DESIGN AND DEVELOPMENT OF MOBILE OPERATED END EFFECTOR

S. Kingsly [1], A. Krishnaraj [2], E.M. Pradeep [3] , P. Gopu[4]

PG Student, Mahendra Engineering College, Tiruchengode, namakkal, Tamil Nadu 637503 [1]

Assistant Professor, Mahendra Engineering College, Tiruchengode, namakkal, Tamil Nadu 637503 [2]

Assistant Professor, Department of Mechanical Engineering, Cape Institute of Technology, Tirunelveli-629401, Tamil Nadu, India [3]

Placement Officer and Assistant Professor, Department of Mechanical Engineering Sandwich, Lord Jegannath College of Engineering and Technology, PSN Nagar, Ramanathichanputhur-629402, Tamil Nadu, India[4].

Abstract

The aim of this project is to get familiarized with the modern field of robotics and to find the technology know how. Also here we are using the sophisticated emerging technology embedded system. Here we have designed a robot arm, controlled by a microcontroller. We choose this deign because it is the most common form of robot we can find anywhere in industries like car. The driver circuits for these motors are to be controlled using 8051 microcontroller with a control key panel. The movement is established using gear motors. Pick and place robots are the small robots using for continuous purpose in the industries then let us go through something about pick and place robot by this project. In this developed model the main advantage is the robotic arm movement is controlled by mobile phones through android application.

Keywords: Robotics, Robot arm, Microcontroller

INTRODUCTION

Robotics is the branch of technology that deals with the design, construction, operation, structural disposition, manufacture and application of robots and computer systems for their control, sensory feedback, and information processing. A robot is a mechanical or virtual intelligent agent that can perform tasks automatically or with guidance, typically by remote control. In practice a robot is usually an machine that is guided by computer and electronic programming. Robots can be autonomous, semi-autonomous or remotely controlled.

The concept and creation of machines that could operate autonomously dates back to classical times, but research into the functionality and potential uses of robots did not grow substantially until the 20th century. Today, robotics is a rapidly growing field, as we continue to research, design, and build new robots that serve various practical purposes, whether domestically, commercially, or militarily. Many robots do jobs that are hazardous to people such as defusing bombs, exploring shipwrecks and mine.

LITERATURE REVIEW

Robot is an integral part in automating the flexible manufacturing system that is greatly in demand these days. Robots are now more than a machine, as robots have become the solution of the future as cost labor wages and customers' demand [1]. Even though the cost of acquiring robotic system is quite expensive but as today s rapid development and a very high demand in quality with IS0 (International Standard Organization) standards, human are no longer capable of such demands. Research and development of future robots is movingly at a verv rapid face due to the constantly improving and upgrading of the quality standards of products. Robot and automation is employed in order to replace human to perform those tasks that are routine dangerous, dull and in a hazardous area. Today In the world of advanced technology, automation greatly increases production capability; improve product quality and lower production cost. Robots have their historical past though they came into existences in 1961. A. Che Soh, S.A. Ahmad, A.J. Ishak and K. N. Abdul Latif introduced a paper, "Development of an Adjustable Gripper for Robotic Picking and Placing Operation" in which adjustable gripper for robotic system is designed to identify the shape and size of an object which is needed in many applications especially for picking and placing operation [2]. The main objective is to design a robust gripper that can perform easier and faster picking and placing operation for multiple shapes and sizes objects. This adjustable gripper for robotic system can to improve the picking and placing operation in manufacturing field in producing more outputs without the needs to. P.S.Ramaiah, M.Venkateswara Rao, Raghu and G.V.Satyanarayana presented a system entitled "A Microcontroller Based Four Fingered Robotic Hand". In this paper, design and development of a Four Fingered Robotic

Hand (FFRH) using 8-bit microcontroller, sensors and wireless feedback is explained. The design of the system is based on a simple, flexible and minimal control strategy. This system has 14 independent commands for all the four fingers open and close, wrist up and down, base clockwise and counters clockwise, Pick and Place and Home position to move the fingers. The tendering system of the double revolute joint mechanism and wireless feedback network provide the hand with the ability to confirm to object topology and therefore providing the advantage of using a simple control algorithm. Finally, the results of the experimental work for pick and place application is enumerated. Author Girish Patel, and Devendra Chauhan introduced a paper entitled "SIFT Based Approach: Object Recognition and Localization for Pick-and-Place System". In this paper, the system typically employs machine vision to analyze the scene, identify and locate the specified object and provide feedback to the robot arm for subsequent operations. For successful picking, the vision system needs to recognize the position and the orientation of the objects, the Scale Invariant Feature Transform (SIFT) is used for this purpose. Korayem et al. [3] presented the design of a robot for an assembly line, and the proposed robot is applied for one of the important stations in the assembly line. Kinematic and dynamic modeling, finite element analysis (FEA), quality function deployment (QFD), and failure mode and effect analysis (FMEA) are used in this paper. Ghayoumi et al. [4] have performed the experimental test on Cartesian robot. They reduced correlation error applying a fuzzy model in stereo vision of a 3p robot. Azhdari et al. [5] obtained a dynamic model for a two degree-of-freedom planar robot arm. The links of the arm, connected to prismatic and revolute joints, were considered to be flexible. They assumed to be fabricated from either aluminum or laminated composite materials. The model was derived based on the Timoshenkov beam theory in order to account for the rotary inertia and shear deformation. Callegari et al. [6] presented a high-speed Cartesian robot produced by Campetella Robotic Center. This robot was characterized by good dynamic performances but was chosen by the producer for re-engineering that should allow it to meet even more advance targets. Ion [7] performed some experimental tests on a waling robot in order to determine the condition of robot in static and dynamic stabilities. In this work, different methods of leg adjustments and body adjustments were integrated into the strategy. Also, they analyzed the possibilities of determination of the limit conditions for the stable displacement of the walking robots. Maddahi et al. [8], [9] proposed an algorithm for determination of load capacity of a redundant mobile robot and performed some experimental tests in order to determine the performance of robot. Also, they implemented some designed tests on a 4R pick and place robot including path tracking (kinematically) and determination of load carrying capacity (dynamically). Ismail et al [10] evaluated the performance of an industrial robot under payload and

various distances within the working envelope. Relationship between the location and pay load versus repeatability were obtained. Jackson et al. [11] addressed the issues that must be accounted to develop the architecture for robotics within the infrastructure. These issues are the basis for design decisions in developing robotic infrastructure systems. Baron and Tondu [12] presented a deductive method for safety analysis. In order to apply this technique for a medical robot, they analyzed human safety factors by using FMEA and FTA, as well as obtained different failure modes and their effects on the human. D. Masumoto [13] proposed a sensory information processing system that can solve the ill-posed problem of sensory information processing. P.Markus [14] presented a novel grasp planning algorithm based on the medial axis of 3D objects. And proposed an algorithm to be met by a robotic hand is the capability to oppose the thumb to the other fingers which is fulfilled by all hand models. Laser range data and range from a neural stereoscopic vision system is presented by P. Stefano [15], and explained the estimate robot position is used to safely navigate through the environment. L. Ying [16] described an approach that handles the specific challenges of applying shape matching to grasp synthesis. A. Nicholas [17] designed to identify and locate objects lying on a flat surface and described a new method for the recognition and positioning of 2-D objects.

From the above literature survey it clearly indicates that the controlling of robotic arm through some remote based devices may largely use and some developed program also used. But in this research a separate android based application is developed to control the end effector in an efficient manner.

PROPOSED SYSTEM

Robots need to manipulate objects; pick up, modify, destroy, or otherwise have an effect. Thus the "hands" of a robot are often referred to as end effectors, while the "arm" is referred to as a manipulator. Most robot arms have replaceable effectors, each allowing them to perform some small range of tasks. Some have a fixed manipulator which cannot be replaced, while a few have one very general purpose manipulator, for example a humanoid hand. The below figure 1 shows the proposed system model of the work.
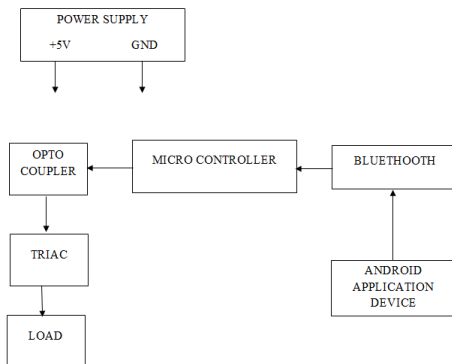
Figure 1 Block Diagram
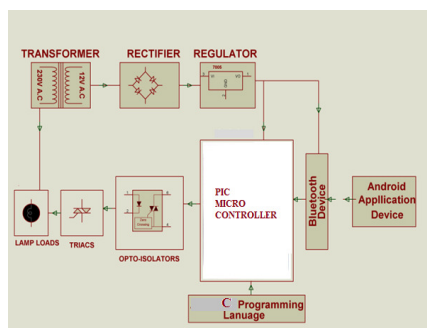
Figure 3 Circuit Diagram

The entire work of the circuit diagram is shown in the above figure 2. In this model the power supply unit is used to regulate the supply voltage from +230V AC to +5V DC. The loads can be turned ON/OFF remotely. The loads are operated by Arduino board through opto-isolators and thyristors using triacs. A 230volt AC transformer is used to convert 12volt AC. This voltage is used to regulate the supply voltage from +12V to +5V with the help of regulator through the rectifier. Whenever Bluetooth connection is established the transmitter and receiver device are ready to perform according to the commands of the user. Arduino board receives the command through the RX pin and matches with the given programming code of the compiler and passes the appropriate command to the opto isolators. Smart phone sends ON/OFF commands to the receiver where loads are connected. The loads can be turned ON/OFF remotely. The loads are operated by Microcontroller board through opto-isolators and thyristors using triacs.

EXPERIMENTAL MODEL

The figure 3 shows the actual setup we fabricated to perform the task. In this fabricated model three 10 rpm gear motors were used to operate the end effector. This system has two grippers which are fixed to the rack and pinion arrangement for open close operations. The first motor is fixed directly with the grippers, which rotates in clock wise and anticlockwise direction for gripper opening and closing. The second motor is used to turn the grippers at left or right direction and the third motor is used to turn the entire end effector at 360° in clockwise as well as anti clockwise direction. All the motors were controlled by separate relays which receives the signals from the microcontroller.
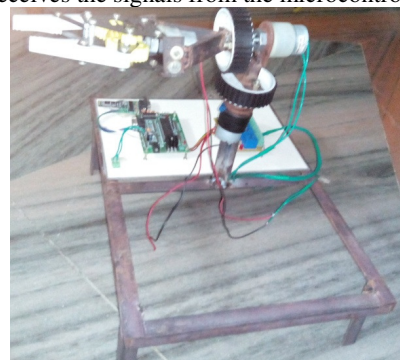
Figure 3 Experimental set up pick & place robot

CONCLUSION

This robot is used for pick the object in one place and place that objects in required places through android mobile phone application. Some industrial works are harmful for humans this robot is mainly used for reduce the risk process and consuming time and avoid labours. Human are tired for hard work such as assembly line, material handling etc. this robot does all those things it mainly reduces the manual work our robot is designed at low cost as well as high efficient one. This model is to give the way for providing bigger effective robot for industrial applications.

REFERENCES

[1] Jegede Olawale, Awodele Oludele, Ajayi Ayodele, "Development of a Microcontroller Based Robotic Arm", In Proceedings of the 2007 Computer Science and IT Education Conference pg: 549-557.

[2] "Robotic Arm" - www. NASA explores. com from Teacher Sheets pg:1-2

[3] M.H. Korayem, N. Shiehbeiki and T. Khanali, "Design, manufacturing, and experimental tests of a prismatic robot for assembly line", The International Journal of Advanced Manufacturing Technology, vol. 29, 2006, pp. 379-388.

[4] M. Ghayoumi, P. Porkar Rezayeyeh and M. H. Korayem, "Correlation Error Reduction of Images in Stereo Vision with Fuzzy Method and Its Application on Cartesian Robot", 19th Australian Joint Conference on Artificial Intelligence, vol. 4304, 2006, pp. 1271-1275.

[5] A. Azhdari, N. G. Chalhoub and F. Gordaninejad, "Nonlinear Dynamic Modelling of a Revolute-Prismatic Flexible Composite-Material Robot Arm", Journal of Vibration and Acoustics, vol. 113, 1991, pp. 461-468.

[6] Massimo Callegari, Ferdinando Cannella, Sergio Monti, Claudio Santolini and Paolo Pagnanelli, "Dynamic Model for a Re-Engineering of a High-Speed Cartesian Robot", IEEE/ASME Int. Conf. on Advanced Engineering Mechatronic Proceedings, Italy, 2001.

[7] Ion Ion, Luige Vladareanu, Ion Simionescu and Aurelian Vasile, "The Movement of Modular Walking Robot MERO in the Obstacles' Area", WSEAS Transactions on
System, Issue 7, vol. 7, 2008, pp. 843-865.

[8] Y. Maddahi, "Calculation of Load Carrying Capacity on a Redundant Manipulator", 2nd WSEAS Int. Conf. on Circuits, Systems, Signal and Telecommunications (CISST'08), Acapulco, Mexico, 2008, January 25-27.

[9] H, Ghorabi, Y. Maddahi, S. M. Hosseini Monsef and A. Maddahi, "Design and Experimental Tests of a Pick and Place Robot: Theoretical and Experimental Approaches", Applications of Electrical Engineering (AEE '10), Malaysia, 2010, March 23-25.

[10] A. R. Ismail, A. Hassan, S. Syamsuddin, M. Zakinuawi, S. Abdullah and H. M. Ibrahim, "8th WSEAS Int. Conf. on Robotics, Control and Manufacturing Technology (ROCOM '08), Hangzhou, China, April 6-8, 2008.

[11] J. D. Jackson, D. W. Callahan, D. S. Appleby and L. B. CALLAHAN, "Design Requirements and Framework for a Robotic Infrastructure System", Proceedings of the 5th WSEAS Int. Conf. on Circuits, Systems, Electronics,Control and Signal Processing, USA, November 1-3, 2006.

[12] Guiochet J, Tondu B, Baron C. Integration of UML in human factors analysis for safety of a medical robot for tele-echography. In: Proceedings of the international conference on intelligent robots and systems, IROS03, October 2003.

[13] D. Masumoto, T. Kimoto, and S. Nagata, "A Sensory Information Processing System Using Neural Networks", in Proc. Neural Networks, IEEE International Conf., 1993, pp. 655 - 660.

[14] Markus Przybylski, Tamim Asfour and R udiger Dillmann, "Unions of Balls for Shape Approximation in Robot Grasping", Intelligent Robots and Systems (IROS), in Proc. IEEE/RSJ International Conf., 2010, pp. 1592-1599.

[15] Stefano Pagnottelli, Sergio Taraglioy, Paolo Valigi and Andrea Zanelay, "Visual and Laser Sensory Data Fusion for Outdoor Robot Localisation and Navigation," in Proc. Of IEEE International Conf., 2005, pp. 171 -177.

[16] Li Ying, Pollard and N.S, "A Shape Matching Algorithm for Synthesizing Humanlike Enveloping Grasps," in Proc. of Carnegie Mellon University Research Showcase, 2005, pp. 442 - 449.

[17] Nicholas Ayache, Alivier and D. Faugeras, "HYPER: A New Approach for the Recognition and Positioning of Two - Dimensional Objects", IEEE Trans. on Pattern Analysis and Machine Intelligence, vol. 8, pp. 44 - 54, January 1986.