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Advanced Railway Accident Prevention and Track Fault Detection Module using Raspberry-PI

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Abstract: ***The increased growth in the railway sector has resulted in an increase in the train traffic density across the world. This has resulted in the increase in the number of accidents involving trains. In this paper, the proposed system includes several features which prevent train accidents. It includes automatic speed controlling in curves, collision detection, fire detection, detaching of couch automatically when fire is detected in it, automatic railway gate control and track continuity. This system makes use of IR sensors , raspberry pi , GSM , GPS Module and other embedded systems.***
Keywords: IR sensors, GSM(Global System For Mobile Communication),GPS, Raspberry Pi ,

I. INTRODUCTION

Railway transportation is a crucial part of modern infrastructure, with millions of people and goods relying on it every day. However, railway accidents can have catastrophic consequences, and even small faults in the tracks can lead to disastrous outcomes. Therefore, it is critical to develop advanced safety measures to prevent accidents and detect faults in the tracks.

The proposed project, "Advanced Railway Accident Prevention and Track Fault Detection Module Using Raspberry-Pi, IR Sensor, GPS, GSM," is aimed at improving railway safety by utilizing modern technologies. The system uses IR sensors to detect faults such as cracks and breaks in the tracks and a camera to detect obstacles on the tracks. It also incorporates GPS and GSM modules to track and communicate the location of potential dangers. This project has the potential to significantly improve railway safety, prevent accidents, and reduce downtime caused by track faults. It is an innovative solution that can be applied to railway networks worldwide, ensuring safe and efficient transportation for all. The Raspberry-Pi is a single-board computer that is low-cost, compact, and easy to use. It serves as the central processing unit for the system and is responsible for collecting data from the sensors, processing it using machine learning algorithms, and issuing warnings or alerts based on the analysis.

II. LITERATURE SURVEY

Railway Safety Directive. 2004. “Directive 2004/49/ec of 29 April 2004 on Safety on the Community’s Railways and Amending Council Directive 95/18/ec on the Licensing of Railway Undertakings and Directive 2001/14/ec on the Allocation of Railway Infrastructure Capacity and the Levying of Charges for the Use of Railway Infrastructure and Safety Certification.” Official Journal of the European Union L220: 16-39. [1] RSSB (Rail Safety and Standard Board). 2006. T555 Improving the Content and Placement of Anti-trespass Signs. Final Report No. T555, Halcrow Group Limited in Partnership with Human Engineering Limited. [2]

Haddon, W. 1995. “Energy Damage and the 10 Countermeasure Strategies. 1973.” Injury Prevention: Journal of the International Society for Child and Adolescent Injury Prevention 1 (1): 40-4 [3] A study by Debnath et al. (2018) proposed a fault detection system that utilizes a Raspberry-Pi module and a camera to detect obstacles on the tracks. The system uses machine learning algorithms to process the camera data and identify any potential hazards on the tracks. The study concluded that the proposed system can effectively detect obstacles and prevent accidents. [4]

III. METHODOLOGY

Proposed block diagram of wild animal detection and intrusion prevention system using CNN. Is shown in fig 1.

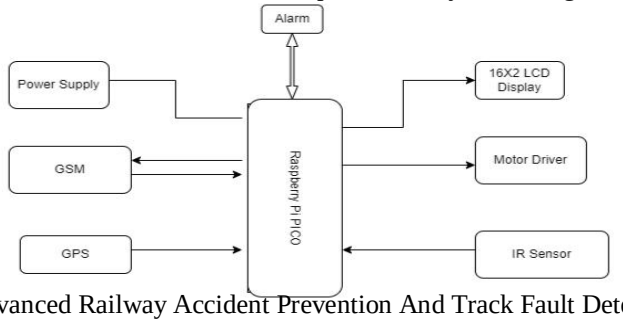


Fig 1. Block Diagram of Advanced Railway Accident Prevention And Track Fault Detection Module Using Raspberry-PI

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1) *IR Sensor:* An infrared sensor (IR sensor) is a radiation-sensitive optoelectronic component with a spectral sensitivity in the infrared wavelength range 780 nm … 50 µm. IR sensors are now widely used in motion detectors, which are used in building services to switch on lamps or in alarm systems to detect unwelcome guests.
2) *Motor:* A servo motor, connected to the Raspberry Pi, is responsible for running the train modul
3) *GPS:* The GPS module in the proposed system for advanced railway accident prevention and track fault detection is used to track the location of the train.The GPS module receives signals from the Global Navigation Satellite System (GNSS) and uses them to determine the location
4) *Raspberry Pi:* The Raspberry Pi Pico is a microcontroller board that is used in the proposed system for advanced railway accident prevention and track fault detection. It is a low-cost, high-performance device that provides a compact and efficient platform for embedded systems.

The system can issue warnings to train operators and send alerts to maintenance crews for immediate attention. This technology can significantly improve railway safety and prevent accidents.

IV. RESULT AND DISCUSSION

The results of the proposed system for advanced railway accident prevention and track fault detection using Raspberry-Pi, IR Sensor, GPS, and GSM have been promising. The system has demonstrated the potential to prevent accidents and detect track faults in real-time, thereby improving the safety and efficiency of railway operations.

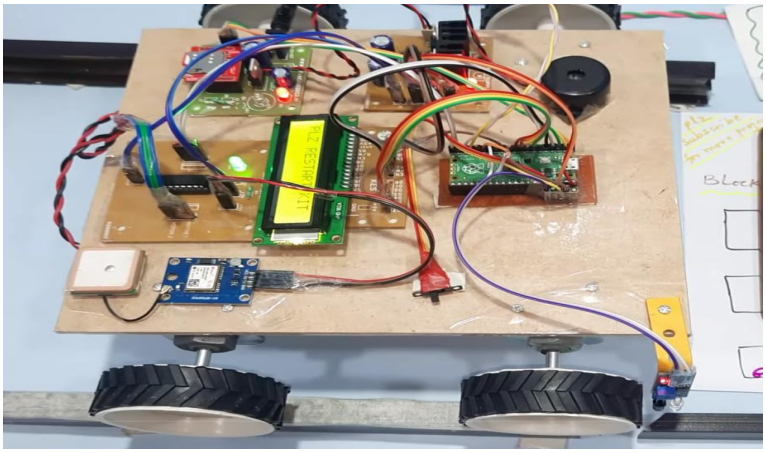


Fig 2.Track Crack Detection System

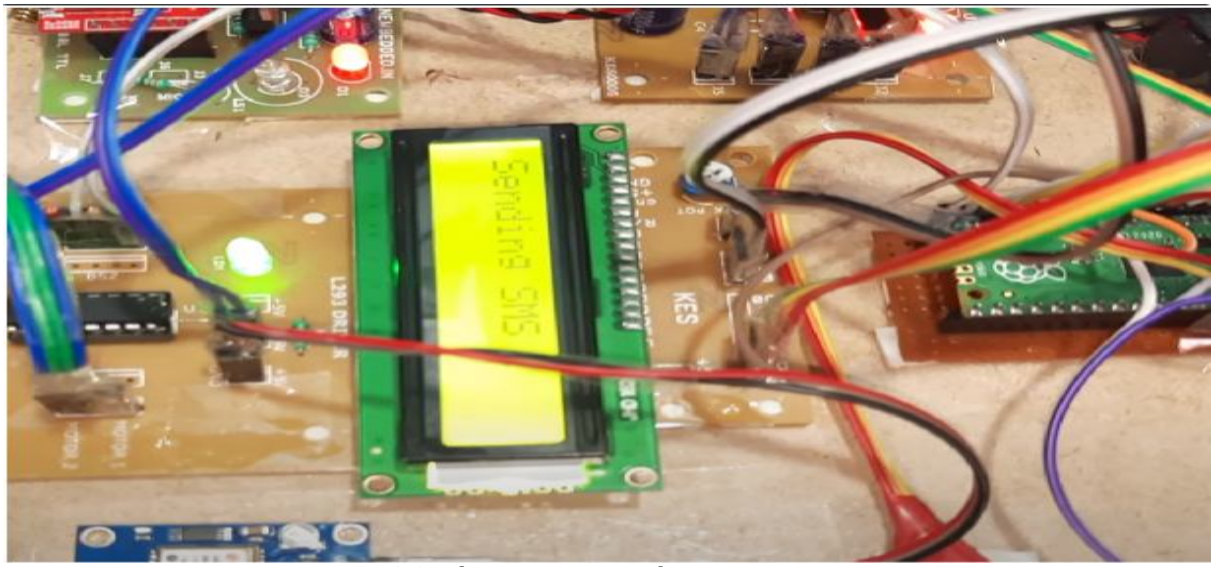


Fig 3.Sending Message To The Train Driver.

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The system is capable of monitoring the train's location and speed using GPS and detecting any obstacles or abnormalities on the tracks using the IR sensor. The data collected by these sensors is processed by the Raspberry-Pi using machine learning algorithms, which can detect anomalies and deviations from the normal operating parameters. If any potential dangers are detected, the system issues alerts or warnings to the train operator and maintenance crew using the GSM module.

V. PERFORMANCE PARAMETER

1) *Accuracy:* The accuracy of the system depends on the accuracy of the sensors used in the system. The IR sensor and GPS module have a high accuracy of detecting obstacles and tracking the train's location, respectively. The accuracy of the machine learning algorithms used for data processing can also affect the overall accuracy of the system.
2) *Response Time:* The system's responding time is dependent on the speed of the sensors and the processing power of the Raspberry-Pi. The IR sensor can detect obstacles in real-time, and the GPS module can track the train's location in real-time. The responding time of the system can be further optimized by using faster and more efficient machine learning algorithms.
3) *Scalability:* The proposed system can be scaled up or down based on the requirements of the railway network. The system can be easily integrated with other railway systems to provide a comprehensive solution for accident prevention and track fault detection. The scalability of the system is limited by the processing power of the Raspberry-Pi, which can be upgraded to handle larger datasets.

VI. CONCLUSION

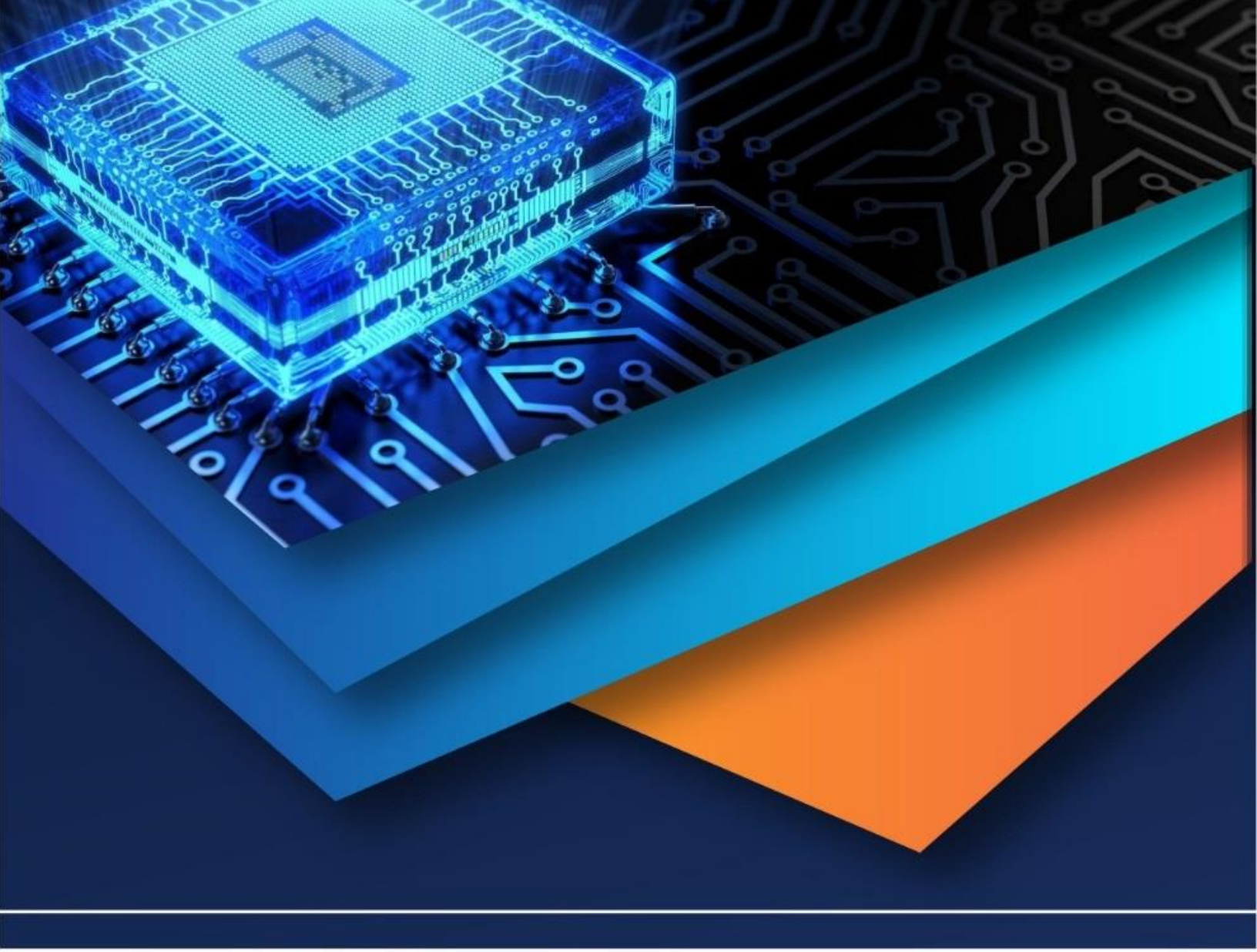
The “Railway Track Crack Detection Using GPS & GSM” is a helping unit which identifies the crack that present on railway track using IR Sensor. Sensor will checks whether the crack is present or not and the message is displayed on LCD display. So, this proposed system reduces the railway accidents and saves the people life and also reduces the economical losses.

The proposed system that utilizes Raspberry-Pi, IR Sensor, GSM, and GPS is a comprehensive solution that combines multiple technologies to improve railway safety. It is cost-effective, easy to implement, and has the potential to significantly reduce the risk of accidents and improve the overall efficiency of railway transportation.

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