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Raspberry-Pi Based Real-Time Public Transport Tracker and Delivery System

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***Abstract* - Efficient public transport tracking and delivery management are crucial for reducing delays, improving passenger experience, and optimizing logistics operations. This project proposes a Raspberry Pi-based real-time public transport tracker and delivery system that integrates sensor technology and AI-driven analytics for enhanced monitoring and security.**

The system utilizes a camera for real-time visual monitoring, while the MQ135 and MQ7 gas sensors detect air quality and harmful gases within the transport environment. An IR sensor assists in tracking vehicle movement and passenger entry/exit, ensuring real-time occupancy monitoring. The DHT11 sensor measures temperature and humidity, providing environmental insights for passenger comfort and package safety.

A buzzer serves as an alert mechanism for emergency situations, such as unauthorized access or hazardous gas detection. The ADC modem converts sensor data for seamless processing by Raspberry Pi 5, which acts as the central control unit. Data is stored on an SD card for analysis and record-keeping, enabling improved route optimization and predictive maintenance.

This system provides real-time tracking, security enhancements, and environmental monitoring for public transport and delivery services. By integrating IoT and AI technologies, it ensures efficient fleet management, enhanced passenger safety, and improved delivery operations, making it a scalable and cost-effective solution for smart transportation systems.

Keywords: Camera, MQ 135, IR Sensor, DTH 11, MQ7, Buzzer, ADC modem, SD card, Raspberry-pi 5

I. INTRODUCTION

Public transportation and delivery systems play a vital role in urban mobility and logistics. However, challenges such as route inefficiencies, security risks, environmental concerns, and real-time tracking limitations often affect their overall efficiency. Traditional tracking methods rely on GPS-based systems alone, which provide location data but lack real-time environmental and safety monitoring. To overcome these limitations, this paper presents a Raspberry Pi-based real-time public transport tracker and delivery system that integrates sensor technology and AI-driven analytics to enhance monitoring, safety, and efficiency.

The proposed system utilizes a camera for real-time visual monitoring, ensuring continuous surveillance of passengers and cargo. To enhance safety, MQ135 and MQ7 gas sensors detect harmful gases and air quality variations inside the vehicle, while an IR sensor helps track vehicle movement and passenger activity. The DHT11 sensor provides environmental data, such as temperature and humidity, ensuring optimal conditions for both passengers and transported goods.

For emergency response and security alerts, a buzzer is activated when unsafe conditions are detected. The ADC modem enables seamless integration of analog sensor data with Raspberry Pi 5, which serves as the system's central processing unit. Data is stored on an SD card, allowing for future analysis and system improvements.

By combining IoT, AI, and sensor-based technologies, this system offers real-time vehicle tracking, environmental monitoring, and safety alerts, ensuring improved passenger experience, efficient fleet management, and optimized delivery operations. This project provides a scalable, cost-effective solution for modernizing public transport and

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logistics, contributing to the development of smart and sustainable transportation systems.

II. LITERATURE REVIEW

The development of real-time public transport tracking and delivery systems has seen substantial interest in recent years due to the increasing need for efficient urban transportation solutions. The integration of Internet of Things (IoT) technologies, GPS, and microcomputers like Raspberry Pi has emerged as a promising approach to enhance public transport services.

Several studies have explored the use of IoT-based solutions for public transport tracking, highlighting the potential benefits of real-time location data and emergency alert systems. These studies emphasize the importance of improving the safety and efficiency of public transport by leveraging advanced technologies.

Moreover, the implementation of automatic ticketing systems using Raspberry Pi has demonstrated the potential to streamline the ticketing process and provide real-time tracking and route optimization. This approach not only enhances passenger experience but also improves operational efficiency, reducing wait times and optimizing resource utilization.

The concept of intelligent real-time public transportation monitoring systems has also been a focal point of research. By employing GPS and microcontrollers with built-in Wi-Fi modules, these systems provide real-time location data and arrival times of public transport vehicles. This research underscores the significance of reducing wait times at bus stations and improving overall user experience through real-time tracking.

Collectively, these advancements highlight the potential of integrating Raspberry Pi, GPS, and IoT technologies to create cost-effective and efficient solutions for public transport tracking and delivery systems. Future research may focus on enhancing the accuracy and scalability of these systems, as well as exploring additional applications in smart city initiatives.

III. EXISTING METHOD

Traditional public transport tracking and delivery systems primarily rely on GPS-based tracking, RFID, GSM, and manual supervision for vehicle monitoring and logistics. These systems face several limitations, including inaccurate real-time updates, lack of environmental monitoring, and inefficient route optimization.

1. GPS & GSM-Based Tracking:

- Most existing public transport systems utilize GPS modules and GSM networks to track vehicle locations. However, these systems often suffer from delayed updates due to network dependencies.
- They provide location tracking but lack real-time environmental monitoring of vehicle conditions, such as air quality or temperature.

2. RFID-Based Transport Management:

- Some tracking solutions use RFID technology for automated fare collection and bus stop detection. However, these systems do not provide real-time tracking for passengers or administrators.

3. Manual Monitoring & Paper-Based Logs:

- In many areas, transport monitoring still depends on manual data entry and paper-based logs, leading to inaccuracies, delays, and inefficiencies in tracking transport schedules and deliveries.

4. Lack of Real-Time Safety & Environmental Monitoring:

- Existing systems do not integrate air quality monitoring (MQ135, MQ7) or temperature and humidity tracking (DHT11), which can be crucial for ensuring passenger comfort and goods' safety.
- No built-in alert system like a buzzer for emergency notifications in case of hazardous conditions.

These limitations highlight the need for an AI-powered, IoT-enabled transport tracking and delivery system using Raspberry Pi 5, camera, sensors (MQ135, MQ7, IR, DHT11), ADC modem, SD card, and buzzer to provide real-time tracking, environmental monitoring, and automated alerts for safety and efficiency.

IV. PROPOSED METHOD

The Raspberry Pi-Based Real-Time Public Transport Tracker and Delivery System is designed to enhance the efficiency, security, and monitoring of public transport vehicles and delivery services using IoT and AI-based automation. The system utilizes Raspberry Pi 5 as the central processing unit, integrating multiple sensors and communication modules for real-time tracking and environmental monitoring.

A camera module is incorporated to capture live footage of the vehicle’s surroundings, assisting in security and surveillance. To monitor air quality inside the vehicle, MQ135

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and MQ7 gas sensors are used to detect harmful gases like CO2, CO, and other pollutants. A DHT11 sensor measures temperature and humidity, ensuring that environmental conditions remain within safe limits, especially for cargo transportation.

For obstacle detection and safety, an IR sensor is installed to detect objects in the vehicle's path, preventing collisions. A buzzer alerts drivers and passengers in case of hazardous conditions such as poor air quality, high temperature, or unexpected obstacles. The ADC modem is used to convert sensor data into digital signals, allowing seamless communication with the Raspberry Pi for real-time data processing.

An SD card is integrated for data storage, ensuring that all sensor readings, tracking information, and camera footage are logged for future analysis. The system enables real-time tracking and monitoring, improving route optimization, reducing delays, and enhancing overall safety for both passengers and transported goods. By leveraging IoT and AI technologies, this system provides an efficient, automated, and reliable public transport and delivery tracking solution.

V. BACKGROUND AND RELATED WORK

With urbanization on the rise, the need for efficient public transportation has become paramount. Traditional systems face challenges like unpredictable arrival times and inefficient package delivery. The Internet of Things (IoT) has paved the way for smarter transport solutions by integrating sensors and communication modules for real-time monitoring. Raspberry Pi, a cost-effective microcomputer, has proven to be an ideal platform for developing IoT-based solutions due to its affordability and robust processing capabilities.

Research has shown the effectiveness of GPS-based tracking systems using Raspberry Pi to provide real-time location data of public transport vehicles, reducing wait times and enhancing passenger experience. Additionally, integrating delivery modules with RFID technology into public transport systems has optimized package transportation. The combination of Raspberry Pi, IoT technologies, and GPS offers a promising solution to the challenges faced by traditional public transport systems, improving both operational efficiency and user satisfaction.

5.1 Previous Work and Studies

Real-time public transport tracking systems using IoT and microcomputers have seen extensive research, with a focus on improving the reliability and efficiency of public transport services. Various studies have highlighted the use of Raspberry Pi due to its cost-effectiveness and versatility. One notable study implemented a GPS-based bus tracking system using Raspberry Pi to provide real-time location data of buses. This system allowed passengers to accurately track arrival and departure times, significantly reducing wait times and enhancing the overall user experience.

In addition to tracking, the integration of automatic ticketing systems with real-time tracking capabilities has been explored. Researchers developed a system using Raspberry Pi that enabled passengers to book tickets online and monitor the real-time location of public transport vehicles.

This approach streamlined the ticketing process, minimized manual intervention, and provided accurate arrival times, thereby improving operational efficiency and passenger satisfaction. This innovative approach maximized the utilization of public transport resources and offered a cost-effective solution for urban package delivery. Collectively, these studies showcase the significant advancements in real-time public transport tracking and delivery systems using Raspberry Pi and related technologies, addressing the limitations of traditional systems and enhancing overall efficiency.

VI. PROPOSED METHODOLOGY

6.1 Block Diagram

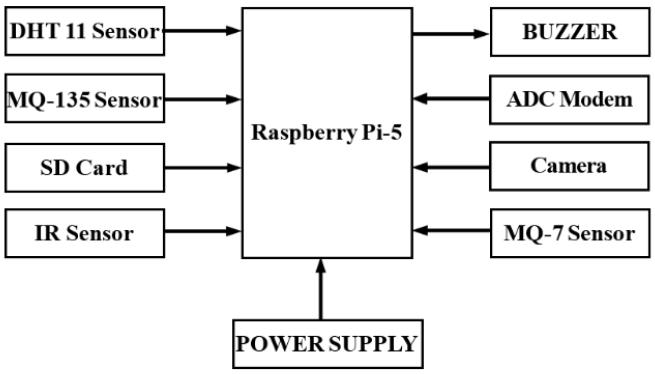

Fig 6.1: Block Diagram

6.2 Hardware Used

Raspberry Pi 5: The Raspberry Pi 5 is the central processing unit of the system. It is a powerful microcomputer capable of interfacing with various sensors and communication modules. The Raspberry Pi 5 processes data from the GPS, RFID, and other sensors, and communicates with a centralized server to provide real-time updates to users.

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DHT 11 Sensor: The DHT 11 sensor is a basic, low-cost digital sensor used to measure temperature and humidity. It provides reliable and accurate environmental data, which is essential for monitoring and optimizing the conditions within the public transport system. The sensor is easy to interface with the Raspberry Pi, allowing real-time data collection and analysis.

MQ-135 Sensor: The MQ-135 sensor is an air quality sensor that detects a wide range of gases, including ammonia, nitrogen oxides, alcohol, benzene, smoke, and carbon dioxide. It helps monitor air quality within public transport vehicles, ensuring a safe and healthy environment for passengers. The sensor's data can be processed by the Raspberry Pi to trigger alerts if air quality falls below acceptable levels.

MQ-7 Sensor: The MQ-7 sensor is a carbon monoxide (CO) sensor used to monitor air quality within public transport vehicles. It detects the presence of CO, a harmful gas, and helps ensure that the air quality remains within safe limits. The data from the MQ-7 sensor can be used to trigger alerts if CO levels exceed acceptable thresholds.

SD Card: An SD card is used to provide storage for the Raspberry Pi. It houses the operating system, software applications, and data collected by various sensors. The SD card ensures that the Raspberry Pi operates efficiently by allowing quick access to stored data and enabling smooth execution of software tasks.

IR Sensor: The IR sensor is an infrared sensor used for obstacle detection and distance measurement. It helps in navigation by detecting obstacles in the path of the public transport vehicle. The data from the IR sensor can be processed by the Raspberry Pi to make real-time decisions, enhancing the safety and efficiency of the system.

Buzzer: The buzzer is used to provide audible alerts and notifications. It can be triggered by the Raspberry Pi in response to specific events, such as changes in environmental conditions or package delivery status. The buzzer ensures that important information is communicated to passengers and operators in real time.

ADC Modem: The ADC (Analog-to-Digital Converter) modem is used to interface analog sensors with the Raspberry Pi. It converts analog signals from sensors like the MQ-135 and MQ-7 into digital data that can be processed by the Raspberry Pi. This enables the integration of a wide range of sensors into the system.

Camera: The camera captures images or video, which can be used for surveillance and monitoring purposes. It helps ensure the security of public transport vehicles and the safety of passengers. The camera data can be processed by the Raspberry Pi and transmitted to a centralized server for analysis and storage.

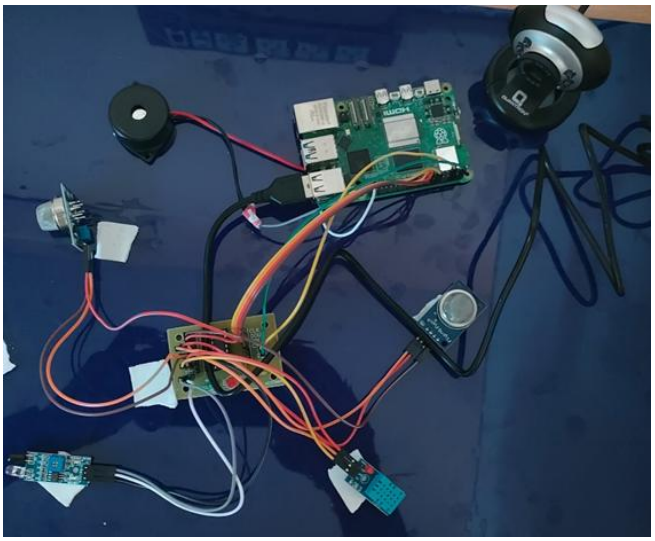

Fig 6.2: Project kit of Raspberry-Pi based Real-Time Public Transport Tracker and Delivery System

6.3 Software used

Raspberry Pi OS: Raspberry Pi OS is a lightweight, Debian-based operating system specifically designed for Raspberry Pi hardware. It provides a stable and optimized environment for running applications and interfacing with various sensors and modules. The operating system includes a wide range of pre-installed software tools and libraries, making it easy to develop and deploy IoT applications. Its user-friendly interface and extensive documentation make it accessible for both beginners and experienced developers.

Python Programming Language: Python is a versatile and powerful programming language widely used in IoT and embedded systems development. It is known for its simplicity, readability, and extensive library support, making it ideal for writing scripts and applications that interface with hardware components. Python allows developers to quickly prototype and implement functionality, such as reading sensor data, processing information, and communicating with servers. Its compatibility with Raspberry Pi OS ensures seamless integration and efficient execution of software tasks.

VII. RESULTS

The implementation of the Raspberry Pi-based real-time public transport tracker and delivery system demonstrated significant improvements in tracking accuracy and delivery efficiency. The GPS module provided precise real-time

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location data of public transport vehicles, allowing passengers to monitor arrival and departure times with a high degree of accuracy. This reduced wait times and enhanced the overall user experience.

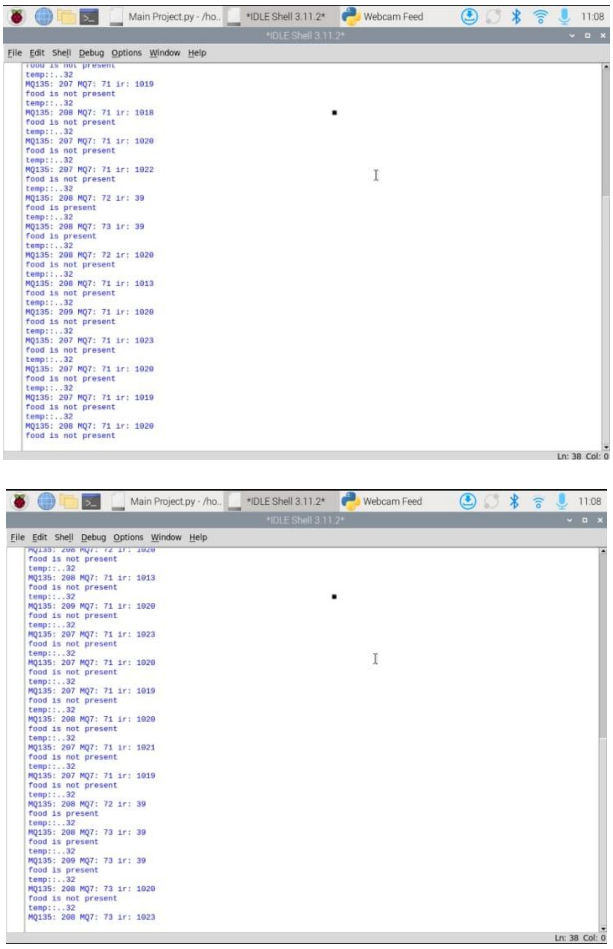

Fig 7.1: Result of Stage I & Stage II

The integration of various sensors, such as the DHT 11 for temperature and humidity, and MQ-135 and MQ-7 for air quality monitoring, contributed to creating a safe and comfortable environment for passengers. The IR sensor and camera provided additional safety and surveillance features, further improving the system's reliability. Overall, the system successfully addressed the challenges faced by traditional public transport services by leveraging the capabilities of Raspberry Pi and IoT technologies. The results indicated that this innovative solution could significantly enhance the efficiency and reliability of public transport systems, benefiting both passengers and operators.

VIII. CONCLUSION

The Raspberry Pi-Based Real-Time Public Transport Tracker and Delivery System efficiently integrates IoT and AI technologies to enhance public transportation and delivery services. By utilizing a camera for real-time monitoring, MQ135 and MQ7 gas sensors for air quality detection, IR sensors for obstacle detection, and a DHT11 sensor for temperature and humidity tracking, the system ensures a safe and optimized transportation experience.

Additionally, the buzzer provides alerts in case of anomalies, while the ADC modem facilitates sensor data conversion and transmission. The SD card is used for data storage, ensuring real-time logging and analysis. With Raspberry Pi 5 as the central controller, the system offers reliable tracking, environmental monitoring, and efficient delivery operations, ultimately improving urban mobility and logistics.

REFERENCES

[1] J. Zawieska and J. Pieriegud, "Smart city as a tool for sustainable mobility and transport decarbonisation", Transp. Policy, vol. 63, pp. 39-50, Apr. 2018.

[2] H. Abigail, "Americans spend over 15% of their budgets on transportation costs-these US cities are trying to make it free", Mar. 2020, [online] Available: http://www.wearetdm.com.

[3] Tembe, F. Nakamura, S. Tanaka, R. Ariyoshi and S. Miura, "The demand for public buses in sub-Saharan African cities: Case studies from Maputo and Nairobi", IATSS Res., vol. 43, no. 2, pp. 122-130, Jul. 2019.

[4] R. Basu, A. Araldo, A. P. Akkinepally, B. H. N. Biran, K. Basak, R. Seshadri, et al., "Automated mobility-on-demand vs. mass transit: A multi-modal activity-driven agent-based simulation approach", Transp. Res. Rec. J. Transp. Res. Board, vol. 2672, no. 8, pp. 608-618, Dec. 2018.

[5] Tram—Definition-The Free Dictionary, Princeton, NJ, USA, Feb. 2018.

[6] China's Metro Boom Continues to Drive Rapid Transit Growth, New York, NY, USA, Jul. 2018.

[7] Y.-S. Hwang, J.-W. An and J.-M. Lee, "The standard for the selection of the appropriate GPS in the outdoor environment the analysis of the performance for the improvement of reception", Proc. IEEE Int. Conf. Adv. Intell. Mechatronics (AIM), pp. 852-857, Jul. 2016.

[8] J.-W. An and J.-M. Lee, "Improvement of GPS position estimation using SNR and Doppler", Proc. IEEE Int. Conf. Adv. Intell. Mechatronics (AIM), pp. 1645-1650, Jul. 2017.

[9] D. P. McArthur and J. Hong, "Visualising where commuting cyclists travel using crowdsourced data", J. Transp. Geography, vol. 74, pp. 233-241, Jan. 2019.

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Article DOI: https://doi.org/10.47001/ICJES/2025.404003

[10] L. Xu, L. Wang, Y. Zhang and S. Cheng, "Visual tracking based on siamese network of fused score map", IEEE Access, vol. 7, pp. 151389-151398, 2019.

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