

# ROBOTIC HAND CONTROLLING USING FLEX SENSORS AND ARDUINO UNO

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**Abstract** - This paper sightsees the robotic hand by which it is possible to do such kind of tasks where human interventions are not possible. In an environment where human interaction cannot be possible to do a particular job where the robots can do. Here we design a robotic hand with the help of flex sensor, Arduino Uno & servo motor. Robotic applications necessitate sensors with high degree of accuracy and consistency. The advantage of using Flex sensor is that, we can achieve the expected results with high degree of exactness. The above structure works on the standard values return by the flex sensor to the controller and by that degree the hand and the fingers has to move to grasp an entity. The five servo motors for each finger are also provided to control the activity of finger.

**Key Words:** Arduino Uno, Flex sensors, Analog to digital convertor, Servo motors.

## 1. INTRODUCTION

Unfortunately, most of persons met with an accident while working with huge machineries, that results in the loss of their limb. They may also have more of their limbs missing from their birth. But with the advent of technology, there are artificial limbs with that it is possible for those people to do things such as running, walking, holding the things, etc. These tools are called as prosthetics. A robotic hand is a mechanical device, which can perform parallel activities to a human hand. Robotic hands are the significant part of almost all the manufacturing firms. In firms, a robotic hand executes various functions such as welding, pruning, cutting and insertion etc. One of the biggest advantage of this hand is that it can work in dangerous areas and also in the areas where it is difficult to human to reach. The central purpose of this research work is to design and build an artificial part that will be strong enough to execute the assigned task. The hand is the one of the most intricate and weight bearing part of our human body which act as an input and output device to human. These objectives are intended by using flex sensor. A sensor is a device which identifies or measures a physical quantity then record it and after that responds to it. Robotic hand manipulators can have different arrangements. Some of these constrictions can be accurately mimic from the human hand domain to the robot's constrained joint space. In this paper a general method of representing human motions to the robotic hand domain has been verified. The hand moment is replied almost exactly by the robotic hand.

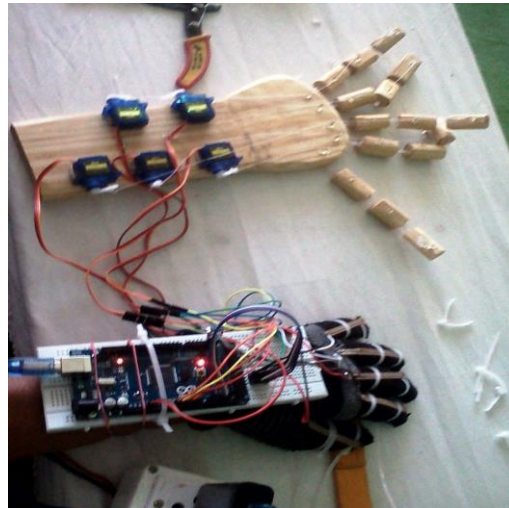
## 2. RELATED WORK:

Explanation of Inertial sensors in a very stimulating way and their inventive applications have been discussed in[1]. [2]explores an inspection of the effect of the distinct sensors on the working of a navigation system. [5] Provides the strategy of a controller proposed for remote operation, by which it is possible to control an anthropomorphic robotic arm through a LAN or via the Internet. [6] gives 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 hand moments can be mapped onto the robotic hand with good exactness. Further the tractability of micro controller coding makes the task much easier.

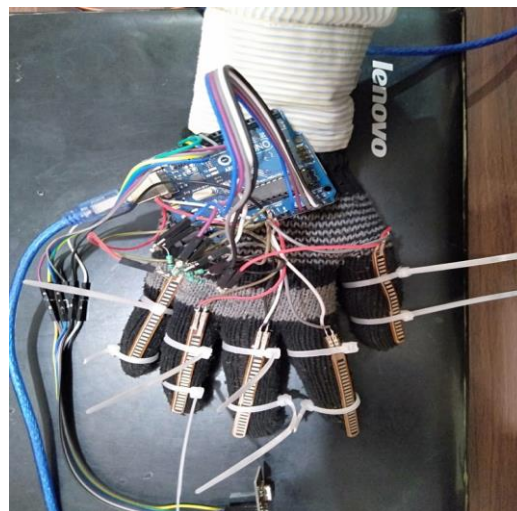
## 3. MODELLING:

The objective is to develop procedures that assist users to manage and program a robot, with a high-level of intellection from the robot specific language. Presenting a robotic demonstration in terms of high-level behaviours like gestures, communication, manual navigation, visual observation of human performance, etc., the user will determine the mechanism what it have to do. Programming and controlling an industrial robot through the use of machine is a critical and long task that needs technical knowledge. Therefore, new and a lot of intuitive ways are needed for mechanism programming and management. In this work many determinations are directed towards recognizing human gestures, relevant to finger

movement recognition and hand motion recognition systems. Accelerometer-based gesture recognition has their graph progressing over the last ten years. The affordable price and relative petite size of the accelerometers makes it a good tool to identify and distinguish the human body gestures. Many studies are conducted on the identification of gestures from acceleration data exploitation Artificial Neural Networks (ANN's).



**Fig -1:** Robotic hand activity



**Fig -2:** Human hand wearing flex sensors

#### 4. METHODOLOGY:

In this design we have used flex sensors for each finger to sense the movement of individual finger. These 5 sensors are organized on a hand glove, which will make the sensors easy to wear. The Other part i.e. mechanical hand consists of 5 fingers which are controlled with the help of five servo motors, one motor for each finger. All together it will be one hand consists of 5 flex sensor one in each finger. Movement like bending of fingers is analysed using ATmega16 microcontroller and the resultant data will be send to one of the port via serial communication. The microcontroller will generate appropriate PWM signals for controlling servo motors. The complexity of the project is reduced by properly categorising the whole project into sub design. It makes it to make a better design and work effectively. The readings of each fingers where measured in the form of voltage, while the movement of each fingers will be given with respect to angle. Thus to relate voltage with respect to angle we plot the graph of each finger and then we get a linear graph. By calculating equation of each line we can relate each other easily.

#### 4.1. Robotic glove:

Robotic glove houses the circuitry which controls the robotic arm. It consists of Arduino Mega 2560 which is programmed in such a way that it transfers the required data with the help of APC – 220 Module as well as it receives the data transmitted by the robotic arm. The Gyroscope and Accelerometer installed takes the angles (alpha, beta and gamma) and acceleration in all three directions of the hand respectively, sends the signals to the Arduino Mega via wires where the values are combined and processed simultaneously. At the same time the Flex sensor is doing its job by sending the degree of movement of the finger to the Arduino Mega.

#### 4.2. Robotic hand:

It is the main instrument where implementation of the program from the robotic glove takes place. It consists of total of 6 nos. of Servos, connected in such a way that it provides 3 DOF's (Degrees of Freedom) to the system. A micro controller Arduino UNO which inputs the values from the module and sends the data accordingly to the servos.

#### 5. FLOW OF ACTION FOR THE ROBOTIC ARM:

- Read values of the sensor.
- Micro controller processes the sensor values.
- Send values from microcontroller to servomotor.
- Mechanical hand corresponds to the finger movement.

#### 6. Flow-chart

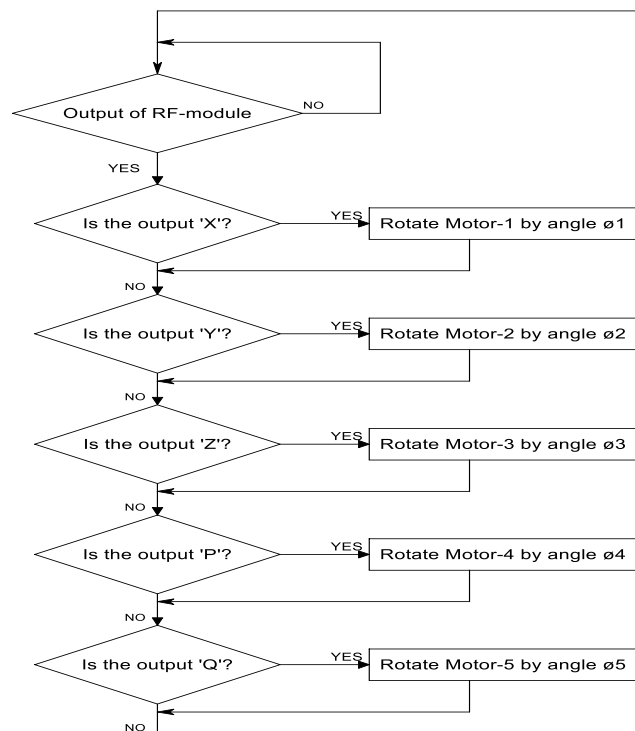


Fig -3: Flow diagram of data communication

#### RESULT:

The performance of the robotic hand is tested using different finger movements. The design of the robotic hand is kept modest without the use of any gears or any multifarious mechanisms. The robotic hand is able to replicate the finger movements. The use of the wireless module enabled to operate the robotic hand from a short distance of a 50 meters.

**CONCLUSION:**

The paper deliberates a combine hardware and software scheme of robotic hand controller with five servomotors employing micro controller. This Robotic Hand is useful for the society as well as manufacturing applications and works successfully at the time of demonstration. Micro controller based programs can be flexibly modified to suit the necessary drive control of the serve motor. Researcher can work for wireless control of the robotic hand by employing some wireless application protocol. Then the robotic hand can be more efficiently employed.

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