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Forward Collision Warning System Using GPS And GSM Module

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***Abstract*— The Train Collision Avoidance system is designed to detect obstacles on the railway track using a combination of microcontroller, ultrasonic detector, GPS, and GSM technologies. Although detecting obstacles may take some time, the system offers several advantages, including the ability to locate the train's position using GPS and GSM technology, and to automatically stop the train if the motorist fails to do so before entering a dangerous area. The ultrasonic detector is connected to the microcontroller to detect obstacles, while GPS is used to track the train's location and send it to the control unit via GSM technology. This system aims to improve safety on railway tracks and prevent accidents caused by obstacles on the track.**

***Keywords*— Microcontroller, Ultrasonic Sensor, GPS, GSM, Obstacle Detection**

I. INTRODUCTION

Railway is a widely used and popular eco-friendly transportation system, providing comfortable and safe travel to its passengers. Due to its affordability and high-volume capacity, it is accessible to nearly everyone. However, the increasing number of accidents caused by obstacles on railway tracks has resulted in the loss of many lives. To address this issue, our project aims to improve train safety by developing an anti-collision device system that can detect obstacles and prevent collisions.

The proposed system is based on GPS technology for accurate positioning and incorporates a distance-measuring system that uses ultrasonic sound and AtMega 238P microcontroller. An ultrasonic sound sensor is used to detect the arrival of the echo and alert the system of potential obstacles on the track.

Our project aims to enhance the safety of railway travel and prevent accidents caused by obstacles on the tracks. By implementing this anti-collision device system, we hope to reduce the number of accidents and provide a safer journey for all passengers.

II. System Design

A. System Block Diagram

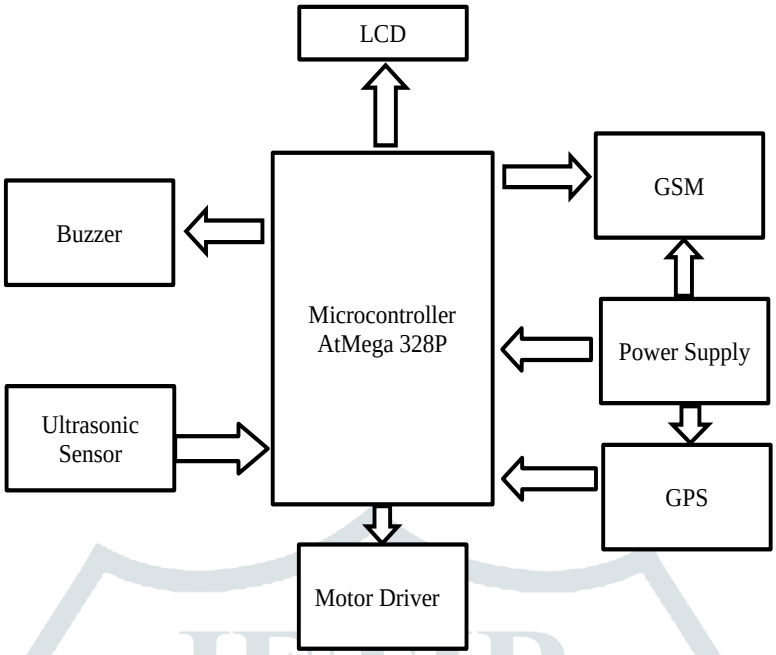

Fig 1 Block Diagram for Train Collision System

Train collision avoidance systems are critical to ensure the safety of train operations by detecting and avoiding collisions. A reliable power supply that maintains a constant voltage between 5 and 12 volts powers the system. This power supply is responsible for powering the microcontroller, GPS, and GSM module, which are the key components of the system.

The system utilizes an ultrasonic sensor to detect obstacles on the track. The sensor emits high-frequency sound waves and detects the echoes that bounce back from objects in its path. The sensor is strategically placed on the train to provide maximum coverage of the track. Once the ultrasonic sensor detects an obstacle, it sends this information to the microcontroller for analysis.

The microcontroller is the brains of the system and is responsible for processing the information received from the ultrasonic sensor. It's programmed to analyse the information and determine if there is a collision risk. If a collision risk is detected, the microcontroller sends an alert to the GSM module.

The GSM module is responsible for alerting the train driver of the potential collision. It achieves this by activating a loud and distinct buzzer that warns the driver of the impending danger. Additionally, the GSM module sends a signal to the motor driver to bring the train to a halt.

The motor driver controls the train's motors and brings it to a safe stop when the GSM module sends a signal. The system is sophisticated and ensures safe and efficient train operations by detecting and avoiding collisions.

The train collision avoidance system is an essential safety feature that reduces the risk of accidents and ensures the safety of passengers and crew. By utilizing advanced sensors and intelligent processing, the system can detect and avoid collisions, ensuring safe and efficient train operations. With the train collision avoidance system in place, passengers can enjoy a safe and comfortable journey.

B. System Flow Chart

The flowchart of the proposed system is illustrated in Figure II, which provides a detailed overview of the system's operation. At the beginning of the process, the system requires a few seconds to start up before interfacing with the microcontroller. The microcontroller declares variable data and checks the GPS and GSM network connections to ensure that the system is ready to operate. This initial start-up process is essential to ensure that the system is functioning correctly and ready to perform its intended functions.

Once the system is ready to operate, the train can begin moving. When the permission button is pressed, the train starts moving and continuously checks for any obstacles that may be in its path. To achieve this, the system uses an ultrasonic sensor that detects obstacles in front of the train. If any obstacles are detected, the train will come to a stop to avoid any potential accidents. The train stopping mechanism is automatic and is triggered by the system upon detecting any obstacles. This feature is essential as it helps to prevent accidents and ensures passenger safety.

Upon detecting an obstacle, the system also sends an SMS notification via the GSM module. This notification provides crucial information to the train operator and the control centre, allowing them to take appropriate action to resolve the situation promptly. Additionally, the system sends the geographical coordinates of the train via GSM, with the data obtained from the GPS module. This information provides vital data to the control canter and allows them to track the train's location accurately.

While the proposed system offers several advantages, it is important to acknowledge its limitations. For instance, the system may be affected by bad weather conditions such as rain or storms. This is because the ultrasonic sensor used to detect obstacles relies on sound waves, and the velocity of sound varies with humidity levels in the air. This limitation may result in delayed detection of obstacles, which could be costly. Therefore, it is essential to conduct regular maintenance on the system to ensure that it operates optimally at all times.

In conclusion, the proposed system is a crucial technological advancement that aims to enhance passenger safety by providing early detection of potential accidents. Despite its limitations, the system offers several advantages, including automatic train stopping upon detecting obstacles and accurate tracking of the train's location.

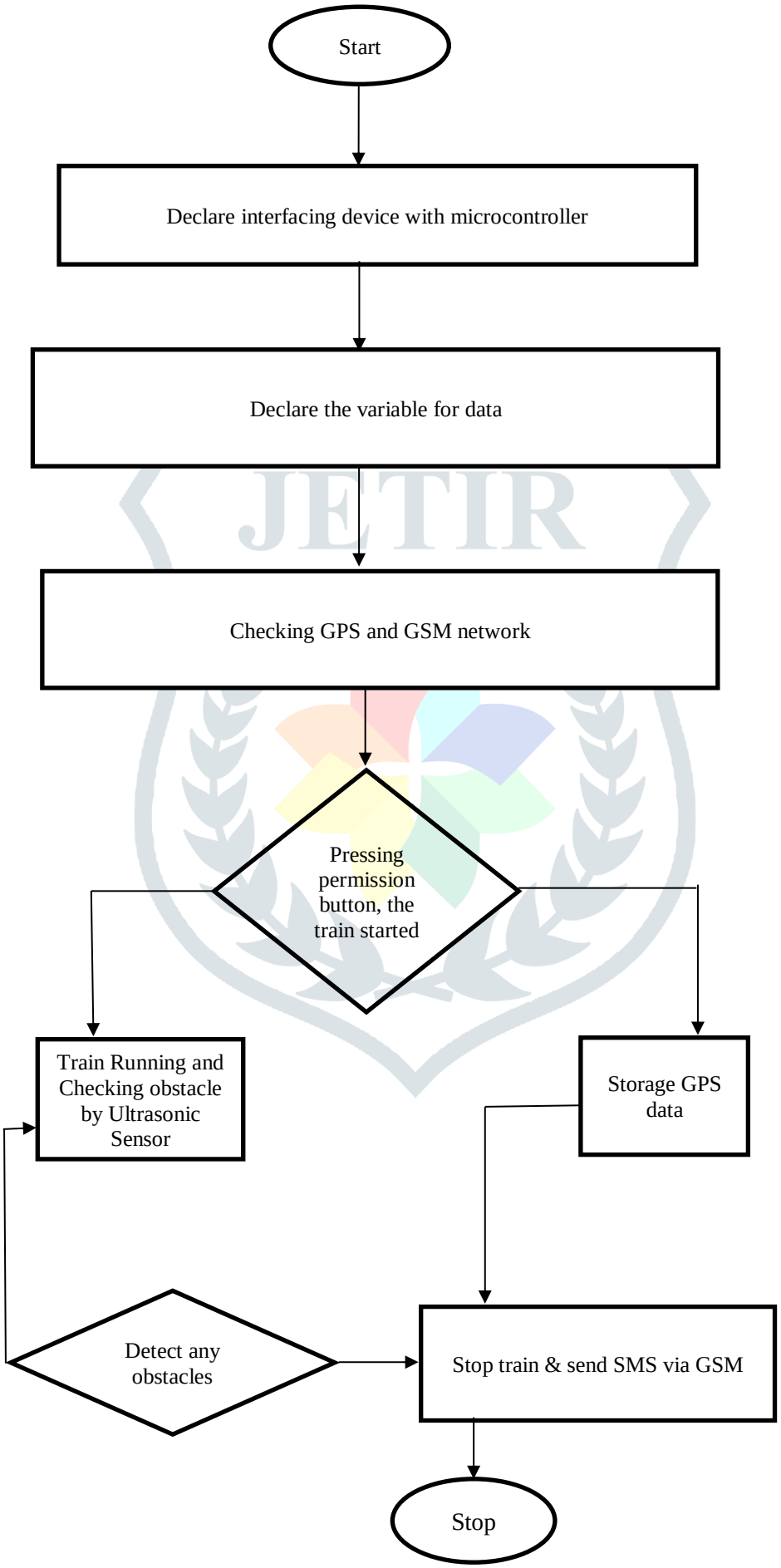

Fig 2 Flow chart For Train Collision System

C. System demonstration

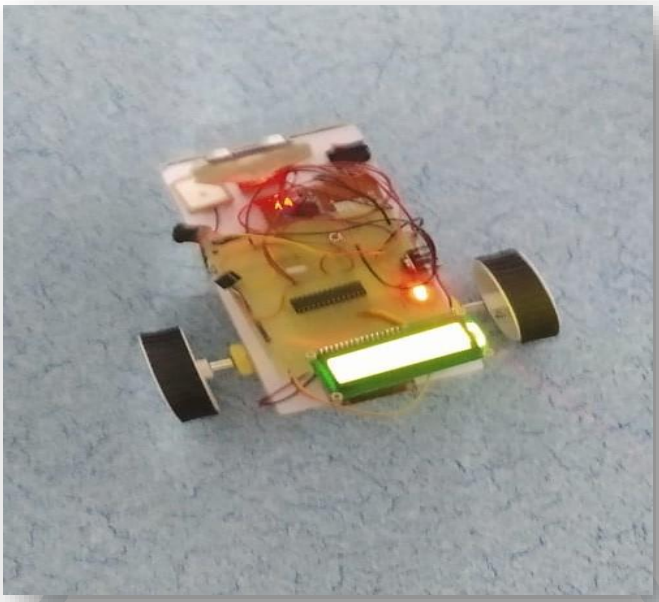

Fig 3 Final demonstration

The microcontroller would serve as the system's brain, collecting and analysing data from the GPS and GSM modules. The system would continuously monitor the position and speed of the trains and use this data to determine if a collision is imminent.

If the system detects a potential collision, it would send an alert to the train operators through the GSM module. The alert would provide information on the location and speed of the other train, allowing the operators to take corrective action.

In summary, a train collision system using GPS and GSM would be a highly advanced safety technology that could significantly reduce the risk of train accidents. It would provide real-time data on train positions, speeds, and directions, allowing operators to take corrective action to avoid collisions.

III. Conclusion

the use of this technology in railway safety is critical in ensuring the early detection of potential accidents and preventing them, thereby ensuring passenger safety. The system utilizes an ultrasonic sensor to detect obstacles and stop the train automatically, which is particularly useful in cases where the driver fails to stop the train before entering into danger. However, it is worth noting that the system's effectiveness may be limited by bad weather such as rain or storms, which can affect the velocity of sound and, in turn, delay obstacle detection. Despite this limitation, the system offers several advantages, such as the ability to locate the train through the GSM module, which sends an SMS containing the train's geographical position obtained from the GPS. This information can be useful in emergency situations, allowing authorities to respond quickly and effectively. Additionally, the system's automatic obstacle detection and stopping feature can help prevent accidents, potentially saving lives and reducing the financial impact of accidents. Overall, this technology represents a significant step forward in railway safety and has the potential to make a significant difference in preventing accidents and ensuring passenger safety.

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