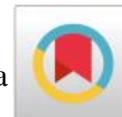




A LOW COST PERSONAL DESTINATION PREDICTOR BY INTERFACING THE GPS AND GSM

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Abstract:

This paper proposes and implements a solution for the navigation difficulty and enhancing the rail transportation in a simple way by combining Wireless Communication and GPS Technology by developing a GPS Based Real Time Personal Destination Predictor. In this method by sending SMS (Short Message Service) and Voice Call to the registered passenger's mobile phone, we alert the passenger about his destination at the specified time before reaching the destination. If the user sends the PNR (Passenger's Name Record) number obviously the server responds with a SMS to the mobile phone of the particular ticket received user. Once the request is responded, the GPS (Global Positioning System) which is the train will locate the live position of the train as latitude and longitude value which will be transferred by the wireless communication to the server and the server will response the location from the Google Maps and intimate the passenger before the specified time of the arrival of the destination station of the passenger, which can be known from the PNR details of the passenger, through SMS and Voice Call. Even the person waiting for the passenger in the destination can avail this facility from his mobile phone by registering with the passenger's PNR number.

Keywords: GPS (Global Positioning System); GPRS (General Packet Radio Service); GSM (Global System of Mobile Communication); Google Map, PNR (Passenger's Name Record); SMS (Short Message Service); Voice Call; Destination Predictor.

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1. Introduction

In the recent past we can see lots of development using Global Positioning System (GPS). And one of the most enhancing developments is GPS combined with any navigation software, e.g. Google map, gives the accurate position and time of any navigating object or any place or building in or near the world like moving vehicles, navigating aeroplane, any monuments, buildings, etc, even it can give the route to any address using various other software. This is used in most of the places of navigation. GPS is very reliable than other positioning system as it is working with the help of 24 satellites around the globe. GPS gives the position in terms of

latitude and longitude which can be given to any navigation software to get the respective place of the latitudinal and longitudinal position in this world.

Also par with this, wireless communication is developing and thus using these two developing platform we can take the GPS Based Tracking System to its next and easily accessible level. With the help of internet access we can easily navigate but a GPRS connection is must to do so. Now a day, GPRS connection can be get through many advanced mobile phone which is also a costlier means. Also it's not that much common with all class of people in India.

Train is the one of the most commonly used mode of transport which connects almost all parts of the country. And when a person travels through the new route in the train, most of the time he ends up with nagging the co passenger to let him know about his destination. And this goes worst when the train is delayed. Recent navigation software with GPS and GPRS facilities solve this problem to certain level. By using the GPRS connection in mobile phone or lap top, the passenger travelling in the train can track his position in Google Map. Also with the train number the passenger can get the time and position of this train which is provided in the Indian Railway website. All this is possible only with the required devices which most of the passenger doesn't have. Even by using this method the non-passenger can track the specific train. But this doesn't solve the problem as the passenger has to sit with the Google Map till he reaches his destination; this is similar to a passenger waiting for his destination by seeing out through the window, which is of no use. Beyond this even Indian Railways took few steps in solving this problem by having current station and next station display which is an added value to the budget.

In this proposed system, we use the integration of GPS and GSM. GPS is used as a positioning device and GSM is used as a communication link between different modules. This system has three modules- *In- Train module* which consists of GPS receiver, GSM/GPRS and dsPIC, *Server module* which consist GSM/GPRS, Server, Navigation software and the *User Module* is the mobile phone of the passenger. These modules are integrated as shown in the block diagram, fig.1.

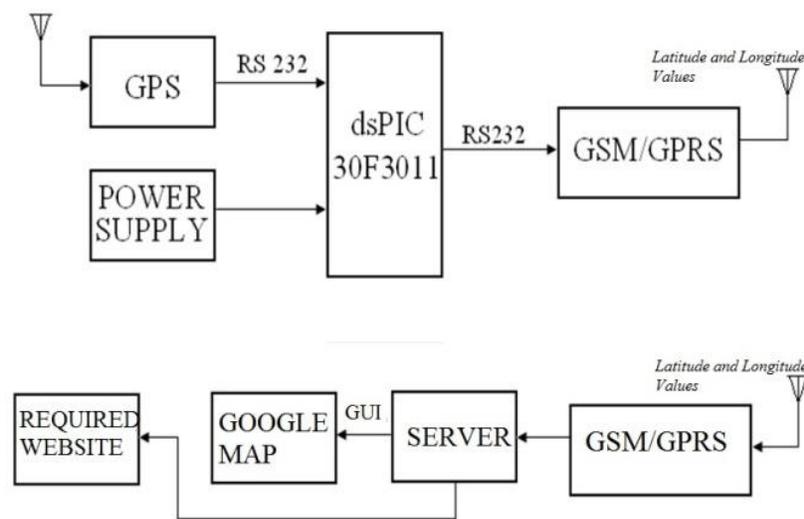


Figure 1: Block diagram of GPS Based Real Time Personal Destination Predictor

2. Hardware Specifications

The following hardware components are used in building the entire system:

GPS Receiver

In order to track record the train, a GPS Receiver is used. In our Indian Railways all the trains are preinstalled with the GPS Receiver to have the track record of the train with specific train number.

Microcontroller

30f3011 DSPIC microcontroller is used as it is high performance Reduced Instruction Set computing (RISC) CPU. It is a modified Harvard Architecture. In this C Compiler is used which optimizes the Instruction Set Architecture with flexible addressing modes. It has 84 base instructions. And in has 24 bit wide instruction and 16 bit wide data path. It has 24kbytes on-chip programmable flash memory space. Also it has timer module with Programmable Pre scalar with 16 bit timers/counters. It is a 40 pin dsPIC.

GSM Modem

A wireless link between the modules is provided with a GSM module. The module can be connected to an external GPS device that supports National Marine Electronics Association (NMEA) standard. The inbuilt NMEA parser can parse the location data from the output that it receives from the GPS device. External microcontroller can use AT commands to communicate with GSM modem and simple remote I/O applications can easily be controlled via text messages.

Alert

The microcontroller unit sends different alerts to the user module which is a mobile phone, to alert about the passenger's destination. The types of alerts given are:

SMS

A SMS is sent to the passenger at the specified time before the arrival of the destination, informing that the destination station of the passenger is going to arrive within the few minutes.

Voice Call

A voice call which is pre-recorded is sent to the passenger's mobile phone followed by the SMS. This voice call says that the passenger is going to reach his destination.

3. System Modules and Network Operation

The entire system/network comprises of three modules:

In-Train module, Server module and User module. The working and interconnection of these modules is described in this section.

In-Train module

In-Train module is installed in every train and consists of a GPS receiver, a GSM module and a microcontroller. After the registration of the PNR number by the passenger with the server, when

the train departs from the source station, the In-Train module starts transmitting the location of the train to the server module. The microcontroller in this module continuously filter the required information, i.e., latitude, longitude and time, from the GPS receiver. The GSM sends this information from the GPS to the server for further processing. The In- Train module block diagram is shown below in Fig.2.

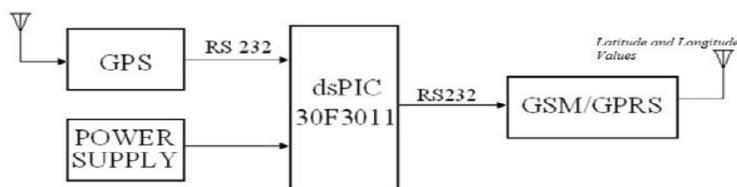


Figure 2: Block diagram of In-Train Module

The Geographical Information System (GIS) is collected through the GPS antenna and send to the GPS which gives the output which is in the NMEA Protocol (National Marine Electronics Association). And the NMEA output message of the GPS is given in the Table.1.

Table.1: NMEA Protocol- Output Messages

NMEA Record	Description
GGA	Global positioning system fixed data
GLL	Geographic position – latitude/longitude
GSA	GNSS DOP and active satellites
GSV	GNSS satellites in view
RMC	Recommended minimum specific GNSS data
VTG	Course over ground and ground speed

But the required output from the above set is given below. It has forty values and its description is given in Table 2.

`$GPRMC,161229.487,A,3723.2475,N,12158.3416,W,0.13,309.62,120598,,*10`

Table 2: RMC Data Format

Name	Example	Units	Description
Message ID	\$GPRMC		RMC protocol header
UTC position	161229.487		161229.487
Status	A		A=data valid or V data not valid
Latitude	3723.2475		ddmm.mmmm
N/S Indicator	N		N=north or S=south
Longitude	12158.3416		dddmm.mmmm
E/W	W		E=east or W=west
Speed Over Ground	0.13	knots	
Course Over Ground	309.62	degree	Tru
Date	120598		ddmmyy
Magnetic Variation		degree	E=east or W=west
Checksum	*10		
<CR><LF>			End of message termination

And dsPIC30f3011 controller is used to filter the required values out of the given forty values. The required values are Latitude, Longitude and UTC. This information is sent to the server module by establishing connection with the GSM in the server module. The flow chart of this process is given below in Fig 3.

Thus the filtered output message from the dsPIC to the GSM which is sent to the server is module is given here:

Example:

UTC 073307 A LT 12.389828,N LO 080.028093,E

Where, UTC- Universal Time Coordinate

Active Signal LT - Latitude LO - Longitude

This information is sent to the server module through GSM. The GSM is located in both the module: In Train module and Server module. The GSM uses AT commands to send, receive and read data.

AT +CMGF - Preferred Message Format
Message format supported are Text and PDU
AT+CNMI - New Message Indication

Selects the procedure for message reception from the network.

AT+CMGS – Send Message Field is the address of the terminal to which the message is sent

Server Module

This module is the central part of the network. It accepts location of the train through respective GSM modems and maps the information on Google Map for visualization. The message received is of the form “UTC 073307 A LT 12.389828,N LO 080.028093,E” . These three strings denote the time and location information respectively. By using this information the destination is tracked.

The server section’s front end is framed using dot NET. The function of this server section is to get the SMS from the passenger’s mobile phone about the PNR number and the requested beforehand time, then to track the train and show in the Google Map interfaced and then alert then passenger beforehand with a SMS and a call. The SMS which tells that “Will reach your destination within few minutes” will be sent to the passenger at the requested beforehand time of the destination of the passenger. The front end will show the phone number of the passenger for which the alert has to be sent and the PNR number of the passenger and the requested time of the alert.

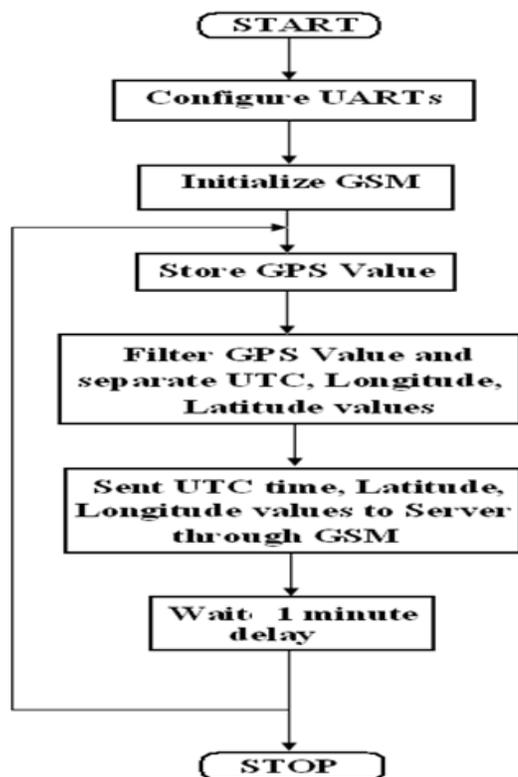


Figure 3: Flow chart of program embedded in In-Train module

The servers section in the Server module gets the latitude and longitude information from the GSM in the In-Train module which is used to point out the actual position of the train. The server is updated with the position of the moving train for every one minute. This update is done by using a one minute delay creation as shown in Fig 3.

The server can be interfaced with other websites of the railways to retrieve the PNR details that reveals the train number of the passenger and about the predetermined run time between the source and destination of the passenger.

The first stage of this server module is the interfacing of the serial port in dot NET. This only opens the serial port open to read or write the data through that port. The flow chart of the process of sending/receiving through the serial port in dot NET is given below in Fig 4. Thus after interfacing the serial port, the data is sent/received properly through it. The simple process taking place on the whole to complete this is shown below in Fig 5;

User Module

This module is the user's mobile phone from which the user sends a SMS and gets registered with this service. The SMS format can be as the ten digit PNR number with a space followed by the two digit requested time. The format for reregistering with the service as "1000023828 10". The first ten digit number is the passenger's PNR number and the next two digit is the beforehand time for alerting. This is sent to the server GSM modem.

Thus the output of the In-Train module and Server module is shown in Fig 6. The output shows the Passenger's mobile number, to which the alert has to be sent, PNR of the passenger, the beforehand alert time requested by the passenger, the latitude and longitude values of the train position which is interfaced with the Google Map and the alert message which will be sent to the passenger.

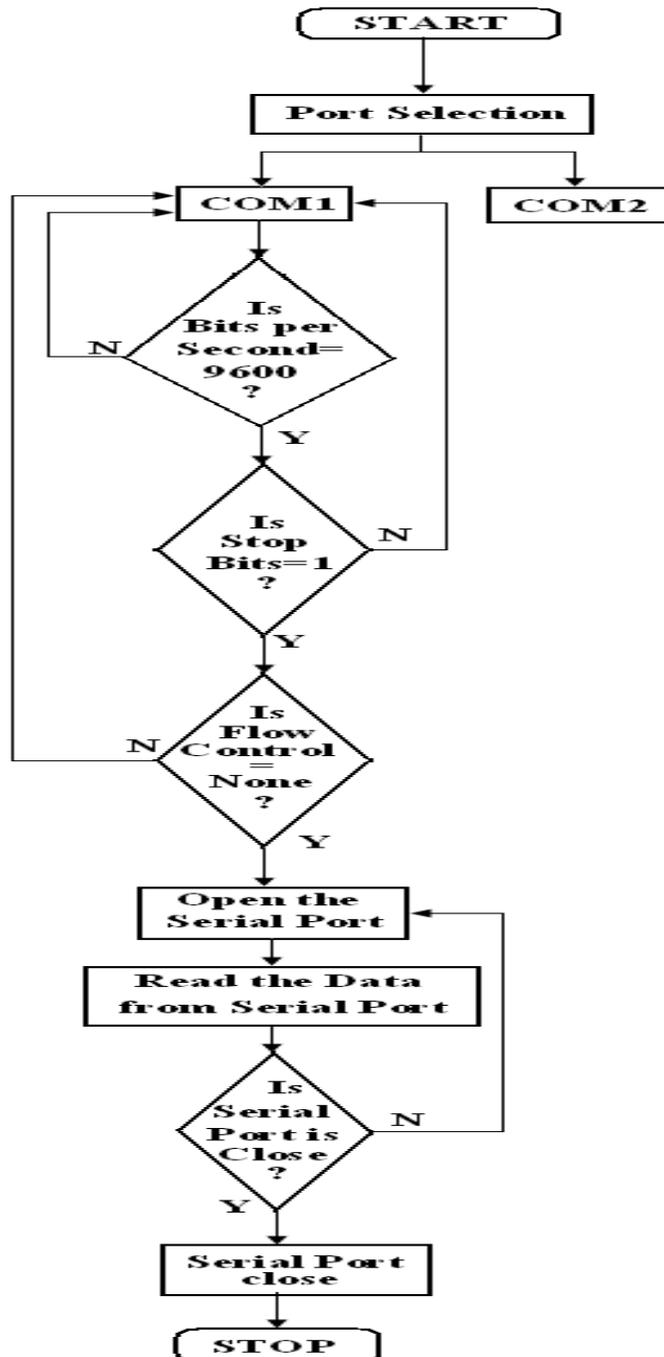


Figure 4: Flow chart of the process of sending/receiving the data through the serial port in dot NET

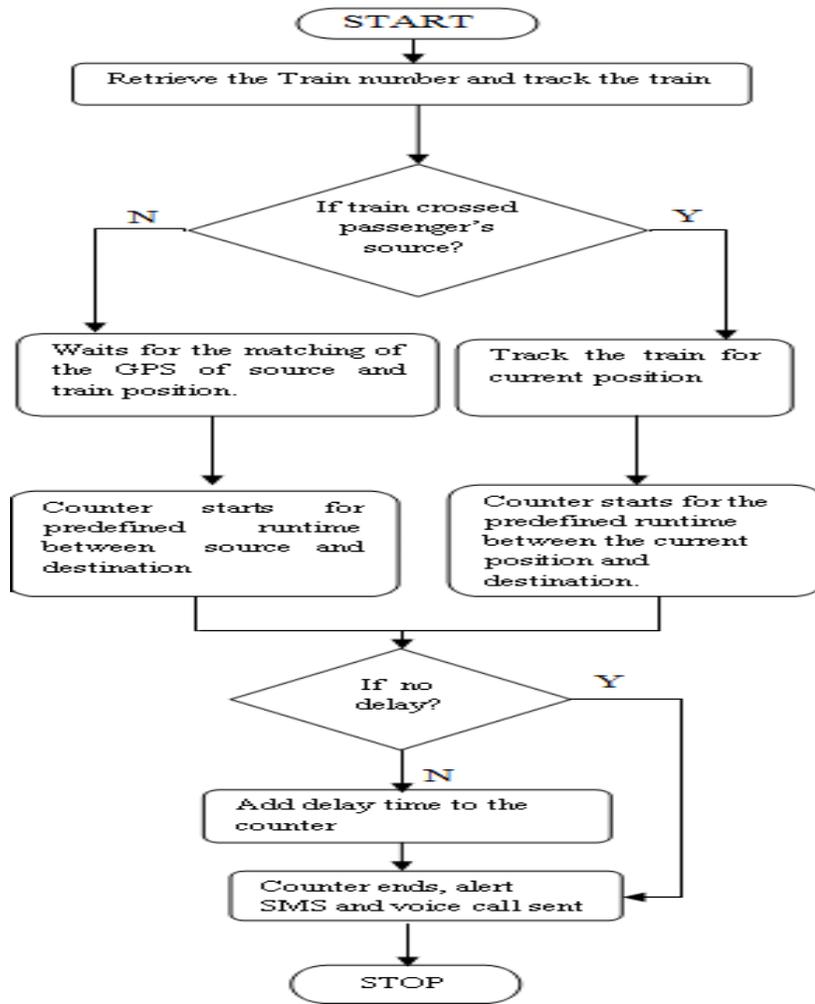


Figure 5: Flow chart for the complete module

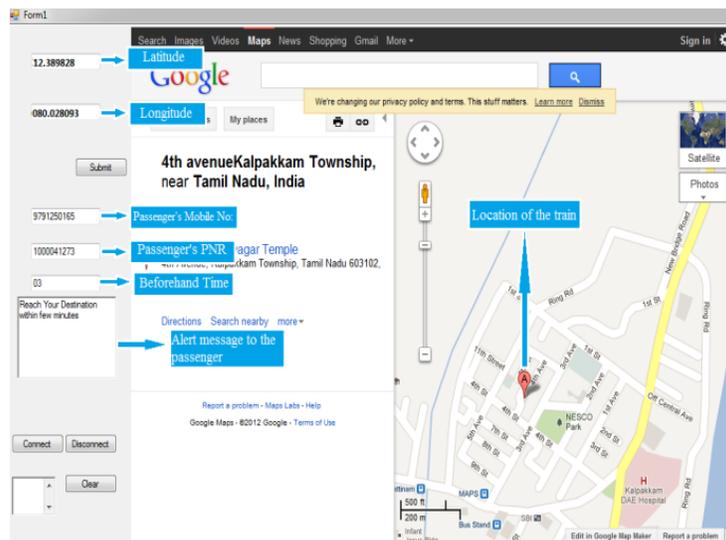


Figure 6: Output of In-Train module and Server module

4. Conclusion

In this paper, the design and development of low cost Personal Destination Predictor by interfacing the GPS and GSM is described. The system comprises of various modules which are wirelessly linked with GSM modems. Cost effective SMS service and voice calling of GSM network is used for alerting of the passenger who travels in the long distance train about their destination beforehand. This service provides both the passenger as well as the person who has to pick up the passenger to know his destination time even in case of any delay. Therefore this service vanishes the need of waiting for the train to arrive its destination in very much advance.

5. Future Enhancement

This service can be enhanced by further providing the current location of the passenger in the train when request through a SMS. By this even the passenger can know his present location with a simple SMS. Also amplifiers to enhance the signal strength of the mobile phone of the passengers can be used in trains to get uninterrupted alert at correct time.

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