ROBOTIC ARM CONTROLLER BASED ON FLEX SENSOR

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Abstract :The sensor is the vital requirements the study of robotics. Sensors are the innovatory devices that are used to detect and responds to electrical or optical signals or in other words a sensor converts the physical parameter into electrical signal. Basically, the sensors must be accurate and precise to be used in field of robotics. Flex sensor is one of a kind which completes the task with being highly accurate. the movement of the fingers in bionic arm can be efficiently controlled by Arduino programming. Its highly challenging research work.

Index Terms: flex sensors, Arduino, servo motors, NRF (Wi-Fi modules)

1. Introduction

The bionic arm is a robot. Which can further be programmable to imitate the movement of human hand the integration of medical sciences and engineering has made the task like complicated surgery simpler by using the bionic arm .for capturing the motion of the human and sensor can be used .most of the time some companies designed different small parts which contain Accelerometers ,magnetometers, gyroscopes those can be further attached to human hand to capture the movement of the hand .these types of parts can be used for the modelling of video games [1], virtual reality is one of the biggest innovations of all time [2,3].activity recognitions used to track the actions of oneself [4].basically sensor is a devices which converts the physical parameters into electrical signals . sensing plays an important role robotics. robotics arms have different configurations and different motions limits. some of these motion limits can be mapped with the human hand. in this paper the broad method of mapping the human hand motion to the bionic arm. In simple words the bionic arm copies the movement of the human hand. the data from the hand is captured by the sensor called the flex sensor which contains a resistive liquid. the glove containing the Flex sensors is worn by the person. any moment of the body can be mapped for example (leg, neck, spinal cord) etc. this type of research can be used in the fields of medical, defence, and some industrial work where working is dangerous for humans.

2. Literature survey

Our story line started with reading some of the research papers. Vis-Tracker [2] suggested the information of impact of the single sensor on the navigation system basically it is the purely vision-based tracker that can operate in arbitrary unprepared environments, even outdoors. Source less Human Body Motion Capture [5] suggested the information of an anthropomorphic robotic arm controlling using internet or LAN. Mobile Robot Positioning Sensors & Technique [6] the gathered information 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 [7,8]. 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 ATmega 328 which contains an inbuilt ADC and a flex sensor .as we know when the sensor is bent it produces a change in the resistance. Which is relative to the bent radius [9]. Servo motor are kind of electro mechanical motors that do not rotate continuously.

3. Structure of the flex sensor based bionic arm

Transmitter section: this part contains flex sensors attached to the Atmega 328 at the Analog pins and further connected to NRF 24l01 Wi-Fi transmitter and adapter.
Nrf24L01 Wi-Fi network: this actually does not exist physically.it contains Wi-Fi modems and receivers attached to the Arduino which contains Atmega 328 micro controller

Receiver section: this part contains the servo motors attached to the Arduino at the Analog pins and connected to NRF24L01 via the transmitter and receiver.

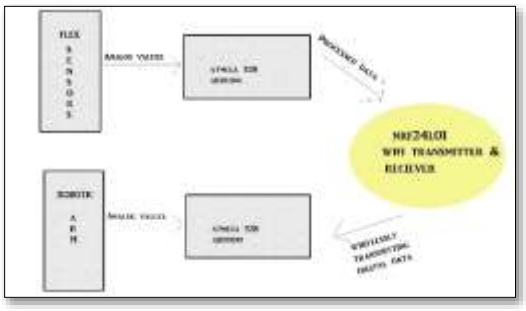


FIG 1.Block diagram of a wireless robotic arm

Flex Sensor

Flex sensor is also called as stoop sensor. It is accurate in sensing any miniature bend in the thin band. Flex sensor consist of thin resistive liquid which corresponds to the resistance change when it is bent Carbon coating is divided into small sections and connected together in series by conductive layer. These sensors are also called as Analog resistors. These sensors work as variable Analog voltage divider. When the substrate is bent the sensor produces change in a resistance output relative to the bent radius.

Microcontroller

Basically, of Robotic arm is controlled by Microcontroller. the micro controller receives the analog signal from the flex sensors and then further wirelessly transmitted over Wi-Fi and then it is converted to digitally.at the other end the receiver-end the micro controller converts the digitally converted signals to analog signal and sent them to the servo motors.

Servo Motor

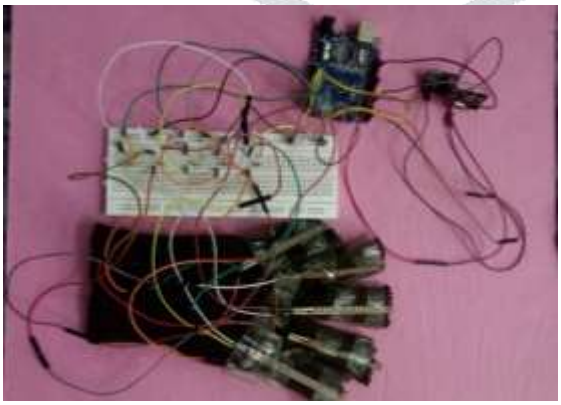
Servo motors are a type of electromechanical motor that do not rotate continuously like DC/AC or stepper motors; rather, they are used to locus and hold some object. They are used where nonstop rotation is not necessary so they are not used to drive wheels (unless a servo is modified). the servo motor holds the position .it retraced back to the position when external f

Power Supply

The signal is passed through the Step-down transformer. And Transformer bounce the output to Full wave rectifier. It converts the input signal into pulsating DC. Rectifier output is changed into pure DC by using filter. The voltage regulator is a particularly designed circuit to maintain the output voltage constant

4. Methodology

In this plan we will utilize flex sensor to detect the movement of our fingers. We will utilize 5 flex sensors that will be organized in a hand glove, which will make the sensors agreeable to wear. The Other part i.e. automated hand will comprise of five fingers that will be controlled utilizing 5 servo engines i.e. one engine for each finger. All together it will be one hand comprises of Five flex sensor one in each finger. Curve of fingers is controlled utilising AT Mega 326 microcontroller and this information will be send to another port through serial correspondence, the microcontroller will produce suitable simple signs for controlling servo engines.



The many-sided quality of the task is lessened by appropriately arranging the entire undertaking into sub outline. It improves it to make a plan and work successfully. The readings of every finger where estimated as voltage, while the development of every finger will be given as for point. So that to relate voltage as for point we plot the diagram of each finger and afterward we get a straight chart. By ascertaining condition of each line, we can relate each other effortlessly. At that point by knowing just a single of the esteem we can compute another esteem effortlessly. This condition will be then bolster to code of microcontroller associated in sensor unit then it will create suitable plot for individual finger. Ones it is done all information will be designed specifically bundle

with the goal that it will be effortlessly taken care of and send over Wi-Fi module. that receives the information from the beneficiary from the opposite end

Fig 2 practical implementation of transmitter

Fig 3 practical implementation of receiver

5. Results:

A model of mechanical hand for utilizing haptic innovation was used. The Arduino sheets were arranged to impart which encouraged the information. Exchange wirelessly. The outcomes appeared underneath to indicate changes in the flex sensor voltages, its Analog values at the transmitting Arduino board and its relating value at the accepting Arduino board which can be mapped utilizing 'Guide" function [10]. The 'AnalogRead' on an Arduino is essentially a voltage meter.

At 5V (its maximum) it would read 1023, and at 0V it peruses 0. So, the twist can be estimated utilizing the adjustment in the voltage values utilizing analogRead (). A voltage divider circuit is produced utilizing a 10kOhm resistor with the flex sensor. The following are the analog read and mapped values for the five flex sensors.

Finger 1

	Analog read values	**Mapping values**
Upper limit	730	20
Lowe limit	630	80

Finger 2

	Analog read values	**Mapping values**
Upper limit	710	175
Lowe limit	520	70

Finger 3

	Analog read values	**Mapping values**
Upper limit	680	10
Lowe limit	510	140

Finger 4

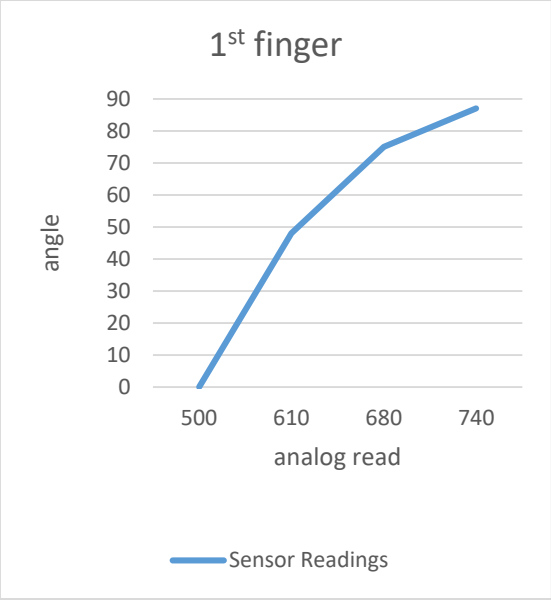
	Analog read values	Mapping values
Upper limit	715	175
Lowe limit	580	90

Finger 5

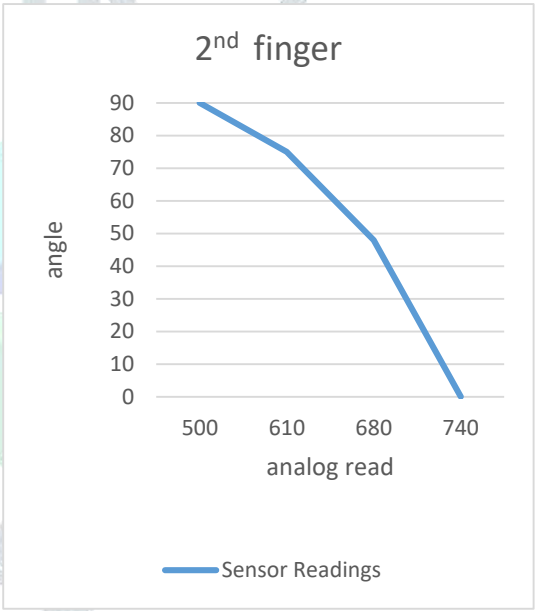
	Analog read values	Mapping values
Upper limit	700	175
Lowe limit	550	90

GRAPHICAL REPRESENTATION

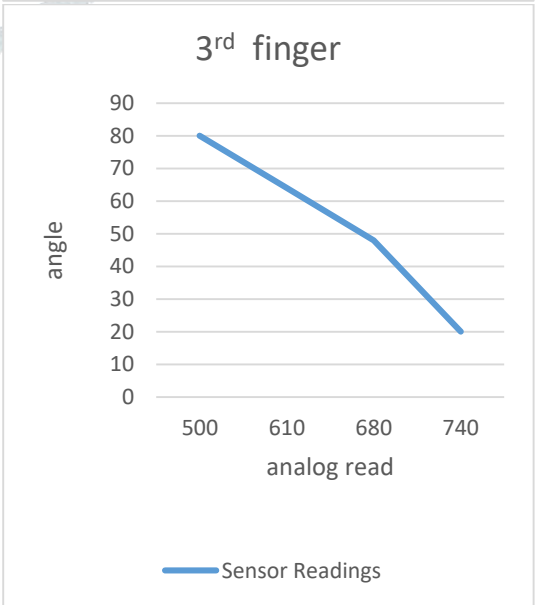
To plot chart, we took the readings of the flex sensor with hands, at that point twist each finger, and move the servo engines physically to set the coveted edge (angle).



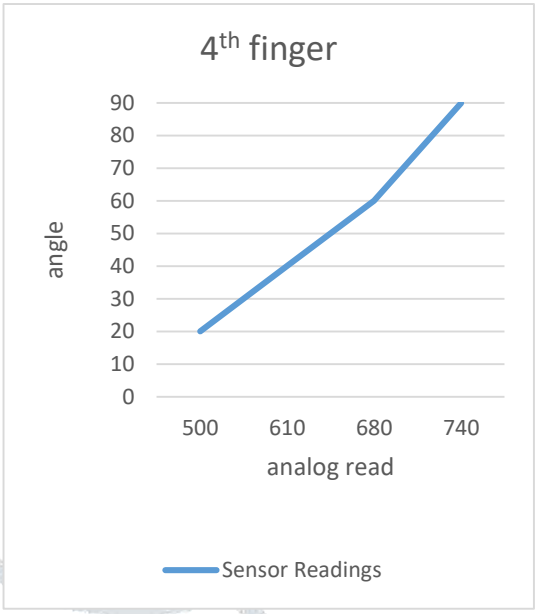
Graph 1: angle vs sensor reading 1st finger



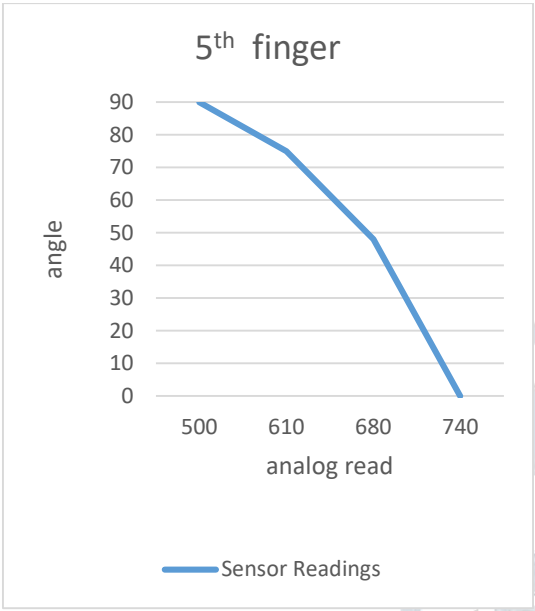
Graph 2: angle vs sensor reading 2nd finger



Graph 3: angle vs sensor reading 3rd finger



Graph 4: angle vs sensor reading 4th finger



Graph 5: angle vs sensor reading 5th finger

6. CONCLUSION

Our model could be used for demonstrating pick up and drop movement, but currently, the major limiting factor that was stunting the development of our model was “Latency” which is the time delay between the instructions Issued by the person and the movement of the robot which Responds to the instructions. With the current level Technology, the person must be in close proximity. Robot control refers to the way in which the sensing and action of a robot is coordinated. There are infinitely many Possible robot programs, but they all fall along a well-defined Spectrum of control. No single approach is "the best" for control of robots; each has its strengths and weaknesses. The accuracy and efficiency of movement have improved greatly because of the Application of robotics in the field. However, there are still more problems that need to be addressed. Research is still being carried out to improve the wireless transmission of Signal and reduce the delay and for the simultaneous Movement of two servos. Thus, the control of a robotic arm was achieved wirelessly Using flex sensor given by the user.

Different technologies summary

Sr.No	Wired/Wireless	Year	Technology
1	Wired	1999	VR TELEROBOT SYSTEM [10]
2	Wired	2006	Trajectory Planning [11]
3	Wired	2001	Pneumatic Actuators [12]
4	Wired	2003	fuzzy logic controller [13]
5	Wireless	2009	Wi-Fi-based and Remote Vision [14]

6	Wireless	2010	Service Tasks [15]
7	Wireless	2015	Smart phone based using raspberry pi, android and Wi-FiG [16]
8	Wired	2014	The Design and Analysis of Robotic Arm [17]
9	Wireless	2013	Remotely Commanding the Lynx motion AL5 Type [18]
10	Wireless	2012	DTMF (Dual tone multi frequency) [19]
11	Wireless	2015	Wireless Control of Anthropomorphic [20]
12	Wireless	2012	Gesture Actuated [21]
13	Wireless	2011	Servo Motor [22]
14	Wireless	2012	LABView [23]
15	Wireless	2009	Remote Vision [24]
16	Wired	2012	A Low-cost Compliant 7-DOF Robotic Manipulator[25]
17	Wired	2015	3D Virtual Game for Facilitated Training [26]

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