RECORD AND PLAY ROBOTIC ARM

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Abstract: Today, technology is developing in the same direction in line with rapidly increasing human needs. Much of the work in the industry is now done by robots. Even though they are able to do very precise work, difficulties appear when trying to do some of the tasks that humans do. This can be changed by making it easy for a human to control the robotic arm and to "teach it" how it's done. The work done to meet these needs makes life easier every day, and these studies are concentrated in robotic arm studies. Robot arms work with an outside user or by performing predetermined commands. The purpose of this project is to develop a robotic arm that is easily controlled by the user. This is done by using the users own arm movement to control the robot. To make the usage more intuitive, a simple hectic feedback system will be implemented. This creates a greater experience where the user is able to "feel what the robot feels".

To be able to create such a system, development of an easy control unit, robotic arm and feedback system has to be made. The steering of the robotic arm is created from reading the user's arm movement with potentiometers, and mapping these values to servos on the robotic arm. Nowadays, the most developed field of robot arms in every field is the industry and medicine sector. Designed and realized in the project, the robot arm has the ability to move in 4 axis directions with 5 servo motors. Thanks to the holder, you can take the desired material from one place and carry it to another place, and also mix it with the material it receives. While doing this, robot automatic control is provided by connecting to the controller. By recording the work the commands will be stored and automatically played by loop programming.

***Index Terms* – Arduino, EEPROM, Robotics.**

I. INTRODUCTION

A Robot is a virtually intelligent agent capable of carrying out tasks robotically with the help of some supervision. Practically, a robot is basically an electro-mechanical machine that is guided by means of computer and electronic programming. Robots can be classified as autonomous, semiautonomous and remotely controlled. Robots are widely used for variety of tasks such as service stations, cleaning drains, and in tasks that are considered too dangerous to be performed by humans. A robotic arm is a robotic manipulator, usually programmable, with similar functions to a human arm.

This Robotic arm is programmable in nature and it can be manipulated. The robotic arm is also sometimes referred to as anthropomorphic as it is very similar to that of a human hand. Humans today do all the tasks involved in the manufacturing industry by them. However, a Robotic arm can be used for various tasks such as welding, drilling, spraying and many more. A self-sufficient robotic arm is fabricated by using components like micro-controllers and motors.

This increases their speed of operation and reduces the complexity. It also brings about an increase in productivity which makes it easy to shift to hazardous materials. The main part of the design is ATMEGA-328p micro-controller which coordinates and controls the product's action. This specific micro controller is used in various types of embedded applications. Robotics involves elements of mechanical and electrical engineering, as well as control theory, computing and now artificial intelligence. According to the Robot Institute of America, A robot is a reprogrammable, multifunctional manipulator designed to move materials, parts, tools or specialized devices through variable programmed motions for the performance of a variety of tasks.

The robots interact with their environment, which is an important objective in the development of robots. This interaction is commonly established by means of some sort of arm and gripping device or end effectors. In the robotic arm, the arm has a few joints, similar to a human arm, in addition to shoulder, elbow, and wrist, coupled with the finger joints; there are many joints. The design process is clearly explained in the next section with detailed information regarding the components which are used.

II. LITERATURE SURVEY

M.Cianchetti, A.Arienti, B.M.Follador, B.Mazzalai, P.dario in the year 2010 they got inspired by the Octopus to and make an interesting model in robotics due to its high dexterity, variable stiffness and very complex behavior. In this experiment they study the key features and patterns of movement of Octopus arm and this features and patterns and patterns of movement are that is elongation, shortening, bending and reaching etc. used for guide the movement of actuator. They conclude that the concept proposed for the mechanism at the base of the robotic arm inspired to the Octopus muscular hydrostat where successfully implemented on mock-ups and the corresponding models have been modified and validate.

Ravikumar Mourya, Amit Shelke, Saurabh Satpuite, Sushant Kakade, Monoj Botre in the year 2011 have main objective of their project is to design and implement a four DOF pick and place robotic arm. They conclude that the CAD tools like Creo1.0 and Auto CAD are used to model the desire manipulator. To determine the end effectors position and orientation, theoretical analysis of inverse kinematics are carried out. Ansys software is used for FE Analysis.

Prof. S.N.Teli, Akshay Bhalerao, Sagar Ingole, Mahesh Jagadale(2017). This project aims to design and fabricate the pneumatic arm for pick and place of cylindrical objects. They conclude that arm is controlled by manually flaw control and

direction control valve. Arm rotation and movement is done by pneumatic cylinder using helical slot mechanism. Total arm weight is 25 kg. The model is expected to lift at least 10 kg weight.

S.Premkumar, K.Surya Varman, R.Ballamurgan(2017), Experimental aim is to collaborate the gripper mechanism and vacuum sucker mechanism working in single pick and place robotic arm. These robot can perform tasks like gripping, sucking, lifting, placing, releasing, in a single robotic arm. It will reduced the cycle time, Ideal time, cost of operation, space consumption. It is user friendly and effectively used in glass handling system.

S.C.Gutierrez, R.Zotovic, M.D.Navarra, M.D.Meseguer(2013). Their purpose of work is to manufacture a light weight robot arm with a low cost budget. They conclude that to avoid negative influence on the total weight of the arm, the plastic material reinforced with fiber is used and vacuum infusion man process is used for manufacturing. Local reinforced elements must be included during construction of arm shell. The mast light gear reducer, harmonic drive types are used but because of lack of alignment causes disassembly of gear package to avoid these flexible couplings are required.

Gabrielle J.M. Tuithaf, Just L.Harder(2013). Current robots are not safe for interaction with humans, especially for children therefore safe four DOF robot arm is develop. Firstly, the joint stiffness of arm is brought to zero then the arm is supplied with pneumatic artificial muscles and their stiffness can be adjusted by open loop stiffness control.

M.Pellicciari, G.Berselli, F.Leali, A. Verganana(2013). This paper shows the method for reducing the total energy consumption of pick and placed robotic arm. Firstly, electro mechanical models of both series and parallel manipulators are derived and then by means of constant time scaling, the energy optimal trajectories are calculated. It is seen that blowing down an operation as much as possible is not always beneficial. Energy consumption of given operation as a function of the task execution time. Future work includes improvement of the motor model, development of online programming algorithms.

Mohd Ashiq Kamaril, Yusuff, Reza Ezucin Samin, Babul Salam, Kader Ibrahim(2016) paper presents the development of wireless mobile robot arm. Wireless PS2 controller is used to control the pick and place operation. The development of this robot is based on Arduino Mega Platform. Analysis of speed, distance, load lifted by arm is done to know its performance. This robot expected to overcome the problem such as placing or picking object that is away from the user, pick and place hazardous object fast and easily.

H. Hagenah, W. Bohm, T. Breitsprecher, M. Merklein, S. Wartzack(2017). This paper will show how modern materials as cellular titanium & nano crystalline aluminium can be used to build advanced light weight robot arms. This paper will cover the definition of the product specification, the setting of a basic design and the optimization of this by means of topology optimization. This optimization requires an intelligent modeling to be able to investigate different initial setting and boundary conditions. Different innovative light weight construction materials and the corresponding manufacturing technologies are developing and analyzed.

Mohd Aliff, Shujiro Dohta, Tetsuya Akagi(2017), flexible Hui Li the aim of study is to develop the and light weight actuator and applied into has flexible hose robot arm. In this paper, the Slavic Master's degree height flexible control and the trajectory control of the robot arm are proposed. This robot arm has 3DOF i.e. bending, expanding and contracting and will be applied into has device for human wrist rehabilitation. In this paper the analytical model of year has flexible hose robot arm is proposed for Slavic Master's degree height control in trajectory control.

III. EXISTING METHOD

In earlier days, industrial control was purely by human beings which required lot of efforts. To overcome the drawbacks of this system there came the concept of automation in industries. There are two types of existing system. They are Human effort heavy vehicles and machineries and the second type is automated machineries but its method of operation uses a set of inductive, capacitive and optical sensors do differentiate object color. When this system is used, there is a need of huge effort of human and it's having a long time. And existing automated machineries based on sensors and half automated like systems. The block diagram of our work is as shown in Fig. 1.

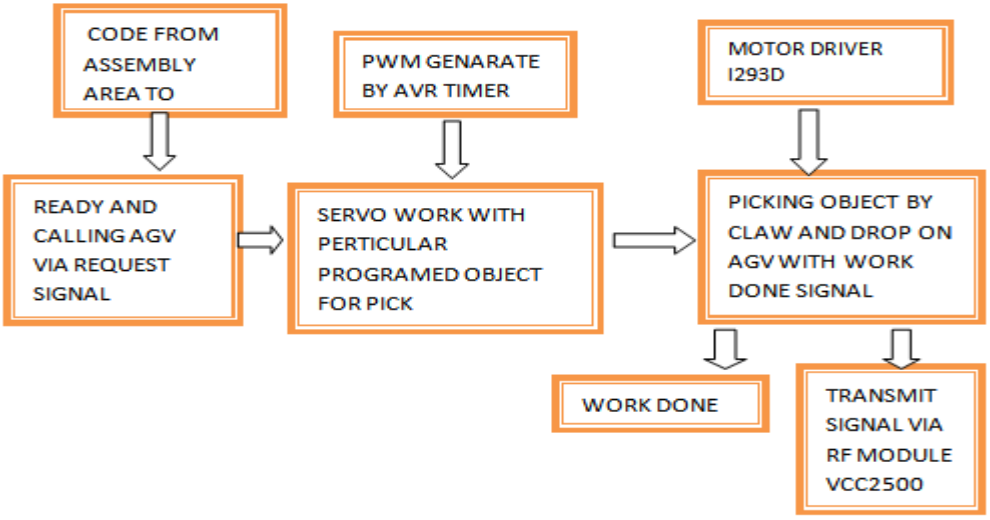

Fig. 1: Block diagram of Existing System

In this system, a pick and place robot is controlled with the push-buttons arranged in the remote. On pressing a corresponding button, a command signal is transmitted to the robot such that the robot moves in the appropriate direction. This project consists of two blocks: transmitter and receiver block. The commands send by a user from the transmitter block are received by the receiver block to perform desired actions. Whenever we press any key, particular data line is grounded. When TE pin is low (TE-transmission enable pin is low active) the address and data are transmitted serially through Data Out pin. When 5V supply is given to circuit all the data lines are low and because of invertors all four outputs of the inverters will be high. Whenever you press any switch from transmitter, then address & data are transmitted together, then RF receiver will receive the data and gives this address.

This work is able to successfully accomplish the defined functionality. A sample robot which can rotate, magnetize an object, lower and raise its arm, by being controlled by the microcontroller is built successfully. The development board is soldered and it used the required procedure for the correct operation of the controller. The development board has been interfaced to the servo & dc motors such that the anthropomorphic like structure can be controlled from the buttons at the base of the structure (robotic arm).

When signal come to robotic arm, it will activated and then it searching for the code object in storage area when it get confirmation of availability thus it call AGV to collect and dispatch that object to its destination of call at the instant of getting signal inbuilt program in AVR controller activate and check signal status incoming signal on USART terminal via RF module thus programmed AVR drive the servos with fix degree which have been place in programming for particular objects ,end effecter as a claw made up of dc geared motor and spar gear assembly with AVR via L293D motor driver h-bridge IC collect the object lift up and drop on AGV and its come back its original position which is mention in its program.

A rotary encoder is an electro-mechanical device for converting the angular position of a shaft or axle to a digital code. When, working with DC motors, a shaft encoder is the most common and accurate way of providing feed-back to the controller. An incremental rotary encoder provides information about the instantaneous position of a rotating shaft in term of pulses. FPGA controller verifies the signal status and sends the corresponding signal that weather motor keep on or stop. The frequency of those pulses is directly proportional the speed of rotation of the shaft and the number of those pulses correspond to the angular displacement of the shaft. The shaft encoder sensor sends information, in the form of electronic signals back to the controller. The Existing method flow chart is shown in Fig. 2.

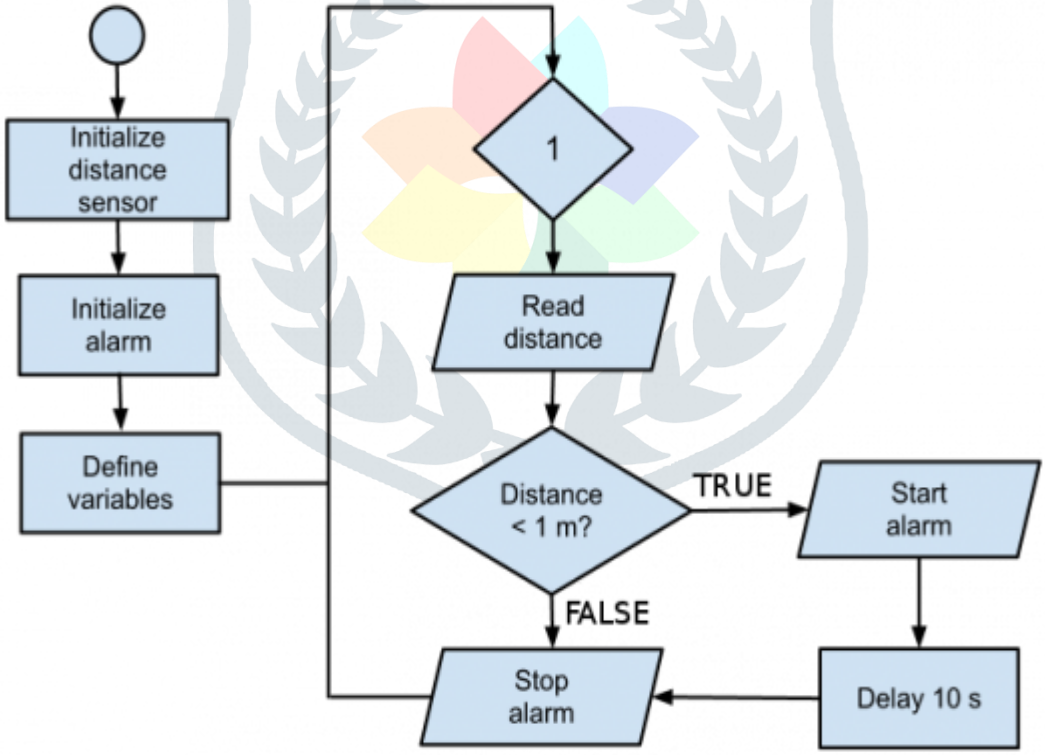

Fig. 2: Flow chart of Existing System

This robot is a mechanical arm, a manipulator designed to perform many different tasks and to perform its assigned tasks, the robot moves parts, objects, tools, and special devices by means of programmed motions and points. The robotic arm performs motions in space. Its function is to transfer objects or tools from point to point, as instructed by the controller.

In manufacturing industry and nuclear industry, a large fraction of the work is repetitive and judicious application of automation will most certainly result in optimum utilization. A pneumatic `Pick and Place' Robot has been developed to achieve automation in applications where great sophistication is not needed and simple tasks like picking up of small parts at one location and placing them at another location can be done with great ease. Precise control of tools during operation. It allows interactivity in real-time with virtual objects.

- They are faster and can get the work done in seconds compared to human counterparts.
- They are flexible and have the appropriate design.

- They are accurate.
- They increase the safety of the working environment and actually never get tired.

IV. PROPOSED SYSTEM

The Proposed system is a smart approach for a real time inspection and selection of objects in continuous flow. Image processing in today's world grabs massive attentions as it leads to possibilities of broaden application in many fields of high technology. The real challenge is how to improve existing sorting system in the modular processing system which consists of four integrated stations of identification, processing, selection and sorting with a new image processing feature. Existing sorting method uses a set of inductive, capacitive and optical sensors do differentiate object color. This paper presents a mechatronics color sorting system solution with the application of image processing.

Image processing procedure senses the objects in an image captured in real-time by a webcam and then identifies color and information out of it. This information is processed by image processing for pick-and-place mechanism. The Project deals with an automated material handling system. It aims in classifying the colored objects by color, size, which are coming on the conveyor by picking and placing the objects in its respective pre-programmed place. Thereby eliminating the monotonous work done by human, achieving accuracy and speed in the work. The project involves sensors that senses the object's color, size and sends the signal to the microcontroller. The microcontroller sends signal to circuit which drives the various motors of the robotic arm to grip the object and place it in the specified location. Based upon the detection, the robotic arm moves to the specified location, releases the object and comes back to the original position.

To be able to create such a system, development of an easy control unit, robotic arm and feedback system has to be made. The steering of the robotic arm is created from reading the user's arm movement with potentiometers, and mapping these values to servos on the robotic arm. Thanks to the holder, It can take the desired material from one place and carry it to another place, and also mix it with the material it receives. While doing this, robot automatic control is provided by connecting to the controller. By recording the work the commands will be stored and automatically played by loop programming.

The microcontroller in turn will control the servomotors by PWM signals. These servomotors will control the movement of robotic arm, by controlling their angular movement. Thus the robotic arm will be fully controlled by servomotors. The gripper of robotic arm will pick the object place it depending on its size. This is fully automatic process no manual support is needed. The microcontroller used here is with the support of Arduino kit. The Arduino is good platform for robotics application. It is the software and hardware also; using both the above system is developed. Thus the real time, continuous object sorting done. The proposed system is shown in Fig. 3.

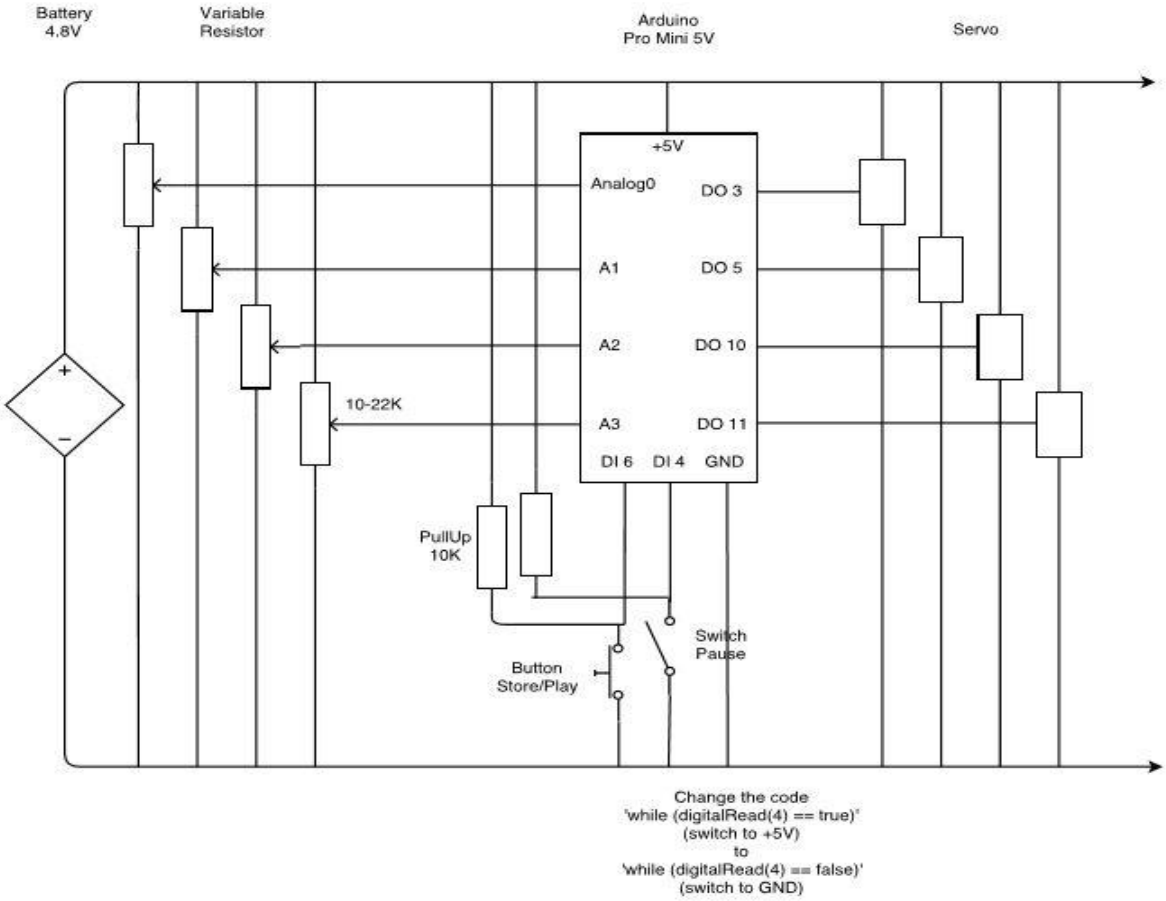

Fig. 3: Block Diagram of Proposed System

V. RESULTS AND DISCUSSIONS

Using the Servo and EEPROM libraries:

Declare the servos. One is the bottom (base) servo, counting up each joint until servo five which is the gripper:

Calibrating the servos requires recording the minimum and maximum values for both the degrees and feedback. These are integers, so declare all these variables for each servo. Also want to create integer variables to hold the calculated replay values for each servo.

Declare and integer variable to store the EEPROM address used to read/write servo values and a boolean variable to keep track of recorded arm motion or not.

Fig. 4: Lifting the object

The setup function will start serial output for debugging; attach each servo to their digital pins, set the LED on pin 13 to output and set the record and playback button pins to inputs.

The easiest method for calibrating the servos is to start them all out at 90 degrees then step through each servos motion starting from one and ending at five to record the analog feedback values when the servos are positioned at their minimums and maximums. The micro servos I used tended to have a good minimum of 30 and maximum of 150. The gripper servo (Five) worked will with minimum 20 and maximum 180.

Fig. 5: Movement of the arm

When each servo is at its minimum, we read the analog value from the respective servo analog pin and store it in the respective variable. After this is complete, Place the servos back a 90 then detach them to both save power and to allow them to be moved by our own hands.

The main code polls the state of the record and replay buttons. When the record button is pressed, the Arduino LED lights up to let you know its time to move the arm in the positions you want. The analog feedback values are read then converted into servo degrees and finally written to the EEPROM. When the replay button is pressed the stored servo positions are read from EEPROM and written to their respective servos. After recording or replaying, each servo is moved back to 90 then detached.

During the replay after the values have been read from EEPROM, there are a series of if statements that control the writing of the servo values. The reason for these conditionals is to create a smooth playback from one recorded position to the next. A quick calculation of the difference between the servo position being read now and the next servo position tells us how to step between those values as we write them to the servos. Instead of writing 120 then 130 to the servo, we want to write every value between 120 and 130 with a short delay in order to create the smooth motion.

Note the if statement for the replay button: if (recorded || digitalRead(6)) Instead of just executing a replay when the replay button attached to digital pin 6 is pressed, it will execute a replay if the boolean variable recorded is true. This is why the servo motion is replayed right after you end recording because the recording code sets the variable recorded to true - before the code even gets to this if statement. The only reason for this is so the first replay happens without needing to press the replay button right after you record a motion. If you do not want the arm to automatically replay its motion after recording, remove the recorded or to make the line: if (digitalRead(6)) instead.

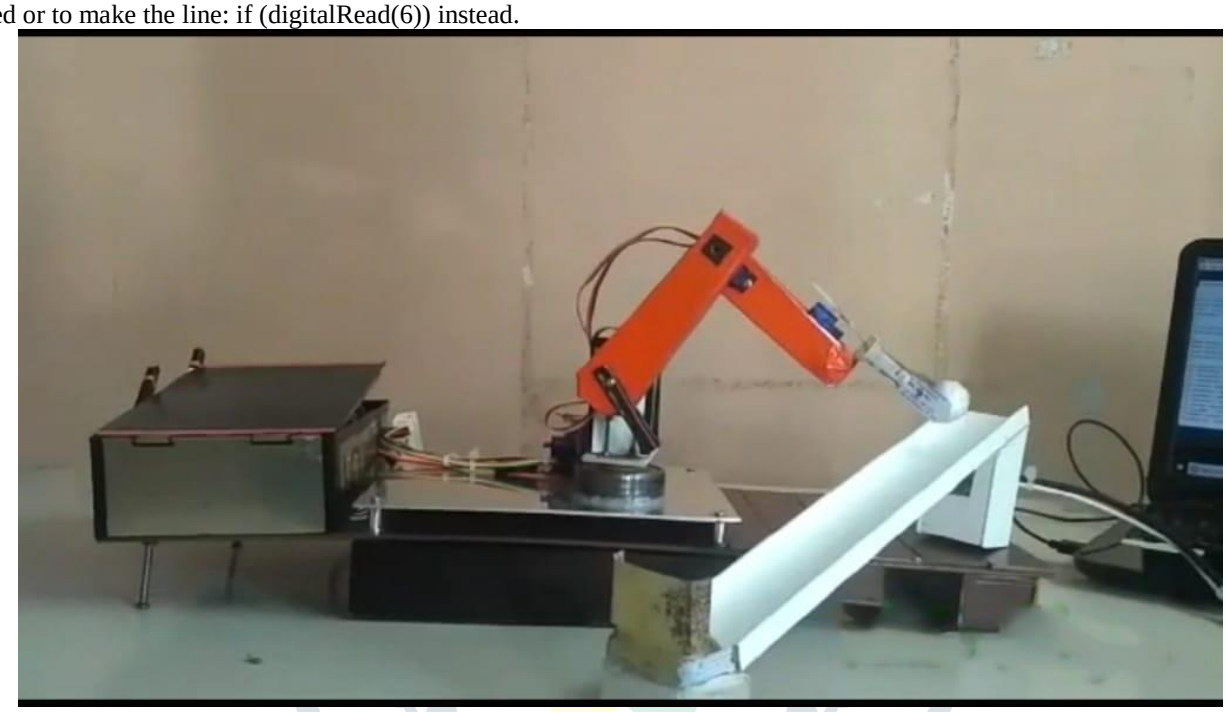

Fig. 6: Holding the object

The final step is to upload the Arduino sketch to your board. As soon as the Arduino resets, the arm should start its calibration routine by moving each servo through its range of motion. When this completes the arm will be positioned straight up and the servos will deatch, allowing you to manipulate the arm without power being applied.

At this point you can press the record button. The onboard LED will light up which means its recording. Move the arm around any way you like then press the record button again to stop recording. The arm will straighten up again then immediately replay the motion it learned. When the replay is complete the arm will position itself straight up again.

You can press the replay button to replay the last learned routine, or teach the arm another motion sequence with the record button.

VI. CONCLUSION

The main focus of this work was to design, and programme robotic arm the robot arm was designed with four degrees of freedom and talented to accomplish accurately simple tasks, such as light material handling the robot arm is equipped with several servo Motors which do links between arms and perform arm movements. A microcontroller that drives the servo motors with the capability of modifying position.

The programming is done on ATMEGA-328p Microcontroller using Arduino programming. The potentiometers are also used to detect the angle of rotation and the signals are then sent to the microcontroller. And you can control the robotic arm also using android device, in today's world; this Robotic arm has turned out very benevolent. Besides Robotics and Automation, these kinds of arms have applications in other fields also.

In this paper ROBOT control model by IOT online communication through mobile phone. It's very useful tmany application process without present that particular place to operate the ROBOT model. The objective of the project have accomplished with remote control application. The control system may also allow us the robo arm both near field and via web too. The controller here used in this system enrich the object oriented program so control the task are easily programmed and burned for ardiuno as so compact. It much better than other tools to accomplish the same project.

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