Passenger Destination Alert and Safety Assistance System

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Abstract— The objective of this system is to develop an Intelligent Real-time Interactive Information System for remote monitoring of the route followed by the vehicle, for alerting passengers during the journey about their destinations through messages, alerting the transport staff through messages in case of any emergency, providing the position of vehicle to the passengers when requested and which system interacts with the central transport system to provide the possible help to the passengers in case of theft or health issues during the journey according to the passenger's information with the help of GPS devices, GSM communication and Wi-Fi router. The advantage of this system is that it overcomes the disadvantages of wired and wireless constraints. Those constrain are such as complicated wiring for constructing the system, difficult maintenance for distance monitoring and controlling the applications. This system will have an embedded system which consists of ARM7 architecture based microcontroller with real time operating system, GPS device, GSM modem, Wi-Fi Router and control devices which monitors the path followed by the vehicle, provides destination alerts to the passengers and assist about the passengers safety during the journey.

Key words: ARM7 Architecture Controller, GPS Receiver, GSM Modem, Wi-Fi Router, SMS, Term UDP

I. INTRODUCTION

The main concentration of this Passenger Destination Alert and Safety Assistance System is on public transportation especially on Railways. People who are affording self transportation would aware of their journey, they do not need to depend on the other passengers destinations. In public transportation like railways there will be number of passengers and number of destinations, if we take one particular route of the journey there are number of passengers and different destinations for passengers in same route of the journey, so passengers should aware of their destinations throughout the journey. The people who are using the railways as their main transportation facing some problems like missing their destinations or stop due to lake of pre notification system about the passengers destinations more frequently in odd timings. Passengers who are travelling the long distances, if they face any emergency situations like health problem, there is no service to intimate their emergency situation to the corresponding staff and if they face any security issue like robbery or life threatening, there is no service to intimate the situation to the security staff.

In order to alert such passengers who are facing the problem like missing the destinations, lake of service for intimating emergency condition or security issue which are faced by the passengers and getting the required safety assistance from the corresponding staff in train journeys, a real time passengers destination alerting and safety assistance system is designed and developed in this project. This project has mainly two sections; one is passenger destination alerting part by sending SMS alert to passenger when destination is approaching, for this service GPS receiver, GSM Modem and destination finding algorithms are required. Second section is passenger safety assistance system which includes Wi-Fi router and GSM modem, whenever passenger is facing health problem or security problem an alert can be transmitted from mobile application through Wi-Fi network which is provided by this system. These two systems are handled by one microcontroller which has corresponding handling algorithms.

II. PDSA SYSTEM ARCHITECTURE

The objectives of this project are:

- First objective is to alert the passengers. Mobile is the best thing to the best way of communication. SMS is the best service for alerting the passenger because SMS service supports any mobile and service provider and it is cost effective.
- Second objective is providing a facility for passengers to intimate any emergency conditions to authorities thorough Wi-Fi network provided by the PDSA system from a mobile application during journey. Wi-Fi network will be free and passengers no need to pay for seeking the help.

Below figure shows the implementation block diagram of "Passenger Destination Alert and Safety Assistance System"

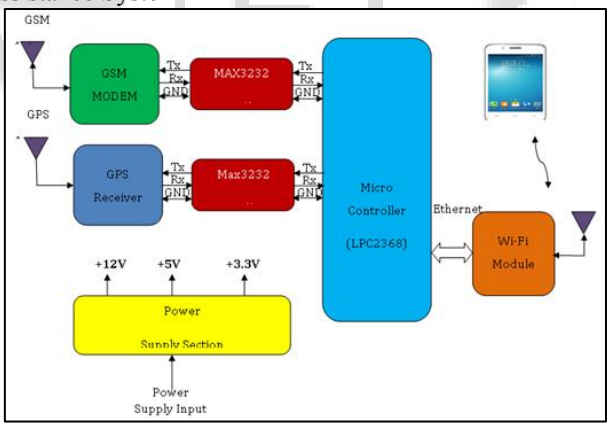

Fig. 1: Block diagram of PDSA system

The block diagram consists of a Microcontroller Unit (ARM7-LPC2368), GPS Receiver, GSM Modem, Level Converter (MAX3232), Power supply and a Wi-Fi module.

A. Microcontroller (LPC2368)

The Micro controller is ARM architecture based general purpose 32-bit micro controller. It offers high performance with high speed operations. This is the heart of the complete system. It is actually responsible for all the process being executed. It will monitor & control all the peripheral devices or components connected in the system. In short we can say that the complete intelligence of the project resides in the software code embedded in the ARM7 microcontroller. The code will be written in Embedded C and will be burned or programmed into the code memory using a programmer.

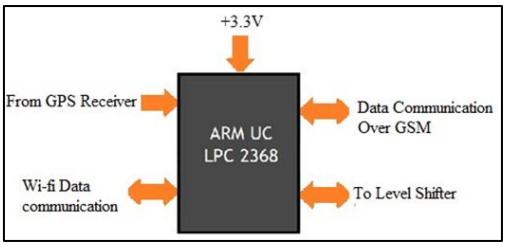

Fig. 2: Microcontroller and Interfaces

B. GPS Receiver (LEA-6)

The LEA-6 module series contains u-blox 6 positioning engine for stand-alone GPS receivers featuring the high performance. It achieves a Time to first fix in less than 1 second. It has tracking and navigation sensitive level at -162dBm and maximum navigation update rate of 5Hz. It supports horizontal position accuracy of 2.5meters and velocity accuracy of 0.1meters/Sec. It supports different types of interfaces to communicate with Host controller, in this system it is interfaced with controller through a serial interface. It supports all types of GPS frames, In PDSA system GPRMC frame is used for location identification.

Fig. 3: GPS receiver Module

C. GSM Module (SIM900)

The SIM900 is a GSM/GPRS Modem which can support quad bands 850/900/1800/1900MHz. It supports many services like Voice, SMS, Data and Fax with high performance by consuming low power. It provides voice service with Half Rate, Full Rate and Enhanced Full rate. It can be configured and communicate with AT cellular Command Interface. It has SPI and serial interface supports different types of baud rates to communicate with host controller. In PDSA system it will be interfaced with host controller through serial interface and configured using AT commands. It will be used for sending SMS to the passengers whenever required.

D. Level Converter (MAX3232)

The MAX3232 is a TTL/CMOS to TIA/EIA-232-F standard level converter and vice versa, TTL levels are supported by the microcontroller and RS-232 levels are supported by the other modules which are interfaced with microcontroller. It has dual driver and receiver that include a capacitive voltage generator to supply Recommendation V.28 TIA/EIA-232-F voltage levels from a single 5-V supply. Each receiver converts TIA/EIA-232-F inputs 1.0-µF Charge-Pump Capacitors to 5-V TTL/CMOS levels. These receivers have a typical threshold of 1.3 V, a typical hysteresis of 0.5 V, and can accept ±30-V inputs.

E. WI-FI Module (VM300)

VM300 Wi-Fi Module is 802.11b/g/n standard support Wi-Fi router operates in 2.4GHz frequency which supports AP client and AP station modes. It can support 300Mbps transmission rate over 1-14 Wi-Fi channels. It has built in Web configuration service to configure the parameters through web. Micro controller in the PDSA system communicates with Wi-Fi module through Ethernet wired interface.

Wi-Fi Module provides a Wi-Fi network which can provide communication with PDSA system to intimate the emergency situation which is faced by passenger then corresponding on-board transport staff will be alerted.


Fig. 4: Wi-Fi module

III. PDSA SYSTEM ALGORITHM

Algorithm for the "Passenger Destination Alert and Safety Assistance System".as follows

A. Algorithm for Destination Alert System

1) Step 1: All passenger's destinations, mobile numbers and corresponding route plan or route details are stored in the PDSA system which information is collected while passengers are booking the ticket.
2) Step 2: Once the journey is started, pre-defined longitude, latitude co ordinations of the current train running route are retrieved from the database for comparing with real time received data. GPS receiver starts receiving the GPS data and transmitted to Micro controller through serial communication.
3) Step 3: Then Micro controller extracts the longitude and latitude co ordinations from the packet and calculates the distance between the current position of the train and next station with pre-defined longitude and latitude of next station.
4) Step 4: Micro controller continuously checks the all passenger's destinations with coming station. If any passenger's destination is matched with coming station then micro controller makes a list of all passengers whose destination is coming station.
5) Step 5: After short listing the passengers, Microcontroller search for their corresponding mobile numbers from the data base.
6) Step 6: When station is approaching microcontroller frames destination alert message and sends the destination alert SMS to corresponding passenger using GSM Modem through serial Communication.
7) Step 7: Passenger will receive the SMS alert from the Passenger alert system.

B. Algorithm for Passenger safety assistance System

– Step 1: Micro controller initializes the Wi-Fi Module through Ethernet Interface.

- Step 2: Wi-Fi Module creates a Wi-Fi network which can be accessible to passenger's mobiles.
- Step 3: Passenger will have a mobile application which is used to intimate the emergency situation that has been facing.
- Step 4: Whenever passenger is facing the health problem, passenger presses the Health button in mobile application then mobile application automatically sends corresponding message with passenger mobile number to microcontroller though Wi-Fi network.
- Step 5: Micro controller reads the message finds passenger's coach and berth number using mobile number in the received message from the passenger mobile application.
- Step 6: Microcontroller frames a message with passenger Coach and Berth number and sends it to TTE or to the corresponding staff's mobile number through Wi-Fi network for in mobile application or sends a SMS through GSM Modem.
- Step 7: Whenever passenger is facing the security issue, passenger presses the Security issue in mobile application then mobile application automatically sends corresponding message with passenger mobile number to microcontroller though Wi-Fi network.
- Step 8: Micro controller reads the message finds passenger's coach and berth number using mobile number in the received message from the passenger mobile application.
- Step 9: Microcontroller frames a message with passenger Coach and Berth number and sends it to TTE or to the corresponding staff's mobile number through Wi-Fi network for in mobile application or sends a SMS through GSM Modem.

IV. SOFTWARE REQUIREMENT

A. CAD Star

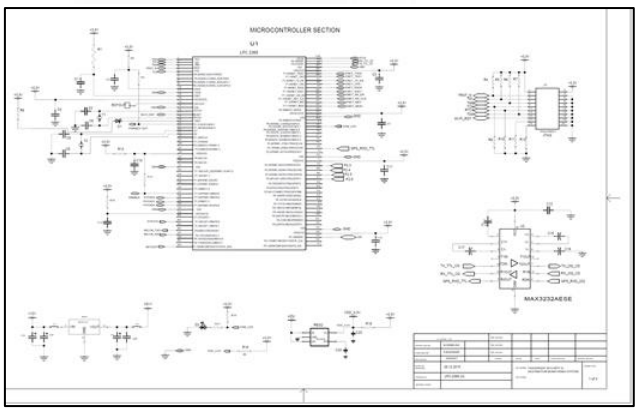

Fig. 5: Schematic design in CADSTAR

CADSTAR is a powerful tool for the schematic diagrams and Printed Circuit Boards designing. It provides a tool for simple or complex schematic designing and multi-layer PCB designing. It supports all the technologies required for total electronic development process in a single environment. It is equipped with over 200,000 components in its libraries. Components in the libraries provide board- level schematic design, PCB layout design, design analysis, creating manufacturing output. It provides design engineers needs like the flexibility to design at the symbol, part, block or sheet level for maximum speed and productivity. It has ability to create mixed hierarchical and multi-sheet schematics helps organize even the most complex designs.

Below figure shows the Schematic design of Microcontroller using CADSTAR software

B. Keil µ-vision 4 IDE

Firmware for ARM7 microcontroller in this system is developed in Keil µVision 4 IDE. It is a sophisticated IDE and Debugger/Simulator that offers numerous benefits to serious ARM embedded developers. Keil's µVision IDE toolsets provide a powerful, easy to use and easy to learn environment for developing embedded applications. They include the components you need to create, debug, and assemble your C/C++ source files, and incorporate simulation for microcontrollers and related peripherals.

The µVision Device Database automatically configures the development tools for the target microcontroller so mistakes in tool settings are practically eliminated and tool configuration time is minimized. It incorporates project manager, editor, and debugger in a single environment so quickly access all your development tools from a single environment. All configuration details are saved in the µVision project.

C. Term UDP Mobile App

Term UDP Mobile app facilitates communication between passengers and PDSA system by using Wi-Fi network. This application works on UDP protocol so it listens on given IP address and port number. It displays the data when received on the listening port and it sends the data to the given IP address on given port number when user submits the data.

V. RESULTS

Project module has been tested and generated results. The Simulation and real time testing results are mentioned below.

A. GPS data received from GPS receiver 000000000000

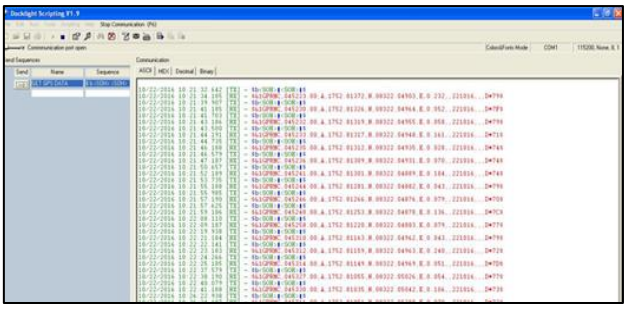

Fig. 6: GPRMCS frame

B. Passengers for the next station is listed and they are alerted with message

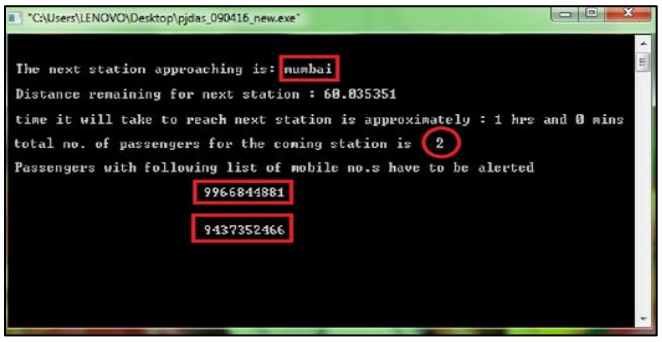

Fig. 7: Passengers list identification

C. Getting destination alert in passenger mobile

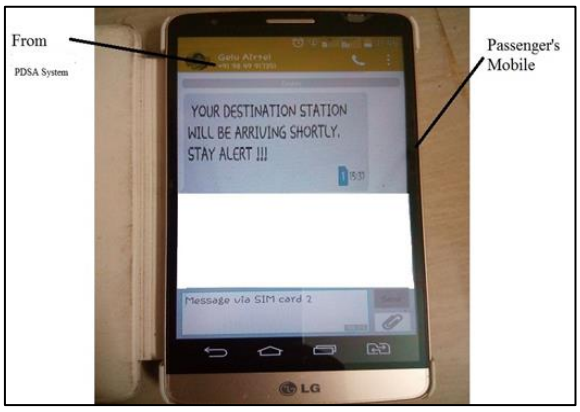

Fig. 8: Passenger mobile

D. TTE receiving about passenger's Health problem request over Wi-Fi

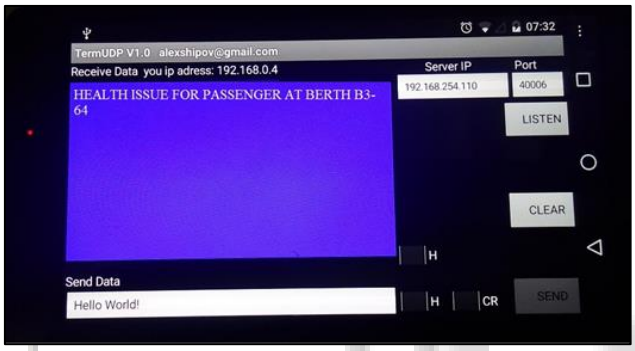

Fig. 9: Term UDP application

VI. CONCLUSION

Passenger being alerted when their destination is approaching so missing the destination station will be avoided and lake of emergency assistance can now be overcome by implementation of Passenger Destination Alert and safety assistance system within the train. Passengers can be alerted before reaching their destinations and they can intimate the emergency issues which they are facing during journey to the corresponding on board staff and will get required safety assistance.

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