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Implementation OF Prosthetic Robotic ARM Using Additive Manufacturing

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Abstract: - In this paper we are designing to fabricate a Prosthetic robotic arm which can be developed by an EMG sensor and STM32 which detects the motion from the lower arm. For an amputee, upper appendages loss has different consequences not only regarding physical but as well as socially, financially what's more, mentally. Three cathodes read the EMG signal which will be connected in lower arm to control the hand. The signal is given to Myo-Electric Sensor. This Servo motor used to controls finger by the help of STM32 from EMG Signals and also gives the body temperature and pulse rate of the amputee which can be checked using IOT.

Key Words:— ***Internet of Things (IOT), STM32, Servo motor, Myo-electric Sensor, EMG Sensor.***

I. INTRODUCTION

India is a big country constituting 17.7% of the world's population and it has near to 5, 28, 000 arm amputees.as per the medical research amputation are performed with two objectives first one is to eliminate the cause of risk and the second is to allow adequate subsequent rehabilitation to achieve the fit of prosthesis and to reset the motor function with the movement of finger.

The primary causes of hand loss are trauma and the dysvascularity and neoplasia which is the major problems for us. Generally, the amputees of the hand are about 67% in men than women. In which the age ranges from 16 to 54 years. This is because the men are more likely lose their hands especially limb amputation during their working ages and this age is the main productive working ages. Similar to other product the development of the prosthetic hand is evolved. But the design and development of this prosthetic hand is not that much easy task. For this purpose, scientist and researches are working continuously and in an advanced technology. The development of this prosthetic hand depends on the age, sex, and the profession.

Prosthetic hands are designed to help people who lost full or partial hand loss retain the function and appearance of a regular hand. Basic prosthetic hands are replicas with only basic function. There are four different types of prosthetic hands

1. Passive Functional Hand Prosthesis
2. Body-Powered Hand Prostheses
3. Myoelectric Hand Prostheses
4. Finger Prostheses

The project is on *Myoelectric Hand Prosthetic* which comes with almost to replacing a normal hand or arm.

If a person who have become an Amputee by some serious traumas those people should be monitored by guardians. This is by implementing device to show the pulse rate (Heart beat) and Body Temperature.

II. PROBLEM STATEMENT

In the recent growing industries and working force there is a lack of safety and care methods and hence this kinds of problems are commonly occurring in humans. The loss of limb or arm is a major cause and also it causes to lose jobs, dependence of other person of the family, physical dependences and medical expenses etc. The prosthesis is the manufacture or making of the artificial part of the body which functions as like natural arm and helps for the people. The prostheses hand is much like human hand and less cost with basics functions.

III. PROPOSED WORK

The aim is to build an interactive smart Prosthetic Robotic Arm on STM32. That controls the operation prosthetic Arm, which gives the Body Temperature and also the Pulse rate of the amputee.

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IV. OBJECTIVES

The goals are as follow:

- Implementing a fully functional prosthetic arm for an Amputee.
- Implementing a device to detect pulse rate of an Amputee.
- Implementing a device to detect body temperature of an Amputee.
- Storing and Analyzing the Data.

Objective 1:

Implementing a fully functional prosthetic arm for an amputee

Measuring the muscle activity through the electrode and the signal is sent to the (EMG) electromyography which is been used from the traditional for medical research of neuromuscular disorders.

There are mainly two type of EMG Sensor, which are Surface EMG Sensor and Intravascular EMG Sensor. The process starts with placing the sensor on the surface of the ARM of the amputee and the electrodes begins to detect the movement of the muscle and thus the movement of the prosthetic ARM is initialized.

This Muscle Sensor does all the measures, filters, rectifies, and amplifies the electrical activity of a muscle and produces an analog output signal that can easily be read by a microcontroller.

Then the signal is going to STM32F20x Microcontroller which belongs to a family with high –performance Arm with operating frequency of 120MHZ also with high speed memory up to 128kbytes 4 Kbytes of backup SRAM.

The signals in STM32 which gets convert to Analog to Digital. Then the signal is pulse width modulated and it is configured according to run the servo motor which controls the operations of prosthetic Arm.

The PWM signal is sent to the servo motor and each finger is controlled using the servo motor to get the correct robotic action.

Objective 2:

Implementing a Device to detect a pulse rate of an Amputee.

The device is mainly used to measure the pulse rate of the amputee. The amputee is monitored who have lost by some serious trauma.

There are two common methods to find the heart beat arte one is by optical method and the other one is by Electrical method. We prefer Electrical method by using a pulse sensor which is done by heart rate sensor for STM32. It is easily available for everyone. The essence is to place the finger tip on the LED through which the light is emitted through the finger and from which the amount of light passed through the finger the pulse of the amputee is measured.

Objective 3:

Implementing a Device to detect a Body Temperature of an Amputee.

Body temperature revels how the person is healthy and the normal human body temperature is the typical temperature ranges from 36.5'C -37.5'C. We are using LM35 Sensor to detect the body temperature of an Amputee.

LM35 sensor measures the body temperature of an Amputee which is controlled by a Microcontroller STM32. Analog signal from the sensor is converted to Digital signal to revel the Body Temperature of an amputee.

Objective 4:

Storing and Analyzing the Data.

The pulse rate and the body temperature of an amputee which are stored in the STM32 Microcontroller are stored in cloud to monitor by a Guardian of an amputee by using IOT. Cloud storage is accessed with the help of internet. For accessing the internet Wi-Fi module Node MCU is used with the help of FTDI. And the data is transmitted to mobile /PC.

V. EXPERIMENTAL WORK

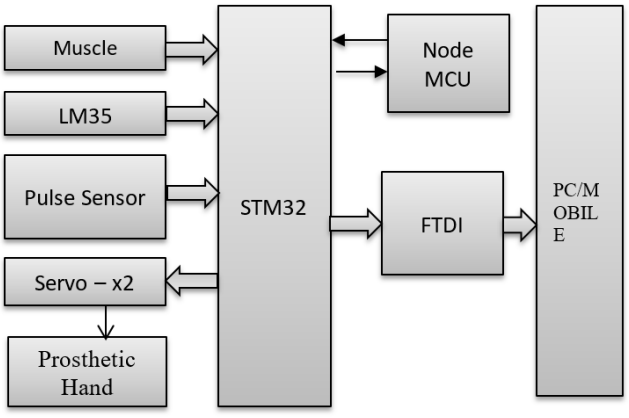

Fig.1. Block Diagram an interactive smart Prosthetic Robotic Arm

Muscle Sensor:

Measuring muscle activity as electromyography (EMG) is used to measure the moment of the muscle by placing the electrode on the surface of the skin.

LM35 (Temperature Sensor):

Is used to measure the temperature of the amputee and the output of the temperature is shown in the PC/Mobile.

Pulse Sensor:

Is used to measure the heartbeat of the amputee by placing the finger on the LED the light is emitted through the finger and when the heart start pumping there will be a flow of blood and the pulse on the body is measured and shown in the PC/Mobile.

Servo motors:

Is used in each finger to get the appropriate robotic action in which a PWM signal is used as the input of the servo motor.

STM32: (Microcontroller):

This is the microcontroller used in which the code is dumped

It is high performance microcontroller and low power consumption.

Node MCU:

Is an open source IOT platform with less cost from which the data is transmitted the data from the sensor to the pc/Mobile?

FTDI (Future Technology Devices International):

This is a device used to transmit the data from the sensor to the PC and also the data transactions with the PC there after look up USB endpoints.

PC/*Mobile*:

Personal computer (PC) OR MOBILE where the result of the pulse rate and body temperature is shown.

ALGORITHM FOR INFORMATION SYSTEM:

Step 1: Initialize the connection of the microcontroller and other Sensors.

Step 2: Is to give the power supply.

Step 3: To check the electrodes is placed on the muscle.

Step 4: To Measure the exact calibration of the person.

Step 5: To display the data in the PC/Mobile.

Step 6: Switch off the power supply after the complete working of prosthetic ARM.

Step 7: End.

VI. CONCLUSION

The prosthetic hand works with the help of electrode that is connected to the surface of the hand and the signal is sent to EMG sensor.

The approximate calibration value of the amputee is measured and the prosthetic ARM is check the prosthetic hand works and the servo motor is used in the movement of the finger.

The prosthetic hand includes the body temperature and pulse sensor through which the amputee is Monitored by the Guardian and the Doctor.

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