IBM - NALAIYATHIRAN

LITERATURE SURVEY

DOMAIN: IOT(INTERNET OF THINGS)

TECHNOLOGY: SMART SOLUTIONS FOR RAILWAYS

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Internet of Things (IoT) and Indian Railways

ABSTRACT

On 26th February 2015, Shri Suresh Prabhu, Minister for Railways presented the Rail Budget in Lok Sabha, which was hailed by the Prime Minister for the technology- driven measures announced. The PM said, "I am particularly delighted that for the first time there is a concrete vision for technology upgradation & modernisation of the Railways," The Rail Budget 2015 proposed all-embracing use of Information Technology and eGovernance initiatives in Railway functioning, from SMS alert service for passengers, provision for Wi-Fi at Railway Stations, digitised mapping of rail land. Corporate India termed the budget, as 'Technology-Enabled Traveller- Centric'.

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EXPLANATION :

This scheme has great potential for the **The Internet of Things (IoT).** The Internet of Things (IoT) has been defined by **International Telecommunication Union** in Recommendation ITU-T Y.2060 (06/2012) as a global infrastructure for the information society, enabling advanced services by interconnecting (physical and virtual) things based on existing and evolving interoperable information and communication technologies. The IoT is a "network" of 'things' that can broadcast data and connect to the internet or to a network. Objects, animals or people are given unique identifiers and the capability to transfer data over a network. All this is achieved without human intervention. The convergence of wireless technologies, micro-electromechanical systems (MEMS) and the Internet leads to IoT.

A "thing" can join in IoT, only when it is tagged as 'smart'. For becoming 'smart", common things or objects, a few action are needed;

1. a unique identity is assigned to the object
2. it has the ability to communicate or to transmit data wirelessly
3. sensing devices must be inbuilt in the object
4. it should have capacity to be remote controlled

Accidents occurring in Railway transportation system cost a large number of lives. So this system helps us to prevent accidents and giving information about faults or cracks in advance to railway authorities. So that they can fix them and accidents cases becomes less.

This project is cost effective. By using more techniques they can be modified and developed according to their applications.

In this paper the system is presented to detect the cracks in the track effectively. We have implemented the Ultrasonic sensor based railway crack detection system using wireless technology. By this system many lives can be saved by avoiding accidents. The idea can be implemented in large scale in the long run to facilitate better safety standards for rail tracks and provide effective testing infrastructure for achieving better results in the future.

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SMART RAILWAY AUTOMATION SYSTEM USING IOT-ALITERATURE SURVEY

ABSTRACT

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 ideassuch 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.

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EXPLANATION :
By using this Autonomous vehicle for purpose of railway track inspection and crack detection, it will have a great impact in the maintenance of the tracks which will help in preventing train accidents to a very large extent.The regions where manual inspection is notpossible, like in deep coal mines, mountainregions and dense thick forest regions can be easily done using this vehicle. By using this vehicle for the purpose of Railway track inspection and crack detection and automated SMS will be sent to pre-defined phone numberwhenever the vehicle sensors detect any crack or deformation. This will help in maintenance andmonitoring the condition of railway tracks without any errors and thereby maintaining thetracks in good condition, preventing train accidents to very large extent Railway track crack detection autonomous vehicle is designedin such a way that it detects the cracks or deformities on the track which when rectified intime will reduce train accidents

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A survey on Smart Railway Track Fault Detection UsingIOT

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ABSTRACT

Indian Railways is the largest railway network in Asia and additionally world's second largest network operated underneath a single management. Due to its large size it is difficult to monitor the cracks in tracks manually. This paper deals with this problem and detects cracks in tracks with the help of ultrasonic sensor attached to moving assembly with help of stepper motor. Ultrasonic sensor allows the device to moves back and forth across the track and if there is any fault, it gives information to the cloud server through which railway department is informed on time about cracks and many lives can be saved. This is the application of IoT, due to this it is cost effective system. This effective methodology of continuous observation and assessment of rail tracks might facilitate to stop accidents. This methodology endlessly monitors the rail stress, evaluate the resultsand provide the rail break alerts such as potential buckling conditions, bending of rails and wheel impact load

Existing train tracks are manually researched. LED (Light Emitting Diode) and LDR (Light Dependent Resister) sensors cannot be implemented on the block of the tracks [3]. The input image processing is a clamorous system with high cost and does not give the exact result. The Automated Visual Test Method is a complicated method as the video color inspection is implemented to examine the cracks in rail track which does not give accurate result in bad weather. This traditional system delays transfer of information. Srivastava *et al.,* (2017) proposed a moving gadget to detect the cracks with the help of an array of IR sensors to identify the actual position of the cracks as well as notify to nearest railway station [4]. Mishra *et al.,* (2019) developed a system to track the cracks with the help of Arduino mega power using solar energy and laser. A GSM along with a GPS module was implemented to get the actual location of the faulty tracks to inform the authorities using SMS via a link to find actual location on Google Maps [5]. Rizvi Aliza Raza presented a prototype in that is capable of capturing photos of the track and compare it with the old database and sends a message to the authorities regarding the crack detected [6]. detection to the concerned authorities.

KEYWORDS: IOT, Raspberry, Smart railway, Fault detection, Ultrasonic sensor.

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EXPLANATION:

Accidents occurring in Railway transportation system cost a large number of lives. So this system helps us to prevent accidents and giving information about faults or cracks in advance to railway authorities. So that they can fix them and accidents cases becomes less.

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Internet of Things for sustainable railway transportation: Past, present, and future

ABSTRACT

The 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 (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.

EXPLANATION:

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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Towards the Internet of Smart Trains: A Review on Industrial IoT-Connected Railways

ABSTRACT
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, signaling 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.

Keywords: IoT, IIoT, internet of trains, railway safety, rail planning and scheduling, predictive maintenance, WSN, railway enhanced services, freight transportation, cyber security

AUTHOR : Paula Fraga-Lamas and Tiago M. Fernández-Caramés contributed to the overall study design, data collection and analysis, and writing of the manuscript. Luis Castedo contributed to the overall writing of the manuscript. All of the authors approved the final version of the manuscript.

EXPLAINATION

This survey examined the role of enabling technologies to revolutionize the railway industry. Broadband technologies, like LTE, provide the capacity needed to create novel services. A formal analysis regarding GSM-R requirements and services was presented to provide an understanding of future customer needs. LTE Release 11 includes the first feature for public safety (i.e., high-power UE). Starting from LTE Release 12, the standard adds characteristics such as IMS emergency calls, ProSe, PoC, GCSE, and eMBMS that will evolve LTE/LTE-A to be used as part of a broadband public safety network. LTE Release 13 includes the first set of specifications for mission-critical scenarios including MCPTT, enhancements of ProSe and GCSE, and the isolated E-UTRAN operation. Although the feasibility of LTE in the railway environment is evaluated, the deployment of a brand-new ecosystem will also require the design of a thorough migration strategy. In addition, WSNs constitute an essential part of the protection of the infrastructure, and M2M technology can boost efficiency by using sensors

embedded into objects and systems to deliver real-time analysis and monitoring while enabling automation.

Furthermore, the adoption of the paradigm opens a wide area of short- and medium-term potential applications. Examples like 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, signaling system, were detailed in order to expose the IoT capabilities to reinforce competitive advantages, to create new business models, and to change railways. For each of the services, the latest technologies and the main academic and commercial developments were thoroughly examined.

After all the analyses performed, it can be stated that the Internet of Trains and IIoT still face many challenges, such as standardization, interoperability, scalability, energy efficiency and cyber security, which would have to be addressed by researchers that will have to cope with the additional issues posed by railway environments and the specific nature of the operations and the networks.

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