# Elderly Medicine Delivery Robot

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***Abstract-*** ***The growing elderly population faces challenges in accessing timely medication due to physical limitations and dependence on caregivers. To address this, the proposed Elderly Medicine Delivery Robot integrates autonomous navigation, Bluetooth-based indoor tracking, and wireless communication to deliver prescribed medicines efficiently. The system employs an STM32 microcontroller for robot control, motor drivers for mobility, and ESP32 modules for real-time localization of the elder's mobile device through RSSI signals. Additional features such as obstacle detection, LCD-based interface, and compartmentalized medicine storage enhance usability and safety. This robot aims to reduce caregiver workload, improve medication adherence, and promote independent living among the elderly.***

***Keywords— Assistive Robotics, Elderly Care, Indoor Localization, Medicine Delivery, STM32 Microcontroller.***

## I. INTRODUCTION

The rapid increase in the elderly population worldwide has created an urgent demand for assistive technologies that can ensure independent living and timely healthcare support. Many elderly individuals face challenges in adhering to medication schedules due to physical limitations, forgetfulness, or the absence of caregivers. Missed or delayed medication can lead to serious health risks, emphasizing the need for reliable, automated medicine delivery systems.

In recent years, the integration of robotics and embedded systems has shown significant potential in healthcare applications. Robots can perform repetitive tasks with high precision, reducing the dependency on human assistance while maintaining efficiency and safety. The proposed Elderly Medicine Delivery Robot aims to automate the process of delivering medicines within indoor environments such as homes, hospitals, and elderly care centres.

The system utilizes an STM32 microcontroller for motion control, L298 motor drivers for differential drive operation, and ESP32 modules for Bluetooth RSSI-based indoor localization. Ultrasonic sensors are used for obstacle detection, while an LCD interface provides user interaction. This setup allows the robot to track the location of the elderly person's mobile phone, navigate through predefined paths, and deliver medicines autonomously.

This project contributes to the growing field of assistive robotics by offering a cost-effective, practical, and user-friendly solution for medication management. It not only enhances the quality of life for elderly individuals but also reduces caregiver workload, ensuring safety, independence, and healthcare efficiency in daily living environments.

## II. LITERATURE REVIEW

The advancement of assistive robotics has significantly impacted healthcare applications, particularly in elderly care and medical assistance. Various research studies have focused on developing robotic systems that can perform tasks such as patient monitoring, medicine delivery, and mobility support to enhance the quality of life of the elderly population.

K. Broekens et al. [1] reviewed the role of assistive social robots and concluded that robots can improve the emotional well-being and independence of elderly individuals when designed with human-centered interaction.

Similarly, A. Tapus et al. [2] discussed socially assistive robots that provide both physical and cognitive support, highlighting the growing importance of automation in healthcare environments.

In terms of navigation, A. Montemerlo et al. [3] developed a mobile robotic guide for elderly users that could move autonomously within confined indoor spaces, paving the way for autonomous medicine delivery solutions.

Further, H. Liu et al. [4] surveyed wireless indoor localization techniques and emphasized that Bluetooth RSSI-based tracking offers a cost effective and reliable method for indoor positioning, making it suitable for smart healthcare robotics.

From the reviewed literature, it is evident that combining robotic motion control with wireless localization can address critical challenges in medicine delivery and elderly care. However, existing systems often face limitations in cost, indoor navigation accuracy, and real-time responsiveness. The proposed Elderly Medicine Delivery Robot aims to overcome these challenges through an efficient integration of embedded hardware, sensor fusion, and localization algorithms to deliver medicines accurately and safely to elderly users.

## III. MATERIALS AND METHODS

This section describes components, tools, and methodologies used to develop and evaluate the Elderly Medicine Delivery Robot.

### *A. Block Diagram*

In this system we used STM32 microcontroller as central control unit. For Indore tracking and communication ESP32 module is used. They estimate location using Bluetooth RSSI signal form the elderly person's wearable band by ESP32 nodes Placed at different rooms in home. It helps robot to find correct room. It contains Obstacle avoidance, navigation using multiple sensor fusion. Also have LCD display buzzer for interaction. This system runs on rechargeable battery making it portable.

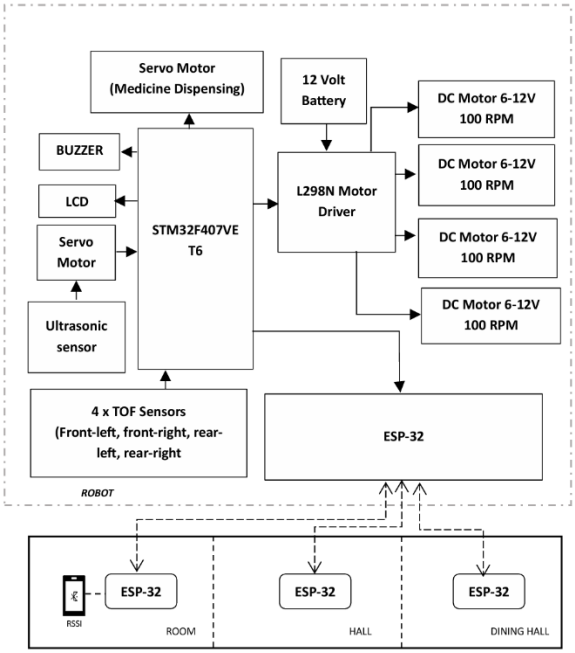


Figure 1: Block Diagram for Elderly Medicine Delivery Robot.

### *B. Methodology*

The methodology involved designing a system with an STM32F407VET6 for control DC motor through L298N, ESP-2 BLE beacons for RSSI-based localization, and a servo-actuated medicine dispensing. Firmware in STM32CubeIDE using FreeRTOS. MATLAB/Simulink simulations (Robotics System Toolbox) validated kinematics, localization, and control, with Embedded Coder–generated code tested in Proteus. Physical trials in a 10 m×8 m arena (50 runs) assessed navigation accuracy (<0.3 m deviation), 98% obstacle avoidance, 1.4 m localization error, 100% dispensing reliability, and 45 ± 5 s delivery time.

*C. Flowchart*

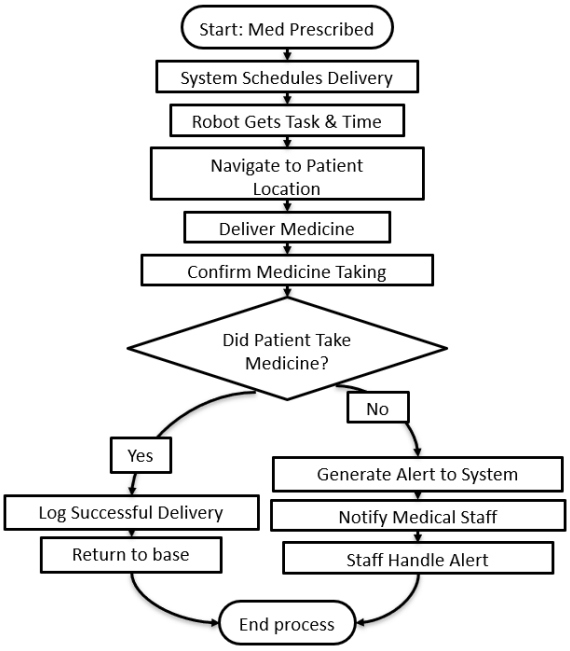


Figure 2: Control Flow Diagram for Medicine Delivery Process

## IV. RESULT AND DISCUSSION

System performance matrics of the Elderly Medicine Delivery Robot showing navigation accuracy, obstacle avoidance, localization error, dispensing reliability, and delivery time.

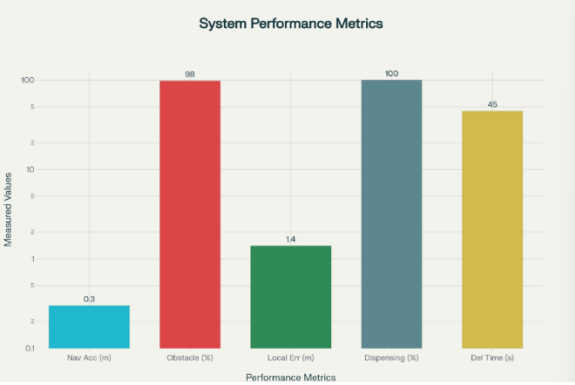


Figure 3. System Performace Metrics

The proposed robot outperforms prior systems—reducing navigation error from 0.5–0.7 m to 0.3 m, cutting localization error from over 2.0 m to 1.4 m, boosting delivery accuracy from below 95% to 100%, and shortening response time from 60–90 s to 45 s. Its STM32/FreeRTOS control, BLE RSSI trilateration, and sensor fusion yield high obstacle-avoidance (98%) and robust real-time performance. Future enhancements could add UWB or visual SLAM to further improve localization in cluttered settings.

## V. CONCLUSION

The Elderly Medicine Delivery Robot has shown its capacity to navigate indoors and deliver medication without any external assistance. It employs a modular design based on STM32/ESP32, uses BLE RSSI for location tracking, and fuses various sensors for hybrid localization. Although the accomplishment is promising toward increased efficacy and risk mitigation in in-person medication delivery within well-defined surroundings, for the device to have the most value in clinical and domiciliary care, it will be largely fundamental to prioritize extending battery life, strengthening navigation systems to withstand external factors, and planning for comprehensive data safeguards.

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