

“RAILWAY ACCIDENT PREVENTION SYSTEM”

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Abstract: This article outlines a design strategy for an Microcontroller ESP8266 based safety system to prevent railway accidents. When a train is some few distance away from an object (a person or an animal), this railway accident prevention safety system commands the train driver (Loco Pilot) if it is on the track. In this system, a high-frequency sound wave is transmitted by an ultrasonic sensor, which then waits for the sound to return before calculating the distance based on the required amount of time. In order to alert people to the impending arrival of a train, an ultrasonic sensor works by scanning for and identifying the vehicle. It then sends a signal to a buzzer to generate an alarm on the railway track. Injuries to train passengers, environmental damage, and property loss can all be caused by the interruption of the rail crossing's right of way. Therefore, there's a need to look into alternate techniques to prevent or mitigate these mishaps, such as using an microcontroller based safety system.

Keywords: Railway Track, Platform, Obstacle.

I. INTRODUCTION

Transport plays a vital role because it enables the act of buying and selling goods and services between persons which is a pre-requisite for the development of a Nation. Transportation has throughout history been a spur to expansion as better transport leads to more trade. The stage in an economic cycle has always been dependent on increasing the capacity and rationality of transport. But the infrastructure and operation of transport has a great effect on the land and is the largest drainer of energy, making transport sustainability and safety a major issue.

Derailment occurs when a vehicle such as a train runs off its rails. Usually, the derailment of a train can be caused by a collision with another object, an operational error, the mechanical failure of the tracks, such as broken rails, or mechanical failure of the wheels. In Ethiopia, the Ethiopian Railway Corporation has in the recent past experienced monetary loss due to train derailment on the Djibouti- Ethiopia line caused by collision with animals and block materials in the country side areas of Ethio- Djibouti line. Obstacles on the right of way of the train (track), smoke on the train and flooding on the track can cause derailment, collision, injuries to train passengers, environmental damage and loss of properties. So there is a need to look at various ways to prevent or reduce the frequency and severity of the these accidents by using Arduino based safety system to mitigate this accidents.

REASON BEHIND OF THE LITERATURE REVIEW

- **Identify research gaps:** It helps to spot what hasn't been explored yet, so you can focus on something new or meaningful.
- **Avoid duplication:** It ensures you're not repeating someone else's work without adding something new.
- **Provide context and background:** Helps set the scene for your research by explaining key concepts, terminology, and developments.
- **Inform your methodology:** Reviewing methods used in previous studies helps you choose or improve your own research design.

II. LITERATURE REVIEW

1. **“Railway track detection system for creature detection using sensors”
designed by M Deepa, C G Raji, VA Ajina, Ashla, Afsal Azra, and George Susanna.**

A Railway Track Detection System is proposed to detect creatures on railway tracks and avoid accidents. Sensors are

placed along tracks to monitor objects. Convolutional neural networks detect objects and alert the nearby control room and loco-pilot to stop train. The system includes two capturing processes and real-time monitoring of the train status. The system aims to reduce accidents caused by animals and vehicles crossing railway tracks and can be a crucial part of an intelligent monitoring system for Indian Railways.

2. “Railway Accident Prevention System” designed by Yash Verma, Vineet Kesharwani, Tushar Kesharwani, and Vaibhav Agrawal.

The aim of this project is to detect obstacles on railway tracks (e.g., animals and boulders) using piezoelectric and PIR sensors with a microcontroller, and alert nearby stations and upcoming trains to take preventive measures. The system is 95% accurate, and improvements can be made by covering PIR sensors and using multiple piezoelectric sensors. Successful implementation of this project can save thousands of animal lives and prevent train accidents cost-effectively every year.

REASON BEHIND OF THE OBJECTIVE

- **Guidance and Focus :** Objectives give the project a clear direction. Everyone knows what the end goal is and can stay focused on it.
- **Better Planning :** Objectives help in making detailed project plans (budget, time, resources, manpower).
- **Stakeholder Alignment :** Many people and organizations are involved in mega projects.
- **Measuring Progress :** With clear objectives, it's easier to track performance. You can see if you're on schedule, on budget, and meeting quality standards.

III. OBJECTIVE

i. **Accident Prevention:** Implement advanced monitoring and control systems to proactively prevent accidents. This might include automated train control systems, collision avoidance systems, and real-time tracking of train movements.

ii. **Incident Detection and Response:**
Develop systems that can quickly detect and assess incidents, such as track obstructions or signal failures, and initiate appropriate responses to mitigate potential accidents.

iii. **Safety Compliance:** Ensure that all safety protocols and regulations are strictly adhered to, and continually update systems to comply with evolving safety standards and regulations.

Real Time Monitoring : Deploy sensors and surveillance systems to monitor various parameters of railway operations in real-time, such as train speed, track conditions, and signal status, to detect and address any anomalies promptly.

Data Analysis and Reporting: Collect and analyze data from railway operations to identify patterns and potential risk factors, which can inform improvements in safety measures and prevent future accidents.

Maintenance and Inspection: Implement systems for regular monitoring and assessment of railway infrastructure, including tracks and signals, to ensure they are in good condition and address any issues before they lead to accidents.

Training and Simulation: Develop training programs and simulation tools for railway personnel to improve their preparedness for handling emergency situations and operating the railway system safely.

Public Awareness and Education: Increase awareness among railway passengers and the general public about safety practices and the importance of following railway safety rules to prevent accidents.

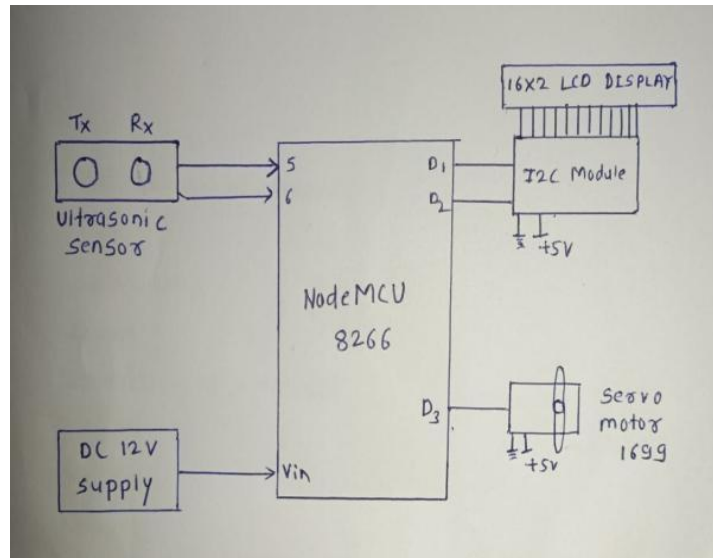
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IV. HARDWARE COMPONENTS

Microcontroller (ESP8266)

The ESP8266 is a low-cost, versatile Wi-Fi microcontroller with built-in TCP/IP networking, suitable for IoT applications, and can be programmed using the Arduino IDE.

Circuit Diagram



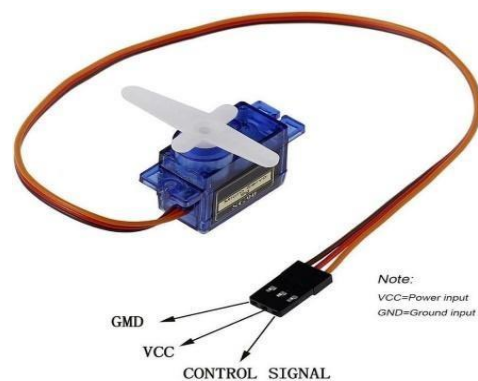
Ultrasonic Sensor module :

An Ultrasonic sensor is a device that can measure the distance to an object by using sound waves. It measures distance by sending out a sound wave at a specific frequency and listening for that sound wave to bounce back.



DC Servomotor:

The working of the DC Servomotor is whenever the input signal is applied to the DC moto then it rotates the shafts & gears. So basically, the rotation of gears output is feed back to the position sensor (Potentiometer) whose nobs turns & change their resistance.



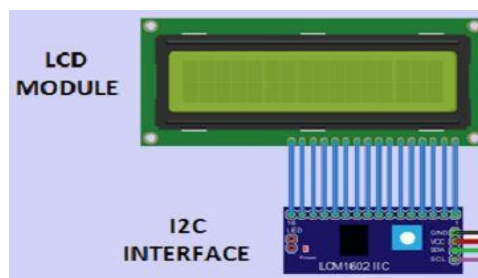
Buzzer:

An audio signaling device like a deliver over 1A output current. Although designed primarily as fixed voltage regulator, this device can be used with external beeper or buzzer may be electromechanical or piezoelectric or mechanical type. The main function of this is to convert the signal from audio to sound. Generally, it is powered through DC voltage and used in timers, alarm devices, printers, alarms, computers, etc. Based on the various designs, it can generate different sounds like alarm, music, bell & siren.



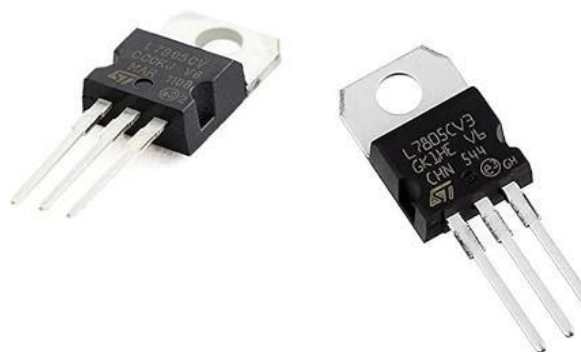
16x2 LCD module :

The LCD Module has 16 pins which are connected to the 16 corresponding pins of the I2C Interface device. The module is then connected to the Arduino nano board via the other 4 pins (GND, Vcc, SDA, and SCL) of the I2C Interface Device.



Voltage Regulator LM7805 :

This regulator can provide local on-card regulation, eliminating the distribution problems associated with single point regulation. It employs internal current limiting, thermal shutdown and safe area protection, making it essentially indestructible. If adequate heat sinking is provided, it can components to obtain adjustable voltages and currents.



V. RESULT

The solution that is suggested makes use of ultrasonic sensors. The sensor is kept out of the path of the train by a barrier on the track. An ultrasonic sensor was employed as a proximity switch to warn individuals when a train was approaching from a distance of approximately 1000 meters away. The ultrasonic sensor automatically blinks a red light and makes a buzzing sound when something blocks it. Ultrasonic sensors generate high frequency sound pulses, and they then examine the echoes they receive. On a railway track, it uses this sensor to find the train.

It can greatly reduce railway accidents, resulting in a smoother operation of the railway and more financial success for the railway industry. Ultrasonic sensor was used as a proximity switch, in the sense that whenever there is obstacle in the way of ultrasonic sensor (in front of the train), it will automatically give an indication through the led which blinks red and the buzzer will continue sounding until the drivers stops the train for the object on the track to be removed.



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