DESIGN AND DEVELOPMENT OF LIBRARY ASSISTANT ROBOT

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ABSTRACT

Library robot is an assistant system used to assist the user who wants to search, locate and collect the required book in the library. The request of the user is processed in the computer based system to have the robot informed about the particular shelf or location. Using this information, the robot has its movement towards the informed location and performs barcode scanning across the shelf to find the requested book. The robot with its sliding arm can scan the books in a particular shelf and barcode matching is done in the control based system. The robot exerts force on the book which is found to be matched by the scanning system and collects the book in the tray. This robot based assistant system is reliable to be incorporated in the library and assists the user to collect the required book. The system with its integrated automatic object recognition and force feedback make the robot to deliver the book as soon as possible by minimizing the search time of the user.

Keywords— Automatic object recognition,Force feedback system, Barcode scanner.

I. INTRODUCTION

Library has many connotations. A library is a collection of information resources and services, organized for use, and maintained by a public body, institution, or private individual. In the more traditional sense, it means a collection of books. Typically we need a librarian to pick the books and hand it over to the person to whom the books are being issued. This might be an easy task in case the library floor area is small. Also, to search for the books by humans takes a lot of time as many a times the books gets overlooked by the human eye. To automate this process of book finding and picking paper suggest a robot with an arm with some degrees of freedom which will be able to find out the book with the required tag and then pick it and place it on the table.

Library assistant robot is a line follower robot to follow a line or path may be a physical mark, already predetermined by the user.IR sensor will trace a black line on white surface. The sensors give mobility of the robot, which works with analog signals from the microcontroller and the digital signal is used to drive the motors. The books are placed in the rack and all the books will be tagged by Barcode tags and a Barcode reader will be placed in the robot. The robot will scan an each book and incase the book is found. Link mechanism has to be introduced to pick the book from the rack and make it to fall on the tray kept just below the mechanism.

The mobile manipulator is to assist the human's in order to pursue the objects from the remote locations. These mobile manipulators can be remotely operated by the operator using the

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remote or they can be teleported from the remote location using the wireless communication or they can be made autonomous based on the multisensory and controller integrated in it. This controller plays a major role like brains for humans, controlling the robot to navigate all around the work space and to accomplish the given task automatically based on the sensor information and the inbuilt program.

II. FEATURES OF LIBRARY ROBOT

The base of the robot is fixed with two motorised wheels and stepper motor is adjust the barcode scanner for different self in a rack. Robot is controlled by ATmega32 microcontroller. Sensor is IR obstacle sensor for line following motion. Barcode scanner is Motorola LS1203 .The Operator sends the task to the mobile robot using system. This command consists of the information regarding the rack system number and the particular rack in that.

The controller based on the received information drives the robot, along the predefined path to reach the destination. The IR Sensor plays a major role in this operation of guiding and detection of the rack. Block diagram of the system is shown in the Figure.1.Controller output is based on the IR sensor and barcode scanner. Controller actuates the mobile platform and manipulator.
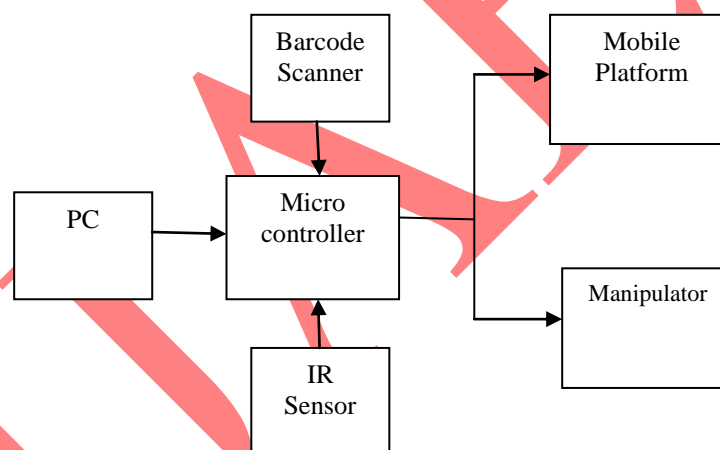
Fig.1 Block diagram of the system

A. *Line Following Motion*

This base house grasps the motion. A motor will be fitted under the base which can be made to move forward/reverse by line following to take this mechanism to all the books in the rack.

B. *The Scanning Mechanism*

The manipulator arm contain barcode scanner. Scanner scans each book of the barcode. It includes several modules necessaries to looking for the required book.

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C. *Gripping Mechanism*

This mechanism is used to hold the components to be picked. The Link will be designed in such a manner that the books which it picks should fall down on the tray, this will be done with the help of rubbery material on the inside surface of the link.

III. HARDWARE SETUP

A. *Mechanical Design*

The Mechanical design of the robot is done using PROE software. The two major subsystem of the robot are manipulator arm and locomotive decvice.The manipulator arm is responsible for picking the book from the rack and the locomotive device is responsible for the gross motion of the robot.PROE model of the robot is as shown in the figure.2.

1. *Manipulator Arm System:*

Books are retrieve from the book shelves and carry them to the user. Manipulator arm require a vertical translation system to move the manipulator to the different rack. The vertical translation system is a sliding rod with the stepper motor for driving a lead-screwed rod. The length of the lead screw is 1000 mm long.Stepper motor is placed at the base of the lead screw. A barcode scanner is installed inside the link in order to recognize and ensure the precision of picking a requested book.Another advantage of having the barcode scanner installed in the link is the freedom of the sensor's motion in 3-D space, similar to the concept of eye-in – hand manipulation. Two servo motors are used to pull down the book from the self. The book falls on the tray where the robot holds it.

2. *Locomotive Device*

Locomotive device is responsible for the gross motion of the robot. The size of the chasis is 500 X 400 X 3 mm. The chasis consist of dual wheels and two supporting castor wheels with individual DC motor form the mobile platform that carries the manipulator arm over it. Front of the chasis having an IR sensor, used to avoid the obstacle in the path. based on the sensor output,microcontroller give a signal to the motor driver LM293 so as to move the motor accordingly.
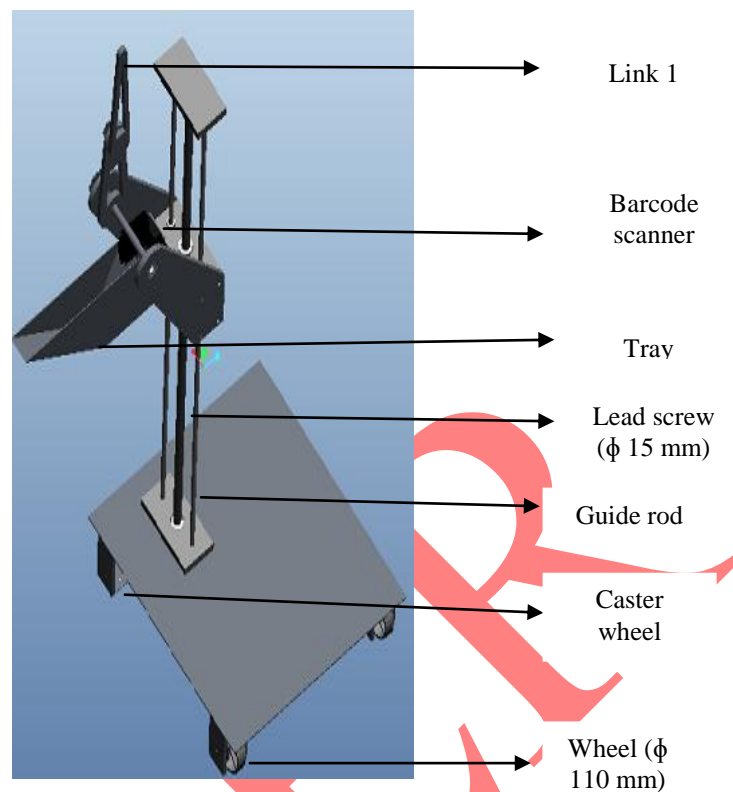
Fig.2 PROE model of the robot

IV. LIBRARY MANAGEMENT SYSTEM

Operation of the robot are

1. To Search the books in the rack.
2. To Monitor the books in the rack continuosly.
   Above operations can be implemented using the library assistant robot the following aspects of library are to be considered.
1. All the books are vertically placed in the rack.
2. Barcodes are paste on the all book at same height and visible.
3. All the book barcodes are faced towards the scanner.
4. Always maintain the distance between barcode scanner and book.

V. BOOK DETECTION METHOD

User selects either the author name or the book name. The database of the entire book details was stored in GUI panel. GUI panel is as shown in the figure.3.If the user selects the book name, the authors for that particular book will be displayed so that the user can also choose the author preferred. Once selected the corresponding rack number is sent to the controller. The controller generates a signal which is used to move the robot for finding the book.
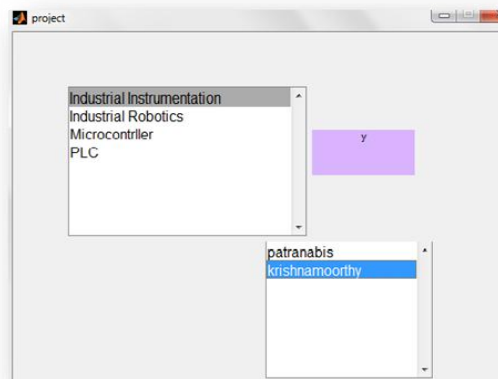
Fig.3 GUI panel of Matlab

Now Barcode scanner scans each book to match with the details already stored in the database. If the book is found the code sends the signal to the controller and it actuates the link mechanism to pull the book down the robot tray.Library assistant robot operation and functions are explained in the flowchart as shown in the figure.4.If the book is not found at the particular shelf,robot search all the rack.The book is not found means the robot come back to home position.Limit switch is fixed in the tray to detect whether the book is present or not.
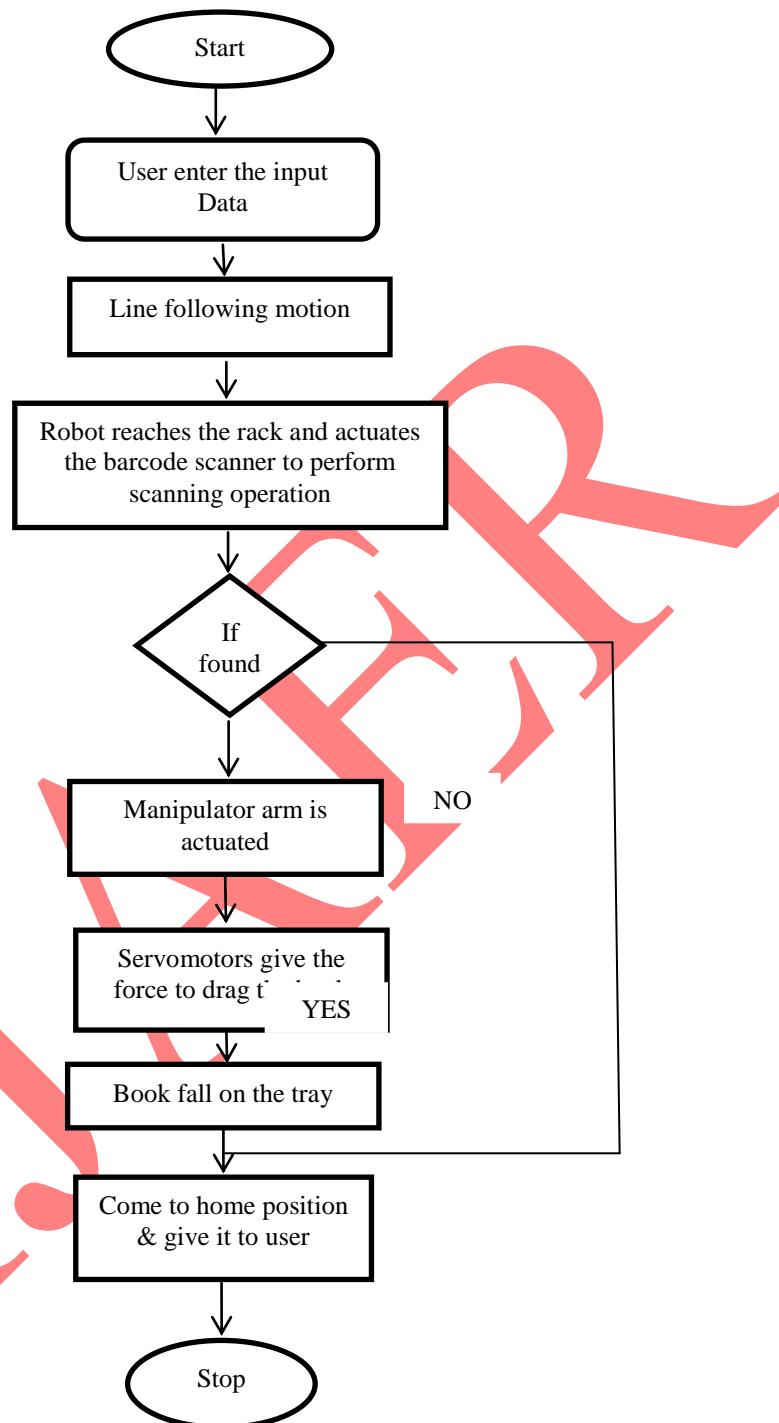
Fig.4 Flowchart of the Robot

VI. CONCLUSIONS

New techniques are being made suitable for improving and making library service effective to the user community as the manual service is time consuming. Using computer networks for resource sharing, enables library to obtain only bibliographic details from the library's collection, but to handle the materials, the designed robot assist in locating the position and collecting the material from the section of rack. The designed assistant robot is efficient in handling the book and is reliable to be adopted in library.

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