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IOT BASED SCHOOL CHILDREN TRANSPORTATION SYSTEM

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ABSTRACT-As most of students are travelling from home to school or vice versa by bus. Safety is the biggest concern and issue. Bus driver and parents are responsible for providing safety and security to the school children. Many of children went to school and never returned home afterwards. This is because the child feels tired and then sleeps after a hard school day. The bus driver did not pay attention to the presence of a sleeping child in the school bus and the bus driver closes the windows and the door, causing suffocation and death. There are also a lot of accidents that might happen on school buses, so researcher is working to find the way of tracking school bus which is very important for the monitoring of location and track students throughout journey from and to school. This research paper presents IOT smart transportation system for a children school. The system consists of IR sensors to calculate the number of students, RFID card and RFID reader to read student data and attendance recording. It also contains a mobile application to get notifications and messages and shows other information such as the time of riding the student on the school bus and coming off the bus you can also take the latest coordinates and thus follow the bus via Google Map.

Keywords: IOT Smart Transportation System, RFID Card, RFID Reader, IR Sensors

I.INTRODUCTION

Providing safety for school children is the responsibility of the parents, and the school administration as well as the bus driver. The parents must teach the child how to protect themselves from the risks they may face on their journey to and from school. It is the school responsibility to provide new school bus systems to keep children safe. The increasing population worldwide, including in Oman, has led to a surge in vehicles and transportation, making it essential to develop new transport systems to reduce traffic accidents. Ensuring the safety of schoolchildren is a shared responsibility among parents, school administrators, and bus drivers [4]. Parents must educate their children on how to protect themselves from risks during their daily commute. Schools should provide new school bus systems to guarantee children's safety, while bus drivers must adhere to speed limits and remain alert and sober while driving [5].

Unfortunately, numerous accidents involving school buses have resulted in the loss of young lives [2]. For instance, in 2016, a four-year-old boy in Oman, suffocated after being left alone on a school bus for several hours. Another tragic incident occurred in the Rui area, where an eight-year-old Sudanese child died due to suffocation after being forgotten on a school bus [6]. To address

these concerns, researchers propose developing smart transportation systems for school buses, leveraging the Internet of Things (IoT) to reduce accidents and forgetting children on buses [7]. These systems would utilize sensors, such as IR sensors to track the number of students on the bus, alcohol sensors to ensure the driver's sobriety, and RFID reading devices to monitor students data and send notifications to parents and school administrators. By implementing such systems can provide a safer and more efficient transportation experience for its schoolchildren.

II.LITERATURE REVIEW

The Internet of Things (IoT) has revolutionized the way we live and work. One of the key technologies that enable IoT is NodeMCU V3, an open-source firmware and development kit that allows for fast and efficient IoT application development. NodeMCU V3 is based on the ESP32 Wi-Fi microchip, which provides a full TCP/IP stack and microcontroller capability. Another important technology that complements IoT is Radio Frequency Identification (RFID) [1]. RFID is a generic term for technologies that use radio waves to automatically identify people or objects from a distance. RFID has numerous applications in various fields, including manufacturing, agriculture, transportation, and industries [3]. In the context of school transportation, RFID and IoT can be used to develop a smart transportation system that ensures the safety of schoolchildren. Such a system can consist of IR sensors to calculate the number of students, RFID cards and readers to read student data and attendance, and alcohol sensors to ensure the safety of the driver [8].

The system can also include a mobile application that allows parents and school administrators to track the location of the bus and receive notifications and messages. The data transmitted through a microcontroller called Node MCU can be sent to the cloud through Wi-Fi, enabling real-time monitoring and tracking [9]. In Oman, where the population is increasing rapidly, there is a growing need for smart transportation systems that can ensure the safety of schoolchildren. The use of RFID and IoT technologies can help address this need by providing a reliable and efficient system for tracking and monitoring school buses [10].]

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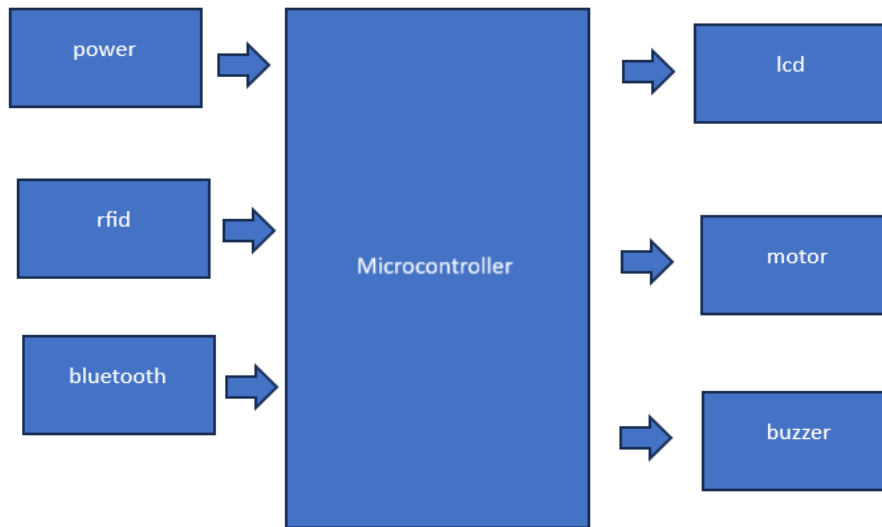
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III.SYSTEM MODEL

Fig1. Block Diagram of IoT Based School Children Transportation System

Each student is provided with an RFID tag, which carries their unique identification data. When the   student boards or exits the bus, the EM-18 RFID reader scans the tag and records the activity. This
ensures attendance tracking and verifies the number of students on the bus. The Arduino acts as the central control unit, processing inputs from various sensors and modules, including the RFID reader and Bluetooth buzzer. It manages data transmission and system logic. The ESP32 connects the system to the internet, transmitting real-time data to a cloud server. This enables parents and school administrators to track the bus location and student attendance through a mobile app or web interface.

The Bluetooth buzzer module provides immediate alerts for critical situations. For instance, if a child's RFID tag is not detected while exiting, the buzzer sounds to notify the driver. It can also be triggered remotely via Bluetooth for emergency alerts or notifications. The LCD displays real-time information for the driver, such as the number of students onboard, attendance confirmation, and system status. This helps in avoiding manual errors and ensures proper monitoring.

When a student enters the bus, their RFID tag is scanned, and the data is sent to the Arduino. The Arduino processes the data and updates it to the cloud via the ESP32 Wi-Fi module. The mobile application fetches data from the cloud, providing parents and administrators with updates on the student's journey, including boarding time and bus location using GPS data. If any anomalies are detected, such as a student not exiting the bus, the buzzer alerts the driver. At the end of the trip, the RFID system checks if all registered students have exited the bus. If a student is detected as

still onboard, the buzzer sounds to alert the driver, preventing incidents of children being left on the bus. This system not only ensures the safety of students but also provides peace of mind to parents through real-time notifications and tracking, making it an excellent use of IoT for transportation safety. For someone staying in a hostel and valuing safety, systems like this can resonate deeply with the importance of secure environments, both at school and during transit.

A. Microcontroller

The ESP32-ESP32S 30P Expansion Module is a versatile development board based on the ESP32 microcontroller, which is commonly used for projects involving IoT (Internet of Things), wireless communication (Wi-Fi and Bluetooth), and real-time control systems. The ESP32S version of the ESP32 is a variation of the original chip with slight differences in packaging and other minor details, but it generally offers the same core functionalities the ESP32 ESP-32S 30P Expansion Module can be used for real-time vehicle and child tracking, notifications, emergency alerts, driver monitoring, and much more. Its flexibility, connectivity options, and low power consumption make it an ideal choice for building a secure, efficient, and scalable school transportation system.
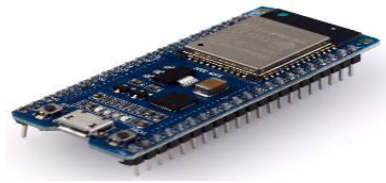

Fig2. ESP32 ESP-32S 30P Expansion Module

B. LCD

A liquid crystal display (LCD) is a thin, flat display device made up of any number of color or monochrome pixels arrayed in front of a lights source or reflector. LCD screens that display text in a grid format (e.g., 16 characters across and 2 rows, or 20 characters across and 4 rows). They are commonly used for simple applications where you need to display short messages like status updates or alerts.

Fig3. LCD

C. RFID

The EM-18 RFID reader module is a widely used device for reading RFID tags. It operates on a frequency of 125 kHz and is typically employed for low-cost, low-frequency RFID applications. The module can read unique identification data stored on RFID tags, making it ideal for projects involving tracking, access control, and attendance systems.

Fig4. EM- 18 RFID Reader Module

D. Buzzer

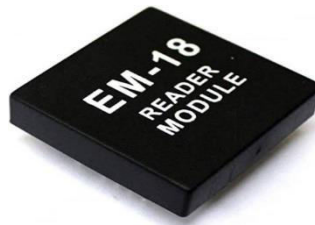A buzzer or beeper is an audio signaling device, which may be mechanical, electro mechanical.

Fig5. Buzzer

E. ESP32 Wi-Fi Bluetooth module

The ESP32 is a versatile and popular microcontroller module developed by Espressif Systems. It is widely used in IoT (Internet of Things) projects due to its powerful features. The ESP32 supports both Wi-Fi (802.11 b/g/n) and Bluetooth (including Bluetooth Low Energy (BLE)), making it suitable for a wide range of wireless communication applications. The ESP32 supports both Wi-Fi (802.11 b/g/n) and Bluetooth (including Bluetooth Low Energy (BLE)), making it suitable for a wide range of wireless communication applications.

Fig6.Bluetooth module

IV.RESULT

The IoT-based school children transportation system successfully ensured accurate attendance tracking and enhanced safety for students. The EM-18 RFID reader reliably identified students as they boarded and deboarded the bus, with data transmitted in real-time to the cloud via the ESP32 Wi-Fi module. Parents and school administrators could access this information through a mobile or web application, providing transparency and peace of mind. The Bluetooth buzzer effectively alerted in case of emergencies, such as unauthorized access or discrepancies in student count, ensuring prompt action. Additionally, real-time location tracking of the bus improved monitoring, while optional features like alcohol sensors further enhanced safety. Overall, the system proved efficient and reliable in addressing key concerns in school transportation.
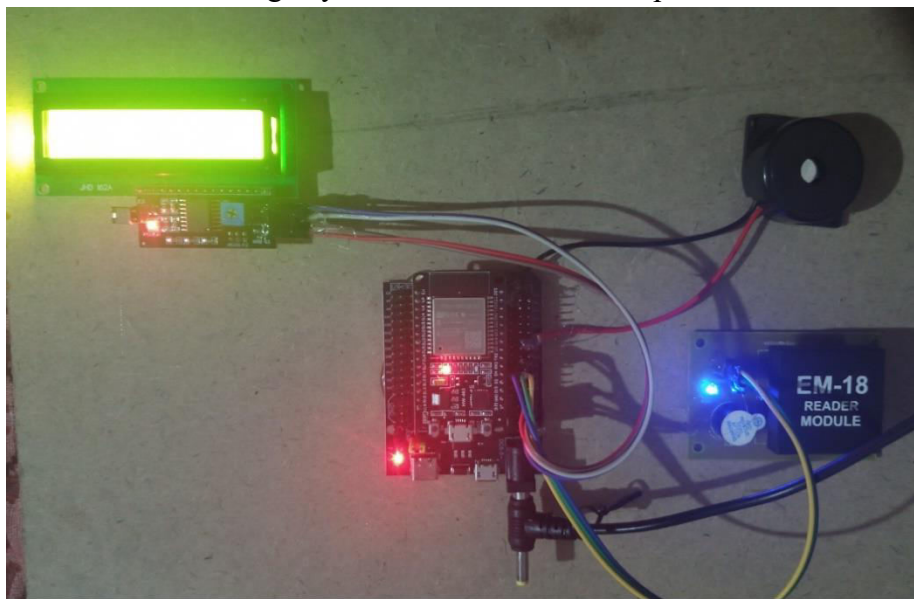

Fig7.Kit for School children transportation System

V.CONCLUSION

In addition to ensuring student safety and accurate attendance tracking, the IoT-based school children transportation system offers significant benefits in terms of real-time monitoring and operational efficiency. By utilizing the ESP32 Wi-Fi module, the system allows for seamless communication between the bus and a cloud platform, enabling both parents and school administrators to track the bus's location at any given time. This real-time tracking not only enhances safety but also helps in route optimization and time management. The integration of RFID technology further streamlines the attendance process, eliminating manual tracking and reducing human error. Moreover, the system's ability to trigger immediate alerts via the Bluetooth buzzer in case of safety breaches, such as a forgotten child or unauthorized access, ensures timely responses to potential threats. With features like alcohol sensors for driver monitoring, the system

emphasizes the importance of maintaining a secure environment on school buses. Ultimately, this project exemplifies the potential of IoT in creating smarter, safer, and more efficient school transportation systems, setting the foundation for future advancements in student safety and transportation management.

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