THE REALTIME BASED EFFICIENT ANTI-COLLISION AND MANAGEMENT SYSTEM IN TRAINS

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Abstract:- In the present railway systems, it is becoming even more safety elements in order to avoid the accidents, the major aspects of the system is to provoke the serious accidents by the existence of obstacle on the tracks, with the help of fixed or mobile communication. This paper is particularly deals the efficient methods to avoid train collision and also the management. A GPS unit is being used to find the exact location of faults on tracks. As particularly this present work having an excellent train tracking management system to manage and improve the railway transport services. It is all only outcome of the solution came from the powerful combination of mobile computing, Global Positioning System (GPS), Global System for mobile communication (GSM) technologies and software. Inbuilt GPS module is identifies the train location with a pinpoint accuracy and transfer the information to the Base Station Control. The available information allows the Base Station controller to take accurate decision as for the train location. GPS positioning is helps to identify the possible safety issues and react to them effectively using the communication system that are provided.

Keywords: GPS, GSM, Base Station Control.

I. INTRODUCTION

Normally, all the transport systems are need more safety, But in case of railway need more safety and reliability are highly considered [1]. In the recent years, rapid growth of population railway wants to speed and more capability of the trains should be improved. So automatically the traffic density gets more serious. So as a result, the requirements to the reliability and safety of the speedy train operations are also increased. However the speed and railway extremely relies on its surrounding environment. The railway accidents are connected in worldwide an increasing tendency year by year. So the grave consequences both in loss of human life and severe damage to the train and other things. On the technical literature, very few number of publications can be found and that dealing with this train collision process to the predicted level of collision/crashes. The accidental report of railway shown below in Table 1.

**Table 1: Number of Accidents in Railways**

<table>
<thead>
<tr>
<th>Year</th>
<th>Collision</th>
<th>Derailment</th>
<th>Fire in Train</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1960-61</td>
<td>130</td>
<td>1415</td>
<td>405</td>
<td>1950</td>
</tr>
<tr>
<td>1970-71</td>
<td>59</td>
<td>648</td>
<td>12</td>
<td>719</td>
</tr>
<tr>
<td>1980-81</td>
<td>69</td>
<td>825</td>
<td>29</td>
<td>923</td>
</tr>
<tr>
<td>1990-91</td>
<td>41</td>
<td>445</td>
<td>9</td>
<td>495</td>
</tr>
<tr>
<td>2000-01</td>
<td>20</td>
<td>350</td>
<td>17</td>
<td>387</td>
</tr>
<tr>
<td>2001-02</td>
<td>30</td>
<td>280</td>
<td>9</td>
<td>319</td>
</tr>
<tr>
<td>2002-03</td>
<td>15</td>
<td>218</td>
<td>14</td>
<td>247</td>
</tr>
<tr>
<td>2003-04</td>
<td>9</td>
<td>202</td>
<td>14</td>
<td>225</td>
</tr>
<tr>
<td>2004-05</td>
<td>13</td>
<td>138</td>
<td>10</td>
<td>161</td>
</tr>
<tr>
<td>2005-06</td>
<td>9</td>
<td>131</td>
<td>15</td>
<td>155</td>
</tr>
<tr>
<td>2006-07</td>
<td>8</td>
<td>96</td>
<td>4</td>
<td>108</td>
</tr>
<tr>
<td>2007-08</td>
<td>8</td>
<td>100</td>
<td>5</td>
<td>113</td>
</tr>
<tr>
<td>2008-09</td>
<td>13</td>
<td>85</td>
<td>3</td>
<td>101</td>
</tr>
</tbody>
</table>
The traditional way of Indian Railways are working as based on the approach of the locomotive to the corresponding station. If sometimes there is a obstruction means, the signal controlling engineer has to control that in advance with the help of lamp based signals that are available in the present system of Indian Railways. But these all are the older versions of the foreign railways, usually the foreign railways are using the realtime visual of the locomotive position with the help of both GPS and GSM. But for the establishment, cost of the unit and the maintenance of it is very high. So here this present system negotiate such kind of maintainability and continuous monitoring by a human involvement. The traditional railway signaling system is shown in the below, Figure 1.

In addition, this paper proposes a system which monitors the locomotive position using the GPS multi sensor based monitoring system setup. If an opposite locomotive approaching the present locomotive in a same track means, the GPS location finder can easily find that with the specific coding that is already enabled in the present work.

II. SYSTEM ARCHITECTURE

This present work is mainly concentrated to avoid collision of the trains and to detect the collision if anything happened. By fullfilling the fundamental requirements of reliable and realtime information of the locomotive positioning for the monitoring and also the administration purpose by the Railway department. This system consists of three main units which communicates with each other and make sure that accidents and over speed information all sort to the authorities within the minimal time. Thus the system is divided into two units

- GPS/GSM Unite
- ZigBee Wireless Module

A. Global Positioning System (GPS)

GPS is a space-based satellite navigation system that provide location and time information in all the weather condition, anywhere on the world [3,10].

B. Global System for Mobile Communication (GSM)

GSM id digitizes and compresses data, then sends it down a channel with two other stream of user data. GSM can operates on either the 900Mhz or 1800Mhz frequency band [10].

C. ZigBee Wireless Module

The basis of ZigBee technology is IEEE 802.15.4, according to the contents of the ZigBee technical agreements. And normally ZigBee divided into 5 layers. IEEE 802.15.4 defines the PHY layer and MAC layer, ZigBee alliance establishes NWK layer and security layer by themselves, this technology can provide a mobile and flexible way to building network for user [4-6]. The solution that this system encompasses a powerful combination of mobile computing, Global System for Mobile Communication (GSM), Global Positioning System (GPS) technologies and software to provide an intelligent locomotive tracking and its management system to improve the older and existing railway services [2,7-9]. All these technologies are seamlessly integrated to build a robust and scalable architecture as illustrated in the Figure 3.
III. HARDWARE ARCHITECTURE

The basic process of this work as concern, is to obtaining the trains location in a same track using the powerful technology called GPS to avoid collisions. If suppose such collisions may happened means the GSM network is used to transfer the data to the control station for analyses the data to take necessary decision. The onboard hardware architecture is illustrated below Figure 3.

The position data is periodically sent to the control server system through the GSM device Transmitter. The server automatically update the current position, speed and direction information on each trains [3]. GPS device in capable to identify the latitudinal and longitudinal positions and ground speed of the specific train by receiving information from the GPS positioning Satellite.

The GPS is the responsible for the anti-collision avoidance. Why because it analyses the present locomotive longitude and latitude value with the approaching trains longitude and latitude value. If it reaches the certain value that the system is already programmed inbuilt ZigBee wireless module take in control to communicate for the train to alert the both loco pilots. The hardwired anti-collision unit is shown in the Figure 4.
V. SYSTEM SOFTWARE DESIGN

To facilitate the Anti-collision device function based on the GPS/GSM module application software was developed. The Anti-collision warning signals was developed by using the ZigBee wireless network devices. Because the ZigBee wireless network is having more reliability and scalability metrics under different environment [11]. The functional elements of GPS value comparison is illustrated in the Figure 5, below.

![Flowchart for GPS Value Comparison](image)

**Figure 5:** Flowchart for GPS Value Comparison

If the GPS device finds the nearer value of another GPS device from the opposite locomotive in a same track means it automatically activate the ZigBee wireless sensors to alert the both locomotives in advance. And the ZigBee S2 device is normally having the capability to reach 800meters in advance, so if a opposite train is approaching the present locomotive in a same track means this present system predict that and alert the locomotives 2Kms in-advance.

A. ZigBee Description

This present work has the ZigBee Series 2 module to transfer the data in-between the locomotives. Series 2 module allows to create the complex mesh network based on the ZigBee mesh firmware. Modules allow a very reliable and simple communication between the microcontrollers with the help of computer serial port. Even though ZigBee series 2.5 is available in market due to the banned usage of it in India, this present work cannot be able to use it. The ZigBee features are follows:

- Input voltage: 3.3V @ 40mA
- Max data rate: 250kpbs
- RF range: 400ft (120mtrs)
- Encryption: 128bits

So it will give more security and reliability to this present work.

**Figure 6:** ZigBee Series 2

If sometimes collision may occurred means the GSM unit is actively sends the information of the locomotives to the authorities along the location of the collision happened. Figure 6, can give the clear view and system setup of the anti-collision unit. It automatically accept the GPS value continuously to monitor the locomotive movements. If such incidents are takes place, it warn both loco pilots in-advance. The functional setup of it given below.
A. Advantages

- Establish an efficient management structure on strong GPS/GSM systems.
- Enhance the percentage of the working efficiency in railway security systems.
- Facility to send and receive the alert warning to the locomotive pilots on a possible collisions.
- It functionally generates the time-distance graph for the movement of Trains/Locomotives.

VI. CONCLUSION

This paper discuss the critical and safety techniques for the rapid growing train operations, based on the train control system environment. So here to ensure the safety operations of trains, this paper proposes a wireless network access framework according to monitor and security enhancement of the surrounding environment on a train obstacle detection. This system has the ability to pinpoint the location and collision possibilities in an accurate manner. The major goal this work to build and implement a cost effective and intelligent full-fledged wireless based anti-collision detection device in railways to avoid such things, and it functionally implemented.

VII. ACKNOWLEDGEMENT

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VIII. REFERENCES


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