

## Intelligent Bus Tracking System for Student Safety

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### ABSTRACT

Student safety is a primary concern in our society. Increased rates of child abduction signify the relevance of a proper mechanism to track children. The current system involves parents calling the cab driver to ensure student has boarded the bus and to know the current location. There is always an element of uncertainty regarding student whereabouts. Proposed system involves a low cost solution by allowing parents to track child location via a mobile application. The system involves allotment of a unique identification for each student using RFID (Radio Frequency based Identification system). Live tracking of the bus is enabled using GPS (Global Positioning System). Wi-Fi module is used to transfer the details over remote server from which this will be made available to parent portal. This work involves identification of students present in the bus along with tracking of bus. The mobile application allows parent's login and displays the current status of the student as well as a link to google map showing the current location of the bus.

**Keywords** - RFID ,GPS , mobile application, IOT

Date of Submission: 09-08-2018

Date of acceptance: 24-08-2018

### I. INTRODUCTION

Cases of student kidnapping and abduction is on the rise in our society. Safety of the future citizen needs to be taken into serious consideration. Most of the abduction takes place while students are not monitored and are on the way to school or on the way back home. Once inside school compound or within the home safety of children is higher. This can be attributed to security personnel at school and adult monitoring at home. The high risk zone is usually when student is in outside the safety of school or home. For working parents constraints at work might demand their presence earlier at office making it difficult for them to take the ward directly to school. This makes ensuring student presence on the boarded school bus a necessity to reduce anxiety of parents.

Usually parents keep calling the driver to check the present location of bus as well as to ensure their ward has boarded the bus. There is always an element of uncertainty involved in this process. It is always possible for the driver to mistake student for another or to give wrong information. More over inability to keep track of ward will increase the anxiety which in turn will affect the quality of work by the parent. The advancement in technology right now makes it possible to live track the location and make this information available anywhere on the planet. This becomes possible with the introduction of Internet Of Things. It allows effective communication of devices over internet enabling data acquisition, transmission as well as analysis [1].

The proposed system involves giving unique identification to the student , live tracking of the school bus and designing a parent portal that enables parents to check student status as well as location via a mobile application.

The paper is organized as follows: section II presents review of related works, section III involves overall system requirement, section IV involves system architecture and section V includes results and conclusion.

### II. LITERATURE SURVEY

RFID based identification system has been used for product monitoring purpose in industries . GPS technology is used for tracking purpose for a wide array of applications. IoT based bus tracking system using Bluetooth technology for unique identification has already been implemented [1]. The implementation strategy involves use of specific algorithm to estimate distance of student from tracker to register student on the bus. The Cubeacon based identification system is not cheap and not easily affordable by all students. This leads to the use of a RFID based identification system as an alternative. Student bus tracking usually involves sending messages to parent's mobile regarding student location as well as status [2]. This leads to spamming of the message box and often alert send to parents gets lost in the sea of messages. Effective solution to this would be a parent portal that allows parents to directly login and check ward status with no message spamming the mail box. Android

application for college bus tracking has been implemented with focus on allowing students as well as staff to check bus availability [3]. This application has no provision to allow parent to track ward. Another application which has different modes such as user mode and admin mode, to allow change in bus schedule and convey any other information has been implemented [4].

### III. SYSTEM REQUIREMENT

The proposed embedded system consists of hardware block as well as software part. The hardware components for implementation require a microcontroller, RFID reader , RFID cards, GPS module, Wi-Fi module, LCD module. Moreover the development of mobile application requires corresponding android studio for software development.

1. Microcontroller: Arduino Mega microcontroller is used as the central part of the school bus sub system. C language program saved in the memory of the controller ensures proper module functionality .The microcontroller has 16 analog inputs, 54 digital input/output pins as well as 4 UARTS. The UARTs are used to connect RFID, GPS and the Wi-Fi module. Arduino IDE is the software used to develop the code.
2. GPS Receiver: SIM 28 ML GPS receiver with low power consumption is used. NMEA format is followed by signals received by the module. It provided co-ordinates of any location on planet Earth with exact Universal Time Coordinated time (UTC). It is used for live tracking with high accuracy and reliability. GPRMC signal contains location information with co-ordinate specification.[5]
3. ESP8266 Wi-Fi module: Wi-Fi module is used to transfer the data to remote server periodically. It follows AT commands and can be connected to the server using TCP protocol. It requires 3.3V power supply and is compact in size. It is easily configurable using Arduino.
4. RFID module: EM18 RFID reader is used along with passive tags for student identification. It operates at frequency of 125KHz. The module radiates 125KHz through its coils and when a 125KHz passive RFID tag is brought into this field it will get energized from this field. These passive RFID tags mostly consist of CMOS IC EM4102 which can get enough power for its working from the field generated by the reader. By changing the modulation current through the coils, tag will send back the information contained in the factory programmed memory array.[6]
5. LCD Display: 16x2 LCD display is used to verify student status at the time of entrance as well as exit. It is compatible with the Hitachi

HD44780 driver. It can be easily interfaced with arduino board. It forms part of school bus subsystem.

### SYSTEM ARCHITECTURE

The system has two sub systems namely the school bus sub system and remote server sub system. The school bus subsystem is associated with student identification using RFID and location tracking using GPS. Each entry and exit in bus involves activation of RFID reader and acquisition of student ID. This is used to determine student status which is transmitted to server via Wi-Fi module. The location is transmitted at regular intervals to server to track the bus. The bus sub system is shown in Figure 4.1.

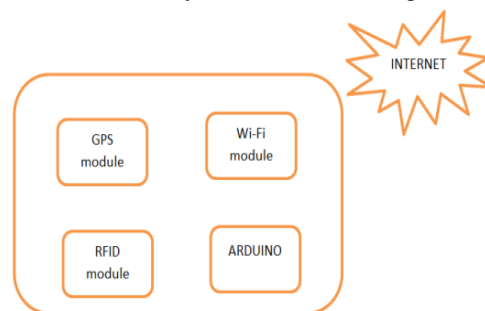


Fig 4.1: Bus subsystem Architecture

The server subsystem involves remote database that stores the student status as well as GPS co-ordinates along with student details. This is used to display relevant information to parents after login. Server subsystem is used to update the data and relay the same to application. Each student has a passive RFID tag which stores unique data for identification. When the tag is in vicinity of reader, internal inductive current produced by the tag in response to the wireless signal transmitted by reader allows the tag to provide the data to the reader. It can work without manual intervention at all making the process automatic.

Server sub system takes care of the data received from bus sub system. It updates the database based on the received query. It extracts relevant data to be included in the application when checked by parents. This is shown in figure4.2.

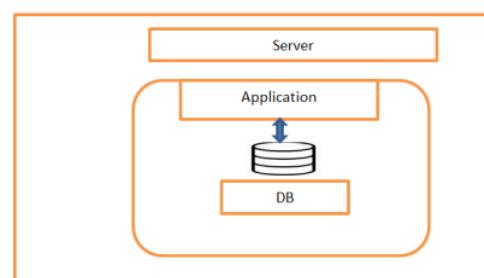


Fig 4.2: Server subsystem Architecture

#### IV. RESULTS AND CONCLUSION

The proposed system provides a low cost feasible solution to ensure student safety on the school bus by enabling live tracking. The system makes use of affordable components such as RFID reader, GPS, LCD display as well as Wi-Fi module. Android application has been developed to allow parents to check the student status as well as access the google map to know the current student location.

Unique username and password is used to allow authentication of the user to the portal. The figure 5.1 shows the screenshots of the application. The future enhancements can include additional modes for admin to convey any schedule changes to parents as well as email notification in case student is not on bus. A web portal of the application can be included to allow parents to access the application without using mobile phone.

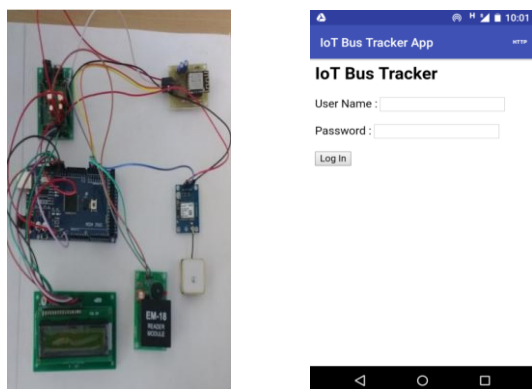


Fig5.1: a. Implemented model, b. Login Screen

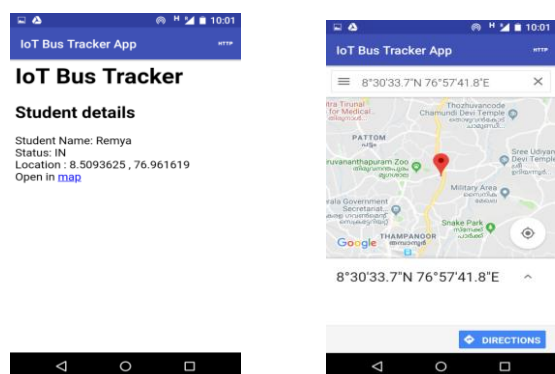


Fig 5.1:c. Initial Detail Page, d. Google map Location Tracking

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Soubhagya S Prabhu "Intelligent Bus Tracking System For Student Safety " "International Journal of Engineering Research and Applications (IJERA) , vol. 8, no.8, 2018, pp 62-64