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Real-Time Public Transport Tracking & Smart Crowd Controlling

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Abstract: *Public transportation plays an important role in our day-to-day life, especially government-operated bus services. However, traditional systems lack real-time visibility, efficient crowd management, and safety mechanisms, leading to increased waiting time, overcrowding, and delayed emergency response. This paper presents a Real-Time Public Transport Tracking System developed for government buses using GPS, IoT sensors, mobile applications, and web-based administration. The system consists of two mobile applications (User App and Driver App) and two web platforms (Admin Panel and Officer Portal). Real-time tracking is enabled through GPS, while IR sensors are used for passenger counting and crowd control. An emergency SOS feature enhances safety by enabling instant alerts to authorities. The proposed system improves passenger convenience, operational transparency, and transport safety, making it suitable for smart city applications*

Keywords: Real-time tracking, Public transport, GPS, IR Sensors

I. INTRODUCTION

Public transport systems play a vital role in reducing traffic congestion and providing affordable mobility. Government bus services are widely used but often suffer from issues such as uncertainty in bus arrival time, lack of real-time information, overcrowding, and inefficient emergency handling. Passengers are forced to wait without accurate updates, while authorities struggle with manual fleet monitoring.

With advancements in GPS technology, Internet of Things (IoT), and mobile applications, it is now possible to track vehicles in real time and provide live information to both passengers and transport authorities. The proposed Real-Time Public Transport Tracking System aims to overcome these limitations by offering live bus tracking, structured role-based management, crowd control using IR sensors, and an emergency SOS mechanism.

II. PROBLEM STATEMENT

Existing public transport systems face the following challenges:

- No real-time bus location information for passengers
- Inefficient allocation of buses and drivers
- Overcrowding due to lack of passenger monitoring
- Delayed response during emergencies
- Manual and centralized management without regional supervision

There is a need for a real-time, intelligent, and safety-oriented transport management system that improves efficiency and passenger satisfaction.

III. PROPOSED SYSTEM

The proposed system is a centralized, role-based real-time tracking platform designed for government bus services. It integrates mobile applications, web portals, and IoT hardware to ensure seamless coordination among administrators, officers, drivers, and passengers.

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System Components:

- User Mobile Application for passengers
- Driver Mobile Application for bus drivers
- Admin Web Application for centralized control
- Officer Web Application for regional supervision
- IoT Hardware Module including IR sensors

IV. LITERATURE REVIEW

Sr. No.	Author(s) & Year	Title / Area	Technology Used	Key Contribution	Limitation
1	Khanna & Anand (2018)	IoT based Smart Transportation	GPS, IoT	Provided real-time vehicle tracking and monitoring	No crowd control or emergency features
2	Madakam et al. (2015)	IoT Literature Review	IoT	Discussed IoT applications in smart cities	Theoretical study only
3	Verma & Gupta (2018)	Crowd Management System	IR Sensors	Demonstrated crowd detection using IR sensors	Not integrated with transport tracking
4	Sharma & Kumar (2020)	Smart Public Transport System	GPS, IoT	Improved passenger information system	No SOS emergency feature
5	Zafari et al. (2019)	Localization Technologies Survey	GPS, Sensors	Analyzed tracking technologies	No real-time transport application
6	Google Developers	Maps & Tracking APIs	GPS, Maps API	Provided mapping and navigation support	Dependent on internet connectivity

V. SYSTEM ARCHITECTURE

Description: The Real-Time Public Transport Tracking System follows a client–server architecture integrated with IoT hardware. Each bus is equipped with a **GPS module**, **IR sensors**, and a **microcontroller** forming the bus unit. The GPS module provides real-time location, while IR sensors count passengers for crowd detection. This data is processed by the microcontroller and sent to the central server through a **4G/5G internet network**.

The **Driver App** is used to start the trip and automatically enable tracking. In case of emergency, the driver can trigger an **SOS alert**, which is immediately sent to the **Admin and Officer Web Portal** for quick action. The **Admin and Officers** monitor fleet status, bus location, and alerts through the web portal. The **User App and Website** display live bus tracking, estimated arrival time (ETA), crowd status, and emergency notifications to passengers.

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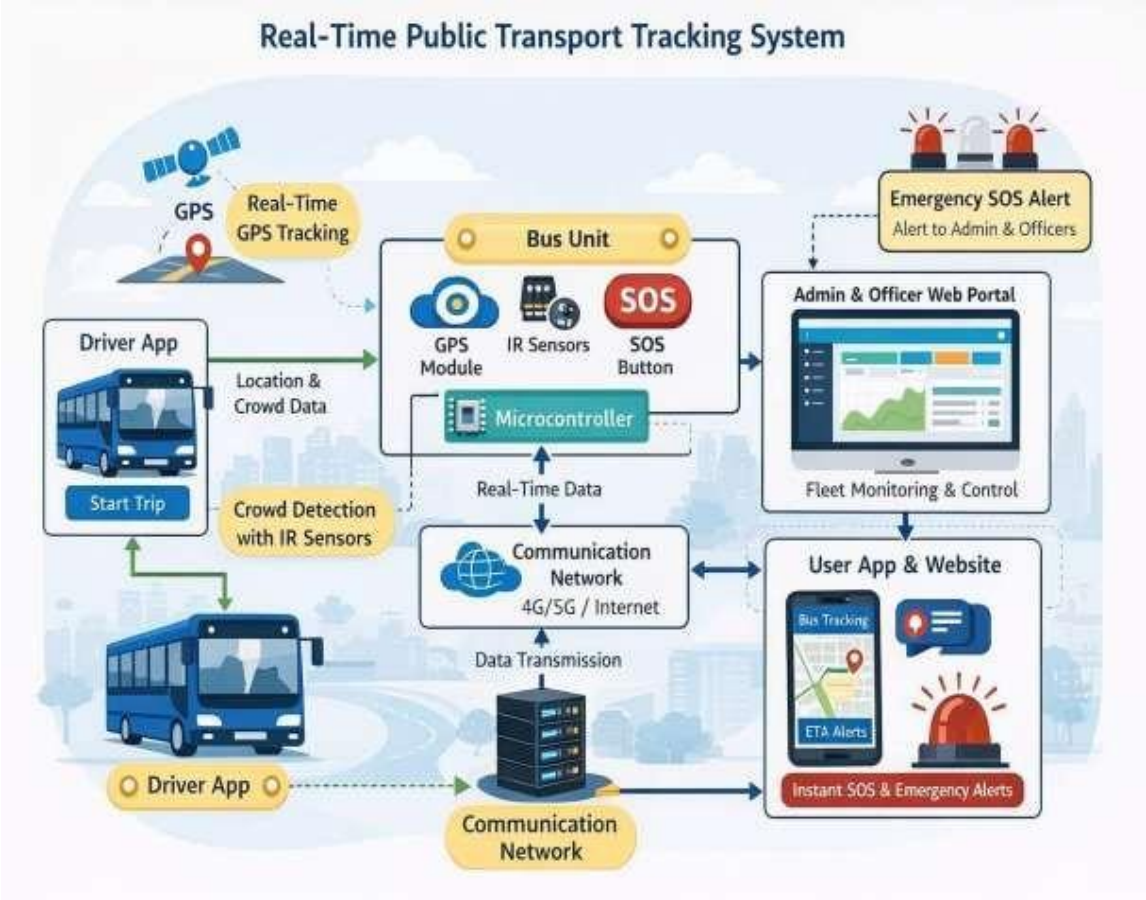

Fig. 1: System flow diagram

VI. MODULE DESCRIPTION

Admin Module

The admin is the main authority of the system. The admin can create buses, register users, allocate officers to specific regions, monitor real-time tracking, crowd levels, and respond to emergency alerts.

Fig.2.1: Admin Login

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Fig.2.2: Admin Dashboard

Officer Module

Officers are assigned to particular routes or areas. They allocate drivers to buses, supervise live tracking, and handle alerts related to overcrowding or emergencies.

Fig.3.1: Officer Login

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Fig.3.2: Officer dashboard

Driver Module

Drivers log in through the Driver App, view assigned bus details, and start trip tracking. Once the trip starts, GPS-based tracking becomes active. An SOS button allows drivers to report emergencies instantly.

Fig.4.1: Driver Login

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User Module

Passengers use the User App to track buses in real time, view estimated arrival time, check crowd status, and receive alerts. This reduces waiting time and improves travel planning.

Fig. 5.1: User App

Fig.5.2: User Dashboard

VII. CROWD CONTROL USING IR SENSORS

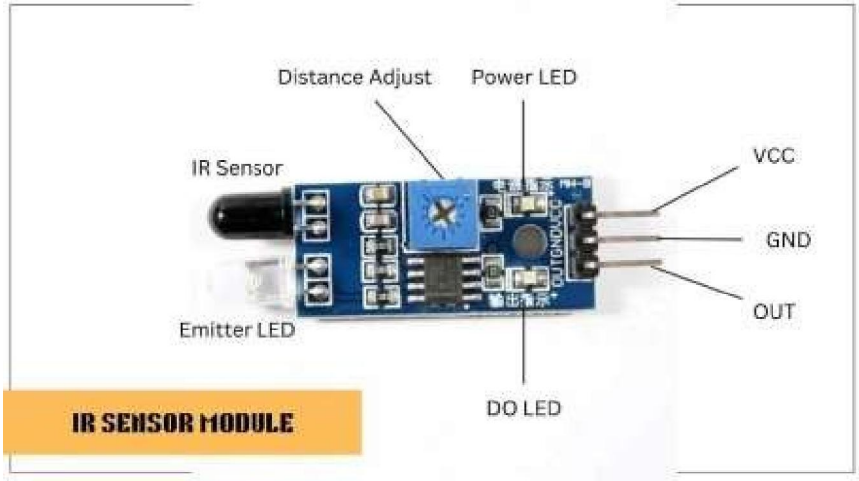

Fig.6: IR Sensor

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IR sensors are installed at the bus entry and exit points to detect passenger movement. The system updates the passenger count in real time. If the count exceeds a predefined threshold, an overcrowding alert is generated and displayed to admin, officers, and users. This feature helps in managing crowd levels and improving passenger safety.

VIII. EMERGENCY SOS FEATURE

An emergency SOS button is provided in the Driver App. During emergencies such as accidents, breakdowns, or medical issues, the driver can trigger the SOS. The system immediately sends alerts along with the live bus location to the admin and officers, enabling quick response.

IX. TECHNOLOGIES USED

Fig.7: Technologies Used

- Hardware: IR sensors, Arduino/Raspberry Pi
- Software: HTML, CSS, JavaScript, Android, Node.js/Python, java
- Database: MySQL
- Communication: Internet / Mobile Network

X. ADVANTAGES

- Real-time bus tracking and ETA
- Reduced passenger waiting time
- Efficient crowd management
- Improved emergency response
- Better fleet management and transparency

XI. LIMITATIONS

- Dependence on stable internet connectivity
- Initial hardware installation cost
- GPS accuracy issues in dense urban areas

XII. CONCLUSION

The Real-Time Public Transport Tracking System provides a reliable and intelligent solution for government bus management. By integrating GPS-based tracking, IR sensor–based crowd control, mobile applications, and web-based administration, the system enhances passenger convenience, safety, and operational efficiency. The proposed solution

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effectively addresses the limitations of traditional public transport systems and supports smart city transportation initiatives.

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