

# Transportation Safety System

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*Abstract: Millions of passengers commute between homes and their workplace every day in our country. Safe transportation of passengers, that it be corporate employees or school children, has been a critical issue as it is observed that vehicles they travel in are often difficult to track. This project finds a solution to this problem by developing a tracking system that can monitor these vehicles by making use of inexpensive hardware and software components. This system monitors and tracks the vehicle using RFID (Radio Frequency Identification), GSM (Global system for mobile communication), and GPS (Global Positioning System) to ensure the safer commute. The process requires minimum human intervention. Apart from swiping the RFID tag, passengers need not perform any additional tasks. In case of school children, this system can also be used to take the attendance of students.*

Keywords - Transportation, GPS, SIM808, RFID, MFRC522, Python, Xterm.

## I. INTRODUCTION

School buses, school vans, company cabs, and shuttle services transport millions of passengers daily from their homes to their workplace and back. The thing observed is that often it is almost impossible to know the location of these vehicles at a particular time of the day. For parents, obtaining a safe transport for their children is a critical issue. Many children find themselves locked in the bus parking lot after falling asleep on their way to school, miss the bus, step into the wrong bus, or leave at the wrong station with no method to track them. This turns out to be a big reason for the families of passengers to worry about, especially families of school children. This project focuses mainly on the safety of school children. A research undertaken by the Scottish Executive Central Research Unit with the purpose of increasing the proportion of non-car travel to school reveals that travelling by bus or coach appears to be by far the safest mode. Statistics suggest that a child travelling by car is seven times more likely to take part or be involved in a road traffic casualty than a child travelling by bus [1].

Statistics from USA, Canada and Australia also confirm that public transport (and school transport in particular) has a high level of safety, just as in Europe. For instance, the Australian College of Road

Safety notes that bus travel is the safest form of road transport, at least 14 times safer than the private car, and that the record for school bus travel in particular is very good [2].

Also, the research undertaken by National Highway Traffic Safety Administration in USA notes that when comparing the number of fatalities of children aged 5 to 18 years during normal school transportation hours, from 1989 to 1999 (school years), school buses are 87 times safer than private cars [3].

The system is designed to monitor children ridership in a safe and non-intrusive way. It will use a combination of RFID, GPS (Global Positioning System), and GPRS (General Packet Radio Service) technologies. Each student is issued one or more unique RFID card(s) to carry. The card will be embedded in the school bag for each student or can be simply carried by the student in hand. As the student's tag is detected by the reader installed in the school bus upon entering or leaving the bus, the time, date and location is logged and transmitted to a secure database. It will require no action on the part of drivers or students, other than to carry the card and will deliver the required performance without impeding the normal loading and unloading process. The system will also send an SMS alert to concerned people about the time and location of the pick-up and drop. One of the aims of this project is to minimize the human intervention in the process as much as possible. This project tested the applicability of Radio Frequency Identification (RFID) in tracking and monitoring passengers during their trip to and from their workplace. This safety system utilized RFID, GSM (Global System for Mobile Communication), GPRS (General Packet Radio Service), and GPS (Global Positioning System) due to its efficient tracking capabilities, low cost, and easy maintenance.

## II. LITERATURE REVIEW

- A. Anon [1], presented a system which is called, Smart School Bus Architecture. The student swipes the card at the RFID reader while boarding the bus, when the RFID reader transmits the student identification to mobile DVR, which will transmit student identification to the CMS server using 2G/3G/WIFI network.

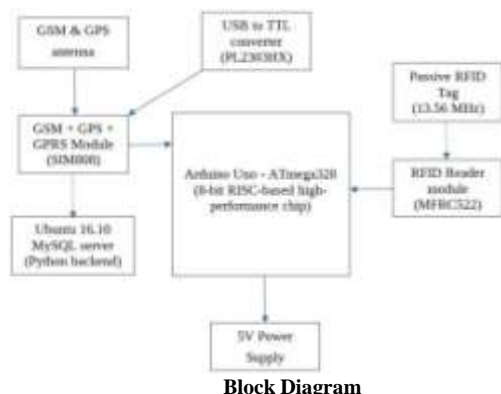
B. Zonar [2], has designed the Zpass specifically for school buses for monitoring and tracking the students in a safe manner. Zpass provides accurate and immediate answers. This system uses RFID with a small card carried by the student containing passive RFID technology that records each student's entry or exit automatically when the student passes from the scanner device that located in the school bus.

C. Ben & Abdullah [3], introduced a system that monitors children inside the bus in a safe manner. It uses a combination of RFID, GPS (Global Positioning System) and GPRS (General Packet Radio Service) technologies. Each student carries a unique RFID card. The card is embedded in each of the student's school bags. Whenever a student enters or exits from the bus, the reader records the time, date, and location and then transfer the data into a secure database and this does not require any action from the drivers and students.

D. James Y.[4], demonstrated a system to remotely track a vehicle using Arduino and GPS shield. The author built a smart tracking device which could be installed in the trunk of a car and was powered by the car's battery.

### III. BLOCK DIAGRAM

i. **ATmega328P (Arduino Uno):**  
 Arduino Uno is a micro-controller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. This development board contains everything necessary to start development of the project right away. Programming of the board is also hassle free as Arduino provides an open-source IDE (Integrated Development Environment) to write a code and upload it on the board. So, backed by correct libraries, developing a software program to go along with the project is pretty easy. These two are the main reasons for the selection of Arduino Uno board.



**Block Diagram**

ii. **SIM808 (GSM + GPRS +GPS) Module:**

SIM808 Module is a high-performance quad-band GSM / GPRS / GPS module of industrial grade, which can be controlled via AT command set or using Arduino IDE. It can be used to make or receive calls, to send and to receive SMS messages. Moreover, it can be used to send and to receive data after connected to the network. Besides, it can realize global positioning by locating its geographical position with GPS. Its features are:

1. GSM/GNSS board
2. Quad-band 800/900/1800/1900 MHz GSM
3. Supports GPS NMEA protocol
4. Arduino compatible
5. SD card interfacing
6. Bluetooth connectivity
7. Built in Li-ion battery charging circuit.

iii. **MFRC522 (RFID Reader):**

The MFRC522 is a highly integrated reader/writer IC for contact-less communication at 13.56 MHz. The MFRC522 reader supports ISO/IEC 14443 A/MIFARE and NTAG (NXP Semiconductor owned trademark for contact-less smart-cards or proximity-cards).

iv. **GSM and GPS Antenna:**

These antennas are used for communication. GPS antenna is used for initial setup of the GPS module i.e. connecting and synchronizing with the available GPS satellites. This process requires the antenna not to be in enclosed environment or in the proximity of metal walls or other metallic structures.

v. **Ubuntu 16.10 MySQL Database:**

This is a primitive database with minimal functionality. It is used to log and store the student attendance in a simple text file. The storing and retrieving operation is performed using a python script that runs concurrently with the other processes.

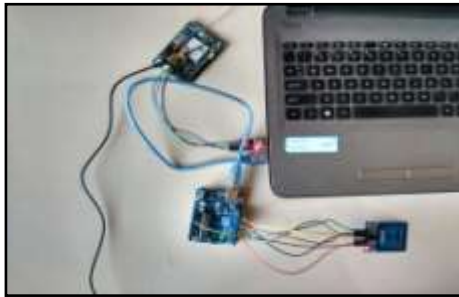
vi. **PL2303HX (USB to TTL Converter):**

This USB to TTL converter is used to connect the SIM808 module to the programming device, may it be a computer or an ICSP port on Arduino board. This is a form of parallel to serial converter which also enables the developer to view the serial GPS data on the computer. The SIM808 module can also be powered by connecting it to the computer directly.

vii. **Passive RFID Tag:**

A Passive RFID tag is used considering its suitability for the project and the lower price point than active RFID tags. Passive tags give response time of 16ms which is slightly greater than

active RFID but tolerable nonetheless.



#### IV. SOFTWARE SYSTEM DESIGN

##### i. **Arduino IDE**

The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino and Genuino hardware to upload programs and communicate with them. Programs written using Arduino software are called 'sketches'. These sketches are saved with an extension .ino. This editor allows writing, reviewing, and compiling the desired code. Once the code is compiled, it is uploaded to the board using USB connector. In this particular project, Arduino IDE is used extensively. A program that is used to synchronize the GPS module clock with the satellite clock is written and compiled in Arduino IDE. The code to read and interrogate the RFID tag is also written in Arduino.

##### ii. **Atom Editor:**

Atom is a highly customizable text editor used for software development purposes. It support cross platform editing which proves useful while switching from one system to other. It has a built-in package manager which helps while writing a branched code where more than one language has to be utilized. Finally, it provides smart auto complete feature that helps a lot while writing a code.

In this project, Atom is used to write all the Python scripts. These scripts are crucial to the project as they handle the most important task of communication with the MySQL database and also the data logging.

##### iii. **XTerm (Linux Terminal):**

XTerm is used to perform time critical tasks such as running the python script periodically to sniff for any activity on the server, logging the data periodically, and also recording the time. A functionality called 'crontab' is used for timing these activities.

#### V. RESULTS

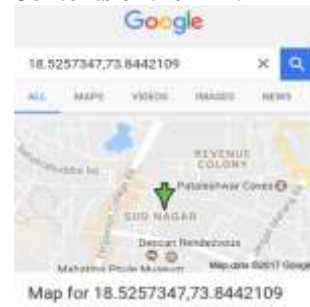
##### 1. **Receiving an SMS**



##### 2. **Receiving an SMS with the link to GPS coordinates:**



##### 3. **Contents of the link:**



#### VI. CONCLUSION

This project aims at making the transportation systems in our country as transparent as possible with minimum human intervention. The project shows that such system can be implemented with relatively low cost and in conformal, space critical environment.

#### VII. ACKNOWLEDGEMENT

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