Literature Survey on "Smart solutions for Railways"

1.Supply Chain in the Public Procurement Environment

This paper provides analysis of supply chain management framework in the public procurement environment through a case study of the Indian railway. The paper provides some insights about the evolution of supplier relationship management and its impact on key performance indicators. Its also provides an integrative framework for management of public procurement. The paper builds on extensive review of literature and follows a case study methodology. The unit of analysis is the Indian Railway's material management function. Analysis uses data of over a period of five years. The finding highlights that supplier relationships with the Indian railway have been geared around arms-length philosophy. The current symptoms of inefficiencies are reflected in high cycle time, high costs associated with supplier selection process, poor accountability, blurring of responsibility and poor value creation for all the stakeholders. The current procurement mechanisms are not crafted around development of long term strategic partnerships. This study is filling the gaps in literature by presenting the challenges of supply chain management in the public procurement environment. Insights from developing country like India can be applied to other public procurement systems. The paper deals with sensitive issue of public procurement system. The findings would be useful for policy makers in developing mechanisms for instilling insights of business management into the realms of public management. The study is first of a kind to provide a conceptual framework for understanding building blocks of the supply chain management in the public procurement environment.

2.Smart Computing Applications in Railway Systems

The demand for safe, fast, and reliable rail services continues to be the reason for concern in all the countries across the globe. Lack of operational efficiency and reliability, safety and security issues, and aging railway systems and practices are haunting various countries to bring about a change in their existing rail infrastructure. The global rail industry struggles to meet the increasing demand for freight and passenger transportation due to lack of optimized use of rail network and inefficient use of rail assets. This is expected to induce rail executives to build rail systems that are smarter and more efficient. The passenger reservation system of Indian Railways is one of the world's largest reservation models. Daily about one million passengers travel in reserved accommodation with Indian Railways. Another sixteen million travel with unreserved tickets in Indian Railways. In this vast system, it is a herculean task to efficiently handle the passenger data, which is a key point of consideration now-a-days. In this paper, the authors have explored different issues of implementing smart computing in railway systems pertaining to reservation models.

3. 5G Key Technologies for Smart Railways

Railway communications has attracted significant attention from both academia and industries due to the booming development of railways, especially high-speed railways (HSRs). To be in line with the vision of future smart rail communications, the rail transport industry needs to develop innovative communication network architectures and key technologies that ensure high-quality transmissions for both passengers and railway operations and control systems. Under high mobility and with safety, eco-friendliness, comfort, transparency, predictability, and reliability. Fifth-generation (5G) technologies could be a promising solution to dealing with the design challenges on high reliability and high throughput for HSR communications. Based on our in-depth analysis of smart rail traffic services and communication scenarios, we propose a network slicing architecture for a 5G-based HSR system. With a ray tracing-based analysis of radio wave propagation characteristics and channel models for millimeter wave (mmWave) bands in railway scenarios, we draw important conclusions with regard to appropriate operating frequency bands for HSRs. Specifically, we have identified significant 5G-based key technologies for HSRs, such as spatial modulation, fast channel estimation, cell-free massive multipleinput multiple-output (MIMO), mmWave, efficient beamforming, wireless backhaul, ultra-reliable low latency communications, and enhanced handover strategies. Based on these technologies, we have developed a complete framework of 5G technologies for smart railways and pointed out exciting future research directions.

4. Energy-Storage-Based Smart Electrical Infrastructure

This paper presents a modified power supply system based on the current alternating current (AC)-fed railways with neutral zones that can further improve the eco-friendliness and smart level of railways. The modified system complements the existing infrastructure with additional energy-storage-based smart electrical infrastructure. This infrastructure comprises power electronic devices with energy storage system connected in parallel to both sides of each neutral zone in the traction substations, power electronic devices connected in parallel to both sides of each neutral zone in section posts, and an energy management system. The description and functions of such a modified system are outlined in this paper. The system allows for the centralized- and distributed-control of different functions via an energy management system. In addition, a control algorithm is proposed, based on the modified system for regenerative braking energy utilization. This would ensure that all the regenerative braking energy in the whole railway electrical system is used more efficiently. Finally, a modified power supply system with eight power supply sections is considered to be a case study; furthermore, the advantages of the proposed system and the effectiveness of the proposed control algorithm are verified.

5. Review and Opportunities for Smart-Railways

Technology development in the field of the Internet of Things (IoT) and more specifically in Low-Power Wide-Area Networks (LPWANs) has enabled a whole set of new applications in several fields of Intelligent Transportation Systems. Among all, smart-railways represents one of the most challenging scenarios, due to its wide geographical distribution and strict energy-awareness. This paper aims to provide an overview of the state-of-the-art in LPWAN, with a focus on intelligent transportation. This study is part of the RAILS (Roadmaps for Artificial Intelligence integration in the raiL Sector) research project, funded by the European Union under the Shift2Rail Joint Undertaking. As a first step to meet its objectives, RAILS surveys the current state of development of technology enablers for smart-railways considering possible technology transfer from other sectors. To that aim, IoT and LPWAN technologies appear as very promising for cost-effective remote surveillance, monitoring and control over large geographical areas, by collecting data for several sensing applications (e.g., predictive condition-based maintenance, security early warning and situation awareness, etc.) even in situations where power supply is limited (e.g., where solar panels are employed) or absent (e.g., installation on-board freight cars).

6. Survey on Formal Methods and Tools in Railways

Formal methods and tools have been widely applied to the development of railway systems during the last decades. However, no universally accepted formal framework has emerged, and railway companies wishing to introduce formal methods have little guidance for the selection of the most appropriate methods and tools to adopt. A work package (WP) of the European project ASTRail, funded under the Shift2Rail initiative, addresses this problem, by performing a survey that considers scientific literature, international projects, and practitioners' perspectives to identify a collection of formal methods and tools to be applied in railways. This paper summarises the current results of this WP. We surveyed 114 scientific publications, 44 practitioners, and 8 projects to come to a shortlist of 14 methods considered suitable for system modelling and verification in railways. The methods and tools were reviewed according to a set of functional, language-related, and quality features. The current paper extends the body of knowledge with a set of publicly available documents that can be leveraged by companies for guidance on formal methods selection in railway system development.

7. Internet of Smart Trains IoT-Connected Railways

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.

8. Smart Ticketing System for Railways

Ticketing system for railways in Mumbai suburbs was introduced in order to authenticate and authorize valid commuters to suit ones comfort, purpose or needs while travelling. Due to very high job prospects in Mumbai city, the population which started travelling through this train increased immensely, which resulted in various issues such in never ending queues, wastage of paper, lots of resource and staff utilization. The alternatives techniques introduced to resolve this issues failed drastically. Moreover in spite of having such a massive amount of data generated of the commuters, no analysis was ever done ever to improve the railway service and the commuter's experiences. To overcome the above pitfalls this paper proposes a smart ticketing system architecture for railways which completely scraps the idea of paper tickets and completely harness the amount of money commuters has invested for their travelling. If the commuter intends to travel from a source to destination with no intention to return on the very same day, then only half ticket costing will be taken into consideration. The commuters will be benefited with the provision of using the seasonal tickets as per there requirements depending on the number of days they has subscribed. This model also enables the authorities to detect those commuters who never pay and buy or fail to carry their tickets or pass while travelling. The proposed system will also have features like crowd analysis and suggesting cost effective offers to the railway commuters.