

# A Review on Control of Robotic Arm using Microcontroller and Flex Sensor

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**1.Abstract;**In this project the implementation of microcontroller controlled robotic arm is planned. Our robotic arm is planned in a way that it comprises of 4 moving fingers each with three linkages, an associated opposing thumb, a rotating joint associated to an elbow. This arm is made to imitate movements and gestures employing a single glove. The hand glove has five flex sensors for all the types of movement in the associated joints. The actuators used here for the arm are servo motors. The movement of the fingers is controlled cable wires that act same as the humans' arm. The arm hence made the robotic arm can be controlled by integrating a wireless module. A working model of gesture controlled robotic arm is created for varied hand movements.

## 2. INTRODUCTION

A robotic arm consists of many sections connected along by linkages that facilitate the arm to travel specifically in an exceedingly designed pattern, with sensors making certain that each one movements area unit precisely of the similar pattern [1]. they're invested with many degrees-of-freedom, giving them the flexibleness to maneuver in several directions throughout multiple angle with utmost ease.

A Robot in a lay man's language is a mechanical machine that has come into existence to make the human life simpler by replacing or replicating human activities, but to offer an excellent amount of precision and accuracy. A robot is defined as a programmable device with parts, tools and movable extensions which can be program controlled and manipulative multifunctional design. A robot that inspiring this project is a machine that addresses the signals it is designed to sense, processes the sensor information, and then uses it to perform the assigned task. A Robotic Arm consists of several sections connected together by linkages. It involves motors coupled with joints that are resolved by computers. Multiple degrees of freedom in robots give them the flexibility to move in many directions through multiple angles with utmost agility and ease. They outwit human errors. This offers reduced production great precision, reduced time and most favorable output in regards to quantity as well as quality.

Most of the major advanced robotic arms have features such as a rotational base, pivoting shoulder and elbow, rotatory gliding capable joints and gripping finger extensions. All of those amenities permit the mechanical arm to copy work closely fit what a person will do solely.

**2.1 Servo Motor,** use of servomotor is made in this project. Automatic control of DC motor in case of rotation angel has portrayed a vital part in the Electromechanical Engineering. A very important role is played by sensors in robotics, they are used to articulate the current state of the system. Applications using robotics demand highly repeatable, precise and reliable sensors to complete this task with accuracy flex sensors are the optimum choice Using the microcontroller programming the pick place function is efficiently managed. The above planned work is very educational and skill enhancing as concept of controlled robots is highly exciting with quality research work in recent years.

**2.2 Power Supply** is a crucial part of any electronic system. We have used 5 servo motors in this project with the required capacity. Each servo motor consumes approximately 1Amp at 5Volt supply, thus all together 5 servo motors will consume 5-6 amp of current. So, the challenging thing was to make a small power supply that can deliver that much of current without changing the voltage regulation. In our design we made use of power transistor (TIP41) in emitter follower config. to deliver 6.0 Amp.

**2.3 Servo Driver** is a hart of this system. Servo motors need continuous PWM signals to achieve the continuous angle configurations, thus we dedicated one microcontroller to control the entire five servos simultaneously. We choose to ATmega328 that is powerful low-cost controller by ATMEL.

**2.4 Flex sensor** can also be called bend sensor. That is effectively capable of sensing any kind of minute bends in its structure. This sensor is designed in a thin plastic strip type material with miniature carbon particles layered on its one of its surfaces. This carbon layer is divided into small sections and connected together in series by conductive layer. flex sensors or bend sensors are sensor that measures the amount of bending or deflection. mostly the sensor is pasted to the surface, and resistance of sensor element is changed by bending the surface. Flex sensor are also analog resistors. Working as an analog

voltage divider is another function of the flex sensor. In the inside of the sensor are carbon resistive elements whose substrate is of thin flexible layer. more carbon means less resistance. Resistance output is received at any moment it is bend which is corresponding to the bend radius. Good form factor is achieved on a flexible surface. Any change in the initial resistance means variation of length. To read the resistance changes conditioning circuit is used which are given to ADC. Digital values corresponding to these signals are created by ADC.

**3 System Overview:** - In this design we will be using flex sensor (bend sensors) to sense the motion of our fingers. We will be using 5 such sensors that will be arranged in a hand glove (left hand in below fig) which will make the sensors comfortable to wear. The Other part i.e. mechanical hand will consist of 5 fingers that will be controlled using 5 servo motors i.e. one motor for each finger (right hand in below fig). All together it will be one hand consists of 5 flex sensors one in each finger. Bend of fingers is analyzed using one of the Atmega328 microcontroller and this data will be send to another Atmega328 via serial communication, another microcontroller will generate appropriate PWM signals for controlling servo motors.

#### 4. LITERATURE REVIEW

We started with reading some of the research papers, this gives the information of impact of the single sensor on the navigation system basically it is the totally vision-dependent tracker that can operate in arbitrary uncalled-for environments, even outside. gives the information of an anthropomorphic robotic arm controlling using internet or LAN, this gives the information about mobile positioning and tracking using GPS. and magnetic compasses etc. pick and placing the object robots can be operated by using a FPGA and some sensor circuits. but our projects major contribution is of mapping the human arm movements to the robotic arm, with good accuracy. further programming the Arduino makes the task easier. This project is implemented using a microcontroller ATmega328 which contains an in-built ADC and a flex sensor .as we know when the sensor is bent it produces a change in the resistance. Which is in relation to the bent radius. servo motor are kind of electro mechanical motors that do not rotate continuously.

#### 5. ADVANTAGES

- These industrial robotic hands can be used for Dull Work, Dangerous Work, Dirty Work.
- Increased productivity
- Precision
- Decreased production cost as the initial fast return on the money put is recovered fast. since the robots increase production speed with almost no mistakes. the overall speed of the production is increased.
- Decreased cycle times, an automatic automation has the capability to act at constant speed while not stopping for breaks or vacations, and finally has the capability to provide additional work in exceedingly short dead line.
- Increased reliability and the quality because the tasks are performed with high precision and repeatability every time. the consistency in the manufactured product is maintained because of the accuracy of production.
- Better floor and space utilization in the working area as the machines seldom demand changing places and they stay put at a place and do their assigned tasks.
- Waste is also reduced as there is accurate calculations minimizing the trash which may not be possible with human hand.
- More customers are attracted because decrease in cost of mass productions leads to decrease in the cost of the final product.
- Safety factor is increased as robots work in a particular sequence which can be effectively monitored without any error. employees are assigned with supervision only from a safe distance and safety instructions. screens and separations are used to keep the employees safe.
- Improved worker safely leads to savings on the paper financial benefit occurs. Customer satisfaction is also increased due to accuracy in production and good quality due to controlled precise actions of automated machinery.
- Multiple application implementation expertise

The machines can be programmed to perform different tasks as per the requirement at hand. That makes them multifunctional and flexible according to the situation. Applications such as welding, cutting, palletizing, dispensing etc.

## 6. DISADVANTAGES

- Although these are not the disadvantages for robotic arm itself, it is more of a user point of perception,
- Complex mechanism
- Difficult inverse & forward kinematics
- Debugging the program of the micro-controller
- Calibration of motors for controlled actions.
- Big starting cost of investment means the initial cost of setup is quite high as integration automated robots in your manufacturing unit or workplaces costs a quite in the start, plus regular maintenance checks and service charges add up.
- Knowing the needs is also a very important aspect of introducing automation to your work. Incorporating industrial robots does not guarantee results. Making a specific production plan from starting to the end is very important if a company has reached farther down the line including automation may not be necessary or beneficial.
- Recognizing Importance of training is crucial as employees need training for programming and changing instructions with the robot equipment. This usually takes finance output and time.

## 7. FLOW OF ACTION FOR THE ROBOTIC ARM

- collect the signals from the sensor.
  - Microcontroller will process the sensor data.
  - send data to servos from the microcontroller.
  - objects are picked up or placed
- /PERFORM REQUIRED ACTION
- keep at the intended position.
  - arm is brought back at the original position.

## 8. CONCLUSION

The paper discusses the hardware and software of the flex sensor based robotic arm using servomotors and employing microcontroller. The Robotic Hand is very fruitful for the society and as well as industrial applications and it works good at the time of demo and showcasing.

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