IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

DESIGN AND FABRICATION OF MOVING ROBOTIC ARM CONTROL USING ANDROID APPLICATION

Dr.K. Senthamarai[1], R. Rajasekar[2], S. Murugan[3], S. Prem[4]

1.Professor & Dean, Department of Mechanical Engineering, Sri Raaja Raajan College of Engineering and Technology, Amaravathipudur, Karaikudi.

2.Asst.Professor& HOD, Department of Mechanical Engineering, Sri Raaja Raajan College of Engineering and Technology, Amaravathipudur, Karaikudi.

3. Asst.Professor, Department of Mechanical Engineering, St. Michael College of engineering and technology, kalayarkoil.

4. Asst.Professor, Department of Mechanical Engineering, St. Michael College of engineering and technology, kalayarkoil.

Abstract: The main focus of this paper was to design and develop the Mechanism for robotic arm for lifting an object. The robotic arm was designed with four degrees of freedom and programmed to accomplish accurately simple light material lifting task to assist in the production line in any industry. three dimensional (3D) printing method is used in this project to fabricate the components of the robotic arm. Therefore, it provides more precise dimensions and huge time and cost- saves in fabrication. The robotic arm is prepared with 4 servo motors to link the parts and bring arm movement. The Arduino, an open-source computer hardware and software, is applied to control the robotic arm by driving servo motors to be capable of modifying the position. Wireless control was done by using a smart phone with an android operating system through a Bluetooth module. The robotic arm was under testing and validating its performance and the results indicate that it can perform the lifting task properly.

Index Terms: 3d printing, AutoCAD, Bluetooth, servo motor etc.

1.INTRODUCTION:

The study, design and use of mechanical frames in assembly are automated. With the rise of modern exercise kitting, a mechanical hand was developed that helped various companies in business or work instead of using manpower. Robots are mostly used to perform risky, dangerous, highly unnecessary and unpleasant tasks. The robot can perform material maintenance, assembly, arc welding, block welding, machinery stacking and unloading capability, painting and spraying, etc. [3, 4]. It is extremely valuable for its great precision, vision and infinite energy levels in managing work rather than individuals. The model typically uses a mechanical arm on an assembly or loading line, lifting small objects with extra motion that a human could not sustain for long periods of time. Lifting light material should be possible by mechanical hand efficiently and effectively, based on the premise that it is not limited by fatigue or human perceived well-being. There are basically two different types of robots which are administrative robot and modern automated. The management robot worked semi- or fully self-sufficiently to perform management that promotes the well-being of people and equipment, in addition to assembly operations [6-8]. On the other hand, a modern robot is formally characterized by an ISO naturally controlled and universal controller that can be programmed to at least three hubs. A mechanical robot is a reprogrammable multi-function controller configuration to move materials, parts, instruments or centralized equipment with factor-modified motion to complete various projects. This is a definition from the American Robotics Institute that captures the main features of current robotics frameworks. A modern robotics framework

can include any number of gadgets or sensors with mechanical robots to perform tasks such as sequencing or interface matching.[3, 9].

1.1 DESIGN WORK

1.1.1 ROBATIC ARM

The mechanical design of the robot arm relies on the robot controller, which has a power comparable to that of a human hand. Auto fittings regularly consist of connections, joints, actuators, sensors and controls. Joints are connected by joints, forming an open kinematic chain. One end of the chain is connected to the leg of the robot and the other end is equipped with a device comparable to a human hand (hand, gripper or end movers) that performs collection and various tasks and interfaces with the climate. There are two types of joints which are kaleidoscopic and rotary joints and they connect adjacent joints.

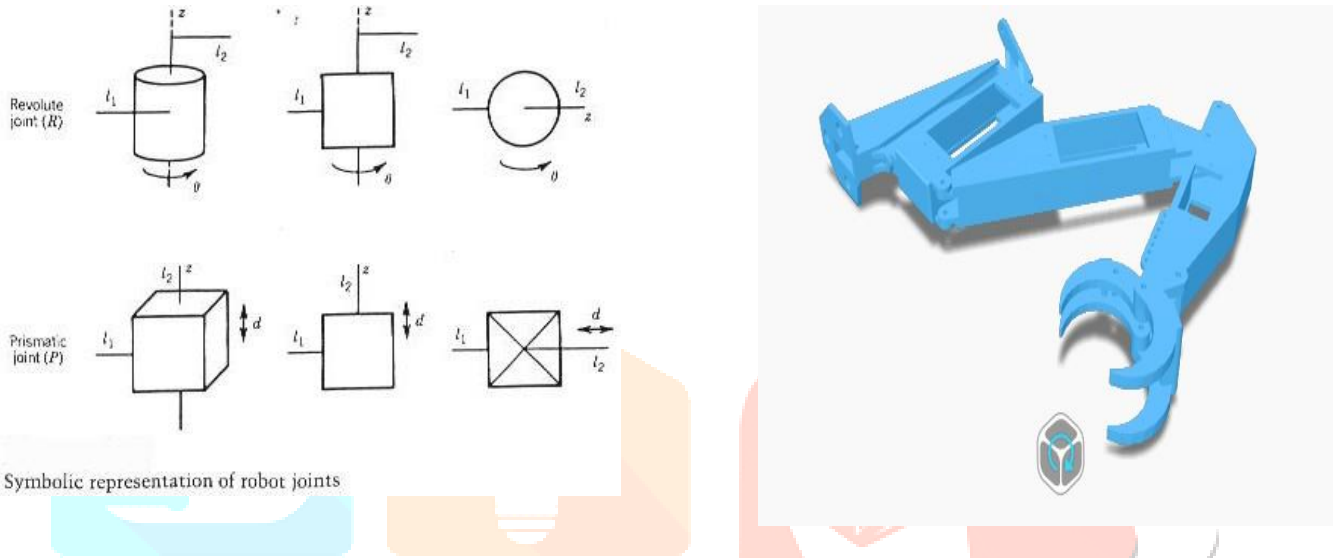

Fig:**1.1 TWO TYPE OF JOINT IN ROBBOT**

The control links are connected by joints that allow rotary motion, and the control links form a free-body diagram of the mechanical plan of the automatic arm of the kinematic chain. With only four options, the mechanical arm is designed to be satisfactory for most major developments. However, it is serious in terms of complexity and cost savings as the number of automatic manual vehicles increases as much as possible. In a mechanical frame, the number of possibilities is controlled by the autonomous common variable Number of degrees for a given DOF. The automated arm has four servo motors, each motor for one DOF, and the motors run on 6 volts. There are four pivoting DOF in the arm and their scopes of revolution are demonstrated in the Table 1.

Table:1.1.1

Degrees of Freedom(DOF)	Degrees
1	180
2	90
3	90
4	90

The zone that the gripper alleged as end-effecter can reach is known as robot workspace. It relies upon the DOF and interpretation restriction, the arm interface lengths, the point at which something should be gotten up robot arrangement. shows the ordinary work district of the
mechanical arm with four level of opportunity (4 DOF) [3].

1.2 AutoCAD assembly of parts.

It is an automated hand tool and is attached to a base. The plan is slightly wider at the bottom and at an angle of 20 degrees from the top. Ribbing was added to the part to add strength due to the stress of the detailed plan. This changed the mathematics of the part and creating the primary strength of the part is real and practical. In addition, this part has a square shape, which breaks the mass evenly, because it is necessary to lighten the huge load of the object lifted, the servo motor and the interface. This attachment is designed to rotate and also has a motor to move the mechanical arm up and down. The prominent part is

where the wires are connected and then excited by the servo motor at the bottom. The engine compartment is conveniently located in the empty part of the attachment. This is also the link to the next part of the up-down movement. The attached insert, which appeared below, is designed in the most extreme flared form, as is the proper belt of the engine. The bottom part is connected to the front attachment with a connecting wire. This part comprises the main part of the automated arm as it contains the gripper motor. The clutch is connected to this mount and the motor limits it with a connecting wire. The sticker consists of a lower and upper foot. It is designed in such a way that the lower click is attached to the attachment motor that went to a fixed point and to the movable upper hook. Hook space is a croissant and can expand an attractive presentation.

1.2.1 Depiction

Bluetooth is a remote innovation standard for trading information over brief distances (utilizing short-frequency UHF radio waves in the ISM band from 2.4 to 2.485 GHz) from fixed and cell phones, and building individual zone organizations (PANs).

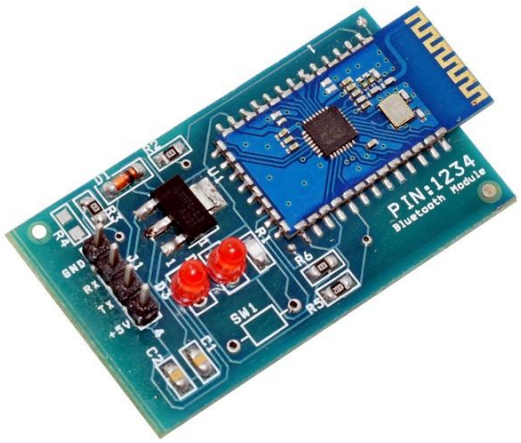

Fig 1.2 BLUETOOTH MODULE

Designed by telecom merchant Ericsson in 1994, it was initially imagined as a remote option in contrast to RS-232 information links. It can interface a few gadgets, conquering issues of synchronization.

Bluetooth UART empowers you to remote send and get sequential information. Gadgets furnished with Bluetooth innovation support remote highlight point associations, just as remote admittance to cell phones. You can just utilize it for sequential port substitution to set up association among MCU and PC for information move

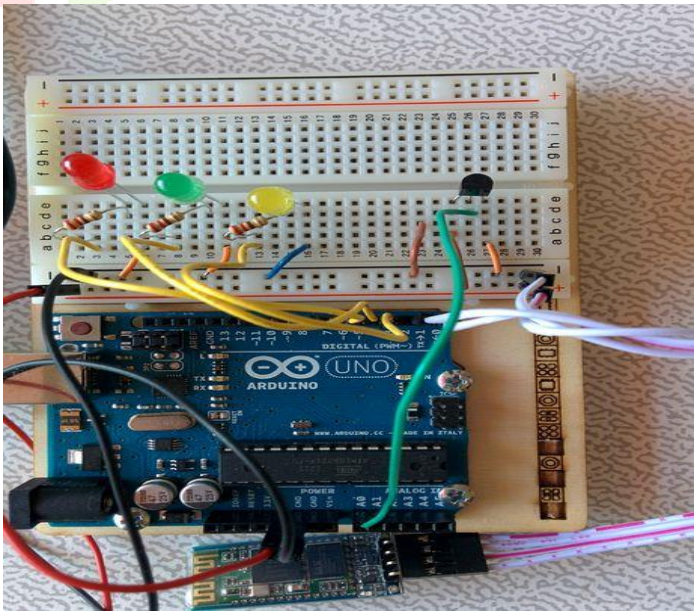

Fig 1.2.1 BLUETOOTH INTERFACE WITH ARDUINO

It delivers the received data and receives the data to be transmitted to and from a host system through a host controller interface. Designed by telecom merchant Ericsson in 1994, it was initially imagined as a remote option in contrast to RS-232 information links. It can interface a few gadgets, conquering issues of synchronization. Bluetooth UART empowers you to remote send and get sequential information. Gadgets furnished with Bluetooth innovation support remote highlight point associations, just as remote admittance to cell phones. You can just utilize it for sequential port substitution to set up association among MCU and PC for information move.

Fig 1.2.2 SERVO MOTOR

Servo motors are not a specific class of motor, although the term servo motor is regularly used to refer to a motor suitable for use in a closed-loop control framework. The motor is connected to some kind of encoder that provides position and speed. In the least severe case, only the position is evaluated. The intended position of the performance is the opposite of the command position, the external input to the regulator. In the event that the flow position deviates from the required one, an error signal is generated, which at that moment forces the motor to turn in both directions, depending on the situation, to move the flow shaft to the installation position. As the stations approach, the error signal decreases to zero and the engine stops.

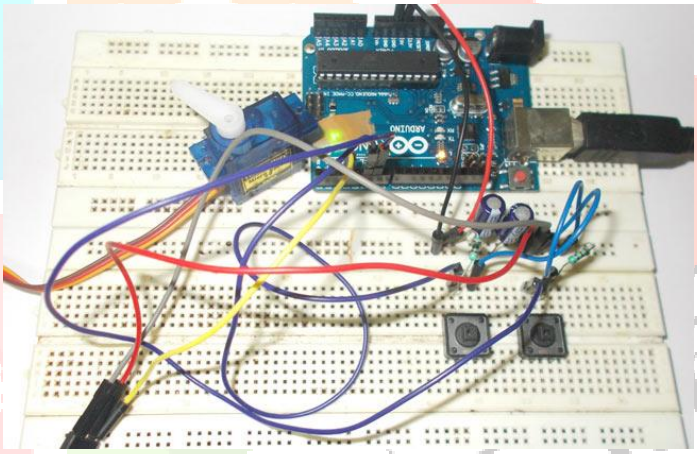

Fig 1.2.3 SERVO MOTOR INTERFACE WITH ARDUINO

A servomotor is a rotating actuator or straight actuator that considers exact control of precise or direct position, speed and speed increase. It comprises of an appropriate engine coupled to a sensor for position criticism. It likewise requires a generally refined regulator, regularly a devoted module planned explicitly for use with servomotors. A servomotor is shut circle servomechanism that utilizations position input to control its movement and last position. The contribution to its control is some sign, either simple or advanced, addressing the position directed for the yield shaft.

1.3 MOTOR DRIVER

L293D is a regular Motor driver or Motor Driver IC which permits DC engine to drive on either direction. L293D is a 16-pin IC which can handle a bunch of two DC engines all the while toward any path. It implies that you can handle two DC engine with a singleL293D IC. Double H-connect Motor Driver incorporated circuit (IC) L293D is a double H-connect engine driver coordinated circuit (IC). Engine drivers go about as momentum intensifiers since they take a low-ebb and flow control flag and give a higher-ebb and flow signal. This higher current sign is utilized to drive the engines.

Fig 1.3 Motor driver

L293D contains two inbuilt H-connect driver circuits. In its regular method of activity, two DC engines can be driven at the same time, both in forward and invert heading. The engine activities of two engines can be constrained by input rationale at pins 2 and 7 and 10 and 15. Information rationale 00 or 11 will stop the comparing engine. Rationale 01 and 10 will turn it in clockwise and anticlockwise ways, separately. Empower pins 1 and 9 (relating to the two engines) should be high for engines to turn over working. At the point when an empower input is high, the related driver gets empowered. Thus, the yields become dynamic and work in stage with their data sources. Additionally, when the empower input is low, that driver is crippled, and their yields are off and in the high-impedance state.

1.4 RESULTS & DISCUSSION

1.4.1 Robotic Arm Movement Coverage

The greatest reach for the automated arm are recorded during the test and appeared in The further get point of the mechanical arm is 2.10cm, and the most extreme point the mechanical arm can reach is 92o, with range from 36^o to 128^o.

1.4.2 FINAL POSITION

This section describes the consequences of the automatic lifting arm at different weights. The mass to be lifted in this study is a block of varying weight. The automated arm is instructed to pick up the block and move it to a certain position. In the research work, the accuracy of positioning with different weight classes, from 20 grams to 100 grams, will be investigated, the source of view is a mass of 20 grams. The accuracy of the mechanical arm for lifting various loads is listed in the table below. Based on the data obtained, the mechanical arm can lift 100 grams into the correct form for this task. In any case, the development of the mechanical shoulder is not smooth when lifting 100 grams, because the solidarity of the joint consisting of 1 mm accelerated wire was missing. This problem can be solved by using a strong connection made of steel.

Weight (grams)	Precision (mm)	
	x- axis	y- axis
20	0	0
40	3	7
60	0	10
80	12	17
100	30	32

Table; 1.4.2 Precision in x and y axis.

1.4.3 Time Duration

A complete lifting cycle can be done at 15.55 seconds and there is an insignificant difference of time taken for various weights.

Table 1.4.3 Duration of lifting process.

Weight (grams)	Duration (second)
20	15.54
40	15.64
60	15.65
80	15.67
100	15.68

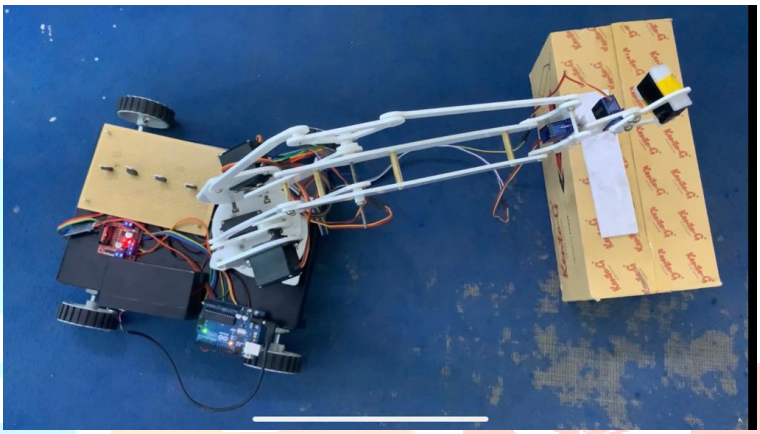

Fig 1.4.4 final model

2. CONCLUSION

This project presents the design and improvement of a mechanical arm for lifting light material. The mechanical arm is built using computer programming, AutoCAD and advanced innovative creation and 3D printing to save cost and time. The mechanical arm is made of ABS (acrylonitrile butadiene styrene) and one connection between the body and the motor is made of PLA (polylactic acid). During 3D printing, we addressed the problem of printing a protruding part that affected the joint, causing extreme deformation. Programming a web mixer that can create support for a prominent part resulting in a filled object. The actuator used to develop the handle is 4 servomotors. The servo motor is controlled with an Arduino Uno by coding. Due to the limitations of the servo motor, the development range of the automatic arm is limited to 180 degrees. The automated arm is designed with four options because it makes sense since most applications involve lifting. Therefore, it is usually a clever and basic development using only 4 actuators. Automatic hand parts are connected with fasteners: screws and nuts. The mechanical hand control framework basically consisted of three segments which are microcontroller, android application and servo motor. Arduino microcontroller is cheaper and easier to customize in C language compared to other microcontrollers. The Servo Arduino Android application interface allows the customer to control the development without preparation, so the automatic arm is easy to understand. The analysis is set to test the representation of the mechanical arm by varying the lifting stack; the automated arm lifting system is validated based on test results.

FUTURE SCOPE

In a later turn of events, the automatic handle can be placed on a versatile 4-wheel platform for comfort and routing. The general design of the gripper is interesting because it can be used to lift various objects. The mechanical arm has sensors that distinguish the situation of objects and the whole cycle is robotic and can also talk to the customer through system management.

REFERENCES

[1] I. Standard, 8373: 1994.

[2] E. Punna, R. K. Nenavath, and B. Maloth, "Labview Controlled Robotic ARM."

[3] A. Elfasakhany, E. Yanez, K. Baylon, and R. Salgado, "Design and development of a competitive low-cost robot arm with four degrees of freedom," Modern Mechanical Engineering, vol. 1, p. 47, 2011.

[4] C. F. Olson, "Probabilistic self-localization for mobile robots," Robotics and Automation, IEEE Transactions on, vol. 16, pp. 55-66, 2000.

[5] I. P. MODEL, "Industry Based Automatic Robotic Arm."

[2] C. Bartneck and J. Forlizzi, "A design-centred framework for social human-robot interaction," in Proceedings of the 13th IEEE International Workshop on Robot and Human Interactive Communication, 2004, pp. 31-33.

[3] G. Katal, S. Gupta, and S. Kakkar, "DESIGN AND OPERATION OF SYNCHRONIZED ROBOTIC ARM."

[4] J. L. Jones, "Robots at the tipping point: the road to iRobot Roomba," Robotics & Automation Magazine, IEEE, vol. 13, pp. 76-78, 2006.

[5] A. C. McDonald, "Robot technology: theory, design and applications," Sir Sanford Fleming Coll., Ontario1986.

[6] S. Yu, X. Yu, B. Shirinzadeh, and Z. Man, "Continuous finite-time control for robotic manipulators with terminal sliding mode," Automatica, vol. 41, pp. 1957-1964, 2005.

[7] M. Hägele, K. Nilsson, and J. N. Pires, "Industrial robotics," in Springer handbook of robotics, ed: Springer, 2008, pp. 963-986.

[8] R.-J. Wang, J.-W. Zhang, J.-M. Xu, and H.-Y. Liu, "The multiple-function intelligent robotic arms," in Fuzzy Systems, 2009. FUZZ-IEEE 2009. IEEE International Conference on, 2009, pp. 1995-2000.

[9] L. B. Duc, M. Syaifuddin, T. T. Toai, N. H. Tan, M. N. Saad, and L. C. Wai, "Designing 8 degrees of freedom humanoid robotic arm," in Intelligent and Advanced Systems, 2007. ICIAS 2007. International Conference on, 2007, pp. 1069-1074.

[10] C. Carignan, G. Gefke, and B. Roberts, "Intro to Space Mission Design: Space Robotics," in Seminar of Space Robotics, University of Maryland, Baltimore, 2002.

[11] R. Bonitz, J. Slostad, B. Bon, D. Braun, R. Brill, C. Buck, et al., "Mars volatiles and climate surveyor robotic arm," Journal of Geophysical Research: Planets (1991– 2012), vol. 106, pp. 17623-17634, 2001.

[12] R. Bonitz, L. Shiraishi, M. Robinson, J. Carsten, R. Volpe, A. Trebi-Ollennu, et al., "The Phoenix Mars lander robotic arm," in Aerospace conference, 2009 IEEE, 2009, pp. 1-12.

[13] R. Boyce and J. Mull, "Complying with the Occupational Safety and Health Administration: Guidelines for the dental office," Dental Clinics of North America, vol. 52, pp. 653-668, 2008.

[14] B. Siciliano, L. Sciavicco, L. Villani, and G. Oriolo, Robotics: modelling, planning and control: Springer Science & Business Media, 2009.

[15] M. A. Rahman, A. H. Khan, T. Ahmed, and M. M. Sajjad, "Design, Analysis and Implementation of a Robotic Arm-The Animator."

[16] P. Singh, A. Kumar, and M. Vashisth, "Design of a Robotic Arm with Gripper & End Effector for Spot Welding," Universal Journal of Mechanical Engineering, vol. 1, pp. 92-97, 2013.

[17] M. W. Spong, Vidyasagar, Robot Dynamics and Control, 1989.

[18] A. J. Critchlow, Introduction to robotics: Macmillan New York, 1985.

[19] M. A. K. Yusoff, R. E. Samin, and B. S. K. Ibrahim, "Wireless mobile robotic arm," Procedia Engineering, vol. 41, pp. 1072-1078, 2012.

[20] G. Mikell and N. Roger, "Robótica Industrial. Tecnología, Programación y Aplicaciones. Ed," ed: Mc Graw Hill.

[21] C. A. Schuler and W. L. McNamee, Industrial electronics and robotics: McGraw- Hill, Inc., 1986.

[22] S. R. Nair, "Design of a Robotic Arm for picking and placing an object controlled using LabVIEW," International Journal of Scientific and Research Publications, vol. 2, pp. 1-4, 2012.

[23] F. J. Diaz-Colorado and R. F. Martinez-Gonzalez, "Design and Implementation of a Low-Cost Embedded System to Turn Android Device into a Robotic Arm Controller," Technology, vol. 2, pp. 7-12, 2015.

[24] J. Olawale, A. Oludele, A. Ayodele, and N. M. Alejandro, "Development of a Microcontroller Based Robotic Arm," in Proceedings of the 2007 Computer Science and IT Education Conference, 2007.

[25] G. A, N. R, K. S, and G. R, "Design and Control of 3DOF Articulated Robotic Arm using LabVIEW and NI-myRIO," International Journal of Innovative Research in Electrical, Electronics, Instrumentation and Control Engineering, vol. 3, 2015.

[26] M. C. C. Mouli, M. P. Jyothi, K. N. Raju, and C. Nagaraja, "Design and Implementation of Robot Arm Control Using LabVIEW and ARM Controller," IOSR Journal of Electrical and Electronics Engineering (IOSR-JEEE) e-ISSN, pp. 2278- 1676, 2013.

[27] R. Pahuja and N. Kumar, "Android Mobile Phone Controlled Bluetooth Robot Using 8051 Microcontroller," Electronics & Communication Engineering, Department, BRCM College of Engineering & Technology, Bahal, India, International Journal of Scientific Engineering and Research (IJSER) www. ijser. in ISSN (Online), pp. 2347- 3878, 2014.