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DESIGNING AND ANALYZING A ROBOTIC ARM

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ABSTRACT
The industry is transitioning from automation to robotics in order to boost output and provide consistent quality. Even while all research is focused on giving industrial robots of today more and more anthropomorphic and humanlike qualities as well as superhuman skills, these machines may not even remotely resemble humans. A robotic manipulator, often known as a robotic arm, is a prominent form of robot utilized in industry.
It is an open or closed system that is any man-made machine that can carry out tasks or other actions typically carried out by humans, either automatically or through remote control. Because robots are so accurate and can perform tasks that humans cannot, they are becoming increasingly common. In addition, because robots can operate in hazardous environments where humans cannot, they have become so popular that scientists are still working to improve them. In our project, we have created a four-degree-of-freedom robot arm. Actually, a number of techniques were used to enable pick-and-place operations to be carried out by a 4-DOF manipulator. A Pneumatics chain with moveable joints connecting stiff links. Links in some configurations may be thought to match the anatomy of the human waist, upper arm, and forearm, as well as the joints at the elbow and shoulder. End effectors, which could be a tool and its fixture, a gripper, or any other device to function, is connected to the arm at the wrist joint.

Keywords:
smart farming, Artificial intelligence, Internet of Things, sensors.

1. INTRODUCTION
A robot is a machine designed to execute one or more tasks automatically with speed and precision. We need robots because robots are often cheaper to use than humans, in addition it is easier to do some jobs using robots and sometimes the only possible way to accomplish some tasks! Robots can explore inside gas tanks, inside volcanoes, travel the surface of Mars or other places too dangerous for humans to go where extreme temperatures or contaminated environments exist. Mechanical, electrical, and computer science are just a few of the disciplines that make up the multidisciplinary field of robotics engineering and science. In addition to computer systems for control, information processing, and sensory input, robotics deals with the design, manufacture, use, and operation of robots.
. Robotic systems have been widely used in manufacturing, military and surgery since robots can perform many advantages and are used as the countermeasure for some job that cannot be conducted by the human excellently. [1]. Robots are employed in a variety of industries, including the military, aerospace industry, and medical. These robots, which could be categorized as manipulator robots, work in tandem with other automated or semi-automated machinery components to do a variety of activities, including welding, loading, unloading, spray painting, and assembly.

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HARDWARE DESCRIPTION

Electronic circuit: Figure 2 depicts the arm robot's electronic circuit.1. After the person faces the Kinect, the processing program splits the person's body into joints and transmits the angle of each joint to the Arduino. To apply the necessary movements, the servos receive control signals from the Arduino Mega that indicate the angles.

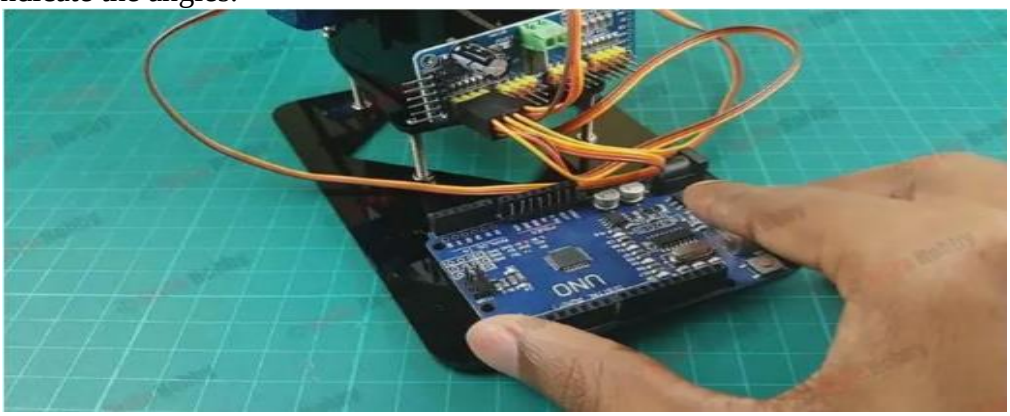

Figure (2.1): The robot arm electronic circuit

Arduino Mega Board

In recent years, Arduino has gained enormous popularity worldwide. The Arduino Mega is utilized in this project to interface with the processing and manage the servos of the arm robot. The following factors have contributed to Arduino's quick spread: 1) Because of the ease of use of the driver in the development environment, it is compatible with all systems. 2) The sophisticated library makes it simple to solve even the most difficult tasks. 3) A wide range of hardware is available that is compatible with Arduino and can function in tandem with it. 4) Because it is open source, communication with the environment is simple. Figure 2.2 depicts the construction of the Arduino Mega.

Figure (2.2): Arduino Mega development board

Servo motor:

The kind of motors that can carry out our desired commands are called servo motors. Even at extremely small or extremely large speeds, they can function consistently. The compact size of these motors allows for the enormous moment to be obtained. Servomotors are primarily geared dc motors with a positional feedback control that enables precise positioning of the rotor (shaft). One pulse with a configurable width serves as the position control signal. There is a range of 1 to 2 ms for the pulse. The servo motor shaft's position is controlled by the pulse width.

The shaft rotates to the extreme counter clockwise (CCW) position (-45') in a 1-ms pulse. The shaft is in the neutral middle position (0') after a 1.5 ms pulse. The shaft rotates to the extreme clockwise (CW) position (+45') in a 2-ms pulse. The servomotor receives the pulse width signal about 50 times per second (50Hz). The link between pulse width and servomotor position is seen in the figure below. [6].

Figure (2.3): Servo motor

MECHANICAL DESIGN-

Strong understanding in a variety of areas, including mathematics, engineering mechanics, strength of materials, theory of machines, and engineering drawing, is essential when developing machine components. Machines are always the same; they consist of a series of linkages, gears, belts, and other mechanics that allow us to put together a whole mechanism to carry out a certain duty.

3.1 THE MECHANICAL DESIGN OF ROBOTIC ARMS

Determining the dimensions and workspace arrangement in accordance with the requirements is the first stage in the robot design process. Selecting each actuator's specifications is the next stage. The robot's base, or lower portion, is where the arm is fastened. It is noteworthy to emphasize that in order to keep the robot balanced while it grasps an object, the base must be significantly heavy. Servo motors are used to move the robot physically, despite the excellent notion of employing stepper and gear motors.

The servos have the benefit of being programmable to return to their starting positions. The servo motors can be programmed to meet specific requirements because they function based on signals obtained from the microcontroller. Figure 3.1 shows the schematic of our robot arm and its coordinates before it is built.

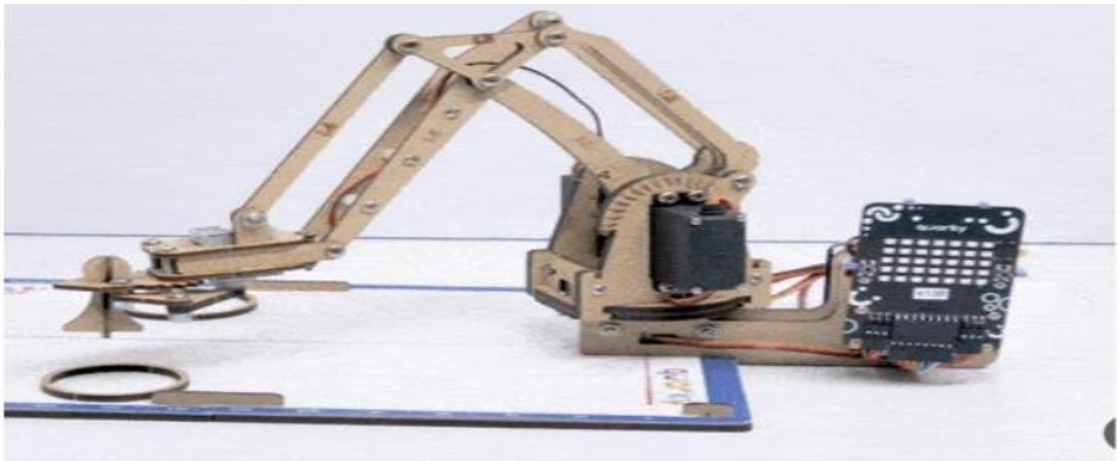

Figure (3.1): Robot arm diagram

The study's robot is a stationary articulated robotic arm with four degrees of freedom (DOF), comprising two revolute joints (wrist, base) and the bases, shoulders, elbows, and gripper. Building the 4-servo motor controller should come before building the robotic arm. We put together a servo motor bracket to test its functionality before integrating the parts into a robotic arm.

PROCESSING CODE

```
#include<Wire.h>
#include<Adafruit_PWMServoDriver.h>

Adafruit_PWMServoDriversrituhobby=Adafruit_PWMServoDriver();

#define servo1 0
#define servo2 1
#define servo3 2
#define servo4 3

voidsetup(){
Serial.begin(9600);
srituhobby.begin();
srituhobby.setPWMFreq(60);
srituhobby.setPWM(servo1,0,330);
srituhobby.setPWM(servo2,0,150);
srituhobby.setPWM(servo3,0,300);
srituhobby.setPWM(servo4,0,410);
delay(3000);
}
voidloop(){

for(int S1value =330; S1value >=250; S1value--){
srituhobby.setPWM(servo1,0, S1value);
delay(10);
}

for(int S2value =150; S2value <=380; S2value++){
srituhobby.setPWM(servo2,0, S2value);
delay(10);
}

for(int S3value =300; S3value <=380; S3value++){
srituhobby.setPWM(servo3,0, S3value);
delay(10);
}

for(int S4value =410; S4value <=510; S4value++){
srituhobby.setPWM(servo4,0, S4value);
delay(10);
}
//////////////////////
delay(2000);
for(int S4value =510; S4value >410; S4value--){
```

```
srituhobby.setPWM(servo4,0, S4value);
delay(10);
}

for(int S3value =380; S3value >300; S3value--){
srituhobby.setPWM(servo3,0, S3value);
delay(10);
}

for(int S2value =380; S2value >150; S2value--){
srituhobby.setPWM(servo2,0, S2value);
delay(10);
}

for(int S1value =250; S1value <450; S1value++){
srituhobby.setPWM(servo1,0, S1value);
delay(10);
}

//////////////////////
for(int S2value =150; S2value <=380; S2value++){
srituhobby.setPWM(servo2,0, S2value);
delay(10);
}

for(int S3value =300; S3value <=380; S3value++){
srituhobby.setPWM(servo3,0, S3value);
delay(10);
}

for(int S4value =410; S4value <=510; S4value++){
srituhobby.setPWM(servo4,0, S4value);
delay(10);
}

for(int S4value =510; S4value >410; S4value--){
srituhobby.setPWM(servo4,0, S4value);
delay(10);
}
//////////////////
for(int S3value =380; S3value >300; S3value--){
srituhobby.setPWM(servo3,0, S3value);
delay(10);
}

for(int S2value =380; S2value >150; S2value--){
srituhobby.setPWM(servo2,0, S2value);
delay(10);
}
```

```
for(int S1value =450; S1value >330; S1value--){
srituhobby.setPWM(servo1,0, S1value);
delay(10);
}
```

CONCLUSION;

- We've finally succeeded in creating a functional PICK AND PLACE ROBOT‖ system after much effort and time. Users will find it to be an excellent buddy. It is very user-interactive and simple to use. A lot of work involves the handling of materials with robotic arms. Even though there is still a lot of functionality to be incorporated, we will take our time to finish the current duties. Over this time, we have discovered User-friendly
- The surroundings and the real-time development of industrial applications. We learned new skills in communicating with experts, working in teams, and completing deadlines.
- We were able to use the Kinect tool to run other machinery during this trial, which demonstrated to us that it is valuable for purposes more than just playing games.

ADVANTAGES

- Adaptable Pick and Place: Flexibility is a major advantage of robotics. Pick and place robots are easy to program. They are flexible enough to adjust to several changes in the shape and composition of the product. Additionally, robots provide a great degree of flexibility and movement.
- Boost Pick and Place Consistency: Robotic solutions for picking and placing can enhance both cycle time and product quality. Because robotic movements are controlled, the outcomes are consistent.
- Cost-Effectiveness: These systems are highly cost-effective due to the combination of the aforementioned attributes. Pick and place systems enable firms to accept orders in bulk, which promotes business expansion and allows them to benefit from large-scale production. This adds to cost effectiveness.
- Aver with Pick and Place Robots: You may significantly reduce your expenses by implementing pick and place robots. Time and material can be used more effectively and with less waste thanks to robotic precision and dependability. Furthermore, the initial cost of a robot is swiftly recovered, making

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