**PROJECT:** ***Smart Solutions for Railways***

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**Smart Solutions for Railways referred from the authors: OHYUN JO, YONG-KYU KIM, JUYEOP KIM.**

The explosively growing demand of internet of things (IoT) has rendered broadscale advancements in the fields across sensors, radio access, network, and hardware/software platforms for mass market applications. In spite of the recent advancements, limited coverage and battery for persistent connections of IoT devices still remains a critical impediment to practical service applications. In this paper, we introduce a cost-effective IoT solution consisting of device platform, gateway, IoT network, and platform server for smart railway infrastructure. Then, we evaluate and demonstrate the applicability through an in-depth case study related to IoT-based maintenance by implementing a proof of concept and performing experimental works. The IoT solution applied for the smart railway application makes it easy to grasp the condition information distributed over a wide railway area. To deduce the potential and feasibility, we propose the network architecture of IoT solution and evaluate the performance of the candidate Radio Access Technologies (RATs) for delivering IoT data in the aspects of power consumption and coverage by performing an intensive field test with system level implementations. Based on the observation of use cases in interdisciplinary approaches, we figure out the benefits that the IoT can bring.

**Smart Solutions for Railways referred from the authors: Dr. A. BENJAMIN JOSEPH1, MOHAN Kumar ARADHYA M S2, N PHANEENDRA3, RANJITH KUMAR G M4.**

Even with greatest of ideas to avoid railway accidents, many trains accidents still happen worldwide. This paper shares an idea on how to avoid train collision by using an automated control incorporated in the trains. In this proposed paper we have implemented ideas such as pre-crashing using RFID sensor, ultrasonic sensor in-order to choose an array of commands which would run as per the conditional algorithm created in the microcontroller. We would also have a EPM to control the speed of the motor to lessen speed. This system will be more efficient since it was fully automated and also it was cost effective.

**Smart solutions for Railways referred from the authors: Mir Sajjad Hussain Talpur**, **Raheel Sarwar**, **Ammar Oad, Halar Buriro, Akhtar Hussain Soomro**, **Abida Luhrani, Hina Rehman, Shakir Hussain Talpur, Erum Saba Chang.**

The railway system is one of the most widely used modes of transportation due to its low cost. To keep the railway system running smoothly, continuous track monitoring is needed. These days, the railway system is manually supervised. As a result, there is a greater risk of disasters, such as fatalities, occurring as a result of human error while monitoring. The main problem with manual system monitoring is that it takes a long time to process all of the necessary data. Since railway tracks are built over thousands of miles, it is virtually impossible to manually control the device over such a long distance. At railway crossings, a lot of accidents happen. Crossing gates are usually opened and closed after receiving direct input from the station. If there is a delay in obtaining information from the station, there is a risk of swearing incidents. The main goal of this research is to simplify and protect the railway system. The proposed system employs Force Sensitive Resistor (FSR) detectors for automatic sideroad crossing protection. Any type of breakage, as well as vibration, can be efficiently detected with a higher degree of precision using Light Dependent Resistor (LRR) and laser detectors. In the event of an unexpected situation, such as an accident, the GSM module will begin communicating via message with the nearest control room for assistance. Sonar sensors are often used for obstacle avoidance when something unexpectedly appears in front of the train. The Internet of Things (IoT) has been added to the system to allow it to be monitored from anywhere in the sphere. The Arduino UNO is a microcontroller that serves as the system's backbone. The frame work has the potential to be extremely beneficial to our country's railway economic growth.

1. ***Smart Solutions for Railways referred from the authors: PRASHANT SINGH, ZEINAB ELMI, VAMSHI KRISHNA MERIGA, JUNAYED PASHA, MAXIM A. DULEBENETS.***

The [Internet of Things](https://www.sciencedirect.com/topics/engineering/internet-of-things) (IoT) symbolizes numerous devices which are connected globally through the internet technology and are able to collect and share relevant data. The IoT has thus achieved a significant advancement in the field of sensors, networks, and communication technologies, such as long-term evolution (LTE) technology, fifth generation (5G) technology, [wireless sensor networks](https://www.sciencedirect.com/topics/engineering/wireless-sensor-network) (WSN), and others. Apart from technological advancements, the ability of IoT to run fully embedded (with or without an operating system), gather real-time data, estimate physical parameters, facilitate decision making based on the data gathered, use of various networks (e.g., local area networks (LAN), low-power wide-area network (LPWAN), cellular LPWAN) has provided enormous opportunities for its applications in the railway industry and other domains. The current study performs a comprehensive holistic survey of various IoT technologies that can be used in railway operations, management, maintenance, video surveillance, and safety at level crossings. This study also discusses current trends in the IoT, emerging IoT technologies, green IoT applications, and various research studies that have been conducted in the areas related to railway applications. Furthermore, various challenges that are associated with the IoT applications are discussed along with potential efforts that can be made to overcome these challenges. The outcomes of this work are expected to offer important insights regarding the applicability of IoT technologies for sustainable railway transportation, their future potential, operational benefits to relevant stakeholders and authorities, as well as critical future research needs that have to be addressed in the following years.

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Nowadays, the railway industry is in a position where it is able to exploit the opportunities created by the IIoT (Industrial Internet of Things) and enabling communication technologies under the paradigm of Internet of Trains. This review details the evolution of communication technologies since the deployment of GSM-R, describing the main alternatives and how railway requirements, specifications and recommendations have evolved over time. The advantages of the latest generation of broadband communication systems (e.g., LTE, 5G, IEEE 802.11ad) and the emergence of Wireless Sensor Networks (WSNs) for the railway environment are also explained together with the strategic roadmap to ensure a smooth migration from GSM-R. Furthermore, this survey focuses on providing a holistic approach, identifying scenarios and architectures where railways could leverage better commercial IIoT capabilities. After reviewing the main industrial developments, short and medium-term IIoT-enabled services for smart railways are evaluated. Then, it is analyzed the latest research on predictive maintenance, smart infrastructure, advanced monitoring of assets, video surveillance systems, railway operations, Passenger and Freight Information Systems (PIS/FIS), train control systems, safety assurance, signalling systems, cyber security and energy efficiency. Overall, it can be stated that the aim of this article is to provide a detailed examination of the state-of-the-art of different technologies and services that will revolutionize the railway industry and will allow for confronting today challenges.