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Gesture Controlled Prosthetic Arm

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ABSTRACT

In human inaccessible areas such as high radiation exposure in power plants and defenses the efficiency of work flow is limited. This paper proposes an idea about a low-cost microcontroller based robotic arm. This robotic arm is implemented by controlling the gesture using accelerometer and microcontroller. This arm will help in doing functions such as holding objects, and wirelesss remote controlled operating of devices in the field where more radiation hazards are present. This method can be improved by using 3-D printing of an arm for prosthetic replacements.

1. INTRODUCTION

In order to increase the use of robot in places where conditions are not certain like rescue operations, robots can be made to follow the instructions of human operator and perform the task accordingly. Gestures plays an important role in people's day to day life. Gestures can originate the gestures control device is only limited to space-electronics and partially in from any bodily motion such as face, hands, etc. The recognition of gestures is an easy way to interact with computers, it improves Humans Machine Interface (HMI). We have implemented the gesture controls in prosthetics and power plant works. This paper explains the use of gesture to control a robotic arm in a wireless manner. HMI-human machine interface

2. LITERATURE

Gesture identification has been developed to replace the approach of conventional controlling mechanism of robots via buttons etc. by hand gesture based controlling [1]. Robot have made efforts for creating "Human Machine Interfacing Device". Using gesture recognition concept, it is possible to move a robot accordingly [2]. An effective tool to detect and recognize the human gestures are its low-moderate cost & relative small size of the accelerometers [3].

2.1 METHODOLOGY

A hand Gesture Control Robot is a kind of robot which is controlled by the hand gestures and not by using buttons. The robot is equipped with two sections- Transmitting section and Receiving section. In the Transmitting section, the Accelerometer is mounted on hand of the user capturing its gesture and moving the robot accordingly. For assigning proper levels of input voltages from the accelerometer, comparator IC is used. The accelerometer sent the 3-D positions of gesture as input signals to the encoder. Encoder IC is used to encode the four-bit data which will later be transmitted by an RF Transmitter module. In the receiving section, the received encoded data by RF receiver module

is then decoded using a decoder IC. The decoded data is processed by a microcontroller and passed onto a motor driver to rotate the motors in a special, to move the robot in the same direction as that of the hand.

2.2 MODEL DESIGN

Objects of any shape or geometry can be produced using digital model data from a mechanical model. which print the model in layer by layer of thermos satiating plastic or any material of interest. The STL file of the prosthetic arm is obtained by the DIY website. The acrylonitrile butadiene styrene (ABS) is used as the printing material as it's resistant to heat and its high flexible nature.

2.3 ARDUINO

Arduino is an open source, computer hardware and software company which produces the microprocessors and microcontrollers kits. The microcontroller what we used is Arduino 328 it is used because it has many features like 32Kb ISP flash memory with read write capability, which allows easy reprogramming and adjusting the device sensitive. Arduino contains number of websites for programming the device.

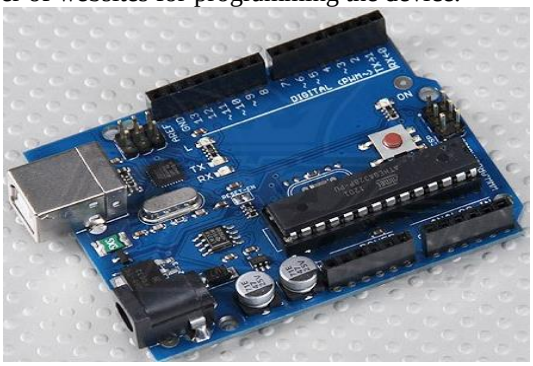

Figure:1, Arduino 328

Source: www.google.co.in *Arduino, http://arduino.cc/images.jpg*

2.4 SERVO MOTORS

Servo motors are small motors with high power output. A servo motor consists of three basic parts: an electronic motor, a feedback variable resistor and controller. It is controlled by the signals sent from the accelerometer fixed for gesture detection. Its best for radio controlled modes of operation the transmitting system used is pulse width modulation. Five high speed servo motors

2.5 RF LINK

RF link 343 is used to transmit the information from accelerometer to the microprocessor. This item is chosen because of low cost and wide operation range up to 10meters.rf link has inbuilt encoder and decoder which convert the parallel data to serial data and again convert it back to serial data respectively. Since we use a specified frequency for transmitting the information there won't be any mismatch between other signal of higher other frequencies.

2.6 ACCELEROMETER

The accelerometer is used to detect the acceleration caused by movement of arm and transducer it to electrical signals. The accelerometer used is highly sensitive and can detect all the 3 dimensions with precision.

3. HAND ASSEMBLY

The hand used in the prototype was mechanical model version of inmoov robot. The STL file was uploaded in the platform and directly printed, it took eleven hours to print the model and finally the model was pipette. Each finger was strung with fishing lines which ran over the hinges of the finger in a zigzag manner. The elastic rubber bands were stretched on the upper part of the finger. The fishing lines firmly adhered to the output shaft of servo motors.

3.1 ARM ASSEMBLY

The arm was mounted on an arm stand which is similar to a tripod stand and the clips used by the stand were adjusted by the clips on the tripod stand and the power wires were extended from the back side of the arm set up.

3.2 BLOCK DIAGRAM

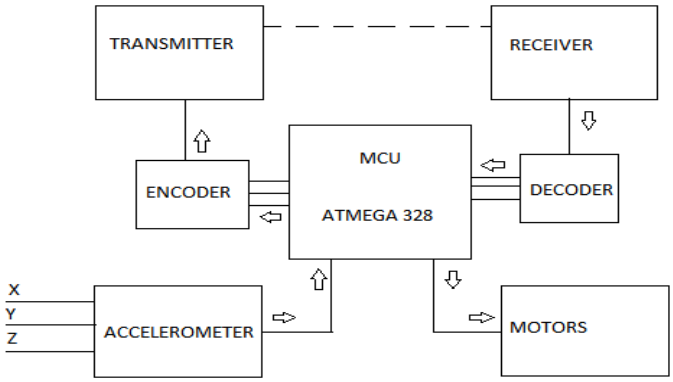

Figure:2, Block Diagram

4. CIRCUITRY

Since the system is wirelessly controlled there were a very few wires used and none of the main current supply was put into used the modules used 9volt batteries (2nos) that's all.

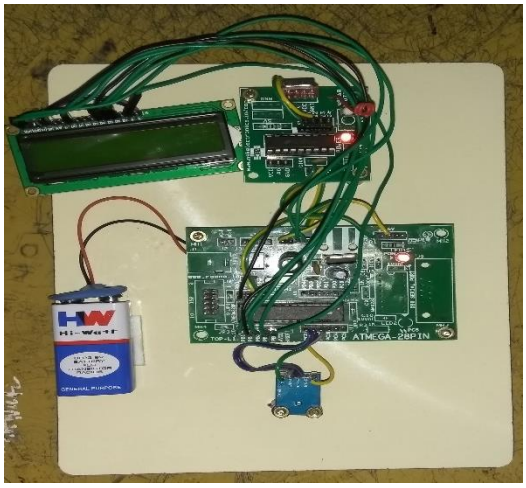

Figure:3a, Transmitter part

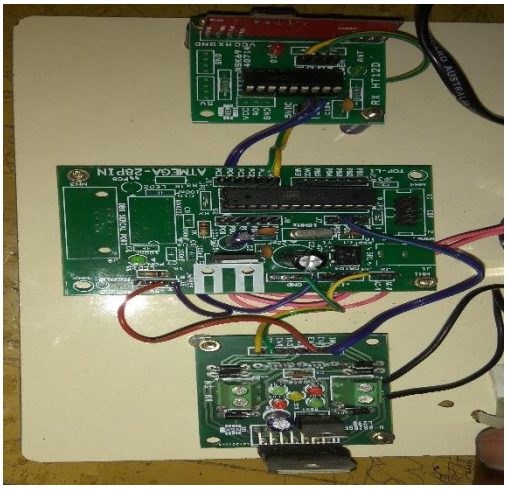

Figure:3b, Receiver part

5. PROGRAMMING

The program was obtained on the Arduino developer's website. The servo motors operation time was the most important aspect of programming the device. Out 32 I/O pins, we used 5 output pins contained in the Arduino board. The position of the servo motor determines how far the figure that it controls would the Arduino was programmed such that it received the signals from the accelerometer and process into pulse form to the servo motor.

6. RESULTS AND DISCUSSIONS

The fully assembled mechanical model can recognize and mimic the hand gestures. Day to day chores of an ordinary man can be aided using this prosthetic arm. The degree of rotation and other lack of flexibility functions were not precisely as human the grab of the arm was strong enough to hold a pen ball and small objects.

Other miscellaneous functions such as wave the hand, Hi-Fi and fist were loaded in the arm which was executed very well. This entire project was built with common available items at low cost of $500.

7. CONCLUSION

Simple prosthetic has potential to make a great impact on amputee's life style. Since it is battery powered and can run up to 4 hours there is no need to carry some bulky batteries the painting on the prosthetic arm is natural skin colored which helps in growing confidence among the amputee. We have done our best to serve humanity by producing a low-cost prosthetic device with many functionalities.

8. REFRENCES

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