TRAIN TRACKING SYSTEM BASED ON GPS & GSM

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Abstract - In the current railway systes, it is becoming ever more necessary to have safety elements in order to avoid accidents. One of the important causes that can provoke serious accidents is the existence of obstacles on the tracks, either fixed or mobile. This paper deals about one of the efficient methods to avoid train collision and obstacle detection. A GPS system is being used top in point the location of faults on tracks. The paper presents a solution, to provide an intelligent train tracking and management system to improve the existing railway transport service. The solution is based on powerful combination of mobile computing, Global System for Mobile Communication (GSM), Global Positioning System (GPS) technologies and software. The inbuilt GPS module identifies the train location with a highest accuracy and transfers the information to the central system. The availability of the information allows the train Controller to take accurate decisions as for the train location. Positioning data along with train speed helps the central system to identify the possible safety issues and react to them effectively using the communication methods provided by the system.
Keywords: GPS, GSM, WI-FI, Embedded System

I. INTRODUCTION

In all transport systems, particularly in the case of railways, safety and reliability are highly considered .In recent years, with the development of high speed railway, speed and capability of the trains constantly improved, and traffic density gets more and more serious .As a result the requirements to the reliability and safety of the high speed train operation enhances increasingly. However, safety of high speed railway extremely relies on its surrounding environment. The number of collision connected railway accidents shows world-wide an increasing tendency year by year. The ever increasing operation velocities cause an increasing degree of the grave consequences both in loss of human life and severe damage to the train and other railway equipment. In the technical literature very few number of publications can be found that are dealing with investigations into the train collision processes to predict the level of forces and deformations realizing in the course of accidental collisions/crashes. The shortage of the literature sources can be explained by the extremely complicated character of the dynamics of train crashes. The paper takes an attempt to develop an iterative computation method for predicting the dynamics of train collisions/crashes.

II. TECHNOLOGY USED TO REDUCE THE TRAIN ACCIDENT BY INDIAN RAILWAY

A. GPS And GSM

The train safety has been an issue with the increasing number of incidents being reported that has caused death and injury. Majority of deaths on the railway involve third parties with the incursion onto the level crossings. Average train accident would cost millions of Indian rupees and these can be avoided if there is a mechanism to track the train location and speed and warn the locomotive drivers about possible safety issues. The solution is a comprehensive GPS/GSM based train tracking system, which provides accurate, dependable and timely information to the controller. The inbuilt GPS module identifies the train location with a highest accuracy and transfers the information of the central system GSM. the availability of this information allows the Train Controller to take accurate decisions as for the train location. Location data can be further processed to provide visual positioning using maps granting a wholesome vie won train location. Positioning data along with train speed helps the administration to identify the possible safety issues and react to them effectively using the communication methods provided by the system. Additionally, this paper proposes a system which monitors the track in front of a train for obstacle detection using multi sensor setup. If an obstacle is detected, the inbuilt GPS module identifies the train location with a highest accuracy and transfers the information to the central system via GSM. The availability of this information allows the Train Controller to take accurate decisions as for the train location. latest information and communication technologies can provide effective and feasible solution for the requirement of are liable and accurate train tracking system to improve the efficiency and productivity of Indian Railways. The solution we propose encompasses a powerful combination of mobile computing, Global System for Mobile Communication (GSM), Global Positioning System(GPS), Geographical Information System (GIS)technologies and software to provide an intelligent train racking and management system to improve the

existing rail way transport service. All these technologies are seamlessly integrated to build a robust, scalable architecture as illustrated in Fig. 1.

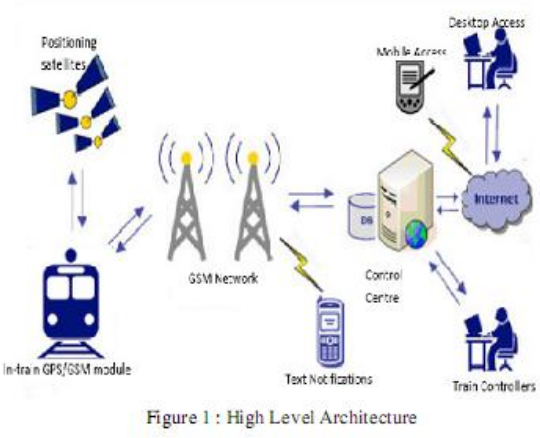

Figure 1 : High Level Architecture

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The fundamental process in our system is obtaining train on using GPS technology and transmitting the data via GSM network to the central control unit for data processing and information analysis and to take appropriate decision. The position data is periodically se no the central server through the GSM transmitter of the module. The server automatically updates the data base with latest position, speed and direction information of each train The GPS receiver of the unit is capable of identifying the latitudinal and longitudinal position and ground speed of the specific train by receiving information from the GPS satellites. The device is capable of storing data in a buffer at a time of GSM connectivity failure, and can synchronize with the remote server when GSM is back online. The device can also respond to commands and data calls from the central remote server as per administrative requirements of the train controller. The use of GSM over GPRS significant improves the feasibility and availability of our system[4]. We have chosen GSM as the communication medium between the train locator and the central server to improve availability of our system by utilizing the existing GSM network which covers the whole country. The central control system includes are mote server for handling and processing all the position information received from train locators via the GSM network.. Our main objective is to avoid collision of trains and detecting objects on track fulfilling the fundamental requirement of reliable and real time in formation of train positioning for monitoring and administration purposes by t he Railway Department.

Global System for Mobile Communication:

GSM digitizes and compresses data, then sends it down a channel with two others terms of user data, each in its own time slot.GSM is a digital mobile telephony system that is widely used in Europe and other parts of the world.GSM uses narrow band TDMA, which allows eight simultaneous calls on the same radio frequency. It operates at either the 900 MHz or 1800 MHz frequency band and is the most widely used of the three digital wireless telephony technologies (TDMA, GSM, and CDMA).

Global Positioning System

GPS is a space-based satellite navigation system that provides location and time information in all weather, anywhere on or near the Earth, where there is an unobstructed line of sight to four or more GPS satellites .The GPS program provides critical capabilities to military, civil and commercial users around the world. In addition, GPS is the backbone for modernizing the global air traffic system as shown in Fig 2. It is maintained by the United States government and is accessible to anyone with a GPS receiver. The use of GSM and GPS technologies allows the system to track train and provides the most up to-date information about ongoing trips. This system finds its application in real time traffic surveillance. It could be used as a valuable tool for real time information, congestion monitoring, and system evaluation. An intelligent, automated train tracking system can resolve following problems such as, late arrivals to scheduled, accident, collision of trains.

B Tail Lamp

Guards have been provided the conventional kerosene lit tail lamps. Guards have been provided with electronic flashing tail lamps, having better visibility than the conventional kerosene lit tail lamps.LED type flashing tail lamps have been provided in rear of all trains for better visibility to prevent rear end collision. Automatic train protection and warning

C.Auxiliary Warning System

System provides audiovisual warning to the driver and prevents him from passing signals at danger. Presently, an AWS is working on Mumbai suburban area of western and central railways.AWS on 128kms stretch of southern railway is in progress.

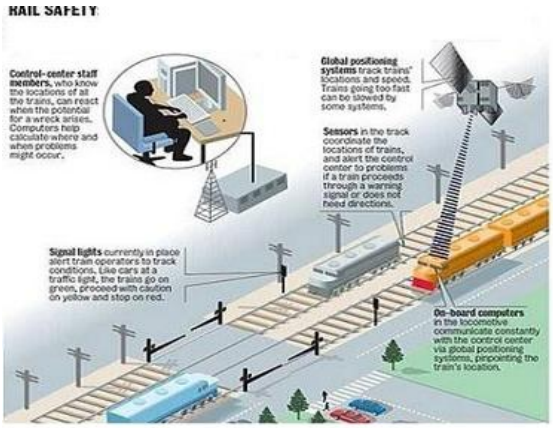

Figure 2: Communication between various devises

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III. RESEARCH CHALLENGES

Year	Collision	Derailment	L-Xing accidents	Fire in train	Total	Incidence of accidents per million train kms.
1960-61	130	1415	181	405	2131	5.50
1970-71	59	648	121	12	840	1.80
1980-81	69	825	90	29	1013	2.00
1990-91	41	445	36	9	532	0.86
2000-01	20	350	84	17	473	0.65
2001-02	30	280	88	9	415	0.55
2002-03	16	218	96	14	351	0.44
2003-04	9	202	95	14	325	0.41
2004-05	13	138	70	10	234	0.29
2005-06	9	131	75	15	234	0.28
2006-07	8	96	79	4	195	0.22
2007-08	8	100	77	5	194	0.21
2008-09	13	85	69	3	177	0.20

Figure 3: Number of Accidents in railway

1) One of the reasons that can provoke serious accidents is the existence of obstacles on the tracks, either fixed or mobile. Paper proposes the combined use of diverse techniques of data fusion, based on fuzzy logic to validate the existence of objects, providing a highly reliable detection system .2) Controlling the railway track geometry: surveying system is an alternative to classical geodetic measurement methods that are often used for controlling the railway track geometry. Track gauge, super-elevation, gradient, and track axis coordinates, which are railway geometrical parameters, can be instantly determined. Determining these information' son time and taking precautions is important for the safety of railway systems .3) Safety Framework for train operation based on environmental Environment monitoring consist of weather monitoring, flood monitoring, Earthquake monitoring where as Device monitoring consist of crossing monitoring, track monitoring, tunnel monitoring etc .4) Monitoring the status of joint less track based on analyzing the principle of FBG (Fiber Bragg Grating)

Sensors and the structure of double columns end thorns. Joint less track is an essential part of high speed railway .5) Detecting dangerous Mountains in the railway line. Natural phenomena such as the mountain collapse, mountain slide and so on along the line of railway, which badly affect the traffic and transport safety of the railway. The slide and collapse can destroy the line, prevent the train from running; destroy the railroad bridge and other facilities, cut off the tunnel, destroy the bright cave, and bring about the traffic accidents with turning over the train and people's death .6) Signal system for improved safety and provides a cost-effective solution for high-speed train operation. The principle of signaling is to prevent trains fromcolliding.7) Level crossings (LCs) are identified as critical security points in both road and rail infrastructures. A Level crossing (LC) is an intersection point between railway and road traffic at the same level. In areas with high traffic density, LCs are equipped with automatic protection systems (lights, barriers, and alarms) .8) Old Track and Poor State of Rolling Stock: The major problem faced by Indian railways is that the tracks are old and out dated. These old tracks cause many serious railway accidents. This has also resulted in speed restrictions. Virtually, every new timetable, running time of all trains has been increased while railways in other advanced countries are reducing it drastically.[1-8]

IV. RELATED WORK

Conventional train control systems using track circuits for train detection require huge investment in equipment and maintenance. There are several reasons: various ground facilities must be installed on and around the track; train positions cannot be detected very accurately; many signal cables are required to connect ground facilities; etc. In addition, because train control is implemented by block, conventional systems cannot effectively support changes in transportation mode, such as development of new, high performance vehicles. However, by utilizing IT as the core and redesigning the distribution of functions between the ground and on-board equipment, it is possible to configure an ideal control system in which individual train sex change train position information with each another to control train intervals. This new train control system utilizing Cutting Cost: Reducing the number of ground facilities cuts construction and maintenance costs. In addition, the costs of large-scale improvement and signal installation works during renewal of train control systems can be cut.2) Facilitating system renewal: Since the system does not depend on ground facilities, it can easily support changes in transportation mode, such as higher train speed and shorter headway.3) Improving safety: The system does not depend on the train crew for control. It improves safety by positively preventing entry of trains into a closed section

and by providing a protective pattern for brake control at level crossings. In addition, the fewer ground facilities reduce problems, contributing to improved transportation reliability.

.**Author proposes**

[1] A multisensory system that can inform the monitoring system for the existence of obstacles. The system for obstacle detection consists of two emitting and receiving barriers, which are placed on opposing sides of the railway, respectively, and use infrared and ultrasonic sensors, thus establishing different optical acoustic links between them.

Paper [3] discusses the key technical problems about ensuring the safe operation of the high-speed train, and puts forward a high-speed railway safety framework based on CPS (Cyber Physical Systems).It uses the thought of wireless sensor network to built the high-speed railway infrastructure, in order to timely collect, transfer, analyze and process the surrounding Heterogeneous Network Access Technology for High- Speed Train Operation Environment Safety Monitoring System.

Author proposes [4] , a system designed for monitoring the status of joint less track based on analyzing the principle of FBG (Fiber Bragg Grating) sensors and the structure of double columns end thorns. In this system for monitoring purposes, temperature sensors, strain sensors, displacement sensors of different measuring ranges are used. CCU (central control unit) receives the measured wavelength value from SM125 through Ethernet cable, and sends the measured results to the RMC (remote monitoring center) through GPRS wireless module GF-2008CW. The software of CCU is programmed with Visual Basic. The main functions of RMC are data receiving, saving, analyzing and graphic display.

In paper [10] anti-collision system is designed based on vision. The performance of the system is demonstrated on an image dataset. An anti-collision system for rail track maintenance vehicles monitors the space ahead of the train for obstacles. System can help to maintain a safe distance between maintenance trains.

V. PROBLEM IDENTIFICATION

The status of the present Indian Railway is as follows:

1. Presently railway-crossing gates are operated manually. At present scenario, in level crossings, a gatekeeper operates the railway gate normally after receiving the information about the train's arrival. When a train starts to leave a station, stationmaster of the particular station delivers the information to the nearby gate. The above said procedures are followed for operating the railway gates.

Problems Faced:

Sometimes the road traffic is so busy that it becomes impossible for the gatekeeper to shut down the gates in correct time

In many remote areas, railway-crossing gates are open and no person is located for the operation of gates and hence leading to accidents.

Many times gates are shut down too early leading to wastage of time of people stuck at crossing.

2. Presently as such no centralized system is there through which we can track the location of trains from any center point environments information. Paper describes the alarming model for train operation environment and

VI. DISADVANTAGES OF EXISTING SYSTEM

1) Existing systems are not able to predict the cracks on the railway track.

2) Existing systems are not able to manage when the two trains travel opposite to each other.

VII. ADVANTAGES OF PROPOSED SYSTEM

1) Establish management structure based on performance evaluation and monitoring process

2) Enhances the percentage of efficiency.

3) Facility to send alerts/warnings to particular train drivers on possible collisions, derailment through the system.

4) Functionality to generate time-distance graph for trains which can be used to control and plan the train movements.

VIII. CONCLUSION

This paper discusses the critical safety techniques for high speed train operation environment based on the train control system. In order to en sure safe operation of trains ,we propose a wireless network access frame work according to the monitoring network of surrounding environment and the deployment of transition network to avoid collision of trains and obstacle detection. System has ability to pin point the location and other attributes of an operational train in an economical accurate manner. The goal of this work is to design and implement a cost effective and intelligent full-fledged and wireless based Train Anti Collision and detection System to avoid accident.

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