

# “DESIGN AND DEVELOPMENT OF LIBRARY MANAGEMENT ROBOT BY USING E-YANTRA”

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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 book Bar Code ID scan through bar code reader is processed in the computer based pre programmed system, which is stored in Arduino Uno Atmega328 Microcontroller have to informed about the particular shelf or location is classify in such manner odd number for upper and even number for lower shelf of book rack, It also carried bar code Id for each Book. 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 lead screw is positioning vertical distance & sliding arm through rack and pinion mechanism can scan the books in a particular shelf and barcode matching is done in the microcontroller based system. The robot exerts force to pick the book through gripper, which is found to be matched by the scanning system and placed book in issuing counter. Library management robot is a line follower robot to follow a black line path, already predetermined by the user. 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.

**Keyword:** -Bar Code Reader , Arduino Uno Atmega 328 Microcontroller, Lead screw , Rack & pinion , Gripper etc.,

## 1. INTRODUCTION

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. 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 to search, locate and collect the required book in the library and picking book suggest through bar code reader ID a robot mechanized 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 issuing counter table. Library assistant robot is a black line follower robot to follow a line, 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 with the help of gripper from the rack and make it to fall on the issuing counter table The robot with its lead screw is positioning vertical distance & sliding arm through rack and pinion mechanism can scan the books in a particular shelf and barcode matching is done in the microcontroller based system. The robot exerts force to pick the book through gripper, which is found to be matched by the scanning system and placed book in issuing counter. 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.

## 2. OBJECTIVES

The main objective of project is to develop the new bar code technology techniques are being made suitable for improving and making library service automatically effective to the user because the manual service is time consuming.

## 3. COMPONENTS

The main components of the library management robot are mention as follows

- a) **Frame:** The frame is the main supporting structure of the machine upon which all the components of the machine are mounted. The material used for the frame is Aluminum..The frame structure is so designed proto type that it has good strength that can bear the shocks, vibrations produced during the operation and also the load and weight of the components mounted on it. The frame is of 55.5×11.5×6 cm which is joined by pop rivet..This frame is mounted on wooden rectangular block in dimension 29×23.5×1 cm.
- b) **DC Motor Drives:**DC motor drive is also used for the transmission of power of different link 10 RPM four DC motor is used to drive the robot . Other than two 10 RPM DC motor is used two drive rack and pinion mechanism and gripper and only one 200 RPM DC motor is used to drive lead screw.
- c) **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
- d) **The Scanning Mechanism:** The manipulator arm contain barcode scanner. Scanner scans each book of the barcode. It includes several modules necessities to looking for the required book.
- e) **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.
- f) **Arduino Uno microcontroller:** The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter.
- g) **L293D:** L293D is a typical Motor driver or Motor Driver IC which allows DC motor to drive on either direction. L293D is a 16-pin IC which can control a set of two DC motors simultaneously in any direction. It means that you can control two DC motor with a single L293D IC. Dual H-bridge *Motor Driver integrated circuit (IC)*.

#### 4. CAD MODEL OF LIBRARY MANAGEMENT ROBOT

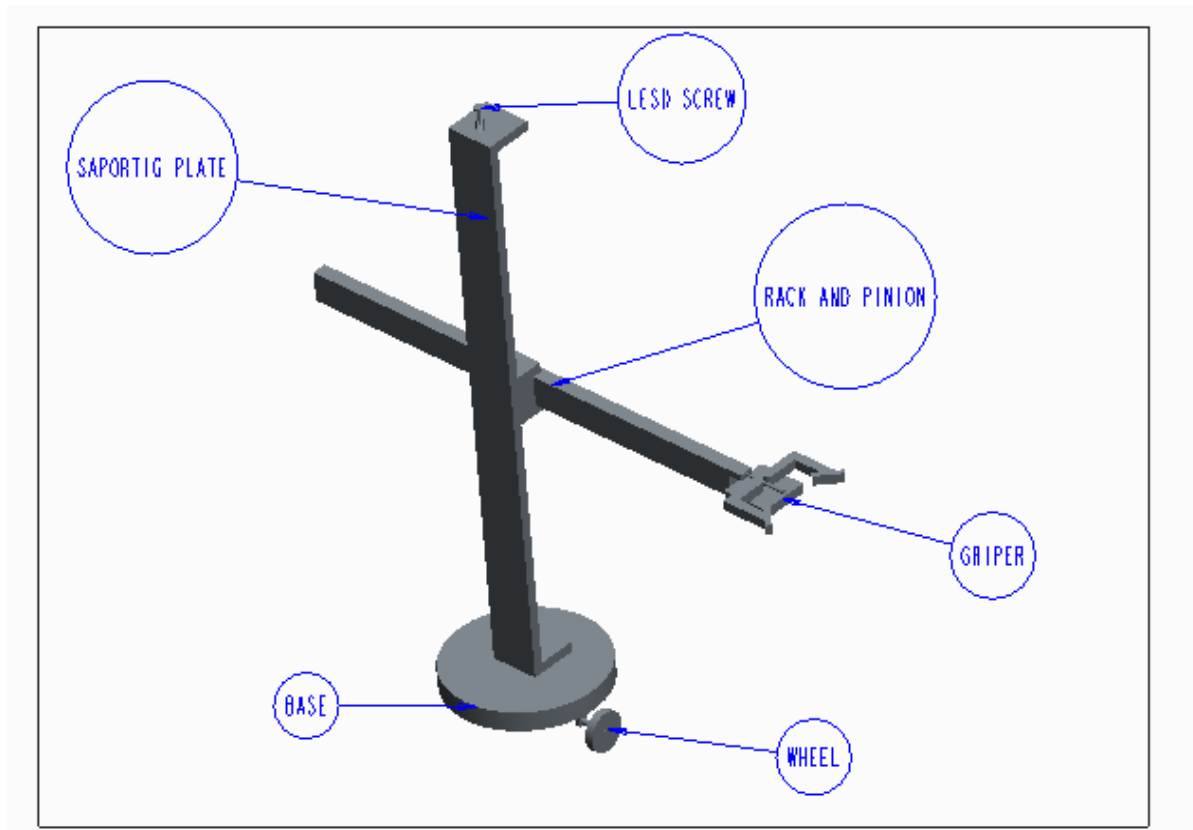


Fig 1: Cad model of library management robot

#### 5. CONSTRUCTION & WORKING

It consists of the frame made up of aluminum plate (55.5×11.5×6 in cm) which provides the foundation for machine. It also consists of the most important part of robot i.e. rack and pinion arm with gripper which is made up of plastic material. It also consist of the bearing (6201) in between the lead screw mechanism for vertical moment supported to roller rail link frame which is made of steel and cooper and lead screw link is connected to the rack and pinion arm for horizontal moment. Bar code reader is mounted on lead screw frame. The base of the robot is incorporated with four motorized wheels and whole assembly mounted on it. Three DC motor is used to drive lead screw with 200RPM and adjust the barcode scanner for different self in a rack. 10RPM motor used to drive rack and pinion and gripper.

Robot is controlled by ARDUINO UNO ATMEGA328 microcontroller. Sensor is IR obstacle sensor for line following motion. Barcode scanner is ECLIPSE 5145 .The Operator sends the task to the bar code tag scanned to the robot. This barcode tag contains 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.



**Fig 2: Fabricated view of Library Management Robot**

**6. COMPONENTS WITH SPECIFICATION:**

**1) Chassis Dimension**

Length of base	29cm
Width of base	23.5cm
Thickness	1cm

**2) Wheel Specification**

Material	Plastic
Diameter of wheel	8cm
Type	Fixed type

**3) Lead screw Specification**

Lead Screw Material	304 Stainless Steel
Length	600mm
Diameter	8mm
Pitch	2mm
Brass Nut Size	10 x 13 x 22 mm

Bearing Pillow Block Size	55 x 26 mm
Weight	200 gm
Material	Stainless steel and brass.

#### 4) Battery Specification

Voltage	6 Volt
Capacity	4.5 Ah
Type	Sealed Lead Acid Battery
Warranty	1 Year
Shipping Weight	2.00 Pounds
Length	2.76"
Width	1.77"
Height	3.98

#### 5) Microcontroller Specification

Microcontroller	ATmega328
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Input Voltage (limits)	6-20V
Digital I/O Pins	14 (of which 6 provide PWM output)
Analog Input Pins	6
DC Current per I/O Pin	40 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	32 KB of which 0.5 KB used by bootloader
SRAM	2 KB
EEPROM	1 KB
Clock Speed	16 MHz

#### 6) Rack and pinion specification

FOR RACK	FOR PINION
1) Module = 1.25 mm	1) Module = 1.25 mm
2) Axial pitch = 4 mm	2) Circular pitch = 4 mm
3) Thickness of teeth = 2 mm	3) Thickness of tooth = 2 mm

4) No. of teeth = 250	4) No. of teeth = 19
5) Length of rack = 500 mm	5) Diameter of gear (pinion) = 24 mm
6) Pinion hub dia. = 6 mm	6) Pinion hub dia. = 6 mm
Material – plastic	Material – plastic

## 5. RESULT

After the complete fabrication of proto type library management robot. We conduct actual testing of robot, we found that less time is required to search and locate the book, when we scanned required book barcode tag and positioning before doing work through pre program micro controller command to judge within two-three second and pick and place the book within 5 minute, its depend upon library layout as compared to manual operation.

## 6. FUTURE SCOPE

- It will be operated with the mobile app application.
- It will be operated with advanced RFID based LBMS with security and surveillance for modern large size libraries.
- Library robot connected to Library Software through Zigbee communication and software interface to user through internet and booking to required book online.

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