



HAND GESTURE CONTROLLED ROBOT

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1. Abstract

In today's human-machine interaction is becoming widespread. So with the introduction of new technologies the gap between machines and humans is being reduced to ease the standard of living. Most of the works are very harm to human health due to this man controlled robots get used for the certain tasks. Sensor plays an important role in robotics. Sensors are used to determine the current state of the system. Robotic applications demand sensors with high degrees of repeatability, precision, and reliability. Flex sensor is such a device, which accomplish the above task with great degree of accuracy. The pick and place operation of the robotics arm can be efficiently controlled using micro controller programming. This is an exciting and high challenge research work in recent year.

2. Introduction

The ever increasing population trend of the new millennium expects new technical innovation to meet the new challenges being faced by human beings. The integration of medical science and engineering has made the task like complicated surgery by robotic arm simpler. To capture the motion of human limbs, sensors can be used. Some companies have

designed units, which can integrate accelerometers, gyroscopes, magnetometers and can be attached to human limbs. These units can be worn for video game character modelling [1], virtual reality [2,3], activity recognition [4]. A sensor is a device that can measure some attribute of motion, being one of this designed work is an educational based concept as robotic control three primitives of robotics (besides planning and control), sensing plays an important role in robotic paradigms. Robotic arm manipulators can have different configurations and kinematic constraints. Few of these constraints can be effectively mapped from the human arm domain to the robot's restricted joint space. In this paper a general method of mapping human motions to the robotic arm domain has been demonstrated.

The arm moment is reciprocated almost exactly by the robotic arm. Data capture is achieved with the special motion capture sensor called "Shape Tape" that is worn by the human operator. Any human arm (or even leg, neck or spine) moment can be mapped on to any of the outline of the paper.

3.Related Work

An interesting description of inertial sensors and some innovative application of sensors have been discussed in [1]. [2] gives an examination of the impact of individual sensor on the performance of a navigation system. [5] gives the design of a controller intended for teleoperation, which is capable of controlling an anthropomorphic robotic arm through a LAN or via the Internet. [6] provides a review of relevant mobile robot positioning technologies like Odometry, Inertial Navigation, Magnetic Compasses, GPS Model Matching etc. Pick and place operation by controlling the speed and position using FPGA and sensor circuitry has been discussed in [7-8]. But the important contribution of present work is that any human arm movements can be mapped onto the robotic arm with good precision. Further the flexibility of micro controller programming makes the task easier. Finally [9] discusses the robotic arm function using MATLAB simulink.

4. Flex Sensor Based Robotic Arm Using Micro Controller

The block diagram consist of three important parts: The wearable data glove controller, Processing unit and the servo controlled robotic. The DG has been designed with two flex sensors, signal conditioning circuit and 3-axis accelerometer. Processing unit consists of micro controller (P89V51RD2), analog to digital converter (ADC0809), stepper motor driver (ULN 2803AG). At other side a 3 degree of freedom robotic arm is built using 4 servomotors and one stepper motor. Experimental set-up .

5.Block Diagram

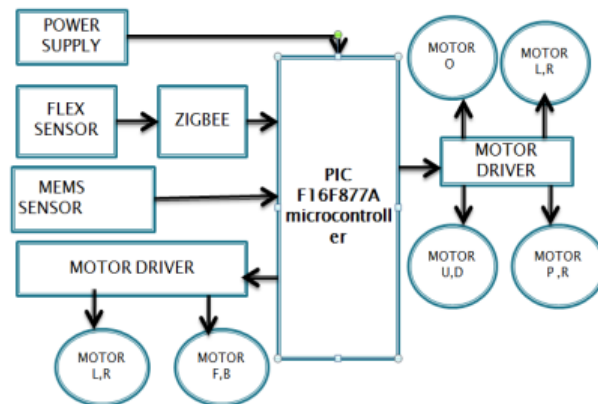


Figure 1-block diagram

Block Explanation

- To move forward tilt the hand in forward
- To move in reverse tilt the hand in backward direction.
- To turn right tilt the hand in right side
- To turn left tilt the hand in left side
- To stop hold the hand straight

6.Circuit Diagram

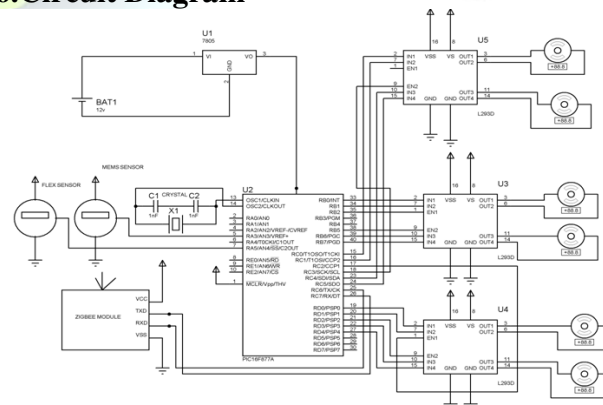


Figure 2 circuit diagram

7. Flex Sensor

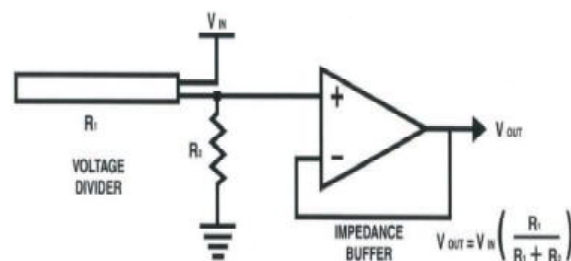
Flex sensors are analog resistors. These resistors work as variable analog voltage divider. Inside the flex sensor are carbon resistive elements with thin flexible substrate. More carbon means less resistance. When the substrate is bent the sensor produces resistance output relative to the bend radius. 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. Smaller the radius, higher will be the resistance value [2].

The impedance buffer in the circuit is a single sided operational amplifier used with these sensors. 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. The signal conditioning circuit is used to read these resistance changes and it is given to ADC.

ADC converts these values into equivalent digital values.

8. Micro controller

The micro controller is responsible for controlling the action of robotic arm. It receives input variation of flex sensor through ADC, which is given in form of proportional current variation to motors attached to robotic arm. The design engineer can choose to run the application with the conventional 80C51 clock rate (12 clocks per machine cycle) or select the X2 mode (six clocks per machine cycle) to achieve twice the throughput at the same clock frequency [8].



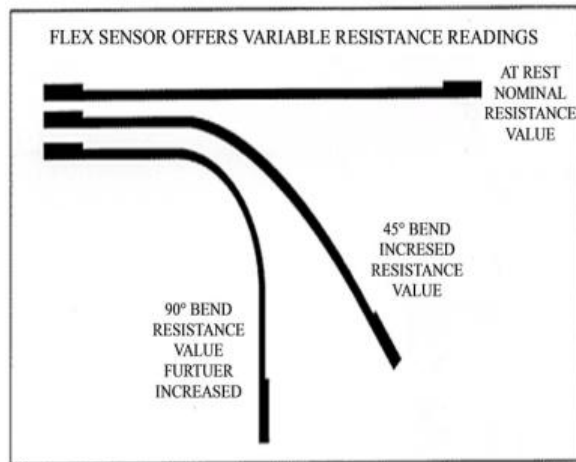
9. Flow of Action for the Robotic Arm

1. Read values of the sensor;
2. Micro controller processes the sensor values;
3. Send values from microcontroller to servomotors;
4. Pick up the objects;
5. Place at the required position;
6. Bring arm at original position.

10. Results and Discussion

Flex Sensor Output Variation

The variation of volt with respect to variation in deflection of flex sensor. Initially the flex sensor is at default position, a constant value of 73 de- gree. The value decreases as we start bending the flex sensor. This particular change in flex sensor value is used to rotate servo motors.



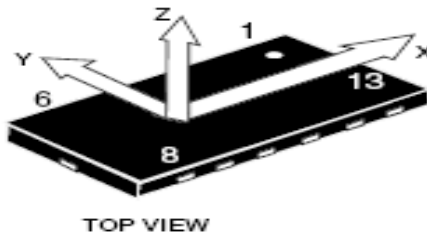
11.MEMS SENSOR

Mems electro mechanical system



- MEMS or MicroElectro Mechanical Systems is a technique of combining Electrical and Mechanical components together on a chip, to produce a system of miniature dimensions ..
- By miniature, we mean dimensions less than the thickness of human hair !!!!

Pin connection

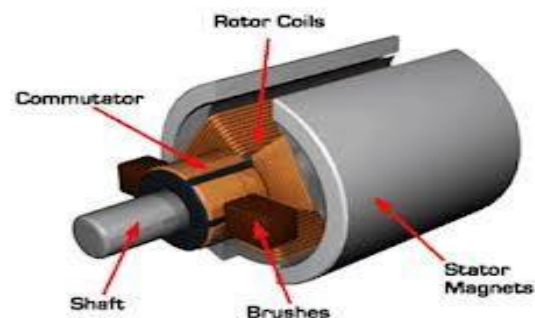


12.Zigbee



1. Technological Standard Created for Control and Sensor
2. Based on the IEEE 802.15.4 Standard
3. Operates at ISM 2.4GHz frequency
4. Low data rate
5. Low power consumption
6. Small packet devices

13.DC Motor





1. A motor is an electrical machine which converts electrical energy into mechanical energy.

2. The principle of working of a DC MOTOR is that "Whenever a current carrying conductor is placed in magnetic field, it experiences a mechanical force".

2. The direction of force is given by Fleming's left hand rule.

14. Conclusion And Future Work

The paper discussed a hardware and software co design of robotic arm controller using four servomotors employing micro controller. Micro controller programming can be done with an ease to suit the requirements. Unlike [7] which employ FPGA based control. Micro controller based programs can be flexibly modified to suit the necessary drive control of the servomotor.

Researcher can work for wireless control of the robotic arm by employing some wireless application protocol. Then the robotic arm can be more efficiently employed.

15. References

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