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GESTURE RECOGNITION ROBOTIC HAND

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ABSTRACT

The project deals with the control of robotic arm by recognizing hand gesture movement. Gesture recognition refers to the identifying movement of hand, face, head. The signals are then processed according to the gesture recognized and the desired action is performed. The project is therefore the replacement of human computer interaction via traditional input devices like keyboard, mouse and joystick. It can be used for guiding deaf people as well as controlling robot from remote location.

INDEX TERMS-*Flex sensor, microcontroller (Atmega 328), RF module, servo motor*

I. INTRODUCTION

Interpretation of human gestures by a computer is used for human-machine interaction in the area of computer vision. The main purpose of gesture recognition research is to identify a particular human gesture and convey information to the user pertaining to individual gesture.
Overall aim is to make the computer understand human body language, thereby bridging the gap between machine and human. Hand gesture recognition can be used to enhance human–computer interaction without depending on traditional input devices such as keyboard and mouse.
Two approaches are commonly used to interpret gestures for Human Computer interaction are:
(a) Glove based Technique: This method uses gloves attached with flex sensors whose resistance varies according to the movement of the fingers. Thus the signals are converted into electrical signal. We can also use colorful markers.
(b) Vision Based Technique: Vision based technique uses camera module or web camera. It records the gesture per unit frame and process it and compares it with the pre-saved image. It uses MATLAB or Python for image processing and thus the signal is send to microcontroller for interfacing the robotic arm.
Hand gestures are extensively used for tele-robotic control applications. The prominent benefit of such a system is that it presents a natural way to send geometrical information to the robot such as: left, right, etc. Robotic hand can be controlled remotely by hand gestures. Research is being carried out in this area for a long time. Several approaches have been developed for sensing hand movements and controlling robotic hand.
Glove based technique is a well-known means of recognizing hand gestures. It utilizes sensor attached mechanical glove devices that directly measure hand and/or arm joint angles and spatial position.

II. IMPLEMENTATION

In this project, we are using flex sensors for directing robotic hand. Gloves, known as data glove, are used on which sensors are fitted to capture the finger movements. The output of flex sensors are stream of data that varies with the degree of bend. The output from sensor which is analogue in nature is fed to PIC microcontroller which converts the analogue data to digital form for further processing.

Flex sensors are analog resistors. These resistors work as variable analog voltage divider. Inside the flex sensor are carbon resistive elements with thin flexible substrate. More carbon means less resistance. When the substrate is bent the sensor produces resistance output relative to the bend radius. The flex sensor achieves great form-factor on a thin flexible substrate. When the substrate is bent, the sensor produces a resistance output correlated to the bend radius as shown in Figure 3. Smaller the radius, higher will be the resistance value

Flex sensor are of two types:-

- Bi-directional flex sensor.
- Unidirectional flex sensor.

In this paper we use unidirectional sensors as fingers are bent in one direction completely. An unflexed sensor has a resistance of about 10,000 ohms. As the sensor is bent, the resistance will increase to 30-40 kΩ when bend is 90 degree.

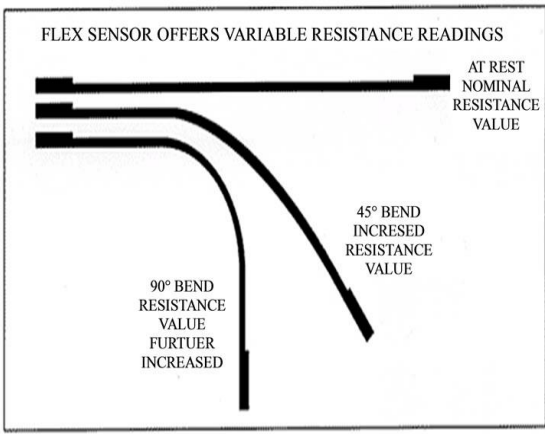

Fig 1:- Flex sensor bend proportional to varying degree of resistance

The impedance buffer in the circuit is a single sided operational amplifier used with these sensors as shown in Figure 4. Since low bias current of the op amp reduces error due to source impedance of the flex sensor as voltage divider. The variation in deflection or bending of flex sensor results in variation of resistance itself.

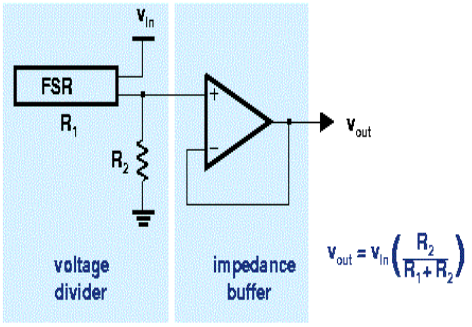

Fig 2:- Basic circuit of flex sensor

Atmega328 is used as microcontroller which is working as ADC which is connected with resistance of 4.7kΩ and thus connected with flex sensor. It gets input in analogue form which is converted into digital form. The output is given to RF module which transmits it to the receiver at 430MHz.

The receiver receives the incoming signal at same frequency, that is, at 430MHz. Servos are controlled by sending an electrical pulse of variable width, or pulse width modulation (PWM), through the control wire. There is a minimum pulse, a maximum pulse, and a repetition rate. A servo motor can usually only turn 90 degrees in either direction for a total of 180 degree movement. The motor's neutral position is defined as the position where the servo has the same amount of potential rotation in the both the clockwise or counter-clockwise direction. The PWM sent to the motor determines position of the shaft, and based on the duration of the pulse sent via the control wire, the rotor will turn to the desired position.

The servo motor expects to see a pulse every 20 milliseconds (ms) and the length of the pulse will determine how far the motor turns. For example, a 1.5ms pulse will make the motor turn to the 90-degree position. Shorter than 1.5ms moves it to 0 degrees, and any longer than 1.5ms will which will turn the servos to 180° When these servos are commanded to move, they will move to the position and hold that position. If an external force pushes against the servo while the servo is holding a position, the servo will resist from moving out of that position. The maximum amount of force the servo can exert is called the **torque rating** of the servo. Servos will not hold their position forever though, the position pulse must be repeated to instruct the servo to stay in position.

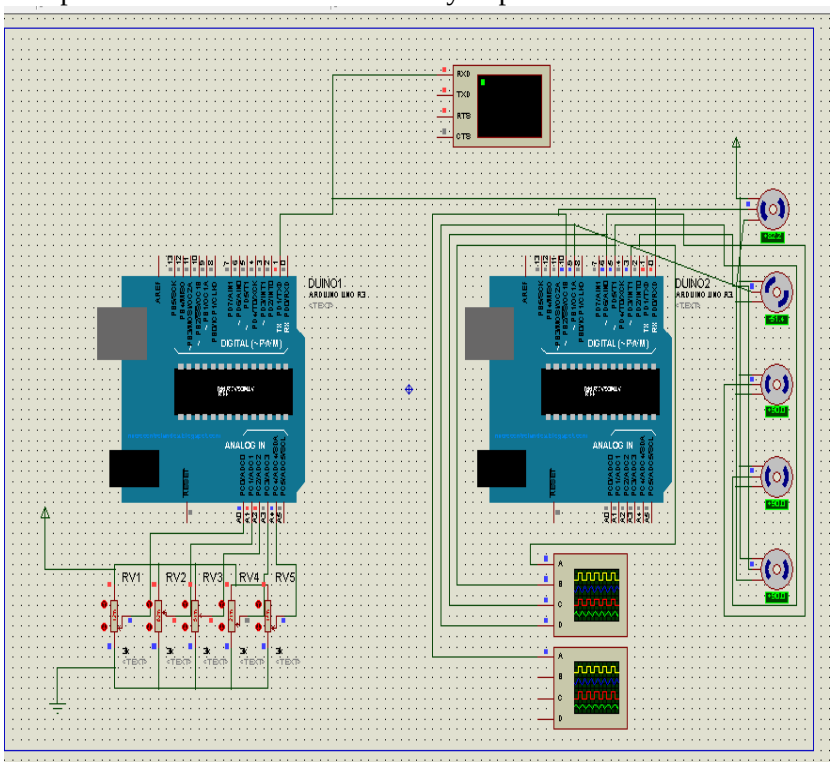

Fig 3:- Circuit Diagram designed on Proteus software

III. BLOCK DIAGRAM

Proposed project contains Hand unit and Robotic unit so there is one block diagram for each. Hand unit consists of Flex sensors. The sensors may be mounted on glove i.e. hand unit is wearable and this unit needs to be wear by the operator.

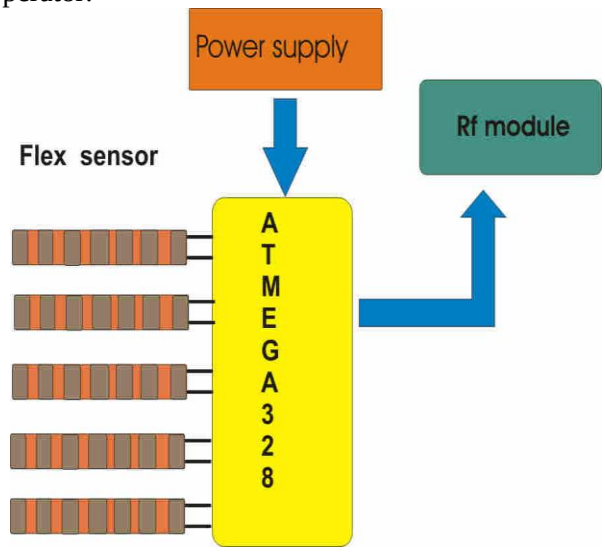

Fig 4:- Hand unit

We can use PIC or AVR microcontroller, Here output from the Flex sensor is given to robotic unit as input through wireless communication using RF module. The input to robotic unit is the position of the each servos, accordingly microcontroller sends PWM wave to the servo motors.

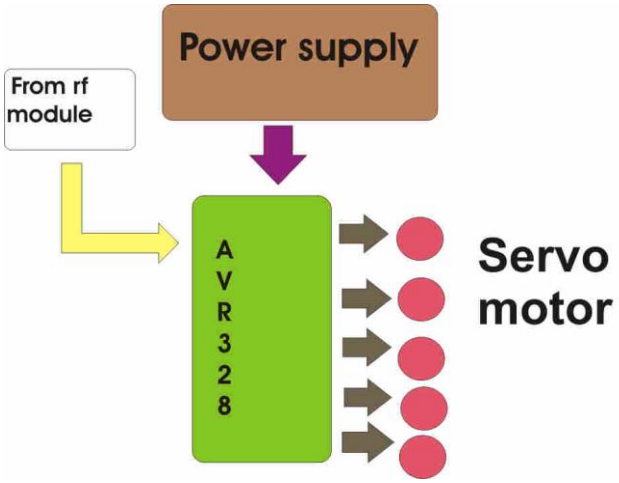

Fig 5:- Robotic Arm unit

IV. RESULT

In this project, resistance value of the flex is varied by the bending of the sensors. This analog value is scaled and changed to digital by microcontroller Fig 6 shows the digital value of angles which are sent to the hand unit on virtual terminal.

Fig 4:- Data sent by hand unit to robotic arm unit

These values are read by the microcontroller on the hand unit and accordingly pwm wave is sent to the servo motor.

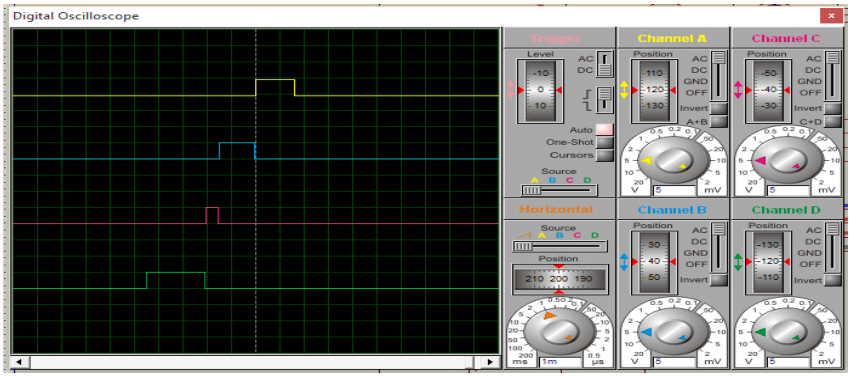

Fig 5:- PWM wave sent to servo motors

Fig 6:- Actual Model

V. APPLICATION DOMAIN

In this section, as the gesture recognition can be used in many more areas, we present an overview of the some of the application domains that employ gesture interactions.

(a) ***Virtual Reality:*** Virtual reality interactions use gestures to enable realistic manipulations of virtual objects using ones hands, for 3D display interactions or 2D displays that simulate 3D interactions.

(b) ***In Warzone:*** It is not always possible for army to enter in to the warzone. Thus it can be manually operated from distance for attacking army and nuclear explosion.

(c) ***Medical Operation:*** Now even in hospitals surgery is done by the robotic hand thus the chance for human errors is increased.

(d) ***Robotics:*** Telepresence and tele-robotic applications are typically situated within the domain of space exploration and military-based research projects. The gestures used to interact with and control robots are similar to fully-immersed virtual reality interactions, however the worlds are often real, presenting the operator with video feed from cameras located on the robot. Here, gestures can control a robots hand and arm movements to reach for and manipulate actual objects, as well its movement through the world.

(e) ***Desktop and Tablet PC Applications****:* In desktop computing applications, gestures can provide an alternative interaction to the mouse and keyboard. Many gestures for desktop computing tasks involve manipulating graphics, or annotating and editing documents using pen-based gestures.

(f) ***Games****:* When, we look at gestures for computer games. A player's hand or body position to control movement and orientation of interactive game objects such as cars.

VI. FUTURE WORK

Through this paper we got to know how versatile the electronics is as we give the idea, how gesture recognition can play a crucial role in advancement of robotics as well as Gaming. By implementing more sensors and hardware this circuit can be modified to fully copy the hand gestures of human hand.

VII. CONCLUSION

Controlling Robotic arm and robot via simple gestures presents an easy and creative idea. Robotics is used in industrial automation, for surgery, 3D interaction, etc. We have used flex sensor for the purpose of movement of Robotic arm. Although it gives high precision but the user may find it uncomfortable as it limits freedom by wearing extra patch of cumbersome devices. Advanced technology has been introduced based on image processing which works on various software like MATLAB and Python, provided certain conditions are fulfilled.

REFERENCES

[1]. G. R. S. Murthy & R. S. Jadon," A Review of Vision Based Hand Gestures Recognition, International Journal of Information Technology and Knowledge Management", July-December 2009, Volume 2, No. 2, pp. 405-410
[2]. Jagdish Lal Raheja, Radhey Shyam, G. Arun Rajsekhar and P. Bhanu Prasad," Real-Time Robotic Hand Control Using Hand Gestures", Digital Systems Group, Central Electronics Engineering Research Institute (CEERI)/Council of Scientic& Industrial Research (CSIR), Pilani, Rajasthan India
[3]. Harish Kumar Kaura1, Vipul Honrao2, Sayali Patil3, Pravish Shetty4," Gesture Controlled Robot using Image Processing", (IJARAI) International Journal of Advanced Research in Artificial Intelligence, Vol. 2, No. 5, 2013
[4]. X. Zabulisy, H. Baltzakisy, A. Argyroszy," Vision-based Hand Gesture Recognition for Human-Computer Interaction",Institute of Computer Science Foundation for Research and Technology - Hellas (FORTH) Heraklion, Crete, Greece
[5]. Dr. Shantanu K. Dixit*, Mr. Nitin S. Shingi**,"Implemntation of flex sensor and electronics compass for hand gesture based wireless automation of material handling robot",International Journal of Scientific and Research Publications, Volume 2, Issue 12, December 2012 1 ISSN 2250-3153
[6]. Saurabh A. Khajone1, Dr. S. W. Mohod2, V.M. Harne3," Implementation of a Wireless Gesture Controlled Robotic Arm" International Journal of Innovative Research in Computer and Communication Engineering (An ISO 3297: 2007 Certified Organization) Vol. 3, Issue 1, January 2015.

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