RAKSHAPATHA: Safe Paths Begin with Smart Tracking

Manjuatha B [1], Lavanya M [2], Chandrakanth N S [3], Manoj B S [4], Sridhara M N [5]
Assistant Professor [1], 4VM21EE026 [2],4VM22E404 [3], 4VM22EE422 [4], 4VM22EE450 [5]
Department of Electrical and Electronics Engineering[12345]
Vidya Vikas Institute of Engineering and Technology, Mysore, Karnataka State, India.

Abstract*—A data from the National Crime Records Bureau reports that a child goes missing for every eight minutes in India. In this era, safety is the foremost concern among parents. To lessen the parent's anxiety about their children, a vehicle positioning system is formulated by merging Radio Frequency Identification (RFID) and Global Positioning System (GPS). The system consists of RFID reader and tags to detect and functioned the entry and exit of a child in a vehicle. Each person is assigned with a RFID tag which holds the precise details. When he/she enters the vehicle, face will be detected for the entry and exit. This information is notified to the concerned authority via SMS using GSM. The proposed system facilitates to know about the area where the vehicle has crossed the path using RFID. The GPS technology connected with this system helps in acquiring updates on student's real time location. The detail of current location is updated in the school server. It is up and coming technology in the field of communication and network. The projected system here is planned to be implemented in school vehicles for the safety of the students.

***Keywords*— RFID, GPS, GSM Module, entry and exit.**

I. INTRODUCTION

Nowadays, parents are worried about their children because of the high rate of kidnapping. Moreover, parents are having long working hours, so they simply do not have as much time to spend for their children. Moreover, they will be persuaded by kidnapper before they enter the school So, it is the responsibility for the school to take care of their students and they also know in-time and able to send an alert message to their parents if the students are not at the school at school start time. However, it is not easy to do this manually. The school authorities cannot check their students individually and cannot send an alert message to their students. So, the suitable solution for this problem is by designing a system that will have automatic notification, which will be send to their respective parent's mobile including the admin panel if their children not arrive at school premise at time. The paper also suggests a bus safety mechanism which is designed to count the entry/exit of students from the bus. The system does various tasks, such as recognizing unique information of each student using RFID tag, which will interchange the data with the RFID reader by means of radio waves and display each student's name on the screen. This will let the driver to know the number of students boarded the bus. Moreover, it also has an emergency switch which driver can use in case of emergency.

II. METHODOLOGY

The proposed vehicle tracking system for children's safety is built on a microcontroller-based framework using Arduino UNO and NodeMCU. The system begins operation by obtaining the real-time location of the school vehicle through a GPS module. This location data is processed and sent to parents or school authorities using a GSM module, ensuring constant tracking and communication. In addition to tracking and access control, a fire sensor is included in the system to detect smoke or fire within the vehicle. Upon detection of any hazard, the system immediately sends an alert through the GSM module to inform parents and emergency services. A servo motor is connected to the door mechanism and is triggered only after successful facial recognition, ensuring controlled and safe access. The combined use of these components ensures real-time monitoring, automated security verification, and emergency response, creating a robust safety system for school transportation.

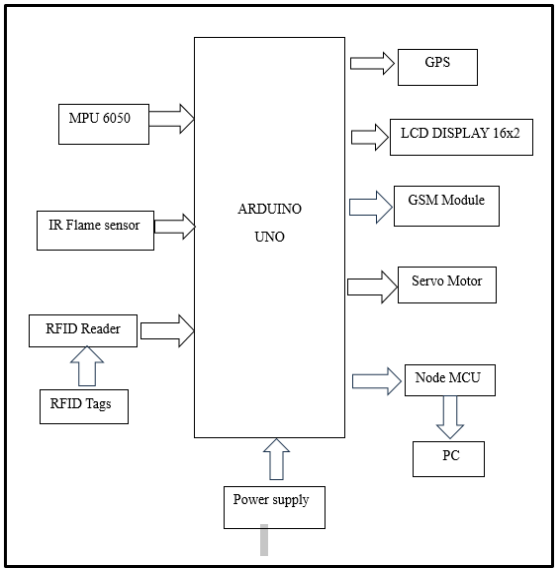

Fig 1: Block Diagram

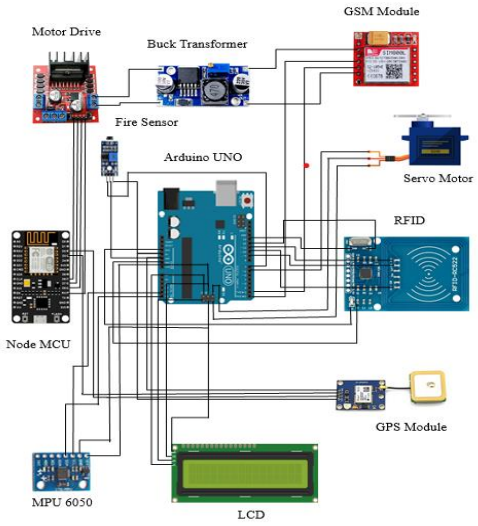

Fig 2: Circuit connection of the model

All components in the system are powered by a centralized power supply that provides the required voltage and current. Most modules operate at either 5V or 3.3V, and the power unit ensures stable and regulated power to prevent malfunctioning due to voltage fluctuations. Without a reliable power source, the sensors, communication modules, and actuators may fail, compromising system performance.

In conclusion, this system demonstrates a well-integrated design where the Arduino UNO serves as a communication hub and controller, processing data from input sensors and peripherals while generating appropriate outputs for display, control, or communication. The combination of RFID, GPS, GSM, servo motor, and NodeMCU offers a robust solution for student safety and vehicle tracking, making the system highly effective for use in school buses or child transportation services.

2.1: HARDWARE REQUIREMENTS

- Arduino UNO
- RFID reader and tag
- NodeMCU
- LCD
- GPS Module
- GSM Module
- Motor Drive
- Buck Transformer
- Fire Sensor
- Servo Motor
- Gyrosensor

System works as follows,

- RFID Scanning & Identification: The child scans their RFID tag when approaching the vehicle. The RFID reader reads the tag and sends the unique ID to the Arduino UNO. Arduino verifies the ID against the database to confirm the child's identity.
- Automated Door Control: Upon successful verification, Arduino triggers a servo motor to unlock the vehicle door. The child boards the vehicle, and the door is securely closed again.
- GPS-Based Location Tracking: A GPS module continuously monitors the real-time location of the vehicle.
- SMS Notification via GSM: The GSM module sends an SMS to the parent or guardian, including the child's boarding/exiting status and the current location of the vehicle.
- Emergency Alert Handling: In case of route deviation, emergency (like fire), or unauthorized access attempt, the system immediately sends an alert to guardians using the GSM module.

III. IMPLEMENTATION

Fig 2: Circuit Connection

The image shows the internal view of a smart school bus prototype designed using a cardboard model. At the heart of the system lies an Arduino Uno microcontroller, which controls and manages the operations of various connected components. The setup includes several essential modules that work together to demonstrate the safety features of a modern school transport system. A GPS module is integrated to track the real-time location of the bus, while a GSM module is used to send location or alert messages to parents or guardians, ensuring constant communication. A blue LCD display mounted on the front side of the bus provides visual feedback, such as location or system status. An ultrasonic sensor is placed on the side of the model, which likely helps in obstacle detection or monitoring the surroundings. A motor driver module (L298N) is also included, which controls the wheels for movement, powered by a dual Li-ion battery pack mounted inside. Additionally, a fire or gas sensor might be included to enhance safety features by detecting hazards inside the bus. All the components are neatly arranged and connected with jumper wires, indicating a well-planned prototype aimed at demonstrating how embedded systems and IoT technologies can be used to ensure the safety of children during school transportation. This project serves as an excellent example of how and smart monitoring can improve real-world applications.

IV. RESULT

- Only authorized children are allowed to enter the vehicle through verified RFID (and optionally facial recognition), reducing the risk of unauthorized access.
- Parents and guardians receive timely SMS notifications with the child's boarding status and the vehicle's exact location, ensuring constant awareness.
- The servo-controlled door operates automatically based on verification, improving safety, efficiency, and minimizing human error.
- The system promptly notifies guardians in case of emergencies or unusual route deviations, allowing faster and more effective responses.

V. CONCLUSION

The Rakshapatha safe path begins with smart tracking system endeavours the safety transportation for the school children during daily outing. The system uses RFID for detecting the child whether boards or leaves the bus along with the stopping (boarding place) of the children. The message will be sent simultaneously to the parents and the school. The details of the boarding and leaving the school bus will also be updated in the school database. The GPS used is to track the position of the bus if it goes other than the usual path. The developed system successfully combines hardware and software to deliver a practical and effective safety solution, not only preventing unauthorized access but also making it easier for parents and school authorities to monitor the transportation process.

VI. FUTURE SCOPE

- Implementation of deep learning algorithms to improve the accuracy and speed of facial recognition, even under varied lighting or environmental conditions.
- Adding sensors to monitor children's health parameters (like temperature or heart rate) during transit, especially useful during health outbreaks or for children with medical needs.
- Using gyroscope and accelerometer data to track and report rash driving, speeding, or abrupt braking, improving overall safety and accountability.
- Storing data on a cloud platform for long-term access, analysis, and reporting, this can help improve route planning, attendance logs, and security audits.
- Linking the system with smart city infrastructure (e.g., traffic signals, school systems) for optimized routing, reduced delays, and better emergency coordination.

REFERENCES

[1] Anwaar Al-Lawati, Shaikha Al-Jahdhami.,"*RFID-based System for School Children Transportation Safety Enhancement"* 978-4799-8422-0/15/$31.00©2015 IEEE

[2] G. Bharathi, L. Ramurthy in *"Implementation of Children tracking system using ARM7 Microcontroller"* International Journal of Industrial Electronics and Electrical Engineering, ISSN: 2347-6982 Volume-2, Issue-12, Dec.-2014

[3] P. Santharaj, V. Anuradha in *"Design and Implementation of Children Tracking System using ARM7 on Android Mobile Terminals"* International Journal of Scientific Engineering

and Technology Research ISSN 2319-8885, Vol.03, Issue.21, September-2014

[4] Maryam Said Al-Ismaili, Ali Al-Mahruqi, Jayavrinda Vrindavanamin" Bus Safety System for School Children Using RFID and SIM 900 Modem" International Journal of Latest Trends in Engineering and Technology (IJLTET) Vol. 5 Issue 1 January 2015 ISSN: 2278-621X

[5] Jianqiang Wang, Daiheng Ni and Keqiang Li „*RFID-Based Vehicle Positioning and Its Applications in Connected Vehicles"Sensors*2014, *14*, 4225-4238; doi:10.3390/s140304225 ISSN 1424-8220 www.mdpi.com/journal/sensors

[6] Timothy Talty, Andrew Macdonald *"Intra-Car Wireless Sensor Networks Using RFID: Opportunities and Challenges"*978-1l-4244-1l690-5/07/$25.OO0 C2007 IEEE