Real Time Tracking and Monitoring System for Train

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Abstract

Late arrival of the passenger trains has become a routine matter making annoyed commutators switch to other means of transportation. Due to unscheduled timing in these trains, where either a train does not leave a station at fixed time or it stops at undesired station which wastes the time and money of passengers. This work is aimed to design real time system that is used to track monitor the speed, location unauthorized stops of train to update the status of train locations and timings to headquarter. We will establish methodology to interface arduino board, GSM/GPRS and GPS modules. GPS receiver module is interfaced with GSM/GPRS module to give data and provide exact information of train locations to railway headquarter station. PIR sensor is used to detect the movement of driver; if motion is not detected in each five minutes, then the system will send message to headquarter. This work can be provided as a premium service to passengers and provides a low-cost solution and has real-time capability, emerges by putting modern information technologies together and be able to form a real time accurate, effective comprehensive transportation system.

Keywords—GSM/GPRS; GPS module; location; PIR; arduino

I. INTRODUCTION

Railway transport is a safe land transport system when compared to other forms of transport. Railway transport is capable of high levels of passenger and cargo utilization and energy efficiency. The time of passengers are wasted by waiting for the next arrival of train, indirect routes to their destination, stopping for passengers with other destinations, and often confusing or inconsistent schedules. The major issue facing by passengers is delay in timing of trains which not only wastes the time but also money of passengers and government of Pakistan. To avoid time wastage, accidents by unresponsive behavior of drivers and allow better conveniences to passengers the communication between train and central control headquarters are being established. Nowadays, technology expanding at fast speed, automated automobile tracking system is being worked in a variety of ways to track and display locations in real-time. [1] GSM and SMS technology are widely used for wireless data transmission. The GSM network provides a use location information [2,3]. Application of short message service (SMS) has turned out to be popular because it does not require much cost. It is an appropriate and available way of transferring and receiving data with high reliability [4]. In this paper, we have proposed real time system which is used to track & monitor the speed, location & unauthorized   stops of train to update the status of train locations and timings to headquarter. This project combined hardware and software to make possible solution.

II. RELATED WORK

A. Existing System

The existing systems of trains in Pakistan are based on old signpost and most tracks are accompanied by a signalling system. The location of the train is informed manually through telephone and RF communication. There is no any other way to know about the arrival of train. And people contact the station master. Proposed system can help and guarantee the good quality of service and check and balance without any delay of time.

B. Literature Review

Researchers have proposed different implementation techniques for existing system. In authors designed a scheme to prevent accident between trains through the microcontroller. This research indicates that if the train moves in an incorrect path, the signal give the direction it in the proper way. If the internet packet addresses are mismatched it will alarm the driver by using a buzzer to break the train manually as well as automatically by using sensors [5]. The authors proposed tracking each train by which individually monitored and passing necessary messages to the trains during emergency situations of collision occurrence. The authors [6] proposed a system that focus in-house parameters such as temperature and humidity in each coach can be monitored in real time. The sensors collected the information of firefighting, alarming, and automatic water sprinkler and ended more rapidly relevant system. In [7] described a system to avoids the collision in an efficient way by alert the status of two trains in the same track when they are separated by three kilo meters. This is done by warning the driver both visually and by giving a sound alert.

III. PROPOSED WORK

The first part is to track the train which is achieved when GPS receiver module outputs the positioning information continuously in form of string. Arduino extract the required data from string then sends data to GSM/GPRS. This information is called latitude and longitude. The web server stores the incoming positional data in a database. An html page is created, which serves up as a tracking page. Then it merges information into google maps which displays the position on a map. The maps updated at the same frequency, a real time GPS tracking effect is achieved.

When train stopped at location then a text message is sent to headquarter station showing latitude and longitude information. Now headquarter person will go to see which location is it just manually enter the latitude and longitude information in google maps. Once he finds the exact location name then he will check the location of train station through railway maps if he checks the available train stopped at their selected station then it is authorized stop. But if he finds the available train is not stopped at right station then it is unauthorized stop.

A. Implementation Details

The development of this project is based on hardware and software design techniques are needed. Figure 1 shows the schematic diagram of system hardware.
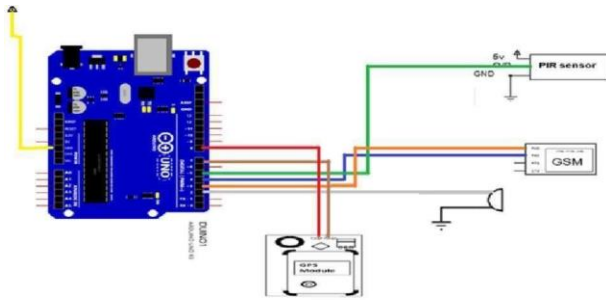
Fig. 1. Schematic diagram of designed hardware

Fig. 2. Arduino UNO R3

1)   Arduino Microcontroller: The Atmega328 based arduino UNO R3 microcontroller is used as the brain to control the train tracking system.

2)   GPS Receiver: This receiver combines a high level of integration capability with flexible connectivity options in a small package. The GPS NEO-6M/7M The Global Positioning System in vehicle tracking systems is commonly used to provide users with information such as the location coordinates, speed, time, and so on, anywhere on earth.

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Fig. 3. GPS Receiver

Fig. 4. GSM SIM900A

3)   GSM/GPRS Module: The SIM900A delivers GSM/GPRS 900/1800MHz performance for voice, sms and data in a small factor and with low power consumption. This is an ultr a-compact and reliable wireless module. The GSM/GPRS module is responsible of establishing connections between a device and a remote server for transmitting the train's location information, using TCP/IP connection through the GSM/GPRS network.

4)   PIR SENSOR (HC-SR501): A passive infrared sensor (PIR sensor) is an electronic sensor that measures infrared light radiating from objects in its field of view.
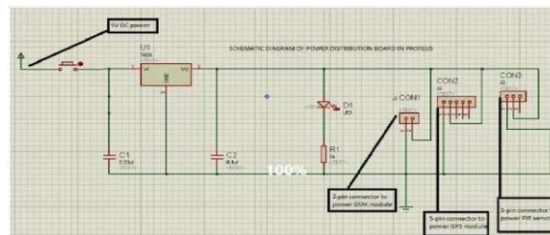

Fig. 5. HC-SR501 PIR Sensor

Fig. 6. Schematic diagram of power distribution board

5)   Power Section: 9V DC input supply is required to the power distribution board and arduino separately. The best way to ensure accurate +5V volts is to use a 7805-voltage regulator. Here we

connected 2 batteries of 4.5 volts in series to make potential difference of 9 volts to drive power to the board. We provided exclusively 5V power to the arduino board. PIR sensor, GSM and buzzer proceeds power from the power distribution board but the arduino needs separate power. Although we can drive power for GSM and other components from arduino board. 9 volts are applied at its input and it provides 5 volts at its output. But here you cannot power the GSM module from the arduino, as it is incapable of supplying the necessary peak currents. The Sim900 draws about 2A every so often. It's not necessary to build a 2A supply, as a large storage capacitor on the power supply output will supply the current.

6)   Working Mechanism: The whole circuit operation controlled through the arduino board. When GPS receiver module accepts the positioning information and sends that information at receiving pin to arduino board. Arduino board reads data given by GPS receiver from its serial pin, this is raw data and needs processing before it can be understood. The GPS data is calibrated by controller to provide longitude and latitude. This data along with code format is passed on to sim900 which pushes data to webpage using GPRS interface. By using google maps insert site into an external website, on to which site specific data can be overlaid. The tracking page displays the position information to central headquarters. The controller can also be re-programmed by serial-port programming. During this process, the GSM module sends three messages to headquarter mobile phone. First, it sends message when we turn on the hardware. And very first location of train is displayed on webpage and on a mobile phone. Second message it sends to mobile phone when motion of driver is not detected during moving train and last message when train stopped at location and train speed comes to zero.
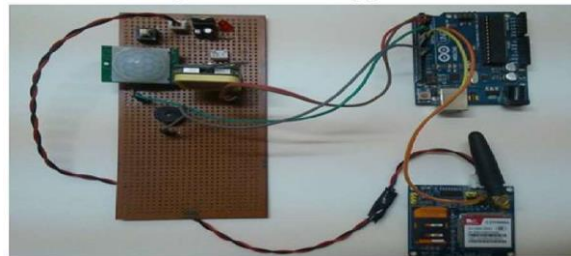

Fig. 7. Hardware Design

7)   Software Implementation

The proposed system has development tools for arduino programs may be written in a programming language with a compiler that produces binary machine code.

i.   Algorithm-

            Step 1: Start the process

            Step 2: Initialize power is supplied to GSM/GPRS and GPS modules.

            Step 3: "System is on wait for GPS co-ordinates" message sent to Control Room from Mobile Phone.

            Step 4: To send GPS co-ordinates to mobile phone and webserver

            Step 5: If speed is greater than zero then send sms to Headquarter. And when the speed of train is zero (means train is in rest position).

            Step 6: If motion detects then send updates to webserver.

            Step 7: When motion of driver is not detected during train then send message to headquarter and buzzer will be on.
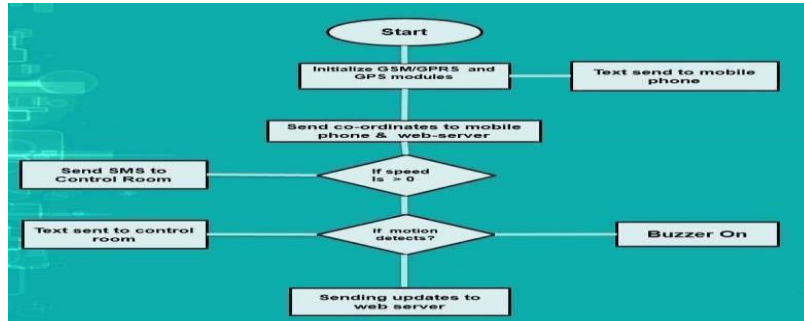
ii.   Flowchart-

Fig. 8. Flowchart of Designed System

IV.   EXPERIMENTAL RESULT

1)   It was time to test real hardware. A number of test experiments were also performed for the adjustments of the hardware operations and performance. We have achieved results according to design requirements.

2)   The GPS module receives geographic coordinates from satellites.The coordinates from sateittes.The train's location information is read from the GPS module by the arduino board. The location information are transmitted to the webserver through GSM/GPRS. The GSM/GPRS module is used for TCP/IP communication.

Fig. 9. Location of Electronic Department, QUEST, Nawabshah

Fig. 10. Received Mobile Phone Message

TABLE 1. A REAL LOCATION

Time	Latitude	Longitude	Status
12:38 P.M	……….	………….	1stSmS Received: "System is ON, Wait for GPS Coordinates" on mobile phone
12:43 P.M	26.235229	68.88778	2ndSmS Received: Latitude and Longitude information on mobile phone.
12:44 P.M	26.235229	68.88778	Status Information on Webpage

V. CONCLUSION

Although GPS tracking is not very new technology but becoming increasingly important and more secured than other system. This project highlights the improvements in public transportation. The design and development of a low-cost transportation management system based on integration of GPS and GSM modules which linked with arduino board. This system can be provided as a premium service to passengers and therefore vanished necessary stops of trains at unauthorized stations or don't need to wait for trains at stations and thus saving a lot of time.

It is completely integrated system so that once it is implemented in all trains, then it is possible to track anytime from anywhere and our project enhances when GPS coordinates of a train displays on a dedicated webpage. Furthermore, motion detection circuit is placed in train 's driver portion, when train is on running track and his motion is not detected then the system will send alert message showing "no movement detected from driver" to headquarter station and this feature will greatly deal to reduce the train accidents occurred due to careless behaviors of drivers. Not only that, the system can be scaled further to display more information about the train by adding various sensors.

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