

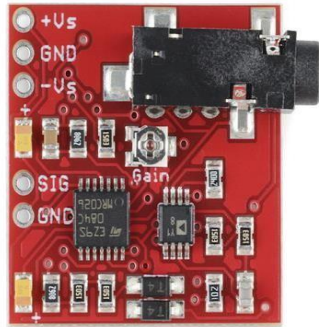




3D Printed Prosthetic Hand



EMG Sensor



Servo Motor (MG995)



parts. Thumb is assembled from the thumb joint, thumb tip, and joint.

**Step 2:** Four Servo motors are placed in the Forearm region and tightened with a screw provided with the servo motor. Threads are connected to the servo on the horns. The infant finger and the ring finger are connected to a similar servo, as they provide the same functionality. Four Gesture Recognition of a Robotic Hand using EMG.

**Step 3:** Cut ten 20 inches of fishing line. Two fishing lines per finger are used. Crimp them by feeding the fishing line from one side. Feed the fishing line from the fingertips till the fishing line exists from the palm.

**Step 4:** Now the fishing line is attached to the corresponding servo motor. The fishing line should be tensioned. To check the fishing line is tension's move. The motor is counter-clockwise with the hand and the finger will move inward. By rotating it clockwise the finger should open.

**Step 5:** Now stick the electrode pads and then connect Arduino with motors and place the forearm cover on the forearm body.

**6. PROGRAM**

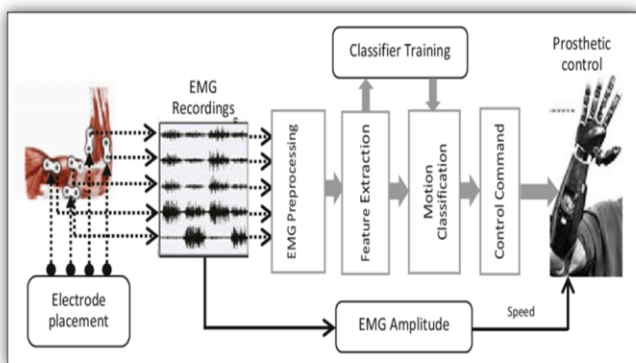
The following code is for the Electromyography Sensor:

```
int EMGPIn = A0;
int EMGVal = 0;

void setup() {
  Serial.begin(9600);
}

void loop() {
  EMGVal = analogRead(EMGPIn);
  Serial.println(EMGVal);
}
```

**4. BLOCK DIAGRAM**

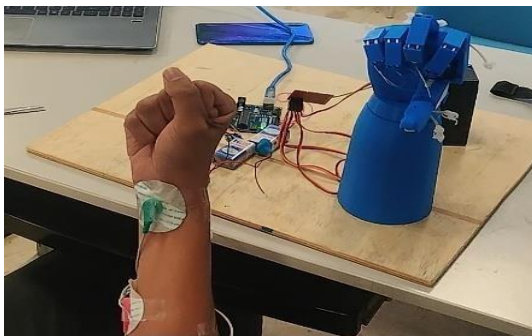


**5. ASSEMBLY**

**Step by step procedure to assemble the hand:**

**Step 1:** All fingers except the thumb are assembled from the fingertip, joint, and knuckle. The string is used to join these

The following code is for making a wrist:



```
#include
<Servo.h> int
EMGPin = A1;
int EMGVal = 0;
Servo servo1;
Servo servo2;
Servo servo3;
Servo servo4;
Servo servo5;

const int servoPin1
= 3; const int
servoPin2 = 5; const
int servoPin3 = 6;
const int servoPin4
= 9; const int
servoPin5 = 10;

void setup() {
Serial.begin(9600);
servo1.attach(servoP
in1);
servo2.attach(servoP
in2);
servo3.attach(servoP
in3);
servo4.attach(servoP
in4);
servo5.attach(servoP
in5);

servo1.write(0);//pi
```

```
servo3.write(1
80);
servo2.write(0
)
servo4.write(0
);
servo5.write(0
); delay(2000);
servo1.detach(
);
servo3.detach(
);
servo2.detach(
);
servo4.detach(
);
servo5.detach(
); delay(2000);
}
```

```
nky delay(1000);
servo1.detach();
servo2.write(180);//midd
le delay(1000);
servo2.detach();
servo3.write(0);//thumb
delay(1000);
servo3.detach();
servo4.write(180);//4
delay(1000);
servo4.detach();
servo5.write(180);//5
delay(1000);
servo5.detach();
}
```

```
void loop() {

//***** FOR READING OF EMG
*****EMGVal = analogRead(EMGPin);
Serial.println(EMGVal);
delay(20);
//*****
*****

if (EMGVal >= 120 && EMGVal <= 200)
{ //***** FOR CLOSING OF FINGERS
*****servo1.attach(servoPin1);
servo2.attach(servoPin2);
servo3.attach(servoPin3);
servo4.attach(servoPin4);
servo5.attach(servoPin5);
servo1.write(180);
```

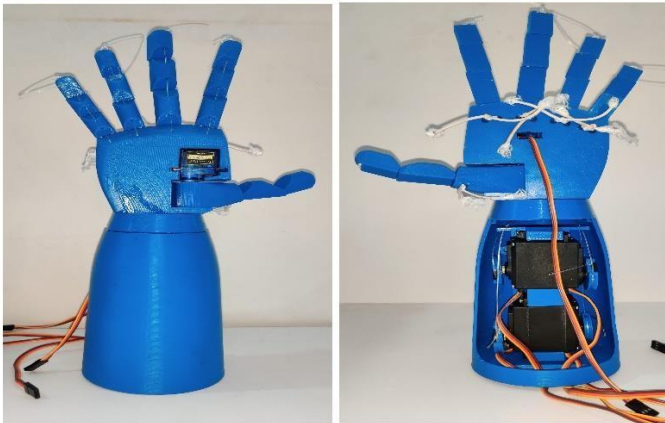
```
if (EMGVal >= 50 && EMGVal <= 100)
{
//***** FOR OPNING OF FINGERS
*****

servo1.attach(s
ervoPin1);
servo2.attach(s
ervoPin2);
servo3.attach(s
ervoPin3);
servo4.attach(s
ervoPin4);
servo5.attach(s
ervoPin5);
servo1.write(0);
servo3.write(0);
servo2.write(18
0);
servo4.write(18
0);
servo5.write(18
0); delay(2000);
servo1.detach();
servo3.detach();
servo2.detach();
servo4.detach();

servo5.detach();
delay(2000);
}

//***** FOR TESTING UNCOMMENT IT AND COMMENT
ALL *****
// servo1.attach(servoPin1);
// servo2.attach(servoPin2);
// servo3.attach(servoPin3);
// servo4.attach(servoPin4);
// servo5.attach(servoPin5);
// servo1.write(130);
// servo3.write(0);
// servo2.write(0);
// servo4.write(0); // servo5.write(160);
// delay(2000);
// servo1.write(0);
// servo3.write(180);
// servo2.write(200);
// servo4.write(180);
// servo5.write(0);
// delay(2000);
// servo1.detach();
// servo3.detach();
// servo2.detach();
// servo4.detach();
// servo5.detach();
// delay(2000);
```

## 7. CONCLUSION



In this project, we have designed and developed the lightweight 3D-printed prosthetic robotic hand which works on Arduino UNO, Servo motor, and EMG sensor. The Arduino board is programmed in such a way that the whole system is controlled to perform the daily life activities. This system helps the disabled person to overcome their obstacles in daily life and it also has many applications in manufacturing industries, the medical field, and many more. The proposed model is of low cost and the hardware components of the system are easily available.

## ACKNOWLEDGEMENT

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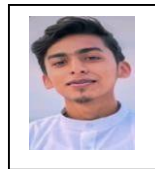
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