TEA OR COFFEE SERVING ROBOTIC ARM

A PROJECT REPORT

Submitted in partial fulfillment of requirement

for the degree of

Bachelor of Engineering

in

Electronics & Telecommunication

Submitted by

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A.Y. 2021-22

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Declaration

We declare that this written submission represents our ideas in our own words and where others' ideas or words have been included, we have adequately cited and referenced the original sources. We also declare that We have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in our submission. We understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed. We take sole responsibility for the work presented by us in this report. We also declare that we will submit our completed project along with all necessary hardware and software to the department at the end of the 2nd semester.

Signature.....

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Signature.....

STUDENT NAME : Shruti Malpure

Place : Pune

Date :

Abstract

In recent years the industry and routine works are found to be more attracted and implemented through automation via Robots. The pick and place robot is one of the example of technologies used in manufacturing industries which is designed to perform pick and place operations. The system is designed in such a way that it eliminates the human error and human intervention to get more precise work. There are many fields in which human intervention is difficult but the process under consideration has to be operated and controlled. This leads to the area in which robots find their applications. Literature suggests that the pick and place robots are designed, implemented in various fields such as; in bottle filling industry, packing industry, used in surveillance to detect and destroy the bombs etc. The project deals with implementing an pick and place robot using microcontroller for any pick and place functions. Most importantly using them has also helped in making processes more efficient and less noisy. The use of Robotic arm is highly recommended for industries especially for safety and productivity reasons. The pick and place robot so implemented is controlled using potentiometer. The project deals with designing and analysing the structure of robotic arm with different materials. It will pick and place an object from source to destination safely. The soft catching gripper used in the arm will not apply any extra pressure on the objects.

Keywords: Pick and Place Robot, Robotic arm.

Contents

Certificate ii

Declaration vi

Abstract vii

Contents viii

List of Figures x

1 Introduction 1

1.1 Background 1

1.2 Robotic Arm 2

2 Literature Survey 5

3 Proposed Methodology 13

3.1 Problem Statement 13

3.2 Objective 13

3.3 Problem Motivation 14

3.4 Requirement Analysis 14

3.5 Impact Analysis 21

3.6 Professional Ethics Practices to be followed 22

4 Project Implementation 24

4.1 Circuit Designing 24

4.2 Simulation 25
4.3 PCB designing 26
4.4 Programming 28

5 Result and Discussion **31**

6 Conclusion and Future Scope **35**
6.1 Conclusion 35
6.2 Future Scope 35

References **36**

List of Figures

1.1 PICK AND PLACE ROBOTIC ARM 3

3.1 MG995R SERVO MOTOR 14
3.2 Sevo Motor 15
3.3 ATMEGA328P MICRO-CONTROLLER PIN DIAGRAM 16
3.4 POTENTIOMETER PINOUT 17
3.5 PUSH-BUTTON 17
3.6 POTENTIOMETER PINOUT 18
3.7 OLED DISPLAY 19
3.8 ICON OF PROTEUS 20
3.9 ICON OF PROTEUS 20

4.1 BLOCK DIAGRAM 25
4.2 SIMULATION DONE ON PROTEUS PHASE I 26
4.3 PCB LAYOUT 27
4.4 COMPONENTS MOUNTED ON PCB BOARD 28
4.5 FLOWCHART 30

5.1 The servo motor which is mounted in robotic arm on gripper which moved after simulation phase I. 31
5.2 The servo motor which is mounted in robotic arm on Wrist which moved after simulation Phase I 32
5.3 SCHEMATIC PHASE II 33
5.4 PROJECT HARDWARE SETUP PHASE II 34

Chapter 1

Introduction

Pick and place robot is an emerging sector in both robotics and mechatronics. This pick and place robot aims at eliminating a number of issues related to the food industry. Construction of the robotic arm is based on human arm. The robot has the ability pick cup of coffee from coffee maker and place to the customer side.

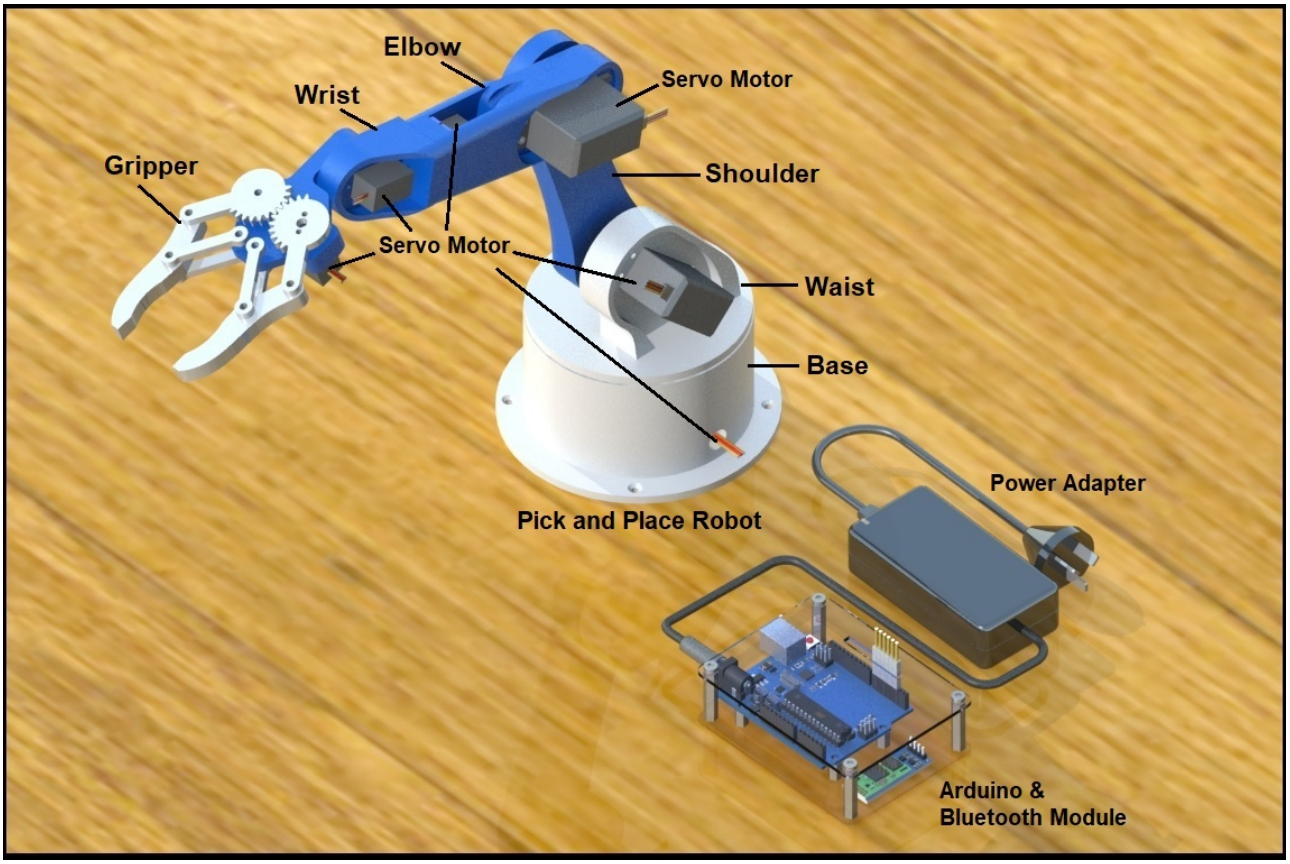
1.1 Background

The word " robot" was popularized nearly a hundred years ago by a Czech playwright in a hit 1920s play. The origin of the word robot came from an old Slavic word, rabota, that referred to forced labor or servitude. In the play, a company called Rossum's Universal Robots (R.U.R.) used biotechnology to produce artificial workers- a far cry from today's mechanical robots. While the play was popular, it took more than 30 years for the first true robot invention in 1954. In the patent application for his programmable robot arm, George Devol described it as a " Programmed Article Transfer", referencing the device's ability to be programmed to move materials. The history of robots might have been dramatically different if not for a fateful meeting. At a cocktail party in 1956, George Devol and Joseph Engleberger discovered a shared excitement for science fiction and entrepreneurship. This started them down to becoming business partners - dramatically changing the future of robotics.

1.2 Robotic Arm

As continue to automate the world to make our lives easier, the fundamental nature of work is changing. Manpower required in factories have reduced significantly because most of the work is now being done by machines. In simple words human arms are being replaced by robotic arms. Robots is now a day are very much in the treads of new technologies. People are in the race of finding solutions in every aspect of life with the help of robots. One of the latest trend is to use robots in food industry. Robots are ferment javas is the latest technology trend working towards eliminating labor shortages and diminishing ever increasing workforce-related expenses. Unmanned cafes and bars, furnished with similar mechanism, are not mere dreams about the future anymore. In the food industry, it seems, the robot revolution are well underway with machines mastering skilled tasks that have been performed by people. In Boston, robots have replaced chefs. Removing the human efforts from ordering a cup of tea or coffee is one of the company's selling points.

Consequently robotic arm takes on the burden of manual, repetitive tasks, freeing people to achieve their potential. Also these automated arms produce better results, reduces injury and drives industry further. Most importantly using them has also helped in making processes more efficient and less noisy. The use of Robotic arm is highly recommended for industries especially for safety and productivity reasons. The basic function of a pick and place robot is done by its joints. Joints are analogous to human joints and are used to join the two consecutive rigid bodies in the robot. They can be rotary joint or linear joint. To add a joint to any link of a robot,need to know about the degrees of freedom and degrees of movement for that body part. Degrees of freedom implement the linear and rotational movement of the body and Degrees of movement imply the number of axis the body can move. Pick and place robotic arm is a system which can be designed in many different ways according to its applications. They heavily depend on joints, which are used to join or connect the two consecutive bodies in the robot and can be rotary joint. Joints define the movement of the arm. Arm decide the degree of freedom of the components.



golangbot.com/diy-pick-and-place-robot

Figure 1.1: PICK AND PLACE ROBOTIC ARM

Consequently all robotic arm consists of following basic components.

- Controller
- Servo Motors
- Gripper
- Power source

The mechanical construction in this project is to build and assemble the robotic arm body. After giving a thorough consideration of all the preceding works in this field, a five degree of freedom manipulator having variable programmed motions to carry out variety of tasks in diverse environments is chosen. This is a five-axis manipulator designed to pick and place objects. This robot arm is a revolute type that intently looks like the human arm. Shoulder or midriff that mounted on the base which can move the arm upto 180 degrees, it tends to be turned from level to vertical on each

side. The shoulder utilizes extensive scale servo, give the torque expected to lift the remainder of the arm, just as any item that it might get a handle on. Joined to the shoulder piece is an elbow that can travel through 180 degrees, likewise controlled by an expansive scale servo. The wrist is comprised of one standard servo and can travel through 180 degrees, in vertical heading. Connected to the wrist is a two-fingered gripper that uses a one of a kind structure worked around a solitary standard servo.

Chapter 2

Literature Survey

The design methodology involves the hardware, software part and implementation of both designs. The results obtained were very satisfactory. The use of Robotic arm is highly recommended for industries especially for safety and productivity reasons.

In research paper[1] author concluded that the pick and place robot is one of the technologies in manufacturing industries which is designed to perform pick and place operations. The system is so designed that it eliminates the human error and human intervention to get more precise work. Literature suggests that the pick and place robots are designed, implemented in various fields such as; in bottle filling industry, packing industry, used in surveillance to detect and destroy the bombs etc. The project deals with implementing an pick and place robot using Robo-Arduino for any pick and place functions. The pick and place robot so implemented is controlled using RF signal.

In research paper[2] the author says that the robotic arm is a robotic manipulator, usually programmable, with similar functions to a human arm. Humans pick things up without thinking about the steps involved. In order for a robot or a robotic arm to pick up or move something, someone has to tell it to perform several actions in a particular order from moving the arm, to rotating the "wrist" to opening and closing the "hand" or "fingers". So, we can control each joint. This paper presents a three joint automatic robotic arm which can be used in industries to do repetitive task such

as moving the things from conveyor to another place, a sensor will be used to detect the obstacles if present while carrying out the task. If there is any obstacle while moving the object, the arm will wait for a predefined time for the clearance of the object. If the obstacle is cleared, the arm will continue its work. If the obstacle is still present, a buzzer will be turned on so that personnel from the industry can attend the problem and clear the obstacle.

In research paper[3] the author describes various aspects of designing a Robot is described. It deals with different types of Arm design, controlling techniques, vehicle design etc. ER. Rajput. In this paper the operation and control of robots is discussed. The pick and place robot being implemented to ease the process of sorting, process of moving heavy materials etc. Usually the transfer process of the heavy materials is being carried out, using man power and if the transfer process is repeated f or a period of time, it can cause injuries to the operator. By using the particular robot the operator, will no longer have to bent and lift up heavy loads thus preventing injuries and increasing the efficiency of the work. Operator will make mistakes whether small or big in a while. In the industrial world, the industry cannot afford to take any kind of mistakes. As every mistake is costly whether intern s of time, money and material.

In research paper[4] the design of a Remote-Controlled Robotic Vehicle has been completed. A prototype was built and confirmed functional. This system would make it easier for man to unrivalled the risk of handling suspicious objects which could be hazardous in its present environment and workplace. Complex and complicated duties would be achieved faster and more accurately with this design. The use of Robots is highly recommended for Industries especially for safety and productivity reasons. In their design work, they included a Robotic arm of five Degree of Freedom with its base resting directly on top of the vehicle, a body having four drive wheels coupled to the ends. In the mode of operation of robot ,they included operation such that when the operator issues a command from the remote control to the robotic vehicle all necessary tasks will be carried out by sending signals to the microcontroller. The microcontroller then issues command to the respective channels that makes up the

communication links. The electric motor will operate as per given command and the direction, speed and motion of the motor is regulated by the microcontroller.

This research paper[5] presents the development of a wireless mobile robot arm. A mobile robot that functional to do pick and place operation and be controlled by using wireless PS2 controller. It can move forward, reverse, turn right and left for a specific distance according to the controller specification. The development of this robot is based on Arduino Mega platform that will be interfaced with the wireless controller to the mobile robotic arm.

Analysis such as speed, distance, load that can be lifted of the robot has been done in order to know its performance. Finally, this prototype of the robot is expected to overcome the problem such as placing or picking object that far away from the user, pick and place hazardous object in the fastest and easiest way.

This research paper[6] concluded that the project is proposed to separate the objects from a set according to their colour. This can be useful to categorise the objects which move on a conveyer belt. The proposed method of categorisation is based on colour of the object. In this project the system categorise balls of three different colours. The detection of the particular colour is done by a light intensity to frequency converter method. The robotic arm is controlled by a microcontroller based system which controls DC servo motors.

This research paper[7] concluded that versatile and low cost "Pick and Place Robot" that can be controlled is developed. The robot uses two Arduino microcontrollers connected in a master/slave configuration. The master controls the robotic arm while the slave controls the robotic base.The arm utilizes servomotors to provide motion in the required axis. The base consists of dc geared motors and tracked wheels for transporting the robotic arm with the griper. The result of this project is a miniature robot that provides pick and place functions that can be used in several applications by changing the program of controller. The structure is designed to lift light loads. The applications of this system include warehousing,performing tasks in factory lines and even it can be employed as a personal helper for people with disabilities.

This research paper[8] concluded that an autonomous robot with adjustable gripper that perform pick and place operation has been successfully designed and developed. The robot has been able to pick the object and place it effectively. The robot is also able to perform lifting upward and downward smoothly. By using microcontroller, the robot has performed the task perfectly according to the program that being made. Beside than that, the adjustable gripper with sensors is able to open its grip according to the size of the object. Due to this advantage, the robot can pick. This system can be used in various applications like in gripper, fabrication process, and inspection, processing, spraying, stamping and welding for work piece.

In research paper[9] the author described the work is designed to develop a pick and place robotic arm vehicle with a soft catching gripper that is designed to avoid extra pressure on the suspected object for safety reasons. The robotic vehicle is android application controlled for remote operation. At the transmitting end using android application device, commands are sent to the receiver to control the movement of the robot either to move forward, backward and left or right etc. At the receiving end four motors are interfaced to the microcontroller where two of them are used for arm and gripper movement of the robot while the other two are for the body movement of the vehicle. The main advantage of this robot is its soft catching arm that is designed to avoid extra pressure on the suspected object for safety reasons. The android application device transmitter acts as a remote control that has the advantage of adequate range, while the receiver end Bluetooth device is connected to the microcontroller to drive DC motors via motor driver IC for necessary operation. Remote operation is achieved by any smart-phone/Tablet etc., with Android OS; upon a GUI based touch screen operation.

In research paper[10] the author concluded that in a place where science fiction of yesterday is rapidly becoming reality of today. The world needs less physical interaction and more productivity. An android device controlled robotic arm via Bluetooth wireless technology is presented here. Such device is very much required where human reach is not possible or must be avoided.

In this paper an android based robotic arm is designed to provide access to places where human presence must be avoided such as places with very low or very high atmospheric pressure, war zones and even bio-hazardous places. It can also be used for repetitive and cumbersome works like automobile painting, assembly work in manufacturing processes.

In research paper[11] the author describes that in recent years the design, fabrication and development of dexterous robotic arms and robotic hands have been active research areas all around the world. This paper describes a mechanical system design concept and a prototype implementation of a 5 DOF jointed-arm robot, which should perform industrial task such as pick-and-place operation. This robot arm, being controlled by a microcontroller and interfaced to a computer, has base rotation, shoulder, elbow and wrist motion, and a functional gripper. Two-fingered gripper has been built as end effector and is capable of grasping diverse objects, even under external disturbances, within own workspace of the arm possible. Control of the robotic arm has been achieved successfully using six servo motors. The microcontroller implements inverse kinematics algorithms and position control on the motors. The design aims to provide fine manipulation in performing industrial tasks, while still maintaining the simplicity of design, miniaturization, and lightness are also achieved.

In research paper[12] the author concluded that many robots have been built for manufacturing or for different applications for lifting the heavy loads with accurate displacement, orientation and to perform the same work repeatedly. The idea behind this work is to reduce the utilization of human energy for hazardous applications. This work involves in development of pneumatic controlled pick and place arm. To achieve this goal we intend to incorporate a simple linkage actuation mechanism. An AC motor is used along with spur gears and a threaded shaft arrangement. The gripper can perform the basic function of picking, holding and grasping of objects by means of a DC motor and it forms the mechanism. This work gives details about how to design and assemble the pneumatic pick and place robotic arm and analyze the design for better material properties to bare the maximum load conditions. The gripper can

easily accessible for any design of components without slipping.

In research paper[13] the author described that the project is designed to develop a system in which robot is used for pick and place application. In this highly developing society, time and man power are critical constrains for completion of task in large scales. The automation playing important role to save human efforts in most of the regular and frequently carried works. The pick and place robot is one of the technologies in the manufacturing industries which is designed to perform pick and place operation. The system is designed in such a way that, in which the human error are eliminated to get more precise work.

In research paper[14] the author described that Robotic arm is one of the major projects in today automation industries. Robotic arm is part of the mechatronic industry today's fast growing industry. This paper mention that the project is a pick and place robotic arm. On large scale it can be used as in environment, which is either hazardous (e.g. radiation) or not accessible. As the size of the robots scale down, the physics that governs the mode of operation, power delivery, and control change dramatically, restricting how these devices operate This also include it's characteristics like its extension, positioning, orientation, tools and object it can carry. This paper is on how we can make robotic arm with non useful materials and its application for small purposes.

In research paper[15] the author concluded that Robot manipulator is an essential motion subsystem component of robotic system for positioning, orientating object so that robot can perform useful task. The main focus of our work is to design the robotic arm for the above mentioned purpose. Robotic arm consists of revolute joints that allowed angular movement between adjacent joint. Three double acting cylinders were used to actuate the arm of the robot. Robot manipulators are designed to execute required movements. By using this collaborated mechanism the success rate of pick and place robots are increased.

In research paper[16] the author described that Robots are springing up everywhere like mushrooms having found a steady hold in the production industry. Not only do

they increase the productivity and efficiency of the system, but they also improve the accuracy and the uniformity of the products. They are a sign of an ever developing technology. One of the most important indications would be the industrial pick and place robot.

In research paper[17] the author said that the more increase the number of industries in developing countries, the more require labourers or workers in that. To reduce the cost of labour force and to increase the manufacturing capacity of industries, the advanced robot arms are more needed. The aim of this journal is to eliminate the manual control for object sorting system. Robot arm design in this research uses two joints, three links and servo motors to drive. In this research the position control of robot arm was designed by using kinematic control methods. There are two types of kinematic control methods which are forward and reverse kinematic methods. For sorting system, Metal detector is used to detect the metal or non-metal. This position control of pick and place robot arm is fully tested and the result is obtained more precisely.

In research paper[18] the author said that the mechanical design of the robot arm is based on robot manipulator with similar function to human arm. The configuration of robot arm is similar to articulated robot arm which has five revolute joints and irregular workspace. Robotic arm system consist of links, joints, actuators, sensor and controller. The main focus of this journal is motion simulation and design the articulated robotic arm using software.

In research paper[19] the author concluded that the robot arm is widely used in many industries and dangerous areas. Automatic control of the robotic manipulator involves study of kinematic. The kinematic problem is defined as the transformation from the Cartesian space to the joint space and vice versa This system include the kinematic control which is used for picking and placing the object in its workspace. There are many types of robot arm in the world of engineering. This research describes design of jointed robot arm control system using kinematic modelling. The main focus of this system is to control the end-effector of robot arm to achieve the desired position in

the workspace using programming, microcontroller and inverse kinematic modelling.

In research paper[20] the author described that The proposed concept of pick and place robot using Arduino is implemented via RF play station. It is found that, the robot so implemented has the ability to locate itself to the location where the object to be lifted is available with the help of chassis and four dc motors. Further depending upon controlling action provided to servo motor it lifts the object and locates the same at required destination.

In research paper[21] the author concluded that the aim of this paper is to design a Robotic System capable of picking objects from a predefined location and placing them at a target destination. Robots are versatile instruments of technology that work to make the life of human beings easy. The perceptive visualizations of a task being done are theorized and modeled into real-time algorithmic executions. Pick and place systems are highly advantageous due to their consistency, accuracy, precision, repeatability, reliability, resolution and efficiency.

In research paper[22] the author concluded that the goals of this project is building up the equipment and programming for a Bluetooth controlled automated arm. From perception that has been made, it unmistakably demonstrates that its development is exact, and is anything but difficult to control and easy to understand to utilize. The mechanical arm has been created effectively as the development of the robot can be controlled. This automated arm control strategy is relied upon to conquer the issue, for example, putting or picking protest that far from the client, pick and place risky item in a quick and simple way.

Chapter 3

Proposed Methodology

Proposed system for serve tea or coffee automatically from coffee maker to customer is solved with the help of robotic arm.Using the industry standard components accuracy and precision has been achieved.

3.1 Problem Statement

The aim of this project to design and implement robotic arm to serve tea or coffee. To enhance the productivity in various food industry, shops using automation.

3.2 Objective

- Pick cup of tea from source and place to the destination.
- Serving of tea without spreading of liquid in the cup.
- Increase speed of serving.
- Make serving process hygienic.
- Reduce errors and human efforts.

3.3 Problem Motivation

During the situation like covid need to manage social distancing. It is only done with the help of robots and automation coffee/tea is one of the world's most popular hot beverages and see getting your hot drink couldn't be easier. This robotic arm will help ease in quick serving tea or coffee to the customer with maintaining social distance and help to automate food section.

3.4 Requirement Analysis

Required Resources are:

Hardware:

1. Servo motor:

   A servomotor is a rotary actuator or linear actuator that allows for precise control of angular or linear position, velocity and acceleration.

   - MG995R Servo specification:

     Weight: 55 gm

     Operating voltage: 4.8V 7.2V

     Stall torque @4.8V : 10 kg-cm

     Stall torque @6.6V : 12 kg-cm

     Rotational degree : 180°

     Gear material : Metal

Figure 3.1: MG995R SERVO MOTOR

- SG90 Servo specification:

  Torque: 2.0kg/cm(4.8V), 2.2kg/cm(6V)

  Speed: 0.09s/60°(4.8V), 0.08s/60°(6V)

  Rotate angle: 180°

  Operating voltage: 4.8 6V.

  Gear: plastic

  Weight: 10.5

Figure 3.2: Sevo Motor

2. ATMEGA328P MICROCONTROLLER:

   ATMEGA328P is high performance, low power controller from Microchip.

   Specifications:

   - IC type: AVR microcontroller
   - Core size: 8-bit
   - Speed: up to 20MHz
   - Number of I/O: 23
   - Program memory size: 32Kb (16K x 16)
   - Program memory type: Flash

- EEPROM size: 1K x 8
- RAM size: 2K x 8
- Package: DIP-28 (0.1” x 0.3” pin spacing)
- Supply voltage: 1.8 V - 5.5 V
- Lead-free (RoHS compliant): Yes
- Manufacturer: Atmel
- Manufacturer part number: ATmega328P

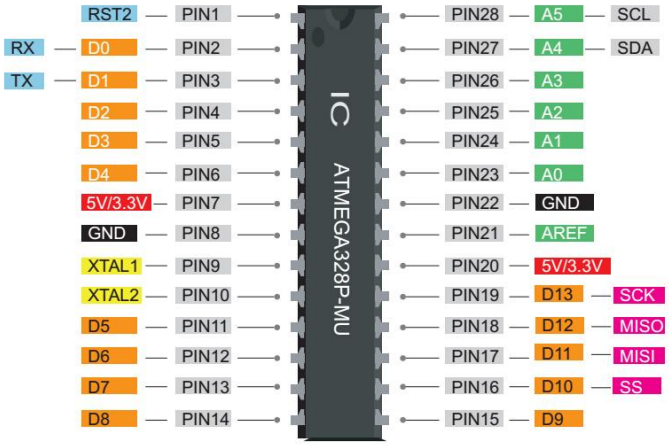


Figure 3.3: ATMEGA328P MICRO-CONTROLLER PIN DIAGRAM

3. POTENTIOMETER:

   It is a single turn 10k Potentiometer with a rotating knob. These potentiometers are also commonly called as a rotary potentiometer or just POT in short. These three-terminal devices can be used to vary the resistance between 0 to 10k ohms by simply rotating the knob

   Specifications:

   - Material Used : Plastic
   - Linear type with a single turn
   - Compact size

- Value:- 0- 10K
- Resistance Tolerance:- ±10
- Rotation angel:- 210 ±20 °
- Rotational Life Cycle:- 200 cycles
- Temperature range : - -55 to +125 °C

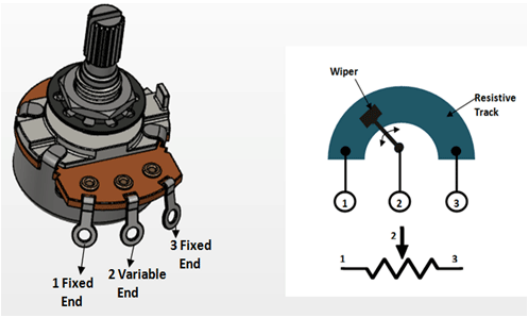


Figure 3.4: POTENTIOMETER PINOUT

4. PUSH BUTTON

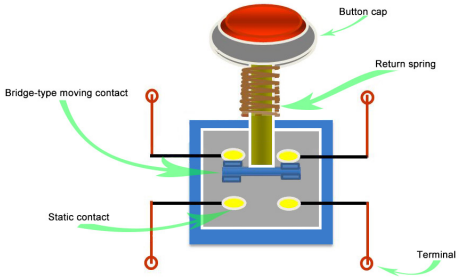


Figure 3.5: PUSH-BUTTON

Specifications:

- Mode of Operation: Tactile feedback
- Power Rating: MAX 50mA 24V DC
- Insulation Resistance: 100Mohm at 100v
- Operating Force: 2.55±0.69 N

- Contact Resistance: MAX 100 Ohm
- Operating Temperature Range: -20 to +70 ℃

5. 7805 IC :

   The 7805 Voltage Regulator IC is a commonly used voltage regulator that finds its application in most of the electronics.Internal Thermal Overload and Short circuit current limiting protection is available.

   Specifications:

   - 5V Positive Voltage Regulator
   - Minimum Input Voltage is 7V
   - Maximum Input Voltage is 25V
   - Operating current(IQ) is 5mA
   - Junction Temperature maximum 125 degree Celsius
   - Available in TO-220 and KTE package

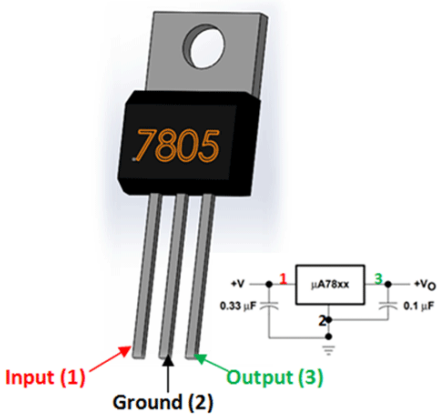


Figure 3.6: POTENTIOMETER PINOUT

6. OLED DISPLAY:

   An organic light-emitting diode (OLED or organic LED), also known as organic electroluminescent (organic EL) diode, is a light-emitting diode (LED) in which

the emissive electroluminescent layer is a film of organic compound that emits light in response to an electric current. Specifications:

- High-resolution at 128x64 pixels.
- 160 degrees viewing angle.
- Lower power consumption: only 0.06W with normal use.
- Power supply AC3V-5V, working very well with Arduino.
- Working temperature: -30 degrees to 70 degree Celsius.
- Dimensions: L27. 8 x W27. ...
- Compatible 3.3v and 5.0v chip I/O level.
- Driver IC SSD1306

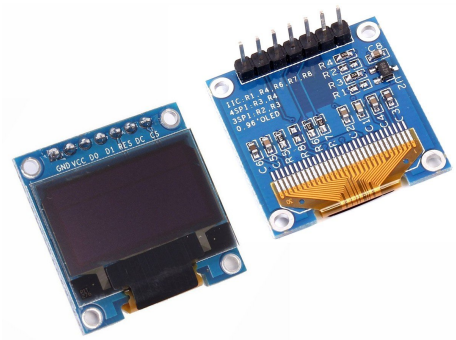


Figure 3.7: OLED DISPLAY

7. Crystal Oscillator(16 MHz)
8. 3D printed robotic arm

Software

Proteus:

Proteus is a powerful tool used worldwide to teach electronics, PCB design and Micro Controller at all levels of education from beginner to degree. It is a software tool set,

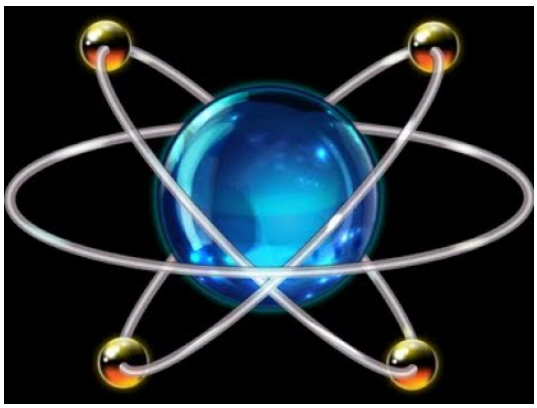


Figure 3.8: ICON OF PROTEUS

mainly used for creating schematics, simulating Electronics Embedded Circuits and designing PCB Layouts. The 8.6.23165 version of Proteus is available as a free download on our software library. The most frequent installation filenames for the software are: ARES.EXE, ISIS.EXE, runas.exe, Proteus.exe and PDS.EXE etc. ".rgn", ".dsn" and ".lyt" are the extensions this PC software can process.

Easy-eda:

EasyEDA is an easier and powerful online PCB design tool that allows electronics engineers, educators, students, makers, and enthusiasts to design and share their projects. Whether you are using Linux, Mac or Windows, it is highly recommended to use Chrome or Firefox as your browser. EasyEDA Has a Free Version for Everyone. Easy

Figure 3.9: ICON OF PROTEUS

to use. If you have used other PCB tools then you can use it even more quickly. Light weight, less resource hungry, smoother experience, speed up your design.

Arduino IDE:

Arduino IDE is an open-source software, designed by Arduino.cc and mainly used for writing, compiling uploading code to almost all Arduino Modules. It is an official Arduino software, making code compilation too easy that even a common person with no prior technical knowledge can get their feet wet with the learning process. It is available for all operating systems i.e. MAC, Windows, Linux and runs on the Java Platform that comes with inbuilt functions and commands that play a vital role in debugging, editing and compiling the code. A range of Arduino modules available including Arduino Uno, Arduino Mega, Arduino Leonardo, Arduino Micro and many more. Each of them contains a microcontroller on the board that is actually programmed and accepts the information in the form of code.

The main code, also known as a sketch, created on the IDE platform will ultimately generate a Hex File which is then transferred and uploaded in the controller on the board. The IDE environment mainly contains two basic parts: Editor and Compiler where former is used for writing the required code and later is used for compiling and uploading the code into the given Arduino Module. This environment supports both C and C++ languages.

3.5 Impact Analysis

Impact of project :

3.5.1 Social Impact

Positive Impact:

1. Using of robotic arm in shops industry help in managing social distance during the case like covid.

2. Robotic arm will replace the human arm and thats why shops or industry require less manpower.

3. Robots never take breaks or disturbed by other things so it will save time.

Negative Impact:

1. Using of robots leading to the reduction of jobs and increase the risk of unemployment.

3.5.2 Enviromental Impact:

Positive Impact:

Robotic arm provide contact free alternative .so it will help keeping safe from virus.

Negative Impact:

Robotic arm will result in consumption of power due to automation.

3.6 Professional Ethics Practices to be followed

1. Transparency:

   There should be a transparent view of how the data is being utilized or sold.

2. Asset protection and assurance:

   Transferring assets from an unprotected to a protected ownership structure

3. Industry standard components must be used.

4. Trustworthiness:

   We seek information that demonstrates the greatest ethical standards, such as honesty, trustworthiness, and moral character.

5. Dedication:

   Dedicated for the whole completion and proper execution of the project.

6. Responsibility:

   Data privacy of Users and protected, robust and safe circuit.

7. Accountability:

   If there is no accountability, the trust of user is failed.

8. Minimal Information Acquisition:

   The data collected should be minimal and requisite for the project.

9. Information Validity:

   Validation of Information updated on the Blockchain is verified using constraints on input data.

Chapter 4

Project Implementation

4.1 Circuit Designing

The tea or coffee serving robotic arm consist of components like a potentiometer, servo-motor, robotic arm, microcontroller, and power supply. The hard plastic material used for making a Robotic arm. With the help of 3D printing the skeleton of the robotic arm is ready.

After that interfacing of all components with the microcontroller is done. So firstly potentiometers interfaced with analog pins of microcontroller Atmega328p ADC0, ADC1, ADC2, ADC3. After that Interfaced motors to the controller pins PD5, PD6, PD7 and PB0 respectively.

After that need to make a power supply to turn on the microcontroller. The project needs a power supply of 5v 2A so giving supply through the adaptor. To protect the controller from oversupply 7805 IC is used. 7805 IC has three pins that interfaced like IN, OUT, GND. For in the Power-jack is Connected and for out Vcc is connected.

In the project, there are push buttons like save, reset, and start/run. So save button inter- faced to controller pin PB2. Reset button interfaced to controller pin PC6. Run button interfaced with PB3.

The OLED is used to display all movements and instruction while pressing buttons. OLED interfaced with pin no ADC4 and ADC5.

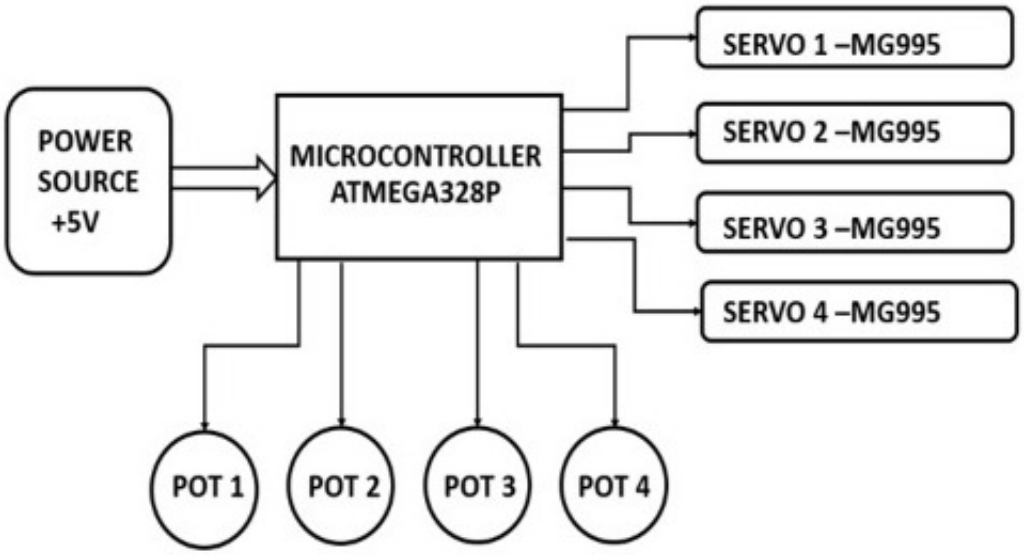


Figure 4.1: BLOCK DIAGRAM

4.2 Simulation

Step by step procedure for proteus simulation:

STEP 1: In step 1, select the device from the display bar by typing the device name (Ex: Logic gates, switches, and basic electronic devices).

STEP 2: Placing the components.

STEP 3: Place component on the drawing area and right-click on the component and select edit properties.

STEP 4: Component reference: This is assigned automatically Component value: Editable

STEP 5: Source selection

STEP 6: Place voltage source (VSOURCE) in the drawing area. Then right-click on VSOURCE, click on edit properties then click on OK.

STEP 7: Wire connection, click on the wire auto-router and connect the component terminal as required by topology.

STEP 8: Adding terminal/Ground: Click on Terminal, Select ground and place

Ground in the drawing area.

There are two types of simulations: Interactive simulation Mostly used for digital signals. Graph-based simulation Mostly used for analog signals.

Then done simulation in proteus. servo motor changed their position according to the varying potentiometer. Saved robotic arms position. By push button it is saved in memory.

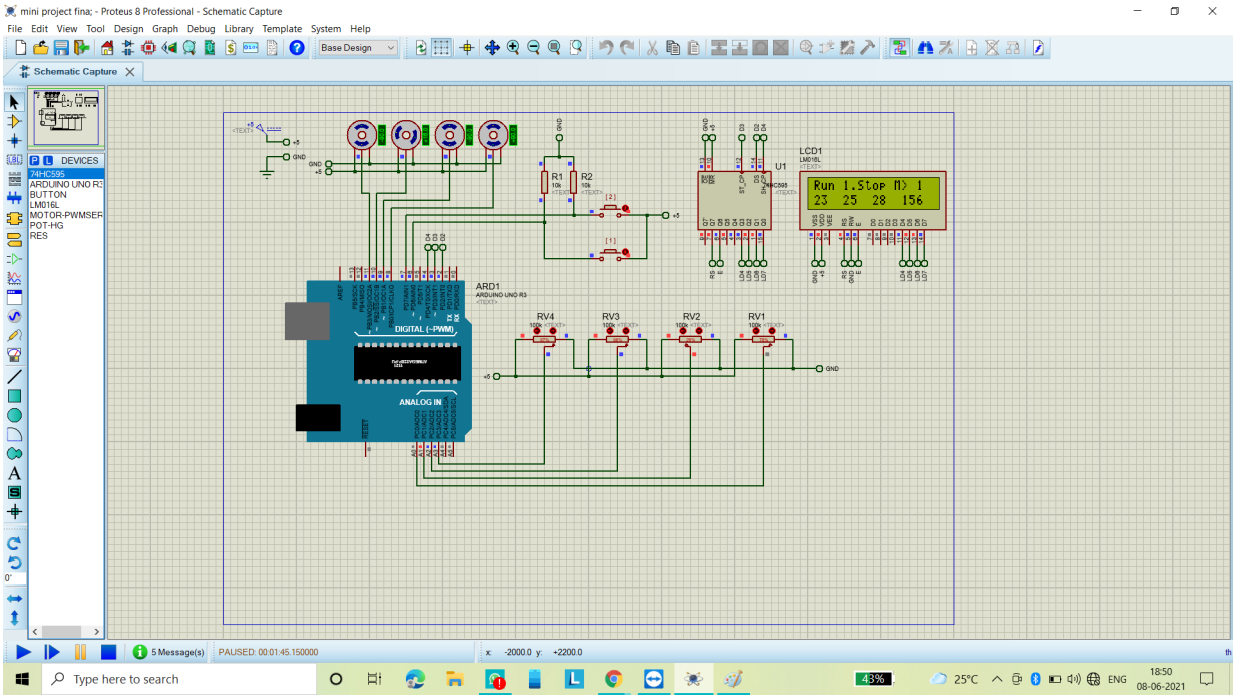


Figure 4.2: SIMULATION DONE ON PROTEUS PHASE I

4.3 PCB designing

For PCB design we used software easyEDA its also online platform for PCB design.

Step by step procedure for proteus simulation:

Step 1: Schematic

Go to easyEDA. com,Create a Account and click new project

Click new schematic

Click Parts (In the Left Tab) and Enter Battery in search and select BATTCON20MM

You can choose Battery Holder based on your choice and Click Place.

Click Parts (In the Left) Tab and Enter Switch in search and select SW-08 and Click

Place.

Click Parts (In the Left Tab) and Enter LED in search and select LED-805 and Click Place.

Press 'W' as connect the component as per the image

Press Ctrl+S to save and Click convert project to PCB (3rd opt after Zoom)

Step 2: Arrange Components

Arrange the components as per the image (Blue lines are called ratsnest) or arrange keeping close to each other(not too close).

Step 3: Autoroute

Click Auto router..(check image)or you can click track in PCB Tool and route of your own and Click Run (You can change the parameter as per requirement). See the image, the red lines connecting components are called Tracks.

You can add Drill Holes(if you require), By Click Hole in PCB Tool.

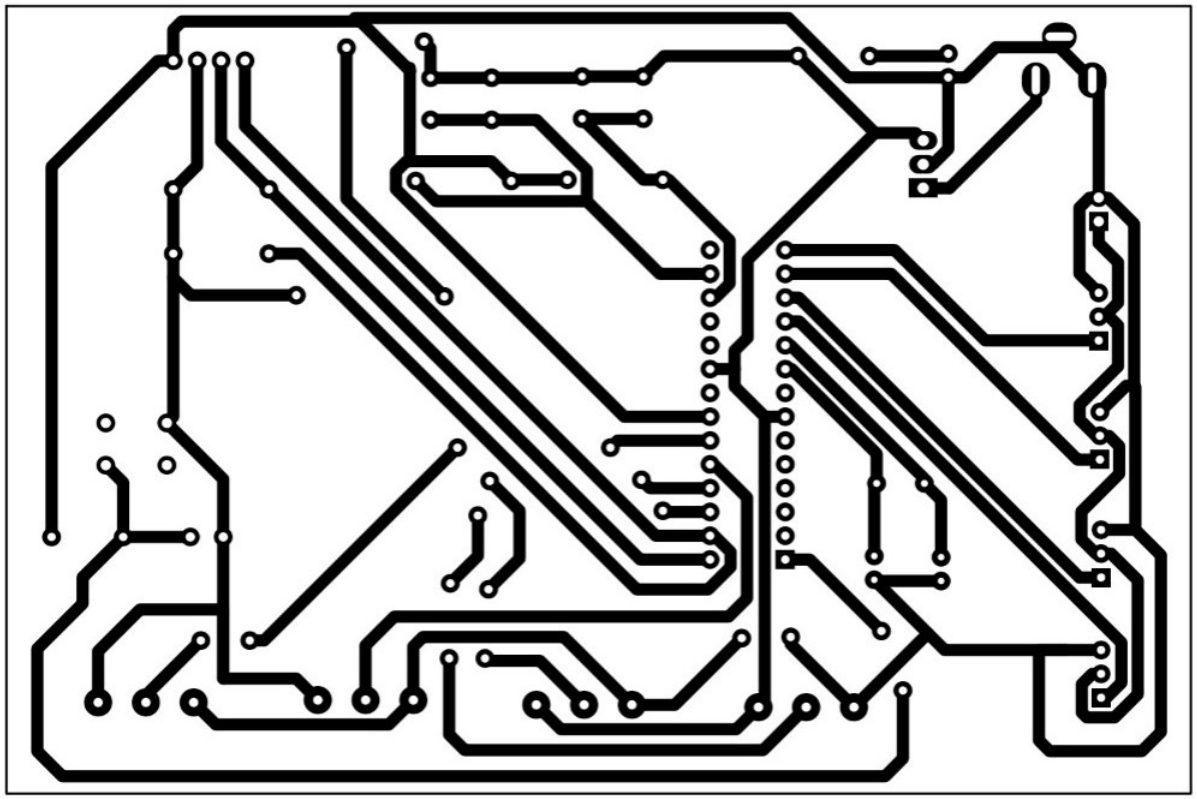


Figure 4.3: PCB LAYOUT

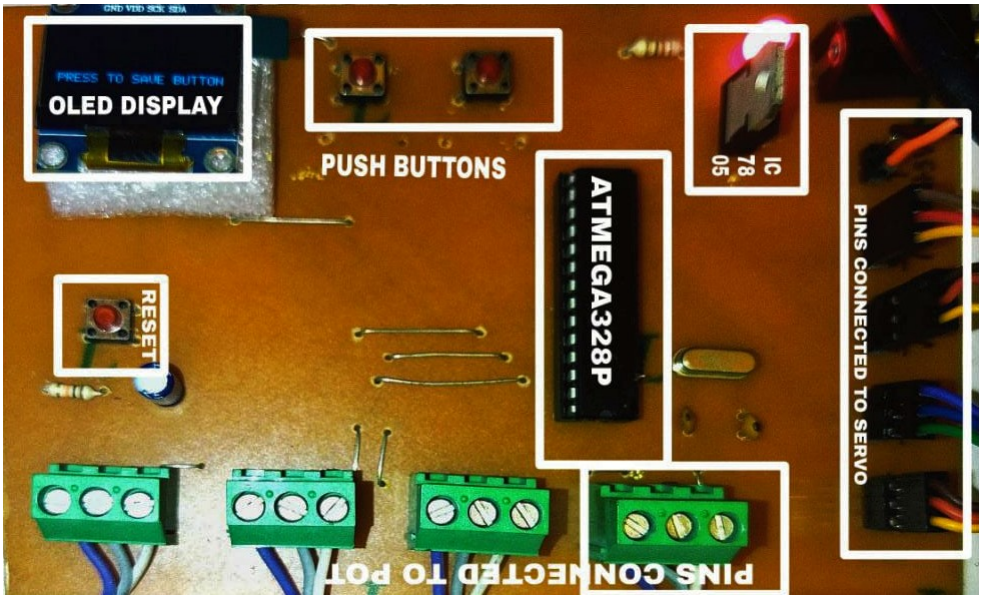


Figure 4.4: COMPONENTS MOUNTED ON PCB BOARD

4.4 Programming

In simulation we operate the motors with a use of variable potentiometer and save the position and it's done by programming.

For programming Arduino IDE is used. Following are the steps to connect a servo motor to the Arduino:

Step1 : The servo motor has a female connector with three pins. The darkest or even black one is usually the ground. Connect this to the Arduino GND.

Step2 : Connect the power cable that in all standards should be red to 5V on the Arduino.

Step1 :Connect the remaining line on the servo connector to a digital pin on the Arduino.

Step3 :Insert library through the command of include ¡Servo.h¿

Step4 : Declare the Servo pins for example int servoPin = 3;

Step5 : Create a servo object

Step6 : We need to attach the servo to the used pin number Step7:If the servo motor is connected on another digital pin, simply change the value of servoPin to the value of the digital pin that has been used.

It is a square wave similar to PWM. Each cycle in the signal lasts for 20 milliseconds and for most of the time, the value is LOW. At the beginning of each cycle, the signal is HIGH for a time between 1 and 2 milliseconds. At 1 millisecond it represents 0 degrees and at 2 milliseconds it represents 180 degrees. In between, it represents the value from 0–180. This is a very good and reliable method. The graphic makes it a little easier to understand.

step8:Code breakdown - The code simply declares the servo object and then initializes the servo by using the servo.attach() function. We shouldn't forget to include the servo library. In the loop(), we set the servo to 0 degrees, wait, then set it to 90, and later to 180 degrees. Remember that using the Servo library automatically disables PWM functionality on PWM pins 9 and 10 on the Arduino UNO and similar boards.

Algorithm:

Step1-Initialize circuit with 5 v supply given to microcontroller.

step2-Signal passed to microcontroller.

Step3-Rotate four potentiometer,it will provided position rotation to arm

Step4-ADC channel covert analog signal to digital signal.

Step5-Digital value given to the servo motor for moving arm.

Step6-These digital value given to the shift register which is connected to display.

Step7-Press the push button to save memory.

Step8-The memory and run status displayed on OLED display.

Step9-Repeat the process.

Flowchart:

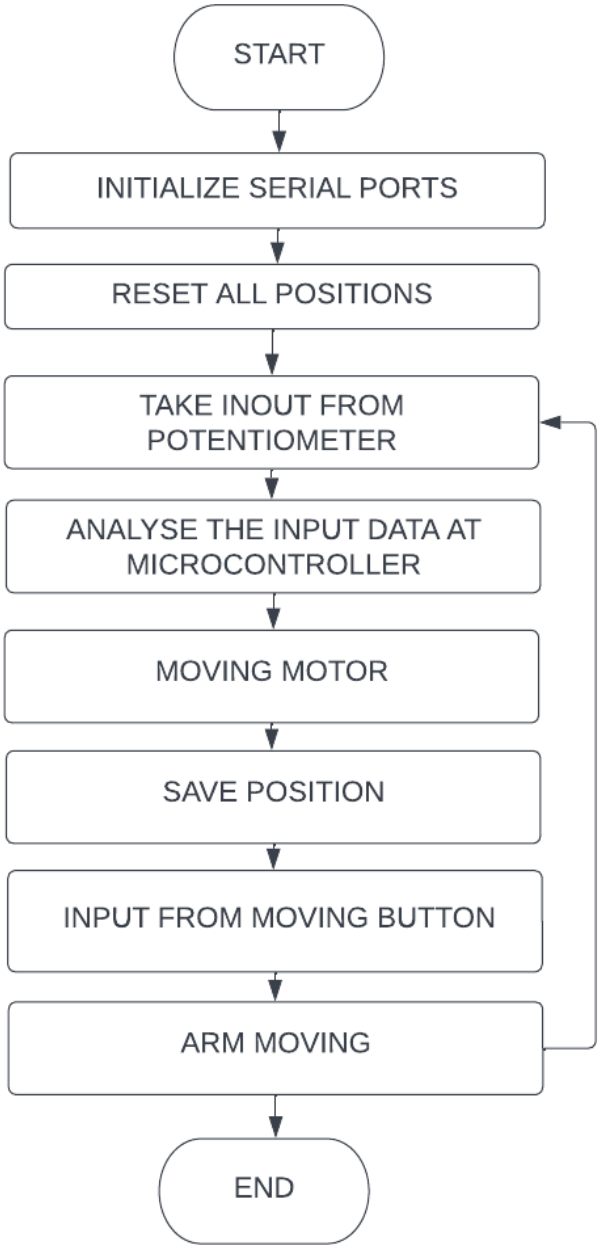


Figure 4.5: FLOWCHART

Chapter 5

Result and Discussion

The working of the robot is based on the pick and place robotic arm. The gripper is used to pick the cup of tea or coffee and put it at the customer position. The robotic arm motions are controlled by potentiometer after saving all position arm moves in saved direction simulteneously.

In the robotic arm servo motors are mounted in every join as shown in figures of result.

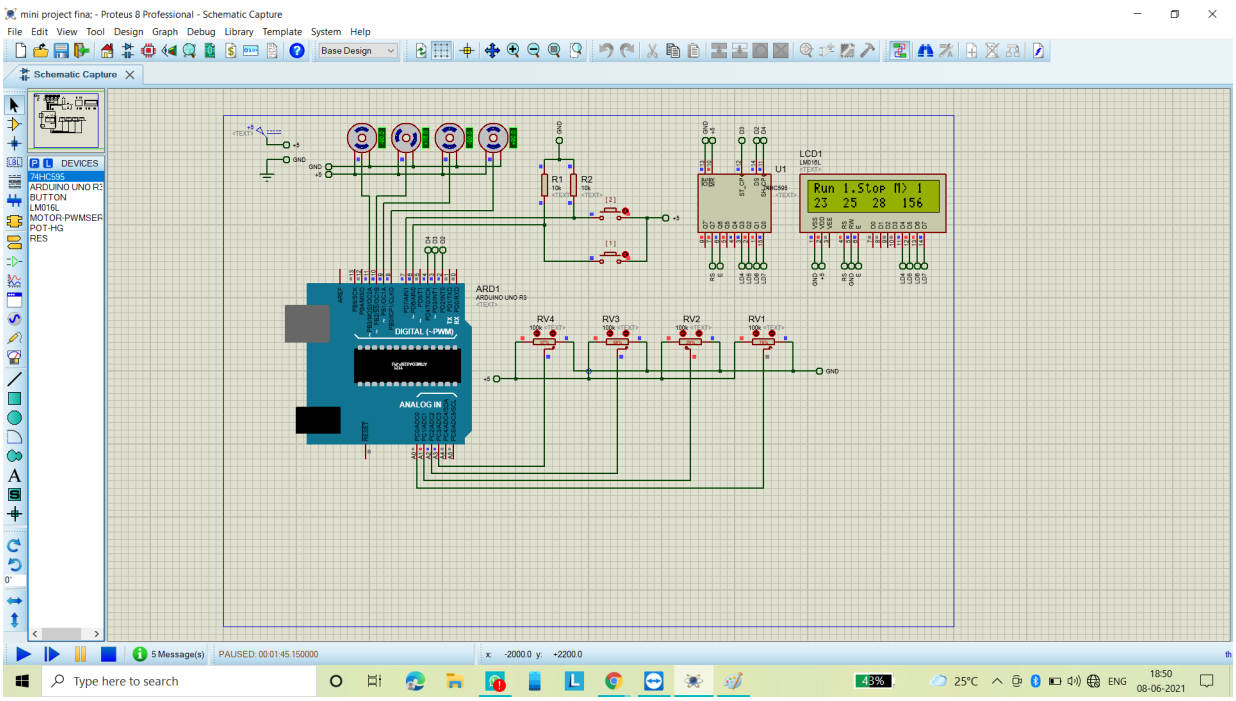


Figure 5.1: The servo motor which is mounted in robotic arm on gripper which moved after simulation phase I.

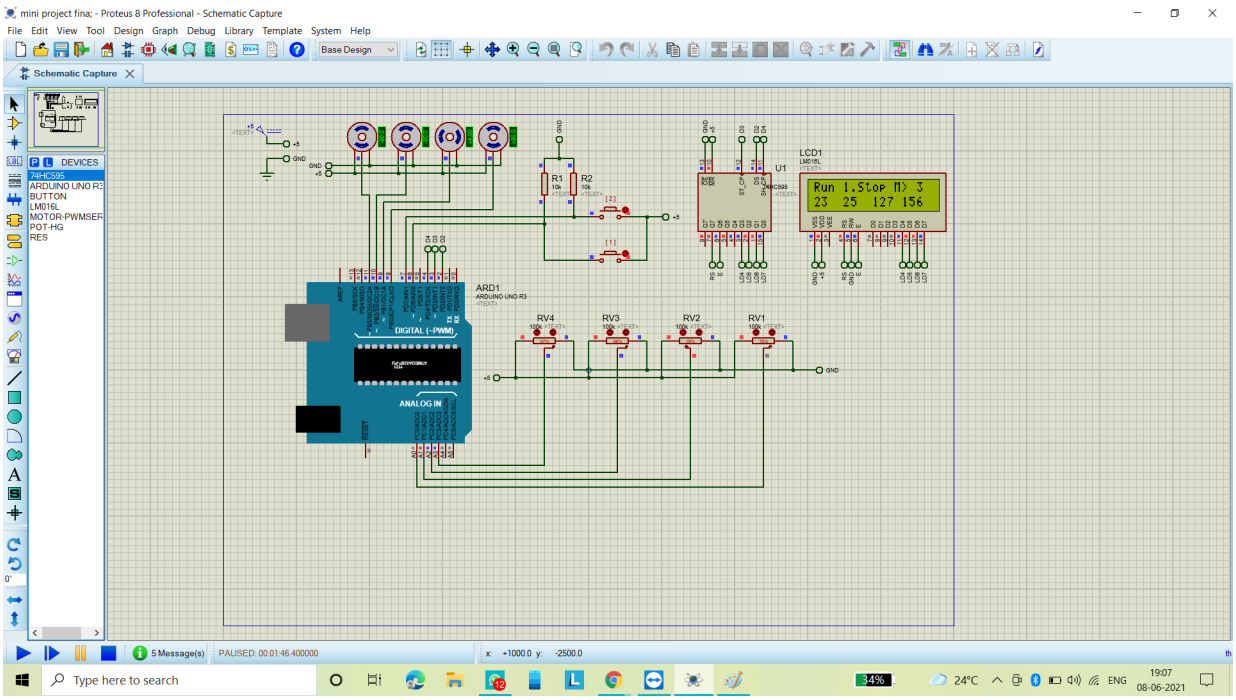


Figure 5.2: The servo motor which is mounted in robotic arm on Wrist which moved after simulation Phase I

Schematic Explaination

Project need power supply of 5v 2A so giving supply through the adaptor. To protect controller from over supply 7805 IC is used.

7805 IC have three pins which are IN ,OUT,GND.The IN pin is connected to power-jack and the OUT pin is connected to vcc.

Three push buttons are used. Pin no 1 is RST(RESET) pin is connected to the push button to reset the positions of servo motors.

Pin no 16 is connected to second push button to save the positions. And third one is connected to pin no 17 to run the positions.

Pin no 9(XTAL1) and 10(XTAL2) is connected to Crystal Oscillator.

Pin no 11(T1 PD5), 12(AIN0 PD6), 13(AIN1 PD7),and 14(PCINT0 PB0) are connected to Motor1, motor2, motor3 and motor4 respectively.

Pin no 23(PC0 ADCO),24(P ADC1), 25(PC2 ADC2) AND 26(PC3 ADC3) are connected to potentiometer1, potentiometer2, potentiometer3, and potentiometer4 respectively. Pin no 27(SDA) and 28(SCL) are connected to OLED.

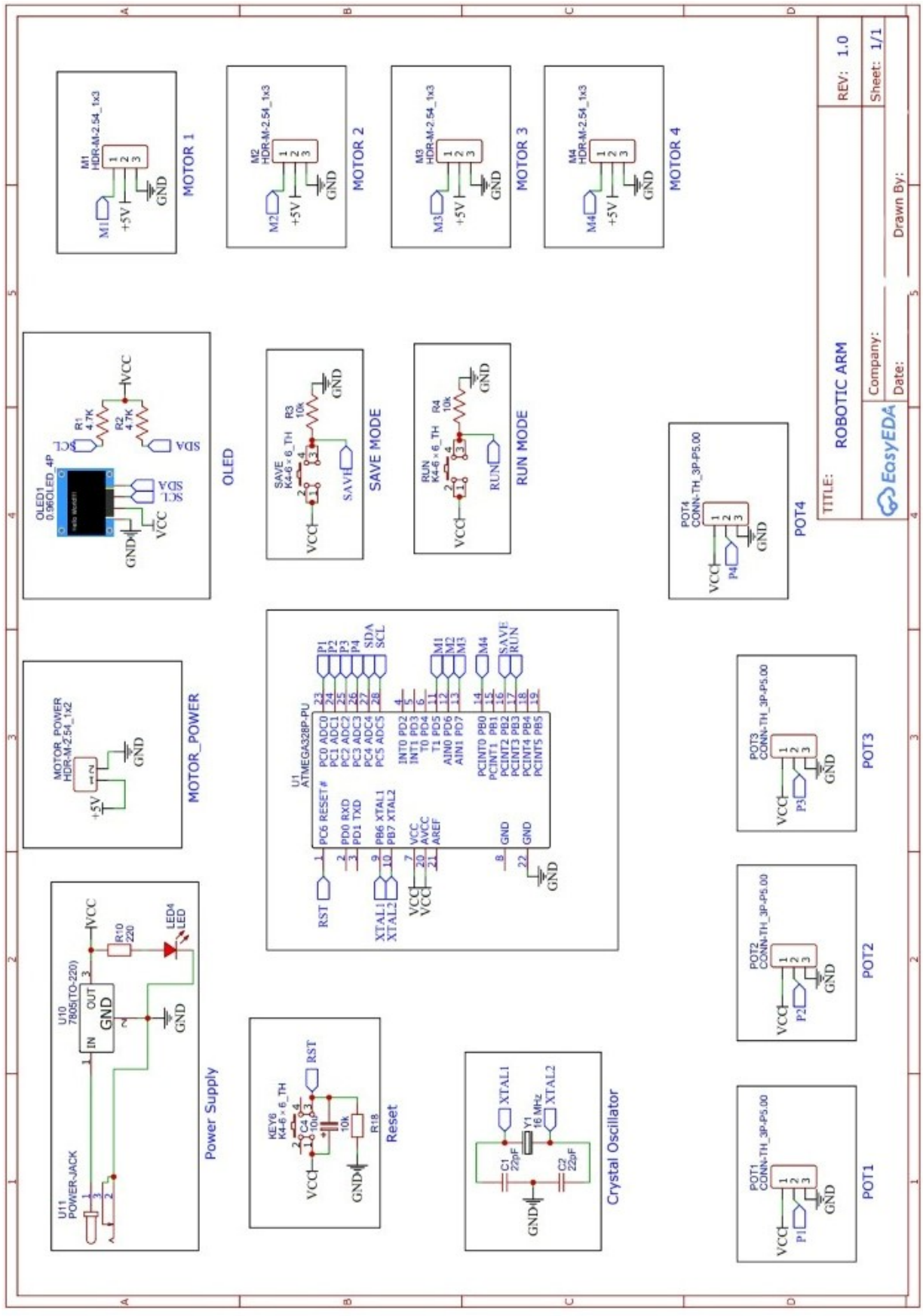


Figure 5.3: SCHEMATIC PHASE II

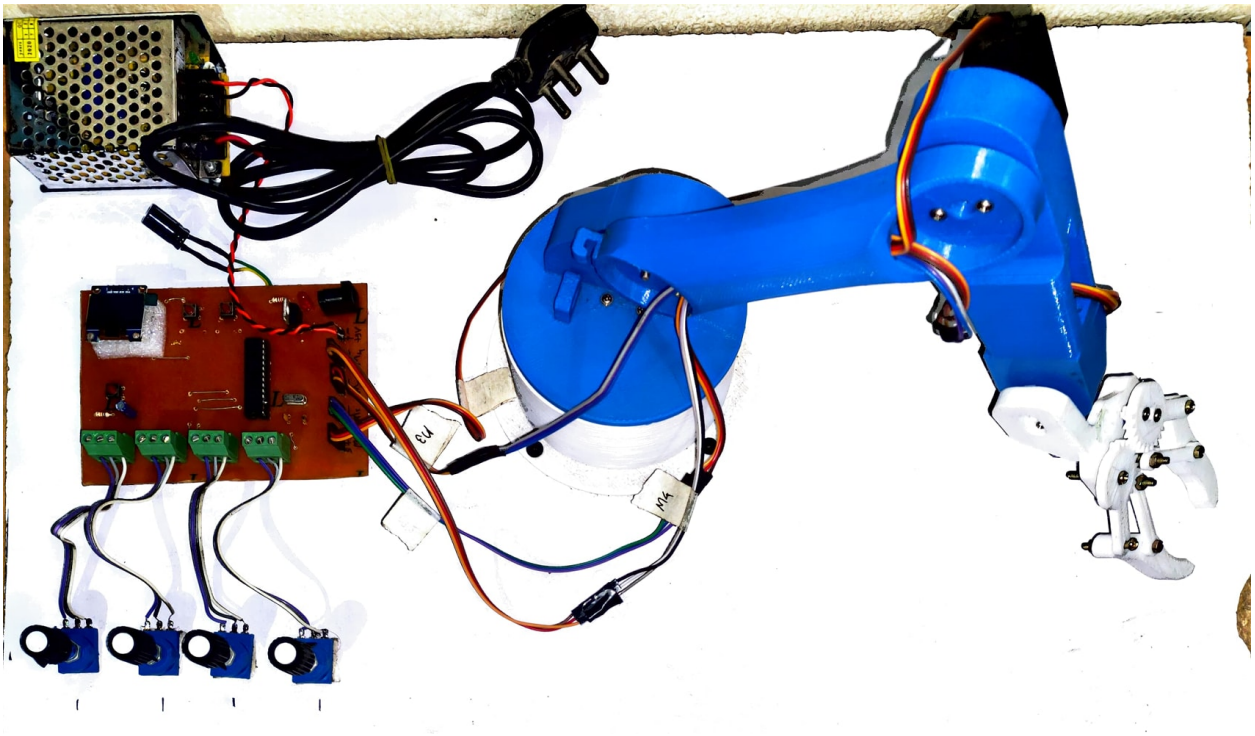


Figure 5.4: PROJECT HARDWARE SETUP PHASE II

Chapter 6

Conclusion and Future Scope

6.1 Conclusion

This project has made a working prototype of the tea/coffee serving robotic arm. The robotic arm used here contains a soft catching gripper, which safely handles the object. In the modern era, time and man power are major constraints for the completion of a task. By the use of product, the industrial activities and hazardous operations can be done easily and safely in a short span of time. From observation it clearly shows that the movement of Robotic arm is very precise, accurate, easy to control and user friendly to use. It is inexpensive and the cost of building of robot is low. Hence this robots can be installed in any cafe/industry/shops.

6.2 Future Scope

Robotic arm has a huge scope of improvement in the future where the palms can be able to carry out every undertaking as human beings . Creativeness is the limit for its destiny applications. It could be a real boon for handicapped people, who're paralyzed or misplaced their fingers in some accident. The arm may be skilled to listen to the command from a human and perform that challenge. A unique gesture managed machine is likewise possible. Wearable devices may be used to send the command and manage the moves of the arm. Brain command Interface (BCI) is an

emerging subject of studies. BCI may be used to accumulate alerts from the human brain and manipulate the arm. The gadget can work inside the identical manner as human arm. Someone who may also have misplaced his hand in any accident can resume his lifestyles like previous with the aid of such synthetic palms. Robot palms are versatile and have huge ways of implementations.

References

[1] Harish K , Megha D , Shuklambari M , Amit K ,Chaitanya K Jambotkar.,"Pick and Place Robotic Using Arduino".

[2] Dr. Bindu A Thomas, Stafford Michahial, Shreeraksha.P, Vijayashri B Nagvi, Suresh M,"Industry Based Automatic Robotic Arm".

[3] Er. R.K.Rajput, "Robotics and Industrial Automation", *S. Chand Publications*, 2014.

[4] B.O. Omijeh, "Design Analysis of a Remote Controlled "Pick and Place" Robotic Vehicle".

[5] Mohd Ashiq Kamaril Yusoffa, Reza Ezuan Saminb, Babul Salam Kader Ibrahimc, "Wireless Mobile Robotic Arm", *International Symposium on Robotics and Intelligent Sensors 2012 (IRIS 2012)*, 1072 – 1078.

[6] Nikesh. R. Vange, Atul .V. Nar, Dhananjay .B. Surve, Anita. P. Trimukhe, Manisha .M. Patil, Rajesh .A. Patil, "Object Sorting Robotic Arm Based on Color Sensing Mechanism ",*International Journal of Emerging Technology and Advanced Engineering*, Volume 5, Issue 5, May 2015.

[7] ArkaSain, JanardanDattani and Dhara M Mehta, "Design and Implementation of Wireless Control of Pick and Place Robot Arm", *International Journal of Advanced Research in Engineering and Technology (IJARET)*, Volume 9, Issue 3, May – June 2018.

[8] M.J.Sawarkar, TruptiR.Raut, Nutan P. Nemad, Sonal C. Meshram, Pournima P. Tabhane, "Pick and Place Robotic Arm Using Android Device", *International Research Journal of Engineering and Technology (IRJET)*, Volume: 04, Issue: 03, Mar-2017.

[9] Muhammed Jabir.N.K, Neetha John, Muhammed Fayas,Midhun Mohan, Midhun-Sajeev, Safwan.C.N, "Wireless Control of Pick and Place Robotic Arm Using an Android Application", *International Journel of Advanced Research in Electrical, Electronics and instrumentation Engineering*, Volume 4, Issue 4, April 2015.

[10] BabuGanesh. K, Hari Shankar.K, KolanchiMani.V, Thennarasu.S, Ramu.S, "Android Controlled Robotic Arm Vehicle",*Advances in Natural and Applied Sciences*, e-ISSN: 1998-1090, 2017 February 11.

[11] M.T. Islam, M.A. Wazed and T.Mohammad, "Design and Fabrication of a 5 DOF Dexterous Robotic Arm for Industrial Tasks", *International Conference on Mechanical Engineering 2007*, 29-31 December 2007.

[12] N.Rishikanth, Dr. J. Suresh Kumar, Dr.A.Srinath, "Design and Analysis of Intelligent Robotic Arm",*International Journal of Scientific Engineering Research Volume 8*, Issue 12, December-2017 ISSN 2229-5518.

[13] A shly baby, Chinnu Augustine, ChinnuThampi, Maria George, Abhilash A P and Philip C Jose, "Pick and Place Robotic Arm Implementation Using Arduino", *IOSR Journal of Electrical and Electronics Engineering (IOSR-JEEE)*, Volume 12, Issue 2 Ver. III (Mar.-Apr. 2017)

[14] Priyambada Mishra, Riki Patel, TrushitUpadhyaya and Arpan Desai, "Development of Robotic Arm Using Arduino UNO", *International Journal on Recent Researches In Science, Engineering Technology*, Volume 5, Issue 5, May 2017

[15] RavikumarMourya, Amit Shelke, SourahSatpute, Sushant Kakade, Manoj Botre, "Design and Implementation of Pick and Place Robotic Arm",*International Jour-*

nal of Recent Research in Civil and Mechanical Engineering (URRCME), Volume 2, Issue 1, April-September 2015.

[16] VighneshDevgirkar, Akash Sharma, AbhijeetChavan, Pratik Dhobi, Boomika Shukla, "Design and Manufacturing of Pick and Place Robotic Arm",*International Journal of Advance Engineering and Research Development*, Volume 4, Issue 4, April 2017.

[17] Khin Moe Myint, Zaw Min MinHtu, HlaMyoTun, "Position Control Method for Pick and Place Robot Arm for Object Sorting System",*International Journal of Scientific Technology Research*, Volume 5,Issue 06, June 2016.

[18] Mo Mo Aung, Saw Aung NyeinOo, "Design and Implementation of Trainable Robotic Arm", *International Journal of Science, Engineering and Technology Research (IJSETR)*, Volume 7, Issue 2, February 2018.

[19] Wai Mar Myint, Theingi, "Kinematic Control of Pick ad Place Robot Arm",*International Journal of Engineering and Techniques*, Volume 1, Issue 4, July-Aug 2015.

[20] Harish K , Megha D, Shuklambari M , Amit K , Chaitanya K Jambotkar, "Pick and Place Robotic Arm Using Arduino ",*International Journal of Science, Engineering and Technology Research (IJSETR)*, Volume 6, Issue 12, December 2017.

[21] Manjula VS and KaramagiRI,"Automatic Pick and Place Robot Manipulation Using a Microcontroller",*Journal of Applied Computational Mathematics*,ISSN: 2168-9679

[22] Dr.P.Gomathi, S.Baskar, "Design and Implementation of Pick and Place Robot Using Arduino for Smart Grid Monitoring". *International Journal of Advanced Information Science and Technology (IJAIST)*, Vol.6, No.9, September 2017