OPTIMIZATION OF RAILWAY SYSTEM THROUGH THE APPLICATION OF ADVANCED TECHNOLOGIES

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By

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1. AIM OF THE PROJECT
The objective of this project is to make Railway System truly automated, modern, safe, profitable and timely by putting highly advanced and optimum system in place based on technological pathways, generated through the application of state-of-art geo-spatial programs, for providing an integrated solution to the loads of problems in the Railway System in most scientific, effective and inexpensive manner.

2. PROBLEMS OF RAILWAY SYSTEM
On top of resource crunch, a variety of other problems associated with Railway System makes train journey an enduring and risky job. Traveling by trains is not safe in India. Head-on collisions are the most dangerous and take heavy toll on life and property. Apart from human errors, problems in switching and signaling systems aggravate the problem. With few exceptions, running of trains behind schedule has become a well established and accepted norm, especially in foggy conditions. Inadequate financial resources and sub-optimal track utilization are other vexing issues.

3. OBJECTIVES OF THE PROJECT
The following aspects would be looked into simultaneously in an integrated manner while developing Optimized Railway System (ORS) that would be loaded with the following features:
- Optimization of entire railway operations.
- Minimization of financial support needed for implementation of ORS.
- Maximization of financial income by optimum track utilization.
- Optimization of train (both passenger as well as goods) movement.
- Automation of train movement. This includes driverless driving and stopping all collisions due to human and system errors.
- Optimization of train timing. Ensuring punctuality even in dense foggy conditions.
- Automation of signaling system.
- Automation of switching system.
- Automatic web-based Management Information System (MIS) updation.
- Advanced Information Dissemination System (IDS).

4. TECHNOLOGY TO BE ADOPTED
Dedicated state-of-art geo-spatial programs, developed by the author for addressing the pertinent issues of safety and optimization of railway operations, would be applied to put in place the Optimized Railway System that would automatically control all the systems of railways. Railways Automatic Tracking Program (RATP) and Program for Optimization and Automation of Railway System (POARS) would be used extensively for this purpose. Real time tracking of trains would be done through the application of RATP. The Decision Support System (DSS) for the optimization of the entire Railway System would be generated through the application of POARS. Subsequently, automatic control and command for train movement, switching, signaling etc would also be done through the application of POARS.

5. METHODOLOGY TO BE APPLIED
The following methodologies would be applied.

5.1. OPTIMIZED RAILWAY SYSTEM
The ORS would include the following.

5.1.1. Hardware: This would include the following:

5.1.1.1. Central Hub (CH): A CH would be developed at one. The CH will be connected with Peripherals.

5.1.1.2. Peripherals: This would include the following:
- Communication devices: The following devices would be used for communication of information/data.
  - Electronic Signaling Communication Device (ESiCD)
  - Electronic Switching Communication Device (ESwCD)
- Motor devices: These would implement the commands received from the CH through the communication devices.
  - Electronic Brake Motor Device (EBMD)
  - Electronic Acceleration Motor Device (EAMD)
  - Electronic Signaling Motor Device (ESiMD)
  - Electronic Switching Motor Device (ESwMD)
- Multi-function devices: These would have multiple roles to play.
  - Electronic Tracking and Communication Device (ETCD)
  - Electronic Movement Monitoring Device (EMMD)
  - Electronic Signal Sensor Device (ESiSD)

5.1.2. Systems: The ORS would consist of the following sub-systems:

5.1.2.1. Automated Train Movement System (ATMS): Apart from CH, the peripherals including ETCD, EMMD, EBMD, EAMD and ESiSD would be included in ATMS. EMMD and ESiSD, fitted on each train, would generate data on speed and distance of the train, and on signaling respectively. These would seamlessly send data to ETCD. ETCD onboard each train would generate geo-spatial tracking data. ETCD would seamlessly send data, generated by itself as well as received from EMMD and ESiSD, to the CH. The tracking data would be processed in the CH through the application of RATP for generating meaningful geo-spatial data regarding location. The CH would automatically process all the data and optimize entire railway operations by generating DSS through the application of POARS. Thereafter, ETCD would receive commands from CH regarding decreasing or increasing the speed. ETCD would get those executed through EBMD and EAMD, which would be fitted on board for applying brake and acceleration respectively.

5.1.2.2. Automated Signaling System ASiS): Apart from CH, the peripherals including ESiCD, ESiMD and ESiSD would be included in ASiS. The ESiCD would receive commands from CH regarding signaling, once the CH generates the DSS through the application of POARS. ESiCD would get those executed through ESiMD, which would be fitted on each signal. Although ESiSD is a part of ASiS since it detects the signal status, it plays an important role in ATMS too.

5.1.2.3. Automated Switching System ASwS): Apart from CH, the peripherals including ESwCD and ESwMD would be included in ASwS. The ESwCD would receive commands from CH regarding switching, once the CH generates the DSS through the application of POARS. ESwCD would get those executed through ESwMD, which would be attached with each rail switch.

5.2. OPTIMIZATION OF FINANCIALS
This includes the following:
5.2.1. **Revenue:** The ORS would optimize operations of goods trains also. The back end data regarding shipment, including source station, destination, volume, weight and quantity of goods, preferred dates and timings etc, would be processed in the CH. Subsequently, optimization of track utilization and minimization of loss of resources would be ensured through the application of POARS. This would result in substantially increasing the revenue from freight charges.

5.2.2. **Financial support for implementation of ORS:**

5.2.2.1. **Technology:** Although the geo-spatial programs, RATP and POARS, are technologically the most advanced, these are less expensive compared to other similar technologies available globally.

5.2.2.2. **Capital Expenditure:** All the devices used in ORS are less expensive.

5.3. **INFORMATION DISSEMINATION SYSTEM**

Geo-spatial information regarding location of trains would be updated on a dedicated portal on real-time basis. The portal would also contain other related information like expected time of arrival and departure etc. Information dissemination through SMS and open access to the portal would be other important features of IDS.

5.4. **EMERGENCY SITUATION**

Proper alternate arrangements would be made to deal with emergency situations, which might arise due to power outage or non-availability of communication signals, since these 2 are the mandatory prerequisites for seamless transmission of data across the CH and peripherals. First stage of safety mechanism would be triggered in such situations; trains would halt and signals would turn red automatically. Second stage of safety would be triggered when train operations would turn into manual mode after manual control take-over is reported to ETCD, ESiCD and ESwCD. The ORS would again restore automatically once the emergency situation ends.

6. **PROJECT MANAGEMENT**

All the software mentioned in the project are proprietary software of the author. The project may be handled by the agency that has unlimited exclusive right to use these software.

7. **ADVANTAGES OF THE PROJECT**

The proposed ORS would have the following distinct advantages:

- State-of-art technology; superior to other known techniques globally
- Complete optimization of entire railway operations
- Additional resource generation; railways to turn into profit making business
- No train accidents; automatic application of brake for avoiding accidents
- Low cost of implementation
- Automatic train movement; driverless driving
- Automatic signaling and switching systems
- Timely movement of trains; no delay even in dense foggy conditions
- No loss of life and property
- Public satisfaction
- Real time and public friendly Information Dissemination System