Child security System for school bus using IOT

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Abstract-Child safety in school transportation has become a critical concern for parents and educational institutions. This paper presents an Internet of Things (IoT) based child security system tailored for school buses. The proposed system employs RFID cards for student identification, GPS for real-time bus location tracking, GSM for instant communication with parents and school authorities, and a cloud-based interface for data storage and monitoring. The system ensures safe boarding and deboarding, prevents negligence-related incidents, and provides real-time alerts, making it a reliable and scalable solution for school transportation.

Index Terms—Cloud Monitoring, GSM, IoT, RFID

I. INTRODUCTION

Child safety during school transportation is a growing concern worldwide due to increasing incidents involving negligence, miscommunication, or lack of proper monitoring. Parents often worry about their child's whereabouts after boarding the school bus, especially in cases of delays or emergencies. Similarly, schools are responsible for ensuring that each child is safely picked up and dropped off at the correct location.

With advancements in *Internet of Things (IoT)* technology, it is now possible to build smart, automated systems that improve safety and communication in real time. The proposed system integrates RFID, GPS, GSM, and a cloud-based dashboard to track students, monitor bus routes, and provide alerts to parents and school administrators.

Each student is provided with an RFID tag, which logs their entry and exit from the bus. The GPS module tracks the bus location, and GSM technology sends SMS alerts when students board or deboard. A cloud platform maintains a secure record of attendance and location history, accessible to both parents and schools.

II. PROCEDURE FOR PAPER SUBMISSION

A. Review Stage The review stage involves the preparation and preliminary evaluation of the manuscript before final submission. For the proposed IoT-based child security system, the following steps were followed:

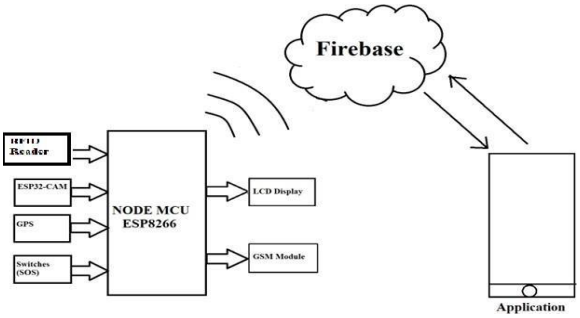
Step 1: Problem Identification
Understand the critical issues in child safety during school bus transportation, including lack of real-time tracking, unauthorized deboarding, and poor communication between schools and parents.
Step 2: Literature Review
Review existing research papers and systems related to GPS tracking, RFID-based attendance, and IoT safety systems to identify gaps and best practices.
Step 3: Requirement Analysis
List and analyze all hardware and software requirements:

- *Hardware: Node MCU, RFID Reader (MFRC522), GPS Module (NEO-6M), GSM Module (SIM800L)*
- *Software: Arduino IDE, Firebase (for cloud), MIT App Inventor (for mobile interface)*

Step 4: System Design
Design the system architecture—highlighting communication between components like RFID → Microcontroller → Cloud → Notification Services.
Step 5: Prototype Development
Develop and integrate the modules. Test basic functions like RFID scanning, location tracking, and SMS notifications.
Step 6: Simulation and Testing
Simulate real-time usage (student boarding, deboarding) and observe data logging, cloud syncing, and parent notifications.

B. Final Stage
After acceptance, the manuscript was formatted as per IJIRT guidelines in two-column layout using Times New Roman font. All figures and tables were properly inserted. The signed copyright form was submitted along with the final Word document. The paper is now in the publication process, and IJIRT holds the right to do the final formatting before publishing.

C. Figures-



III. MATH

In IoT-based systems like yours, where the bus's location, RFID scans, and alerts are sent to a cloud server (e.g., Firebase), it is essential to control the rate at which this data is uploaded. Sending too much data too often can:

- Increase data costs
- Drain power
- Overload network or server capacity

Hence, you define an upload frequency (f), such as how many times per second the device should capture and send data.

Using the formula:

T=1fT = \frac{1}{f}T=f1

You can calculate the upload interval — how many seconds to wait between each data upload.

IV. HELPFUL HINTS

A. Figures and Tables-

1]ESP8266 Microcontroller
Power Consumption: Sleep: 20µA, Standby: 1.0mA, Transmit: 170mA
Operating Voltage: 3.0V - 3.6V
Operating Current: 70mA (average), 240mA (peak)
Memory: 64 KB SRAM, 4 MB Flash
Connectivity: Wi-Fi (802.11 b/g/n)

Fig. 3. ESP8266

2]RFID Reader
Power Consumption: 50mA (operating), 15mA (idle)
Operating Voltage: 2.7V - 5.5V
Operating Current: 13mA (read mode)
Frequency: 13.56 MHz

Fig. 4. EM Module

3]RFID Tag
Frequency: 13.56 MHz
Read range: Up to 10 cm
Memory: 1KB – 4KB

Fig. 5. RFID Tag

V. PUBLICATIONPRINCIPLES

This paper titled "Child Security System for School Bus Using IoT", authored by Saurabh Tanpure, Siddharth Shirke, and Kakade Tejas, is a result of original research and implementation. The aim of this project is to enhance the safety of school-going children through a real-time monitoring system that integrates RFID, GPS, GSM, and IoT technologies. The research has been conducted with the highest level of academic integrity and adherence to ethical guidelines.

The content presented is entirely original, and the system has been designed, developed, and tested by the authors as part of a practical academic initiative. All references and external resources have been appropriately cited to ensure intellectual honesty. The data, diagrams, and methodologies included are accurate representations of the actual system developed and tested under real-world conditions.

This project offers a technological solution to a socially important issue—child safety during school transportation. The IoT-based system ensures real-time tracking of the school bus and the automatic recording of children boarding and deboarding using RFID. Alerts are sent to parents and school authorities, significantly increasing transparency and safety.

The authors affirm that:

- The work has not been published or submitted elsewhere.
- No part of the manuscript has been plagiarized.
- All system designs, flowcharts, and figures are either self-created or used with proper acknowledgment.

This research has been submitted with the intention of contributing meaningful and socially impactful innovation to the fields of IoT, embedded systems, and transportation safety. The authors are committed to the values of transparency, innovation, and knowledge sharing in technical research.

VI. CONCLUSION

The Child Security System project emphasizes the importance of leveraging technology to ensure children's safety. By integrating real-time tracking, alert mechanisms, and user-friendly features, it provides parents and guardians with a reliable tool to monitor their child's location and well-being. This system demonstrates the potential of modern innovations in addressing critical social concerns, making it a valuable contribution to child security solutions. We also perform simulation on Easy EDA software with 100% result.

VII.APPENDIX

A. List of Hardware Components

Sr. No.	Component	Quantity	Description
1	Node MCU (ESP8266)	1	Wi-Fi-enabled microcontroller for IoT interface
2	RFID Reader (RC522)	1	To read RFID tags for student identification
3	RFID Tags	As per students	Unique ID tags for each student
4	GPS Module (NEO-6M)	1	For real-time bus location tracking
5	GSM Module (SIM800L)	1	For SMS communication to parents/authorities
6	LCD Display (16x2)	1	For displaying system status
7	Buzzer	1	Alert sound for entry/exit
8	Power Supply (Battery/Adapter)	1	For system power supply
9	Jumper Wires, Breadboard	As required	For wiring and circuit connection

B. Software and Platforms Used

- Arduino IDE – for programming the Node MCU
- Firebase / Blynk – for real-time data monitoring and alerts
- Google Maps API – to display GPS location
- Proteus / Fritzing – for circuit simulation and diagram creation

C. System Flow (Summary)

1. Student taps RFID tag while entering/exiting the bus.
2. RFID reader sends the tag ID to Node MCU.
3. Node MCU fetches GPS location and sends info via GSM.
4. Parent receives SMS with child's status and location.
5. Data is logged in real-time on Firebase for school use.

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