

# Design and Implemented Smart Pass Transit Monitor System

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**Abstracts-** The Smart Pass Transit Monitor is an intelligent bus access and monitoring system designed to enhance safety and efficiency in college transportation. It operates using RFID-based authentication, allowing only authorized students to access the bus. When a valid card is scanned, the system verifies the user and automatically controls the door, while unauthorized access is denied. The system also provides real-time support to the driver by displaying the next bus stop and maintains a record of students boarding at each stop along with their details. This enables effective monitoring and quick communication when required. The system is implemented using ESP32, RFID reader, RTC, GPS module, LCD display, and a servo motor for door control.

**Keywords:** ESP32, RFID, Smart Bus System, Student Monitoring, IoT-Based Transport System

**Introduction:** The rapid growth of embedded systems and Internet of Things (IoT) technologies has enabled the development of smart transportation solutions. In educational institutions, bus transport is essential for ensuring safe and reliable student travel. However, most existing systems depend on manual methods for attendance,

student verification, and route tracking, which are often inefficient, time-consuming, and prone to errors. The Smart Pass Transit Monitor System is developed to overcome these limitations by integrating ESP32, RFID, GPS, RTC, and IoT-based communication. The system automates student authentication, monitors bus location, and provides real-time updates to drivers and administrators. This approach improves operational accuracy, enhances student safety, and reduces manual workload in transportation management systems.

## II. SYSTEM DESCRIPTION AND BLOCK DIAGRAM:

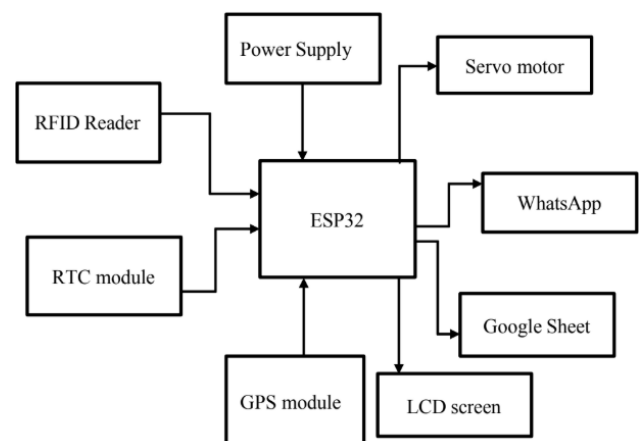


Fig: Smart Pass Transit Monitor System

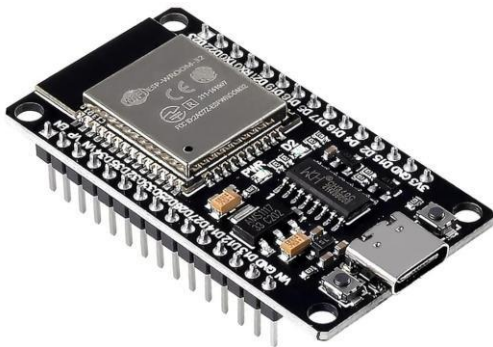
**ESP32:**

Fig. ESP32

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**Twilio Application:** Twilio is app to send WhatsApp messages on user WhatsApp.

**Google Sheet:** Google sheet is cloud platform to store student data

**RFID & Cards:**

Fig. RFID &amp; Cards

RFID technology is used for student identification in the system. Each student is assigned a unique RFID card containing encoded data. When the card is scanned, the reader verifies the identity and grants access. This ensures secure, fast, and contactless authentication for efficient bus entry and monitoring.

**GPS Module (Neo 6M):**

Fig. GPS module

The GPS NEO-6M module is used to track the real-time location of the bus. It receives satellite signals to provide accurate latitude and longitude data. This information helps in route monitoring, navigation, and updating bus location for drivers and administrators.

**RTC Module (DS3231):**

Fig. RTC module

The DS3231 RTC module provides accurate real-time clock and date information for the system. It maintains time even during power loss using a backup battery. This ensures proper timestamping of student entry, attendance records, and synchronization of system operations.

**LCD Display:**

Fig. LCD Display

The I2C LCD display is used to show system information such as student details, entry status, and bus stop updates. It communicates with the ESP32 using minimal pins through the I2C interface. This reduces wiring complexity and provides clear, real-time visual output for monitoring.

**Servo Motor:**

Fig. Servo Motor

A servo motor is used to control the opening and closing of the bus door in the system. It operates with precise angle rotation based on signals from the ESP32. This ensures controlled movement, reliable operation, and secure access during student entry and exit.

**Power Supply:**

Fig. Power Supply

The power supply unit provides stable voltage to all components of the system, ensuring reliable operation. It converts input power into required levels for ESP32, RFID, and other modules. Proper regulation and filtering protect devices from fluctuations, supporting continuous and efficient system performance.

The steps of proposed work as given below:

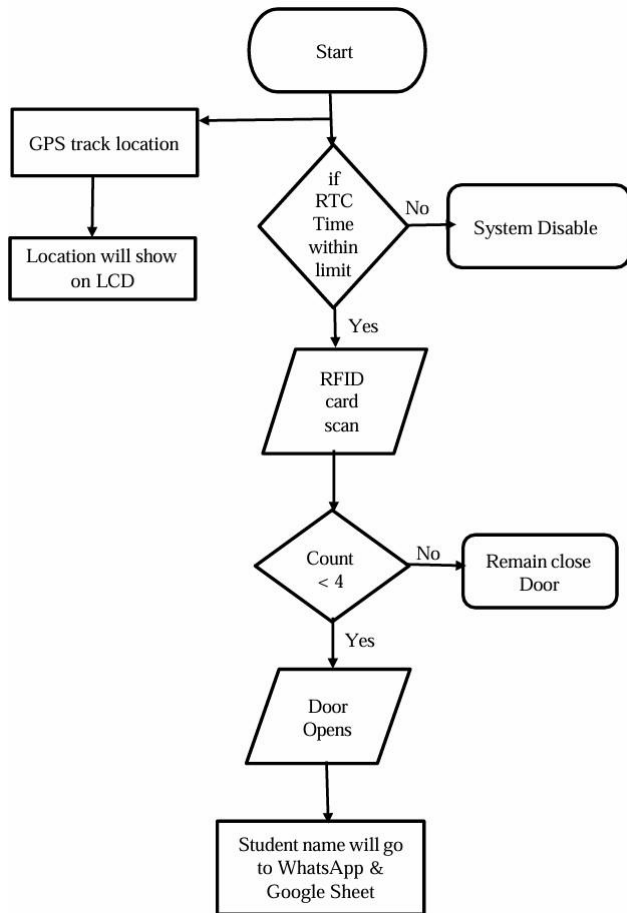


Fig: flow chart Smart Pass Transit Monitor System

Step 1: GPS starts detecting Location and If Bus Stop is coming then the location will show on the LCD display.

Step 2: RTC check the allocated Time slot if in time then RFID card scan and Open the Door of College bus but the card scan only 4 times in allocated time slot.

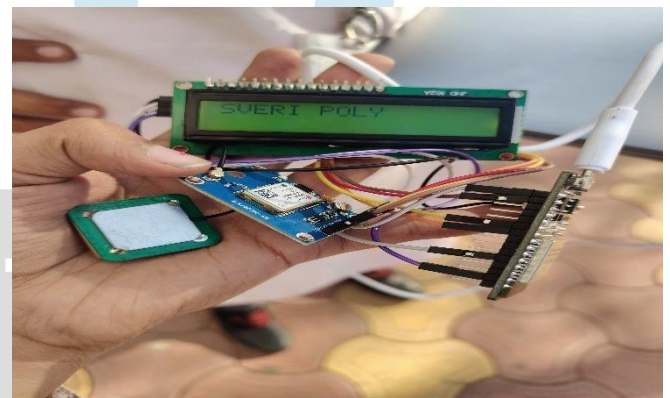
Step 3: The Student Entry and Exit will go on the Drivers WhatsApp as well as Google sheet of the College bus Administrator.

### III. RESULTS AND DISCUSSIONS

The Smart Pass Transit Monitor system enables secure RFID-based student authentication and automated door control. It provides real-time bus location updates and stops information.

Student entry and exit data are sent to the driver's WhatsApp and stored in the administrator's Google Sheet for monitoring, improving safety and efficiency.

### IV. ACTUAL RESULT



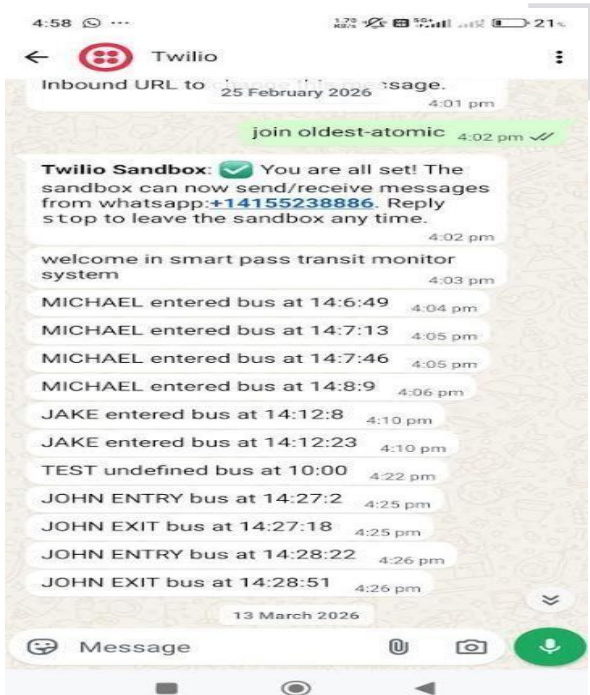
Name	RFID UID	BUS ID	Time	Entry/Exit
MICHAEL	F6306A05	F6306A05	5:50:17 PM	ENTRY
MICHAEL	F6306A05	F6306A05	5:50:42 PM	EXIT
JAKE	939D7F31	939D7F31	5:51:17 PM	ENTRY
JAKE	939D7F31	939D7F31	5:51:25 PM	EXIT
JAKE	939D7F31	939D7F31	5:51:35 PM	ENTRY
JAKE	939D7F31	939D7F31	5:51:46 PM	EXIT
EMILY	FAE92B1F	FAE92B1F	1:22:28 PM	ENTRY
EMILY	FAE92B1F	FAE92B1F	1:22:42 PM	EXIT
EMILY	FAE92B1F	FAE92B1F	1:23:11 PM	ENTRY
MICHAEL	F6306A05	F6306A05	2:34:44 PM	ENTRY
MICHAEL	F6306A05	F6306A05	2:34:53 PM	EXIT
MICHAEL	F6306A05	F6306A05	2:35:02 PM	ENTRY
MICHAEL	F6306A05	F6306A05	2:35:46 PM	EXIT
MICHAEL	F6306A05	F6306A05	4:42:26 PM	ENTRY

## CONCLUSION

The Smart Pass Transit Monitor System successfully demonstrates an efficient integration of embedded systems and IoT technologies for automating student transportation monitoring. By combining RFID-based authentication, GPS tracking, and real-time clock functionality, the system ensures accurate and reliable entry and exit recording. The use of cloud platforms like Google Sheets enables real-time data storage and easy accessibility, while Twilio-based notifications enhance communication and transparency.

The system reduces manual effort, improves security, and provides real-time insights into student movement. Overall, the project offers a cost-effective, scalable, and practical solution for modern transportation management, making it highly suitable for educational institutions.

Additionally, the system ensures better coordination between drivers and administrators by providing timely updates and structured data records. It supports future enhancements such as mobile applications and advanced analytics, further improving system performance, reliability, and user convenience.



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