

# Real Time GPS for Railway Automation System

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## Abstract

The concept of the paper idea is to automate the railways system. We are using the idea of Global Position system(GPS) for tracking every trains and a proposed system by which every trains 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 train units 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. Method of Metro implements modern techniques to control the railways motivate us to design a system for the complete railway system.

## 1. Introduction

As civilization developed, we depend 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 makes 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 is also an important issues now a days. Because train collision takes 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 trains through wireless, share their location details and track and details between every trains passenger. This paper

presents a GPS based train control system. The main goals are to improve safety and provide reallocation of the train to passenger using common sensors like differential GPS. The paper states the motivation for the development, and presents the system with its components.

## 2. Literature Survey

Isaac Skog & Peter Händel (2004) -In Car Positioning And Navigation Technologies – A Survey. This study has been basic application for the GPS receivers. Advance driver assistant systems (ADAS) control 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.

Shaik Nahid 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 in 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 an 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 to monitor the status of the alcohol dunked state of the driver and the train speed also. [6]

## 3. System Modeling

### 3.1 Background of the train control system

Territorial branch lines are very frequently operated by radio basis operational train control. The track line traffic

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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 the have shown this risk.

### 3.2 Limitations of the Existing System

- This system does not provide real-time tracking since each station is located far away from each other 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.

### 3.3 The GPS Based Train Control System

With the arrival of GPS and all over 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 trains. All the trains on that particular route will update the central railway server with their direction, speed and location information. The server combines all such information, calculates the speed of travel for each train and dispatches this information to those trains on the route. A real time GPS for railway automation system uses the train unit has an on board GPS module and a GSM module. A passenger can simply query the location of a train through SMS from its mobile phone. The train units will response to the user mobile with the GPS coordinates of the present location it is travelling.

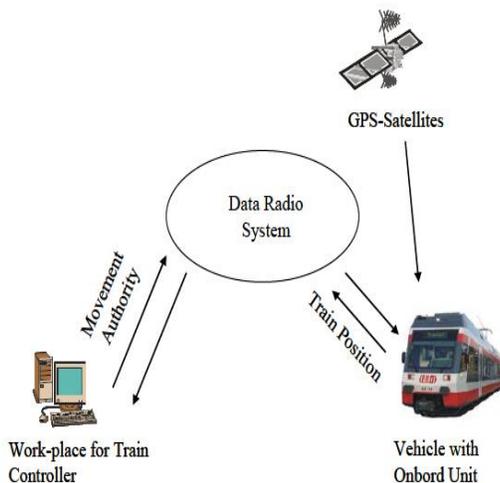


Fig.1 Schematic overview of automated system

## 4. Management Description

The main parts of 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.

### 4.1 Train unit

The main functions of the train 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 train unit operates as 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 train 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 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 train unit consists of a 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 train 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 load on the former.

### 4.2. Server

The server is at the centre 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 position at specific stops from users; a GSM modem appendages to the server transfers these enquiries 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 source station to destination station, at any time.

#### 4.2.1 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 train 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. Status of train change to invalid when its driver signals the breakdown in the components. 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.

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

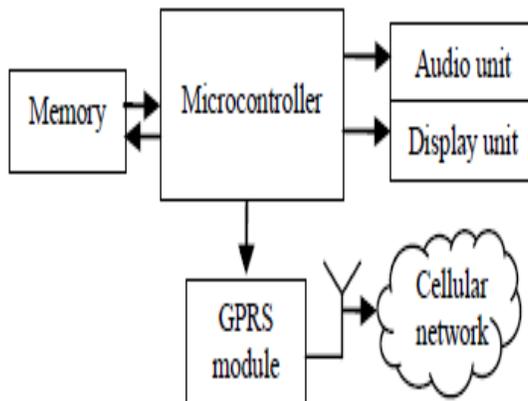


Fig.2 Station Unit Block Diagram

#### 5. Conclusions

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. 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 other 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.

Rise in 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 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.

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