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Smart Tracking System for School Buses for Ensuring Child Security using IoT Implications and GPS Technology

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Abstract - *In present time due to increase in the number of kidnapping and road accident cases, parents always worry about their school going children. This paper recommends an android based solution which assists parents to track their children's location in real time using IoT implications. To track the location GPS technology is used and to identify the identity of the child a biometric identification is used which is inbuilt in the system. Whenever a child boards a bus, the system will identify the child and update logs on the server. This information consisting the current location and time which will be saved on school server and would be send to the parent's cell phone. Also, when the child reaches home; parent need to send a text message to the school server ID; this will act as an acknowledgement of child reaching home safe. Also, alcohol sensor will check and inform school server if the driver or the bus attendant have consumed alcohol and boarded in the bus. Overspeeding condition of the bus is also tracked in order to assure safe driving throughout the bus journey of the school children.*

Key Words: Kidnapping, IoT implications, GPS technology, biometric identification, school server, bus attendant, Overspeeding.

1. INTRODUCTION

School bus plays an essential role in carrying most of children everyday all over the world. While there are several problems that might disturb the parents with respect to the travel of school going kids; the paper aspires to look into initiating the safety with respect of school buses through bus tracking and security system that will help the school kids' transportation in a protected and more secure way. The circumstance of forgetting kids in the bus is one of the problems suffered, that has risen considerably in recent years. This has often led to the demise of many students due to suffocation. An article published in India says in every eight minutes a child goes missing as data published by national crime records bureau. Statistical report says that around 50,000 children go missing every year from which 42% children are not found.

This system is designed using single microcontroller which will reduce the hardware size and so the cost. The biometric identification of the child using a fingerprint module help to identify and maintain records of students travelling to and fro between school and their respective drop point. The real time monitoring of the bus through GPS technology will help parents to track the school bus and their estimated time to reach home back. Alcohol intake detection using an alcohol sensor and over-speeding of the bus is tracked as a safety measure. The paper also suggests an IoT based bus safety mechanism which is designed to count the entry/exit of students from the bus, through which it intends to create an appropriate environment via following certain set of criteria of security and wellbeing for the school transport that will have a positive impact on safety of children.

2. Characteristics

1. Fingerprint scanning of driver, attendant and children with time and location; which is notified to parent.
2. If driver has consumed alcohol then buzzer triggers and alert SMS will be send on school server and parent's android app
3. Automatic speed control takes place when high speed is detected with buzzer indication
4. The system is monitored and controlled using Microcontroller through IoT.
5. Real time tracking of the bus is possible on the parent's android device using GPS technology.

3. Challenges

Interfacing of hardware and IoT: High level programming of the controller to perform respective functions is needed in order to ensure child security.

Data gathering to server: As we are maintaining our database on cloud in real time; internet connectivity with no latency on server side is needed.

Demo implementation for all features in a single project design is a challenge to work upon.

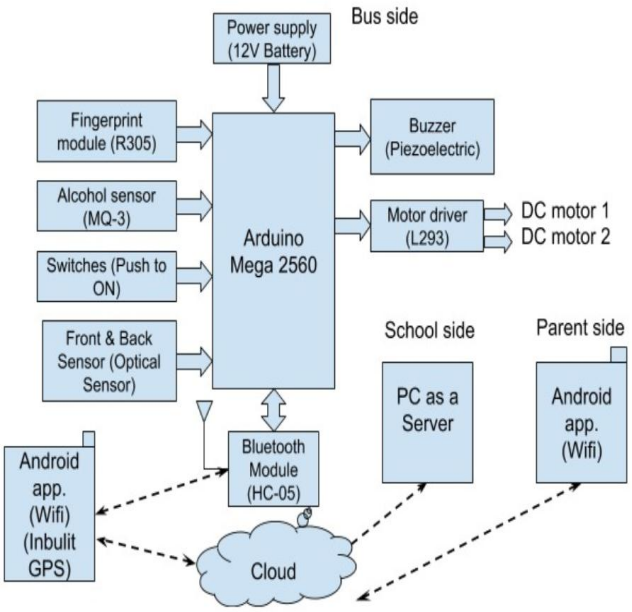

Chart -1: Block Diagram

4. Description of the block diagram

1. A source Android based solution which assists parents to track their children location in real time using Arduino controller.

2. To track the location Bluetooth module is mapped with an android application which has inbuilt GPS used to track different locations of bus.

3. Before using the system, Users – driver, attendant, children's needs to register their fingerprints using fingerprint module and switches. Fingerprint module will assign each user one ID.

4. GPS technology is used to track the location. And all location details are send on server via Wi-Fi module.

5. Whenever a child boards a bus, the biometric identification done using Fingerprint scanner in the bus and the system will identify the child and send time and location of child using Wi-Fi module to server and server will pass on this message on parent's android application. Data log update on server and will send to the parents consisting the current location and time.

6. When children will reach to school again they will scan their fingerprint and Arduino will send this information on server.

7. And server will send this information to parents, as their child is reached in school. If Child fingerprint not detected in the morning, that means child is absent for the whole day. And parents will get this notification in speech form.

8. Now while coming from school to home again process will repeat, first driver will select the route and scans the fingerprint. After that children will scan their fingerprint. Attendant have to scan his fingerprint in end indicating all the children are boarded into bus. These information are send on parent's android app via server using IOT.

9. If any child's fingerprint is missing means the child is still in the school or may be kidnapped. Parents will get speech notification in android application for immediate response. And data will also get logged.

10. To avoid any kind of accidents, alcohol sensor is used to detect the alcohol consumption of driver. If driver have consumed the alcohol then buzzer will turn on and notification will be send on server and parent application using IOT and also the bus ignition system will get off automatically through the dc motors.

11. There is one emergency switch , if this switch is pressed then alert message will be send on server and android application in speech form so that immediate action can be taken.

12. There is one more feature present that; we can provide password protection to the fingerprint kit to avoid misuse of it by the children's or any other person.

Speed detection

13. For this feature bus model will be there with DC motors and switches to control it.

14. There will be one switch to increase the speed of bus. When this switch is pressed then Arduino will detect the high speed and buzzer will get on for the indication and automatically reduce the speed and bring that to normal.

Hardware and Software Requirements:

Hardware Requirements

- Arduino MEGA controller-ATmega2560

- Fingerprint module-R305

- Bluetooth Module

- Motor Driver-L293D

- DC motors-x2

- Alcohol sensor

- Switches

- Buzzer

- Power supply

- Optical Sensors

Software Requirements

- Arduino IDE- for Arduino coding

- B4A for Android coding purpose

- VB 6.0 (Visual Basic software) for PC side desktop application

- mySQL- for creating database

- PHP - for Cloud scripting

- Diptrace - PCB layout

5. Review of Smart tracking system for school buses for ensuring child security using IoT implications and GPS

Numerous approaches to vehicle tracking, monitoring and alerting system has been proposed so far. **Ankit Kesharwasni, Vaishali Sadaphal** proposed system to overcome problem of public transportation. Wireless sensor network was used for monitoring of bus transportation system and record of arrival time of buses at bus stops. This system was to **detect delay and arrival time of buses at the bus stops** [2].

An anti-theft system used for tracking was proposed by **Kunal Maurya, Mandip Singh and Neelu Jain**. Vehicle tracking system has been a real time system which worked on the GPS and GSM technology to provide the location of vehicle to the vehicle owner in the case of vehicle is stolen. It is also used in wildlife tracking, asset tracking and in stolen vehicle recovery [2].

Xing Jianping, Zhang Jun, et al. proposed a **GPS real time vehicle alarm monitoring and alerting system** which used GPRS and CSD on the embedded system. Compared with the conventional single mode of GPRS, this method has replaced the disadvantage of high time delay and incertitude of time delay in data transmission [1]. Transportation has been a very important shared resource that enabled efficiently using resources like GSM modem and GPS unit that can be installed on a vehicle and used to track its location. This system is located on the bus and GSM modem communicates via SMS with a server connected to a basic GSM phone [1].

R. Anil Kumar, G, Jyothirmayi and K. Ramesh Babu proposed **Vehicle positioning System Based on ARM alongwith a combination of GSM and GPS** which can upload the information of the vehicle such as the position and speed to the Monitoring center in time and made it convenient to control the traffic. This vehicle position system has an advantage of small size, scalable, reliable and powerful expansibility [2].

5.1. Data Acquisition- Data acquisitioning through the standard internet protocol suite (TCP/IP) are used for real time embedded application [2]. These embedded hardware consists of use of microcontrollers and microprocessors for their functioning which is then mapped to several network based components making the system bulky.

5.2. Physical digital identification technologies- These digital identification techniques are widely used in two technologies as follows:

I. RFID identification- This smart cards are used in various applications for digital identification. Magnetic stripe card or inductance are used for data communication [3].

II. Biometrics identification- Biometric identification is used biometric identifier such as a fingerprint or facial scan. Biometric identification is difficult to copy or misuses so it is considered safe digital identification [3].

5.3. Positioning using GPS- Position and timing information are sent to server for proper location coordinates of a vehicle. This data further processed to view vehicle location on google map [1]. It is impossible to check and map coordinates each time because of the rotation phenomenon of the earth.

5.4. SMS based tracking system- SMS offers the system unique features. Information such as GPS coordinates and time are gathered and sent to the parent's phone that's preregistered on the module kit. The communication between the parent and the child module kit is done using Short Message Service (SMS)[4].

5.5. Portable wireless women safety device and school bus tracking system- The embedded device has emergency press button for alert purpose, and electronic camera for capturing image of that instance. GSM system traces the current location of victim and send alert message to registered contact. The embedded camera captured image are sent with an alert message. The system consists of children transportation security system for school bus. Overspeed monitoring was also done with the help of sensors. If the vehicles speed reached beyond the specified value of the speed, even then the warning message will be sent from system to the owner's mobile. This makes secure transportation for school children[5].

6. CONCLUSION

In order to prevent Kidnapping and bunking of school going kids; is the motive of the paper. This paper shows that android based school bus tracking technology using IoT is feasible and it is an alternative way for supervising and tracking the Children when they are driving to and from school and home. Combining Fingerprint, GPS and android advances along with sensors like alcohol detector and speed detector for safety and security reason is incredibly vital.

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BIOGRAPHIES

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