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Bionic Arm

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***Abstract**: Around 1 million people were injure during the Iraq war, most of them amputed. Also around 3 million people lose their limbs due to accident and some by birth. Many amputees in the world lose hope in life after losing the arm so in this report we have described as to how to build a Bionic Arm. Also, we have designed a prototype of Bionic Arm with 4 Degrees of Freedom capable of mimicking a normal arm. With our project we are aiming to provide a low cost solution to the amputees so that they can lead a normal life like others. Our project provides a remotely controlled substitute for the arm. It can also be used for industrial applications.*

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I. INTRODUCTION

Bionic Arm is a best revolution idea for the amputees across the world. This is as close as we can get to our natural limb. The main objective is to make the arm move with our brain unlike previous prosthetic upper limbs. In case of bionic arm we take the never signals from the brain and amplify it so that we can register the signal and convert that electrical signals to mechanical energy so as to move the mechanical device. The arm prosthetics is being used and constantly being perfected to suit human needs. Various types of prosthetics have been made to suit many actions but not all. But the bionic arm will be able to perform all kinds of movement of the human upper limbs.

A bionic arm combines robotics, biotechnology, and electronics to recreate the functions of the human arm. Advances in bionics can improve the lives of millions of people with lost limbs. In this challenge you will design and test a robotic arm, and learn how engineers create working artificial arms. This project aims at developing a neuro-controlled upper limb prosthesis intuitively controlled and felt by the amputee as the natural one. This will be possible by means of a novel neural interface able to provide a stable and very selective connection with the nervous system. This goal will be achieved by combining micro technology and material science and will allow, on one side, recording of the motor-related signals governing the actions of the amputated hand/arm for the motion control of a mechanical prosthesis. On the other providing sensory feedback from tactile and kinesthetic sensors through neuromorphic stimulation of the adequate afferent pathway within the residual limb.

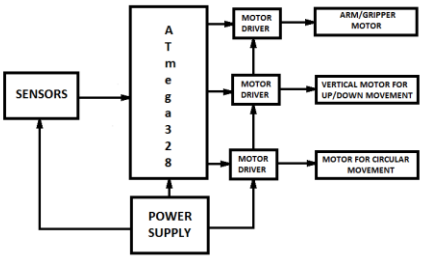
II. LITERATURE REVIEW

[1] Wing, I. A., Conner, H. D., Biermann, P. J., and Belkoff, S. M., "The Bionics: A Social and Functional Interface" This paper gives overall idea of how to control Bionic Arm. We use Infrared signals to operate the arm. This project based on Arduino platform which is Free Open Source. So the implementation rate is inexpensive and it is reasonable by a common person. With the wireless Infrared connection in microcontroller permits the system installation in more easy way. The system has been designed successfully and aimed to control the arm using a TV-Remote which is Infrared-enabled via TSOP-1738. We have discussed a simple prototype in this paper but in future it can be extended to many other regions.

[2] Michael M. Bridges, Matthew P. Para, and Michael J. Mashner . "Control System Architecture for the Modular Prosthetic Limb ", In this paper detail information about system has been given in which we can use the prototype of the arm using Infrared Remote. It increases stability of the arm as accurate values can be given. In case the user loses his remote he can use any other remote to control the arm. First the user combination will be compared with pre-recorded values which are stored in the system memory. User can go for certain number of wrong values as the system won't respond for wrong values. The arm will work only if user combination matches the correct values. The different parts of the arm can be moved by selecting different modes. If one mode is selected, the other mode will only work only if we exit from the current mode and enter to the required mode. Until we exit a mode it will remain in the same mode.

III. PROPOSED SYSTEM

In this section we discuss the various design methods involved and the parameters influencing the construction of robotic arm. Robotic Arm is a very useful tool in industries and invaluable support for amputees. So the research in this field has been of paramount importance. The following section illustrates the basic block diagram of a robotic arm.



The TSOP1738 middle output pin is connected to one of the pins of arduino and the arduino code written on computer uses the state of that pin which corresponds to a hexadecimal number. When the TSOP1738 gives a hexadecimal number the arduino program is set such that it actuates the part of the arm corresponding to the output of the TSOP1738. The Bluetooth module is connected to It is connected to Arduino by two TX(Transfer) and RX(receiver) pins. The bluetooth's TX is connected to Arduino's RX and RX is connected to TX. This whole setup is an alternate for TSOP1738.

IV. DESCRIPTION OF BLOCKS:

TSOP1738:

The TSOP 1738 is a member of IR remote control receiver series.. The output of TSOP is active low and it gives +5V in off state. When IR waves, from a source, with a centre frequency of 38 kHz incident on it, its output goes low. Lights coming from sunlight, fluorescent lamps etc. may cause disturbance to it and result in undesirable output even when the source is not transmitting IR signals.

Arduino Uno AtMega-328

Arduino is an open-source project that created microcontroller-based kits for building digital devices and interactive objects that can sense and control physical devices.Arduino combines a micro-controller along with all of the extras to make it easy to build and debug projects.

L293D:

The L293 and L293D devices are quadruple high-current half-H drivers. The L293 is designed to provide bidirectional drive currents of up to 1 A at voltages from 4.5 V to 36 V. The L293D is designed to provide bidirectional drive currents of up to 600-mA at voltages from 4.5 V to 36 V.

Servo:

Tiny and lightweight with high output power. Servo can rotate approximately 180 degrees(90 in each direction), and works just like the standard kinds but *smaller*.

HC-05:

HC-05 module is an easy to use Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup. Serial port Bluetooth module is fully qualified Bluetooth V2.0+EDR (Enhanced Data Rate) 3Mbps Modulation with complete 2.4GHz radio transceiver and baseband. It uses CSR Bluecore 04-External single chip Bluetooth system with CMOS technology and with AFH (Adaptive Frequency Hopping Feature). It has the footprint as small as 12.7mmx27mm.

Specifications:

Typical -80dBm sensitivity

- Up to +4dBm RF transmit power
- Low Power 1.8V Operation ,1.8 to 3.6V I/O
- PIO control
- UART interface with programmable baud rate

V. IMPLEMENTATION OF THE PROPOSED SYSTEM

```
#include <IRremote.h>
#include <Servo.h>
#define N 5  //number of servos
#define D 15 //delay for rion
Servo S[N];
int pos[5];

int RECV_PIN = 6;//pin 6 of arduino to data pin of ir receiver
IRrecv irrecv(RECV_PIN);
decode_results results;
void setup()
{
  S[0].attach(2);  //base
  S[1].attach(3);  //shoulder motor 1
  S[2].attach(4);  //shoulder motor 2
  S[3].attach(5);  //elbow
  S[4].attach(6);  //wrist
  S[5].attach(7);  //gripper
  Serial.begin(9600);
  irrecv.enableIRIn(); // Start the receiver
}
void loop()
{
  pos[0] = 0;
  readval();
  if (results.value == 0xE12440BF)
  { Serial.println("BASE");    base();
  }
  else if (results.value == 0xE12428D7)
  { Serial.println("SHOULDER");  shoulder();
  }
  else if (results.value == 0xE1246897)
  { Serial.println("ELBOW");  elbow();
  }
  else if (results.value == 0xE124B847)
  { Serial.println("WRIST");  wrist();
  }
  else if (results.value == 0xE124F00F)
  { Serial.println("GRIPPER");  gripper();
  }
  else ;
}
```

```
void shoulder()
{

  while (results.value != 0xE12448B7)
  {
    readval();
    if (results.value == 0xE12458A7)
    { pos[0] += 20;
      Serial.println("3");
    }
    else if (results.value == 0xE124A05F)
    { pos[0] -= 20;
      Serial.println("4");
    }
    else ;
    //S[1].write(pos[0]);
    //S[2].write(pos[0]);
  }

}


void elbow()
{
  while (results.value != 0xE12448B7)
  {

    readval();
    if (results.value == 0xE12458A7)
    { pos[0]++;
      Serial.println("3");
    }
    else if (results.value == 0xE124A05F)
    { pos[0]--;
      Serial.println("4");
    }
    else ;
    //S[3].write(pos[0]);
  }

}
```

```
void shoulder()
{

  while (results.value != 0xE12448B7)
  {
    readval();
    if (results.value == 0xE12458A7)
    { pos[0] += 20;
      Serial.println("3");
    }
    else if (results.value == 0xE124A05F)
    { pos[0] -= 20;
      Serial.println("4");
    }
    else ;
    //S[1].write(pos[0]);
    //S[2].write(pos[0]);
  }

}


void elbow()
{
  while (results.value != 0xE12448B7)
  {

    readval();
    if (results.value == 0xE12458A7)
    { pos[0]++;
      Serial.println("3");
    }
    else if (results.value == 0xE124A05F)
    { pos[0]--;
      Serial.println("4");
    }
    else ;
    //S[3].write(pos[0]);
  }

}
```

```
void wrist()
{

  while (results.value != 0xE12448B7)
  {
    readval();
    if (results.value == 0xE12458A7)
    { pos[0]++;
      Serial.println("3");
    }
    else if (results.value == 0xE124A05F)
    { pos[0]--;
      Serial.println("4");
    }
    else ;
    //S[4].write(pos[0]);
  }

}


void gripper()
{

  while (results.value != 0xE12448B7)
  {
    readval();
    if (results.value == 0xE12458A7)
    { pos[0]++;
      Serial.println("3");
    }
    else if (results.value == 0xE124A05F)
    { pos[0]--;
      Serial.println("4");
    }
    else ;
    //S[5].write(pos[0]);
  }

}
```

VI. CONCLUSION

Various research papers and reports were studied to make this review report on bionic arm as prosthetic arm. Various models are available in the market around the global working on various mechanisms but their moto is the same i.e. to make a prefect prosthetic arm. The outcome of the review report was basically that the bionic arm can be used as the prosthetic arm as it is more like the natural arm and various manufacturers and researchers have made efforts to make this possible by developing more perfect and accurate prosthetics to match the need of the user which will help him to do his daily works with the use of artificial limbs.

VII. FUTURE WORK

The robotic arm currently built can be implemented into a bionic by using a novel neural interface. We can include elbow by using more powerful servos. Also we can use Brain-Wave detector instead of IR remote to control the arm just by generating brain signals. Also we can implement fingers using micro dc motors.

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