RAILWAY MANAGEMENT SYSTEM USING IOT

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ABSTRACT

Railway Track Tracer System for creature detection is a system for detecting cracks on the railway tracks. This system will help to avoid many accidents that occur on rails. The presence of cracks can be easily identified and then necessary actions can be taken to prevent accidents. Internet of Things is the most studied field and its applications are endless. Internet of Things (IOT) is implemented to give an up-to-date update on the railway management. In this mode IR sensor is used for checking the availability of the platform. This system is used update the platform availability to the upcoming train to avoid the prevent accidents. To detect fire and automatic engine detachment. To update the platform availability.

Keyword: - *Platform Availability, Crack Detection, Fire Detection, Detachment of compartment and Water Sprinkler.*

1. INTRODUCTION

When going through the daily newspapers many accidents in railroad railings are found. Railroad related accidents are more dangerous than other transportation accidents in terms of severity and death rate etc. Therefore, more efforts are necessary for improving safety. Destructive forces of a train are usually no match for any other type of vehicle. Train accidents cause a major catastrophe, as they cause severe damage to life and property. Railway safety is a crucial aspect of rail operation all over the world. Here the aim is to help the railway administrations concerned to strengthen their safety culture and develop the monitoring tools required by modern safety management. The first problem tackled is cracks in the railway track. Also railroad intersections are very unique, special, potentially dangerous and yet unavoidable in the world. During the normal operation, there is every possibility of accidents occurring even with very little negligence ins procedure and the result is of very high risk. A derailment is said to take place when a vehicle such

as a train runs off its rails. This does not necessarily mean that it leaves its track. Although many derailments are minor, all result in temporary disruption of the proper operation of the railway system, and they are potentially seriously hazardous to human health and safety. In emergency situations, deliberate derailment with derails or catch points is sometimes used to prevent a more serious accident. So a method to detect any problem in the track is implemented. Each year, accidents at level crossings not only cause fatalities or serious injuries to many thousands of road users and railway passengers, but also impose a heavy financial burden in terms of disruptions of railway and road services and damages to railway and road vehicles and property. A very high number of these collisions are caused by the negligence, incompetence or incapacity of road vehicle drivers. This is the second problem tackled here. Since it is the railway which must bear the responsibility for ensuring that it is protected from the transgressions by road users (despite the fact that in many countries the law gives it priority of passage over road users), it is the railway which also has to shoulder most of the financial burden of providing this protection. So a method to prevent this kind of accidents is also implemented. In India, most of the commercial transport is being carried out by the railway network and therefore, any problems in the same has the capacity to induce major damage to the economy-notwithstanding the societal impact of loss of life or limb. Fire causes more damage in less amount of time. The goods and compartments burned in the fire cannot be recovered. It also causes severe damage to lives. A method to detect the fire and immediately control it is implemented in this system. Each of these is explained in detail.

2. PROBLEM STATEMENT

"We have proposed a solution in this paper by using IoT based system for inspecting the tracks for faults, Platform availability, Fire detecting, Detaching the compartment and water sprinkler the necessary authorities at the earliest. Collaborate with railway authorities, emergency services, and technology experts for effective implementation. Provide training sessions for staff and stakeholders to ensure smooth adoption"

3. BACKGROUND WORK

When going through the daily newspapers many accidents in railroad railings are found. Railroad- related accidents are more dangerous than other transportation accidents in terms of severity and death rate etc. Therefore, more efforts are necessary for improving safety. Destructive forces of a train are usually no match for any other type of vehicle. Train accidents cause a major catastrophe, as they cause severe damage to life and property. Railway safety is a crucial aspect of rail operation all over the world. Here the aim is to help the railway administrations concerned to strengthen their safety culture and develop the monitoring tools required by modern safety management. The first problem tackled is cracks in the railway track. Also railroad intersections are very unique, special, potentially dangerous and yet unavoidable in the world. During the normal operation, there is every possibility of accidents occurring even with very little negligence ins procedure and the result is of very high risk. A derailment is said to take place when a vehicle such as a train runs off its rails. This does not necessarily mean that it leaves its track. Although many derailments are minor, all result in temporary disruption of the proper operation of the railway system, and they are potentially seriously hazardous to human health and safety. In emergency situations, deliberate derailment with derails or catch points is sometimes used to prevent a more serious accident. So, a method to detect any problem in the track is implemented.

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4. OBJECTIVE

- **Enhance Safety Measures:** Implement IR sensors for track monitoring to detect obstacles, potential hazards, and cracks, ensuring early identification and mitigation of safety risks. Integrate fire sensors to rapidly identify and respond to fire incidents within train compartments or the railway environment, prioritizing passenger safety.
- **Optimize Train Movement:** Utilize DC motors for precise control over train acceleration, deceleration, and movement, enhancing overall operational efficiency and passenger comfort.
- **Automate Emergency Responses:** Employ relays to automate the detachment of train compartments in the case of fire emergencies, preventing the spread of fire and minimizing potential damages.
- **Fire Suppression Mechanism:** Integrate water pumps to activate automatically in response to fire incidents, contributing to the rapid suppression of fires within the railway premises.
- **Real-time Communication:**UtilizeNodeMCU for real-time communication, enabling immediate message intimation to relevant stakeholders such as authorities, emergency services, and passengers during critical situations.
- **Seamless Connectivity with Zigbee:** Implement Zigbee technology to establish seamless communication between different components of the railway system, facilitating remote monitoring and efficient data exchange.
- **Platform Availability Monitoring:** Deploy IR sensors for continuous monitoring of platform occupancy and availability, streamlining train scheduling and optimizing passenger boarding processes.
- **Improve System Resilience:** Design the system to be robust and resilient, ensuring its reliability under various operating conditions and minimizing downtime for maintenance.
- **Facilitate Remote Monitoring:** Enable remote monitoring of the railway system to provide authorities with real-time updates on train positions, track conditions, and emergency situations through Zigbee-enabled devices.

5. LITERATURE SURVEY

"An Evolution of Radio Frequency Identification Grids for Crack Detection" by Jun Zhang and Guiyun Tian.[1] The

paper explores using RFID tag antenna-based sensors (TABS) in the ultra-high frequency (UHF) band for crack detection in metal structures, with a focus on its application in structural health monitoring (SHM), including railway tracks. It discusses the feasibility, challenges, and principles of crack detection using RFID grids, aiming for widespread adoption of smart skin technology. The study emphasizes the importance of non-destructive testing and evaluation (NDT&E) methods for detecting defects like cracks in engineering structures.

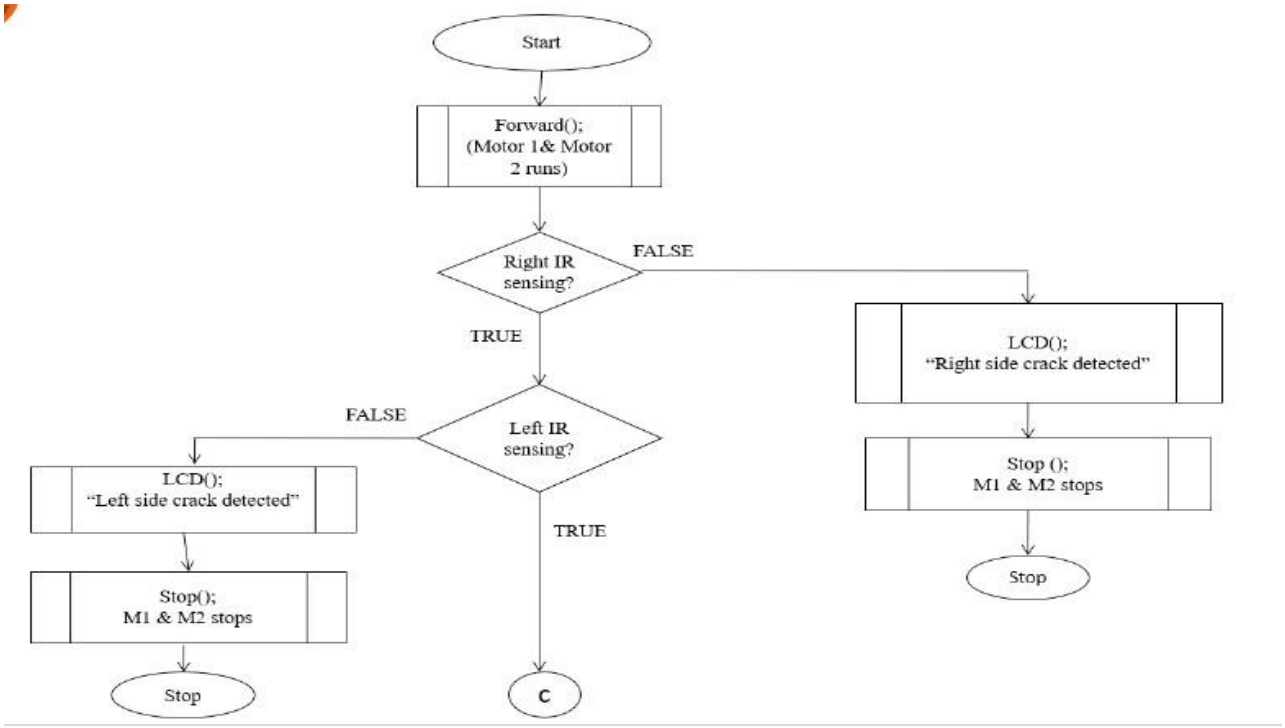
"Automatic Fire Initiated Braking and Alert System for Trains" by Sumit Pandey, Abhishek Mishra, Pankaj Gaur and Amrindra Pal. [2] The paper proposes an Automatic Fire-initiated Braking and Alert System (AFIBSAS) for trains. It utilizes sensors to detect fire, activates emergency measures like pulling the chain and sounding alarms, and alerts the driver and guard room. The system aims to swiftly respond to fire incidents, safeguarding passengers' lives and minimizing damage.

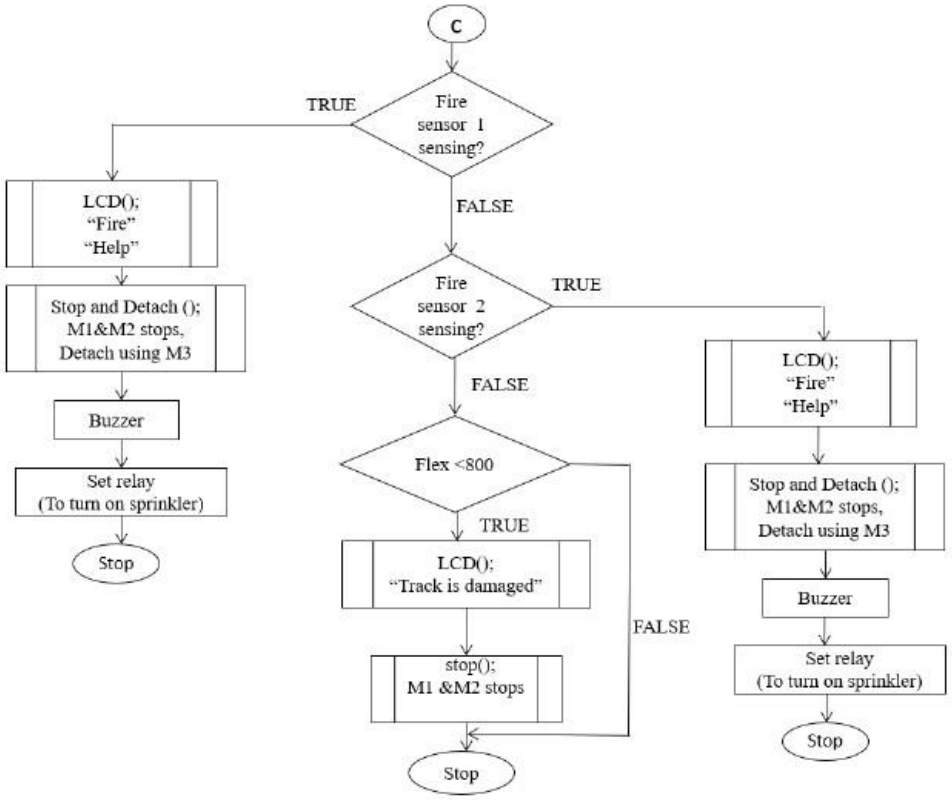
"Computer Vision System for Railway Track Crack Detection using Deep Learning Neural Network" by R. Thendral and A. Ranjeeth.[3] The research presents a computer vision-based railway track crack detection system using images captured by a rolling camera attached beneath a self-moving vehicle. It achieves 94.9% accuracy in differentiating between cracked and crack-free track images with a 1.5% overall error rate.

6. METHODOLOGY

1. **System Design and Planning:** Define the overall system architecture and identify the key components such as Arduino boards, sensors, actuators, and communication modules. Establish the system requirements, including safety features, emergency response protocols, and communication interfaces of Station Module and Train Module.
2. **Sensor Deployment and Calibration:** Install IR sensors along the railway tracks for crack detection and platform availability monitoring. Deploy ultrasonic sensors for object or human detection on the tracks. Calibrate sensors to ensure accurate readings and responses.
3. **Fire Detection System Integration:** Integrate fire sensors within train compartments and the railway environment. Develop algorithms to interpret sensor data and trigger emergency responses in the event of a fire.
4. **DC Motor Control for Train Movement:** Implement DC motors to control the movement of trains. Develop algorithms for precise acceleration, deceleration, and speed control.
5. **Relay and Water Pump Integration:** Integrate relays to automate the detachment of train compartments in case of a fire. Connect water pumps to the system to activate automatically during fire incidents.
6. **NodeMCU for Real-time Communication:** Incorporate NodeMCU for real-time communication between different system components. Develop protocols for message intimation, ensuring timely communication during emergencies.
7. **Zigbee Communication Setup:** Set up Zigbee communication for seamless connectivity between stationary and moving units. Develop communication protocols to exchange real- time data and updates.
8. **Emergency Response Algorithms:** Develop algorithms to initiate emergency responses based on sensor data, including fire suppression, train compartment detachment, and communication protocols.
9. **Platform Availability Monitoring System:** Deploy additional IR sensors for continuous monitoring of platform occupancy and availability.

7. ARCHITECTURE





8. RESULTS

- Implementation of the Railway Management System (RMS) with IoT technology enhances safety measures through real-time crack and fire detection, along with station availability monitoring.
- Crack detection system enables timely maintenance, preventing accidents.
- Fire detection sensors trigger immediate alerts for emergency response.
- Station availability monitoring improves passenger flow and resource allocation.

9. CONCLUSION

- Implementation of IoT technology in the Railway Management System (RMS) significantly enhances safety, efficiency, and passenger satisfaction in railway operations.
- Real-time monitoring of crack detection, fire detection, and station availability enables proactive risk mitigation and optimization of system performance. Reduction in safety incidents, operational disruptions, and maintenance costs is observed due to the RMS implementation.
- The adoption of IoT in railway management represents a shift towards smarter and more efficient operations.
- The RMS ensures a sustainable transportation network for the future by leveraging technology advancements.

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