

IOT-Based School Children Transportation Safety System

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Abstract— Ensuring the safety and security of school children during their daily commute is a growing concern for parents and school administrators. An IoT-based school children's transportation safety system is proposed to address this challenge. This system leverages IoT technologies to provide real-time monitoring, tracking, and alerts about the children's whereabouts, condition, and safety while on the school bus. The system includes sensors, devices, and communication technologies that can be installed in the school bus, children's backpacks, and other components of the transportation system. These technologies can monitor the location of the bus, track the entry and exit of children, monitor the temperature and air quality inside the bus, and alert the driver and parents in case of emergencies or abnormal situations. The system provides unprecedented visibility and control over the transportation process, ensuring that children are transported safely and efficiently. Additionally, it can help schools and transportation providers to comply with safety regulations and improve the overall quality of transportation services for school children. In case of an emergency such as an accident or a breakdown of the bus, the IoT system can send alerts to parents and school administrators. This allows for a quick response and appropriate action to be taken.

Index Terms—RFID, MEMS, MQ2, GPS, L293D

I. INTRODUCTION

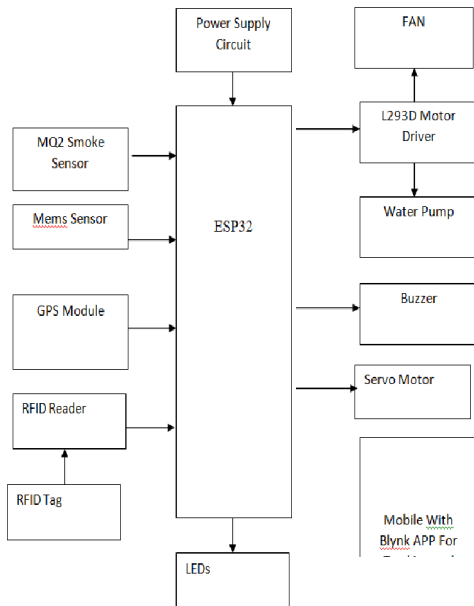
An IoT-based school children's transport safety system is a solution that utilizes the Internet of Things (IoT) technology to ensure the safety and security of children during their transportation to and from school. With the growing concern for the safety of school children, especially during their daily commute, such a system can provide parents and school administrators with real-time information and alerts about the children's whereabouts, condition, and safety while on the school bus. The system can

be designed to include various sensors, devices, and communication technologies that can be installed in the school bus, children's backpacks, and other components of the transportation system. These technologies can monitor the location of the bus, track the entry and exit of children, monitor the temperature and air quality inside the bus, and alert the driver and parents in case of emergencies or abnormal situations. By leveraging the power of IoT, this safety system can provide parents and school administrators with unprecedented visibility and control over the transportation process, ensuring that children are transported safely and efficiently. Additionally, it can help schools and transportation providers to comply with safety regulations and improve the overall quality of transportation services for school children. Overall, an IoT-based school children's transport safety system is an innovative solution that can help to address the safety concerns of parents and school administrators while providing a safe and secure transportation experience for school children.

II. PROPOSED SYSTEM

An RFID reader is used in the Bus to get valid student entry into the bus. if any tag is present in the vicinity of it. The decoder then responds to the microcontroller about the valid Card. ESP32 processor has an internal SPI module which directly supports the Wi-Fi module serial communication. This system utilizes a stand-alone Wi-Fi controller IC which handles most of the network protocol requirements. The IC communicates directly to the ESP32 using a standard serial interface using the Arduino IDE software platform. Here we have used the EM-18 RFID reader, It has low cost and low power consumption to read the 125 KHz tags in the distance of reaction 2-10 cm. When a student swipes

the card on the entry door or gate of the bus then the RFID reader will read the information and check for validation. if the entered card is Valid then the ESP32 microcontroller will give the command to the Servo motor to open the Gate to enter the Bus. And at the same time, the authentication of the Student is updated into the Blynk IOT Server so the parents and the Management will get the Notification. If the student swipes the invalid RFID Card to the tag then the RFID reader will read the information and check for authentication. if the entered card is invalid then the ESP32 microcontroller will give the command to the Servo motor to close the Gate and not enter the Bus. And at the same time, the authentication of the Student is updated into the Blynk IOT Server so the parents and the Management will get the Notification.



III. METHODOLOGY

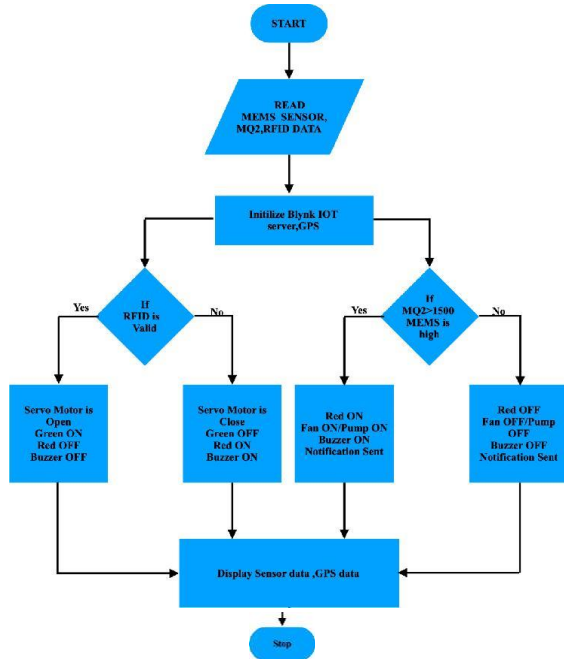
An IoT-based school children's transportation safety system can be designed to ensure the safety of children during their transportation to and from school. Here are some components and features that can be included in such a system:

- **GPS tracking:** A GPS tracking device can be installed on the school bus to monitor its location in real-time. This allows parents and school administrators to know the location of the bus at all times.

- **RFID tags:** RFID tags can be attached to the backpacks of children to track their entry and exit from the bus. This ensures that no child is left behind or gets off at the wrong stop.
- **Emergency alerts:** In case of an emergency such as an accident or breakdown of the bus, the IoT system can send alerts to parents and school administrators. This allows for a quick response and appropriate action to be taken
- **Mems:** It stands for "micro-electro-mechanical systems." These are tiny devices that combine electrical and mechanical components, typically with dimensions ranging from a few micrometres to a few millimetres. MEMS devices can be made from a variety of materials, including silicon, glass, polymers, and metals. Some examples of MEMS devices include accelerometers, gyroscopes, pressure sensors, microphones, and inkjet print heads.
- **MQ2:** It is a gas sensor module that can detect various gases such as smoke, propane, methane, and carbon monoxide. The module consists of a sensing element, a signal conditioning circuit, and a heater. The sensing element detects the gas and the signal conditioning circuit amplifies and filters the signal to provide a digital output that can be read by a microcontroller or other electronics.
- **L239D** is a popular motor driver IC (integrated circuit) used to control DC or stepper motors. The IC consists of four half-bridge drivers that can be configured to drive two DC motors or one stepper motor. The IC can handle a maximum current of 600 mA per channel and can operate at a voltage range of 4.5V to 36V.
- **BLYNK IOT Server:** It is a cloud-based Internet of Things (IoT) platform that allows developers to build IoT applications for various hardware platforms, such as Arduino, Raspberry Pi, and ESP8266. The Blynk platform consists of a mobile app, a server, and a set of APIs and libraries. The Blynk mobile app can be used to control and monitor connected devices. The Blynk server is responsible for managing the connections between the devices and the mobile app. It is a cloud-based server that stores the user's data and provides access to the APIs and libraries. The server supports various communication protocols such as Wi-Fi, Bluetooth, and Ethernet.

IV. FLOW CHART

- Smart school bus monitoring system with fully automated features that efficiently alert the bus driver by overcoming the limitations of the existing systems. RFID readers placed in bus doors are used to sense the entry and exit of students through the bus door and it is sent to the microcontroller and also tracks the Bus using GPS.



- We are using ESP32 Board for the processing and fire detection we use a flame sensor and MQ2 smoke sensor which will sense the fire And smoke whenever there is a fire accident occurred when fire or smoke is detected the alerting and prevention system gets activated and turns of the water pump to stop the fire and exhaust fan gets turned ON to remove the Smoke from the bus. And at the same time, the system will send a notification to the authority regarding the accident and also the exact location of the bus.
- In emergency cases like when an accident, Fire incidences occur then it will directly connect to the Emergency Service (100,108 Etc..), parents and management about the incident and the location of the incident occur. In such cases, we can Save children as many as because it will Directly contact emergency services. So, they reached in time to the place that type of incident occurs.

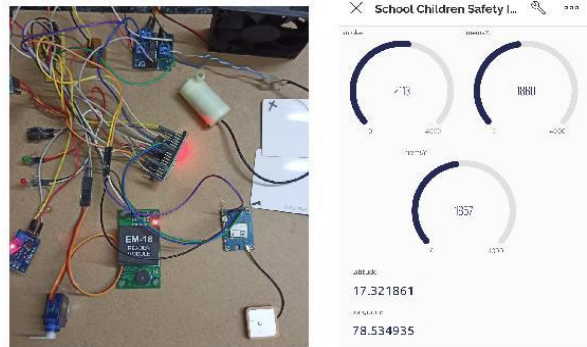
- This tracking system can be monitored by the authority whenever it is needed. And all the system is interconnected to the IOT-based server which is the BLYNK server. Blynk app is installed on the mobile so that the authorized person can get accessed it.

V. EXPERIMENTAL RESULT

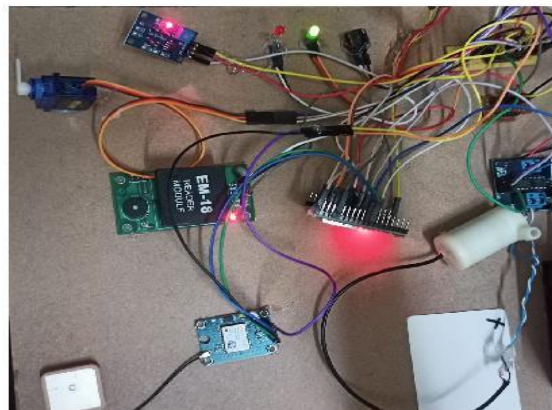
This project is well prepared and acting accordingly (including all the hardware and software) as per the initial specifications and requirements of our project. Because of the creative nature and design the idea of applying this project is very new, and the opportunities for this project are immense.

The practical representation of an experimental board is shown below

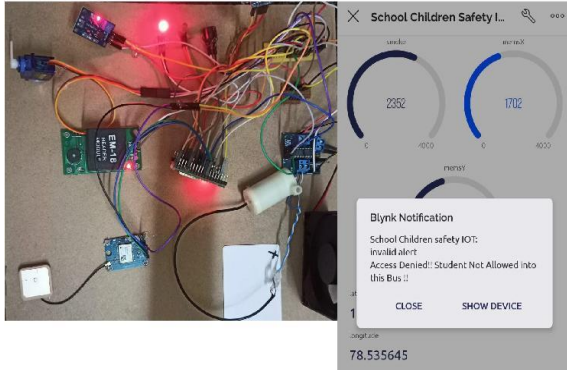
- When Power Supply is ON”, The RFID EM-18 Reader is ON”



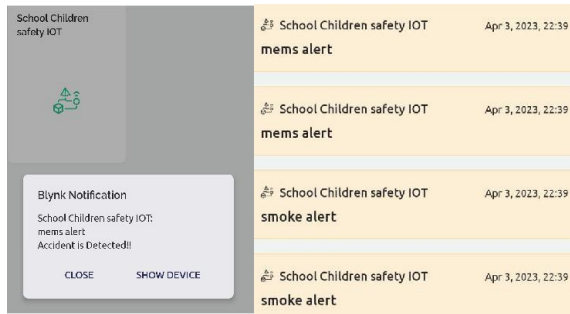
- When a Valid Student ID card is swapped to the RFID Reader, Reads the card due to a valid student ID card. So Green LED is ON”



- When a Valid Student ID card is swapped to the RFID Reader, Reads the card due to a valid student ID card. So Green LED is OFF”



- In an emergency case like an accident or smoke etc are detected. It sends notifications to register devices through the IOT server.



V. CONCLUSION

Combining RFID, GPS and IoT advances for safety and security reason is incredibly vital. Presently, as a result of an increase in mishaps of kids getting out at the wrong stations or children getting missed on the bus, this may lead to demise due to suffocation. This proposal shows that RFID-based school bus tracking technology is a feasible alternative for supervising and tracing pupils during their drive to and from school. Additionally, the expense associated with tagging material is moderately low. Also, the IOT prevention system and the gate control system play a major role to help the children commute safely. In this manner the system is capable of notifying parents/guardians thru text notification once the child enters/leaves the varsity, enabling parents/ guardians to trace the bus, helping smooth and safer rides to the various destinations.

VI. ADVANTAGES

- Fast due to IoT connectivity.
- Economical
- Accurate and easy to use

VII. APPLICATION

- Can be used in defence vehicles.
- Can be used in industries.
- Can be used in cars

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