D. Y. PATIL COLLEGE OF

ENGINEERINF AND TECHNOLOGY

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(AN AUTONOMOUS INSTITUTE)

ELECTRONICS AND TELECOMMUNICATION ENGINEERING

ARDUINO BASED ROBOT ARM WITH

SMARTPHONE CONTROL.

PROJECT REPORT

PROJECT **REPORT** SUBMITTED TO THE DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION FOR THE SUBJECT MINI PROJECT.

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ABSTRACT

With the advancement of technology and innovation at its peak, fabrication of systems and designs akin to human skills are increasingly integrated into working task to cater the rapid surge of human needs. Such innovations are made with the hopes of making people's live easier. This paper concentrates on the development of a robotic arm which is functional to do a pick and place operation and controlled by using a mobile application via Android phone. Designed to work on predetermined commands, the robot arm has the ability to move in a 4 axis direction; upward, downward, left and right direction at a specified angle with 6 servo motors and according to the mobile app specifications. Designed and realized, the robotic arm control is through the use of a mobile application, via Bluetooth module, that has been programmed through Arduino UNO microcontroller.

INTRODUCTION

In the industrial world, automation is one of the most important elements for development. It avails to reduce the need for humans by creating additional help systems that can increase efficiency and productivity. The field of automation manufactures and fabricate sophisticated equipment's which are used daily for people who needed auxiliary machines in place where their strength was not enough. These machines, which are operated with the need for human assistance in advance, have been made to operate spontaneously without the need of human power with the progress of technology (Safdar, 2015). And one of the most widely used components of automation systems is robots, and the most common type in the market is the robotic arm which is commonly used in industrial purposes.

A robotic arm is a mechanical model arm, usually programmable, with similar functions to a human arm. It is connected by joints allowing either rotational motion (such as in a articulated robot) or linear displacement (Rajashekar et al.,2012). Akin to the purpose of a human arm, robotic arms are designed to fulfill tasks determined in a controlled environment in accordance with predetermined commands.

With technology advancing and the rapid increase in the flow of information, people are now guided to search different markets that caters with the rapidly increasing human needs and people have then entered the competition to manufacture quality products cheaply.In the project, Arduino UNO Microcontroller written in c+ + language is programmed and servo motor control is provided. Thus, it is possible to perform the

desired operations by means of the elements located on the Arduino without any circuit construction other than the circuit where the servo motor inputs are located. For the mechanical part, the robot arm is drawn with the SolidWorks program and the dimensions of the robot arm are specified. A 5V power supply is also preferred for the robot to work.

Components required

Components	costs
MG996R Servo Motor -3	850
SG90 Micro Servo Motor -3	250
HC-05 Bluetooth Module	369
Arduino Board	700
5V 2A DC Power Supply	200
total	2369(rupees)

3-D printer was provided by our department itself for printing all the 3-D components.

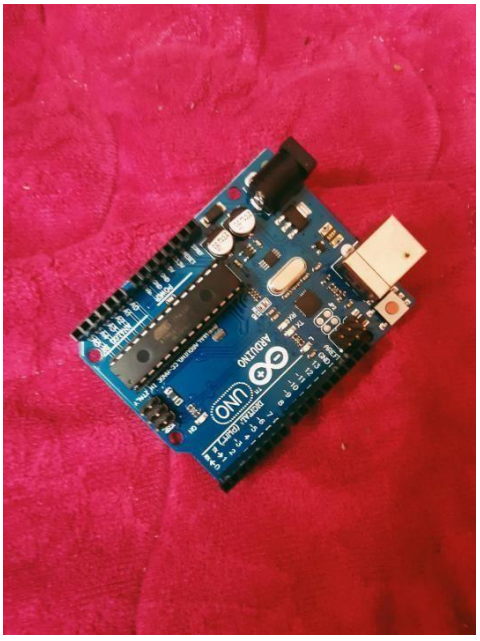
Approximate cost for this project is goes to 2369 Rupees.

THEORETICAL INFRASTRUCTURE

The theoretical background of the project is examined below as main headings and subheadings.

Arduino UNO Microcontroller

Arduino UNO is an open-source microcontroller word based on the microchip ATmega328P microcontroller and developed by Arduino cc. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. The microcontroller was introduced in the electronics industry with the intention of making tasks easy. It is based on arduino's past wiring and processing `projects. Processing is written for nonprogramming users. Arduino wiring is produced on the basis of programming language.



Arduino UNO Microcontroller use

HC- 05 Bluetooth Module

This is a module which can add two-way wireless functionality to your projects. It is used to communicate between microcontrollers or communicate with any device with Bluetooth functionality. This is considered as the perfect choice if you are looking for a wireless module that could transfer data from your computer or mobile phone to a microcontroller or vice versa.

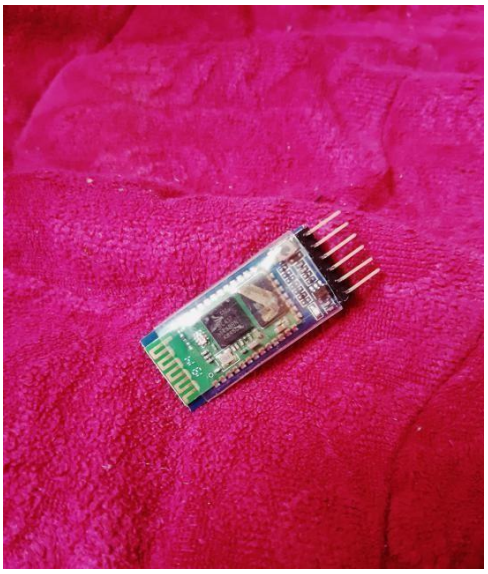


Figure4. HC- 05 Bluetooth Module

2.1. Circuit Diagram (Above Board)

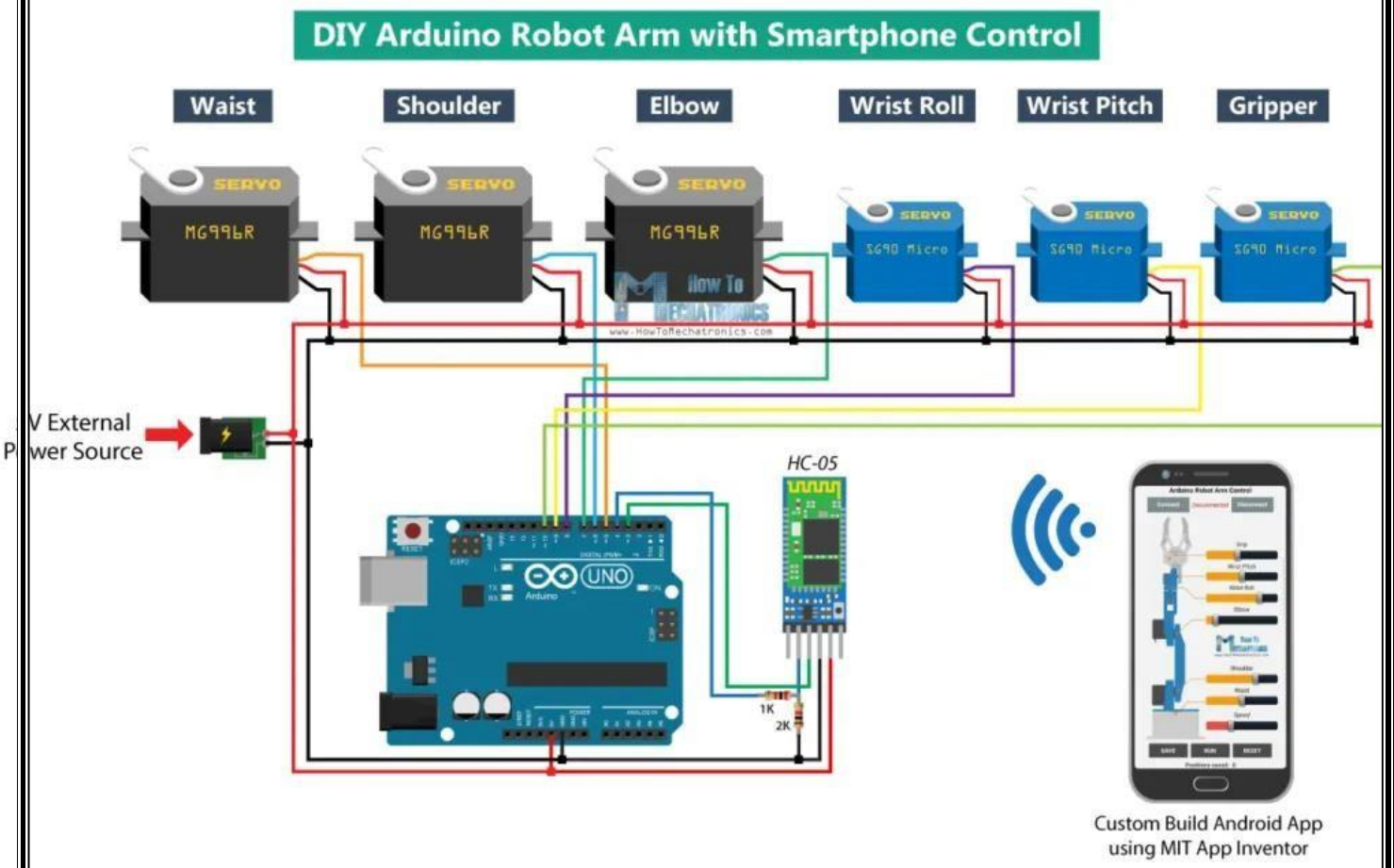


Figure5. Cicuit

2.2. Power

A power supply takes the AC from the AC source then produces a DC output of 2A and 5V. The power supply chosen to supply the servomotors' control circuit is capable of supplying the same current even though all though all the synchronous servomotors are working.

BLOCK DIAGRAM

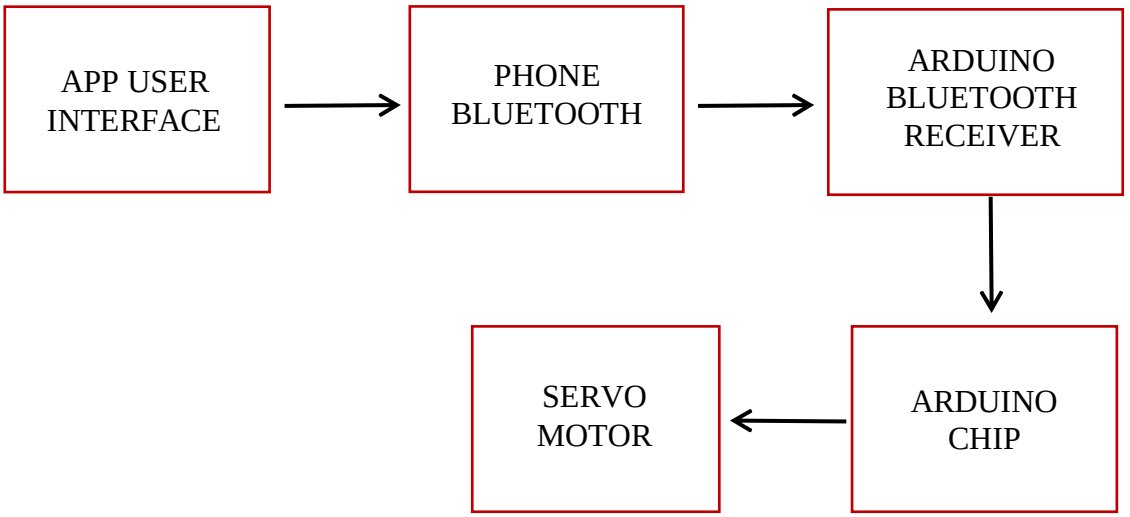


Figure6. Block diagram of robot arm using Arduino

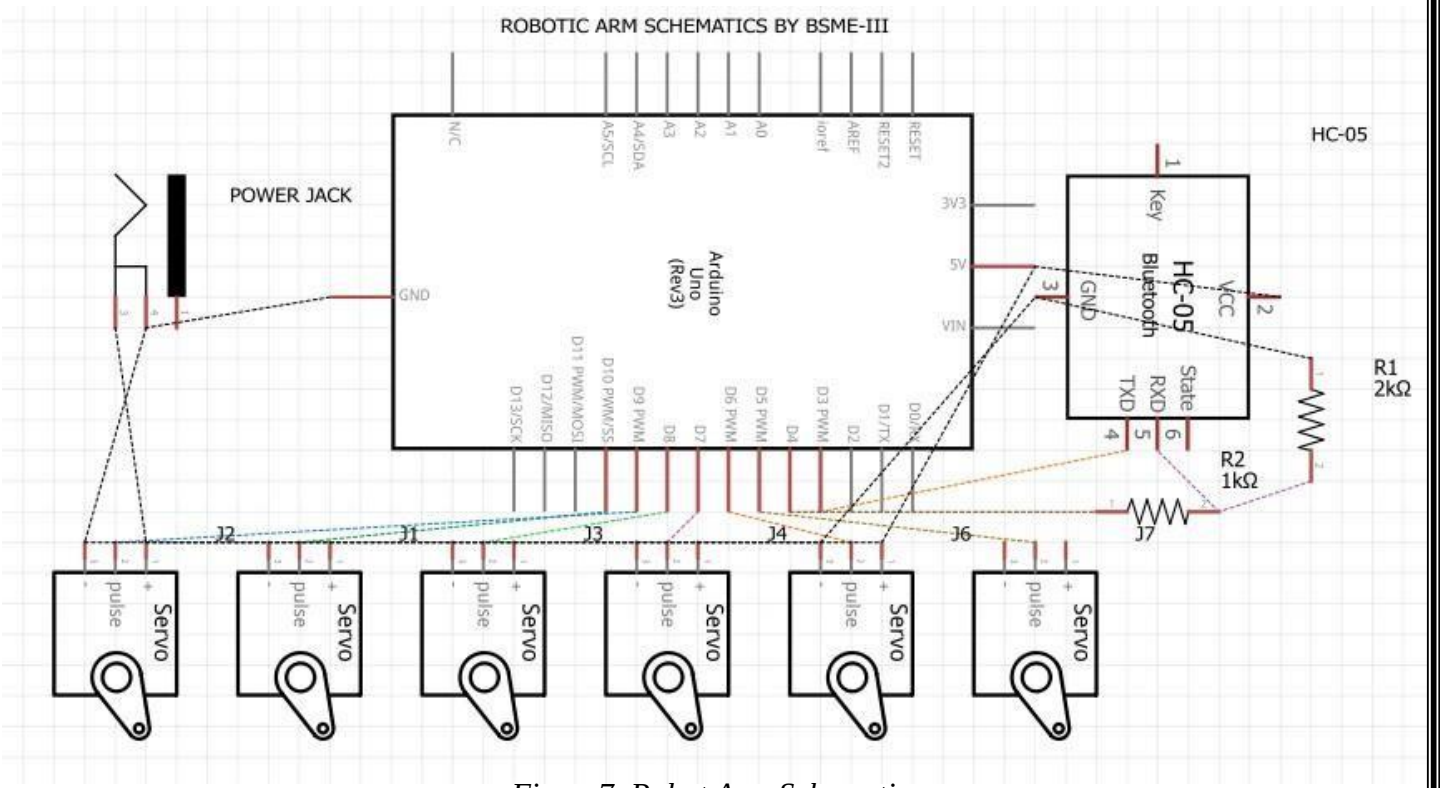


Figure7. Robot Arm Schematic

ROBOT ARM DESIGN

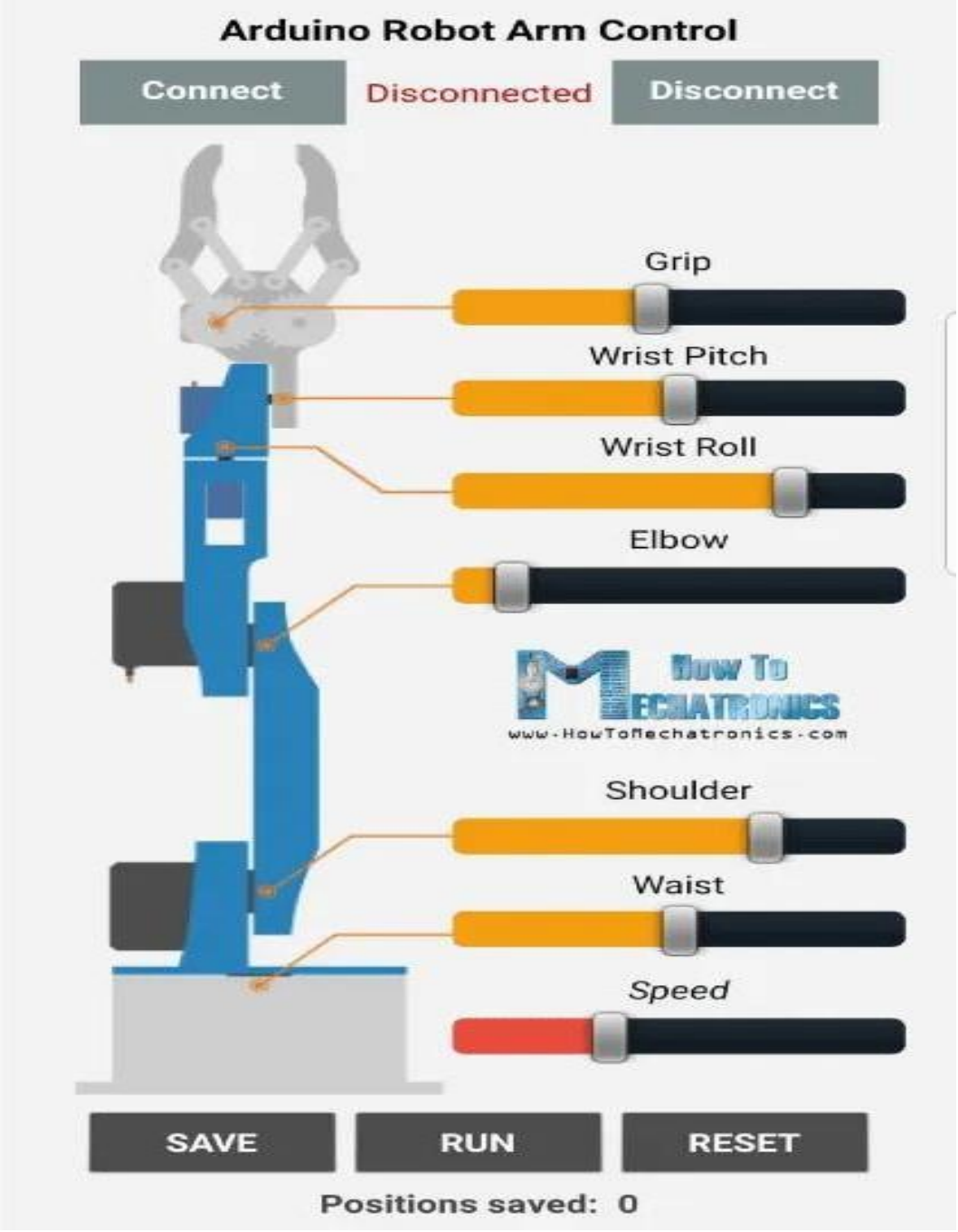
The robot arm design is divided into two parts, the mechanical design parts and mechanical installation. In this project, the hardware and software function are combined to make the system reliable.

4.1. Mechanical Design

Materials needed for the mechanical part of the robot arm were supplied, and were drawn on SolidWorks in IPS unit form. The Robot Arm will have 5 outputs which consist of the base, grip, wrist, elbow, shoulder and waist. The robot has a combination of a round and rectangular base capable of housing the Arduino UNO microcontroller and the body of the robot arm. Chipboard 20 pt was used as the main material for the construction of the robot arm because it is easy to be formed, cheap and can bear the motor weight and movement. The robot degree- of- freedom mechanism is powered by two different type of servo motors. The robot gripper is also made of plastic filament.

Design of the Android Application

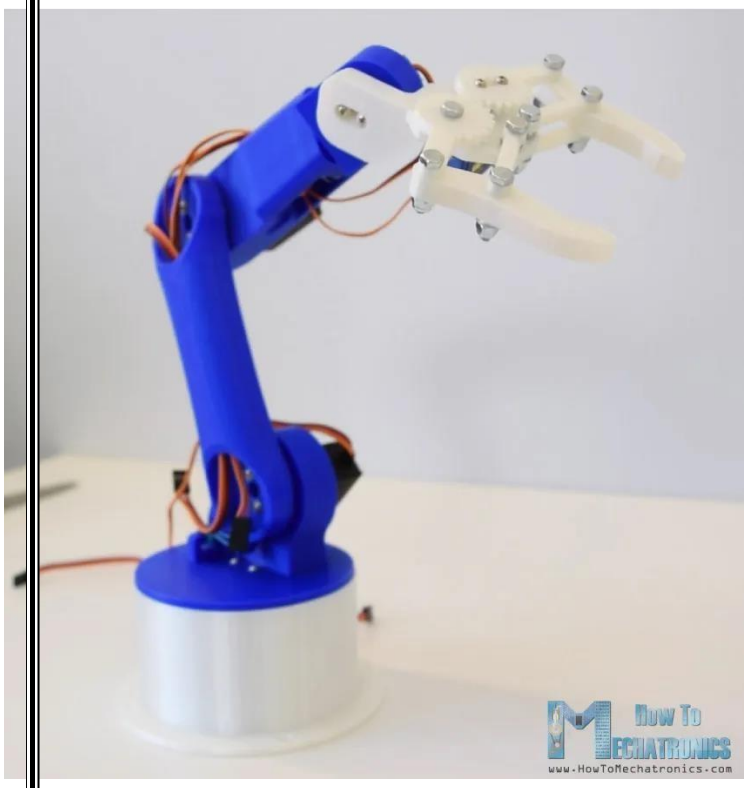
(c)



Projected Method

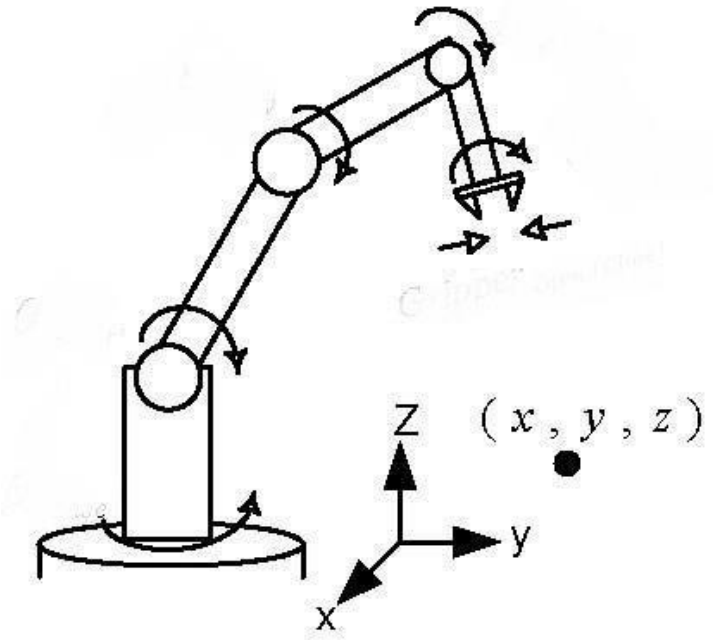
A research on possible designs and basic information about the robotic arm was initially made. Using Solidworks – a software used for planning, visual ideation, and feasibility assessment, in finalizing the design. Using 6 servo motors, the robotic arm could move in different directions and could hold or release things with its gripper. For the optimal control of the robotic arm, the microcontroller Arduino UNO is used. This microcontroller was preferably used since it is low cost and good for beginners especially in writing the program. The program code was written in c+ + language which is one of the most popular and fundamental programming languages. We also created a mobile application that will be connected to the microcontroller Arduino UNO via Bluetooth module. Controlling the robotic arm will be possible by using the mobile application.

Designing of Robot Arm



Operational of Robot Arm

The workplace of the robot arm is illustrated in Figure. For this project the robot arm has 5-DOF



No.	Servo Part	Maximum Angle(°)
1	Waist	180
2	Shoulder	60
3	Elbow	85
4	Wrist Roll	180
5	Wrist Pitch	180
6	Grip	90

RECOMMENDATION

The result of the tests indicates the inability of the servo to perform complex operations due to certain limiting factors. Successful benchmarks during pre-assembly show that the communication between the robotic arm and the smartphone is without issue. It is, however, failing when it comes to post-assembly tests due to the underpowered servo motor. To increase the performance, a torque not less than that of a 1501MG servo motor is recommended. Reducing the prototype's density may also improve the overall usability. PLA (Polylactic acid) is a material with excellent rigidity to weight ratio and can be manufactured easily with 3-D printing. Saving operations greater than five directions may also pose a problem to the Arduino board. Although the code only occupies 60 percent, simultaneous procedures prove to be too taxing for the processor. Continuous operating modules like the HC-05 also adds to the performance losses of the CPU. As such, an Arduino Mega is recommended since it also offers more serial UART and a faster processor than the UNO R3.