MANUALLY OPERATED HYDRAULIC ROBOTIC ARM

[1]A ABHISHEK, [2]ABINAND M, [3]AFIF, [4]ASHWIN R,[5]MANJUNATHA G

[1,2,3,4] Student, [5]Assistant professor

School of mechanical engineering, REVA University, Bangalore, India

Abstract: Manually operated hydraulic robotic arm is a model introduced to work with an idea of helping the patients affected by any pandemic diseases (like COVID). The working of this model is effective as it's operated by a person from a distance rather than the person getting into direct contact with the patient thereby reducing his risk of getting affected by the virus. Taking into consideration our main objective, we designed and fabricated a functional prototype model of manually operated robotic arm. In this work, Graphical user Interface (GUI) based touch screen operation in the Android application acts as a transmitter and sends commands to the receiver to control the movement of the robot. Six motors are interfaced to the microcontroller where four motors are used for arm and gripper movement of the robot while the other two motors are used for the motion. The receiver end WIFI device is fed to the Arduino to drive DC motors via motor driver IC (Integrated circuit).

IndexTerms – **Arduino, GUI, Android.**

1.INTRODUCTION

Hydraulic robotic arm is a system which is coupled by machines and hydraulic. It is widely applicable in all kinds of large engineering equipment's. Such as arm frame of crane. The arm system of redundant freedom, strong, nonlinear, coupled with rigid and flexible characters. In hydraulic robotic arm the dynamic differential equation built with the driving force of the hydraulic cylinders as the main force. A robotic arm which is hydraulically operated and controlled by syringes filled with some fluid. It consists of various parts connected to each other in pre-designed manner which are guided in a constrained way to obtain required output.

Pascal's law is the basis of hydraulic drive systems. As the pressure in the system is the same, the force that the fluid gives to the surroundings is therefore equal to pressure × area. In such a way, a small piston feels a small force and a large piston feels a large force. The same principle applies for a hydraulic pump with a small swept volume that asks for a small torque, combined with a hydraulic motor with a large swept volume that gives a large torque. Hydraulic systems will remain in interest and if such a system is available, it is easy and logical to use this system for the rotating drives of the cooling systems, also. An important advantage of a hydraulic drive is its high-power density: the mass of a hydraulic drive is several times smaller than the mass of an electric drive of the same power.

1.1 Prototype model of manually operated hydraulic robotic arm.

The controlling of the Robot movement and pick and place operation is done wirelessly through Android smart phone using the WIFI feature present in it. Here in the project the Android smart phone is used as a remote control for operating the Robot. The controlling device of the whole system is done through ATmega328 Microcontroller present in Arduino UNO Board. Microcontroller acts as an interface to the Motors, WIFI and Android mobile which has a WIFI present in the mobile. WIFI module receives data from Android smart phone and its feeds that data as input to the controller. The controller acts accordingly on the DC motors of the Robot. In achieving the task, the controller is loaded with a program written using Arduino Software.

Robotics is the branch of engineering science & Technology related to robots, and their design, manufacture, application, and structural disposition. Robotics is related to electronics, mechanics, and software. Robotics research today is focused on developing systems that exhibit modularity, flexibility, redundancy, fault-tolerance, a general and extensible software environment and seamless connectivity to other machines, some researchers focus on completely automating a manufacturing process or a task, by providing sensor-based intelligence to the robot arm, while others try to solidify the analytical foundations on which many of the basic concepts in robotics are built. In this highly developing society time and man power are critical constrains for completion of task in large scales. The automation is playing important role to save human efforts in most of the regular and frequently carried works.

One of the major and most commonly performed works is picking and placing of jobs from source to destination. Present day industry is increasingly turning towards computer-based automation mainly due to the need for increased productivity and delivery of end products with uniform quality. The inflexibility and generally high cost of hard-automation systems, which have been used for automated manufacturing tasks in the past, have led to a broad-based interest in the use of robots capable of performing a variety of manufacturing functions in a flexible environment and at lower costs.

1.2 Components of Robot

Power Supply - The working power to the robot is provided by batteries, hydraulic, solar power, or pneumatic power sources.
Actuators - Actuators are the energy conversion device used inside a robot. The major function of actuators is to convert energy into movement.

Electric motors (DC/AC) - Motors are electromechanical component used for converting electrical energy into its equivalent mechanical energy. In robot motors are used for providing rotational movement.

Sensors - Sensors are the parts that sense and can detect objects or things like heat and light and convert the object information into symbols or in analog or digital form and then robot reacts according to the information provided by the sensory system.

Controller - Controller is a part of robot that coordinates all motion of the mechanical system. It also receives an input from immediate environment through various sensors.

2.METHODOLOGY

- The mainframe holds the entire robot in position and there by continuous respective function.

- Four wheels are used in the entire system, among which two adjacent wheels are connected to two individual motors of 60rpm, whose regulations alters the speed and angle of motion.

- Arm is mounted on horizontal plate which rotates over a point concentric to motor shaft to rotate. The arm is connected with lead screw mechanism & two motors for linear motion (i.e., up and down, forward and backward).

- The relays are connected between the motors and the battery, for controlling the speed of motors.

- Micro controller is used to control the entire actions via WIFI

- The gripper arm is connected to a motor for holding and releasing, which provides a firm support for holding things.

3.RESULT AND DISCUSSION

3.1 ASSEMBLY

- The assembly is the combination of a main frame, 4 wheels, arm, gripper to the control unit which all together performs the required function.

Fig.1 Manually operated robotic arm prototype

- The above Fig.1 is the final assembly of the manually operated robotic arm prototype

Fig.2 Wheel, Arm and gripper arrangement

- Two 60 rpm motors are connected to the rear wheels for the movement.

- The 360-degree arm setup is mounted on the frame using arc welding and it uses 10 rpm motor for the rotation.

- The movement of the arms (i.e., up and down, forward and backward) is operated using lead screws which is mounted on the respective arms using arc welding.

- The 200rpm motor is used for the movement of arm and gripper

- The arms are inter-connected using nut and bolt joint.

- The above Fig.2 is the connection of micro controller, relay, dc to dc convertor, battery, switch and wires which all together comprises the control unit.

- The relays control the motors for respective functions.

- The microcontroller receives an input signal from user through WIFI and passes it to the relays, there by controlling motors.

- The Arduino controller is fed with operation codes, with which the user can control the device through an android smart phone.

- Embedded C is the programming language used.

- It is an extension of c program with some additional headers.

- Blynk is the application used.

4.CONCLUSION

The prototype was confirmed as functional working of manually operated hydraulic arm. This system would make it easier for human beings to pick and place the risk of handling suspicious objects, which could be hazardous in its present environment and workplace.

•Various functions can be achieved faster and more accurately with this design. The robotic arm used here contains a catching gripper, which safely holds the object.

•By use of this product, the industrial activities and hazardous operations can be done easily and safely in a short span of time.

•In this project, it was observed that the control through wireless communication is between the mobile, the control unit, and serial communication exist between the control unit and the GUI application.

REFERENCES

1. Hiraoki seki, shota Nakayama, kunio uenishi, tokuo tsuji, mashatoshi hikizu, yutako makino, akira kakiyuchi, yoshikazu kanda., "development of assistive robotic arm for power line maintenance", precision engineering October 2019

2. Mohammad Ali Farooqui, Mohammad Farhaan Fahim, Mohammad Shumail, Mohammad Asif, Mohammad Naseem, Mohammad Quassim, Mohammad Shafahaad. HYDRAULIC ROBOTIC ARM" June 2017.

3. Mohammad Javed Ansari, Ali Amir. Microcontroller based robotic arm: Operational to gesture and automated mode. April 2014

4. M.A. Ismail, N. Mustaffa, M.H. Ismail. Design and Development of a Mechanism of Robotic Arm for Lifting. December 2015.

5. Anita Gade, Yogesh Angal "Development of Library Management Robotic System", International Conference on Data Management, Analytics and Innovation, February 2017

6. Tarkesh S Pujari, S B Deosarkar "Design of Intelligent and Robotic Library System", International Conference on Recent Trends in Electronics Information & Communication Technology (RTEICT), May 2017.

7. Masahiko Mikawa, Yuya Morimoto and Kazuyo Tanaka "Guidance Method Using Laser Pointer and Gestures for Librarian Robot", IEEE International Symposium on Robot and Human Interactive Communication. September 2018.

8. B.R.Sathishkumar, M.Krishnaprabha, S.Priya, M.Ragavi "Automated Library System using Android Based Robot", International Journal of Recent Technology and Engineering (IJRTE), July 2019.

9. Anusha Ronanki , M. Kranthi , "Design and Fabrication of Pick and PlaceRobot to Be Used in Library", International Journal of Innovative Research in Science,Engineering and Technology, June 2015.

10. P.S.Ramaiah, M.Venkateswara Rao, G.V.Satyanarayana, "A Microcontroller Based Four Fingered Robotic Hand", International Journal of Artificial Intelligence & Applications (IJAIA), April 2011.

11. Biswas Palok, S. Anandan Shanmugam, "Design and Development of a 3 axes Pneumatic Robotic Arm", International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, September 2016.