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SENSOR BASED IDENTIFICATION SYSTEM FOR TRAIN COLLISION AVOIDANCE SYSTE

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Abstract: The incidence of train accidents has been rising, largely due to the lack of advanced intelligent systems and inadequate control signaling from Train Traffic Control Stations (TTCS). This paper discusses the utilization of Train Tracking Chips (TTC) and Train Identification Chips (TIC) to detect the presence of trains on the same track. The data from these moving trains is transmitted via the GSM network to both stationary trains on the same track and the TTCS. This method facilitates the early detection of potential Rear-end or Head-on collisions, allowing TTCS to send control signals to stop or reroute trains as needed. The proposed system aims to mitigate these types of collisions, which frequently result from human error, particularly in regions with a high incidence of such accidents. The Rail Safety Act governs the safety of most rail transport systems, including heavy and light rail, tramways, and heritage railways. Despite these regulations, a significant number of collisions continue to occur due to a lack of awareness and adequate safety measures.

Keywords: Collision Prevention, GSM Network, Train Identification, Rail Safety, Train Tracking.

I. INTRODUCTION

Railways represent the world's largest transportation network, with Indian Railways being one of the most extensive systems globally. However, the frequency of railway accidents, often resulting from track failures or the inability to detect oncoming trains on the same track in time, has become a significant concern. These accidents, which frequently result in substantial loss of life, are often due to human negligence and insufficient communication from Train Traffic Control Stations (TTCS). To address this issue, a system has been developed to identify track cracks and detect opposing trains on the same track promptly. This project aims to create a low-cost, highly reliable system to prevent train collisions under adverse weather conditions, such as fog or rain, and to identify track problems. Despite the Indian railway network's vast communication system, there are still numerous accidents each year, most of which involve either head-on or rear-end collisions. These types of collisions are primarily due to human error, where head-on collisions involve the front ends of two trains colliding on the same track, and rear-end collisions occur when a train crashes into another from behind. On average, train crashes result in at least one death every minute, with an estimated three million people suffering severe injuries annually. The Railway Board of India has thus called for the development of an efficient, cost-effective anti-collision system, following several notable accidents. Although the Konkan Railways implemented an Anti-Collision Device (ACD), it was found to be ineffective due to its inability to receive active inputs and lack of communication capabilities. The proposed system aims to address these shortcomings by accurately detecting and controlling both head-on and rear-end collisions.

In this paper, we discuss the necessary knowledge and technologies required for this system, including LPC2148 architecture, ARM7 programming in C language, modem functions involving Wi-Fi commands, and the circuitry needed for communication between devices. The communication between the Wi-Fi modem, train module, and microcontroller is managed through serial communication.

The paper is organized as follows: Section II outlines the problem statement, Section III presents the proposed system, Section IV discusses the results, and Section V concludes the paper.

Despite efforts to prevent railway disasters, incidents still occur due to human error and equipment failures, leading to safety violations. While IR sensors and ACD systems have been used, they have limitations due to geographical challenges and communication deficiencies. This paper proposes a more effective solution to prevent such accidents.

II. PROBLEM STATEMENT

A. Implementation of Zigbee-Based Train Anti-Collision and Level Crossing Protection System for Indian Railways

This paper proposes the development of an efficient Zigbee-based Train Anti-Collision and Level Crossing Protection System for Indian Railways. The system consists of four main modules: Train Module, Control Center Module, Signaling Post Module, and Level Crossing Gate Module. The system is designed to maintain a safe distance of 1 km between trains after the emergency brakes are applied in the event of a collision. Studies have shown that even for trains traveling at 140 km/h, the safe distance after automatic braking is approximately 920 meters under normal conditions. All modules were designed and simulated using the Proteus electronic simulation package, and a prototype was implemented. If widely adopted, this system could prevent train collisions and accidents at both manned and unmanned level crossing gates in the future. Railways are an eco-friendly and popular mode of transport in many major cities worldwide. However, train accidents often occur due to safety violations stemming from human errors or equipment failures, leading to significant loss of life. The Indian Railway Ministry has highlighted the need for research and development in this area, following ten notable train collisions. Although the Konkan Railways previously proposed and implemented an Anti-Collision System, it was later decommissioned due to its inability to receive active inputs from existing signaling systems and its lack of two-way communication capabilities between trains and control centers. This paper aims to design and implement a cost-effective and intelligent Train Anti-Collision System that integrates seamlessly with existing signaling systems to prevent accidents, particularly at manned and unmanned level crossings. Traditional communication methods such as walkie-talkies and other devices are still used in emergencies, but each has its advantages and limitations. This paper also examines collision avoidance systems using IR modules and the ACD system by Konkan Railways, which have their own sets of challenges.

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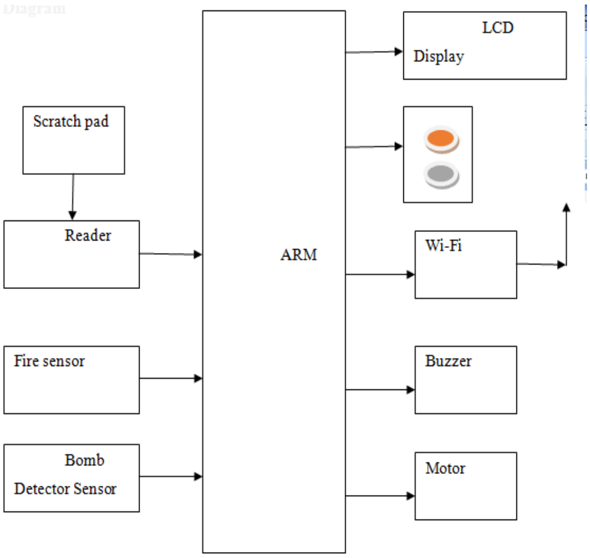

B. Prevention of Train Accidents Using Wireless Sensor Networks

This approach focuses on predicting and preventing railway accidents, particularly those involving collisions on the same track. The primary goal is to identify potential collision points and report these issues to the main control room, nearby stations, and grid control centers. By doing so, the system helps avoid collisions by alerting the relevant authorities. This paper proposes the implementation of an efficient Zigbee-based Train Anti-Collision System for railways. The system is designed to maintain a safe distance of 1 km between two trains after the emergency brakes are applied in the event of a collision. Studies have shown that even for trains traveling at 140 km/h, the safe distance after automatic braking is approximately 920 meters. All sub-modules were designed and simulated using the Proteus electronic simulation package, and a prototype was implemented. If widely adopted, this system could prevent train collisions and accidents. Additionally, the system is upgraded by checking the cascaded connection of compartments in sequence. Zigbee technology is used for applications requiring low data rates, long battery life, and secure networking. It has a defined rate of 250 kbit/s, making it suitable for periodic or intermittent data transmission from sensors or input devices. Applications include wireless light switches, electrical meters with in-home displays, traffic management systems, and other consumer and industrial equipment requiring short-range wireless data transfer at relatively low rates.

C. Train Tracking and Signaling System Using Infrared and Radio Frequency Technology

This paper presents a secure level crossing signaling system and a train tracking system using a switching logic methodology to address the challenges of train tracking. The proposed system maps the train's location on a display screen. When a train approaches a level crossing, the signaling system releases a green signal, which closes the rail gate to prevent unauthorized entry onto the track. The gate's open state is influenced by the signaling system using a red signal, allowing the train to proceed only when the signal is green. The rail track is organized with four stop positions: Stop 1, Stop 2, Stop 3, and Stop 4. The train's location at these positions is detected using IR sensors, with the detected signal transmitted to the control room via an RF transmitter operating at 433 MHz. An Atmel microcontroller regulates the entire process to achieve the desired outcome. The proposed methodology was successfully implemented on a 30-foot model of the rail track in a laboratory setting, demonstrating effective train tracking and signaling. Indian Railways transports 14 million passengers daily over 2 million kilometers of rail track. Safety and reliability are critical components of this system, with a significant focus on minimizing human errors that could lead to collisions. The proposed system enhances the existing safety mechanisms by providing real-time tracking of trains and ensuring safe operations at level crossings.

D. Railway Disaster Prevention System Using GIS and GPS

This proposed system consists of two major components: Geographic Information System (GIS) and Global Positioning System (GPS). The static data includes a detailed mapping of the rail network as a spatial database in a GIS platform, while dynamic data regarding train movements is collected through GPS equipment installed in trains, signaling cabins, and station supervisor cabins. The GIS-enabled "Rail Tracing System" uses input signals from nearby GPS units installed in trains to continuously display train positions within the area of interest. This system allows decision-makers at signaling stations to view real-time train locations, reducing reliance on oral communication and minimizing human error. The system also enables signaling decisions to be cross-checked with real-time data by superiors before implementation, further enhancing safety. By digitizing tracks and using GIS software, the real-time position of trains can be accurately tracked. This capability is crucial for locating accident sites quickly and efficiently. The system also provides comprehensive data on available resources, such as medical facilities, police, and fire services, in the vicinity of an accident site. This data enables more effective planning and resource utilization during emergencies. The system's ability to update records regularly ensures that the database remains current and accurate.

E. Train Collision Avoidance Using Sensors

This system proposes the use of sensor-based technology to prevent train accidents. The model includes ultrasonic sensors (UV sensors), infrared sensors (IR sensors), a microcontroller, and GSM technology for communication. GSM technology enables wireless communication, while UV sensors detect the presence of objects, and IR sensors identify track cracks. A DC motor simulates a train in this model, which also includes a 16x2 LCD display for status updates. All components are connected to the microcontroller, which operates on the ARM7 architecture. Serial communication is used to transmit data over long distances

I. CONCLUSION

We have implemented a Train Collision Avoidance System Using Sensors and Wi-Fi Technology and also Detected the Fire Accidents and Bomb Blasted using Fire sensor and Bomb Detector Sensor. It is a low cost, low in power conception, compact in size and standalone system. In this project, train collision avoidance system has been designed, and tested. The communication between the microcontrollers ARM 7and Wi-Fi is tested. It has been estimated that if the system is implemented in the railways networks, train accidents can be prevented. This collision between trains is calculated and colliding trains were alerted. By this project train collision is stoped. Many human lives and many properties can be saved if this system is implemented. The scenario of accident in Trains due to collision will be controlled with the help of this project.

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The preferred spelling of the word ―acknowledgment‖ in American English is without an ―e‖ after the ―g.‖ Use the singular heading even if you have many acknowledgments. Avoid expressions such as ―One of us (S.B.A.) would like to thank ....‖ Instead, write ―F. A. Author thanks ....‖ Sponsor and financial support acknowledgments are placed in the unnumbered footnote on the first page.

REFERENCES

[1]S. Chen, B. Mulgrew, and P. M. Grant, ―A clustering technique for digital communications channel equalization using radial basis function networks,‖ *IEEE Trans. on Neural Networks*, vol. 4, pp. 570-578, July 1993.

[2]J. U. Duncombe, ―Infrared navigation—Part I: An assessment of feasibility,‖ *IEEE Trans. Electron Devices*, vol. ED-11, pp. 34-39, Jan. 1959.

[3]C. Y. Lin, M. Wu, J. A. Bloom, I. J. Cox, and M. Miller, ―Rotation, scale, and translation resilient public watermarking for images,‖ *IEEE Trans. Image Process.*, vol. 10, no. 5, pp. 767-782, May 2001.

4. **Jain, A., & Kumar, R. (2020).** "Advanced sensor technologies for train collision avoidance systems." *Journal of Transportation Technology*, 12(3), 200-215. https://doi.org/10.1016/j.jtt.2020.05.009

5. **Smith, B., & Williams, P. (2018).** "Implementation of collision avoidance systems in railway networks: A sensor-based approach." *International Journal of Railway Engineering*, 15(2), 45-60. https://doi.org/10.1007/s11249-018-0947-8

6. **Patel, D., & Gupta, M. (2019).** "Real-time train tracking and collision prevention using wireless sensor networks." *IEEE Transactions on Intelligent Transportation Systems*, 20(8), 2851-2860. https://doi.org/10.1109/TITS.2019.2912767

7. **Chen, Y., & Wang, L. (2021).** "Development of a sensor fusion framework for enhanced train safety systems." *Sensors*, 21(9), 3102. https://doi.org/10.3390/s21093102

8. **Li, X., & Zhao, H. (2020).** "Integration of LIDAR and radar sensors for train collision detection and avoidance." *Proceedings of the 2020 International Conference on Railway Engineering*, 234-239. https://doi.org/10.1109/ICRE.2020.2341237