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GESTURE CONTROLLED ROBOTIC ARM

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Abstract: **The goal of this project is to control the movement of robotic arm using an accelerometer attached to a hand. This gives more interactive way to communicate with robots and also help in teaching the robots rather than programming it in the conventional way using computers. Also in this approach we make the robot more reactive i.e., for even a small input from the accelerometer the will have some movement.**

Keywords: **Robotics, Servo motor, Accelerometer, Pic Microcontroller (PIC 16F877).**

I. INTRODUCTION

Proposed an accelerometer-based system to control an industrial robot using low-cost and small 2-axis accelerometer. These accelerometer are attached to the human arms, capturing its behaviour (gestures and postures). The robotic arm starts the movement at the same time as the user starts to perform gesture or posture. New and more natural human-robot interfaces are of required to the evolution of robotics.

The main objective is to increase the high precision using high torque dc motors. Using the hitec C we simulate the various values of inputs and results of output and fixed perfectly

II. COMPONENTS UTILIZED

- MICRO CONTROLLER
- MOTOR DRIVER
- ACCELEROMETER
- RECTIFIER UNIT
- FILTERING UNIT
- VOLTAGE REGULATORS
- TRANSFORMERS
- CRYSTAL OSCILLATOR
- PWM

MICRO CONTROLLER:

The micro controller we use is PIC 16F877. It is a 40 pin microcontroller. Some features of this micro controller are operating speed at 20MHz clock input. It has a Flash Program memory up to 8K x 14 words and also it has 368 x 8 bytes which serves as Data Memory (RAM).It has a interrupt capability of 14. Also it has Power on reset(POR) and power up timer(PWRT). It has wide operating voltage range: 2.0V to 5.5V. We used port B and port D. PORTB is an 8-bit wide, bi-directional port. Port D is also 8 bit wide each pin is individually configurable as an input or output

MOTOR DRIVER:

The L298 is an integrated monolithic circuit. It is a high current and high voltage dual full-bridge driver to accept standard TTL logic levels. It helps to drive inductive loads such as DC and stepping motors , solenoids and relays. Two

enable inputs are provided to enable or disable the device independent of the input signals. The emitters of the lower transistors of each bridge are connected together and the corresponding external terminal can be used for the connection of an external sensing resistor. Another additional supply input is provided so that the logic works at a lower voltage.

ACCELEROMETER:

We use ADXL320 accelerometer. It has some features such as small and thin about 4 mm × 4 mm × 1.45 mm LFCSP package and it has 2 m*g* resolution at 60 Hz. Wide supply voltage range: 2.4 V to 5.25 V and Low power consumption: 350 μA at V_S = 2.4 V (typ). It also has good zero *g* bias stability and good sensitivity accuracy. Its main applications are

- Cost-sensitive motion
- Tilt-sensing applications
- Smart hand-held devices
- Mobile phones
- Sports and health-related devices
- PC security and PC peripherals

RECTIFIER UNIT:

The rectifier circuit is a circuit which rectifies AC voltage into DC voltage. Most of the electronic applications we will be requiring DC voltage that it constant voltage supply. We require constant DC voltage from the AC voltage supplied to our homes. In order to get DC voltage level from AC we will have to use rectifier circuit where diode is used.

FILTERING UNIT:

A filter is an electrical network that alters the amplitude and/or phase characteristics of a signal with respect to frequency. Ideally, a filter does not add new frequencies to the input signal, nor will it change the component frequencies of that signal. It will change the relative amplitudes of the various frequency components, phase relationships as required. Filters are often used in electronic systems to accept signals in certain frequency ranges and reject other frequency ranged signals.

VOLTAGE REGULATORS:

A voltage regulator is designed to automatically maintain a constant voltage . A voltage regulator may be a simple "feed-forward" design or might have an negative feedback control loops. It may use an electromechanical mechanism or electronic components. Depending on the design, it may be used to regulate one or more AC or DC voltages.[8]

TRANSFORMERS:

When a magnetic field fluctuates around a piece of wire, an electric current is generated in the wire. So if we put a second coil of wire next to the first one, and send a electric current into the first coil, we will create an electric current in the second wire. The current passed into the first coil is called the primary current and the current in the second wire is the secondary current.[9]

CRYSTAL OSCILLATOR:

A crystal oscillator is an electronic oscillator circuit that uses the mechanical resonance of a crystal of piezoelectric material. This helps us to create an electrical signal with a very precise frequency. Frequency is used to keep track of time (as in quartz wristwatches), to provide a stable clock signal for digital integrated circuits. The most common type of piezoelectric resonator used is the quartz crystal, so oscillator circuits using them are known as crystal oscillators.

PWM:

Pulse width modulation (PWM) is a powerful technique for controlling analog circuits with a processor's digital outputs. PWM is employed in a wide variety of applications, ranging from measurement and communications to power control and conversion. PWM is a way of digitally encoding analog signal levels. Through the use of high-resolutioncounters the *duty cycle* of a square wave is modulated to encode a specific analog signal level. [6]

To start PWM operation, the software should:

- Set the period in the on-chip timer/counter that provides the modulating square wave

- Set the on-time in the PWM control register
- Set the direction of the PWM output, which is one of the general-purpose I/O pins
- Start the timer
- Enable the PWM controller[6]

III. ALGORITHM

STEP 1: Start the program

STEP 2: Initialise the microcontroller registers such as ???//

STEP 3: for motor 1- if accelerometer output y<300 turn left call delay

STEP 4: for motor 1- if accelerometer output y>400 turn right call delay

STEP 5: for motor 2- if accelerometer output x<300 rotate down call delay

STEP 6: for motor 2- if accelerometer output x>400 rotate up call delay

STEP 7: delay is sub function called for slow movement of the motor. In this PWM is utilized so that motor will move slowly. This can be modified according to the speed requirement.

STEP 8: Stop the program.

IV. CIRCUIT DETAILS

Initially a program is written and dumped into the microcontroller using pic programmer. We had used a transformer for stepping down the voltage to 5v. Then a bridge rectifier for its higher efficiency and full wave rectification with the four diodes IN4007. This is continued with the filter circuits. From the filter we give input to the voltage regulator. Through this we give input to the micro controller.

This 5v supply is not enough for driving the motors. So we use another transformer for stepping down the voltage to 12v for this purpose alone. Other components like rectifier, filter and regulator are not required for this. This output from the transformer is given to motor driver IC L298.

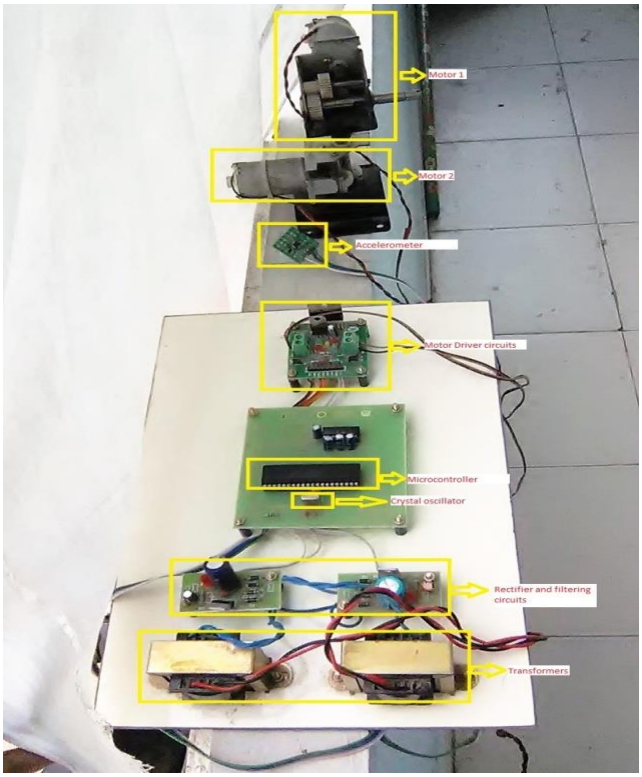

Fig1. Total view of robotic arm

V. APPLICATIONS

Such types of robotic arms can be put to use in various types of applications as follows:

- Control of various functions of robots in arduous and dusty atmospheres industrial jobs as in painting shops, shot blasting chambers etc. The operator controls the robotic functions from outside the hazardous chambers looking through a glass door.
- Automatic picking of small objects (bottles, bags, tumblers etc) moving on a conveyor and placing at other desired location in industries manufacturing various types of cosmetics, food products, medicines etc.
- Automatic metal cutting machines in particular desire profiles, which are located in high temperature zones.
- Advanced robotic toys, operated with state-of-art hand operated control systems.
- Robots controlled cranes, lifting forks etc operated from a distance with fingers/hands controlled remote system

VI. CONCLUSION

A novel method of using accelerometer as input for controlling a robotic arm is done. In this we implemented a arm with 2 degree of freedom.

Future work could be done using multiple accelerometers and increasing the degree of freedom of robotic arm. And finally a human like arm can be made. If this could mimic the human arm then it can be widely used.

The response time should be made equal to the same as human arm. And also the processing of multiple accelerometers is a tedious task to be done.

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