LOW COST USER DRIVEN BIOROBOTIC ARM FOR AMPUTEES

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ABSTRACT

This abstract presents a low-cost biorobotic arm designed for amputees. The proposed design is user-driven, meaning that the user can control the movements of the robotic arm using their own muscle signals. The biorobotic arm is based on a myoelectric control system, which measures muscle signals from the user's residual limb and translates them into movements of the robotic arm. The design utilizes low-cost materials, making it affordable for those who cannot afford expensive prosthetic devices. The user-driven aspect of the biorobotic arm provides a more natural and intuitive interface for amputees, allowing them to perform daily activities with greater ease and independence. The design is scalable and adaptable, meaning that it can be modified to suit the individual needs of each user. Overall, the low-cost user-driven biorobotic arm has the potential to greatly improve the quality of life for amputees, particularly those in low-income communities.

Keyword : - *Biorobotics, robotic hand designer ,Degrees of freedom*

1. Introduction

Human hands enable people to perform a variety of different activities. They allow the person to hold objects and devices, generating the forces necessary for grabbing. The replacement of the lost hand with a robotic artificial hand may help the patient regain some of the normal functionality.

Biorobotics is the science and engineering of robotics applied in the Biomedical field, with the development of biomedical devices for surgery and rehabilitation, as well as with the modeling of biological systems.

Robotic hands are valuable to amputees because they can help restore some of the capabilities lost compared to normal situations. The robotic hand designer should take into consideration the man-device interface. Although robotic artificial hands have still not advanced to the point where they can rival the functionality provided by biological hands, the capabilities they do provide can be significant specially by having the same degrees of freedom as normal hands. Great strides are being made each day in the field of robotics, and while great technological challenges remain, artificial hands are becoming increasingly similar to real hands. The proposed biorobotic hand is delivered to resemble the natural human hand as much as possible, so the prototype design tries to mimic the natural movements of the human hand to the biorobotic hand. This device is put forward in which anyone can use. The person should wear the glove gantlet in his hand and control the robotic arm manually and desirably depending on the bending movement of the glove. The device is simple and friendly to utilize.

1.1 Problem Statement

Human hands play a vital role in everyday life, allowing individuals to manipulate objects and tools to carry out various tasks. For amputees who have lost their hands, the ability to carry out these tasks can be severely

limited. The development of a biorobotic hand that closely resembles the natural human hand aims to provide a solution to this problem.

The biorobotic hand is designed to mimic the movements of a natural hand, allowing the user to grasp and manipulate objects in a similar way. The hand is equipped with sensors and control systems that enable it to detect the forces required for grasping and to generate the necessary grip strength to hold objects securely. The prototype design of the biorobotic hand aims to closely resemble the natural human hand, both in terms of appearance and function.

One of the key challenges in developing a biorobotic hand is creating a design that can replicate the complex movements and fine motor skills of the human hand. The design team has spent countless hours studying the natural movements of the human hand and developing algorithms that can replicate these movements in the biorobotic hand. By using advanced materials and technologies, they have been able to create a hand that closely mimics the flexibility, dexterity, and strength of the natural human hand.

The benefits of a biorobotic hand are clear for amputees who have lost their hands. With the use of this technology, they will be able to regain some of the functionality that they have lost, allowing them to perform everyday tasks with greater ease and independence. Additionally, the biorobotic hand can be programmed to perform a wide range of specific functions, such as gripping and manipulating tools, making it highly versatile and adaptable to a variety of situations.

In conclusion, the development of a biorobotic hand that closely resembles the natural human hand holds great promise for amputees. With its advanced sensors and control systems, the biorobotic hand can enable users to perform a wide range of tasks with greater ease and precision. The technology behind the biorobotic hand is constantly evolving, and with further advances, it has the potential to transform the lives of millions of people around the world who have lost their hands..

2. LITERATURE SURVEY

A literature survey is a check of scholarly initiators (similar as printed work, research papers, and so on) connected to a determined content or survey question. It is frequently written as part of a thesis, discussion, or exploration paper, in order to stick your work in relation to being knowledge. It shows beyond doubt of the authors' in- depth apprehension and knowledge of their department concern. It gives the surroundings of the research. Portrays the scientific penmanshipplan of testing the research result. Make Brighter on how the comprehension has converted within the department. So, basically thorough below research papers we have created our project. In which May 2020 is the our base paper and also the June 2013.

Year of Publication	Author	Publication Paper/Conference	Advantages & Disadvantages	Application
2020	Subhodeep Bakshi, Karan Ingale, Atishay Jain and S Karuppudiyan	IOP Conference Series: Materials Science and Engineering[5]	Low cost since manufactured using a 3D printer	Operated via human gesture by using the Accelerometer and Gyroscope Module.
2018	MD. Arif Abdulla Samy, Aurnab Islam, Mohammed Fattah Saqib	2018 3rd International Conference for Convergence in Technology, Pune, India. Apr 06-08, 2018[2]	Cost analysis and the movements of the artificial muscle	Degree of Freedom, Actuation, Flex sensor, Peltier effect, 3D-print, Prosthetic

2016	Zirong Luo, Jianzhong Shang, Guowu Wei, Lei Ren	2016 3nd International Conference on Advances in Biomedical Engineering[1]	Design and analysis of a bio-inspired module-based robotic arm	Bio-inspired module for robotic arm.
2013	Mohamad Hajj-Hassan, Rabah Abou Kansour, Mustapha Barakat,	2013 2nd International Conference on Advances in Biomedical Engineering[4]	Use of flex sensors and why degree of freedom is important	Enhancement in medical field for amputation
2019	J Butterfass, G Hirzinger, S Knoch	ieeexplore.ieee.org[3]	Easy readable language and practical	Bio robotic arm

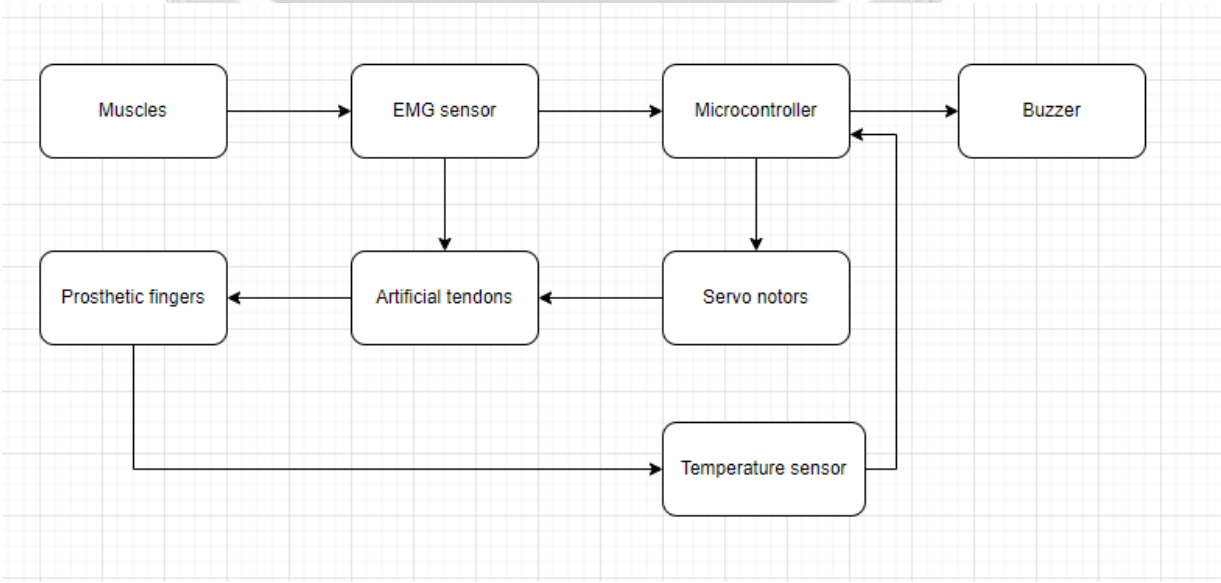
3. PROPOSED SYSTEM

This paper presents a robotic arm that is designed and manufactured using 3D printing technology and is controlled by human gestures through the use of an accelerometer and gyroscope module. The proposed robotic arm has potential applications in the medical field, military operations, hazardous conditions, and industries to maximize human safety.

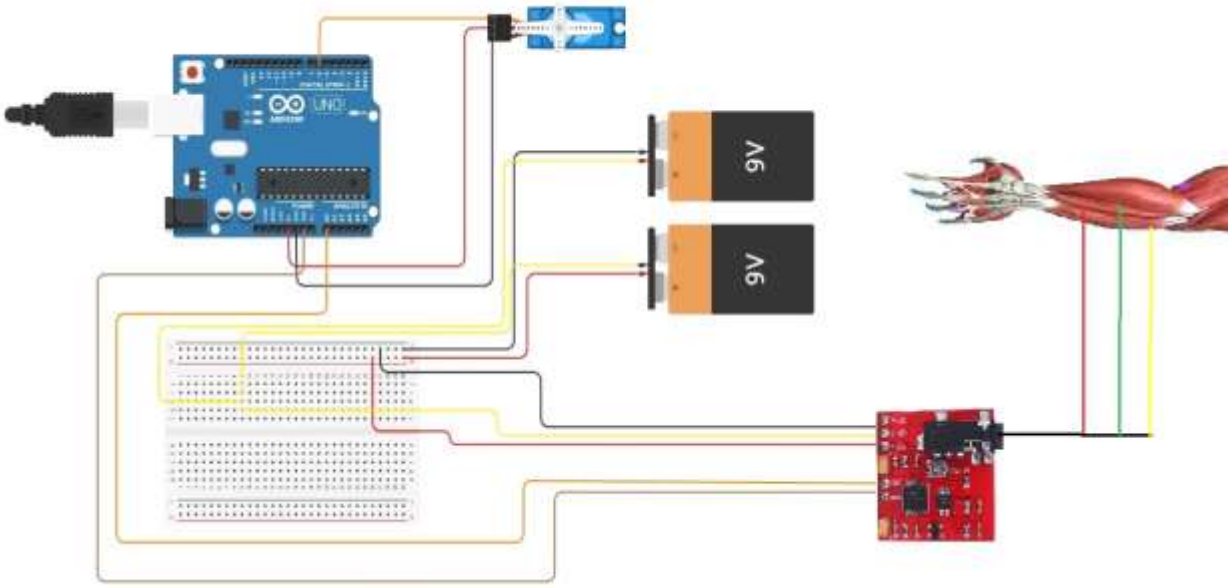
The robotic arm is designed with five degrees of freedom that are controlled by the 3-axis accelerometer mounted on the IC placed on the user's glove. This module replicates the movement of the user's hand to extend, retract, and rotate the robotic arm accordingly to accurately position it as required for the intended application. The user's finger action is used to manipulate the gripper of the robotic arm.

Gesture control is a computerized interface that allows computers to record and interpret human gestures into commands to execute actions. In this case, the accelerometer and gyroscope module allows the user to control the movements of the robotic arm through natural hand and finger movements. Overall, the proposed robotic arm has the potential to improve safety and efficiency in a variety of fields by allowing for intuitive and precise control through human gestures.

3.1 BLOCK DIAGRAM



3.1 CIRCUIT DIAGRAM



The above diagram shows how the circuit works.

- The EMG module is a sensor that measures electrical activity in muscles. It can be used to detect muscle contractions and movements.
- The Arduino is a microcontroller board that can be programmed to control various electronic components.
- In this circuit, the Arduino is connected to the EMG module using analog pin 1. This allows the Arduino to read the electrical signals from the EMG module.
- The Servo motor is connected to digital pin 6 on the Arduino. The Servo motor is a type of motor that can rotate to a specific angle based on the signal it receives from the Arduino.
- To power the EMG sensor 2, 9 volt batteries are connected in series. This provides a total of 18 volts of power to the EMG sensor.

3.2 CODE ALGORITHM

- Define the threshold value for controlling the servo motor with the EMG sensor.
- Define the pin number for the EMG sensor (Analog 0) and the servo motor (Digital PWM 3).
- Import the Servo library.
- Define the Servo motor object.
- In the setup function, set the Baud Rate to 115200 for the Serial monitor and attach the Servo motor object to the digital pin 3.
- In the loop function, read the value from the EMG sensor using the analogRead() function and store it in a variable called "value".
- If the value is greater than the threshold value, set the Servo motor to rotate to 170 degrees using the write() function.
- If the value is less than the threshold value, set the Servo motor to rotate to 10 degrees using the write() function.
- Print the value of the EMG sensor to the Serial monitor using the println() function.

- Use the Serial monitor to adjust the threshold value based on the readings shown when opening and closing your hand.

4. CONCLUSIONS

The aim of this project was to create a prosthetic that could potentially change the life of an amputee. The initial goal was to develop a low-cost 3D printed prosthetic arm that could be easily produced and customized for individual needs. After extensive research and development, the team was able to achieve their initial goals and expectations.

Through this project, the team was able to successfully create a functional and cost-effective prosthetic arm that could improve the quality of life for individuals with limb loss. The use of 3D printing technology allowed for the production of prosthetics that were easily customizable and could be tailored to meet the specific needs of each individual.

The successful outcome of this project has paved the way for several new ideas to be researched in the future. The potential for 3D printing technology to revolutionize the field of prosthetics is significant, and future research could lead to even more advanced and customizable prosthetics.

Overall, the success of this project has demonstrated the power of collaboration between technology and healthcare to improve the lives of individuals with disabilities. By continuing to push the boundaries of prosthetic technology, we can help individuals regain their independence and improve their overall quality of life.

5. REFERENCES

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