

# Book Handling Robot for Libraries

Sharath H.K.

M.Tech. Student, Dept. of Mechanical Engg.,  
Malnad College of Engineering,  
Hassan, India.

Shivashankar B.S.

Asst. Professor, Dept. of Mechanical Engg.,  
Malnad College of Engineering,  
Hassan, India.

**Abstract**— The use of robots in industrial production has grown significantly in the past decades worldwide. In contrast the use of robots in other applications is still limited. Service robots which are partially or fully automated perform tasks for people instead of serving industrial manufacturer.

Recently, the idea of using robots in library application has become more interesting. Book picking robot is a service robot which perform tasks such as book finding, picking and delivering it to the reader.

The process of book finding and picking is automated by this work. The robot developed move towards the book and the navigation of robot is controlled through camera. The robotic arm will move close to the book and then the gripper will close the jaws to get a hold of the book and then the robotic arm is lifted, after which the robot returns back to deliver the book to the reader.

## I. INTRODUCTION

A Robot is a reprogrammable, multifunction manipulator designed to move material, parts, tools or specialized devices through various programmed motions for the performance of a variety of tasks.<sup>[1]</sup>

Robotics is a branch of technology that deals with the design, construction, operation and application of robots as well as computer systems for their control, sensory feedback and information processing. Robot anatomy is concerned with the physical construction of the body, arm and wrist. The body is attached to the base and the arm assembly is attached to the body. At the end of the arm is the wrist. The wrist consists of a number of components that allow it to be oriented in a variety of positions. Relative movements between the various components of the body, arm and wrist are provided by a series of joints. These joint movements usually involve either rotating or sliding motions. The body, arm, and wrist assembly is called the manipulator.<sup>[1]</sup>

Robots have replaced humans in the assistance of performing those repetitive and dangerous tasks which humans prefer not to do, or are unable to do due to size limitations, or even those such as in outer space or at the bottom of the sea where humans could not survive the extreme environments.

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.

## PROBLEM DEFINITION

In present situation, 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 human takes a lot of time as many a times the books get overlooked by the human eye.

This process of book finding and picking can be automated by developing a robot with an arm with some degrees of freedom, which will be able to find out the book and then pick it and place it on the table.

Here the books are placed in a rack. The robot will move near the rack, in case the book is found the robotic arm will move close to the book and then the gripper will close the jaws to get an hold of the book and then the robotic arm is lifted, after which the robot returns back to deliver the book to the reader. In this case, the proposed robot will make the life of the librarian a lot simpler and the books can be handled easily.

## II. SYSTEM OVERVIEW

The complete book picking robot is a combination of two subsections: Robotic mechanism and Hardware driver circuit.

### Robotic mechanism

The complete mechanism is made up of metal sheets and plastic. It has movable base, fixed body, moving arm and a gripper.

**Movable base:** Movable base provides complete housing to driver circuit and two motors which drive the wheels. It provides the platform to move and rotate the robot.

Four wheels are mounted on base. Two wheels on each side are connected by a chain mechanism made up of plastic. The two backward wheels are driven by DC motors and controlled by controller through H-bridge driver circuit. They can move in forward and backward direction.

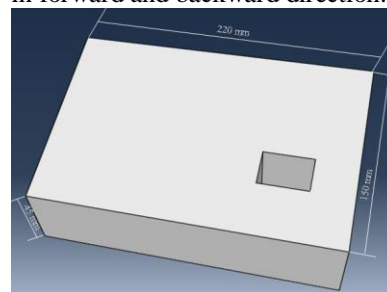


Fig.1 3-D view of movable base

**Raiser block:** Raiser block is mounted on base to increase the reach of the robot arm.

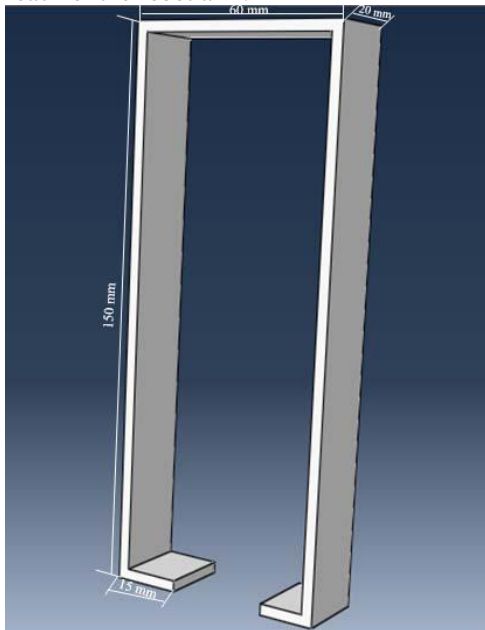


Fig.2 3-D view of raiser block

**Body:** Body is mounted on raiser block. It provides housing to moving arm and DC gear motor.

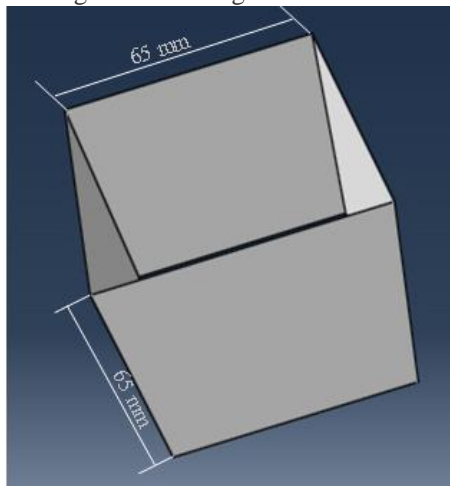


Fig.3 3-D view of body

**Moving arm:** It is coupled to DC gear motor with the platform provided on fixed body. It is allowed to move up & down freely maximum up to 90 degree.

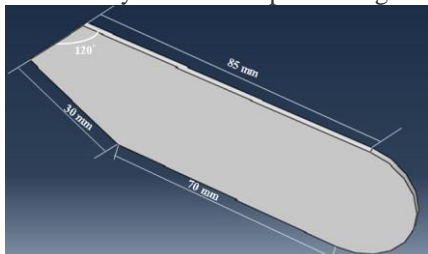


Fig.4 3-D view of arm

**Gripper:** Gripper is located at the front end of arm. Grips are allowed to slide forward and backward with the use of DC gear motor. The end of arm provides housing to motor which is directly coupled to sliding grips. Here the angular (circular) movement of motor is converted in to linear movement of sliding grip by using worm gear.

### III. SYSTEM REQUIREMENTS

The hardware requirements include microcontroller, DC motors, relays, resistors, worm gears, baterries, RF module and camera.

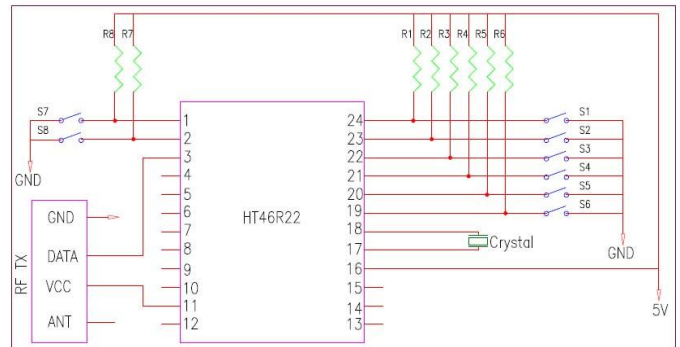


Fig.5 Circuit diagram of microcontroller connection in transmitter module.

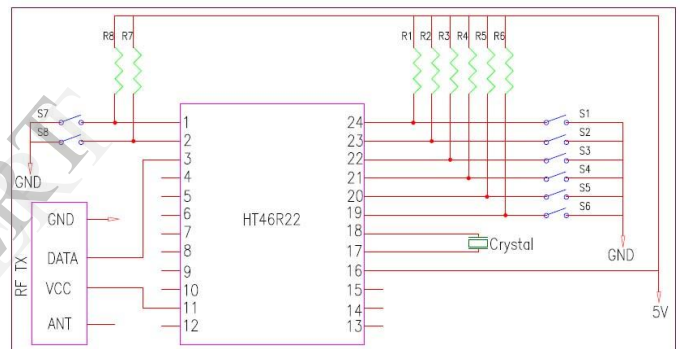


Fig.6 Circuit diagram of microcontroller connection in receiver module.

### IV.RESULTS AND OBSERVATIONS

The book picking robot developed is made up by three main parts: a mobile platform, a robot arm and a camera.

The process of book finding and picking is automated by the robot. The robot moves towards the book and the movement of robot is observed with the help of camera. The robotic arm will move close to the book and then the gripper will close the jaws to get a hold of the book and then the robotic arm is lifted, after which the robot returns back to deliver the book to the reader.

The robot lifts book weighing below 150 grams. It moves up to 40 m and performs book finding and picking operation.

The experiments with this system show an important improvement with respect to previous attempt both in the quality of the results obtained and in the final time expended for the complete process, namely localization, identification and extraction of a book.

Librarian can control the robot sitting at his place by watching video of robot movements in his computer.

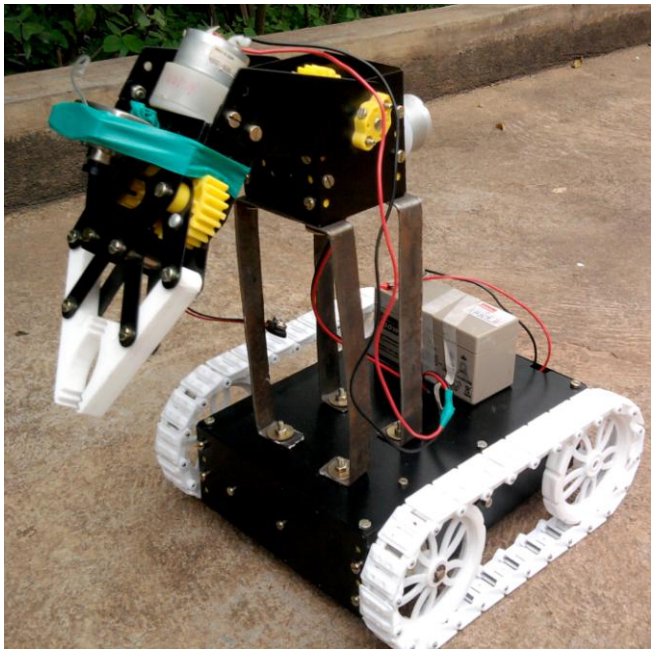


Fig.7 Book picking robot

#### REFERENCES

- [1] Mikell P.Groover, Mitchell Weiss, Rogern Nagel, Nicholas G.Odrey, "Industrial Robotics", Mc GRAW-HILL International Edition, 1996.
- [2] Julie Behan, "The Development of an Autonomous Library Assistant Service Robot", University of Limerick, Limerick, Ireland,2008.
- [3] M.T. Haque, A.A. Anam, M.K.A. Hasan, M.A. Sufiyan AND N. Afroz, "Conniving, mechanized and scheming of a pick & place automation having best condition", J. Innov. Dev. Strategy 5(1):1-5 April 2011.

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