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An Intelligent Location Tracker for Public Transport

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***Abstract*—Public transportation system has a greater impact on economic development of the country. The major problems experienced by the passengers using public transport are undue waiting time at bus stops, uncertainty about the bus arrival, lack of information about the bus timings, etc. If people travelling by bus get the location of bus and the passenger count inside the bus, it will increase the trustworthiness in the public transport and helps the passengers to plan their travel accordingly. Proposed is a solution, targeted to provide a safe and efficient transport. This solution allows a better tracking of the bus and avoids the uncertainties in knowing the current status of the bus. A user friendly mobile application is developed which displays the details of the selected bus from the IoT cloud. An emergency panic button is also provided inside the bus, the status of which will be updated to the cloud.**

***Index Terms*—Transportation, GPS, Tracking, Location, IoT, MIT App Inventor**

I. Introduction

An efficient transportation system should provide effective movement of goods and people which leads to better quality of life and better social and economic growth of the society. With the population boom, vehicle population is also rapidly increasing which further leads to heavy traffic. Optimal solution to this problem is the use of public transport which plays a major role in every aspect of life. Tracking, monitoring, scheduling and alert services are the major challenges faced by the public transport system. In daily operation of a bus system, the movement of buses is affected by unknown conditions such as dispatching buses at irregular time intervals from the depo or traffic. At the bus stop, people have to wait for long time without knowing the arrival time of the bus or the no of passengers in it. If the arrival time of a particular bus at a particular destination is known, they can plan their journey accordingly even from their homes, else they need to think of some other modes of transport to reach their destination. If the availability of buses and no of passengers inside the bus is known, it leads to an effective solution for most of the issues faced by the public transport system.

The proposed system will be a great advantage for the public transport sector. Being a developing nation, common people depends mainly on public transport. By introducing the proposed system, we can assure the safe and efficient travel of common people. Various features included in this supervision can be extended to various transport sectors like health care, educational transport system and taxis. As a part of safety measure, a panic button is provided in our system which can instantly alert the authorities and immediate action can be taken. The current running status of the bus will also be displayed in the mobile application. In case of emergency, this information can help the public to take alternate measures. As public transport becomes more efficient, it will gain the trust of common people, so that dependency on private vehicles can be reduced which in turn will reduce the environmental pollution. This solution will have a great impact on the economic development of our country.

II. Literature Survey

Real time tracking experience can be provided with public transport buses having RFID tags within them. RFID readers are placed at every bus stops. Arduino is the central controller for this system. GSM module is used to send the tracking messages to the authorized persons for continuous monitoring. GPS is used to obtain the location of the bus. Bus tracking details will be notified to the users in their mobiles through IoT. The inputs from RFID readers are continuously updated to Arduino for processing the data. [1]

By integrating GPS device on the bus, current position of the bus is acquired. Coordinates of the bus are send by either GPRS service provided by GSM networks or RFID or SMS. On the tracking device, GPS device is enabled and the information is send directly to the bus stops using RF receivers or is send to centralized control unit. [3]

III. Proposed System

The features of the proposed system are:

- Location tracking of the bus.
- Passenger Count inside the bus.
- An emergency panic button which when pressed will alert the authorities.
- A user friendly mobile application that displays the current status of the selected bus.

The system contains the following components:

A. Arduino UNO

The Arduino Uno is an open-source microcontroller board which is based on the Microchip ATmega328P microcontroller. It is the heart of the system. The board consists of digital and analog input/output (I/O) pins that may be interfaced to various circuits and expansion boards. The board is programmable with the Arduino IDE (Integrated Development Environment). It can be powered by the USB cable or by an external power supply. The microcontroller features a 2 KB SRAM, 23 general purpose I/Os, three timer/counters, internal

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Fig. 1. Arduino UNO

and external interrupts, serial programmable USART, internaloscillator, etc. The device operates between 1.8-5.5 volts.

B. GPS Module

Fig. 2. GPS Module

The global positioning system (GPS) is a satellite-based navigation system. It consists of a network of 24 satellitesand provides essential information freely to civil, military and commercial users around the world. An estimate of 2D position (latitude and longitude) is obtained by the GPS receiver when locked to atleast three satellites. This information is used to track the movement of the equipment where theGPS receiver is mounted. The receiver can determine the 3D position (latitude, longitude and altitude) with four or more satellites in sight. Other information like speed, time, distance to destination, etc. can be obtained, once the vehicle position has been determined. Messages received by GPS module is in National Marine Electronics Association (NMEA) message format. GPS messages starts with the $Ḟor e.g., $ GPGGA, $ GPGSA, $ GPGSV, $ GPRMC. The GPS module is connectedto Arduino module using UART interface.

C. GSM Module

The GSM modem can be considered as a cell phone without display. It is equipped with a SIM card that operates on a subscriber's mobile number over a network. The GSM communication network consists of a mobile device, base station subsystem (BSS), the network switching subsystem (NSS) and the operation and support subsystem (OSS). A communication is established between mobile devices which are under the

Fig. 3. GSM Module

network coverage. The subscriber identity module (SIM) card provides the network with information about the mobile user. The GSM module is connected to Arduino module using UART interface.

D. IR Sensor

An infrared sensor module is an electronic device which consists of an IR transmitter and an IR receiver. IR receiver (sensor) detects the radiation from IR transmitter and convert them to electrical signals on the output pin of the module. It can be used to measure the heat of an object as well as detects the motion.

Fig. 4. IR Sensor

E. Push Button

A push button switch when pressed will close the two con- tact points momentarily and is detected by the microcontroller.

IV. Hardware Design

The proposed system provides an efficient location tracking using the GPS module. The unit is placed inside a bus andit consists of Arduino, GPS and GSM modules. The GPSwill give the exact location and co-ordinates of the Bus. Web connectivity is provided using GSM/GPRS module. The IR sensors are placed at the door and increments the number of passengers entering the bus and decrements the no of passengers exiting the bus. A push button switch is placed inside the bus which can be accessed by the passengers in case

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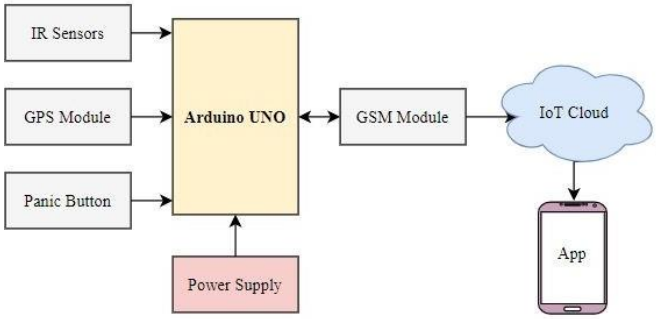

Fig. 5. Block Diagram

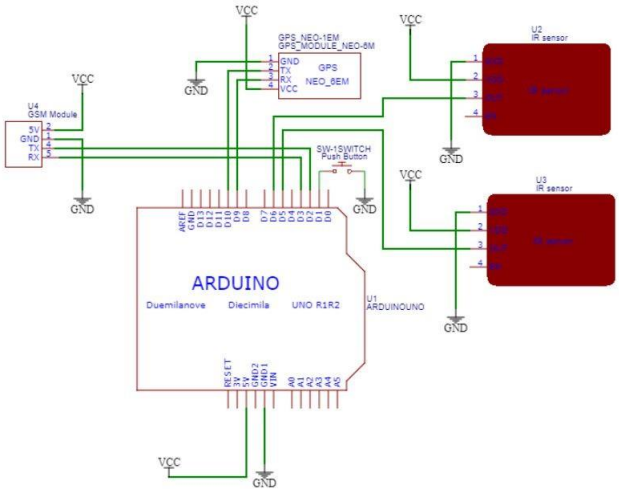

Fig. 6. Circuit Diagram

of emergency. The block diagram and the circuit diagram ofthe proposed system is shown in Fig.5 and Fig.6 respectively.

The circuit diagram shows the connection details of the different modules. Information collected by the microcontroller like location, passenger count and current running status will be updated on IoT Cloud Server. Thingspeak IoT platform is used for data storage. This information is updated in a user friendly mobile application which is integrated with google maps and the exact location is displayed. The android app also displays the passenger count and panic button status of the bus.

V. Mobile Application

The details about the bus can be known from an android based mobile app developed using MIT App inventor. MIT App Inventor is a free and open source application development IDE developed by Google and now maintained by Massachusetts Institute of Technology (MIT).It provides a graphical user interface using which application software can be developed easily for Android and iOS operating Systems. It provides a block editor that runs within a web browser and allows to drag and drop the blocks and build our application easily.

Fig. 7. App Layout

The Android based mobile application developed in this project allows the passengers to view the details like the current location, passenger count and running status of the selected bus. The running status field displays the status of thepanic button. If the button is pressed in case of an emergency, it is indicated in the app. Also a Panic alert message willbe send to the authorities with the current location and bus number, using which immediate action can be made.

Fig. 8. Select Bus Feature

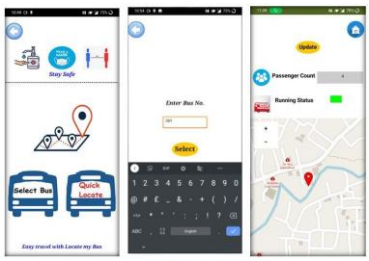

Fig. 9. Quick Locate Feature

The layout of the app is shown in the Fig.7. The applicationhas two main features which allows the users to select a bus. First feature (Select Bus) shows a list of available buses from which user can select and know its details as shown in Fig.8. The second feature (Quick Locate) allows the user to quickly

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locate a bus if its bus number is known in advance, without going through the list and thus allows a fast selection. This is shown in Fig.9.

VI. Result and Conclusion

This paper describes a system which helps the passengers to plan their travel effectively by a user friendly mobile application. The experimental set up and the unit are shown in Fig.10 and Fig.11 respectively.

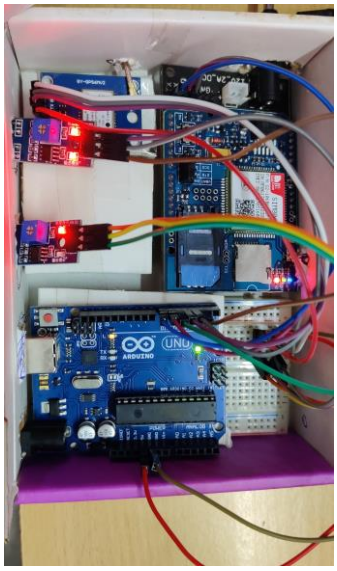

Fig. 10. Experimental Set Up

Information collected by the unit are send to the IoT cloud at regular intervals and is updated in an Android based mobile application. The application displays the location in google maps and thus allows efficient tracking of the bus. The number of passengers inside the bus and the current running status of the bus will also be displayed in the application as shown in Fig.12.

Fig. 11. Unit

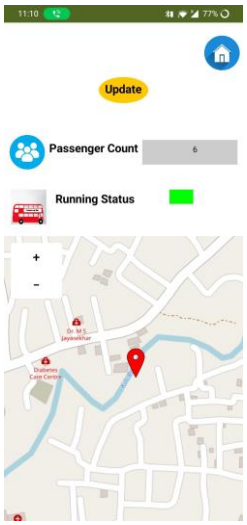

Fig. 12. Mobile Application

VII. Future Scope

The current mobile application allows the user to select a bus from a list. So our future work includes the development of a web based application for the authorities using which the list of busses and its details can be updated to the server, and from which the mobile app collects and displays the information in its GUI. Also, if the number of passengers in a particular route is greater, then more buses can be allocated for that route by the authority.

As a future scope, the efficiency and flexibility of the proposed system can be improved by adding e-ticketing facility using which the passengers can ensure their seats. For passengers without a mobile app, a display can be placed inside the bus for displaying the next stop.

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