LIBRARY ASSISTANT ROBOT

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Keywords:

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Introduction:

The Library Assistant Robot project aims to develop an autonomous robotic system capable of identifying, picking, and delivering books within a library setting. This robot is designed to enhance the efficiency of library operations by minimizing manual effort and ensuring quick and accurate book retrieval.

The Library Assistant Robot is a semi-autonomous mobile system designed to identify, pick, and deliver books based on user input received through a web interface. Unlike traditional robots that rely on obstacle detection using IR sensors, this robot operates based on a pre-mapped layout of the library, allowing it to navigate specific paths accurately and efficiently.

The system is powered by Arduino Uno for motor and actuator control, and ESP32 for Wi-Fi-based communication between the robot and the control website. The user selects a book through the website, which sends a command to the robot. Based on the predefined map, the robot moves to the designated book location using hard-coded coordinates or path sequences. Once it reaches the target, a servo-controlled robotic arm picks the book and delivers it to a drop-off location.

The prototype demonstrates the integration of embedded systems, robotic control, and web-based automation. It eliminates the need for manual searching and offers a smart,

touchless way of accessing books, making it especially useful for academic institutions looking to implement automation in their libraries.

Objectives:

- Improve the accessibility and management of books in libraries.
- Reduce the workload on library staff.
- Implement automation and IoT for a real-world problem.
- Provide a scalable solution that can be adapted to larger or commercial libraries.

Methodology:

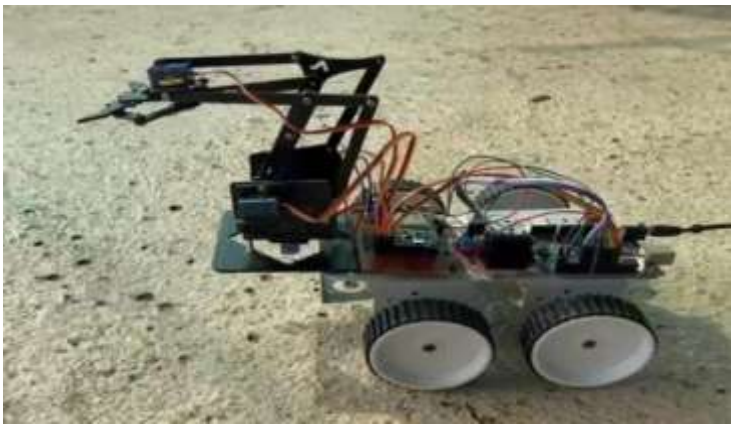
The Library Assistant Robot is an innovative solution developed to automate the process of book retrieval and delivery within a library. This project addresses the common challenges faced in traditional libraries, such as time- consuming book searches, dependency on manual labor, and inefficient resource handling. The robot is designed to operate based on a predefined map of the library layout, eliminating the need for real-time obstacle detection and enabling precise movement across designated paths.

Users interact with the system via a custom-built website interface, where they can search and request specific books. Once a request is made, the system sends instructions wirelessly to the robot using the ESP32 microcontroller, which is responsible for handling communication and executing commands. The robot then navigates through the library following a pre-programmed path to the location of the requested book.

The robot's motion is driven by motors controlled using Arduino Uno, while a servo-actuated robotic arm is used to pick the book from the shelf. After retrieval, the robot proceeds to a predefined delivery point to drop off the book for user collection. The entire system is modular and designed for scalability, allowing it to be adapted for larger libraries or integrated with advanced features like RFID and dynamic navigation in the future.

Result and Conclusion:

The primary innovation lies in the combination of autonomous navigation using static mapping, robotic manipulation, and IoT-based control through a web interface, making the system an ideal fit for smart library automation. This project showcases the practical application of embedded systems, control systems, and web technologies in addressing real-world challenges and aligns with the ongoing push for digitization and automation in educational institutions.



Future Scope:

1. Incorporate RFID for book recognition
2. Add path-planning algorithms for dynamic route finding
3. Explore voice-command integration using AI assistants
4. Commercialize for smart educational campuses