

School Bus Tracking System

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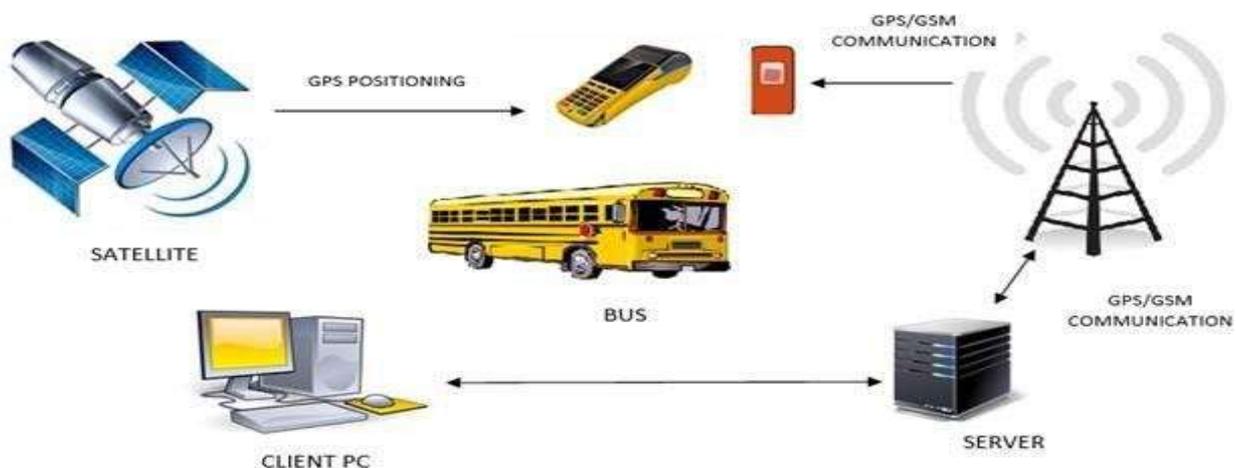
ABSTRACT

The **School Bus Tracking System** is a real-time GPS-based solution designed to enhance the safety and efficiency of school transportation. This system enables parents, school administrators, and transport authorities to track school buses using GPS technology and mobile applications. It provides real-time location updates, estimated arrival times, route optimization, and emergency alerts in case of deviations or delays. The system improves student safety, reduces waiting time, and enhances communication between stakeholders. Implemented using IoT, cloud computing, and mobile technology, the project ensures a secure and efficient school transportation system.

Keywords: GPS Tracking, Real-time Monitoring, School Transportation, Student Safety, Mobile Application, IoT (Internet of Things), Route Optimization.

INTRODUCTION

The **School Bus Tracking System** is a GPS-based solution designed to enhance student safety and improve the efficiency of school transportation. It enables parents, school authorities, and transport managers to track the real-time location of school buses using mobile applications or web platforms. The system provides features such as live tracking, estimated arrival times, route optimization, and emergency alerts in case of deviations or delays. By integrating IoT, cloud computing, and GPS technology, this system minimizes risks, reduces waiting times, and ensures seamless communication between all stakeholders.



LITERATURE REVIEW

A Several researchers have done considerable amount of work relating to Li-Fi it is as follows:

- **GPS-Based Tracking Systems**

Several studies highlight the effectiveness of **GPS technology** in real-time vehicle tracking. Research shows that GPS-integrated systems improve fleet management, enhance security, and provide accurate location updates.

- **IoT and Cloud Computing in Transportation**

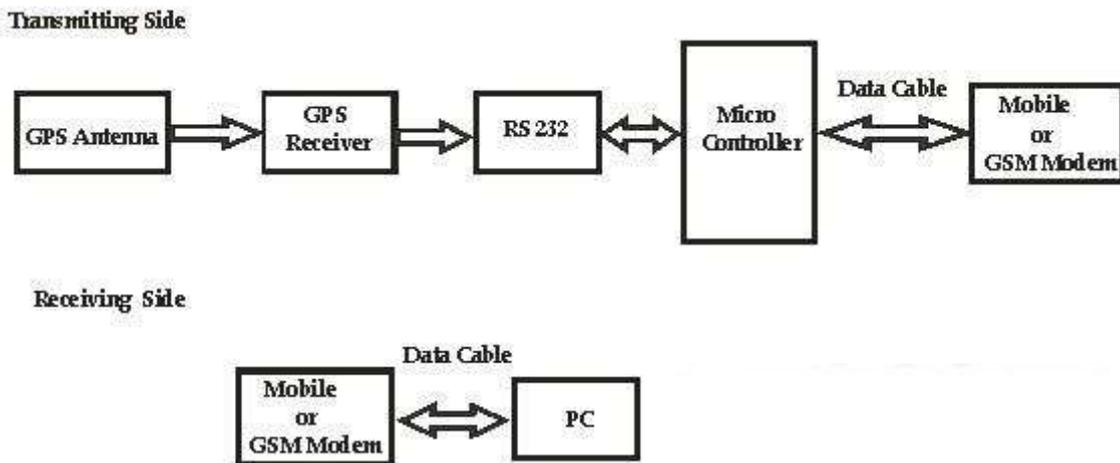
Research on **IoT and cloud-based systems** indicates that they enhance data storage, processing, and accessibility. These technologies enable real-time monitoring, remote management, and better decision-making in transportation systems.

- School Bus Safety and Security**

Studies emphasize the importance of **student safety** during transportation. Geo-fencing, emergency alerts, and automated attendance tracking have been identified as key features to enhance security in school bus management systems.

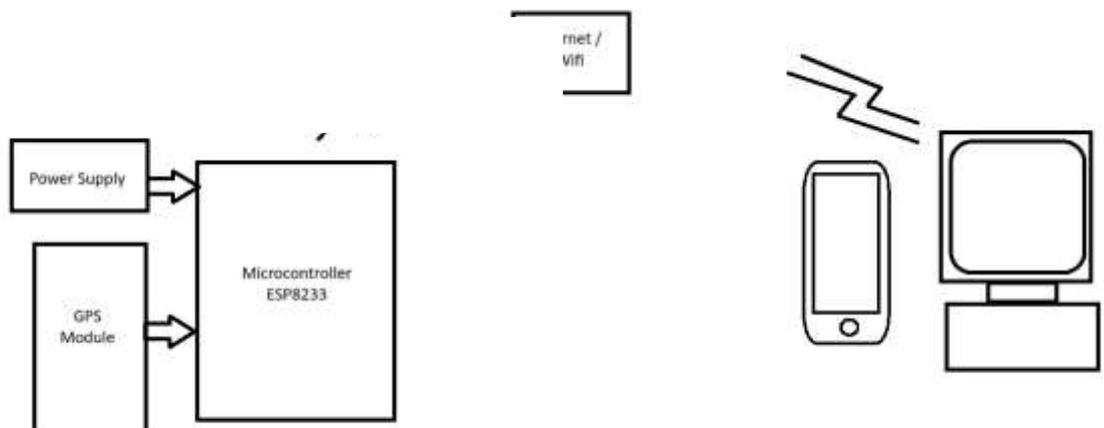
BLOCK DIAGRAM

A typical Block Diagram of School Bus Tracking System is shown in figure 2. It Consist of School Bus with GPS Module, Microcontroller/Processing Unit, Communication Module (GSM/GPRS/IoT), Cloud Server/Database, User Interfaces (Mobile App/Web Portal), Emergency Alert System.



CIRCUIT DIAGRAM

A Circuit Diagram of Project is shown in figure 3. Here Node MCU ESP8266 is used in Transmitter for modulation of signal. GPS Module NEO 6M is used for GPS communication and connectivity.



ADVANTAGES

- a) **Real-Time Location Tracking** – Parents and school administrators can monitor the exact location of the bus, ensuring better safety and time management.
- b) **Enhanced Student Safety** – Geo-fencing, emergency alerts, and route deviation notifications help protect students from potential risks.
- c) **Reduced Waiting Time** – Estimated time of arrival (ETA) updates allow parents and students to plan accordingly, minimizing unnecessary waiting at bus stops.
- d) **Improved Fleet Management** – Schools can optimize routes, monitor driver behavior, and manage fuel efficiency for cost-effective operations. Integration with existing lighting infrastructure leads to better utility.

DISADVANTAGES

- a) **High Initial Cost** – Setting up GPS hardware, cloud servers, and mobile applications can be expensive for schools.
- b) **Internet & Network Dependency** – The system relies on stable internet and GPS signals; poor connectivity in remote areas can affect tracking accuracy.
- c) **Privacy Concerns** – Continuous tracking raises concerns about data security and unauthorized access to student location information.

COMPARISION WITH EXISTING TECHNOLOGY

Table 1: Comparison between existing Technologies

Features	Traditional System (Manual)	GPS-Based Tracking System	IoT-Enabled Smart Tracking System
Tracking Method	Manual logs & phone calls	GPS-based real-time tracking	IoT with cloud-based real-time monitoring
Accuracy	Low (depends on driver updates)	Moderate to High	High with advanced AI & ML algorithms
Notifications	No automated alerts	Basic SMS alerts	Real-time push notifications & emergency alerts
Connectivity	No internet required	Requires GPS & internet	Uses GPS, internet, and cloud for seamless data access
Safety Features	Limited (driver-dependent)	Geo-fencing & route monitoring	AI-based safety predictions, face recognition for attendance
Cost	low	Moderate	Higher initial cost but cost-effective in the long run
User Accessibility	Requires direct contact with the driver	Web & mobile app interface	Smart app with real-time updates & voice assistants
Scalability	Difficult to manage for multiple buses	Scalable but requires manual updates	Highly scalable with automated system upgrades

ACTUAL SETUP



CONCLUSION

Traditional methods rely on manual tracking, which is inefficient. Basic **GPS-based tracking** improves location accuracy, but **IoT-enabled smart tracking** offers advanced features like AI-based safety, automated attendance, and predictive analytics, making it the best option for modern school transportation management.

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