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COMPACT HUMAN ARM FOR MEDICAL AND INDUSTRIAL USE

SHAILENDRA SINGH CHAUHAN, SHUBHAM. K. AJITSARIA, GAURAV KUMAR & MD. DANISH KHAN

Department of Mechanical Engineering, Sikkim Manipal Institute of Technology Majhitar, Sikkim, India

ABSTRACT

Human arm is a very crucial organ which allows us to perform important day to day activities like lifting any object, dressing up, eating, clenching, gripping something to name a few of them.

Since it is so important for us that this organ functions well, so if in an accident or due to any other reason the arm gets damaged, life becomes very difficult.

This artificial human arm will enable such physically challenged people to perform all these day to day activities. Not only this, this can also be used as an extra attachment in various robotic machines to enhance their efficiency.

We have used chains, springs, wood and servo motors for its construction and it can perform the tasks like clinching of fist and curling of fingers very efficiently.

Another positive point is that the size has been kept really compact as compared to the currently available humanoid arm. This is well equipped to perform human interactive tasks.

KEYWORDS: Servo Motor, Arduino Uno, Springs, Metallic Chain Pieces, Transmitter Receiver, Bread Boar

INTRODUCTION

Science grows with the growth in revolution of different inventions and discoveries in various fields but often these inventions and discoveries tend to ignore the need for the development of physically challenged people. What if they would be able to do their day to day activities as fast and as well as any normal person? If the limitations of these people are addressed and resolved, we might be able to have some more innovative brains working with us and this HUAMANOID ARM could be the first step towards such an initiative. By using this humanoid arm a physically challenged person would be able to do almost everything which a normal person does with hand and they would not have to be dependent on anybody else.

The Palm

The base of the palm (figure 1) of the humanoid arm is made up of medium wooden sheet. The base has a length of approximately 11cm. Five chain pieces (used in bicycle) are used for making the fingers of the palm so that the movement of the fingers becomes as smooth as possible. Three small pieces of springs are attached to each finger so as it can act as a powerful joint of the finger. Each finger is connected to their respective servomotor with the help of a strong plastic string through the medium of thin and strong plastic pipes so that the string does not move through its firm and assigned position.

Figure 1: The Plam

SERVO MOTOR

Figure 2: Servo Motor

The motors (figure 2) used in 'HUMANOID ARM' are all servo motors which allow precise control of angular position, velocity and acceleration. It consists of a suitable motor coupled to a sensor for position feedback. It operates under the voltage of 4.8-6.0V DC with the operating speedof 0.20sec/60degree(4.8V),0.16sec/60degree (6.0V). These servo motors are basically used to move the fingers of the humanoid arm precisely at a particular degree. The quantity of servo motors used here is 5, i.e. one for each finger.

Transmitter and Receivers

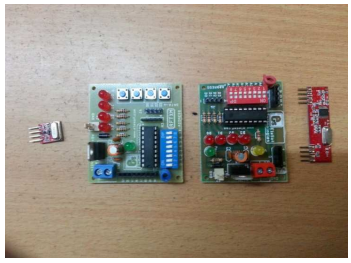

Figure 3: Transmitter and Receiver

A " 434MHZ RF 4CH " wireless remote control was operated as a transmitter and also as a receiver. This device is a two module-a transmitter and receiver. Together they make an addressable wireless system that can range up to 65 meters. This RF module used is compatible to HT12D/12E standards.

Transmitter

Transmitter of wireless remote control is a powerful transmitter module based on CMOS technology. There is an internal calibrated crystal oscillator in module HT12E. This module has 18 pin encoder IC [HT12E], with which the pin female connector compatible with 12DRF transmitter antenna is connected and one 8 bit address selected is connected and one 8 bit address select gives us the option of isolation the communication between the transmitter and the receiver module

4 bit data is available for providing input to the encoder I.C. On board we have a L7808 voltage regulator that regulates the voltage ranging from 3V -24 V.

Receiver End

Receiver of wireless remote is a powerful transmitter module base on CMOS technology. There is an internal calibrated crystal oscillator in module IC HT 12D, so there is no need to provide crystal oscillator externally.

This module has 18 pin decoder IC (HT12D), with which 8 pin female connector compatible with 12DRF receiver antenna is connected and 8 bit address select is connected. 8 bit address select gives us the option of isolating the communication between the transmitter and the transmitter and the receiver module.4 bit data pins data pins are given for data output. One LED is connected to denote valid transmission.

Chain Pieces (Fingers of the Arm)

Figure 4:Chain Pieces

Five different sizes of chain pieces (figure 4) were cut from a long cycle chain used over the gear. The cycle chain was used due to its ability of smooth movement in the required position just like real fingers.

Table 1: (Length of Each Finger)

INGER TYPE	LENGTH (IN CM)
Index finger	9.5
Middle finger	11.5
Ring finger	9
Baby finger	8.5
Thumb	7.5

Arduino Uno

Figure 5: Arduino Uno

The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an

ICSP header, and a reset button. It is connected to jack, an ICSP header, and a reset button. It is connected to a computer with a USB cable or is powered by AC-to-DC adapter or battery to get started.

Bread Board

Figure 6: Bread Board

The breadboard acts as a wiring socket for shorting and inter connections of the components of the robots which require electrical power. It is a conducting strip of metal arranged horizontally or vertically. The metal strip are embedded in a plastic or wood case and has holes for inserting wires for interconnections

Springs

Figure 7: Springs

Small spring pieces are used as the joint for the finger each finger consists of three small springs. One spring at the bottom most of the finger, the middle spring is attached above approximately 2.5 cm above the bottom spring and the topmost spring is above 1 cm of the middle one also each spring is almost 2cm to 2.5 cm in size.

Programming

```
#include <Servo.h>

Servo servo1;

Servo servo2;

Servo servo3;

Servo servo4;

int pos = 0;

void setup()

{
```

```
servo1.attach(3);
servo2.attach(5);
servo3.attach(6);
servo4.attach(9);
        }
void loop()
{
for(pos = 0; pos <= 150; pos += 1)
servo1.write(pos);
delay(10);
servo2.write(pos);
delay(10);
servo3.write(pos);
delay(10);
servo4.write(pos);
delay(10);
}
//delay(2000);
for(pos = 150; pos>=0; pos-=1)
{
servo1.write(pos);
delay(10);
servo2.write(pos);
delay(10);
servo3.write(pos);
delay(10);
servo4.write(pos);
delay(10);
}
```

}

Future Prospective

Well talking about the future scope of this arm we can say that there are a lot of things which can be implemented in it such as controlling this arm with motion sensors and not the regular ones but with the *SHADOW MOTION CAPTURE* technique which is a revolutionary sensing technique and what if it can be *controlled just with our minds* in a similar way how a normal person does, thus after implementing such kind of things in it, its needless to say that how useful it could be with the touch of perfection.

CONCLUSIONS

This project is worth noticing considering about the development in science for each and every being present and sensing the need of the people who can no longer be behind due to some irrational reasons such as loss of arm. This artificial arm will serve the purpose same as that of real human arm and also can be used as an attachment in robotic machines. This arm will act as a precise device in medical field while doing complex surgery. By using shadow motion capture technique which detects motion by noting in change the shadow cast by moving object in a confined area we can get the desired work by operating it from a distance. This system is equipped with Servo motors and Arduino Uno for controlling the motion of four fingers and thumb. The fingers were made by using bicycle chains and spring in order to make the movement flexible. The spring were attached at every joints of the fingers that is three spring at three joints of the four fingers and two springs at the two joints of thumb in order to make the fingers functional just like the real human fingers. The concept behind the use of chains for construction of fingers is derived from the fact that they give maximum degree of freedom.

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