

Intelligent Bus Tracking and Implementation in FPGA

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Abstract
Traditional methods of operating and monitoring systems for vehicle tracking are a difficult task and are inefficient. This usually leads to missed or late arrivals to scheduled stops, improper use of company time and resources, unsafe driving habits, lack of adherence to assigned routes, inefficient dispatching, passenger's dissatisfaction and low quality of service. Real time tracking is becoming more and more popular as devices utilizing the Global Positioning System (GPS) become more readily available. The proposed work is an attempt to design a tracking unit that uses the global positioning system to determine the precise location of an object, person or other asset to which it is attached. Using GSM technology, the exact position of the vehicle can be sent to the control station. This could be used as a useful innovation in traffic surveillance.
Keywords: Vehicle tracking, Global System for Mobile (GSM), Global Positioning System (GPS), Field Programmable Gate Array (FPGA).

I. INTRODUCTION

Nowadays vehicle (BUS) is very important mode of transport to move from one place to other place**.** The use of GSM and GPS technologies [2] allows the system to track buses and provides the most up-to-date information about ongoing trips. This includes various features like ingenuity, simplicity of design and easy implementation. It is completely integrated so that once it is implemented in all vehicles, then it is easy to track vehicle any time [1]. The system has an "On Board Module" which resides in the vehicle to be tracked. The
On-Board module consists of GPS receiver, a GSM modem and FPGA. It can provide tele-monitoring and management system for inter-cities transportation vehicles such as taxis and buses [2]. The objective is

- To track buses in fixed intervals of time, transmit and extract the information using software. The obtained results/locations are displayed in Google Maps.
- To detect collision/accidents and transmit the information.
- To provide information like delays due to traffic and technical faults.
- To provide passenger count using sensors.

II. RELATED WORKS

For the efficient bus transportation many works have been done. In earlier proposals, zigbee is used as a communication medium. This gives the information about the bus which will arrive to their bus stops. The main disadvantage of the work is that it is not applicable in cities because zigbee communication covers very short distance and if there is any hurdle, the signal does not reach the destination. In some other system, GPRS is used as communication medium. But using GPRS is not possible in all the bus and if so then the costing will be high. In other existing systems using GSM-GPS, the position of the bus in the form of coordinates are received as sms in cellular mobile phones [3]. The disadvantage of this method is that there is no proper means for interpretation of the coordinates.

III. PROPOSED METHOD

The hardware architecture of the proposed method consists of two sections: transmitter and receiver. The transmitter section will be in the bus while the receiver section in the control section which monitors the bus tracking.

IV. TRANSMITTER SECTION

The transmitter section consists of IR transmitter and receiver, sensors, FPGA, LCD display, keypad, GPS and GSM modem. FPGA forms the heart of the tracking unit. Spartan 3E FPGA is used here. The program for FPGA is stored in the PROM. It controls the other devices connected to it. (Fig.1)The LCD displays the commands and results to the driver. Driver could feed data into the transmitter using a keypad.

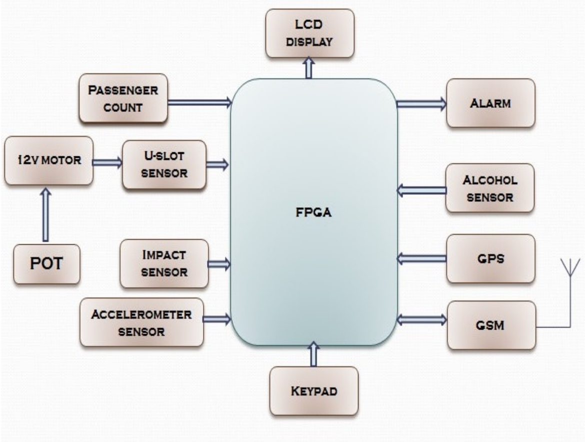

Fig.1 Transmitter Block Diagram

a) **SENSORS** and **FPGA**

In case, the driver is drunk, the alcohol sensor senses it, the amplified voltage is sent to the FPGA that triggers the alarm. ADXL3XX is used for this. The +12 V Tape motor forms the miniature of the engine. It is used for measuring the speed. In the case of alcohol sensing, it stops the engine. The IR transmitter- receiver section counts the number of passengers present in the bus, sends the signal after giving to Signal Conditioning Unit to the FPGA. If the bus is met with an accident, the accelerometer sensor gives the command to the FPGA [6], thereto the control station. Impact sensor/ crash sensor measure how quickly the bus slows down in a frontal crash or accelerates to the side in a side- impact crash. The control station does the necessary precautions after receiving them.

b) **GPS MODULE**

The GPS receiver of vehicle terminal receives and resolves the navigation message broadcasted by GPS position satellites, computes the longitude and latitude of vehicle coordinates, transforms it into the GSM message form by GSM communication controller, and sends the message to monitoring center via the GSM network. The hardware interfaces for GPS units are designed to meet NMEA requirements. The GPS receiver provides data in NMEA 0183format with a 1Hz update rate.

c) **GSM MODULE**

A GSM modem is a specialized type of modem which accepts a SIM card, and operates over a subscription to a mobile operator, just like a mobile phone. The core of data communication about this system lies in wireless communication control terminals that uses GSM Modules to transfer long-distance data extensively and reliably. It supports instructions of AT commands [4] [5].

V. **RECEIVER SECTION**

The receiver section consists of a GSM modem, RS232 interface and a personal computer. The GSM modem receives the coordinates sent by the GSM module at the transmitter (Fig.2) Latitude as well as longitude for the current position of the bus is received. The RS232 interfaces the module to the PC. Data are sent serially.

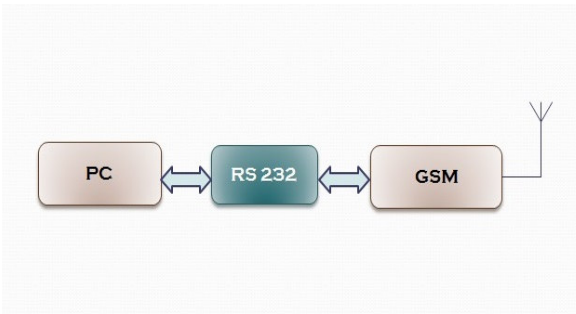

Fig.2 Receiver Block Diagram

a) **GRAPHICAL USER INTERFACE**

The GUI for the PC is written in Visual Basic. This front end unit displays the latitude, longitude and the mobile number. This is updated in intervals as the bus changes the position. An effective tracking unit is achieved by displaying the position on Google maps corresponding to the coordinates. This makes the interpretation of data easier.

VI. FLOW GRAPH

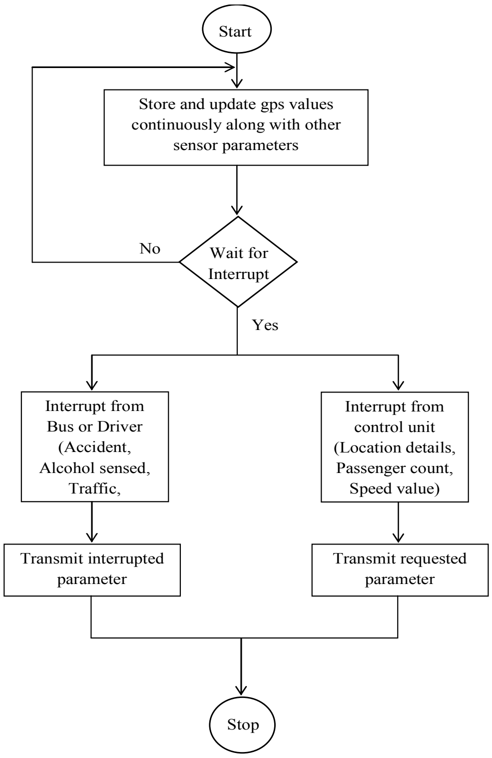

Fig.3 shows the flow graph of the tracking unit.

The VHDL program will be coded in a way to store and update GPS coordinates once when the transmitter is switched ON. The sensors will be monitored continuously. The program can be interrupted by two actions. First, Sensor output value. Second, Request from control station. FPGA identifies the interrupt and transmits the interrupted or requested parameter to the control station.(Fig.3)

VII. OUTPUT AND RESULTS

Initially, the sensor output values were transmitted via GSM modem to a pre-programmed mobile number upon a key press in a 5 switch keypad. Each key had a specific function. (Fig.4)

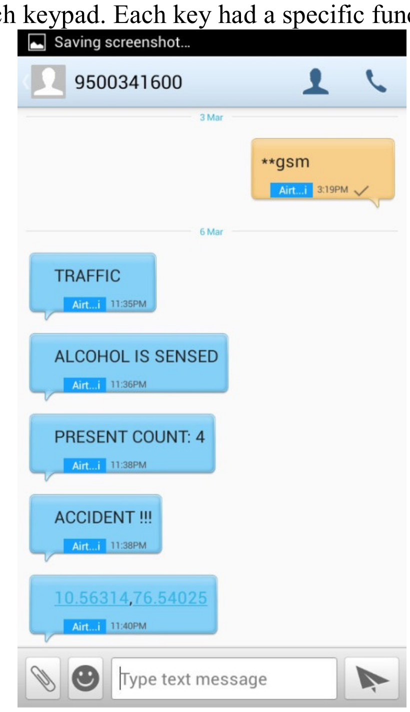

Fig.4 The snapshot of received messages from the transmitter unit.

Next, A GUI(Graphical User Interface) was created in PC using Visual Basic 6.0. The user can request for the present location of the vehicle via a SMS (Fig.5) and the transmitter unit in vehicle will acknowledge with GPS Coordinates which is plotted in Google maps by interfacing it.(Fig.6)

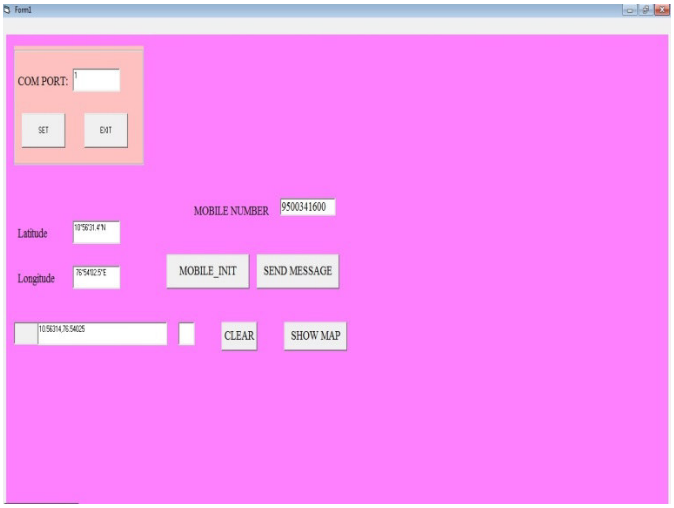

Fig.5 First GUI window for COM port and GSM modem initialization and showing Received coordinates

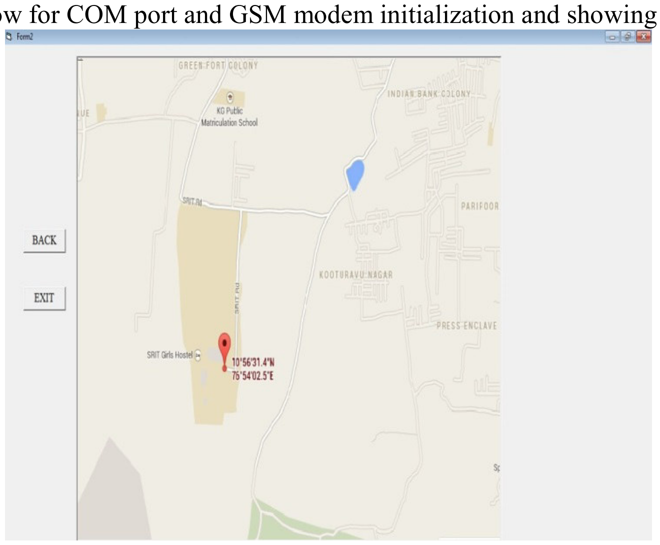

Fig.6 Second GUI window showing plotted location in Google map

VIII. FUTURE WORK

The proposed version is a miniature of control unit setup with one test vehicle having the transmitter unit setup. Interrupts will occur with the sensing of alcohol consumption or accident or receiving of message from control unit. The location of the bus in terms of latitude and longitudinal values, Speed of the bus, Number of passenger count can be transmitted upon request. Also, It describes the nature of the accident with amount of impact and position of the bus like whether it is in normal position or upside down.

This project can also be enhanced in future by modifying the program in a view to prevent accidents as a primary concern. In many accidents, Rash driving is considered as one of the major reasons. So, if we could modify the program so as to monitor the speed of the vehicle and warn the control unit in case abnormal driving, necessary actions can be taken on the driver.

This project can be used to prevent vehicle theft. In case of any theft, the owner can find the location of the vehicle. With some additional equipment installed, the owner can control the car remotely like braking, shutting down the engine etc. For companies, the code can be modified to make their vehicles transmit its location values periodically, so that the company can monitor the behavior of the vehicle like its travel route, average speed, halting locations etc.

In public transportation system, the implementation of this equipment will ease people. When public transport systems like bus, trains are installed with this equipment, people can know the location and arrive at stop in time. Creating a database for all buses or trains reaching at a particular station will help the passengers to check for available buses/trains, seat availability, journey distance and approximate travel time.

IX. CONCLUSION

Tracking system is becoming increasingly important in large cities and it is more secured than other systems. It is completely integrated so that once it is implemented in all vehicles, then it is possible to track anytime from anywhere. It has real-time capability, emerges in order to strengthen the relations among people, vehicle and road by putting modern information technologies together and able to forms a real time accurate, effective comprehensive transportation system. This system has many advantages such as large capability, wide areas range, low operation costs, effective, Strong expandability and Easy to use in vehicle traffic administration. Upgrading this setup is very easy which makes it open to future a requirement which also makes it more efficient.

Thus we can make use of the available technology to the benefit of the people by saving the lives of the people and helping the owners of the vehicle to keep track of their vehicles.

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