing.
- **Sensor Integration:** Code for sensor initialization, data reading, and processing.
- **Alert System:** Develop functions to trigger alarms based on sensor data..
- **Safety Features:** Include error handling and fail-safes.
- **Testing:** Use IDE tools for testing and debugging.

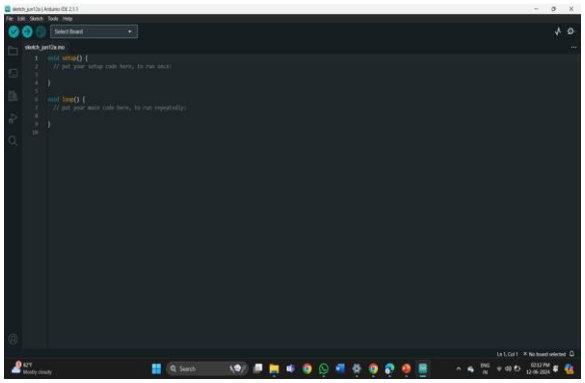


Image-2.2.1

CHAPTER-03

IMPLEMENTATION AND WORKING

3.1 IMPLEMENTATION:

❖ BLOCK DIAGRAM:

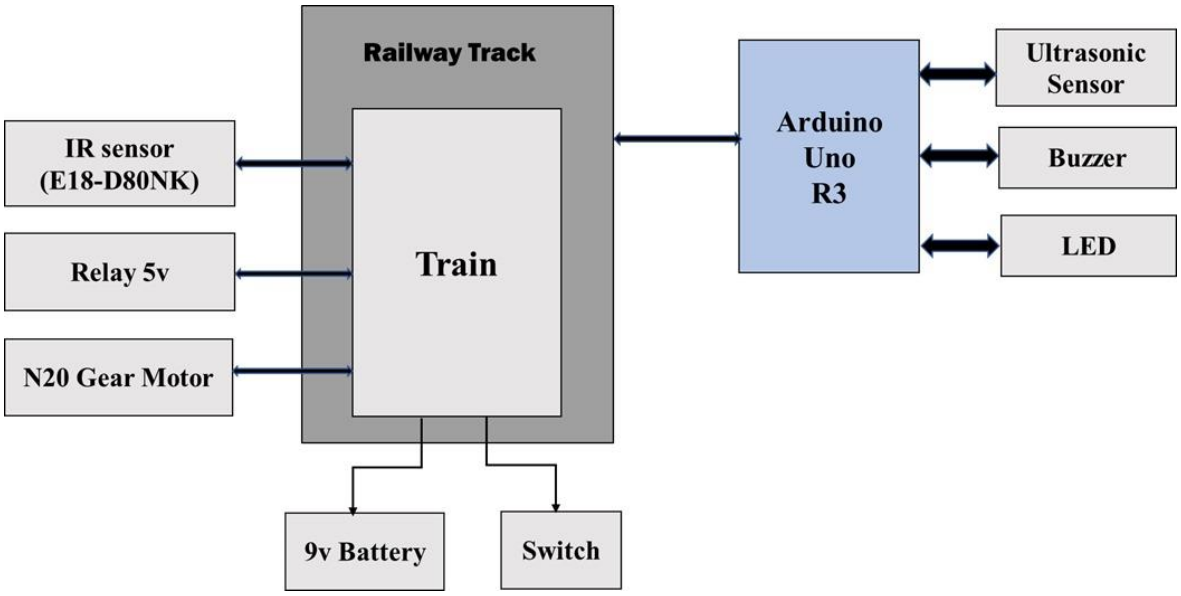


Fig-3.1.1

The block diagram for the railway track system consists of an Arduino Uno R3 microcontroller, an ultrasonic sensor for obstacle detection, an IR sensor for train presence detection, a buzzer and LED for alerting, a 9V battery-powered N20 gear motor for train movement, a 5V relay for motor control, and a manual switch for manual control. When an obstacle is detected, the Arduino triggers the buzzer and LED, and the IR sensor triggers the relay to stop the train automatically.

❖ METHODOLOGY:

- **Alerting humans and animals on tracks.**

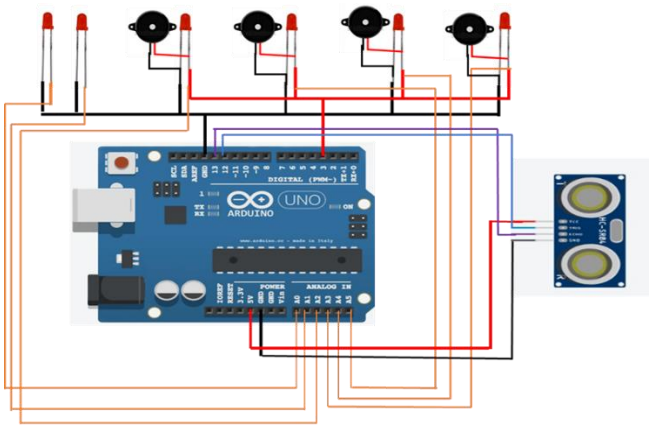


Fig-3.1.2

The railway track system is controlled by an Arduino Uno R3, which receives input from various sensors and controls outputs to different components. The system includes an ultrasonic sensor to detect obstacles in the train's path, and an IR sensor (E18-D80NK) to detect the train's presence on the track. When an obstacle is detected, the ultrasonic sensor signals the Arduino, which then triggers the buzzer to sound an alert and the LED to light up.

- **Preventing collisions between trains.**

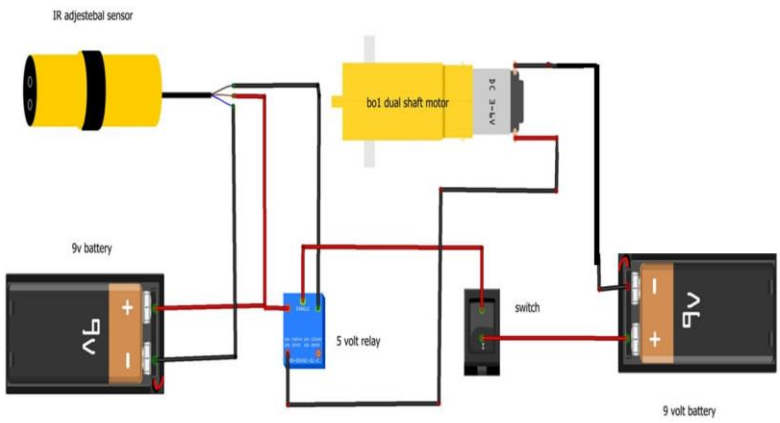


Fig-3.1.3

The system has a train that runs on a railway track. The train is powered by a 9v battery. The movement of the train is controlled by a small motor (N20 gear motor) which is connected to a relay (5v). The relay is like a switch that turns the motor on/off. The relay is triggered by an IR sensor (E18-D80NK), with a detection range of 2-80cm, that detects when the train is near. This allows the train stop automatically. There's also a manual switch that lets you control the train manually.

❖ FLOWCHART AND CODE:

- **Alerting humans and animals on tracks**

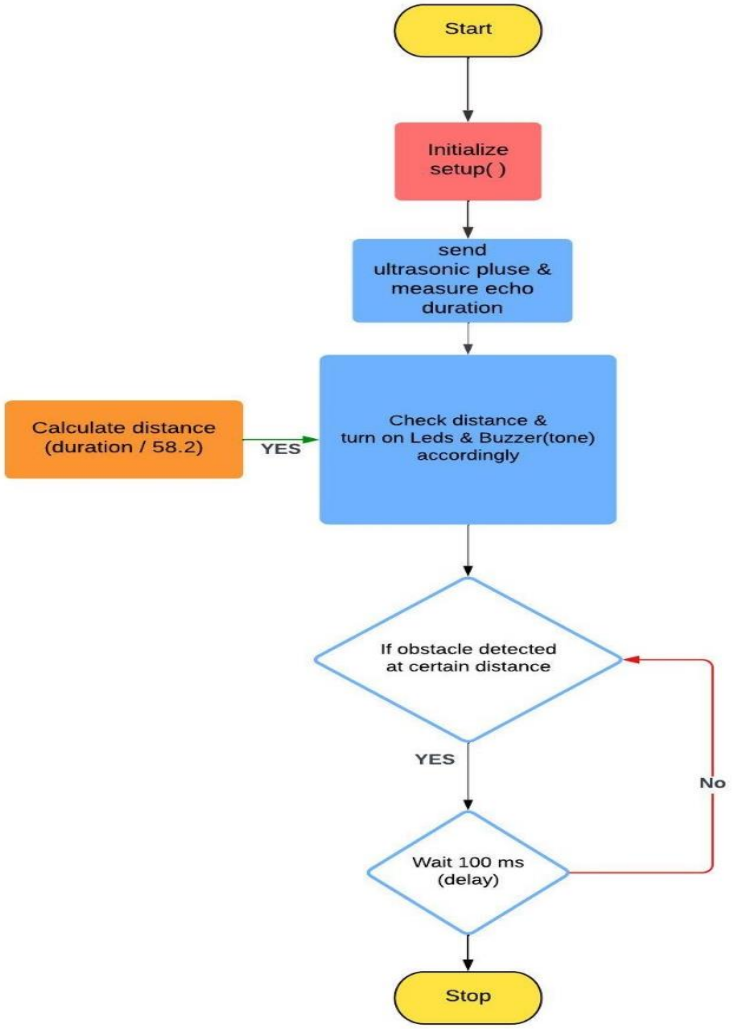


Fig-3.1.4

- **CODE:**

```
const int trigPin = 12;
const int echoPin = 13;

const int LED1 = A0;
const int LED2 = A1;
const int LED3 = A2;
const int LED4 = A3;
const int LED5 = A4;
const int LED6 = A5;
const int LED7 = 2;
const int buzzerPin = 3; // Add a buzzer pin

int duration = 0;
int distance = 0;

void setup()
{
  pinMode(trigPin , OUTPUT);
  pinMode(echoPin , INPUT);

  pinMode(LED1 , OUTPUT);
  pinMode(LED2 , OUTPUT);
  pinMode(LED3 , OUTPUT);
  pinMode(LED4 , OUTPUT);
  pinMode(LED5 , OUTPUT);
  pinMode(LED6 , OUTPUT);
  pinMode(LED7 , OUTPUT);
  pinMode(buzzerPin,  OUTPUT);  //  Initialize  buzzer
     pin as output
  Serial.begin(9600);
}
void loop()
{
  digitalWrite(trigPin, LOW);
  delayMicroseconds(2);
  digitalWrite(trigPin, HIGH);
  delayMicroseconds(10);
  digitalWrite(trigPin, LOW);
  duration = pulseIn(echoPin, HIGH);
  distance = duration/58.2;
  if ( distance <= 10 )
  {
    digitalWrite(LED1, HIGH);
    tone(buzzerPin, 2500); // Produce a 1kHz tone on
      the buzzer pin
  }
  else
  {
    digitalWrite(LED1, LOW);
    noTone(buzzerPin); // Stop the buzzer sound
```

```
}
if ( distance <= 14 )
{
  digitalWrite(LED2, HIGH);
}
else
{
  digitalWrite(LED2, LOW);
}
if ( distance <= 21 )
{
  digitalWrite(LED3, HIGH);
}
else
{
  digitalWrite(LED3, LOW);
}
if ( distance <= 28 )
{
  digitalWrite(LED4, HIGH);
}
else
{
  digitalWrite(LED4, LOW);
}
if ( distance <= 35 )
{
  digitalWrite(LED5, HIGH);
}
else
{
  digitalWrite(LED5, LOW);
}
if ( distance <= 42 )
{
  digitalWrite(LED6, HIGH);
}
else
{
  digitalWrite(LED6, LOW);
}
if ( distance <= 49 )
{
  digitalWrite(LED7, HIGH);
}
else
{
  digitalWrite(LED7, LOW);
}
delay(100);
```

- **Preventing collisions between trains.**

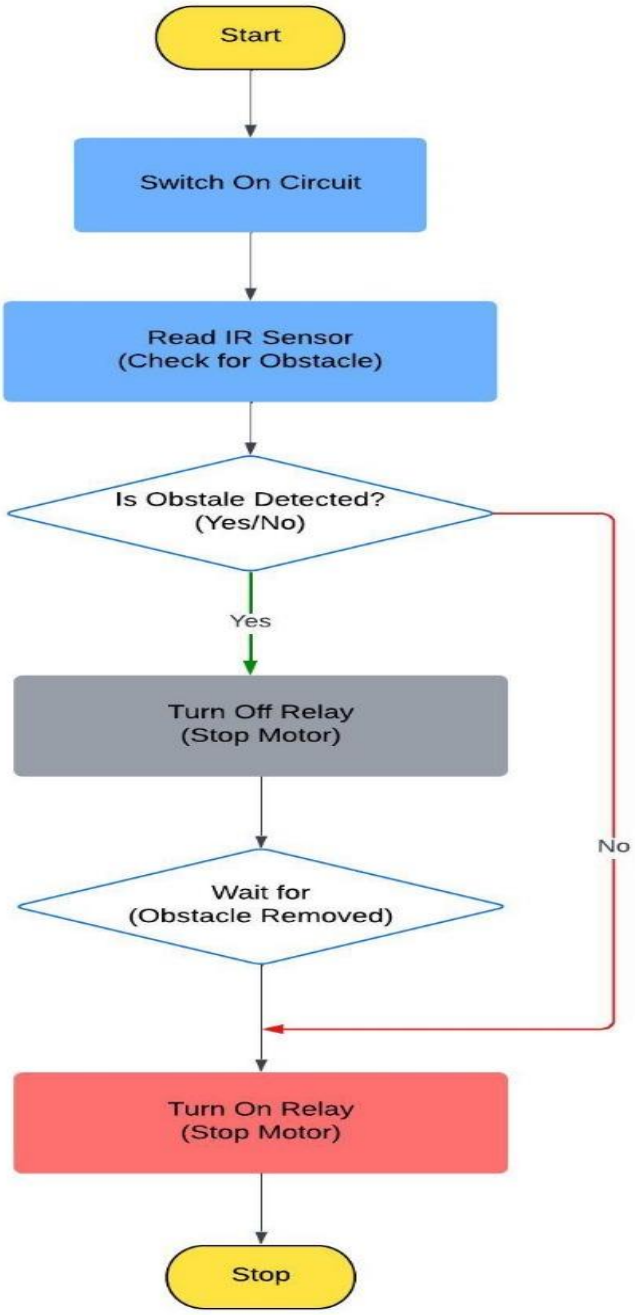
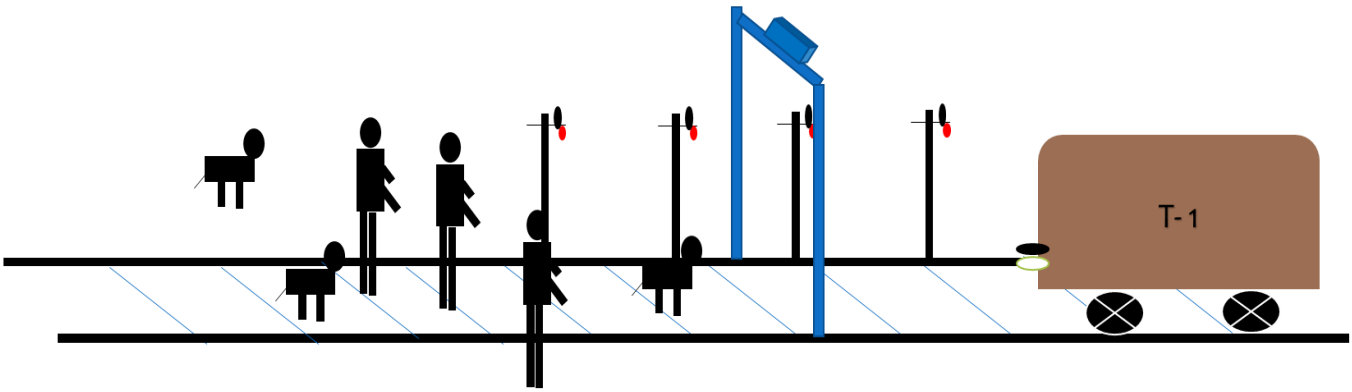


Fig-3.1.5

3.2 WORKING:

- **Alert alarm for humans & animals while walking on the train track**



- **Automatic train stop when two trains are in same train track**

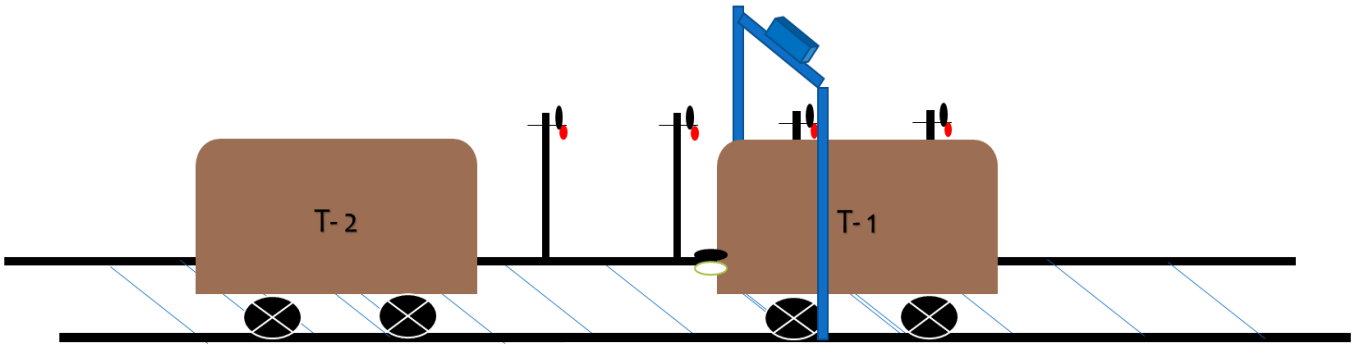


Image-3.2.1

- **Ultrasonic Sensor for Train Sound Detection:** these sensors installed along tracks and those are emitted ultrasonic waves that bounce off objects when a train approaches it generates sound and reflect back to the sensor and indicates presence of train.
- **Alert Alarm Activation:** when train is detected then ultrasonic sensor triggers alert alarm, the alarm alerts nearby humans and animals to clear the track**.**
- **Infrared (IR) Sensors for Train Detection:** It installed at strategic point of train1 to monitor train2 presence.
- **Automatic Train Stop Mechanism:** Upon detecting presence of train2 using IR sensor, the system calculates the distance between trains on the same track. If two trains are to close to each other, indicating a potential collision risk, the system activates an automatic braking mechanism. The brakes are applied to trains and stopped at a safe distance.
- **Safety measures:** Signage and warnings are placed along the tracks to educate the public about the presence of these safety systems. Continuous monitoring and maintenance of sensors ensure their reliability and effectiveness. Regular training for train operators and track maintenance personnel on the proper use and maintenance of these safety systems is conducted.

CHAPTER-04

RESULT

4.1 RESULT:

- **Alerting humans and animals on track.**

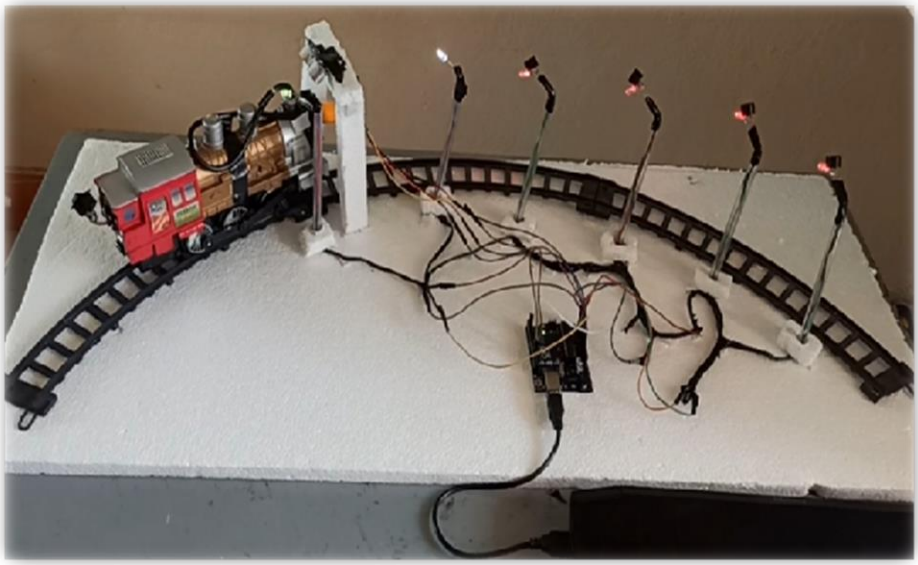


Fig-4.1.1

- **Preventing collisions between trains**

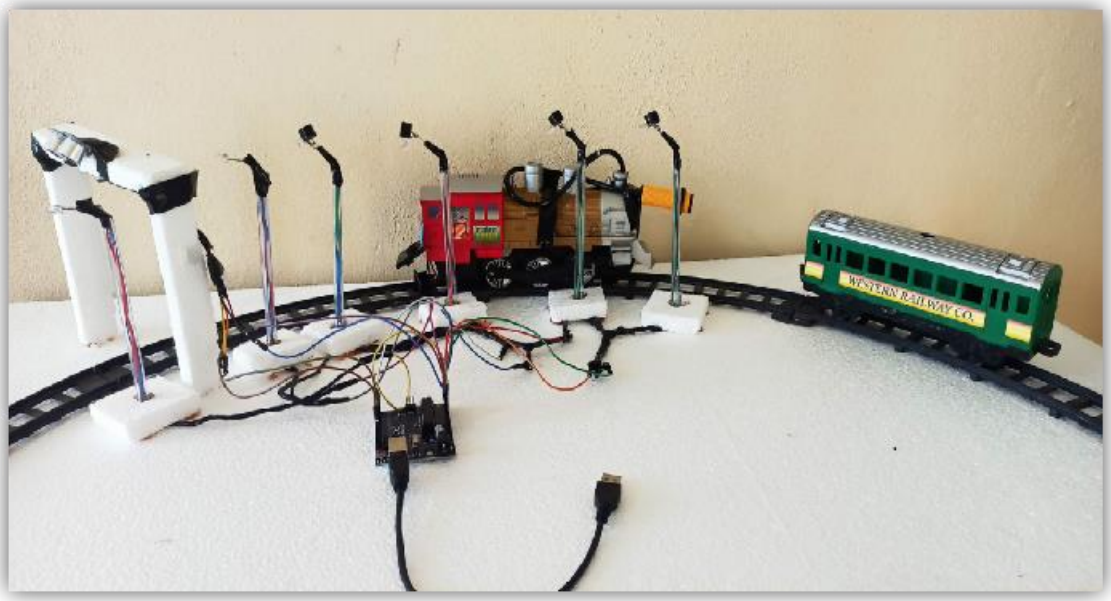


Fig-4.1.2

CHAPTER-05

ADVANTAGES AND DISADVANTAGES

5.1 ADVANTAGES:

- Enhanced safety
- Early warning system
- Reduce collision
- Improvises public awareness
- Minimize the risk to humans and animals
- Versatility and Adaptability
- Scalability

5.2 DISADVANTAGES:

- High initial investment costs for implementation and installation.
- Dependence on advanced technology and sensors can lead to errors or malfunctions.
- Cyber-attacks or data breaches can compromise system security and integrity.
- False alarms or false negatives can cause unnecessary delays or complacency.

CHAPTER-06

APPLICATIONS

6.1 APPLICATIONS:

- **Railroad Crossing Safety:** Alerts for approaching trains & Automated barrier control.
- **Wildlife and Human alert on Tracks:** Animal intrusion prevention & alert Human by train presence detection.
- **Train Collision Avoidance:** In-track, train detection & Automated braking for collision avoidance
- **Platform Safety Systems:** Passenger safety alerts & Crowd management on platforms.
- **Tunnel and Bridge Monitoring:** Train detection in confined spaces & Structural integrity monitoring
- **Maintenance and Monitoring Systems:** Track and train condition monitoring & Automated inspection for defects.
- **Level Crossing Safety Enhancements:** Obstacle detection and warning & Integration with emergency response systems
- **Operational Efficiency in Train Yards:** Automatic shunting and sorting & Equipment and personnel safety monitoring

CHAPTER-07

CONCLUSIONS AND FUTURE SCOPE

7.1 CONCLUSION:

This project has successfully integrated safety and efficiency measures, resulting in a more secure, efficient, and comfortable rail industry experience. The use of ultrasonic and IR sensors has improved safety along train tracks, preventing accidents and increasing awareness with alert alarms. Additionally, the project has enhanced operational efficiency and significantly reduced the risk of train collisions, ensuring a safer journey for passengers and staff. The implementation of advanced technologies, collaboration between stakeholders, and a focus on reducing operational costs and risks have set a new standard for the industry, with the potential to impact transportation safety and efficiency in other industries. Overall, the project is a significant step forward in enhancing the overall rail industry experience.

7.2 FUTURE SCOPE:

- The system can be expanded to more train tracks and routes to enhance safety.
- Integration with existing rail management systems can improve overall efficiency.
- Advanced analytics and AI can be used to predict potential safety risks and prevent accidents.
- A passenger-facing app can be developed to provide real-time safety information and updates.
- The system can be optimized to reduce operational costs and improve efficiency.
- Standardized safety protocols can be developed and implemented industry-wide.
- Research and development can focus on improving sensor accuracy and reliability.
- The system can be customized and implemented in international markets to enhance global rail safety. The system can be customized and implemented in international markets to enhance global rail safety.

CHAPTER-08

REFERENCES

- Prevention of wild-life collision in railway tracks, Kalaivani A, Hemalatha J, Sathyabama Institute of Science and Technology
- Automation of animal, fault detection in railway tracks using plc. M. Balamurugan, T. Parthinban, & S. Manoj Kumar International Journal of Current Research and Modern Education (IJCRME) 2455 – 5428
- 'Collision Avoidance of Trains by Creating Mutual Communication Using Embedded System'-T.Saijyothsna, P.Umamaheswari.
- 'Prevention of Train Accidents Using Wireless Sensor Networks'- Mr. M. Sambamurthy, S.K.Hasane Ahammad.
- Bhatt,Ajay Kumar A,' An Anti-collision Device(ACD) Network- A train collision Prevention System(TCPS)'