International Journal of Engineering Innovation & Research
Volume 2, Issue 3, ISSN: 2277 – 5668

Enhancement of Safety in Train Operations in Indian Railway using Lookup Controller

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***Abstract* – The aim of this paper is to highlight the enhancement of safety in train operations using control system. The new generation of supervision systems in industry can achieve operation from display variables to all automated control where human is just monitoring automation. In railway specific industry, the supervision is organized in switching zones and aims to be centralized in an integrated control centre. In Indian railway, many companies dealing with a great variety of different works as like commercial operators in contact with clients, operators in charge of train traffic or station management, reporting with station manager at any railway stations. This model is providing safety track for controlling all the operation during running status according to railways signal. With the help of this model controlling the speed of the train as a average speed at the upcoming station. Reduce the accident due to the proper signal is not receive by the train driver.**

***Keywords* – Driver Machine Interface, On Board Computer, Sensor Transmission System, Antenna, LEU.**

I. Introduction

TRAIN control centre have evolved over time to include many other functions than the initial ones of tactical and strategic control over the traffic network. In keeping with technological developments, customer requirements on train control centres have become ever more sophisticated, requiring increasing numbers of functions in order to exact the best from their existing assets. In the same way, low cost system is now requested and offering increased functionality for a given cost. Facing the need for cost reduction, instead of purchasing a control system for each type of application

(Traffic, energy, auxiliaries, telecommunication etc) customers now request just one control system able to offer a fully integrated feature set. Enhancement of the expertise of traffic controllers by optimally adjusted simulation systems, e-learning and classroom teaching in education and further training The aim of this paper is to highlight the skills shortage facing the Indian railway rail industry and to begin to examine possible solutions to that shortage. The first section of the paper therefore will provide an overview of the data those national skills academy for railway engineering (NSARE) has been collecting and evaluating over the Skills Forecasting research. At railway stations, railway companies are dealing with a great variety of different actors as like Commercial operators in contact with clients, operators in charge of train traffic or station management, reporting either to the station manager, the infrastructure manager or the companies responsible for train operation, operators involved in building management i.e. maintenance, management of rental premises, safety issues (fire protection, environment), refurbishment, construction work. Providing training for all actors involved is a special challenge for Indian railway. Train Operation is an operational safety enhancement device used to help automate operations of trains. Mainly, it is used on automated guide way transits and subways which are easier to ensure safety of humans. Many modern systems are linked with train control and train protection where normal signaler operations such as route setting and train regulation are carried out by the system. The train control and train protection systems will work together to maintain a train within a defined tolerance of its timetable. The combined system will marginally adjust operating parameters such as the ratio of power to coast when moving and station dwell time, in order to bring a train back to the timetable slot defined for it. The inability to brake effectively in low adhesion conditions has both important safety implications and carries Performance/cost penalties. Although large strides have been made in the development of better Wheel slide Protection Systems, these systems can only optimize the prevailing wheel rail adhesion. Wheel slide protection systems protect the wheels on the train during a stop, but do not necessarily improve stopping performance. The result is that US commuter rail operators sometimes disable Wheel slide Protection Systems during emergency stop situations, allowing stops to be made with all wheels locked. This helps make stopping distances more consistent but leads to the costly creation of flats on the train wheels as they slide to a stop. There are two options available to commuter rail operators, and both have significant down sides. The first is to tolerate wheel flats. However flats cause noise and present a risk to the railroad. The second is to re-true the wheels on a wheel lathe, which is costly, as material must be removed from an expensive component. In addition, there is no guarantee that the wheels will not be subject to flatting again in a short period. The safety of Indian railway has improved as a reduced risk of red light violations and Station run-bys, Improved stopping performance during low adhesion rail conditions, Improved stopping reliability (sand is available in all brake demands) , Reduction in air consumption during train stops, Reduced risk to track circuits, through optimal (not excessive) sanding.

II. Train Safety on Indian Railway

1. Introduction of Indian Railway

Indian Railways is the second largest Railway network in the world with a total of about 63,200 route-kms of track. A major portion of the track is on broad gauge (1,676 mm), but some portions are still on metre gauge (1,000 mm) and certain limited stretches on narrow gauge. High density and suburban routes totalling around 28% of the route-kms of the track is electrified at 25 kV, 50 Hz. For effective management of this network, the Railway is split into 16 Zones. Each of these zones is further divided into divisions – ranging from three to six per zone. A matrix structure of organisation is adopted for the management with three levels of administration – The Railway Board at the apex, followed by the Zones and Divisions. Each level has its own administrative head – Chairman at the Board level, General Managers at Zonal level and Divisional Managers at divisional level. They are assisted by functional department heads. The functional departments also have their hierarchy at the three levels.

2. Accidents

For statistical and analysis purposes, the accidents are classified as “Consequential accidents”, “Indicative accidents”, “Other train accidents” and “Yard accidents”. The first three categories of accidents involve trains, but the last category deals with accidents occurring at shunting, loco and marshalling yards and do not involve trains. Though both consequential and other train accidents involve trains, the difference between the two categories is based on whether the repercussions of the accident – cost of damage, period of disruption and injury to persons – exceeded the specified threshold values. These are further categorized as follows:

Consequential Accidents: Collisions, Fire cases Level Crossing accidents, Derailments, Miscellaneous cases.

Indicative Accidents: Averted collisions, Breach of block rules, Signal passing at danger.

A study of the consequential accidents which occurred on the Indian Railways for the five year period from 1999 to 2004 indicates that 1,717 cases out of a total of 2,021 cases i.e. 84.9% were attributed to human failures. Out of the 1717, Railway employees were responsible for 1,175 cases (58.1% of total) and balance 542 cases (26.8% of total) were attributed to outsiders.

3. Dependence on Human Element

If such a high percentage of train accidents are caused due to human element, why is there so much dependence on the human element? The following are the reasons for large level of human intervention affecting train operations in India

a. Limited Financial Resources

One of the primary and major reasons for dependence on human element in train operations is limited financial resources and technology. The Railways have to necessarily meet the bill for wages, operating expenses, pension obligations, materials for maintenance of assets dividend liabilities etc., and at the same time provide for replacement of over-aged assets. Next priority is the funding for on-going/new projects. With the Indian Railways being fully under the control of the Government and funding cleared by the Parliament, demands from various quarters will need to be accommodated while these projects are approved. Developmental activities naturally tend to get a lower priority. Signaling works for improving the train operations are taken up only on a limited scale. Most of the advanced technologies for reducing dependence on human element will need to be imported, funds for which are limited. Driving of trains is currently fully on manual control, except for some warning devices on very limited sections. Similarly at many of the stations, track circuiting/interlocking is not available and obstruction-free tracks for dealing with trains is required to be ensured physically.

b. Equipment Failures

Even in areas where equipments have replaced or reduced dependence on human element, it has become necessary to revert back to manual intervention during emergencies arising out of equipment failures. Such provisions have been made to enable movement of trains even under failure conditions, provided certain procedures and safeguards are observed. Typical cases are failure of signals and points, failure of level crossing gate interlocking, failure of certain equipments which could be temporarily bypassed or isolated in locomotives etc.

c. Level Crossings

Level crossings constitute another major concern for safety in train operations in India. Vehicles on two, three, four and multiple wheels ply across the length and breadth of the country powered by motors, humans as well as animals and a majority of them have scant knowledge of or regard for road safety rules. There are about 41,000 road crossings across the 63,000 route-km of railway tracks, but there could be several more unauthorized and unofficial crossings. Even considering the official figure, one could expect a level crossing at an average of every 1.5 kms of track. Combined with the fact that almost 60% of these level crossings are unmanned and without any gates, the level of dependence on the road users to prevent a collision is quite high. Even though the balance 40% is manned, full protection in the form of interlocking with the signals is available for only about 15% of the total population. This leaves 25% of the total level crossings with manual operation and dependence on the gatekeeper. The close intervals of level crossings also puts a tremendous physical and psychological pressure on the loco drivers, who are required to constantly keep a watch on some possible trespass and have to keep whistling frequently and continuously. Statistics indicate that even though the level crossing accidents constitute only 16% of the total number of accidents, 46% of the total casualties due to train accidents are on account of level crossing accidents, and needless to say, most of them would be the road users.

d. Contribution of Passengers and Others

Railways are part of the day-to-day life for many in several parts of the country. They commute to their places of work and back, carry materials inside the passenger and luggage compartments and even carry out their business inside the compartments. With the high volume of passenger traffic handled, it is practically impossible for a physical check of their luggage to prevent carrying of inflammable materials. A large number of persons earn their living by doing unauthorized vending inside the train compartments using open stoves and similar items which could cause a fire accident easily.

III. Methodology

A method for automatic train control in a digitally controlled model railroad system, this paper method comprising: applying a control voltage to a track of the system, control voltage being a square-wave operating voltage which is modulated corresponding to control information and has a symmetric amplitude; generating an asymmetric-amplitude control voltage that is otherwise essentially identical to the symmetric control voltage and applying this asymmetric control voltage to a section of the track that is used for influencing train control and is galvanic ally isolated from the rest of the track; detecting a polarity change of the control voltage applied to the track by means of a digitally controlled motor vehicle running on the track; after each detection of a change of polarity, sampling the voltage level of said control voltage applied to the track independently for one side and the other side of the track by means of said digitally controlled motor vehicle running on the track; comparing the voltage values sampled for each side of the track to each other; evaluating the comparison result with regard to any asymmetry occurring in the amplitude of the control voltage with reference to the side of the track; and depending on the result of the evaluation, influencing the travel behavior of the motor vehicle that is otherwise controlled by the digital control system. Automatic Train Protection (ATP) automatically stops a train going through danger signals. Computerised equipment is installed in both the train and at key points along the track. The design should eliminate human error from SPADS (signals passed at danger) incidents. The system is designed to stop trains travelling at up to 200mph from going through danger signals. First we start from on board computer(OBC), it is Reading of Euro-balise, Processing track messages ,Speed sensing, Speed and position control, Braking management, ERTMS levels & modes, Display/controls with driver , Record data ,Power 110 V dc, 270 W. second point is driver machine interface, The ERTMS architecture for the onboard ATC encompasses a driver machine interface (DMI) component whose functions and ergonomic requirements are defined so as to satisfy all the CENELEC (European Committee for Electrotechnical Standardisation) related requirements. Next sensor transmission system, Sensor technologies have significant roles for train operations, many sensors have been developed and installed. At present, performances of these sensors are high enough to ensure safety operations of trains, but not enough to maintain the stable work of signal devices. Therefore, advanced sensor system is expected. Furtherly used antenna, Antennas on the roof of a vehicle must allow multi-band operation. This approach eliminates the need to install more than one antenna and covers also future communication standards. Easy installation and maintenance-free products are the top priorities here. The wheel sensor used for the system is supplied by M/s Medha systems, Hyderabad. The existing wheel sensor used in Railways is also of the same make. For the TPWS requirement, suitable modifications have been carried out by adding one more additional output to the existing wheel sensor. This is done to obtain the directional information from the wheel sensor. The line side electronic units are electronic devices that generate telegrams to be sent by balises, on basis of information received from external trackside systems. Final line side sensor, This Sensor System is sited at a position determined by linespeed and gradient. The loops are separated by a distance that should not be traversed within a pre-determined period of time (approximately 1 second) if the train is running at a safe speed approaching the signal at "danger".

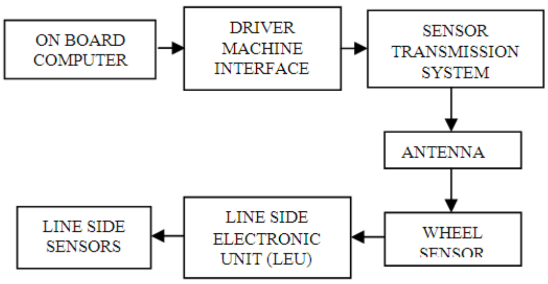
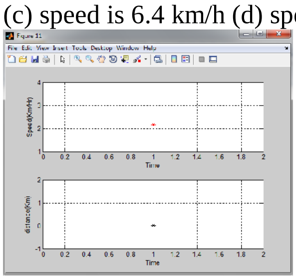


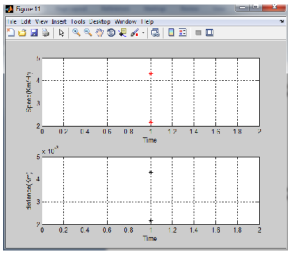
Fig.1. Proposed Method

IV. Simulation Results

Case 1 (a) speed is 2.16 km/hr (b) speed is 4.32 km/hr (c) speed is 6.4 km/h (d) speed is above 6.4 km/hr



(a)



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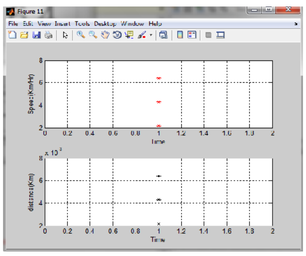

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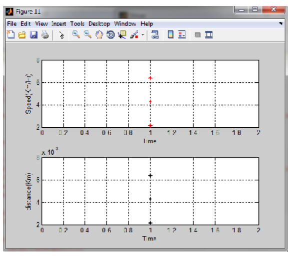
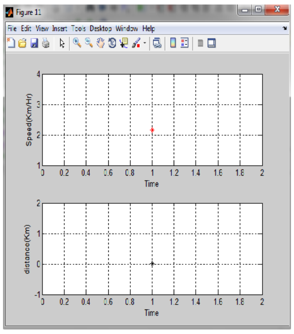


(d)

International Journal of Engineering Innovation & Research
Volume 2, Issue 3, ISSN: 2277 – 5668

Case 2 (a) speed is 2.16 km/hr (b) speed is 4 km/hr (c) speed is 6 km/h (d) speed is 6.4 km/hr (e) speed is above 6.4 km/hr



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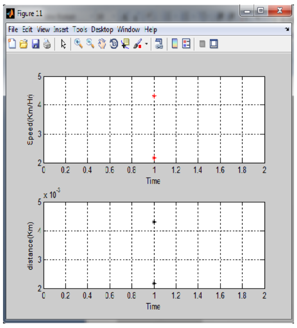

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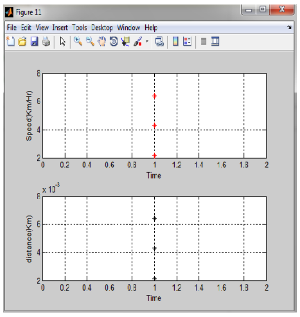

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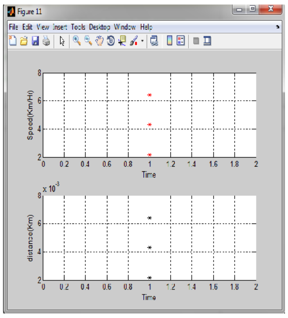
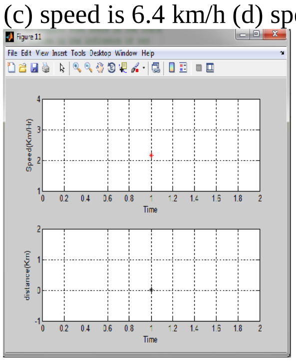


(d)

Case 3 (a) speed is 2.16 km/hr (b) speed is 4.32 km/hr (c) speed is 6.4 km/h (d) speed is above 6.4 km/hr



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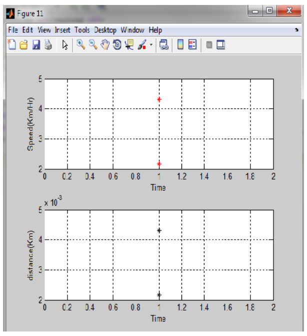

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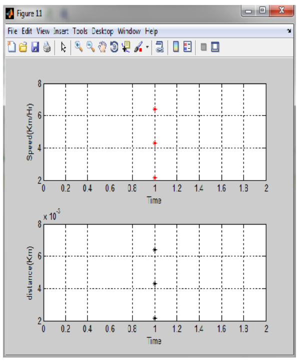

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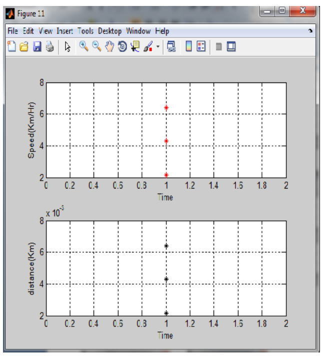

(d)

V. Conclusion

Safety development of supervisory software is far from obvious, but we argue that well understood interfaces between man and machine could contribute in safety. Major problem come from bad requirements. Our purpose method intends to analyse human supervisory behaviour in such particular serious cases in order to highlight lack in requirement. Capability for safety and automated working adequacy of human performance are the underlying research plan**.** This model is providing safety track for controlling all the operation during running status according to railways signal. With the help of this model controlling the speed of the train as a average speed at the upcoming station. Reduce the accident due to the proper signal is not receive by the train driver.

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