

Smart ID Card with Parental Monitoring System

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Abstract: *This project presents the design and development of a Smart Student ID Card with 4G alert, GPS tracking, and parental monitoring system. The system is developed using an ESP32 microcontroller integrated with a camera module, SIM A7672S 4G GSM module, and L86-M33 GPS module. Parents can monitor their child through camera access and track real-time location using GPS, even beyond college hours. When a parent sends a request message to the ID card, the system retrieves the current location and sends it to the registered mobile number through the GSM network. An emergency alert button is also provided, which forwards a call to the parent in case of danger. The proposed system is compact, reliable, and designed to enhance student safety through real-time communication and monitoring.*

Keywords: Smart Student ID Card, ESP32, 4G GSM Module, GPS Tracking, Parental Monitoring, Emergency Alert System

I. INTRODUCTION

Smart monitoring systems are becoming very important in modern technology. Systems that ensure student safety and parental awareness are gaining popularity in educational environments. Parents often want to know the real-time location and safety status of their children. Traditional ID cards do not provide any tracking or safety features.

Inspired by these needs, this project focuses on designing a simple and low-cost Smart ID Card with Parental Monitoring System. The system allows parents to monitor their child using technologies such as GPS, GSM, and a camera module. Parents can request the location of their child, and the system sends the real-time location to their registered mobile number.

The system also includes an emergency alert button that allows the student to immediately contact their parents in case of danger. This project helps in understanding embedded systems, real-time tracking, wireless communication, and safety-based applications.

NEED OF STUDY.

Ensuring student safety has become increasingly important in today's environment. Students spend time both inside and outside college premises, and in unexpected situations immediate communication becomes necessary. Traditional ID cards are limited to identification purposes and do not provide any monitoring or alert features.

There is a need for a smart and reliable system that enables real-time location tracking and instant communication. The proposed Smart Student ID Card allows location sharing, camera monitoring, and emergency alert support, helping improve overall safety and timely response in critical situations.

TECHNICAL ARCHITECTURE

Methodology

The proposed system is implemented using an ESP32 (ESP32-CAM) microcontroller integrated with a SIM A7672S 4G GSM module and L86-M33 GPS module to enable real-time monitoring and communication. The GPS module continuously acquires location coordinates, while the GSM module facilitates secure data transmission via cellular network. Upon receiving a location request from the registered parent number, the system processes the GPS data and

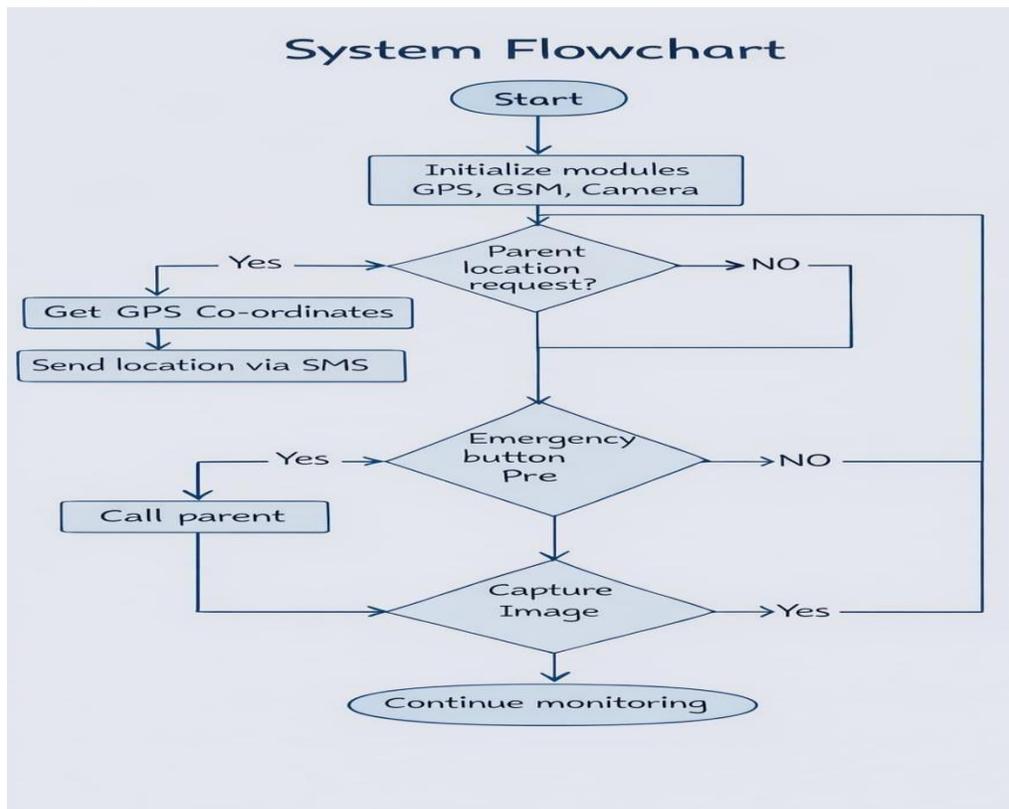


transmits the current coordinates through SMS. The ESP32-CAM supports image capture for remote monitoring when required. An emergency alert mechanism is incorporated, wherein activation of the alert button automatically forwards a call to the registered parent number, ensuring immediate response and enhanced student safety.

Working Mechanism

The system initiates when the Smart ID card is powered on and connected to the cellular network. The ESP32 (ESP32-CAM) continuously interfaces with the L86-M33 GPS module to acquire real-time location coordinates. When a parent sends a predefined location request message to the registered SIM number, the GSM module receives the request and forwards it to the ESP32 for verification. The system validates the registered number to ensure authorized access. If the number is not authorized, the request is ignored. If authentication is successful, the ESP32 retrieves the current GPS coordinates and transmits the location details to the registered parent’s mobile number via the SIM A7672S 4G GSM module. For monitoring purposes, the ESP32-CAM captures images when required and enables remote observation. In emergency situations, when the alert button is pressed, the system immediately initiates a call to the registered parent’s mobile number to ensure rapid response and communication. After successful transmission or alert execution, the system returns to monitoring mode.

FLOWCHART



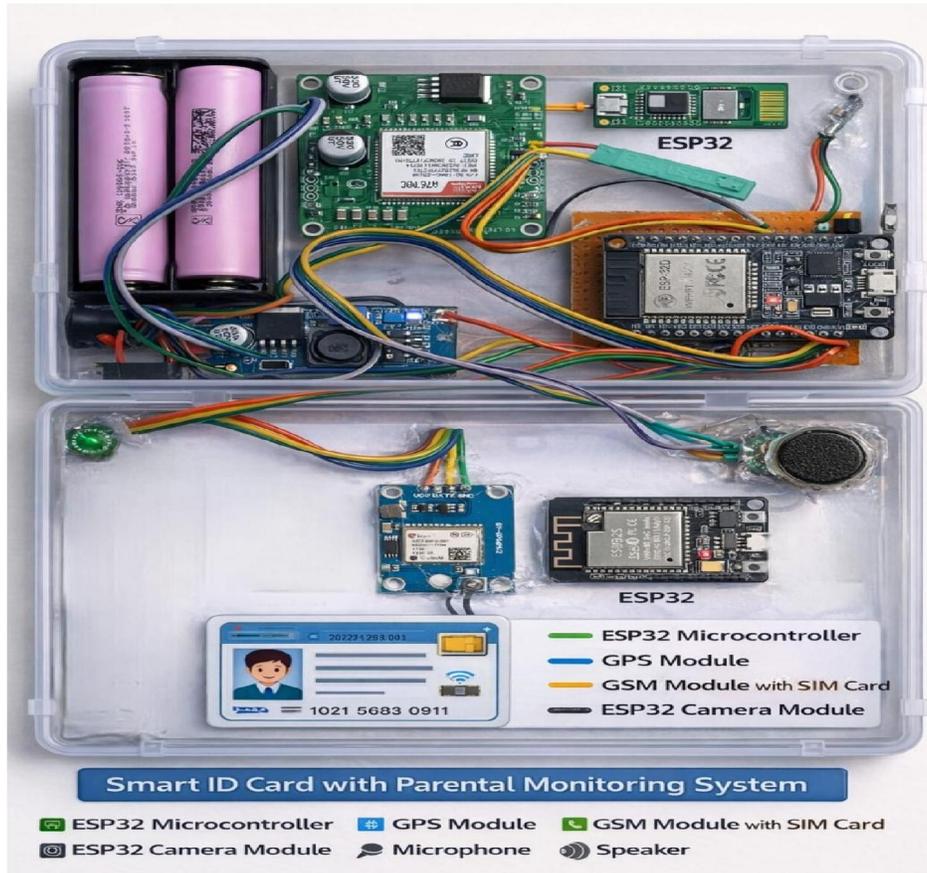
BLUEPRINTS/DESIGN ASPECTS

The design of the Smart ID Card with Parental Monitoring System focuses on safety, reliability, and real-time communication. The ESP32 microcontroller acts as the main control unit, connecting all components efficiently. The GPS module is used for real-time location tracking, while the GSM module enables communication with the parent’s



mobile phone. A camera module provides visual monitoring, and the microphone and speaker support audio interaction. An emergency alert button is included to send immediate alerts or calls to parents during critical situations. The system is designed to be compact, portable, and easy to use, ensuring effective monitoring and student safety.

WORKING DIAGRAM



WORKING FLOW

The proposed system operates with the ESP32 microcontroller as the main control unit powered by a battery supply. The ESP32 is connected to modules such as GPS for location tracking, GSM with SIM card for communication, camera module for monitoring, and microphone and speaker for audio interaction.

When the student presses the location button, the system activates the GPS module to obtain the real-time location. The ESP32 processes this data and sends the location details to the parent’s registered mobile number using the GSM module. The camera module can be used to monitor the student’s surroundings when required. In case of an emergency, the student can press the emergency alert button, which immediately sends an alert or initiates a call to the parent.

This system ensures quick communication, real-time location sharing, and improved safety for the student



HARDWARE COMPONENTS

The hardware setup include :

- ESP32 Microcontroller
- GPS Module
- GSM Module with SIM Card
- ESP32 Camera Module
- Microphone
- Speaker
- Location Button
- Emergency Call Button
- Call Button (Accept/Reject Call)
- Battery Power Supply

These components are interconnected and controlled by the ESP32 to perform location tracking, communication, monitoring, call handling, and emergency alert functions.

VALUE ADDITION

Real-Time Location Tracking: Enables parents to monitor the live location of their child using GPS technology.

Enhanced Student Safety: Emergency call button allows students to quickly contact parents during dangerous situations.

Parental Monitoring: Provides direct communication between parents and children through GSM and call features.

Remote Surveillance: Camera module allows parents to monitor the surroundings of the student when required.

User-Friendly Design: Compact and portable smart ID card makes it easy for students to carry and use.

Cost-Effective Solution: Provides an efficient safety system at a lower cost using embedded technology.

APPLICATION AREAS

Educational Institutions: The system can be used in schools and colleges to monitor student safety and provide real-time location updates to parents. It also helps in improving communication between parents and institutions.

Personal Safety: The smart ID card can be used by children for personal safety during travel or outdoor activities, ensuring parents can track their location when needed.

Emergency Situations: The system is useful in critical situations where the student can send an emergency alert or call to parents for immediate help.

Smart Monitoring Systems: Can be integrated into smart security systems for real-time tracking and monitoring applications.

SOCIAL IMPACT

The Smart ID Card with Parental Monitoring System significantly improves student safety by providing real-time location tracking and instant communication with parents. It reduces parental anxiety by allowing continuous monitoring of their child's whereabouts.

The system enhances security by enabling quick response during emergency situations through the emergency call feature. It also promotes the use of smart technology in daily life, making safety solutions more accessible and practical.

Overall, the system contributes to a safer environment for students and strengthens trust between parents and children through reliable monitoring and communication.



KEY FEATURE

- Real-Time Location Tracking: Provides live location of the student using GPS technology.
- Location Sharing Button: Allows the student to send their current location to parents with a single press.
- Emergency Call Feature: Enables the student to immediately contact parents during dangerous situations.
- Call Handling System: Supports accepting and rejecting calls through a dedicated button.
- Camera Monitoring: Allows parents to monitor the surroundings of the student when required.
- Audio Communication: Microphone and speaker enable voice interaction and communication.
- GSM Communication: Sends messages and alerts to the parent’s registered mobile number.

EXPECTED OUTCOMES

- Improved Student Safety: The system ensures better safety by enabling real-time location tracking and emergency communication.
- Quick Location Sharing: Students can easily send their live location to parents using a single button.
- Faster Emergency Response: Emergency call feature allows immediate contact with parents during critical situations.
- Better Parent-Child Communication: GSM and call features provide reliable communication between parents and students.
- Effective Monitoring System: Camera and tracking features enable proper monitoring of the student’s activities and surroundings.
- User-Friendly Operation: Simple and portable design makes the system easy to use for students.

RESULT & DISCUSSION

Result of Smart Id card with parental monitoring device

| Variable | Minimum | Maximum | Mean | Std. Deviation | Test Value | Sig |
|--------------------------------|---------|---------|------|----------------|------------|-------|
| GPS location accuracy(%) | 85 | 98 | 92 | 4.2 | 1.78 | 0.070 |
| Response time(sec) | 1.5 | 3.0 | 2.2 | 0.5 | 1.40 | 0.210 |
| GSM message delivery time(sec) | 2 | 5 | 3.5 | 0.8 | 1.55 | 0.190 |
| Emergency call success rate(%) | 90 | 100 | 95 | 3.5 | 1.60 | 0.180 |
| Power consumption(w) | 2 | 6 | 4 | 1.0 | 1.35 | 0.250 |

The table displays the performance parameters of the Smart ID Card system during testing. The values represent the minimum, maximum, mean, and standard deviation observed during multiple trials.

The mean values indicate the average performance of the system, while the minimum and maximum values show the variation under different conditions. The standard deviation represents the consistency of the system performance.

The analysis shows that the response time of the system remains within an acceptable range and does not vary significantly. The GPS location accuracy is high, ensuring reliable tracking of the student. The GSM module successfully delivers messages within a short time, enabling effective communication between the student and parents.

The emergency call feature shows a high success rate, indicating that the system can respond quickly during critical situations. Minor variations in performance may occur due to network availability and environmental factors.

Overall, the results demonstrate that the system is reliable, efficient, and suitable for real-time student monitoring and safety applications.

Table 1 Table type styles

| Parameter | Description | Observation1 | Observation2 |
|---------------|-----------------------------|--------------|--------------|
| Response time | Time taken to send location | Stable | Within limit |
| GPS accuracy | Location tracking accuracy | High | Consistent |



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