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Innovative System of Zero Visibility Navigation for Railway Networks

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Abstract :- **Indian Railway is most economical and fastest transportation system for long distance. It gives a good support to our country economy, but due to fog trains get delayed or cancelled and it do hamper our railway budget. Indian Railways has huge losses due to cancellation, delay and accident of trains. Also many people have heavy losses in personal life due to delay of trains or accident. In December and January, locomotive pilots grapple with zero visibility on the tracks and government policy of delay or cancelling has worsen the crisis. Therefore this research deals with smooth functioning of Indian Railway even in dense fog, by introducing concept of zero visibility navigation and overcome such constraints.**
This concept of "Zero Visibility Navigation" uses technology and software skills. This uses laser signaling systems, RF signaling systems, Embedded Systems, Digital Communication system, etc. with some visual graphics and animation systems. The application of this system can be made practically possible, as the driver can locate the tracks and signals by using laser light during the fog without physically sighting outside the window. A speedy and safer transportation can reduce the accidents, overcome the delays, and thus change the face of Indian lot of adversity in the operations of the railways. It's because of the dense fog and railways making it very efficient and feasible.

Keywords: **- zero visibility, Indian railway, safer transportation, laser signal, dense fog.**

I. INTRODUCTION

A Scenario of Indian Railways

Indian Railways is the lifeline of the nation. About 60% of its population use Railways as the primary means of transport. It's a huge national asset. It's also one of the oldest networks and the only organization working under a single system. In an earlier era, the Indian Railways have been described as "imperium in imperia", an empire within an empire. The size and scale is gigantic. The United States, China and Russia are the only countries that have longer railway lengths, measured in kilometers. With the advancement in technology, the countries like Japan, Germany, China, France, etc. have achieved high speeds of transportation thus setting benchmarks for the Indian Railways to accompany them. This has led to the demand of having speedy transportation within the country, but at a cheaper rate. For a country like India, which has all the seasons' up to their peak, it would be tough to manage a speedy network to a precision. Amongst the seasons, the winter season brings a cold winds that the drivers find it difficult to have a peek outside the window

The Dense Fog causes the following problems: -

1. Due to extremely low visibility many serious rail accidents occur causing severe loss to life and property.
2. The trains get late by hours together causing difficulties to passengers and losses to the railways.

The train accidents reportedly took place due to dense fog, low clarity and manual error. The accidents have raised serious concerns on railway safety. As per the norms of Indian Railways, during fog conditions trains must stick to the speed limit of 30 km per hour and in the dense fog International 8 km per hour. Railway officials say most accidents are due to the failure of their own staff. But of the 177 accidents that occurred in 2008 to 2010, less than half were due to manual error. The truth is the railways are still using outdated techniques like detonators to warn the train drivers during fog. When the train passes over them the driver gets a warning to slow down. Another technique is the LED signaling system. But it is also incapable of penetrating the fog. This has led to the development of an innovative concept of "Zero Visibility Navigation System".

II. LITERATURE SURVEY

Navigation basically is a field of study that focuses on the process of monitoring and controlling the movement of a craft or vehicle from one place to another.

Zero Visibility Navigation System is an innovative concept that allows the loco pilot to look at the tracks without actually peeking outside the window even during the dense fog condition where visibility is

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very low. Hence, the speed of the train remains constant without any mishap or delays.

A Significance in Indian Railways

In the Northern cities like Delhi, Amritsar, Ghaziabad, Meerut, etc. where the network of railways is quite dense and as it is the main route for connectivity with the rest of the country, the operations of the railways should be speedy in order to tackle the heavy traffic and avoid the delays.

But, the dense fog creates the problems of cancellation and delays of many long bound and prestigious trains, thus creating chaos between the passengers and the railway management.

So, considering all these aspects the recent technology of Indian Railways can't fulfill the voids in the system. Hence, introducing this "Zero Visibility Navigation System" will help in building a full fledge operating system that can work efficiently in all the critical conditions.

III METHODOLOGY

A. Working Principle

Firstly, a detailed survey has to be done of rails so get relative positioning of points of important landmarks which is to be fed into a software. It should contain all the intermediate stations, warning signs, important signs, symbol boards, speed limit boards and bridges, tunnels, etc.

After feeding this into software a locomotive will have display which will allow driver to see the tracks without looking outside. Also, all signals will be using laser light which can easily pierce fog. Hence the driver will be looking at the virtual animation video of the happenings outside and he does not need to look outside while running the locomotive and hence the problem of visibility is solved. In short, the driver merely follows an animated video like one plays a computer game. In the games like Road rash, the speed taken into account is the instantaneous speed, but calculating the instantaneous speed of the model toy train is not possible, so we assume the speed of the remote-controlled train as constant. Hence, the position of the landmarks can be fixed as per the time required to reach them.

We already fed the complete database of the route (say an example from Agra to New Delhi). From Agra to New Delhi the relative positions of all the expected and important landmarks will be surveyed in detail. Such landmarks will be numerous such landmarks present on this railway route. But our database system will be efficient to hold all this data. The data will comprise of all necessary landmarks to be considered along with their relative distances of occurring e.g.

All the intermediate signals

- All the intermediate stations
- Warning Signs.
- Important signs, symbol boards
- Speed limit boards

Information about forthcoming bridges, tunnel, trench, elevation, angle-turning, level-crossing etc.

B. Structure

Expected Time of appearance
Landmark 1(Signal) ---- (To be filled by
Landmark 2(Blow Horn symbol) ----- user as per the
Landmark 3(Signal) ----- requirement)

Fig 1 Visibility During Dense Fog Conditions.

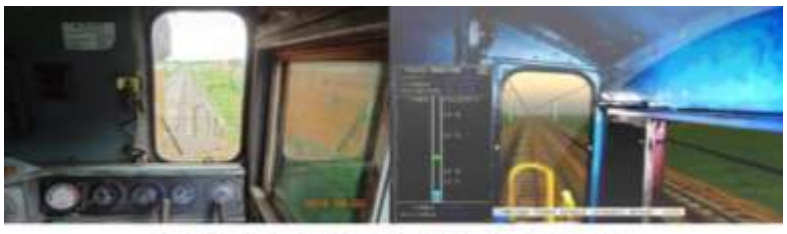

Fig 3 Conversion of actual view to virtual view

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FIGURES

Fig 2.1 Basic database

Fig 2.2 Basic structure of the system

III. CONCLUSION

This technology of "Zero Visibility Navigation System" is very innovative as it deals with the safety of the passengers as well as the railways. This system is very efficient as it saves the time and money required for the journey. It will help in easy transportation during not only the dense fog but also in the other critical conditions like heavy rains, storms, smog, etc.

While making this system to be implemented precisely, the priority should be given to those areas which are worst hit during the dense fog conditions. As the railway network is dense in these areas of dense fog i.e. North India, this system must be put into practice on urgent basis. But as this system requires large number of databases, so it will take a considerable time to get the system fully functioning. All the other routes can be advanced step by step.

In the practical implementation, we can use the technology of graphical image processing, just as we see in the simulators i.e. virtual imaging. Hence, instead of just displaying the name of the landmark, we can have a digital image of the landmark. Also, the use of computer screens in the locomotives will help in proper view of the scenario ahead without looking outside.

As this system is computer driven, the data from other modern devices like the Anti-Collision Device (ACD) and the Vigilance Control Device (VCD) should also be correlated to make the system more accurate and intact.

This has proved to be an aid for the loco pilots while driving the train. This technology can change the face of Indian Railways as it is more feasible and cost-effective.

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