Hand Gesture Controlled Robotic Arm

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***Abstract*— In many industries wireless operations are necessary especially in dangerous or hazards areas. In some of the industries it is necessary to handle few jobs with very high temperature which is not possible by human hand in such cases wireless operations are more efficient. This paper focuses on design of hand gesture controlled robotic arm using microcontroller.**

***Keywords*— Robotic manipulator, hand gesture controlled arm, flex sensor**

Introduction

In today's life automation plays very important role. Robotic arm is called as robot manipulator which can perform various functions as human arm performs. Many industries use a robot for various functions where important part of any robot is Robotic arm or called as robot manipulator should be controlled precisely depending upon application. In industry or any application robot manipulator can be used for applications like welding, trimming; picking etc. advantage of such robotic arm is it can work in hazards area, which cannot be accessed by human. Many parameters of robot are designed according to requirement. There are different ways to control robotic arm like Voice Controlled, Keypad Control, Gesture Control, etc. Implemented system consists of transmitter & receiver. Transmitter is nothing but human hand with flex sensors & receiver is robot manipulator. Motion of transmitter is wirelessly transmitted to receiver through X-bee module. Robotic arm which is receiver is nothing but a mechanical system formed by different joints and end and effectors i.e. gripper movements of these fingers or gripper can be carried out using stepper motor or servo motor when user carry out motion of hand for any application at transmitter side same movement is copied by receiver as on transmitter there are flex sensors mounted on glove at transmitter which change its resistance depending on movement of user.

1. BLOCK DIAGRAM

1.1 TRANSMITTER

The below fig 1.1.1 is block diagram of transmitter consist of Microcontroller with two inputs from flex sensor & accelerometer. As shown in fig 1.1.2 Flex sensors are analog resistors. It works as variable analog voltage divider. Internally it consists of carbon resistive element with thin substrate. As substrate is flexible when it is bent, sensor produces resistive output which is equivalent to bend radius. The flex sensor provides greater accuracy for small movements also. Smaller the radius higher will be the resistance value.These flex sensors are mounted on human palm as user moves palm for particular applications flex sensor also bends by same amount as they are flexible.

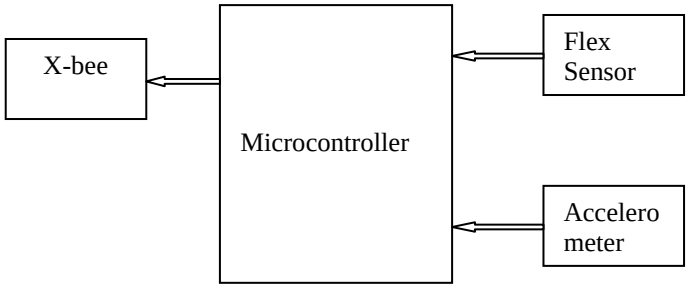

Fig – 1.1.1 Block Diagram of Transmitter

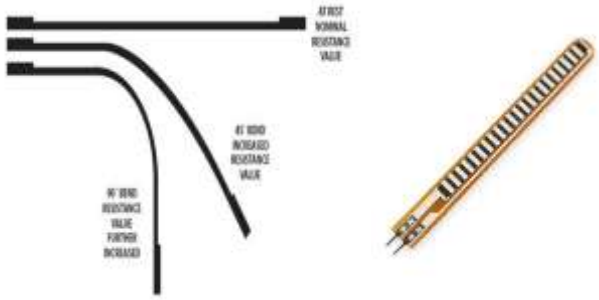

Fig - 1.1.2Flex Sensor

The changes due to tilt of accelerometer are in forward, backward i.e. X-axis, left, right i.e. Y-axis and up, down i.e. Z-axis. Accelerometer converts deflection into proportionate voltage & Analog to Digital converter convert analog signal into proportionate digital value. So according to positive & negative deflections motor either rotates in clockwise or in anticlockwise direction.

1.2. RECIEVER

The below fig 1.2.1 is block diagram of receiver, in the transmitter side x-bee transmit the signal and this signal is received by the receiver x-bee and then fed to the microcontroller which drives motor through motor driver to control movement of robot manipulator.

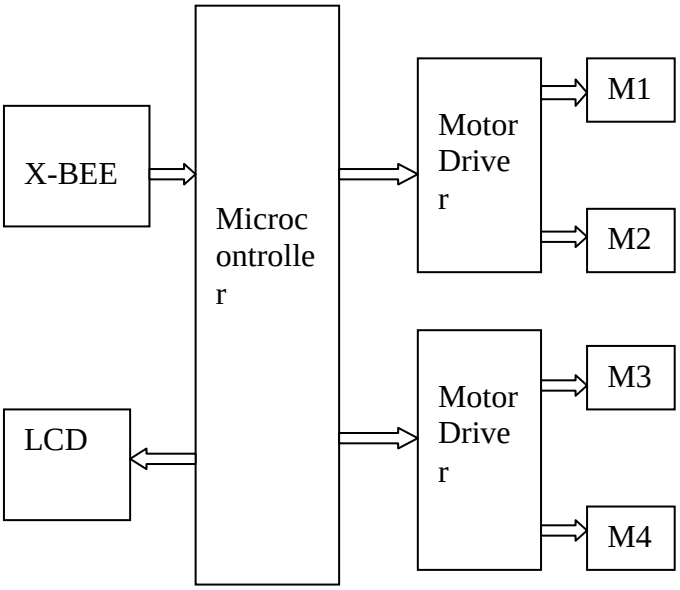

Fig – 1.2.1 Block diagram of receiver

BO motor is used to move robot manipulator gripper in forward & backward direction.BO motor is brushless electric motor that divides rotation into equivalent number of steps. The position of motor can be controlled through these steps
It can hold one of these steps without any feedback sensor. If DC voltage is applied to the terminals of motor, it rotates contentiously. It accepts DC voltage as input & converts it into train of pulses i.e. square wave. Each pulse defines increment in shaft position, thus each pulse rotates shaft through a fixed angle.

Fig – 1.2.2 BO Motor

2. SIMULATION RESULTS

Below window (fig 2.1) shows simulation of LCD & Motor in proteus.

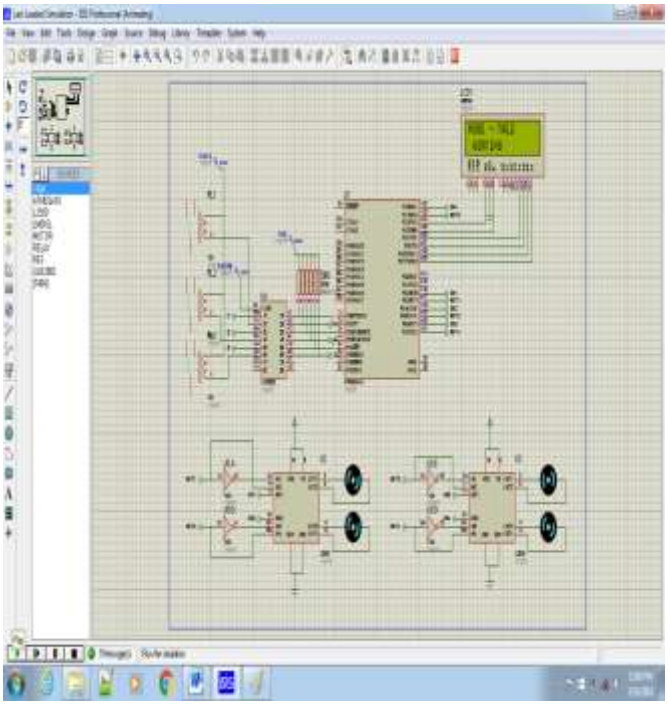

Fig – 2.1 Simulation of Motor & LCD

3 EXPERIMENTAL SETUP

Following figure 3.1 shows experimental setup which consists of transmitter i.e. glove mounted on human palm with flex sensors & receiver which is robot manipulator arm. This setup shows receiver is following movement of transmitter.

Fig- 3.1 Experimental setup

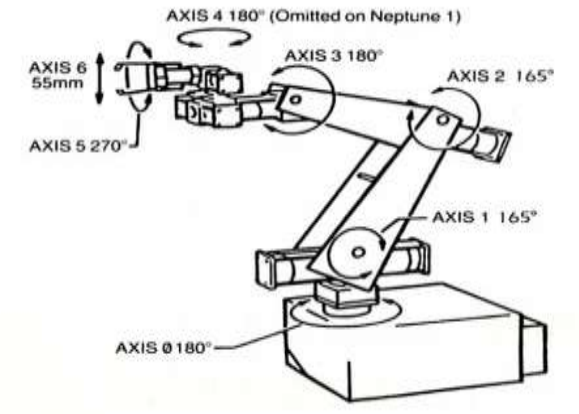

Fig 3.3 Robot manipulator Arm

4 CONCLUSION

Such type of hand gesture controlled robotic arm is mostly useful for Industrial, Medical & Military applications. This type of the hand gesture technology can be used where the humans are unable to sustain in the difficult or harsh environments. This might reduce some of the labor that is used in industry and also the life risk factor.

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