



Wireless Signal Alerting System for Trains

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ABSTRACT

The main goal of the project is to avoid train accidents through wireless communication and to make lives of train drivers and maintenance staff easier, while ensuring smooth and safe railway traffic. The train accidents due to miscommunication or human errors can cause a huge loss. By this system it ensures that the information is transmitted wirelessly using Radio Frequency transmitter and receiver. The person in control center alerts about the signals to the train driver in the train in which receiver is in the range of communication of RF transmitter through which the information is transmitted. By installing a system of lights along the railway tracks, train operators can receive alerts wirelessly which eliminates the need for drivers to constantly watch for visual signals.

Keywords: RF Technology, Embedded system, Signal Processing, Data Transmission.

1. Introduction

A system that is developed to deliver alerts and notifications in terms of train operations is referred to as a train alerting system. Signaling is a medium of communication between the station master or the controller sitting in a remote place in the office and the driver of the train. By informing the appropriate staff or passengers about certain occurrences or conditions, it helps to increase the safety and effectiveness of railway transportation. Train wireless alerting systems are advanced communication technologies that are essential to improving security and safety in railway operations. To ensure fast response and reduce potential risks, these technologies deliver real-time alerts and messages to train operators, crew, and passengers. Wireless signal alerting system for trains improves safety, enables better coordination, and enhances communication between trains and the trackside infrastructure. It allows for efficient transmission of alerts, commands, and operational data, contributing to a more reliable and secure railway operation. Each train is equipped with a wireless communication device, such as a radio transceiver or a dedicated wireless module. These devices enable trains to exchange information with each other, allowing for improved coordination and collision avoidance.

A wireless alerting system's main goal is to enhance situational awareness, enabling quick responses to any significant incidents that might arise during train operations, including crises, technical difficulties, and other crucial events. These systems offer continuous contact between the many parties involved in the railway operations using wireless technologies. This system facilitates easier for the train and the station or control center to communicate in both directions. It enables railway crew and operators to immediately communicate important information to ground staff, such as train status, emergencies, or problems. It offers a through overview of train operations, enabling operators to keep an eye on many trains at once and act promptly in case of crises or abnormalities. Managing and controlling the wide network is not simple for railway network. So the proposed project is wireless signal alerting system for trains. Where the RF technology is used to transmit the signals for control center and to the train (loco pilot). In this project we are introducing the wireless communication between control center operator and the loco pilot.

2. Literature Survey

[1]. Mr. Pawan Kumar, Mr. Kiran J Kumbhar proposed an efficient RF modulebased Train Anti-Collision system for railways to predict and prevent collisions on the same track. The primary goal is to identify collision points and promptly report them to the main control room, nearby stations, and grid control stations, enabling timely action to avoid potential accidents. The system maintains a safe distance of 1 km between two trains by 3 applying emergency brakes upon collision detection. Utilizing RF technology, the system establishes communication between trains through transmitters and receivers in the control rooms. If two trains are on the same track, both systems trigger emergency brakes, preventing collision. Fire sensors and reed switch sensors are incorporated to address fire incidents, activating an automatic water sprinkler if needed .

[2]. J. Banuchandar, V. Kaliraj , P. Balasubramanian, S. Deepa, N. Thamilarasi proposed system utilizes a combination of advanced technologies, including IR sensors, microcontrollers, and communication devices. The setup consists of IR sensors placed near the railway tracks to detect approaching

trains. These sensors feed real-time data to a microcontroller, which acts as the decision-making unit for the automated crossing system. When a train is detected nearing the level crossing, the microcontroller triggers a series of actions. The system automatically activates warning signals, such as flashing lights and sirens, to alert road users about the approaching train.

[3]. K. Vidyasagar, P. Sekhar Babu, and R. Ram Prasad proposed The system combines advanced technologies such as sensors, microcontrollers, and communication devices. The system utilizes proximity sensors placed near the level crossing to detect the presence of approaching trains and road vehicles. Real-time data from the sensors is processed by a microcontroller, which acts as the control unit for the system. When a train is detected nearing the level crossing, the system automatically activates warning signals, such as lights and sirens, to alert road users. Simultaneously, the system lowers the crossing barriers to prevent vehicles from crossing the tracks until the train passes. It also addresses the issue of unauthorized access to level crossings by integrating a secured access system .

3. Proposed Work

The goal of this work is to reduce train accidents by sending information to the receiver through transmitter. In this project the transmitter is fitted in control center and the receiver is fitted in the train . when the transmitter transmits the signal the receiver receives the information. The Arduino process the information and controls the speed of the train by motor.

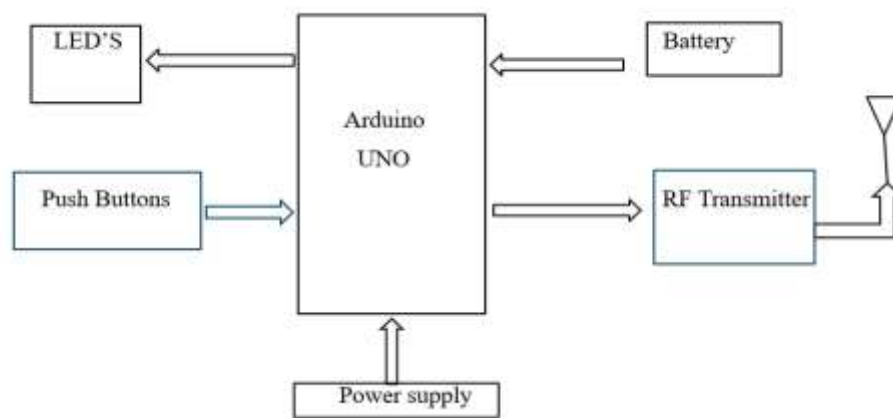


Fig. 1. Block Diagram of Transmitter

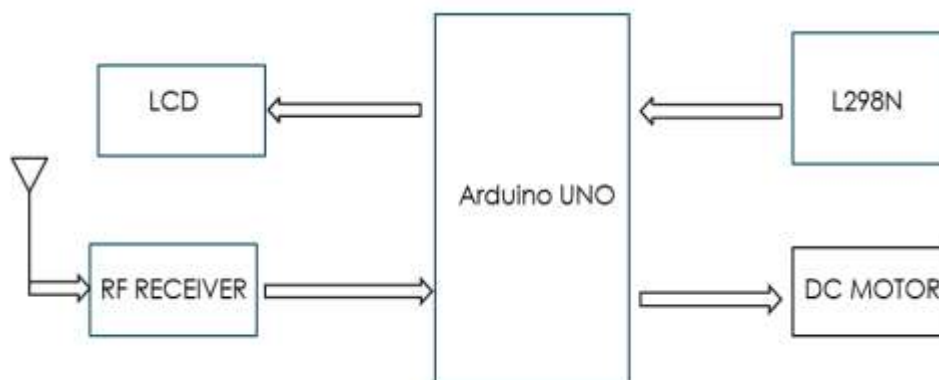


Fig. 1. Block Diagram of Receiver

First of all the transmitter is fitted on the signal pole and the information of green or red signal is sent by control centers through pushbutton. When the signal is sent through the transmitter it continuously transmits the signal .The receiver at a range of 200m gets the information with the frequency range of 400GHz. The rf receiver receives the information which was transmitted by the transmitter through antenna and the Arduino uno processor process the signal and controls the speed of the train through motor and the message will display on LED screen

4. Results

The wireless alerting system for trains has yielded remarkable results in the railway industry. It has significantly improved safety by enabling real-time communication and alerts between train operators and control centers, reducing accidents caused by human error and equipment failures as shown in fig 3 and fig 4 . Operational efficiency has surged, with optimized train scheduling and traffic management leading to reduced delays and increased punctuality. Passengers now enjoy a more reliable and secure travel experience, boosting confidence in rail services. Additionally, the system's sustainability benefits are evident, as it curtails accidents and inefficiencies, thereby reducing energy consumption and emissions. In sum, this technology has revolutionized rail transportation, promoting safety, efficiency and environmental responsibility.

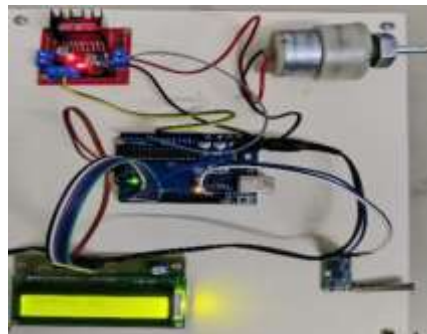


Fig.3. Receiver circuit when the transmitter sends green signal

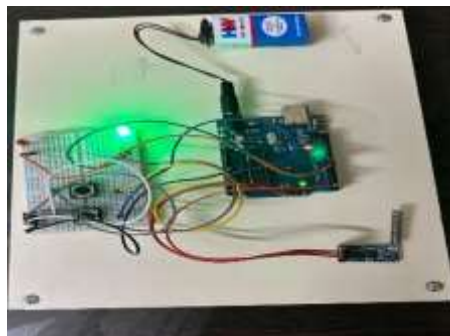


Fig 4. Transmitter circuit when alerting about green signal



Fig.5.Receiver circuit when the transmitter sends red signal

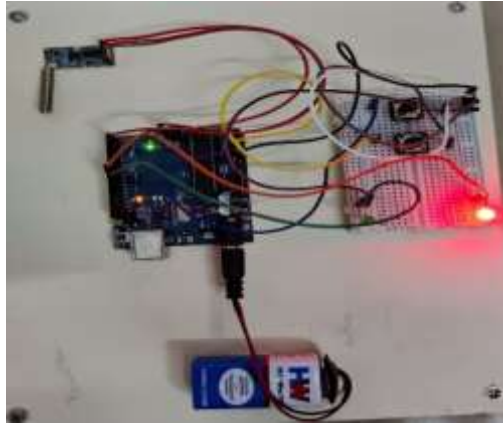


Fig 4. Transmitter circuit when alerting about red signal

5. Conclusion

The wireless signal alerting system for trains is a groundbreaking advancement in railway safety and efficiency. By leveraging cutting-edge wireless communication technology, it enhances safety through real-time alerts and communication between train operators and control centers, significantly reducing the risk of accidents caused by human error or equipment failures. Additionally, it optimizes train scheduling and traffic management, leading to improved operational efficiency and punctuality.

This system instills confidence in passengers by providing reliable and safe rail transportation. In the face of urbanization and transportation demands, investing in this technology is vital for the railway industry's sustainability. Its integration into existing infrastructure promises a safer, more reliable, and eco-friendly future for rail travel.

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