

IOT Based Smart Bus Tracking and Passenger Information System Using RF Communication

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Abstract - The rapid growth of urbanization has increased the demand for efficient and intelligent transportation systems. This paper presents a Bus Tracking System using RF Communication integrated with the Internet of Things (IoT) to provide real-time passenger information. The system utilizes RF modules for short-range communication between bus units and bus stops, while IoT ensures remote monitoring through cloud platforms. RF transmitters installed in buses are detected by receivers at bus stops to identify arrival and departure. The collected data is transmitted to a centralized IoT platform via a microcontroller for processing and display on web or mobile applications. The implementation demonstrates a cost-effective, scalable, and reliable solution that minimizes passenger waiting time and improves operational efficiency.

Key Words: Bus tracking system, Internet of Things (IOT), RF Communication, GPS tracking

INTRODUCTION

Public transportation is a vital, economical mode of transport for urban populations. However, traditional systems lack real-time tracking, leading to uncertainty and long waiting periods for passengers. Delays due to traffic or operational issues often go uncommunicated, resulting in poor time management.

By combining Radio Frequency (RF) communication for cost-effective short-range transmission with IoT for global data access, a smarter transportation network can be developed. This system aims to provide accurate, real-time updates to enhance the reliability of public transport and contribute to the development of smart cities.

SYSTEM ARCHITECTURE

The system architecture defines the flow of data between the physical hardware and the cloud monitoring tools. It is divided into two primary units:

- **Transmitter Unit (Bus Unit):** Installed inside the bus to broadcast identification signals.

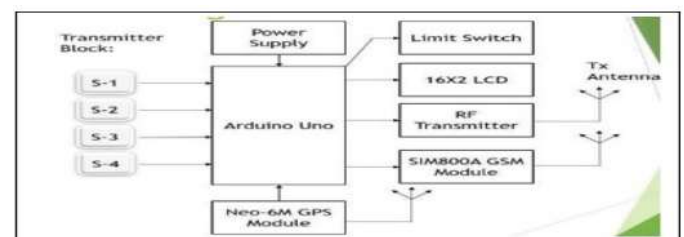


Fig-1: Transmitter Block Diagram

- **Receiver Unit (Bus Stop Unit):** Located at the bus stop to capture signals, process data via a microcontroller, and update the display and cloud.

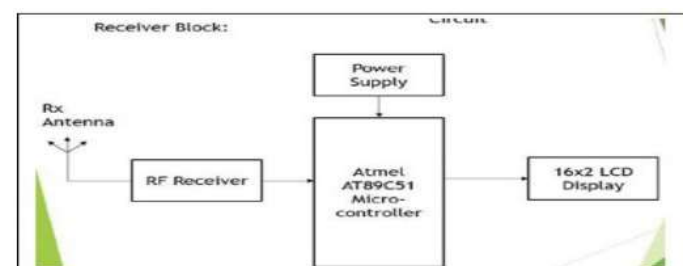


Fig-2: Receiver Block Diagram

HARDWARE AND SOFTWARE METHODOLOGY

The hardware backbone consists of RF modules (433 MHz) for wireless transmission, an Arduino/ESP32 microcontroller for data processing, and an ESP8266 Wi-Fi module for internet connectivity. A 16x2 LCD display provides immediate visual arrival status to passengers at the stop

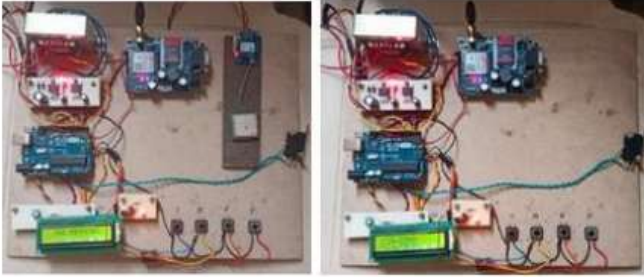


Fig-3: Hardware of TX & RX

The software is developed using the Arduino Integrated Development Environment (IDE) in Embedded C. The workflow involves:

1. Initializing hardware and reading RF signals
2. Decoding bus identification data.
3. Uploading processed information to IoT platforms like ThingSpeak or Blynk for remote user access.

RESULTS AND ANALYSIS

Implementation results confirm that the system successfully detects buses entering the receiver range with minimal delay

- **Accuracy:** High precision in bus identification within the RF operational range
- **Reliability:** Stable performance observed under normal operating conditions.
- **Communication:** Consistent synchronization between the LCD display and the IoT cloud dashboard.

CONCLUSION

The IoT-based Smart Bus Tracking System using RF communication offers a practical, low-cost alternative to expensive GPS-only systems for localized environments like schools or college campuses. While RF range remains a limitation, the integration of IoT provides a scalable foundation for future enhancements, such as AI-based arrival prediction and mobile app integration

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