

Automatic Book Collector Robot

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ABSTRACT: A Library is a place where we can find different books and other sources of information. Librarians manage all the work in library such as to keep track of all the books and also manage its members at the same time but sometimes managing all these things is not possible for Librarians when the bulk of students lined up to issue or to return books. On the basis of this we decided to build a project in which we are developing one robot with an arm like mechanism which will be able to manage books and keep track of all the books in library. The robot is able to calculate distance between the returning section and the place where book is to be placed and is able to place that book in its place with the help of an arm mechanism without any error. Our project also aims at expanding the scope of our project by developing one system which will be able to scan books and send information of that book to the members to keep track of the books they are issuing. We can increase robot accuracy of avoiding obstacle present in library also we can make system wireless by using RF connectors and the system can further modified for finding and picking books from library. The main aim of our project is to reduce the workload of Librarians which will make their life a lot simpler and the books can be handled easily.

Keywords: Robot, Robotic arm, RFID, library management.

I. INTRODUCTION

Management of books in libraries, keeping track of all books and providing proper service to users and other different tasks are not possible for librarians to handle at the same time. This project aims to build and design "the Automatic Book Collector Robot" which has the capability to scan books returned by the user and when the information of the book is found, to place that book in its place. Tracking of books on shelves and the books given to the user is an important but time-consuming task. In particular, books in libraries

which are frequently borrowed and returned, can be fully managed by this robot.

The Automatic book collector robot is an autonomous service robotic assistant who will help librarians to reduce their work load. The time consuming process of returning the book will no longer exist in this process. But using the automated system the reissuing of that book by another student can be easily done in less than 1 day.

II. PROBLEM DEFINITION

Main problem with library system is lack of handling rush at book returning centre, it takes more than 20 to 30mins if students gather in bulk, we need a librarian for returning process and then that librarian will hand it over to a person who will place that book in its place.

This process of returning books and placing it over to its original place can be automated by developing a robot with an arm mechanism which will be able to scan the book information and placed it in a rack. In the older system in library returned book can reissue by other student takes 2 or more days

III. LITERATURE SURVEY

3.1 Background

In older days librarians required more manual power to manage a library. In particular, a library might easily contain hundreds of thousands of books that are frequently borrowed and returned by the students. Typically we need a librarian for returning process and another librarian who will place that book in its place. This might be an easy task if the library floor area is small. i.e. It is difficult for librarians to run a library manually if the floor area is large, therefore proper maintaining libraries will not be possible for librarians as it requires more time and extra manual power.

We can overcome these drawbacks through our project. In this method we are aiming to build a robot with an arm like mechanism which

will help in carrying books from one place to another and keep track of all books present in library, which will be very helpful in places like Libraries, Book shops, publication houses and can be used for industrial purpose etc.

This project is aimed at making the job of a librarian or shopkeeper easier as it will help in the maintenance of the library or the book shop. The books will be kept at their respective places with the help of this robot. This robot will also reduce the time required to maintain the library, which may be a hindrance if it is done by a person.

3.2 Existing monitoring system

As continuous increase in Modern Library book capacity, taking care of all the books in library is very time consuming and laborious task. Only lean on traditional methods to manage work in library will take a lot of time, manpower and financial resources, and because of this lot of mistake can happen and can bring unnecessary trouble. Although there are many new technologies to use in library such as stick bar-code or RFID technique to identify and manage books, this has improve efficiency and does not tackle the problem at its root. At this moment, automation based on robots becomes a trend of the development of libraries in future. Robot replace mankind employee complete books upper undercarriage, borrow, give back, debugging looks into heavy and other book keepings, its execution efficiency is high, and accuracy is high, can meet the needs of library's daily management mission completely. The present invention relates to a library with a AI

robot which will be able to perform various tasks in library such as transferring books from one place to another, scanning books returned by the users and arranging them on the book shelves on time.

3.3 Proposed System

To build any system or to start making any project in a hardware form it is very important to initially build the block diagram and then proceed to design the appropriate circuit diagram. In the initial stage of planning of our project, we decided to design the hardware part of our project which contain movable base and an arm like mechanism to collect books. Additionally, we took into account the short time span we had to complete this project, and believed it'd be more effective to focus on developing our design than getting caught up in designing the software. Programming and software part was used for the interfacing and controlling action.

The Fig 1 shows the block diagram of the Automatic Book Collector Robot. It consist of the power supply which provides power for the operation of the different components in the hardware. Arduino Mega 2560 microcontroller board and Raspberry piis the controller used in the hardware, Cameras, A4988 Motor driver, NEMA 17 Stepper Motor, QTR IR sensor array, Servo motor and External switch all these components are required to perform the different actions in the working of the robot.

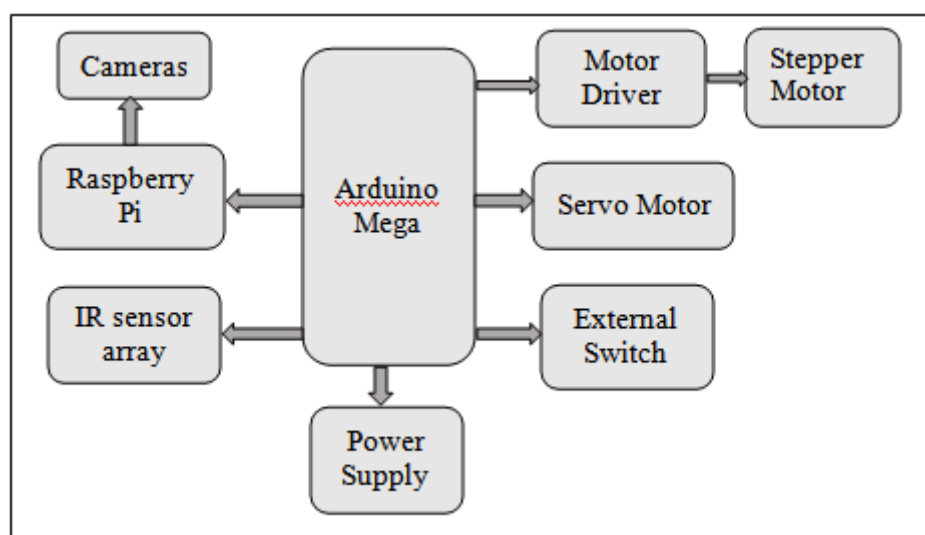


Figure 1. Block Diagram of Automatic Book Collector Robot.

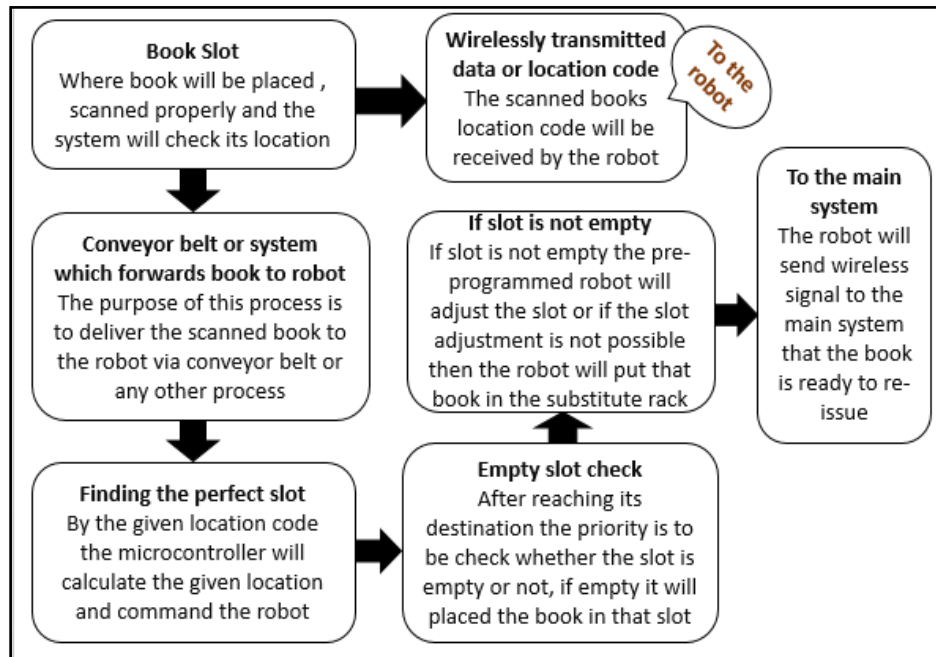


Figure 2. Process of Whole Project

IV. WORKING

The project is extremely easy to operate and can easily be modified according to the future scopes. The project is basically used for arranging books in library at the institutional level. The Automatic Book Collector Robot will scan the books returned by the users and then will arrange those books in the shelves with the help of its arm like mechanism. whenever we return the books the robot will scan the barcode sticker over it, the

barcode will contain information of the book and its original place in shelf, the robot will take that book and move near the shelf and the robotic arm will collect book from students after successfully verifying identity of student, another bot will move near the shelf and place that book in its place. In this case, the proposed robot will make the work of the librarian a lot simpler and the books can be handled easily.

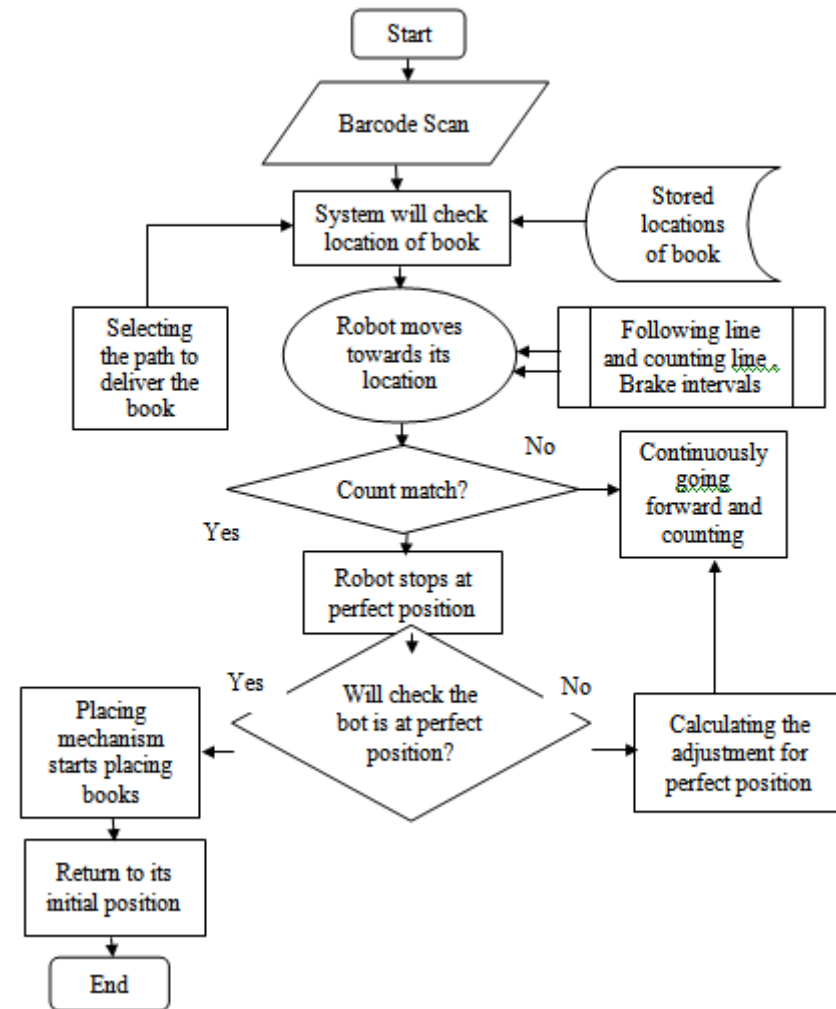


Figure 3. Flow Chart of Operation.

The whole part is divided into two parts; the hardware part and the software design for the control action. The hardware on the board has initially a power supply section which steps down the voltage and gives regulated 5volts and 12volts. This is directly given as an input to the Arduino and Raspberry Pi. And Servo Motor, Stepper motor, Motor Driver, Infrared Reflective Sensors are interfaced with arduino controller and Raspberry pi. The Infrared Reflective Sensors are used for line following as the basic robot is the line following robot.

At first, the barcode reader will scan the barcode sticker of the book and give the information about the book to the RFID system after the student submits the book on the robot rack. Then, depending on the information received, the robot rack will take the book and with the help

of the robotic arm, place the book on the required shelf which is known with the help of the information provided by the RFID system. For the working of the project, we will require a robotic arm, a barcode reader which will scan the barcode sticker of the book, a RFID system which will tell us the information about the book with the help of the scanned barcode, and another robot which will have a rack to place the book on their respected shelves.

The time consuming process of returning the book will no longer exist with this process. But using the automated system the reissuing of that book by any other student can be easily possible in less than 1 day. Hence in this manner, the working of the project will take place.

V. HARDWARE IMPLEMENTATION



(A) (B)
Figure 4. Hardware Implementation (A-Top view, B-Side view)

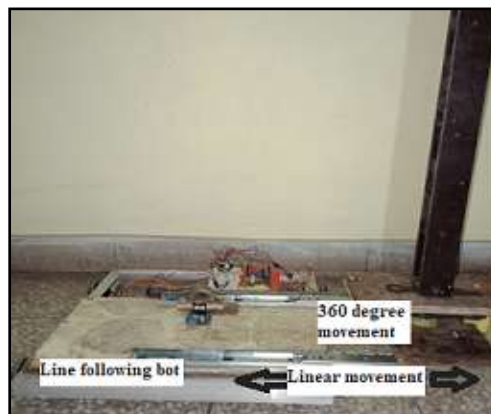


Figure 5. Hardware Implementation

The Fig. 4 and 5 shows the hardware part of our project in which we are using line following bot as a basic robot for our project and two movable slide in which bottom one is used for the linear movement of the arm while the above slide is for 360 degree movement of the arm.

VI. CONCLUSION

We validated the effectiveness and advantages of our proposed methodology by doing software testing. Each module of the program was verified with various test cases. The device was programmed through Arduino Mega and Raspberry Pi efficiently. Though the project was developed for institutional level, it can be extensively be used on a large scale with incorporating certain modifications. The main aim of this project was to arrange books at the institutional level. The Automatic Book Collector Robot has movable base which helps the robot to move freely, and an arm like mechanism to collect book and to arrange them. The future scope is wide and the sensors are handy and user friendly.

VII. FUTURE SCOPE

Future improvements and modifications can be envisaged for Automatic Book Collector Robot that would make it more efficient. One such improvement is by developing one system which will be able to scan books and send information of that book to the members to keep track of the books they are issuing. We can increase robot accuracy of avoiding obstacle present in library, also we can make system wireless by using RF connectors and the system can further modified for finding and picking books from library. The primary objective of our project is to place returned books in its shelves, so at present it is basically focusing on the institution level. Later this can be further extended on the larger scale. Still there is not complete efficiency in finding books and returning to its place, so some other technique can be incorporated to increase its efficiency.

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