

# LIBRARY ROBO USING IoT

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## ABSTRACT

Manual technique of library management is often weary and time consuming. This project proposes the application of line following robot for library inventory management system. Library robo is a line following robot which is designed using sensor operated motors to trace the predetermined path. Basically it consist of a user module and a robotic module. The user module consists of a personal computer or a mobile application to enter the input and an RF transceiver for data transmission. The robotic module consists of an Radio frequency Identification reader along with a robotic arm for detection and picking of the library books. After picking the book, the robo returns back to its initial position. Library robo is also capable to return the book in exact position according to the preprogramed data done by the software 'Arduino ide'. An Android app is proposed to reduce human effort by pre-booking and publishing books online without going to the library. It is an advanced technology which can be done by our smart phone with Internet of Things (IoT). The robo is used for searching, issuing, pre-booking and returning of library books according to the user request.

**Keyword :-** IoT, RFID , IR Sensor , Robotic Arm , Android app

## 1. INTRODUCTION

Library is a collection of information sources. It provides valuable services to its members to a wider local community. Finding books in the library can sometimes be a challenging task Typically, we need a librarian to pick up the books and handover it to the person whom the books are being issued. This might be an easy task for a small library. But in case of huge libraries it takes more time and it seems to be difficult. To overcome this problem, we introduce an automation in library for fast detection and picking of books.

The innovation of robotics made a huge development in today's world. Robots are used for many purposes to ease the human effort. Because robots are time saving, accurate and adjustable to dynamic environment . Hence they are used industrially or socially for pick and place the objects. Robots use different method for their motion. Line following robots are one among them. They are the robots designed to follow the predetermined path. The path may be a physical mark on the floor which is black or white in color.

The basic operation of the line follower is capturing line position with IR sensors and ultrasonic sensors mounted at front end of the robot and steer the robot to track the line with steering mechanism. Two DC motors are used for governing wheel's motion and another DC servomotor for the arm performance.

The database created in PC consist of detailed description of books in the library. When we give an input to the PC, the robot maps the location of book. Following the black line, they pick the desired book and return back to its initial

position. At the time of returning the robot is able to place the book in corresponding rack. To reduce time consumption, we can access the books through mobile application.

An Android app is created to issue the book in online. If he/ she didn't get the requested book, user will receive a message later when the book is available. It gives a way to check the profile of the user also. These reduces the human effort and time consumption. And also, we can develop this system with real time.

The paper organizes as follows; the second section discusses about the literature review, the third section represents the proposed system in detail, the fourth section mentioning about the work flow of system and finally the last section describes about the conclusion and the future scope

## 2. LITERATURE REVIEW

[1] *Karthika K, Kiran kumar B.M, Dr Sanjay and Lakshminarayanan* in this paper introduced "Design and development of robotic arm" and taught about the need for auxiliary robots that are expanding as they allow people to work independently and do impossible tasks with them. This paper presented the design and development of 5 DOF (degrees of freedom) robotic arm used to feed the elderly or challenged, when the joint position is controlled by the user. Using the principles of kinematics and MATLAB, the robotic arm is controlled. The Arduino board MEGA2560 I / O is the main heart of this project that connects the interface of braking, motors and sensors. The simulated robotic arm is built in MATLAB and is performed in a way that is unique to the algorithm to see the accuracy of the algorithm [2] *Jia Liu , Feng Zhu , Yanyan Wang , Xia Wang* in this paper introduced ' RF-Scanner : Shelf Scanning With Robot – Assisted RFID Systems ', a good program called RF-Scanner, which can do automatic scanning by combining robot's technology and RFID technology. It mostly contains 3A regulations. They are, Accuracy, Automation and Availability. [3] *Mrs. Rasika Yenorkar and Prof. Dr. U M Chaskar* in this paper introduced ' GUI Based Pick And Place Robotic Arm For Multipurpose Industrial Applications ' developed a GUI based, trainable robotic arm which is being automated for multipurpose industrial applications. The basic aim is to achieve the ability of commanding and controlling the arm through MATLAB Graphical User Interface (GUI) and to make the system more efficient. Mainly it consists of two parts, AVR Microcontroller and the program. AVR Microcontroller is programmed for the central controlling station which has GUI access and the arm control. [4] *Pathak , Manish Pandit, Surbhi Kanthed, Rohit Sanvaliya* proposed a paper "Library management robot ", in this paper introduced r , they demonstrated a robot which is very helpful in library to ease human efforts. The robot is able to arrange the books in shelves according to the data stored in its memory. The LMR system consist of an RFID tag which is used to find the location of book in shelf. That is, if a book is wanted to place in a shelf the LMR system first scan its RFID tag. According the RFID tag, the corresponding location of the book is extracted from the stored data and placed the book in shelf. The robot is moved through the floor by following a particular line. The robotic system consist of microprocessor ATmega 328 , 2 motor for motion of wheels, 4 motors for rotation of arm, RFID reader and sensors to gather the environmental information.

[5] *Ramanan N.V and Mr Manoj senthil* proposed a paper "Library Management System to Issue and Retrieve Books from User Using Autonomous Robot in this paper introduced using Autonomous robot in the use of book management in the library, avoids the library searching manually accounting and management systems. The robot is designed to use motor driven sensors to keep track of the preparations on a bookshelf. This proposed system provided automation in the library to provide the book to the user using a robot with the help of database information. Robot found the details of a book that will be a PC search by Zigbee. The books are transported from one place to another with the help of an IR sensor. The robotic arm picked up the book and handed it to the user. [6] *Kazi mahmud Hasan,Abdullah-Al Nahid, Abdullah Al Mamun* 'Implementation of autonomous line following robot' introduced an autonomous robot that detects and follows a line in which the path may appear as a black line in a white state or may return laterally or does not appear to be magnetic. Using a loop control system located near the robot. The robot has to feel the line and move properly to stay in the process while repairing the wrong movement using feedback mechanisms thus creating simple but effective loop systems. The robot is designed to follow very strict degrees as the information from the sensors progresses naturally. [7] *Bomble pranct , R.G Deepika , and Dr Shaikh Meeravil* in this paper introduced 'Library Management System using Zigbee Transceiver Robot' the robot shows the location of the book in shelf. Communication between the pc and robot through the ZigBee transceiver . User enter the input in the pc then the output data is transmitted from pc to robot ZigBee transceiver. The robot consist of barcode reader which helped to identify the book. After finding the particular book. Robot sense the

particular book through pc. In case the book is not present robot gave an alarm to user .[8] *Mehmetcan Gulesci and Murat Orhun* in this paper introduced ‘Android Based WI-FI Controlled Robot Using Raspberry pi ’ developed a way to control a robot using Raspberry pi and application built in the Android platform. By using the Raspberry pi , the robot can move upward, backward, right side and left side and get a live video on Android phone from USB Cam. WI-FI network is the interconnection between Android phone and Raspberry pi. Robot can be controlled by the commands from Android application. Raspberry pi can receive the signals from Android app according to the program written in the Python programming language in the Raspberry pi. Mainly it consists of two arms, one to control the robot by using WIFI network and the other is to get a live video stream from the camera by using Raspberry pi. It is mainly a combination of hardware and software parts.[9] Mohammed, Amin & Sunar, M in this paper introduce the concept of Kinematics Modeling of a 4-DOF Robotic Arm.

**3.PROPOSED SYSTEM**

The library robo consist of two modules user module and robotic module. User module is the platform in which user can interact with robotic module. Through this module the user enter the name of book that he wants to issue . Here the user module consist of two options. First one is issuing the book through a mobile application. In this case an android application is developed .User can enter its login id and password in application for issuing the book. Through this user can search and enter the name of book that he wants to issue. If the particular book is available in library the entered input is transmitted to robotic module through IoT . If the book is not available ,at the time of issuing the app displays book is not available. Through this application user can return the book.

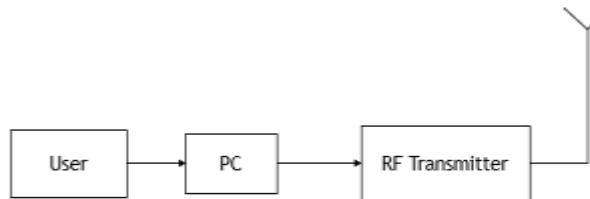
The second method is issuing and returning the book through the pc provided in the library. In this method a webpage is created in which user can enter it through his login id. After login he can search and enter the name of book that he wants. If the book is available in library the input data is transmitted to robotic module through rf transmitter. If it is not available pc displays book is not available.

The transmitted data from user module is received by the robotic module. The robotic module consists a database, which includes the detail of books in the library. The robotic module receives the data from user module through rf receiver or through ESP8266 Wi-Fi module. After receiving the information, robot maps the rack in which the book is present. Then it follows the predetermined path drawn on the floor with the help of its sensor and ultrasonic sensor. For tracking the rack position the robot is programmed in such a way that a pair of rack is placed at a particular distance from robotic module. And using the distance travelled by the robo it identifies in which rack it is present.

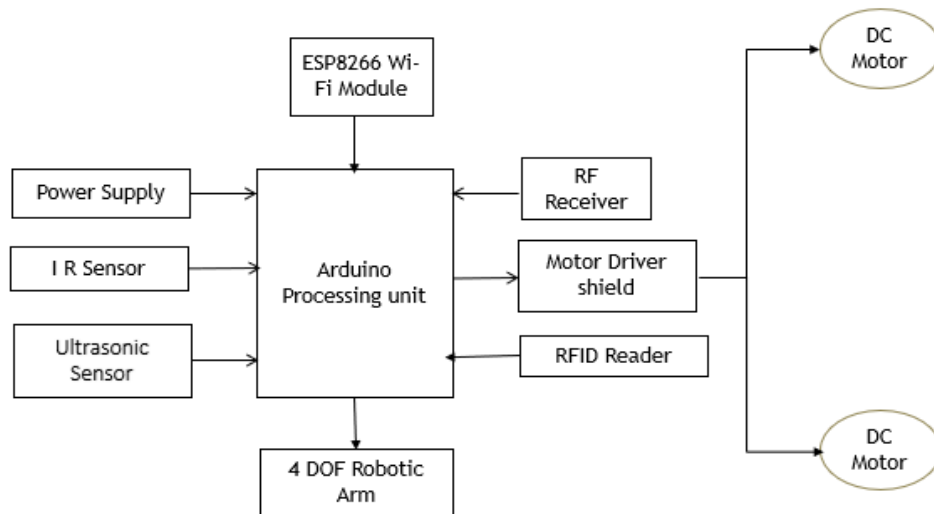
**3.1 Block diagram of library robo :**



**Fig 3.1 :** Block diagram of User Module when user issue book through mobile application



**Fig 3.2 :** Block diagram of User Module when user issue book through pc in the library



**Fig 3.3:** Robotic Module

**Processing unit:** It consist of an Arduino board with ATmega 328 microcontroller. This processing unit process all the information of modules connected to it and gives the corresponding outputs.

**Power supply:** It provides the required power for the Arduino board.

**IR Sensor:** It is used for line following. It detects the black line drawn on the white surface of the floor. According to the output of IR sensor, the robotic module moves.

**Ultrasonic sensor:** It is used to detect the obstacles in the path. It have both transmitter and receiver section. It works in the range of 40 KHZ to 70KHZ.

**RFID reader:** It is used to read the RFID tag placed on each book in the library. The RFID reader is placed on the back side of robotic arm, which helps to search and identify the desired book.

**Robotic arm:** Here we using 4 degrees of freedom robotic arm with 4 servo motors. The servo motors are used for controlling movement of robotic arm. Using this 4 DOF robotic arm book is pocked and placed in the basket.



**Fig 3.4 :** Robotic Arm [9]

**RF transmitter:** It is used to transmit the data from personal computer in the library. When the user enter the name of book in pc, the rf transmitter transmit the data from user module to robotic module.

**RF receiver:** It is used to receive the information from rf transmitter. That is, the robotic module collect's the data of book from pc through this rf receiver.

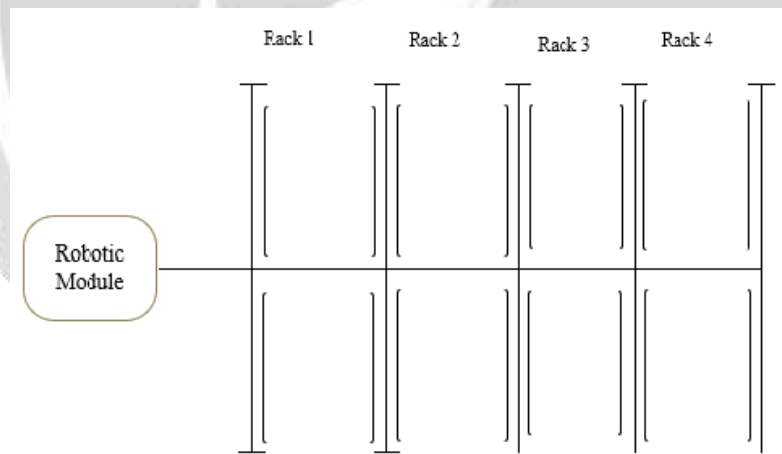
**DC motor:** The Dc motor in the motor driver shield controls the wheel motions. Four wheels in the robotic module are controlled by 2 DC motors. According to the output of IR sensor and ultrasonic sensor the DC motor drives the corresponding wheels and provide motion in robotic module.

**ESP 8266 WIFI module:** It is used for getting information from the user module when we are using mobile application. Through this Wi-Fi module the data from the cloud server reaches the robotic module.

### 3.2 Layout of Library:

The layout of the library with the robotic module is shown below. According to this layout if the issued book is in rack 3 the robot starts from the initial position and stops when it covers the distance assigned to rack 3. Then it turns to left and follow the path drawn there. At that time RFID reader starts scanning of each book in the rack. Here the RFID reader is placed on the back end of the robotic arm. The RFID reader reads the RFID tag placed on the book and decoded the data from it. When it is seems to be equal with the received data the robotic arm rotates 180 degree and picks the book and place it in the basket.

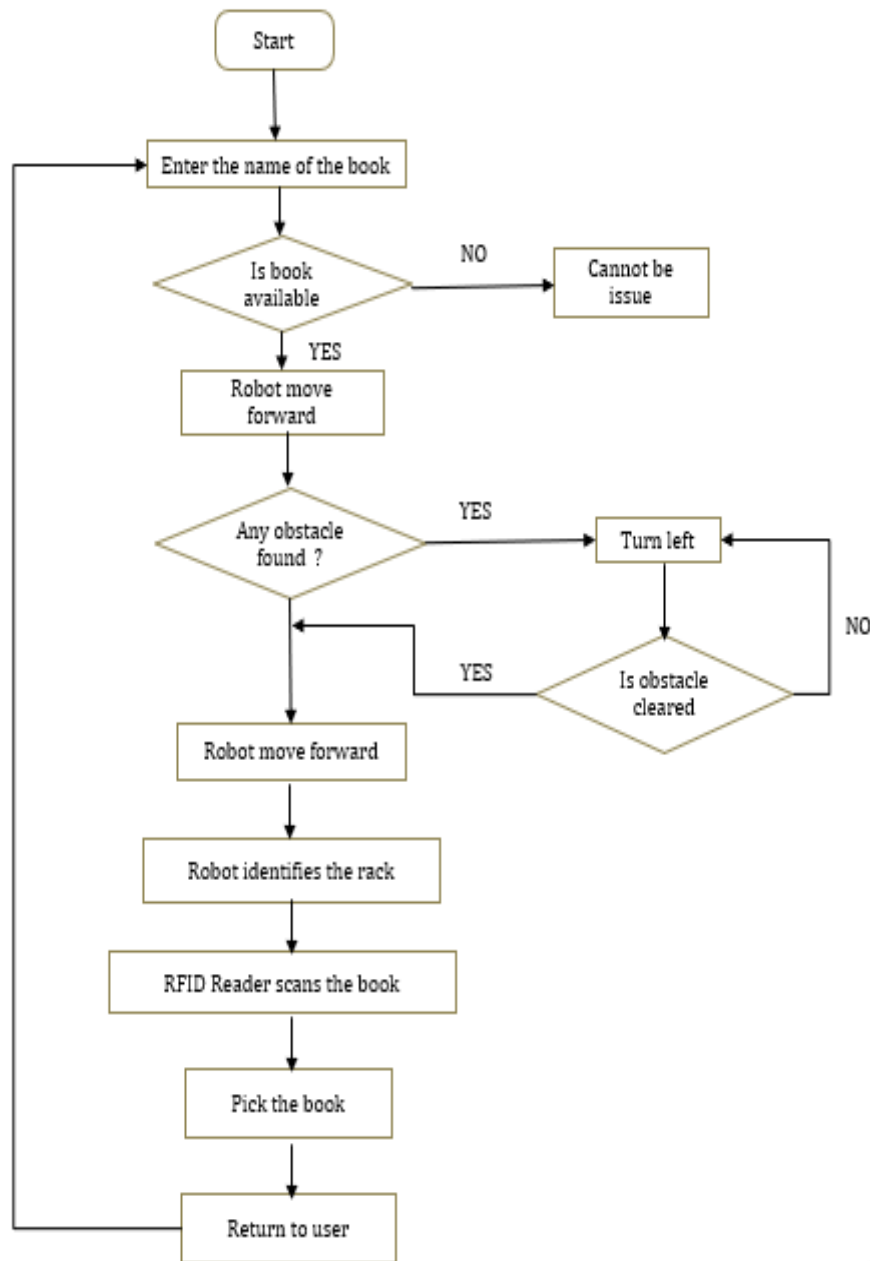
After that it return back to user through the path it covered and issue the book to user. At the time of returning the book, the user enters the name of book in pc provided in the library and place the book in the basket of robotic module. After receiving the transmitted data from pc, the robotic module checks, the basket for the book. If the book is present in basket the robot maps the location of the book. After locating it carries the book and placed it in the rack with the help of robotic arm.



**Fig 3.5 :** Layout of Library

#### 4. WORK FLOW OF THE SYSTEM

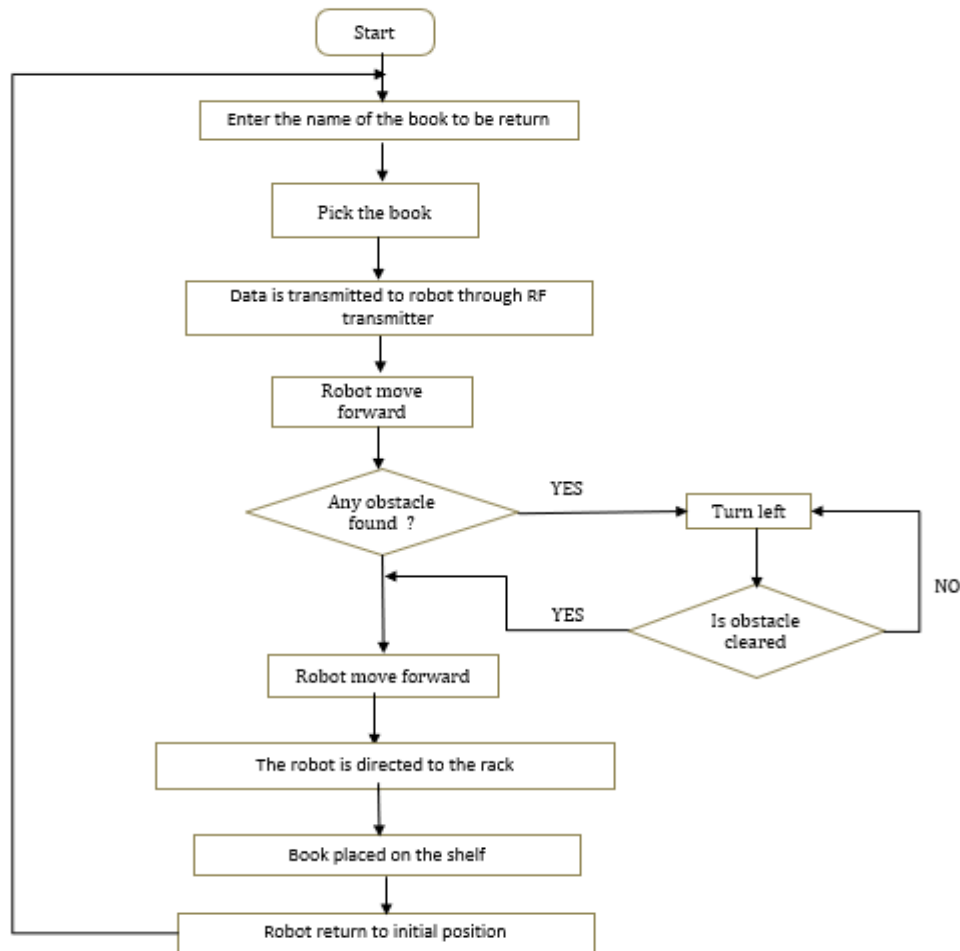
This simplified working of the library robo is defined using below flow chart



**Fig 4.1 :** Flow Chart For Issuing

We will give input as the name of the book to the server followed by checking the availability of the book, if the book is not available then it cannot be issue and if the book is available then the robot will move forward aimed to the requested book. If any obstacles found in the way then it will turn left as per the programmed executed to perform in such a way that the robot will adjust by turning left until the obstacle is cleared. After clearing the obstacle, the robot would be moving forward and identify the corresponding rack and move towards the desired

book with the help of RFID scanner which helps in scanning the tags. After reaching the requested book robot will pick the book with aid of robotic arm



**Fig 4.2 :** Flow Chart For Returning Book

For returning the book initially enter the name of the book to be return so that the information is transmitted to the robot through Rf transmitter, then the robot will move with the book that to be return and the rack in which book is to be place is mapped and directed to the corresponding rack thereby placing the book in the shelf and the robot will return to the initial position.

## 5. FUTURE SCOPE & CONCLUSION

In this paper, a robot for library application, LIBRARY ROBO has been proposed to reduce human effort and time consumption. The robot work on the basis of input data entered by the user through a pc or an android application. By using RFID reader it identifies the position of book and pick the book by using robotic arm .Then it return to the initial position. An android application is developed to improve the performance of library robo. By using this application books can be picked through online.

In future, the designed LIBRARY ROBO will be tested to see how much efficiently they can pick the book. Also we can improve the features of library robo like arranging the misplaced books, finding the damages of books and improve the efficiency by performing more than one book at a time. Also the features of android application can be improved. The proposed work can also be modified to use in different applications like in medical shops where a large number of medicines is to be maintained in racks. It can also be modified to used in grocery stores and supermarkets.

## 6. REFERENCES

- [1] K. Kruthika, B. M. Kiran Kumar and S. Lakshminarayanan, "Design and development of a robotic arm," 2016 International Conference on Circuits, Controls, Communications and Computing (I4C), Bangalore, 2016, pp. 1-4.
- [2] J. Liu, F. Zhu, Y. Wang, X. Wang, Q. Pan and L. Chen, "RF-scanner: Shelf scanning with robot-assisted RFID systems," *IEEE INFOCOM 2017 - IEEE Conference on Computer Communications*, Atlanta, GA, 2017, pp. 1-9.
- [3] R. Yenorkar and U. M. Chaskar, "GUI Based Pick and Place Robotic Arm for Multipurpose Industrial Applications," 2018 Second International Conference on Intelligent Computing and Control Systems (ICICCS), Madurai, India, 2018, pp. 200-203
- [4] Mayank Pathak, Rohit Sanvaliya, Manish Pandit, Surbhi Kanthed, 2016, Library Management Robot, INTERNATIONAL JOURNAL OF ENGINEERING RESEARCH & TECHNOLOGY (IJERT) Volume 05, Issue 10 (October 2016), <http://dx.doi.org/10.17577/IJERTV5IS100285>
- [5] Ramanan.N.V and Mr.K.Manoj Senthil "Library Management System to Issue and Retrieve Books from User Using Autonomous Robot" Asian Journal of Applied Science and Technology (AJAST) (Open Access Quarterly International Journal) Volume 2, Issue 2, Pages 707-715, April-June 2018
- [6] K. M. Hasan, Abdullah-Al-Nahid and A. Al Mamun, "Implementation of autonomous line follower robot," 2012 International Conference on Informatics, Electronics & Vision (ICIEV), Dhaka, 2012, pp. 865-869.
- [7] Bomble Pranit R., and G.Dipika. "Library Management Robot" Internation Journal Of Advance Research And Innovative Ideas In Education Volume 1 Issue 3 2015 Page 29-32
- [8] Guleci, Mehmetcan & Orhun, Murat. (2017). Android based WI-FI controlled robot using Raspberry Pi. 978-982. 10.1109/UBMK.2017.8093402.
- [9] Mohammed, Amin & Sunar, M.. (2015). Kinematics Modeling of a 4-DOF Robotic Arm. 10.1109/ICCAR.2015.7166008.