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Real Time GPS for Railway Automation System

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ABSTRACT

The concept of the paper idea is to automate the railway's system. We are using the idea of Global Position system(GPS) for tracking every train and a proposed system by which every train are personally monitored and passing necessary messages to the individual trains. The train with the GPS Module and GSM module on board. This would enable passenger can simply query the location of a train via SMS from his mobile phone but will also enable us to provide real-time train tracking system. It is developed with a goal to reduce the waiting time of the passenger. The training unit will response to the user mobile with the GPS coordinates of the present location of trains. There is a base station where the train movement will be displayed on a screen. The motivation for the paper came from due to the lack of control over railways in India as we hardly get to know the exact position of the train while standing at the station. The method of Metro implements modern techniques to control the railways motivates us to design a system for the complete railway system.

Keywords: GPS (Global Positioning System), GPRS(General Packet Radio Service), GSM (Global System For Mobile Communication)

I. INTRODUCTION

As civilization developed, we depend on more upon the various inventions that make our day to day life More easier. There is technology that saved much life. Our life is affected largely by technology. After all these years, technology has been developing constantly; it has facilitated our life in all way. In other words, the automated devices that we are using in our daily life make our life more relax and now a day it is difficult to imagine a life without this devices [1].Railways are large infrastructures and are the basic mode of transportation in many countries. The railways have become main of transportation recognize to their capacity, speed, and reliability. The Indian Railways is one of the biggest railway systems in the world under a single management. Indian railways daily transporting 14 to 15 million passengers. Security is outstanding significance to Indian railways. Security and reliability are closely linked components. It runs 12,000 trains every day. Expand across 67 divisions, it occupy 104,000 km of rail track, has over 7,000 railway stations[2]. Planning the locomotion of trains, deciding on priority and crossings, estimation train arrivals and providing this information to all the related within the system, this is a troublesome element of day-to-day operations for the railways, in order to achieve efficiency, ensure security, and provide passenger satisfaction.

Vehicle tracking is one of the very intrinsic issues in this world in recent years. And even train tracking and monitoring are also an important issue now a days. Because a train collision takes the biggest amount of human life and creating a grandiose loss to the railway sector in terms of money and time. So the system that we are proposing here is a real-time wireless based system, which will track trains though GPS, make the communication between every train through wireless, share their location details and track details between every trains and passenger. This paper presents a GPS based train control system. The main goals are to improve safety and provide the real location of the train to the passenger using common sensors like differential GPS. The paper states the motivation for the development and presents the system with its components.

II. METHODS AND MATERIAL

A. Literature Survey

Isaac Skog & Peter Händel(2004) -*"*InCar Positioning And Navigation Technologies – A Survey*"*.This paper has been a basic application for the GPS receivers. Advance driver assistant systems (ADAS) controls the traffic and automatic positioning of the accidents. GNSS (Global Navigation Satellite Systems) which provides vehicle movement sensors and also provide to approximation the vehicle state [3]. The performances of measurements are calculated as precision, integrity, adoptability, consistence of services.

ShaikNahid et.al implemented Rail tracking system (RTS).GPS is adoptive for transmission and receiving of the signals. A communication link is supplied between the RTS and control room using GPS. The location of the train is tracked using GPS-GSM technology [4].

Teresa, Milan´es, E. Naranjo, Gonzalez & Alonso, (2008)-"Autonomous vehicle based on cooperative GPS and inertial systems". This paper proposed a cooperative system based on GPS and inertial navigation systems (INS) for automated vehicle location. INS provides a vehicle location by measuring the angular velocity and linear acceleration utilized on Inertial measurement unit (IMU).IMU is measurement method consists of angular rate sensor and accelerometers [5].

Rajkumar et.al proposed train tracking system using Global positioning system (GPS) and communication link feed using Ethernet technology. A unique IP address provided to track the railways. This paper also concentrated on monitoring the status of the alcohol dunked state of the driver and the train speed also. [6]

B. System Modelling

1. Background of the Train Control System

Territorial branch lines are very frequently operated by radio basis operational train control. The track line traffic controller gives the motion control to the train driver via radio phone. The motion control will be marked in a chart of train running. Using this form of operating principle the standard of security is poor. An error on the part of one single person could result in an enormous accident. Infinite accidents in they have shown this risk.

2. Limitations of the Existing System

- This system does not provide real-time tracking since each station is located for away from each other a part in remote places.
- It does not use GPS technology which is a big drawback because the train location is virtually unknown till it reaches the next station.
- The driver is unknown about what the happenings behind the engine.
- Unmanned railway crossings are the spot for this kind of accident. The existing technology does not hold a clue to prevent this.

C. The GPS Based Train Control System

With the arrival of GPS and all over a cellular network, real time vehicle tracking for better transport management has become possible. These technologies can be applied to public transport systems, especially railways. The increased waiting time and the uncertainty in trains arrival make railway system unattractive for passengers. Automated train control system conducts on the principle of a central railway server and communication devices fixed in every train. All the trains on that particular route will update the central railway server with their direction, speed, and location information. The server combine all such information calculates the speed of travel for each train and dispatch this information to those trains on the route. A real-time GPS for railway automation system uses the training unit has an onboard GPS module and a GSM module. A passenger can simply query the location of a train through SMS from its mobile phone. The training unit will response to the user mobile with the GPS coordinates of the present location it is traveling.

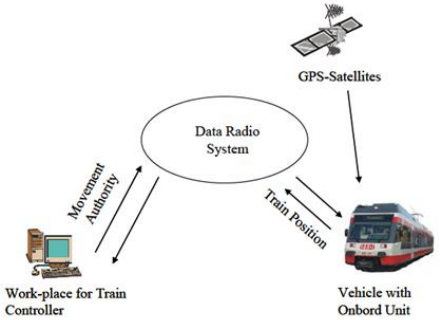

Figure 1. Schematic Overview of Automated System

III. RESULTS AND DISCUSSION

1. Management Description

The main parts of the system are train units in trains, station units at railway stations and a central data processing server. These parts are briefly described in the following sections.

A. Train Unit

The main functions of the training unit are as follows

- To download names and coordinates of stops from the server
- To compute current direction, location and speed of the train.
- To transmit the calculated information to the central server through GPRS.
- To provide "next stop" information.

The training unit operates as follows

The GPS receiver in this unit computes the current location of the train. The latitude, longitude, and speed of the trains are transmitted constantly to a central server using GPRS. The training unit initially downloads the names and coordinates of stops and the current route from the server. This is used to display and announce the name of the stop, for the benefit of passengers inside the train. The configuration factors are stored in memory. The microcontroller precedes the series of operations periodic transmission of GPS coordinates. The software for the training unit consists of an RTOS(Real Time Operating System), application functions that run on the microcontroller and Python scripts that run on the GPS/GPRS module which is used as a coprocessor. RTOS has been used in the training unit for modular software development. Functions related to positioning and communications with the server are handled by Python scripts running on the GPS module. This task partitioning across microcontroller and the module reduces the load on the former.

B. Server

The server is at the center of our RTGARS. The functions of the server are listed below:

- To maintain a database of all the routes.
- To continuously receive location and speed from the train units of all the trains.
- To calculate the location of all the trains at their next and following stops.
- To reply to SMS-based queries requesting a position at specific stops from users; a GSM modem appendages to the server transfers these inquiries to the server.
- Internet web pages hosting, which allow users to track trains in real time, see the route map of any route, and get the position for any route-stop pair and plan trips from the source station to the destination station, at any time.

Server Database

The server maintains a database of information related to the trains, routes, and stops. The server database can be organized in many ways, to rundown memory requirement, the number of queries. To improve the inquiry speed. The relation between the unique train id, train type (ordinary/Express) and route number is stored in the train table. The location updates from the train are stored in the train location. The "direction" field indicates the direction in which the train is headed (Terminus A to Terminus B, or reverse). The direction is calculated in the training unit by comparing time-separated position values with route details. The arithmetic speed is the significant average of the current speed and the previous arithmetic speed. The status of train change to invalid, when its driver signals a breakdown. The train is separated from position calculations based on this field. The train Position Log table stores a copy of the position update sent by trains. This log can be backed up and used for future analysis.

C. Station Unit

The station units are installed at all major railway stops. The station unit functions are listed below.

- To fetch position for all routes through the stop
- To send and display the fetched position.

The architecture, as shown in Figure 2, is similar to that of the training unit, except for the absence of the GPS receiver. Reuse of the similar PCB design rundown the manufacturing expense. It operates as follows. The GPRS module periodically fetches position information for all routes through the stop, from the server via GPRS and the microcontroller sequences this

information. Since the station, the unit is similar to the training unit, the PCB designed for the training unit. This is done by using a GPRS-only module in place of GPS/GPRS module. As for the training unit, the firmware for the station unit is split into microcontroller application tasks for control and sequencing, and Python scripts for communication with the server.

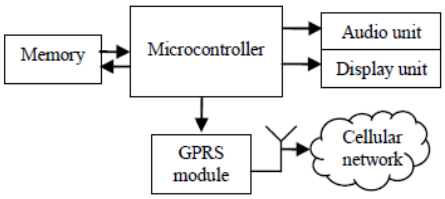

Figure 2. Station Unit Block Diagram

IV. CONCLUSION

There is a rise in a number of train accidents caused due to human errors. In order to avoid such accidents, an automatic train control system without any human operators is proposed. This will avoid train to train collisions, over the speeding problem, Also this system has the facility to provide a way for a passenger to know the train location, speed, and direction in real time. A passenger can query the location of a train via SMS from his mobile phone.

V. FUTURE WORK

As this system uses a combination of processing elements: PCs, Mobile Phones etc., there is a possibility of the overall system malfunction due to a particular type of attack, it is termed as Denial of Service attack by malicious agents who might try to disrupt the function of the system. The similar methodology will be studied to make this Real Time Passenger Information System more robust. proposed system is also quite universal in nature and it is possible to extend the methodology for another type of fleet movement where security is of paramount importance. Reference proposes a novel data hiding technique, based on Stenographic mechanism. Here, the advantage lies in the fact that computationally costly encryption-decryption mechanism is avoided, thus making it suitable for a heterogeneous combination of processing elements, which are being used in our present system. Here, many processing elements e.g. Mobile phone etc. lacks the processing power and battery power, which is required for traditional encryption-decryption system.

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