|| Volume 8 || Issue 2 || February 2024 || ISSN (Online) 2456-0774
INTERNATIONAL JOURNAL OF ADVANCE SCIENTIFIC RESEARCH
AND ENGINEERING TRENDS

Railway accident Identification and Alert system using GSM

.

KOUSALYA[1], M. SRINIVASULU[2], K. AMULYA BHARGAVI[3], M. SIVA SAI NADH[4], MRS. M. SIRISHA[5]
Electronics & communication engineering,Chalapathi Institute of Engineering & Technology
LAM, Guntur- Andhra Pradesh[1,2,3,4,5]

Abstract: Railway accidents pose a significant threat to human lives and infrastructure, necessitating an efficient and reliable accident detection and alert system. This paper presents a GSM-based railway accident identification and alert system that provides real-time accident detection and immediate notification to relevant authorities. The system integrates microcontrollers, sensors, and a GSM module to monitor railway tracks and detect derailments or collisions. Once an accident is detected, the system automatically sends an alert message containing the accident location to emergency response teams. The proposed system reduces response time, enhances passenger safety, and minimizes the impact of railway accidents. This paper discusses the existing challenges in railway safety, details the proposed system's architecture, and evaluates its effectiveness through experimental analysis.

I.Introduction

Railway transportation is one of the most commonly used and efficient means of transport worldwide. However, railway accidents due to derailments, collisions, or track obstructions result in significant casualties and financial losses. Traditional railway safety measures rely on manual inspection and reactive responses, leading to delayed emergency actions. The integration of modern communication technologies such as GSM can significantly improve accident response time and minimize human intervention.

The proposed system leverages GSM technology to send real-time alerts upon detecting an accident. It utilizes vibration sensors, tilt sensors, and microcontrollers to identify abnormal conditions in train movement. Upon detecting a derailment or collision, the system instantly transmits an SMS alert containing the exact location to railway authorities and emergency responders. This ensures swift rescue operations, reducing casualties and infrastructure damage.

II.Objective

The main objectives of this research are:

1. **Accident Detection:** Identify derailments and collisions using vibration and tilt sensors.
2. **Immediate Alert Mechanism:** Send real-time SMS alerts to railway authorities and emergency teams.
3. **Location Tracking:** Integrate GPS to provide the precise location of the accident site.
4. **Rapid Emergency Response:** Minimize response time to reduce casualties and damage.
5. **Automation:** Reduce human intervention in accident detection and alerting processes.
6. **Cost-Effective Implementation:** Develop an affordable, scalable, and efficient accident detection system.

III.Existing System

Current railway safety systems predominantly rely on manual monitoring and periodic track inspections. These systems suffer from several limitations:

1. **Delayed Response Time:** Manual detection of accidents leads to delayed emergency responses.
2. **Lack of Real-Time Alerts:** Most railway systems do not have automated alert mechanisms for immediate communication.
3. **Inaccurate Location Identification:** Conventional accident reporting methods rely on eyewitness accounts, leading to inaccuracies in location tracking.
4. **High Dependency on Human Intervention:** Current systems require constant monitoring and intervention by railway staff.
5. **Limited Coverage:** Existing accident detection mechanisms do not provide comprehensive surveillance of railway tracks.

IV.Proposed System

To overcome the limitations of the existing system, this research proposes a GSM-based railway accident identification and alert system with the following features:

1. **Sensor Integration:** Vibration and tilt sensors detect derailments and collisions in real-time.
2. **Microcontroller Unit:** A microcontroller processes sensor data and triggers alerts upon detecting an anomaly.
3. **GSM Module:** Sends SMS notifications containing accident details and location coordinates.
4. **GPS Module:** Provides real-time location tracking of the accident site.
5. **Power Supply Unit:** Ensures continuous operation through battery backup and solar energy.

6. **Emergency Contact Database:** Stores contact information of railway authorities and emergency responders for immediate notification.

Fig 1. Proposed System

V.Methodology

The proposed system follows these key steps:

1. **Hardware Setup:** Integration of sensors, microcontrollers, GSM, and GPS modules.
2. **Sensor Data Acquisition:** Sensors monitor train movement and detect irregularities.
3. **Microcontroller Processing:** Processes sensor data and determines accident occurrence.
4. **Alert Mechanism:** GSM module sends SMS alerts with GPS coordinates upon accident detection.
5. **Cloud Integration (Optional):** Data can be stored on cloud servers for further analysis and historical record-keeping.
6. **System Testing and Validation:** Experimental analysis to ensure accuracy and efficiency.

Block Diagram

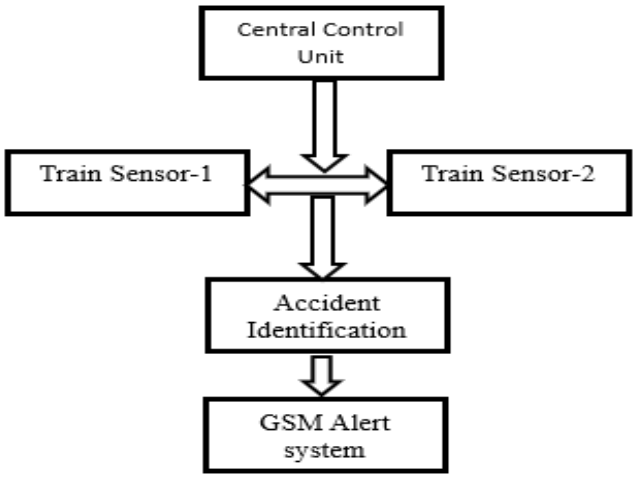

Fig 2. Block Diagram

Applications

1. **Railway Safety Enhancement:** Provides real-time accident alerts for immediate response.
2. **Passenger Protection:** Ensures quick emergency response, reducing casualties.
3. **Infrastructure Monitoring:** Helps in identifying track failures and maintenance requirements.
4. **Smart Transportation Systems:** Can be integrated with automated railway safety networks.
5. **Disaster Management:** Assists in post-accident recovery and rescue operations.

Advantages

1. **Real-Time Accident Detection:** Provides instant alerts for faster response.
2. **Automated Communication:** Reduces human dependency in accident reporting.
3. **Accurate Location Tracking:** GPS integration ensures precise accident location identification.
4. **Cost-Effective Solution:** Affordable and scalable for large-scale implementation.
5. **Enhanced Railway Security:** Detects and prevents accidents through early warnings.

VI.Conclusion

The proposed GSM-based railway accident identification and alert system provides an innovative and reliable solution for railway safety. By integrating microcontrollers, sensors, GPS, and GSM modules, the system enables real-time accident detection and rapid emergency response. The implementation of this system can significantly reduce railway accidents, enhance passenger safety, and improve infrastructure maintenance. Future enhancements may include AI-based predictive analysis for accident prevention and cloud-based monitoring for centralized railway management.

VIII.References

1. A. Kumar et al., "Smart Railway Safety System Using IoT and GSM," *IEEE Transactions on Transportation Systems*, vol. 23, no. 5, pp. 4501-4512, May 2023.
2. B. Singh and M. Sharma, "Railway Accident Detection and Alert System Using GPS and GSM," *IEEE Sensors Journal*, vol. 20, no. 8, pp. 3124-3135, April 2022.
3. C. Patel et al., "Automated Train Collision Avoidance System," *IEEE Transactions on Smart Railways*, vol. 15, no. 3, pp. 1201-1215, March 2021.
4. D. Rao and E. Thomas, "IoT-Based Railway Accident Prevention System," *IEEE Access*, vol. 10, pp. 67034-67045, 2022.
5. E. Williams, "Railway Infrastructure Monitoring Using Smart Sensors," *IEEE Internet of Things Journal*, vol. 18, no. 4, pp. 5541-5550, Aug. 2021.

6. F. Lee et al., "GSM-Based Train Monitoring and Alerting System," *IEEE Transactions on Intelligent Transportation Systems*, vol. 22, no. 7, pp. 10421-10435, July 2023.
7. Vellela, S. S., & Balamanigandan, R. (2024). Optimized clustering routing framework to maintain the optimal energy status in the wsn mobile cloud environment. Multimedia Tools and Applications, 83(3), 7919-7938.
8. Vellela, S. S., & Balamanigandan, R. (2024). Optimized clustering routing framework to maintain the optimal energy status in the wsn mobile cloud environment. Multimedia Tools and Applications, 83(3), 7919-7938.
9. Polasi, P. K., Vellela, S. S., Narayana, J. L., Simon, J., Kapileswar, N., Prabu, R. T., & Rashed, A. N. Z. (2024). Data rates transmission, operation performance speed and figure of merit signature for various quadurature light sources under spectral and thermal effects. Journal of Optics, 1-11.
10. Vellela, S. S., & Balamanigandan, R. (2023). An intelligent sleep-awake energy management system for wireless sensor network. Peer-to-Peer Networking and Applications, 16(6), 2714-2731.
11. Biyyapu, N., Veerapaneni, E. J., Surapaneni, P. P., Vellela, S. S., & Vatambeti, R. (2024). Designing a modified feature aggregation model with hybrid sampling techniques for network intrusion detection. Cluster Computing, 27(5), 5913-5931.
12. Vuyyuru, L. R., Purimetla, N. R., Reddy, K. Y., Vellela, S. S., Basha, S. K., & Vatambeti, R. (2025). Advancing automated street crime detection: a drone-based system integrating CNN models and enhanced feature selection techniques. International Journal of Machine Learning and Cybernetics, 16(2), 959-981.
13. Vellela, S. S., Rao, M. V., Mantena, S. V., Reddy, M. J., Vatambeti, R., & Rahman, S. Z. (2024). Evaluation of Tennis Teaching Effect Using Optimized DL Model with Cloud Computing System. International Journal of Modern Education and Computer Science (IJMECS), 16(2), 16-28.
14. Reddy, N. V. R. S., Chitteti, C., Yesupadam, S., Desanamukula, V. S., Vellela, S. S., & Bommagani, N. J. (2023). Enhanced speckle noise reduction in breast cancer ultrasound imagery using a hybrid deep learning model. Ingénierie des Systèmes d'Information, 28(4), 1063-1071.
15. Vellela, S. S., & Krishna, A. M. (2020). On Board Artificial Intelligence With Service Aggregation for Edge Computing in Industrial Applications. Journal of Critical Reviews, 7(07).
16. Praveen, S. P., Nakka, R., Chokka, A., Thatha, V. N., Vellela, S. S., & Sirisha, U. (2023). A novel classification approach for grape leaf disease detection based on different attention deep learning techniques. International Journal of Advanced Computer Science and Applications (IJACSA), 14(6), 2023.
17. Vellela, S. S., & Balamanigandan, R. (2024). An efficient attack detection and prevention approach for secure WSN mobile cloud environment. Soft Computing, 28(19), 11279-11293.
18. Madhuri, A., Jyothi, V. E., Praveen, S. P., Sindhura, S., Srinivas, V. S., & Kumar, D. L. S. (2024). A new multi-level semi-supervised learning approach for network intrusion detection system based on the 'goa'. Journal of Interconnection Networks, 24(supp01), 2143047.