

Automation in Railway System

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Abstract -This paper addresses the need for automation in today's railway system especially in India. In every sector of industry, automation plays a major role in efficient and accurate working of that particular system. As far as railways is considered, automation is valuable in order to improve the systems accuracy and its efficiency. Reduce worker fatigue and effort or labour intensive operation, prevent materials from being damaged, increase efficiency, collect better data, cost effective and works 24x7. By keeping all these needs in mind, the paper tries to explain different methodologies which can be used to introduce automation, maintenance, management and its safety precautions.

Key Words: Accuracy, Automation, Efficiency, Level crossing, Management, Operation, Safety precautions, Signal Interlocking.

1. INTRODUCTION

In today's world technology is everywhere. Automation is the creation of technology and its application in order to control and monitor the services. It performs tasks that were previously performed by humans. Automation plays an important role in the advancement of science and technology. Nowadays, automation is everywhere except our Indian Railway plays a very important role in our country's economy. Today more than ever, speed reliability and convenience are the decisive factors for ensuring the desirability of modern mass transit railways and therefore for their commercial success. The key to meeting these criteria is optimum line utilization through railway automation.

2. AUTOMATIC TRAIN CONTROL SYSTEMS

Continuous monitoring of trains and safe signalling offers numerous advantages in train operations today. For driver operated and driverless vehicles alike, automatic train control systems ensure maximum efficiency in every case.

2.1 Conventional Automatic Train Protection (ATP)

They ensure optimized headway times, safety, and reliable transmission of information.

2.2 Inductive intermittent train control system

An inductive automatic train control system transmits information from the track to the train. This is done at suitable points along the lines, e.g., at signal locations or before speed-restriction areas. It consists of trackside equipment, the track magnet, and on-board equipment consisting of central unit, vehicle magnets, odometer pulse generator, and control and display elements. It is used on mass transit and main-line railways.

2.3 Intermittent automatic train control system

The intermittent automatic train control system monitors the movement of a train using dynamic braking curve computation and has been especially designed for operation on lines with space restriction. Through this we can continuously monitor the train movements and it also supports the driver with a host of automatic functions such as:

- Train stop at stop signals
- Continuous and reliable monitoring of speed and braking
- Audible alarm when the desired speed is exceeded and automatic triggering of the braking procedure.
- Display of target and actual speed in the driver's cab
- Acoustic alarm if the target speed is exceeded, and automatic triggering of the brakes
- Support of control systems by means of line data.

2.4 Positive train control

Positive Train Control solution for industrial, mining and freight applications. The system comprises a primary Control Module and cab display units, with optional second display. Speed and location is determined through an on-board track database, commercial GPS receiver and axle tachometers. It includes: civil speed enforcement; train separation via movement authority or signal aspect enforcement; switch protection; track bulletin protection.

3. SIGNALLING COMPONENTS:

The non-passive systems and devices in signalling systems and railway automation solutions, such as point operating systems and signals, are very important for the availability of the entire railway system.

3.1 Frequency track circuit

The remote-fed audio-frequency track circuits are used for the precision clear or occupied indication of track sections. The track section is remote-fed with a frequency-modulated voltage. Preferred application areas are for main-line railways as well as on metro, rapid transit, and suburban railways. They are used for the seamless clear and occupied indication of track sections. The track section is remote-powered by a frequency-modulated voltage; the transmitter and receiver can be accommodated centrally in the interlocking which is located at a distance of up to 6.5 km from the track section.

3.2 Point machine

Point machines play an important role in safety in rail traffic. They must operate precisely and reliably and must be capable of withstanding considerable stress. Reliable switching of points guarantees increased train throughput and a high level of operational safety. They also considerably improve the dynamic operating characteristics and prolong the life of the track body.

3.3 Signals

Rugged, high-availability signals play an important role in the safe and smooth running of railway operations. The equipment of signals is extremely flexible –with components that can be selected from a practical modular system. High availability and cost-efficiency of signalling systems are fundamental to the safe and efficient running of railway operations. This requires rugged construction to avoid outages.

3.4 Compact signals

Compact signals play an important role in the safe and efficient running of railway operations. They are rugged, offer high availability, and provide the means for displaying a large number of signal aspects, numbers, and symbols. The ruggedly-constructed signal components can be selected and assembled from a modular system. Equipment of the compact signals and the shield widths can be varied to meet a wide range of different customer requirements. Compact signals are used for the visual indication of signal aspects on main-line railways, rapid-transit and metro railways, and industrial and private railways.

3.5 LED signals

Upgrade your current signals to LED Signals. They increase safety and reduce maintenance of your signalling system. Multiple LEDs and parallel circuitry combined with exceptional reliability of LED technology leads to lower maintenance and operation costs than incandescent lamps. In addition, LED Signals provide constant brightness regardless of the voltage used.

3.6 Axle counter systems

Track vacancy detection systems detect and signal whether line sections are clear or occupied, thereby creating the information basis for controlled track occupancy and safe railway operation.

4. OPERATIONS CONTROL SYSTEMS AND RAIL-IT

With operation control systems, the operation in railways is centrally controlled and observed. Ergonomic user interfaces and integrated automation functions enable efficient dispatching and optimum operations management. One of the biggest challenges of our period is to make sure it is cost-effective, sustainable mobility and, at the same time, provide attractive and exciting offers for railway passengers. In order to handle the ever growing traffic flow in rail transportation, smart operations, control systems which simplify operations, improve the usage of existing capabilities by making complete use of all inventory and also enable a great level of efficiency and quality of rail transportation, even in exceptional operating situations. Networked rail IT solutions also combine all functions for efficient asset and maintenance management, continuous station management and optimized fleet and crew allocation.

4.1 Service/Asset and maintenance management

Investments have to pay off over a long duration. Effective servicing concepts offer sustainable and long term investment security, maximum reliability and resource availability through the whole cycle and they extend systems' service life and offers not only high-performance systems with service and diagnostic functions but also consulting on important subjects relating to servicing.

4.2 Planning and dis-position

Systems enable the simulation and compilation of optimum timetables in terms of intervals and reductions in both energy and resources. These systems thus make a major contribution to maximum usage of the existing infrastructure. In this way, the allocation of lines and nodes can be flexibly adjusted to traffic situations. The following processes can be optimised;

- Passenger transfer optimization
- Timetable validation
- Construction site planning
- Track layout design
- Timetable design
- Energy management

4.3 Communications and its products

Railway operators face the challenge of assuring efficient, safe, and consistent operation. Personnel and passengers need the exact information at the right time and the right place. For this reason, modern, efficient communications are a central element of passenger and freight traffic. Surveillance systems such as emergency or CCTV telephones provide additional security and increase passengers' convenience.

Rail operators now a days have to provide rapid, safe and consistent transportation for increasing number of passengers, while usually dealing with ageing infrastructure and very less budgets. It is a modular scalable solution which allows operators the flexibility to expand the system functionality to meet new and different requirements. It includes advanced technology, project management and process improvement to reduce project lead time, enabling updates to take place without disrupting rail traffic, and therefore increasing safety precautions.

5. ELECTRONIC INTER LOCKING

Electronic interlocking makes sure that railways operate securely. They monitor and control train movements on the lines according to the operational requirements of the railway. Completely preassembled and tested interlocking designed, as modular containers, play a key role in cutting time and costs for installation and commissioning, and so help reduce investment costs. Microprocessor-based interlocking system, with straightforward configuration using ladder logic to deliver almost any vital functionality, the system offers real benefits to railway authorities in terms of cost of ownership, capability and flexibility. Typical applications include simple, medium sized and complex interlocking, radio block systems, trackside control – and provision of vital functionality in Centralized Traffic Control Systems. Microcomputer interlocking is a high-availability, high-reliability and, due to its modular hardware and software, versatile electronic interlocking solution. Both simple regional and line interlocking and complex junction interlocking can be implemented with this system. Electronic interlocking provides an economical solution for interlocking systems in main-line and regional traffic and for industrial railways all over the world. It's compact, modular design, this new interlocking generation can be adjusted quickly and

easily to local conditions and the operational requirements of the particular railway company. Efficient utilization of a marshalling yard is dependent on modern track equipment such as point machines, signalling systems, sensors, efficient retarders and propulsion systems, as well as radio-controlled humping locomotives and appropriately-adapted microcomputer systems. It is a safe, reliable, and cost-effective solution for automating the marshalling system. The computer based interlocking solution not only delivers greater capacity than conventional interlocking, but also significant savings and headroom for future expansion.

6. LEVEL CROSSING PROTECTION SYSTEM

Safety is the prime consideration for public transport systems, and that includes level crossings. A modular level crossing protection system can be readily adapted to the conditions of individual level crossings and to customer-specific requirements. It designed for operators of mainline and industrial railways, regional lines, and light rail transit systems. The electromechanical barrier drive is of modular construction and is suitable for deployment in mass-transit and main-line operations and on rapid-transit and industrial railway lines. Its flexible structure covers all known country-specific requirements for controlling and for power supply. It can be readily adapted to different functional requirements of level crossing systems. The level crossing predictor system provides bi-directional train detection, but at significantly reduced cost compared to conventional technology. By calculating the speed of the train, it is able to provide constant crossing warning times, minimizing disruption to highway users and significantly reducing the risk of crossing abuse. As a constant warning device, provides consistent warning times irrespective of the speed of the approaching train, and this contributes to increased safety by reducing the risk of road users misusing the crossing. The level crossing controller provides complete crossing control for up to six lines and four barriers. Capable of managing complex layouts, such as areas containing stations or multiple lines, the system allows for advanced train detection and crossing control. The system provides complete train detection, crossing control logic, vital indicators, communications and timers, solid state barrier/ light drives, and full event recording. The level crossing barrier machine may be used with existing crossing control equipment. Lightweight and available in a range of configurations, this machine uses less power and requires a smaller equipment housing and footprint than conventional systems. Barriers provide a cost-effective, reliable solution and can be configured as drive up/gravity fall, or drive up/drive down. In addition, separate options are available for entrance and exit barriers – which can be configured to remain in the raised position in the event of power failure.

7. CONCLUSION

The need for automation in present scenario plays a major role to simplify and reduce manpower and at the same time to increase the accuracy and efficiency of any system. Automation played a major role during industrial revolution during 18th century in Europe during which enabled European countries to work to their maximum potential and produce surprising results over a period of time. Similarly, the importance of automation and its advantages needs to be realised and acted accordingly so as to bring about a drastic change-over from the present day manual or semi-automated systems in Indian Railways. Automation of the system will lead to accurate working and it avoids major accidents due to its safety characters. It provides a sense of confidence in passengers and also avoids unnecessary delays which is one of the major issues.

8. REFERENCES

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