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Animatronic Hand Using Arduino

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ABSTRACT

For some time we have been interested in making some sort of robot based on the Arduino. The idea is to change a perception of remote controls for actuating manually operated robotic arm. The robotic hand is very useful for paralysis and handicap person as well as in various medical field so , this paper discuss the design of an electronic product known as animatronic hand based on wireless technology using XBee S2 , Arduino UNO board ,servo motor, flex sensor. As the whole body of the robot would have been of much cost, we will only develop a hand which will act as shadow hand.

Keywords : Animatronic, Arduino-UNO, Flex Sensor, XBee -S2, Servo Motor.

I. INTRODUCTION

Animatronic hand is basically a robotic hand which is designed by using a latest wireless technology. The history of animatronics begins with clock makers. Thus hand replica of human hand which is called animatronic hand. This project intends to implement an affordable electronic product known as animatronic hand based on wireless technology based on XBee-S2 as well as Arduino - UNO board. There are two main parts of animatronic hand first one is electrical components and second is mechanical structure that allows motion. Many times in our day to day life we face a problem with paralysis patients as well as handicap people as they are unable to do their work by their own hence in case of these people an extra person should be there for them who help them to do their work hence this animatronic hand is very helpful for such people. This hand can make them independent somehow, In industries many chemicals are used now a days especially in pharmaceutical companies every day they have to deal with many chemicals in which some are soft but some chemicals are hazardous to human being for their skin like methyl isocyanate and many more , so to deal with these kinds of chemicals animatronic hand is very useful. The main aim of designing this hand is to reduce human efforts and do the same task with less time using arduino-UNO and XBee technology. There are two main parts of this project i.e. transmitter (Control glove) and receiver (mechanical-electronic robotic hand). Control glove consists of flex sensors. There are total five flex sensors placed separately on each finger on the glove. Human hand will control another robotic hand; so that it is called as a control glove.

II. LITERATURE SURVEY

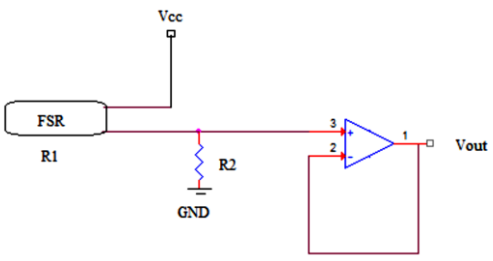
This paper discuss the robotic arm develop by using MEMS-ACCERLOMETER technology. MEMS (Microelectromechanical System) motion sensor were used to sense the movements. These gesture arm were controlled by preloaded code i.e, (automatic) or via joystick .six motor were used, out of this two for shoulder motion and wrist motion and one motor for elbow motion and gripping motion. [1]

This paper discusses the robotic hand which records the gesture using the MATLAB. The hand was implemented using 3 steps, first step was hand segmentation the next step was to track the position & orientation of the hand to prevent error in the segmentation phase and the last step they use the estimated hard state V out = V cc (R2/R1+R2)

to extract several hard features to define the deterministic process of gesture.This paper deals with the design & development of a four fingered robotic hand (FFRH) using 8-bit microcontroller sensors and wireless feedback. The robot system has 14 commands for all the four fingers open and & closed, wrist up& down, base clockwise & counter clockwise, peak & place & home position to move the fingers. The main object of this paper is to design & implementation of FFRH for providing a simple reflexive grasp that be utilized for a wide variety of object .The while structure of the hand consist of the digits, sensor and wires for the other unit of the hand.[3] This paper is highlight the use of wireless communication & its application by developing animatronic hand which can be used in many field like medical, defence, chemical industries. Here, instead of using actual human hand , they can replace it by this wireless robotic hand . This animatronic hand can be mounted on moving platform along with a camera to dfuse the bomb from a safer distance without any harm to human life. This hand can help paralysis patients who can not move their hand by providing a electronic hand which can work on voice command of the bearer .basically there are two main parts of this project i.e. transmitter (control glove) & receiver (mechanical electronic robotic hand).[4] This paper presents the mechatronic design of a robotic hand for prosthetic applications. The main characteristic of the robotic hand is its biologically-inspired parallel actuation system, which was based on the behaviour/strength space of the Flexor Digitorum Profundus (FDP) and the Flexor Digitorum Superficial (FDS) muscles. The direct relation between signal and actuation system lends itself well to interpreting the EMG signal from FDP and FDS. There have been may different approaches taken in the development of an effective prosthetic hand. [5]

III. METHODOLOGY

1) Comparator Circuit



V out = V cc (R2/R1+R2)

Figure. 1 : Comparator Circuit

1. Block Diagram

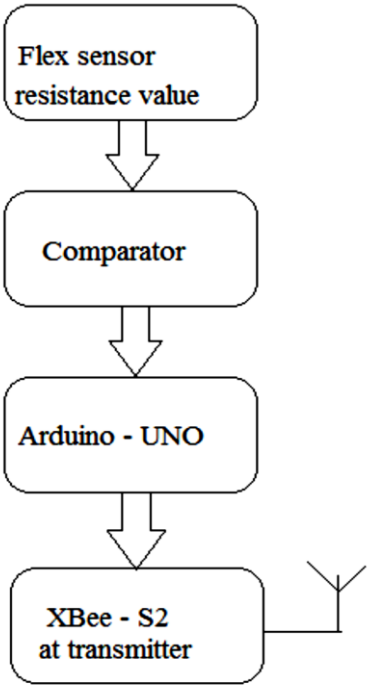


Figure 2. Transmitter circuit

2) Flex sensor: Flex sensor is a variable resistor that gives variable resistance value after bending. Flex sensor is also called as potentiometer. When flex sensor will be connected with analog pins of Arduino-UNO resistance of flex sensor can be measured. Value of resistance increases with bending angles. Bending radius is inversely proportional to resistance value. By applying particular amount of voltage, resistance generated by flex sensor is then compared by comparator circuit and output voltage value calculated.

3) Arduino-UNO: Arduino-UNO is ATMEGA-328 based microcontroller board. It has 14 digital input/output pins in which 6 are analog pins , clock cycle of 16 MHz quartz crystal, a USB cable or power with AC to DC adapter. The ATmega328 AVR microcontroller has 32 KB flash memory (with0.5 KB occupied by the boot loader). It also has 2 KB of SRAM and 1 KB of EEPROM. The board can operate on an external supply from 6 to 20 volts. The microcontroller can be programmed using Arduino-UNO specialized software.

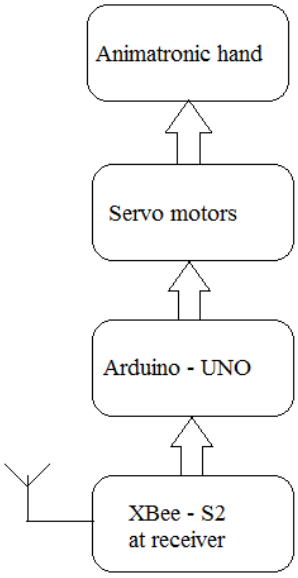


Figure 3. Receiver Circuit

4) Servo motor: Servo motor is electrical motor with great precision that rotates in different degrees. Servo motor can turn 90 degree and 45 degree in either direction for total 180 degree movement. Servo motor expects to see a pulse in every 20 ms. How far motor turns is depends on length of pulse. The input to its control is a signal, either analog or digital, representing the position commanded for the output shaft. Servo motor requires sophisticated controller, often dedicated module design specifically to the motor suitable for the use in the control system. XBEE is a wireless communication module that Digital built to the 802.15.4/Zigbee standards. The XBee shield simplifies the task of interfacing XBee with an Arduino. It has 20 input/output pins. It has operating voltage of 5V DC. XBee Shield has Status LEDs, Prototyping Area, Arduino reset button ,Serial select switch , XBee socket.

IV. ALGORITHM

1. Start
2. Get the analog output from flex sensors.
3. Convert into digital form and send it to XBee serially.
4. Send data wirelessly through XBee on transmitter side.
5. Receive the data wirelessly via XBee on receiver side.
6. Give the output to the servomotors accordingly.
7. Stop.

V. WORKING

The whole working of project is divided into two parts i.e., transmitter and receiver. As far as transmitter is concerned, there are four main stages which are flex sensor, comparator circuit, arduino-UNO and XBee shield. Initially flex sensor is mounted on cotton or woollen gloves, as finger bends to a certain angle flex sensor also get bent at the same angel. As per the property of flex sensor it gives different value of resistance with different angles. This resistance value is then gives to comparator circuit where output voltage value is calculated by the voltage divider formula. As resistance changes at different angles the value of voltage is also changes. This value is then given to arduino-UNO board at its input pins.

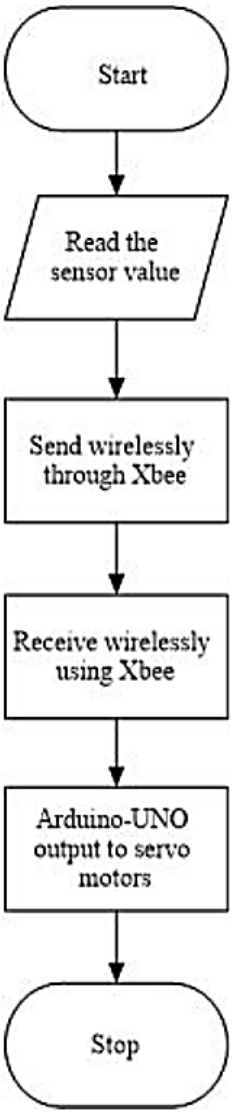


Figure 2. Flowchart

As XBee-S2 shield provides interfacing to arduino-UNO board. This voltage value is then sent to XBee-S2 transmitter pin and the data is send wirelessly to another XBee-S2 which is at receiver side. This data is received by another XBee-S2 at receiver side at its input pins. The output voltage value is sent to another arduino-UNO board through output pins of XBee-S2 to input pins of arduino-UNO at receiver. Servo motors were connected to arduino-UNO at receiver side hence by various voltage values servo motors starts rotating at various direction and finally animatronic hand starts working.

VI. RESULT

A wireless animatronic hand was first tested with a single finger. It was observed that after bending the single flex sensor at the transmitter side, the corresponding robotic finger moved in the same direction and same angle. Servo motor causes the movement of a robotic finger. With reference to this, all five servo motors moved by five flex sensors on a cotton or woollen glove. In this way, a wireless communication has been achieved successfully. So, now it is possible that a man can control a robotic hand from a distance wirelessly.

VII. CONCLUSION

This paper presents a wireless animatronic hand which is implemented by using a latest wireless technology. It can be widely used where there are harmful things to a human hand. It is basically a futuristic project which will be used to make Human hand. Future efforts will be made to make this hand movable from one place to another, more flexible and more precise if possible be implemented in computers using external iris recognition devices.

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