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A NOVEL VOICE, SENSOR AND THOUGHT CONTROLLED ROBOTIC ARM

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ABSTRACT

Robotic hand is the illusion of life achieved by electronic devices. These are used to imitate human and animal activities and are widely used in industry and practiced in movie making to create imaginary life like creatures. This technology makes possible to replicate a living being's action and facial expressions. We designed and developed a robotic hand which can be controlled by voice, sensors and brain thoughts. Developed Arm will simulate the movements of human fingers. There by providing virtual human arm working similar to human arm even controlled by brain Thoughts (EEG signals)

KEYWORDS: Arduino, Voice, EEG signals, EEG signal pattern, Robotic arm, microcontroller.

I. INTRODUCTION

This robotic arm is implemented by using the electronic devices. It is an integration of anatomy, mechatronics and puppetry. The main purpose of this robotic hand is to replace the human in complicated and dangerous tasks such as manufacturing, space, oceaneering and so on. The robotic arm can be designed to perform any desired task such as welding, spinning and gripping etc… depending on the application like robotic arms in automatic assembly lines perform a variety of task such as wielding and parts rotation and placement during assembly. The robotic arm we developed is controlled by voice commands, flex sensors and human brain EEG signals. Thus this will have predominant application for people who lost arms.

II. MATERIALS AND METHODS

Input: Flex sensor, voice commands, EEG signals sends the necessary input.
Process: Microcontroller executes instructions
Control: on the input.
Output: Servos execute the output which controls the movements of fingers on robotic arm

Figure1: ***Flex sensor***

Figure2: ***Arduino board***

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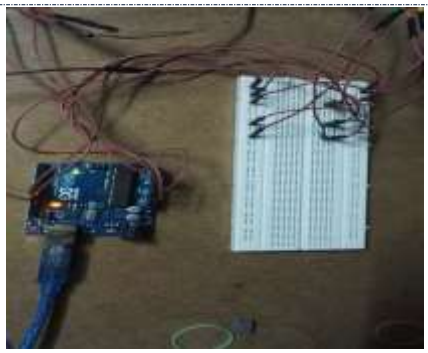

Figure3: ***Connections***

Figure4: ***Robotic arm***

Figure5: ***Voice Recognition module***

Figure6: ***Neurons Sensors***

Description:
Figure1 shows the designed flex sensors using which we can control the arm. Figure2&3 shows Arduino board that we used as microcontroller for coding and controlling arm. Figure 4 is the designed robotic arm connected with servo motors. Figure 5 & 6 are voice module and Neuron sensors compatible with arduino microcontroller.

III. Proposed system

We have developed two modules in our work.

1. Voice based control of Arm.
2. Flex Sensor based control of Arm.
3. Thought based control of Arm.

Module 1:
In this module we have implemented and developed hardware and software where the system can accept voice commands from the user which can control the Arm. In this module we have use arduino compatible voice module with microphone which receives voice commands and converts the voice command to appropriate digital signal. This digital signal is given as an input to arduino microcontroller at digital input pins. Our code controls the appropriate servo motor so that corresponding finger of the arm is operated.

Figure7: ***Voice Recognition module***

The above figure is a speaker-dependent voice recognition module. It supports up to 80 voice commands in all. Max 7 voice commands could work at the same time. Any sound could be trained as command. We trained the module first before it recognizes any voice command. This board has 2 controlling ways: Serial Port (full

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function), General Input Pins (part of function). General Output Pins on the board could generate several kinds of waves while corresponding voice command was recognized.

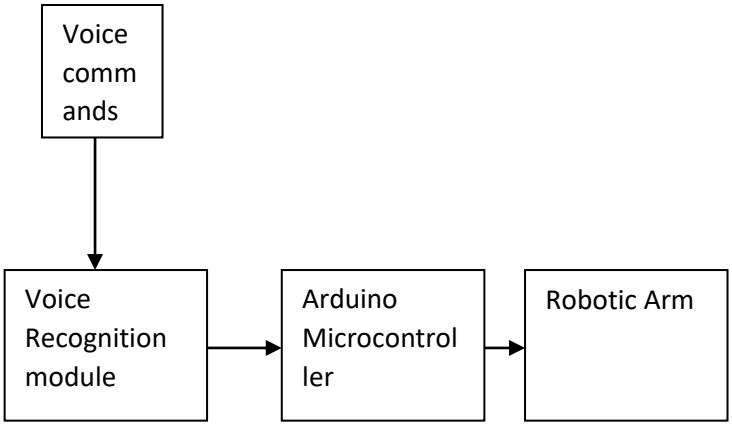

Figure8: ***Architecture for module 1***

Module 2:

In this module we have implemented and developed hardware and software where the system can accept flex sensor inputs from the user which can control the Arm. In this module we have designed flex sensors with aluminum sheets which are attached to glove. As the our finger moves inside the glove the corresponding finger flex sensors senses the signal and fed as an input to arduino microcontroller. Our code controls the appropriate servo motor so that corresponding finger of the arm is operated.

Figure 9: ***Designed Flex Sensors***

In this module whenever the user moves finger the corresponding attached flex sensor on the glove senses the movement and signals the arduino microcontroller. Now microcontroller controls the appropriate servo motor to rotate corresponding to finger of the user. In designing these flex sensors we have used aluminum thin sheets. We cut the sheet into two rectangular pieces per finger. These thin sheets are insulated with sponge material. One piece is given 5v and other piece is grounded. When attached to a glove being thin in thickness these are flexible and contact can be made by simple finger movement.

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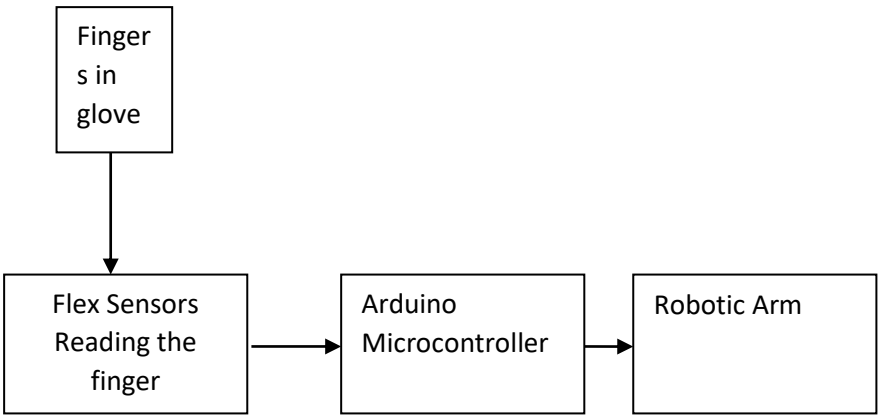

Figure 10: ***Architecture for module 2***

Module 3:

In this module we have implemented and developed hardware and software where the system can accept Neuron sensor inputs from user brain which are nothing but thoughts using which we can control the Arm. In this module we have used Neuron sensors with multiple nodes . These nodes can read Alpha , Beta and Gamma EEG signals (electroencephalogram) coming from human brain. As our brain thinks for a particular finger to move , the sensed EEG signals are amplified and gives as input to Arduino microcontroller. Our code controls the appropriate servo motor so that corresponding finger of the arm is operated.

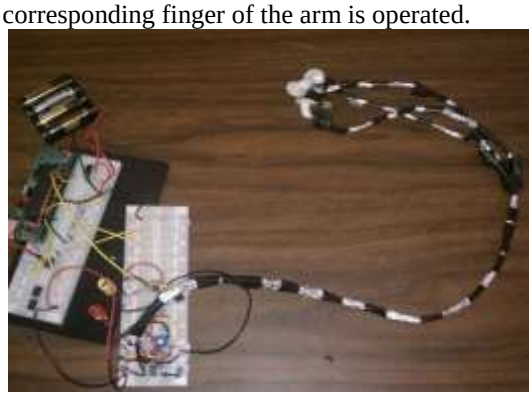

Figure11: ***Neuron Sensors***

In this module whenever the user thinks repeatedly number of times, the neuron sensors attached to the user brain receives EEG signals, Normally a human brain generates different types of EEG signals such as alpha, beta, delta, gamma etc.. depending upon human activity in brain. These EEG signals are normally very weak signals which are preprocessed and then amplified to the required strength and given to microcontroller. The microcontroller then operates the appropriate servo motor to control the exact finger on robotic arm.

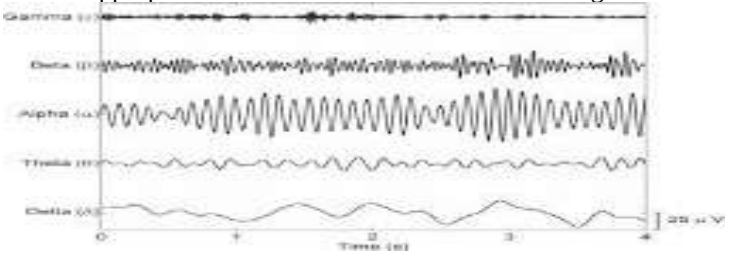

Figure12: ***Different EEG signals from Neuron Sensors***

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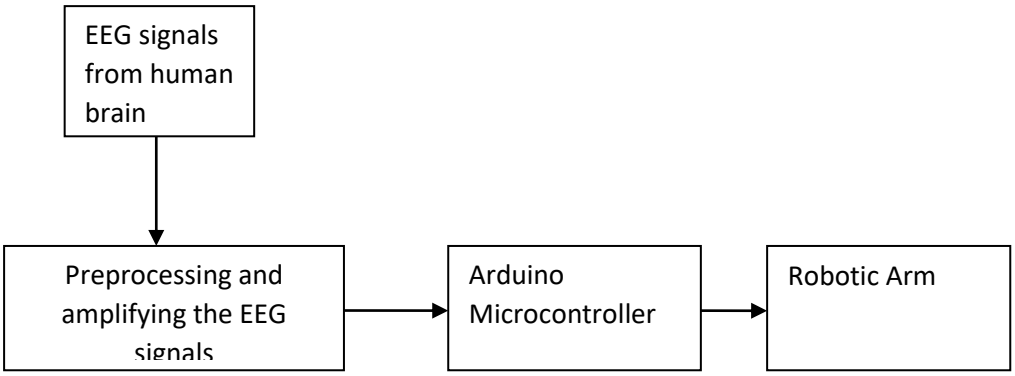

Figure 13: ***Architecture for module 3***

Results:

Table 1: ***Results for module 1***

Voice	*Status*	*Finger1*	*Finger2*	*Finger3*	*Finger4*	*Finger5*	*Output*
1	Yes	Yes	No	No	No	No	Thumb
2	Yes	No	Yes	No	No	No	Index
3	Yes	No	No	Yes	No	No	Middle
4	Yes	No	No	No	Yes	No	Ring
5	Yes	No	No	No	No	Yes	Little
Closed	Yes	Yes	Yes	Yes	Yes	Yes	All fingers are closed
Open	Yes	No	No	No	No	No	All fingers are opened

The above table shows the movement of fingers when corresponding voice is recognized.

Table 2: ***Results for module 2***

Sensor	*Status*	*Finger1*	*Finger2*	*Finger3*	*Finger4*	*Finger5*	*Output*
1	Yes	Yes	No	No	No	No	Thumb
2	Yes	No	Yes	No	No	No	Index
3	Yes	No	No	Yes	No	No	Middle
4	Yes	No	No	No	Yes	No	Ring
5	Yes	No	No	No	No	Yes	Little
Closed	Yes	Yes	Yes	Yes	Yes	Yes	All fingers are closed
Open	Yes	No	No	No	No	No	All fingers are opened

The above table shows the movement of fingers when corresponding sensor is moved.

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Table 3: ***Results for module 3***

Thought	*Status*	*Finger1*	*Finger2*	*Finger3*	*Finger4*	*Finger5*	*Output*
1	Yes	Yes	No	No	No	No	Thumb
2	Yes	No	Yes	No	No	No	Index
3	Yes	No	No	Yes	No	No	Middle
4	Yes	No	No	No	Yes	No	Ring
5	Yes	No	No	No	No	Yes	Little
Closed	Yes	Yes	Yes	Yes	Yes	Yes	All fingers are closed
Open	Yes	No	No	No	No	No	All fingers are opened

The above table shows the movement of fingers according to corresponding thought.

IV. CONCLUSION

In the proposed system we have developed 3 modules. In module 1 the robotic hand is controlled by the arduino compatible voice module with microphone. This recognizes the voice input from the user and sends the signal to the servo motors. Then corresponding finger will move. In module 2 the robotic hand is controlled by the flex sensors. In this when we bent the finger resistance is applied on the sensor and voltage varies. Then corresponding finger is identified and will close. In module 3 the robotic arm is controlled by the Neuron sensor inputs from user brain in the form of Gamma signals. When we think of a number by using the neuron sensor the corresponding motor is identified and finger will close

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