SMART LIBRARY MANAGEMENT ROBOT USING LABVIEW

[1]ANITA GADE, [2]YOGESH ANGAL

[1,2]Elecronics and Telecommunication Engineering,
JSPM's Bhivarabai Sawant Institute of Technology and Research, Savitribai Phule Pune University, India.

Abstract— The objective of this project is to develop smart library management system using robot. This scheme facilitates fast issuing, reissuing and returning of book with the help of robotic arm. It provides the book information and library associate information to the library management system and does not require the manual typing. In case of any difficulty faced by the robot when it does book searching process, the robot halts and sends an alarm. Typically we need librarian to pick the book and give up it to the person to whom the books are being issued. This is not easy task in case the library floor area is large. Humans take a lot of time for searching the book. To overcome this problem we are developing automation in library to fast diction of books using robotic arm with degrees of freedom. Robotic arm will pick and place book at desired location according to sensor data. To implement above mentioned tasks we are using national instruments myRIO model which has wide variety of sensors, actuators, and displays.

Keywords— LabVIEW, myRIO ,RFID, Robot, ,End-effector.

I. INTRODUCTION

The generative modeling approach allows the forecast of grasping tasks given tentative sensory data, as well as object and grasp selection in a task-oriented manner.

This system is employed in order to substitute human tasks. In this project we are developing library management system using sensors for. According to the sensor data the direction of the robot is controlled. By using robotic arm this system detects the books, picks that book from source location and places at desired location. The LabVIEW program enables the robot to travel from a user defined starting point to a destination point through avoiding undefined obstacle on its route. Robot work based on the "Sense, Think and work" model robot senses for obstacle in its route, makes a decision to implement collision avoidance routine and returns to the process of reaching the desired location. In case of any difficulty faced by the robot when it does the searching, the robot halts and sends an alarm. Books can be identified using the pre-programmed data in the system which helps to maintain the books in an order. Robot will Pick the book and place to desired location.

Our system implements book inference and book-based grasp planning suitable for an artificial agent with a specific embodiment, by using RFID technology.

II. METHODOLOGY

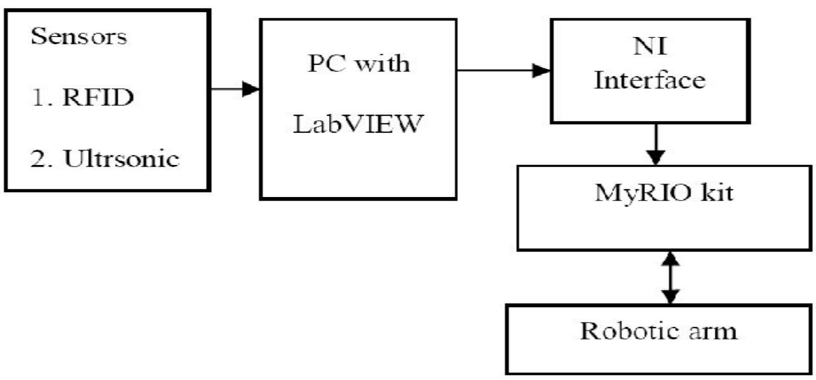

Fig.1.proposed system

A. RFID

Radio-frequency identification make use of eletromagnetic fields to transfer data, which automatically identify and track tags attached to books. The tags hold electronically stored information. The tag information is stored in memory. The RFID tag includes programmable logic for processing the transmission and sensor data, respectively. It can also act as a security device. In fact, library budgets are being reduced for personnel, making it necessary for libraries to add automation to balance for the reduced employees size. Robot gets the data of book which going to be search from the sensors by using RFID sensors

B. Ultrasonic Sensor

Ultrasonic sensors are range finding sensors which work by transmitting high frequency sound. It calculates distance by measuring the time it takes for reflections to come back to the sensor. The ultrasonic sensor is used for obstacle detection. Ultrasonic sensor transmits the ultrasonic waves from its sensor top and receives the ultrasonic waves reflected from an entity. The ultrasonic sensor is very dense and has a very high performance. The ultrasonic sensor emits the short and high frequency signal.

C. myRIO:

The myRIO is a processing element developed by National Instruments. It consists of a dual core ARM Cortex A9 processor and a Xilinx FPGA with analog and digital inputs and outputs that can be used. The main advantage of using this system is that it is able to acquire and process data in real time. NI myRIO is a revolutionary hardware/software platform, integrated SoC technology from Xilinx, the NI myRIO boast a dual-core ARM Cortex A9 processor and an FPGA with 28,000 programmable logic cells.

D. GPS

The Global Positioning system is a space-based direction-finding method that provides book location. self-directed robots using a GPS sensors, which determine latitude, longitude, time, speed, and heading.

E. Robotics Module

Once you are able to obtain data from sensors and control your mobile robot's movement, then apply an obstacle avoidance or path planning algorithm.
After collecting data from sensors robot perform task. Robotic arm is mechanical arm usually programmable, with similar function to human arm. The length of each link can be designed as per necessity. It can be of equal or different lengths. An end-effector is an entity which can act a grasp on an object which is movable .

III. EXPERIMENTAL SIMULATION

A. Arm block diagram in LabVIEW

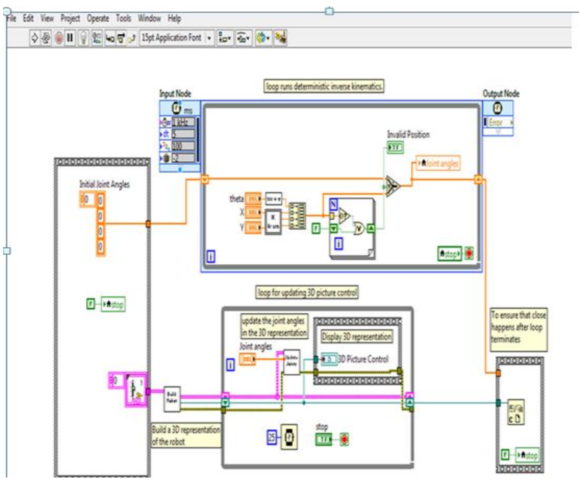

Fig.2. Arm block diagram in LabVIEW

B. Arm front panel in LabVIEW

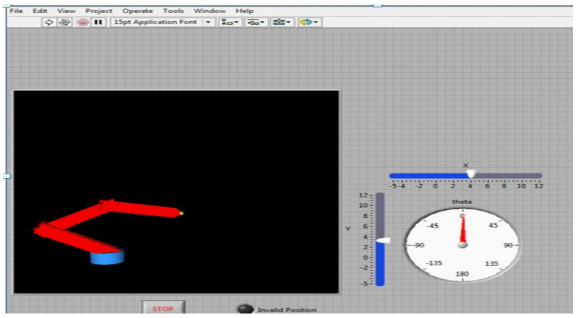

Fig.3 Arm front panel in LabVIEW

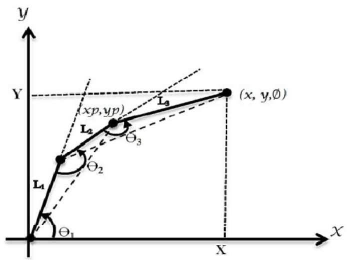

Fig.4 x,y ,ø plane

Fig.4 shows the kinematic form of the robot arm. Basics of trigonometry give the joint coordinates of the robot arm for location and direction of the end effector as follows

$$x = L_1\cos\theta_1 + L_2\cos(\theta_1+\theta_2) + \theta_1 + L_3\cos(\theta_1+\theta_2+\theta_3) \quad (1)$$

$$y = L_1\sin\theta_1 + L_2\sin(\theta_1+\theta_2) + L_3\sin(\theta_1+\theta_2+\theta_3) \quad (2)$$

$$\emptyset = \theta_1 + \theta_2 + \theta_3 \quad (3)$$

Equation (1), (2) and (3) gives the correlation between the effector coordinates and combined coordinates. To find the joint coordinates to the position of end-effector coordinates (x,y,Ø), we needs to evaluate the nonlinear equations for θ1,θ2 andθ3.
Substituting (3) into (1) and (2), θ3 can eliminate so that we have two equations in θ1 and θ2:

$$x - L_3\cos\emptyset = L_1\cos\theta_1 + L_2\cos(\theta_1+\theta_2) \quad (4)$$

$$y - L_3\sin\emptyset = L_1\cos\theta_1 + L_2\cos(\theta_1+\theta_2) \quad (5)$$

Rename the Eqn. (4) & (5) as $x_p = x - L_3\cos\emptyset$, $y_p = y - L_3\sin\emptyset$ for ease.
From Fig and the law of cosines we get Equation (6).

$$\cos\alpha = \frac{x^2 + y^2 - L_1^2 - L_2^2}{2L_1L_2}$$

$$\propto = A\cos\left(\frac{x^2 + y^2 - L_1^2 - L_2^2}{2L_1L_2}\right)$$

$$\theta_2 = 180 - \alpha \quad (6)$$

$$\theta_2 = A\tan 2(y_p, x_p) + A\sin\sqrt{\frac{L_2\sin\theta_2}{x_p^2+y_p^2}} \quad (7)$$

$$\text{From Eqn.(3) } \theta_3 = \emptyset - \theta_1 - \theta_2 \quad (8)$$

By executing the Eqn. (6), (7) & (8) using LabVIEW we can acquire the robot arm end-effector position. By executing Eqns. (7), (9) & (10) we can get the correct joint angles.

$$\theta_2 = \theta_2 - 270 \quad (9)$$

$$\theta_2 = 180 - (\theta_3 + 270) \quad (10)$$

C. Path finding block diagram

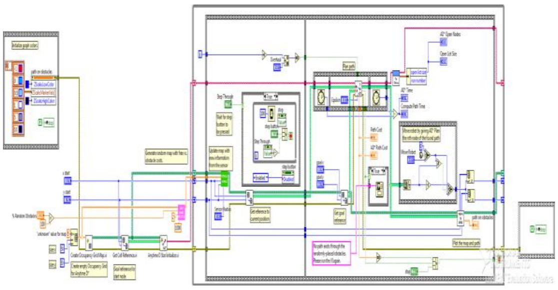

Fig.5 Path finding block diagram

D. Path finding front panel

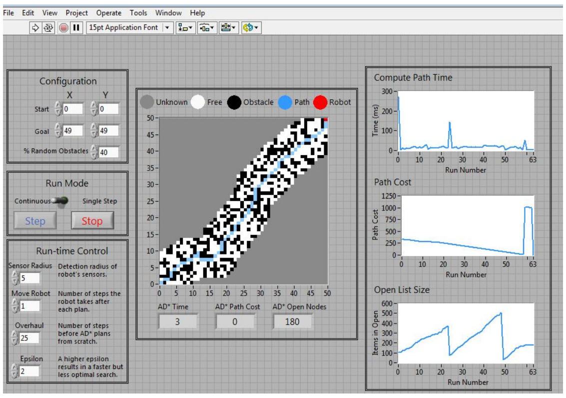

Fig.6 Path finding front panel

CONCLUSIONS

A universal LabVIEW-based test platform has been designed, built, and verified systematically with myRIO device's operation control and characteristic measurement.

It simplifies the design process and shortens the design cycle, reduces development costs and improves product quality. The user can adjust the variable parameters of the robot. This technology can also be extended to other robot control such as path planning, best possible routing, error compensation control and other aspects.The developed method exhibits improved search speed and gives accurate solution.

ACKNOWLEDGMENTS

I put on record and warmly acknowledge the constant encouragement, invaluable supervision, timely suggestions and inspired guidance offered by my guide and Head of Department of Electronics and Telecommunication Engineering, JSPM'S Bhivarabai Sawant Institute of Technology and Research, Dr. Yogesh Angal, this report to a successful Completion. This research is supported by savitribai phule pune university, India.

REFERENCES

[1] Dan Song, Carl Henrik Ek, Kai Huebner and Danica Kragic,"*IEEE* Task-Based Robot Grasp Planning Using Probabilistic Inference", IEEE transactions on robotics, vol. 31, no. 3, June 2015.

[2] Sunny Amatya , Somrak Petchartee,"Real time kinect based robotic arm manipulation with five degree of freedom," in proc. IEEE Asian conf. on defence technology 2015.

[3] Jesus M. Gómez-de-Gabriel, Anthony Mandow , Jesús Fernandez-Lozano, and Alfonso J. Garcia-Cerezo," Using LEGO NXT Mobile Robots with LabVIEW for Undergraduate Courses on Mechatronics", IEEE transactions on education, vol. 54, no. 1, February 2011.

[4] C.N. Thai, M. Paulishen ,"Using robotics bioloid systems for instructional robotics," IEEE 2011.

[5] Marc Peter Deisenroth, Dieter Fox, and Cark Edward Rasmussen,"Gaussian processes for data efficient learning in robotics and control," IEEE transaction on pattern analysis and machine intelligence, vol.37, no.2, February 2015.

[6] Jesus Manuel Gomez-de-Gabriel, Anthony Mandow, jesús Fernandez-Lozano, and Alfonso Garcia-Cerezo, "Mobile Robot Lab Project to Introduce Engineering Students to Fault Diagnosis in Mechatronic Systems, "IEEE transaction on education, Vol.28, no.3, August 2015.

★★★