
THE SELF-NAVIGATING DELIVERY ROBOT USING AI AND IOT

Vishala I. L.*, Chandan G., Chandan A., Bhuvan Y. A.

ECE, SJCIT, Chickaballapur.

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*Corresponding Author: Vishala I. L.

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ECE, SJCIT, Chickaballapur.

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ABSTRACT

Self-navigating delivery robots use artificial intelligence (AI) and the Internet of Things (IoT) to improve how deliveries are made. This project aims to build such a robot that can move and deliver items on its own using GPS for route tracking, ultrasonic and sensor to avoid obstacles, and Bluetooth for wireless control. AI helps the robot make smart decisions while moving. The system uses ESP32 and Arduino Mega microcontrollers to connect the hardware and software smoothly. Raspberry pi to host the website, Early tests show that the robot can navigate well, avoid obstacles, and deliver safely in both indoor and outdoor areas. These robots can lower delivery costs, improve access, and support the future of smart, contactless delivery. With better AI and sensors, they could become an important part of modern delivery systems.

KEYWORDS: Self-Navigating Robot, Autonomous Delivery, Artificial Intelligence (AI), Internet of Things (IoT), GPS Navigation, Avoidance of obstacles, Ultrasonic Sensors, ESP32, Arduino Mega, Contactless Delivery.

INTRODUCTION

In recent years, the integration of artificial intelligence (AI) and the Internet of Things (IoT) has revolutionized various industries, paving the way for innovative solutions to everyday challenges. One such groundbreaking application is the development of self-navigating delivery robots. These autonomous systems combine advanced navigation, machine learning, and real-time connectivity to address the increasing demand for efficient and contactless delivery services. By leveraging AI for decision-making and IoT for seamless communication, these robots are capable of navigating complex environments, optimizing routes, and ensuring safe and timely delivery of goods. This project aims to explore the

design and implementation of a self-navigating delivery robot, focusing on its architecture, functionality, and potential impact on logistics and urban mobility

MATERIALS AND METHODS

The Self-Navigating Delivery Robot using AI and IoT is designed using an Arduino Mega 2560 as the main controller for processing sensor data and controlling robot operations. A 4×4 matrix keypad module is connected to the controller for user input and OTP verification during parcel delivery. The NEO-6M GPS Module is used to determine the robot's real-time location and assist in route navigation, while the ultrasonic sensor detects obstacles and helps the robot avoid collisions during movement. An IR sensor is integrated for additional object detection and navigation support. The HC-05 Bluetooth module enables wireless communication and control between the robot and external devices. The ESP32-CAM module captures and transmits live video of the surroundings for monitoring purposes. The captured data and video are further communicated to the Raspberry Pi, which acts as a central processing and IoT communication unit for real-time monitoring, data transmission, and web dashboard hosting. Together, these components enable autonomous navigation, obstacle avoidance, live tracking, and secure parcel delivery.

METHODOLOGY

The robot powers on and establishes connections with all its sensors and control systems. Once activated, it receives a delivery command and identifies the destination using GPS technology. The robot then fetches its current location, plans the most suitable route, and begins moving toward the destination while controlling its speed and direction. During navigation, sensors continuously monitor the surroundings for obstacles, traffic, or any unexpected objects. If an obstacle is detected, the robot automatically recalculates the route and safely navigates around it while continuously checking for new obstacles along the way. As the robot approaches the destination, it sends an alert and OTP message to the receiver through WhatsApp Business. The receiver enters the OTP to unlock the parcel compartment, and after successful verification, the robot delivers the parcel securely. Once the delivery is completed, the robot returns to its base station and either stops or waits for the next task. In this system, the Raspberry Pi Foundation Raspberry Pi 4 is used for power distribution, data transmission, and hosting the web dashboard for real-time monitoring of robot data.

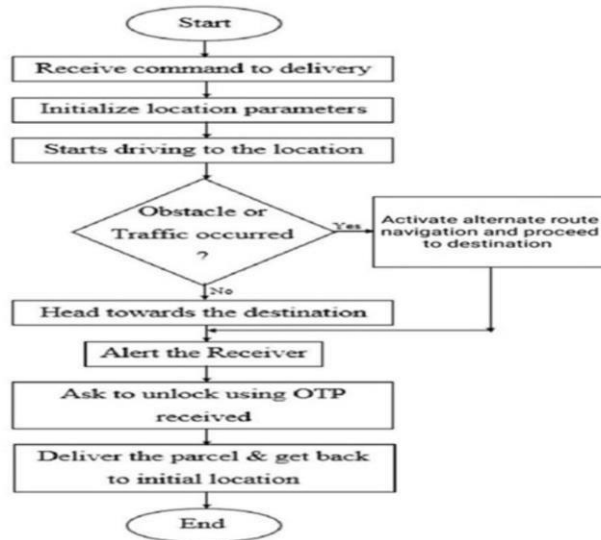


Figure 1. Flow Chart of proposed methodology.

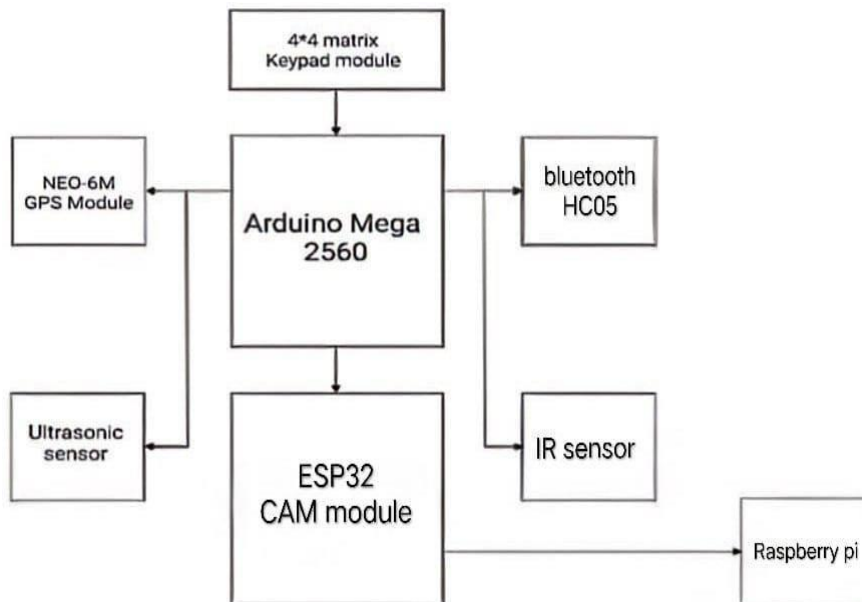


Figure 2. Block Diagram of proposed methodology.

RESULT AND DISCUSSION

The developed delivery robot moved autonomously toward the destination while successfully avoiding obstacles using ultrasonic sensors. The web dashboard displayed real-time data such as speed, distance, and robot status through IoT connectivity, enabling continuous monitoring of the robot’s performance. The ESP32-CAM module provided live video streaming of the surroundings, allowing users to monitor the robot’s movement effectively. The camera delivered clear images with minimal delay, making it suitable for both indoor and outdoor environments. The GPS integrated with Google Maps accurately tracked the robot’s route

and updated its location every second for precise navigation. In addition, the WhatsApp system sent alerts and OTP messages to the receiver, ensuring secure, safe, and contactless parcel delivery.

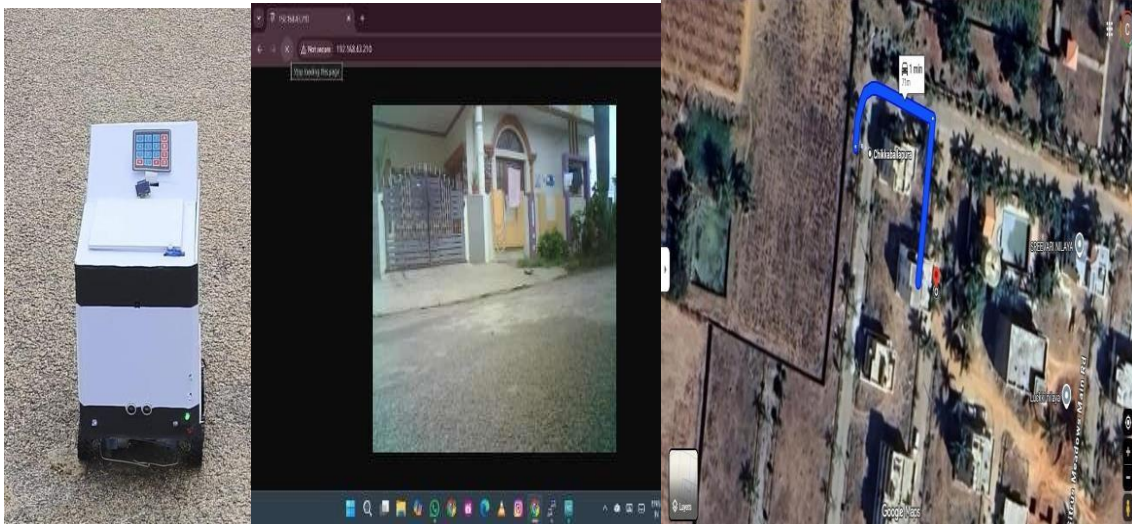


Figure 3. Prototype of the proposed methodology.

CONCLUSION

The self-navigating delivery robot is a transformative innovation that merges artificial intelligence (AI) and the Internet of Things (IoT) to address critical challenges in modern logistics. These robots are equipped with advanced sensors, GPS, and machine learning algorithms that allow them to autonomously navigate complex urban environments, avoid obstacles, and make real-time decisions. By eliminating the need for human intervention, they reduce labor costs, minimize delivery delays, and enhance operational efficiency. Their ability to operate 24/7 and adapt to dynamic conditions makes them ideal for last-mile delivery—a notoriously expensive and inefficient stage of the supply chain. Moreover, their electric powered design contributes to sustainability by lowering carbon emissions and reducing reliance on fossil fuels. Beyond logistics, these robots play a vital role in shaping smart cities and automated ecosystems. They can be integrated with urban infrastructure through IoT platforms, enabling seamless communication with traffic systems, public lockers, and mobile apps. In healthcare, they deliver medicines and lab samples within hospitals; in retail, they handle contactless deliveries to homes and offices. Their modular design allows customization for various industries, from food delivery to industrial supply chains. As e-commerce and consumer demand continue to surge, autonomous delivery robots offer a scalable, secure, and eco-friendly solution. Their widespread adoption not only

enhances convenience for individuals but also drives innovation in robotics, AI, and urban planning.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest regarding the publication of this paper.

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