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Design of Library Robot using IoT

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Abstract: A library robot is a smart system that helps maintain and improve the efficiency of a library. It is equipped with various controllers that allow the users to monitor and control the library services. A robot that can handle the tasks of a library efficiently. It can also save human services time and reduce the load on the staff. It can also monitor the library's activities and provide feedback on its progress. Its goal is to help the libraries cut costs and improve their efficiency. To over this problem, we had suggested this project "Robotic Library System ". In this project, we can organize the books in the racks and monitor the library activities this helps us to reduces the manual power and human errors.

Keywords: Library, Robot, Controller, Books

1 Introduction

Our goal is to create a "Robotic Library System" that will aid in the systematic organization of the volumes in a library. In this paper, a robot is proposed with a degree-of-freedom arm that can find books with the necessary tag, pick them up, and arrange them on the table to simplify the process of book discovery and selecting. The term "robotic arm" refers to a mechanical arm that is manually operated via wired or wireless networks in order to carry out the required activity in a variety of contexts, including military operations, hospital operations, hazardous environments, and agriculture. The main goal of this paper is to create a robotic arm that can pick up a certain book and should be able to do so even if the book is misplaced. Books are placed in designated areas and arranged in a running order according to their so-called call numbers to help users quickly find a certain book. The books must be arranged properly by library staff members, a laborious and time-consuming operation. Library workers must first perform shelf reading, or actively look for volumes that are arranged incorrectly before picking them up and placing them in the proper spot. Usually, they have to select the books and deliver them to the recipient of the books. If the library floor space is small, this process might be simple. Additionally, human searches for books take a long time because the human eye frequently misses them. The goal of this paper is to create an autonomous robot that will assist a library user in finding a book and removing it from the shelf. To automate this process of book finding and picking [1], we propose a robot that will be able to locate the book with the necessary tag and then bring it to the desk. Area is compact. Building a robotic, on-demand, and batch scanning system is the objective of the Comprehensive Access to Printed Material (CAPM) project. This system will provide real-time browsing of printed material via a web interface. The user will activate the CAPM system, which will then launch a robot [2] to acquire the needed item. The robot will transfer this object to a different robotic system, which will automatically open the object and turn the pages. The CAPM system will make use of existing scanners, optical character recognition (OCR) software and indexing software created by the Digital Knowledge Centre to provide full-text searching [3] and analysis in addition to viewing of text-based picture files.

Figure 1 Library Robot

2 Robosoft System

In Mumbai, India, there is a privately held business called Robosoft Systems. Since 2008, Robosoft Systems has focused on research and development in the fields of robotics, automation, and the internet of things. Robosoft Systems began with the goal of becoming a major robotics player. A company approached during the early stages of the project to design and produce a robot for the inspection and cleaning of HVAC systems for IAQ (Indoor Air Quality). The robot created by Robosoft Systems is called DuctBot, created especially to accomplish this task successfully. Not only did Duct Inspection Robots bring us renown, but Robosoft Systems was also awarded Best Innovative Product by TR35 in 2011.

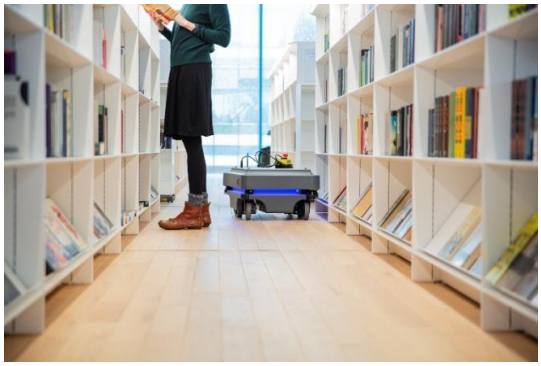

Figure 2 Robosoft System

3 Objective

The major goal of this project is to make the process of organizing the library's volumes into their designated slots as simple as possible. This benefits library staff members and lowers the workforce. This library makes it simple to use the Arduino Robot's features. In particular, it depends on the third-party libraries Fat16, Easy Transfer, Squawk, and IR Remote. Additionally, it makes use of the TFT, SPI, and Wire libraries for Arduino. To reduce the size of the code, their functionality has been duplicated inside the robot's library. The Control and Motor boards can both be programmed. Beginner programmers are advised to start by programming the control board and leave the motor board for later. Through a single object, the library exposes the sensors on both boards. The robot can be controlled by any of two major classes: Robot Control, when using the stock firmware, controls the I/Os and motors on the Motor Board as well as the Control Board. Motor Board is controlled by the robot motor.

4 Existing Problem and Proposed Solutions

Students today have trouble finding the books they need. The majority of libraries use library management systems (LMS) to plan their library systems. This method simply assists the librarian and students in keeping track of the things they possess, the orders they've made, and other data utilizing the library management system. The user needed more time to renew the books because of the books' location and previous loaners. When a user needs to borrow a book, they typically find it simple to look for it. Additionally, the arrangement of the novels is incorrect. A portable robot is being developed to ease the workload for students and librarians. A few different kinds of robots have been designed to help in a variety of fields, including agriculture, industry, and the home. The majority of mobile robots are being created for industry. There aren't many robots that are deployed in public settings like libraries. In this study, a mobile robot with a line guided based library system is suggested as a solution to this issue. This system can be used in a variety of locations, including libraries, resonances, and business events.

5 Methodology

The device is made up of a Raspberry Pi, a mechanical gripper, servo motors, IR and ultrasonic sensors, a linear actuator, and a movable base. It is a basic prototype that is used to more effectively receive and return books. You can maintain order in the books with its assistance. This tool makes it simpler to place books and helps eliminate errors brought on by human fatigue. The hardware is implemented independently as a robot unit and shelf unit. First, use the keypad to enter the name of the book you want to issue. Using a data modem, the robot end transmits data to the shelf end. Robot that follows a queue down a track arrives at the end of a shelf [4]. The shelf unit's IR sensor is compatible with it. When a matching book is found, the RF reader scans for the RF tag. If the robot and shelf end are in sync, the shelf end's arm will push the book into the basket. As a result, the robot unit travels back to its starting point. A line follower robot powered by an ATmega328 microcontroller makes up the robot end. A matrix keypad is used to input the information. The book's title is shown on the LCD. Each book has an RFID tag that the RF transceiver, which is used to communicate between the two ends, scans for. All of the control is handled by the ATmega328 microcontroller [5-6], which communicates with the second microcontroller using an RF transceiver. The shelf end is made up of three motors that are operated by a motor drive and used to push the book from the shelf to the basket in the robot. The detection then changes to 111 (red red red) at the destination location or book rack. The robot stops moving after slowing down. The robot then takes the book and pushes it into the basket. When the black line is once more spotted, the sensor reads 1 (010) and the robot returns to its starting point, where the condition is once more 000."BOOK DELIVERED" will then appear on the LCD. The robot will remain stationary until the start of the following cycle. The robot is prepared for the user's upcoming task.

6 Block Diagram

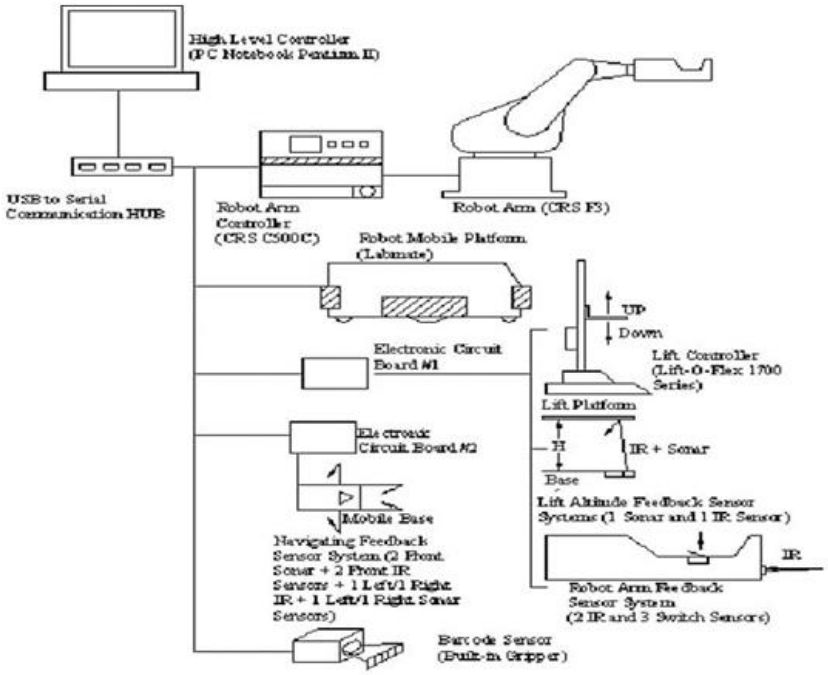

Figure 3 Library Robot Controls

7 Implementation and Results

The first step is to read up on the project and gain a thorough understanding of it. The next step is to gather all the materials needed for the project. The items must then be fixed appropriately and attached. We must ascertain whether the item is operational or not. Finally, make sure the gadget is operational.

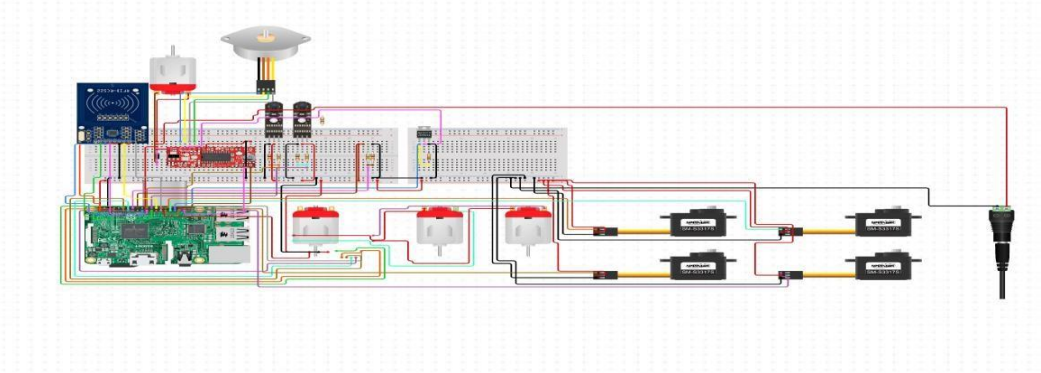

Figure 4 Robot Connections

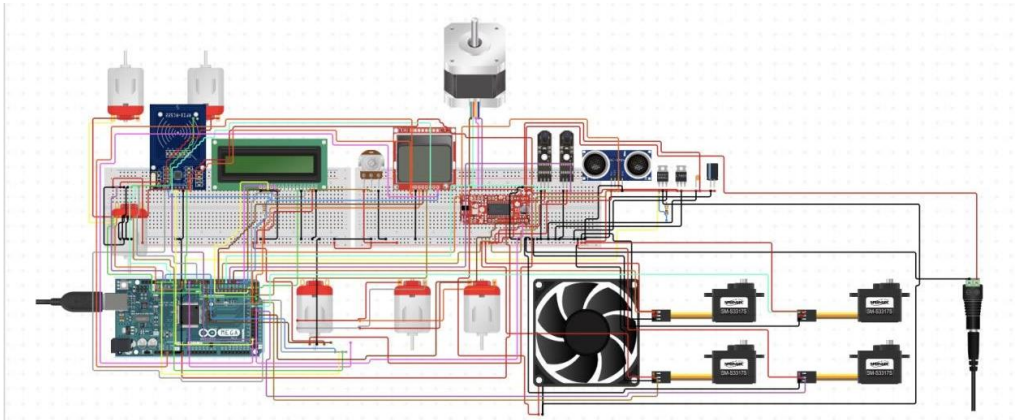

Figure 5 Robot Connections with Stepper Motor

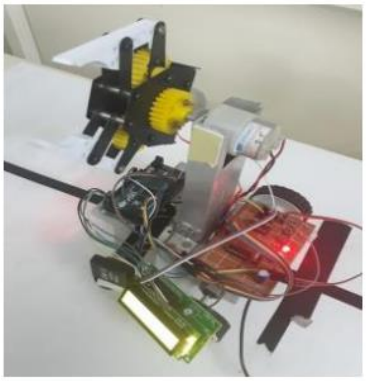

Figure 6 Library Robot Design

8 Conclusion

A robot that assists libraries will relieve staff members of the tiresome chore of book seeking. It is possible to carry out the primary duties of a library staff with increased precision and dependability. Additionally, it aids in lowering the manpower demand, time commitment, and expense of library management. We employ this robot to automate the book-picking procedure; it will select the book from the appropriate areas. A RFID reader will be mounted on the robot, and all of the book racks will be RFID-tagged. This study focused on the challenges young library users face while trying to find materials. To assist and fully address the needs of the patrons, a detailed task analysis from the perspective of performance support was used. The project used the design-based research methodology and featured a team effort between engineering and library science to create a service robot to assist young users in finding resources. In order to enhance the design of the library robot, the needs, preferences, and performances of both children and librarians were carefully considered in light of theoretical and practical hypotheses drawn from previous research as well as observations made in actual settings. The robot was designed using task analysis and iterative cycles engaging the stakeholders.

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