Automatic Indoor Office Robot (Aior) for Smart Document Delivery

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***Abstract*—The Automatic Indoor Office Robot (AIOR) automates document delivery in office environments using Raspberry Pi 5, LiDAR, and ultrasonic sensors for navigation and obstacle avoidance.**

***Index Terms*—Autonomous Robot, LiDAR, Raspberry Pi, Office Automation**

I. INTRODUCTION

- Automatic Indoor Office Robot (AIOR) offers a promising solution for rapid and efficient transportation of documents and small office materials within indoor environments. By using advanced robotics technology, the robot can move through office corridors and departments without human assistance, reducing delays and manual workload.

Equipped with high-torque brushless hub motors and a strong mechanical frame, the robot can safely carry documents, files, and small packages up to 15-20 kg. The platform is designed to securely hold items during movement, ensuring safe delivery. Real-time sensor data from ultrasonic sensors and the RPLIDAR A1M8 helps the robot detect obstacles and navigate accurately.

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- The Raspberry Pi 5 acts as the main controller, processing navigation data and controlling the robot's movement. Users can monitor and control the robot through a touch display or mobile application. Autonomous navigation improves efficiency and reduces the need for continuous human supervision.

- Although challenges such as indoor mapping accuracy and battery management exist, the Automatic Indoor Office Robot has great potential to improve office efficiency, reduce human effort, and support smart automation in modern workplaces

II. SYSTEM OVERVIEW

The system consists of power supply, sensors, controller, motor driver, and output modules.

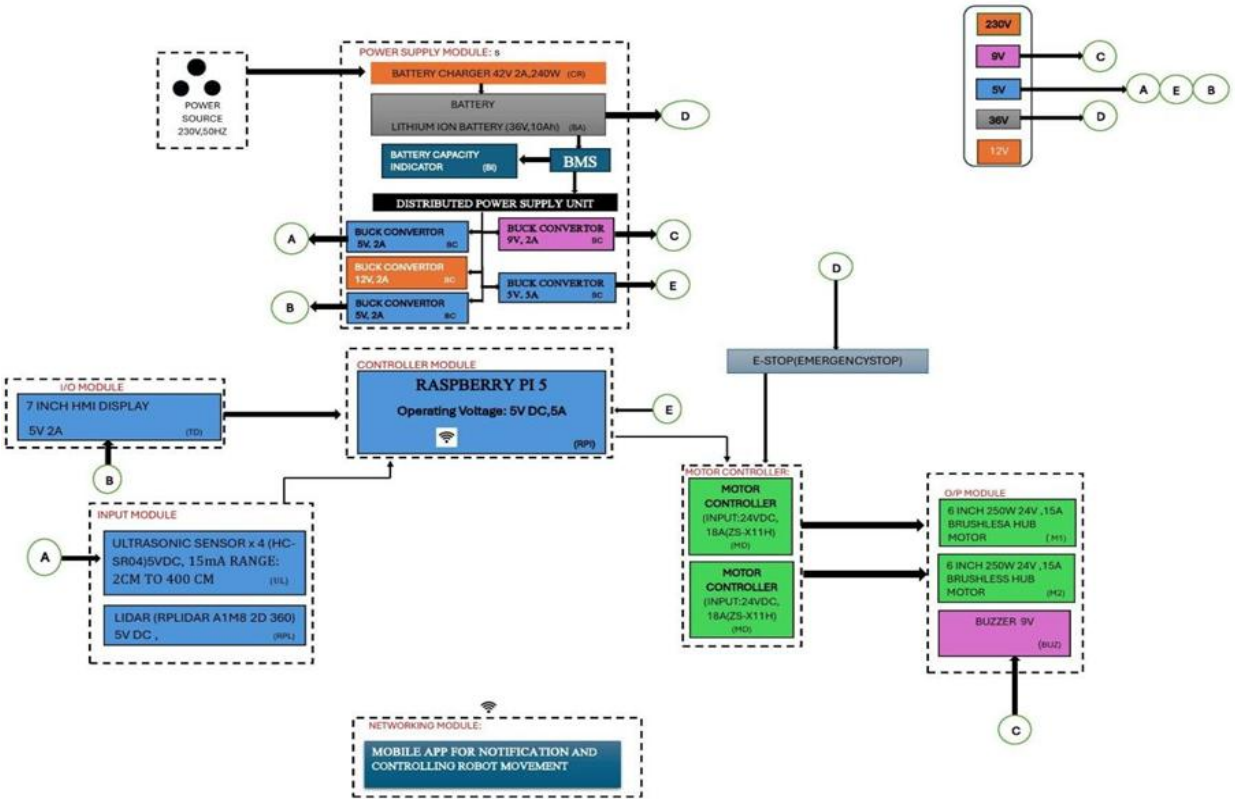

Fig. 1. Functional Block Diagram of AIOR

III. HARDWARE COMPONENTS

Includes Raspberry Pi, LiDAR, ultrasonic sensors, motors, and driver.

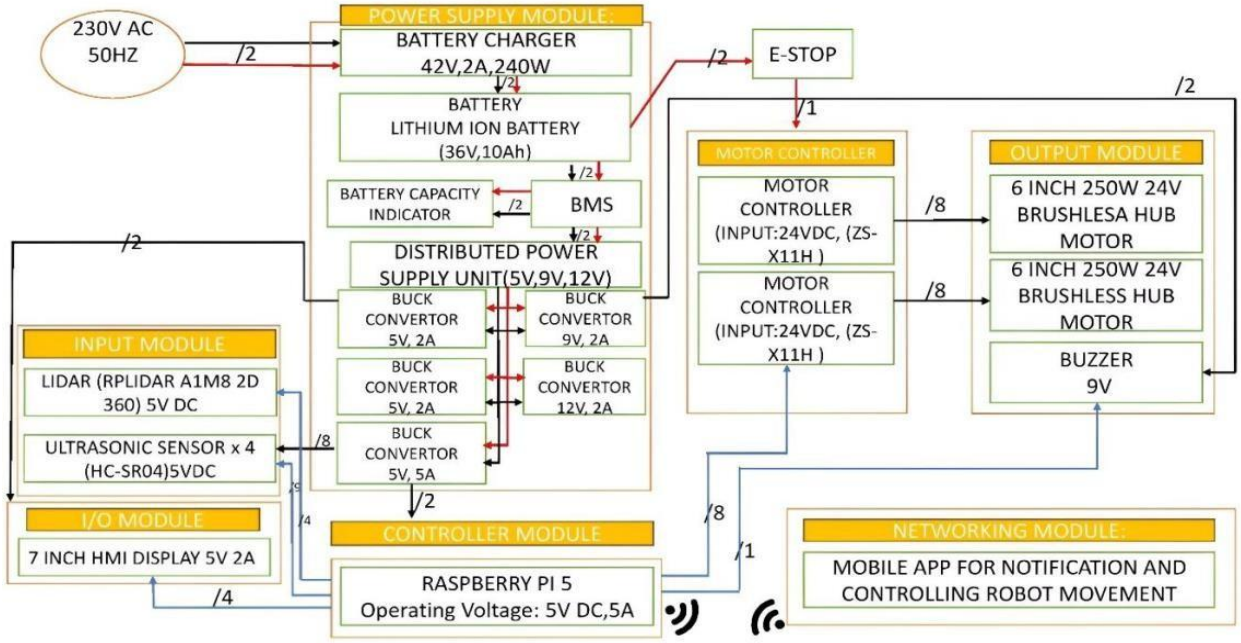

Fig. 2. Modular Block Diagram of AIOR

IV. WORKING PRINCIPLE

- The user selects the destination using the display or mobile app.
- The Raspberry Pi processes the command and activates the system.
- LiDAR and ultrasonic sensors scan the surroundings for obstacles.
- The motor controller drives the hub motors for navigation.
- The robot reaches the destination, alerts the user with a buzzer, and then returns to its base.

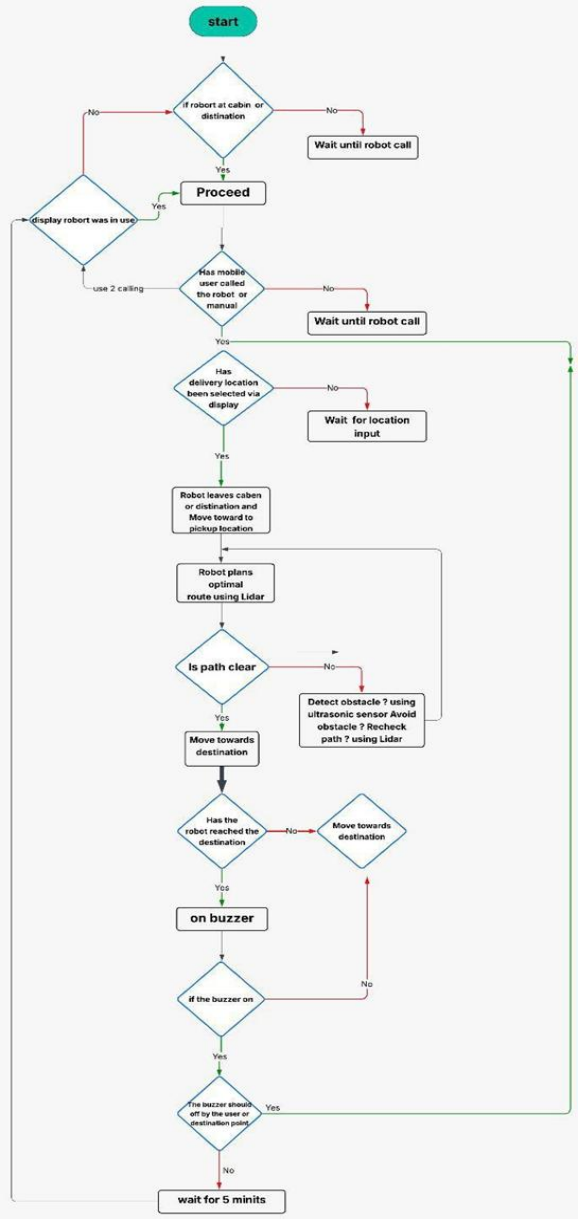

Fig. 3. Flowchart of AIOR Operation

V. SOFTWARE IMPLEMENTATION

- The software for the Automatic Indoor Office Robot (AIOR) is developed using Python programming on the Raspberry Pi 5. The software controls all the main functions of the robot such as sensor reading, navigation, motor control, and user interface.
- The Raspberry Pi receives data from the RPLIDAR sensor and ultrasonic sensors. This data is processed in real time to detect obstacles and understand the surroundings. Based on this information, the system decides the movement of the robot.
- Motor control is achieved using PWM signals, which are sent from the Raspberry Pi to the motor driver. This allows the robot to move forward, backward, and turn smoothly.
- A simple user interface is provided through the 7-inch touch display and mobile application. The user can select the destination, monitor battery status, and control the robot. The system also gives alerts using a buzzer when the delivery is completed.
- The software ensures smooth communication between all components and enables the robot to operate automatically and safely.

VI. MECHANICAL DESIGN

Robot structure designed using CAD and fabricated with acrylic and metal.

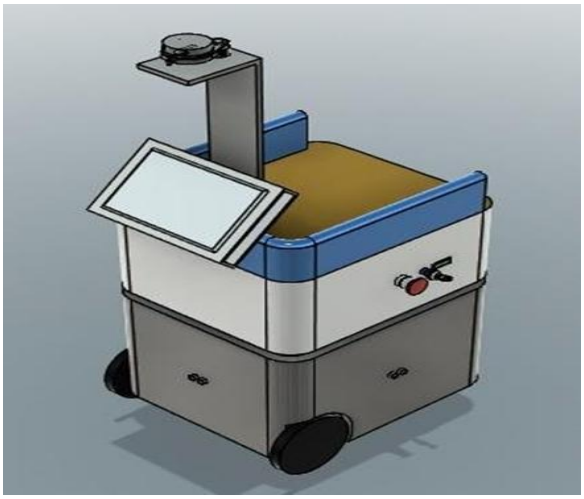

Fig. 4. CAD Design of AIOR

Fig. 5. REAL Model of AIOR

VII. RESULTS AND TESTING

- The Automatic Indoor Office Robot (AIOR) was tested in an indoor office environment to evaluate its performance and reliability.
- During testing, the robot successfully moved between different locations using LiDAR and ultrasonic sensors. It was able to detect obstacles such as walls, tables, and chairs and avoid collisions effectively. The navigation system worked properly, and the robot followed the selected path accurately.
- The motor driver controlled the speed smoothly, allowing stable forward, backward, and turning movements. The robot was able to carry small loads without any instability. The 7-inch display provided clear information about system status, battery level, and navigation.
- The battery performance was also tested. The robot operated continuously for approximately 1 to 1.5 hours, depending on load conditions. Charging time was observed to be around 5 hours.
- Overall, the system performed efficiently and achieved the expected results. The robot successfully completed automatic delivery tasks and returned to its initial position without errors.

VIII. CONCLUSION

AIOR improves efficiency and reduces manual work.