Gesture Control Robo Hand

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Abstract : **This paper presents the future of artificial arms. In today's world, there is an escalating want to create artificial arms for different inhuman situations like bomb diffusing, working in high temperature, where human interaction is hard or impossible. They could involve taking readings from a working active volcano. Here we propose to create a Robotic arm controlled by natural human arm movements. This paper describes the robotic arm controlled by human hand. It consists of two parts, one is transmission part and other is receiver part. The programme is designed by Arduino IDE.**

IndexTerms **- Arduino, Flex Sensor, Servo Motors, Robotic Arm**

I. INTRODUCTION

In real life most of the time every task is done by human hand, but in hazards situations humans are not able to work effectively. Due to recent advancements in the field of robotics it is possible to perform task in hazards as well as inhuman situation using an artificial arm. Robo arm poses low power consumption, high torque, a high degree of freedom, small size, the capacity to work in high temperature. In this paper flex sensors are use to sense our hand movements and XBEE for transfer signal. This signal is modified and processed by Arduino. The Arduino gives the signal to servo motors which are connected to the robo fingers and finally we get robo arm movement according to human hand movement.

1.1 Definition

A robo arm is programmable arm having similar functions to a person's arm. The links of these are connected by joints allowing either rotational motion or translational displacement. The robo arms may be autonomous or controlled manually & can be employed to perform a number of tasks with great accuracy and sensitivity. The Robotic arm may be fixed or on mobile & can be designed for industrial application and or inhuman situation.

This paper relates to a Robotic arm whose objective is always to imitate the movements of a person's arm using Arduino when it comes to data acquisition regarding the natural arm movements. This technique of control allows greater flexibility in managing the robo arm in the place of using a controller where each servo is controlled separately.

2 Components

2.1 Arduino Uno Arduino Uno is a microcontroller board on the basis of the ATmega328P. It has 14 digital input and output pins, 6 analog inputs, one 16 MHz quartz crystal and one USB connection. It includes everything to the microcontroller need. Simply connect it to a pc with a USB cable or power it with a DC output adapter or battery. In the worst case, you can easily replace the chip and start once again. Arduino UNO receives inputs from different sensors.

Micro controller	ATmega328p
Operating Voltage	+5 V
Limited Input Voltage	5-20 V
Digital Input-Output Pins	14
PWM Pins	6
Analog Pins	6
DC Current per Ip/Op Pin	20 mA
Flash Memory	32 KB
EEPROM	1 KB
Clock Speed	16 MHz

Table 1 Technical Specification of Arduino Uno

2.2 Flex Sensor

A flex sensor that measures the actual quantity of bending. The sensor is stuck into the surface; the resistance of sensor element is varied by bending the area. The resistance is directly proportional to the quantity of bend and often called flexible potentiometer

This flex sensor is a variable resistor. The resistance regarding the flex sensor increases while the component body bends. Sensors such as these were utilized when you look at the Nintendo Power Glove. Flex sensors can be purchased in two sizes: one 2.2" (5.588cm) long and another to arrive at 4.5" (11.43cm) long. Left flat, these sensors having approximately 30 kΩ resistance. Since it bends, the resistance amongst the two terminals will increase as 70kΩ (Max resistance) at a 90° angle.

One region of the sensor is printed with a polymer ink which has conductive particles on it. When the sensor is in straight position then particles provide the ink a resistance of approximately 30k Ohms. When the sensor is bent out of the ink, the conductive particles move and increase its resistance. Again when the sensor comes back into original position, the resistance returns to the original value. By measuring the resistance, you can easily decide how much the sensor bends.

2.3 Servo Motor

Small in size and light in weight with a high output power. Servo motor can rotate approximately 180 degrees (90 in each direction), & works much like the standard kinds but smaller. You can make use of any servo code, hardware to regulate these servos.

3 Flowchart

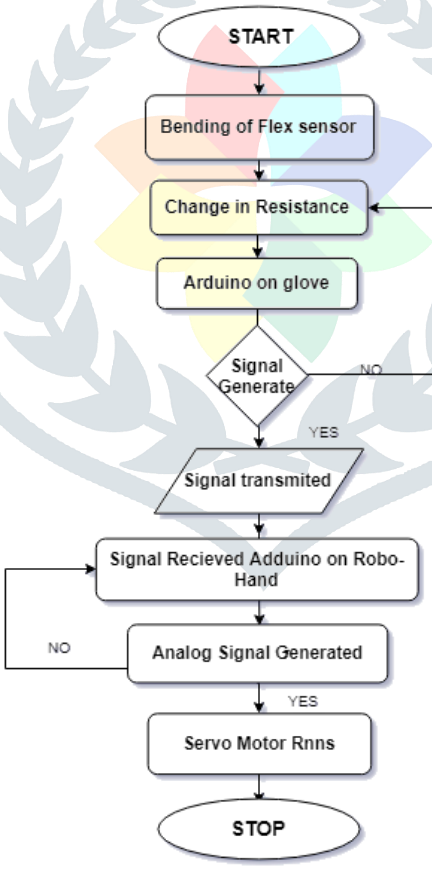

Figure 1 Flow Chart of the Circuit

4 Block Diagram

The basic components of the hand and glove are the hand itself, the servo motors, the Arduino, the glove, and flex sensors.
The Arduino is mounted on the glove with flex sensors. Variable resistors that change their resistance value when they bend. The value of resistance increase when it bends more and its value is minimum in normal condition.

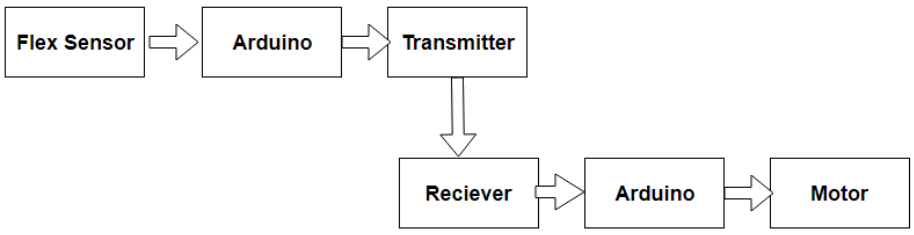

Figure 2 Block Diagram

They are attached to a voltage divider with resistors of the constant value. So we get voltage output according to the change in the resistor value.
This voltage signal is transmitted and received through the wire**.** We use Arduino UNO which having six PWM output pins. Which is programmed to reads the voltage change when the sensors are bent and triggers the servos to move a proportional amount. So, Arduino gives corresponding change in output signal according to the hand movement.
Now we have used five servo motors. The servo motors pull strings that will act as tendons, allowing the fingers for movement. So we get robo hand movement according to changing the movement of the Human hand.

5 Design

5.1 Glove Design

To make the control glove first need to choose the right position of the different components and then connect everything with the proper length of wire.

To make an analog read with Arduino Uno make a voltage divider since that flex sensors don't work like potentiometers (they have only 2 contacts).

First attached the 5 resistors on the Arduino Uno board, one side to the 5 different Analog pins, the other in common to the ground. Then connect the flex sensors, one side to the 5 different Analog pins & the other in common to the positive.

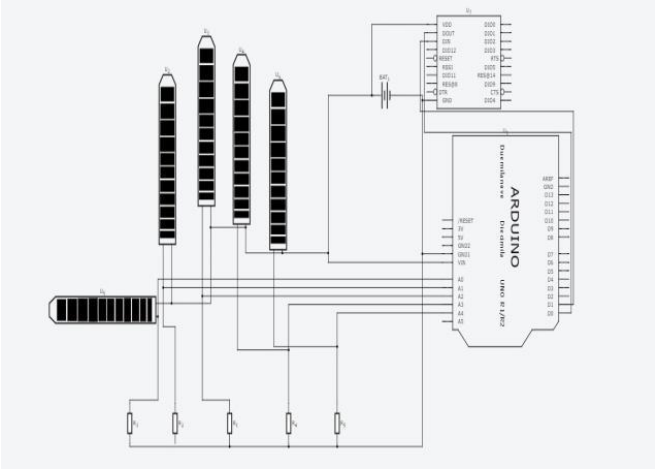

Figure 3 Circuit Diagram of Glove

Then connect the ZigBee Shield, two wires for the power, the other two for the signal. Connect the Tx pin to the Rx & vice versa. Now we need just battery pack, & the glove it's done.

5.2 Hand Design

First, we make a proper design for Robo hand. Here we make 3 parts of a single finger & make a suitable palm. Cut it &do some protrusions similar to those made for the fingers to fix them to palm. Then use the drill to make the other holes for the fishing wire, the thumb will be tricky because it's not vertical as fingers.

After making the hand, we need to make a support for the five servomotors and support for the Arduino UNO boards. We make the right position of the servos, so they don't touch each other while rotating.

The last part consists in connecting the fingers to the servomotors: fix the fishing wires at the top of the finger & make them pass through the holes. When the wires are at the bottom of the hand, turn the rotor (manually, without powering it) at his max rotation (180°) so that it's in a vertical position. So, when the motor is at 0° (vertical) the finger is opened & when the rotor is at 180° (vertical again) the finger is closed.

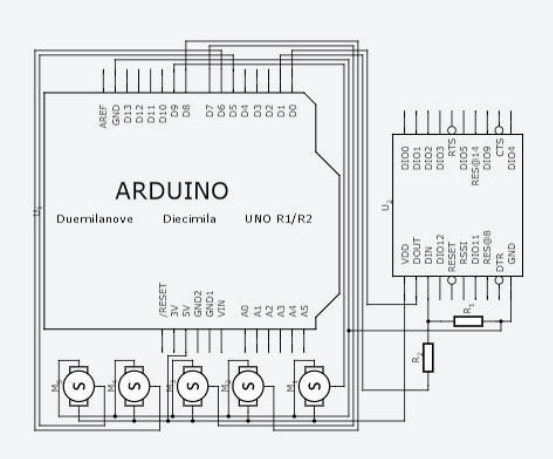

Figure 4 Circuit Diagram of Robo Hand

6 Research Analysis

Flex sensor is a variable resistor that changes their resistance value when it bends. The value of resistance increase when it bends more and its value is minimum in normal condition.
To get output from flex sensor we just need voltage divider circuit. So it makes circuit simple and compact. It also makes our project less expensive.

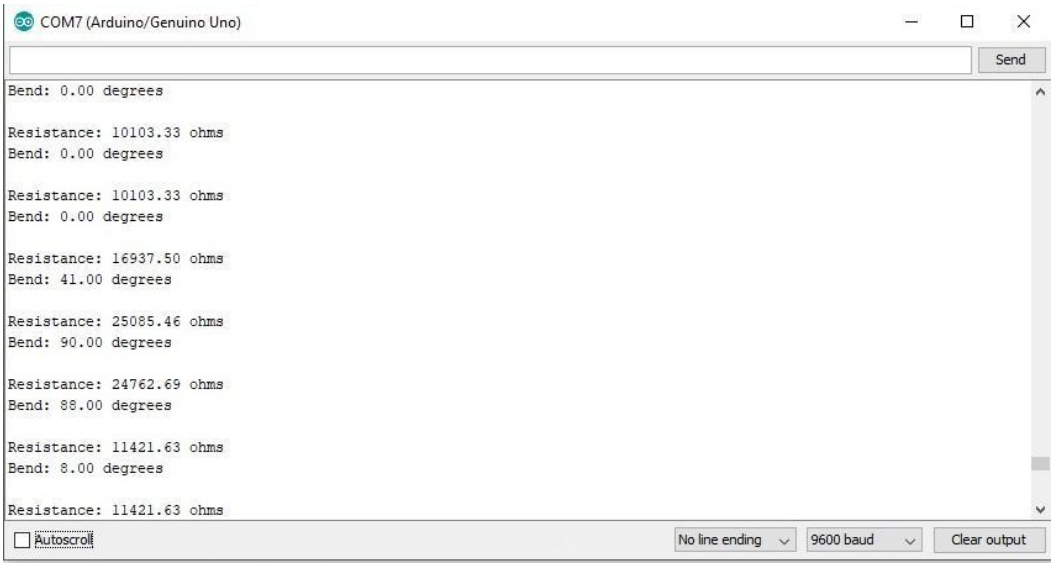

Figure 5 Flax Sensor Banding Angle Output

Figure shows change in resistance according to bending of flex sensor. As it show in normal condition or at zero bending we gets approximately 10200 ohm and at 180 degree bending we gets 40000 ohm resistance.

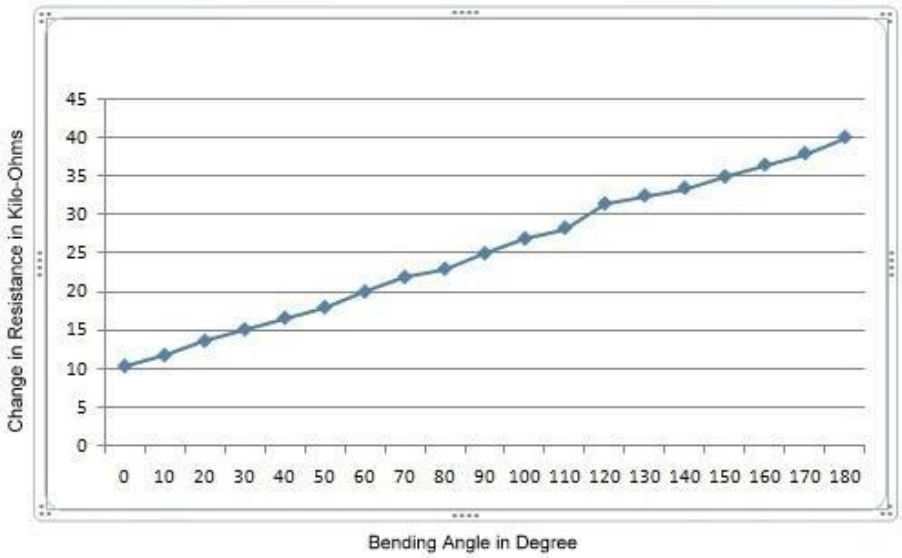

Figure 6 Graph – Bending Angle v/s Resistance

Graph shows resistive characteristic of flex sensor. It shows that resistance increases when we increasing bending.

Future Scope:

Robotic arm has a wide range of scopes.
Research is going on to use brain signals to control the Robotic hand. If we achieved it then that will be very helpful for physically handicapped.
If we will operate this Robo hand through internet then we will control it from anywhere.

Applications:

We also can make a voice-controlled Robo hand which very uses full for domestic purposes.
It is very useful in laboratories or places which are out of human comfort zones like's high-temperature areas or in a dusty atmosphere.
By increasing controlling range robo arm and making some another change we can use it in bomb diffusing.
If it starts to operate through the internet it will be the revolution in industries and medical science.

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