Prosthetic Hand Using Emg

Prosthetic Hand Using Emg

DR MERCY PAUL SELVAN[1], RISHI RAJ[2], R **GOWTHAM SAI[3], DR S. JANCY [4], DR VIJI AMUTHA MARY [5]**

[1][4]Asst. professor, Dept. of CSE, Sathyabama Institute of Science and Technology, Chennai, India.

[2][3] UG Student, Dept. of CSE, Sathyabama Institute of Science and Technology, Chennai, India.

[5] Associate Professor, Dept. of CSE., Sathyabama Institute of Science and Technology, Chennai, India.

mercypaulselvan@gmail.com

Abstract. The prosthetic hand is a device used for the amputee to make them capable of doing daily life stuff. Losing upper limbs is not just a physical loss it also affects the way that person sees their life, they start feeling disabled all the time. This event grows and make them disabled mentally or by god if they can handle it even though people will remind them time to time about their disabilities which may lead to suicide or even worse. To join hand to hand and to makes more abled than disabled, we are introducing prosthetic hand at the cheapest price. It's not that this event is the only device in the market but I could say this event is the cheapest one with these many qualities. It could not be very good looking but it could be better than a decent one. Disability does not differentiate by the salary of a person or capability of someone, so this should be affordable to most of them. In the west, we have some country who can make prosthetic at an affordable price but their money and employment are stronger than us. So, a project like this can make a difference. The concept partially fulfilled the goals and targets set at the outset of the project. The initiative originally had four primary goals. The first goal is to create a tool like a prosthetic hand that can help an amputee with hand loss accomplish simple everyday tasks. Because of all the EMG signal calculation of various hand movements performed on a person who does not lose his her hand the system can only partially accomplish this goal.

Keywords— Amputees, prosthetics, EMG, impulse, signals, Arduino. The first section in your paper

1. Introduction

The prosthetic hand is an artificial device which is designed for the people with upper limb amputations to come up with some functions of the natural hands. The number of amp utees in the developing countries is significantly greater than in developed countries due to minimum medical facilities and the popularity of illnesses that have been cured in the developed world. Loss of upper limbs has many circumstances not only in the sense of physically but also in social and psychological department. Artificial hands and wrists are used to conduct everyday tasks such as washing, writing and picking various items to mitigate these effects and enable the amputee to return to normal life. There are many commercial prosthetic hands available these days in the market. Such devices range from designer cosmetic hands to split hook, myoelectric hook and hand with body harness power. Out of all the variation in their mechanical structures, control signal types, and power sources, most of them are at thousands of rupees incredibly costly. Even cosmetics, prosthetic made specifically for

aesthetics, although not much expensive, but still they cost lakhs of rupees. Hence, in developing countries, very few amputee's have prosthetics not because they are pricey, but also due to distribution and maintenance problem. One of its main goal of our project is to develop a lower-cost 3D prosthetic hand printed for amputees. A standard myoelectric hand, where all the EMG surface electrodes on the amputee hand capture myoelectric signals that are manipulated to enable the hand to open and close. In the past decade, advances in 3D printing have made 3D trans-radial prosthetics a cheap substitute. It provides robust features at an inexpensive price. There are many designs these days that vary in capacity and operate quite differently, such as reliability, control mechanism, hand grips, user interfaces, convenience and cost. Every prosthetic hand has strengths and weakness of its own. The main aim of this bachelor's thesis is to create a 3D printed prosthetic hand that can be operated from the forearm using an EMG signal. The prosthetic to replace the missing hand must be attached to the patient's forearm. To monitor the impulse, three electrodes (EMG stickers) that read the EMG signal will be attached in the forearm at different locations. Five distinct DC motors are available to handle every finger's controls, and one servo motor would be to control wrist rotation. To create an adequate prosthetic hand design, it is important to understand the fundamentals of anatomy and physiology of the human hand. Anatomy is structure analysis, and physiology is role analysis. A successful model of the prosthesis could be produced by observing and understanding into the shape and work of the human hand. The human hand can be a fine instrument in many respects. This represents the various degrees of freedom and can work in an interconnected way. With present technology, it is impractical to assume that any of the standard hand's parameters and output requirements may be replicated in a handmade unit. The human hand can be a fine instrument in many respects. This represents the various degrees of freedom and can work in an interconnected way. With existing technologies, it is impractical to assume that any of the standard hand's parameters and output requirements may be replicated in a handmade unit. With these perfect parameters, consensus can be made and a practical prosthetic hand can be built. The main aim of this section is to examine the natural hand's functional capacity and evaluate the most common grasping patterns of the hand from an unlimited range of patterns.

2. Literature Survey

This project is all about amputees who have lost their upper limb by accident or god's act. It is a very ugly that they feel disabled in such a well-educated society. What we are doing for them, absolutely negligible. India is rich in population so we have many amputees who are living life to finish not to enjoy. So, we are here with a project to make our disabled abled. This project is all about making a prosthetic as advanced as it was never been. Let us see how it works. Base Paper: Wearable Mind Thoughts Powered 3D Printed Open Source Arm with Integrated Feedback Sensor System. Address: https://www.researchgate.net/publication/32738 7513 Wearable Mind Thoughts Powered 3D Printed Open Source Arm with Integrated Feedback Sensor System. Related Projects: Building a Helping Hand: The human body is an extraordinary piece of machinery, and our hands are no exception. With some training, they can perform delicate and complex tasks like grabbing pens and tools to create art. Unfortunately, we have rapidly growing demand for hand replacements. In https://www.sciencebuddies.org/science-fairprojects/project-ideas/HumBio p042/human-biologyhealtNbuild-prosthetic-hand DIY Prosthetic Hand & Forearm, he uses a previously designed Robotic hand that is part of an open-source robotics project called InMoov. https://www.instructables.com/id/VoiceControlled-Prosthetic-Hand-Forearm/ Designing a Human Hand: Current prosthetic hands have limited functionality and are expensive. Design of a cost-effective anthropomorphic prosthetic hand was created. https://web.wpi.edu/Pubs/E-project/Available/Eproject-042612- 145912/unrestricted/MQP PaulV Complete Fi nal 3.pdf IoT Book: The Internet of Things" by Samuel Greengard, Precision: Principles, Practices, and Solutions for the Internet of Things" by Timothy.

3. Algorithm

Step 1 — We must have all the devices used in the project which includes 5 Servo motors 3D Printed hand, two batteries less that 18V, Wires as required, EMG, three EMG Stickers and Arduino.

Step 2 — All the connection should be done properly.

Step 3 — Upload program to the Arduino.

Step 4 — Stick the EMG stickers and give power Supply.

Step 5 — We can see the result after moving our hand.

4. Design

Research in 3D printing over the last decade, have made 3D printed prosthetics an inexpensive option. It provides a complex function at an affordable price. In the market, multiple options range very fluctuating in ability and function such as durable, control system, handgrip, amputees' inputs, comfortable and cost. Each prosthetic has its strength and weakness. The objective of this paper is to design a 3D printed prosthetic hands which can be controlled by EMG signals (impulse) from the forearm. The prosthetic hand will be attached to the patient's forearm to overcome the lost arm. Three electrode stickers reading the EMG signal will be attached in the residual hand to control the prosthetic hand. Five DC motors are used to control fingers.

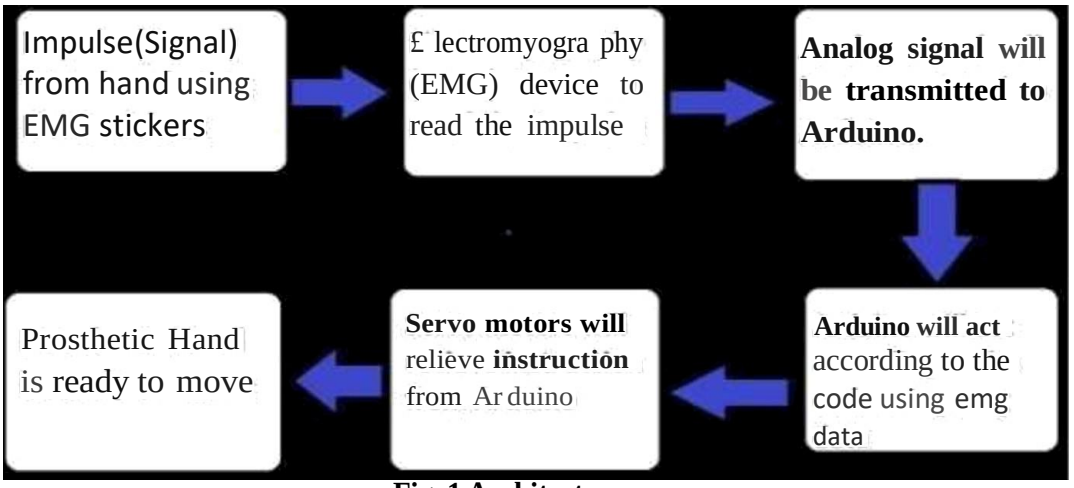

Fig. 1 Architecture

Thus, the first and main task to be solved by performing this research was to design a device in the form of a prosthetic arm which can be controlled by the amputees. The theme is to let the amputee perform simple daily tasks like holding and releasing objects. Since the prosthetic will be attached to the amputee's forearm so the structure should be light and the size should be suitable for amputees. Another purpose of this project was to design an affordable prosthetic hand for poor amputees. A prototype prosthetic was created that has basic hand functionality, a durable yet lightweight structure utilizing 3D printing and a control unit, all available at a fair value for money. This article deals with the method of modelling, manufacturing and evaluating radial 3D printed trans prosthetics. The prosthetic hand works by capturing capturing impulse from amputee. This happens by sticking stickers on amputee's

hand which gives us reading like given in Fig. 3. If a muscle gets a neuromuscular stimulus from the brain, it activates a potential for activity in the muscle cell, it is simply a change in voltage across the cell membrane. Chemical electromyography methods can be used for calculating these voltages on the surface of the skin.

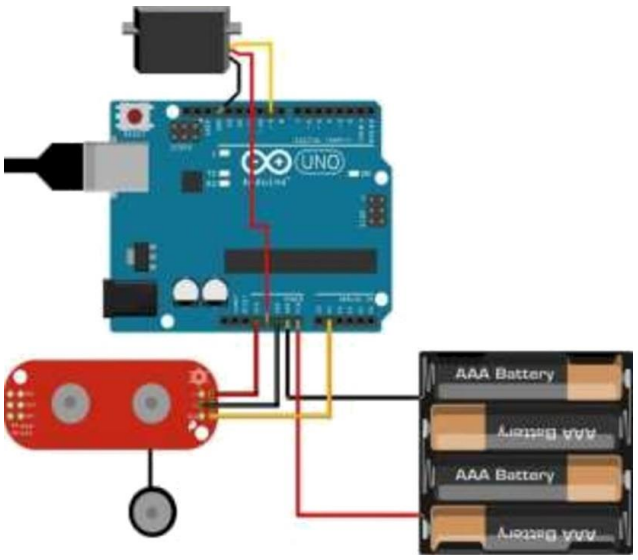

Fig. 2 Connection

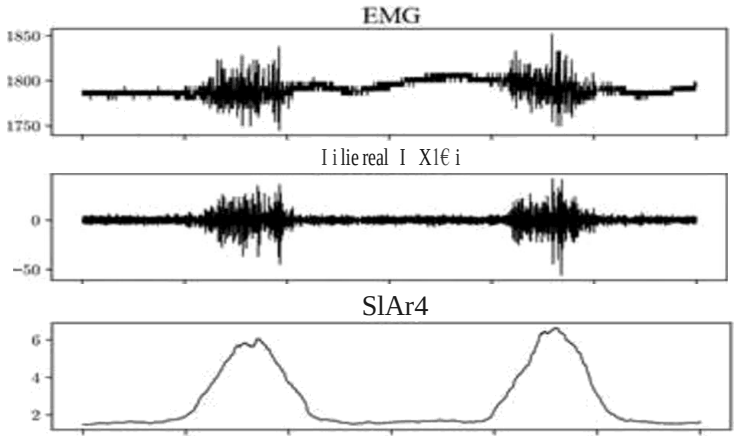

FIG. 3 EMG Reading

The electrical pulse measured on the skin surface can have different frequencies based on muscle contraction strength. To detect the electromyography signals, the EMG sensor is mounted at different locations of the forearm. Although the location and direction of the muscle sensor electrodes has a considerable effect on the intensity of the signal, both theoretical anatomies of the human muscle and scientific studies have carefully selected the positions of the electrodes.

The electrode stickers will be in the centre of the muscle and aligned in the direction of the fibre muscle. Positioning the sensor elsewhere will differ the intensity and efficiency of the signal from the

sensor. The digital representation of electrical impulses from muscles is an EMG signal. Myoelectric refers to muscle electro- signals. If anyone thinks about flexing a muscle their brain sends a neuromuscular or electrical signal to the muscles called an urge. Now the muscles continue to use motor units or bundles of muscle fibres that induces forces behind the muscles. As much as the muscle is flexed, the more motor units are mobilized to induce more muscle energy and the larger the number of motor units, the greater the muscle generates the electrical activity. Any time the impulse arrives from the brain, EMG stickers send it to EMG to reads it and sends it to Arduino.

Fig. 4 EMG SENSOR

Arduino is designed in such a way that the servo motor is shifted in a certain direction as reading crosses the threshold. An SG90 servo motor was selected for finger actuation. This compact and basic motor has been chosen because it can provide all the requisite features such as tiny size, lightweight, built- in gearbox and low price. The SG90 servo motor image is seen in Figure S. The above servomotor still has some drawbacks that had to be changed given the advantages. Initially, it was built for a particular degree of rotation, in this case, this is 180 degrees in all the direction and 90 degrees.

Fig. 5 Prosthetic hand

This trait is induced by the gearbox and potentiometer hardware limit. This servo motors will have continuous continuous rotations and a feedback loop with continuous rotation.

Fig. 6 Servo **Motor**

Power supply will be given to Arduino which will move servo motors.

5. Code

#include <Servo's> Servo myservo; void setup()

myservo.attach(9); Serial.begin(9600); pinMode(13,OUTPUT);

```
void loop() (
    int x — analogRead(A0); Serial.println(x);

    if(x>——300)(

   myservo. write(270); delay(1000);

    else( myservo.write(0);
     delay(50);
    } Serial.println(x);
```

6. Result

Loss of hand can cause many consequences in daily life. Numbers of opportunities is reduced because of hand loss. Hence, Research into producing a prosthetic hand that can be easily operated from the arm by the EMG signal is also a big step towards prosthetics. The prosthetic hand is having 5 servo motors. With this project, it was selected to save time using the open- source

hand model option and the focus of this project is on electronics structure and embedded device coding, not 3D modelling. There is various type of open-source prosthetic hands printed in 3D available on the Internet. Five DC motors actuate the hand, one for each finger plus one for the thumb-opposition. Motors and sensors are scattered all over the house. The built-in control system contains a gesture control subsystem and a visual subsystem. The motion control subsystem is important as the sensory subsystem for both the amputee using a prosthetic and its control algorithms. The aim of this project to develop a low-cost, 3D prosthetic hand-printed using EMG. Though the final device has been fulfilled most of the initial steps, there are other aspects of the new layout that need to be rebuilt for real- life use cases.

7. Current Technology

There are several different trans-radial commercial prosthetics available nowadays and a lot of the hand of the prosthesis is also under production. This segment will discuss, analyze and examine a few groundbreaking designs available in today's market.

References

[1] S. Hasan, et. al., "Wearable Mind Thoughts Controlled Open Source 3D Printed Arm with Embedded Sensor Feedback System", CHIRA 2018 - 2nd International Conference on Computer-Human Interaction Research and Applications, 2018.
[2] Ivan I. Borisov et. al., "Prototyping of EMG — Controlled Prosthetic Hand with Sensory System", IFAC-Papers OnLine, Elsevier, Volume 50, Issue 1, 2017, pp. 16027-16031.
[3] S. Sudharshan et. al., "Design and Development of EMG Controlled Prosthetics Limb", Procedia Engineering, Elsevier, Vol. 38, 2012, pp. 3547 — 3551.
[4] Linda Resnik et. al., "Evaluation of EMG pattern recognition for upper limb prosthesis control: a case study in comparison with direct myoelectric control", Journal of NeuroEngineering and Rehabilitation, Vol. 15, No. 23, 2018.
[5] Ke Xu et. al., "A prosthetic arm based on EMG pattern recognition", **IEEE** International Conference on Robotics and Biomimetics, 2016.
[6] "Real-Time EMG Based Pattern Recognition Control for Hand Prostheses: A Review on Existing Methods, Challenges and Future Implementation", Sensors (Basel), Multidisciplinary Digital Publishing Institute (MDPI), vol. 19, No. 20, 2019.
[7] IoT Book: The Internet of Things" by Samuel Greengard, Precision: Principles, Practices, and Solutions for the Internet of Things" by Timothy.