



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

# IJIRSET

International Journal of Innovative Research in  
**SCIENCE | ENGINEERING | TECHNOLOGY**



# INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 12, Issue 13, April 2023

**ISSN** INTERNATIONAL  
STANDARD  
SERIAL  
NUMBER  
INDIA



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# Bionic Arm Based on Myoware Sensor

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**ABSTRACT:** This project aims to create an affordable and customizable bionic arm that can be controlled by the user's muscle movements. The system consists of bionic 3-D printed hand material, a neural amplifier, a myoware sensor, an Arduino processor, raspberry pi, a camera for the detection of unwanted requirements, and two motors. The myoware sensor is an EMG (Electromyogram) sensor that detects electrical signals generated by the user's muscles and allows the development of a bionic arm to realize the natural movements of the hand. The generated signals get amplified through the neural amplifier. These signals are then processed by an Arduino microcontroller, which controls the movements of the bionic arm. The Raspberry Pi is used to capture visual data through the camera, which can be used to detect the arm's viewpoint. By combining the sensor and camera data, the control system could be made more precise and responsive, allowing the user to perform these tasks with greater ease and accuracy. By using this advanced technology, finally we can grasp an object using this bionic arm. Overall, the bionic arm has the potential to greatly improve the quality of life for individuals with amputees by providing them with a cost-effective, customizable, and functional prosthetic limb. By using 3D printing technology and integrating advanced electronic components, this project represents a significant advancement in the field of prosthetics.

**KEYWORDS:** 3D printing, Myoware sensor, Object detection, Machine learning, bionic arm.

## I. INTRODUCTION

Object detection is a computer vision technique that involves detecting and localizing objects within an image or video. There are many different approaches to object detection, including template matching, edge detection, and machine learning-based methods such as convolutional neural networks (CNNs). CNNs are currently the most widely used method for object detection, as they can achieve high accuracy rates with relatively little training data.

3D printing has revolutionized the field of bionics and prosthetics, including the development of bionic arms. Bionic arms are designed to replicate the natural movement and function of a human arm and provide a range of motion and control to the user. This technology allows for the creation of customized and functional bionic arms that can be tailored to the individual needs and preferences of the user. 3D printing technology has made it possible to create bionic arms that are lightweight, durable, and highly customizable, at a fraction of the cost of traditional prosthetics.

Machine learning is a subfield of artificial intelligence that focuses on the development of algorithms and models that allow computers to learn from data and make predictions or decisions without being explicitly programmed to do so. It has numerous applications in various fields, including image and speech recognition, natural language processing, recommender systems, fraud detection, and autonomous vehicles. It is also a rapidly evolving field, with new algorithms, models, and techniques being developed all the time.

## II. RELATED WORKS

The [1] method involves using a combination of 3D scanning, computer-aided design (CAD), and 3D printing technologies to create a personalized prosthetic arm. The process begins with a 3D scan of the patient's residual limb, which is used to create a digital model of the limb's surface. Using specialized CAD software, the digital model is refined to create a prosthetic arm that closely matches the patient's anatomy. The design can be customized to incorporate features such as finger movement, grip strength, and other functional requirements.

The system[2] consists of a wearable EMG sensor that is placed on the forearm to detect electrical signals generated by muscle activity when a user performs a hand gesture. The EMG sensor is connected to an embedded platform that contains a microcontroller and other components, which process the EMG signals in real-time and generate commands for gesture recognition.

The robotic arm[3] is controlled by surface EMG sensors placed on the user's arm. The EMG sensors detect electrical signals generated by muscle activity and send them to a microcontroller, which translates the signals into commands for the robotic arm. The system's design also includes a user interface that enables users to control the robotic arm's movements and adjust various parameters such as speed and precision. The user interface can be customized to meet the user's needs, such as adapting to different levels of mobility or dexterity.

By this reference, we proposed a bionic arm with object detection techniques to measure the accurate visual representation using a camera and raspberry pi. The grasping of an object is done by a servo motor which is used to control the movements of the finger. So this system provides an affordable and customizable bionic arm that can be controlled by the user's muscle movements.

### III. METHODOLOGY

Object detection in a bionic arm can be a useful feature for individuals with upper limb amputations or other disabilities. It can help them interact more efficiently with their environment by allowing them to accurately grasp and manipulate objects. Implementing this object detection in a bionic arm through computer vision. This involves using a camera mounted on the head to capture images or position of arm movements. These images are then analyzed by a computer program to identify movements to grasp the object. The machine learning techniques that can be used for object detection in a bionic arm, such as convolutional neural networks (CNNs). This system is trained on a dataset of images and can learn to recognize the movement of the finger.

To control a servo motor with an Arduino microcontroller, the pulse width modulation (PWM) technique is used. PWM involves sending a series of electrical pulses to the servo motor to control its position. The duration of the pulses determines the position of the servo motor. Arduino boards have several PWM pins, which can be configured to generate a square wave signal with a variable duty cycle. To control a servo motor using PWM with an Arduino, connect the signal wire of the servo to one of the PWM pins on the Arduino. Then use the Arduino's IDE software to generate the appropriate PWM signal to move the servo to the desired position to grasp the object.

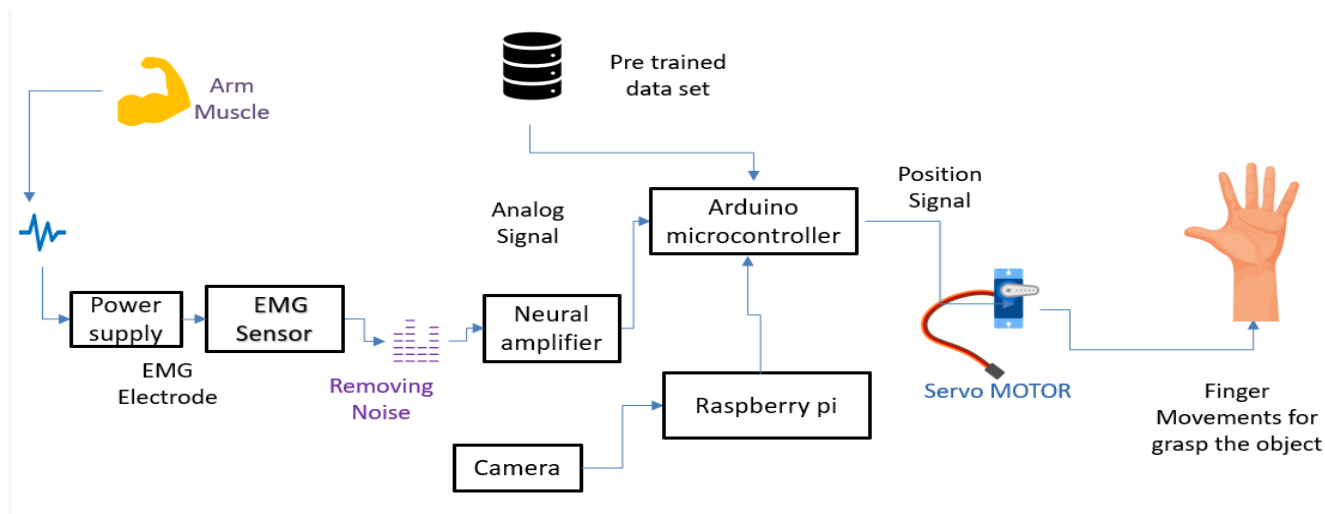


Fig 1-Block diagram

#### IV. EXPERIMENTAL RESULTS

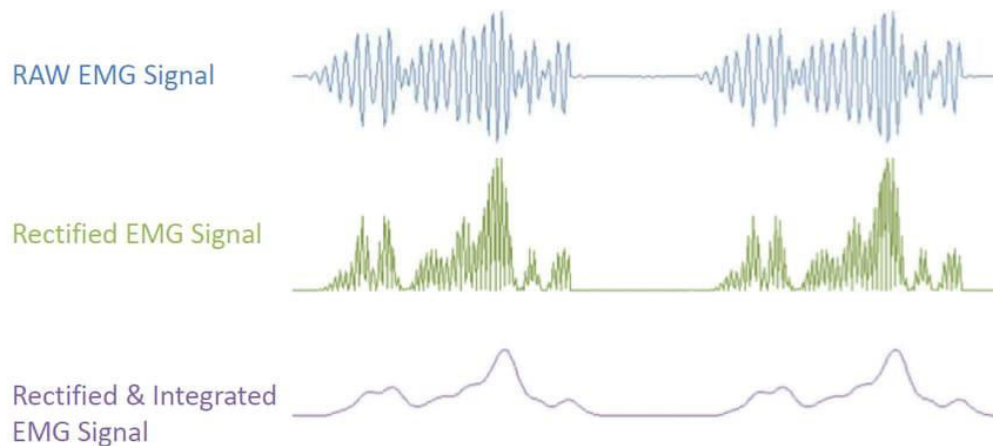


Fig 2-Waveforms associated with myoware sensor

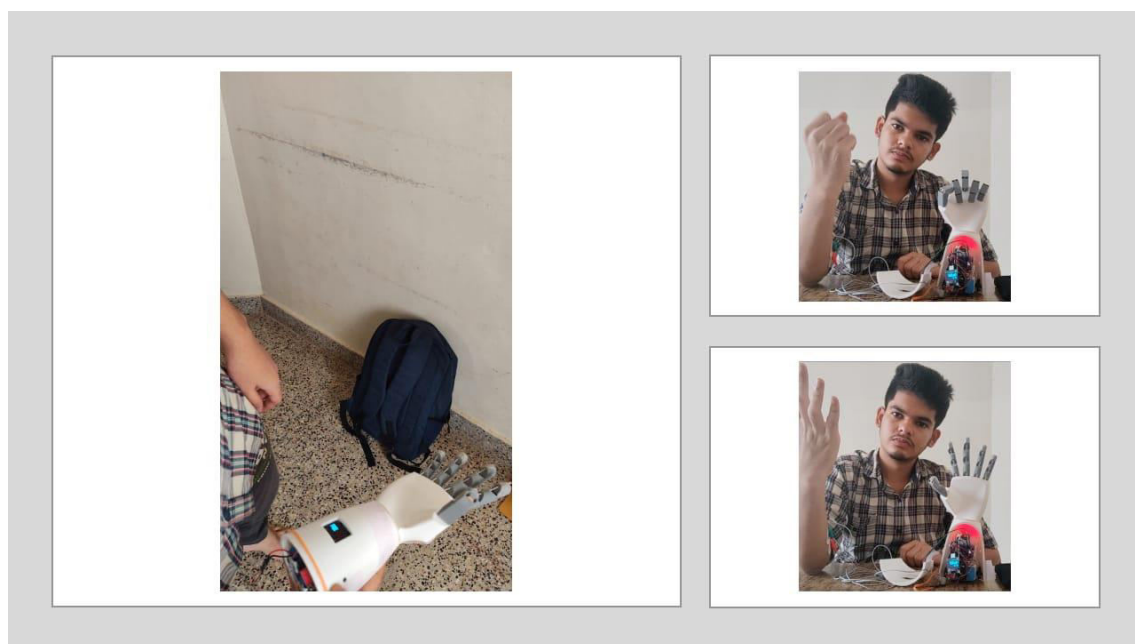


Fig 3-Prototype Image

#### V. CONCLUSION

In conclusion, a bionic arm based on a myoware sensor is a remarkable prosthetic device that can restore the functionality of a human arm by using the EMG signals generated by the user's muscles. This technology offers intuitive control, customization, and versatility to the user, enabling them to perform a wide range of tasks and activities that were previously impossible. The myoware sensor provides an accurate and reliable way of detecting and measuring the electrical activity produced by muscles, making it an ideal sensor for this application. Additionally, the



microcontroller, actuators, and power source work together to provide the necessary functionality and power to the device. Overall, a bionic arm based on a myoware sensor has the potential to significantly improve the quality of life for amputees and those with impaired limb functionality. With further advancements in technology, we can expect to see even more sophisticated and capable bionic arms in the future.

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