BIONIC ARM WITH EMG SENSOR FOR PHYSICALLY DISABLED PEOPLE

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College : C.M.R. Institute of Technology, Bengaluru
Branch : Electronics and Communication
Guide(s) : Dr. K. Venkateswaran
Dr. L. Niranjan
Student(s) : Mr. Neeraj Kumar
Mr. Pradeep Kumar
Ms. Priyanka Priya
Mr. Varun Singh

Keywords:

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Introduction:

The loss of a limb or hand significantly impacts an individual's ability to perform everyday tasks, diminishing their independence and quality of life. Over the years, prosthetic technology has evolved to provide solutions, but many conventional prosthetics lack intuitive control and functionality, leaving users frustrated. Recent advancements in bioengineering and sensor technologies have paved the way for innovative prosthetic devices, such as bionic hands, that offer enhanced functionality and user experience. A bionic hand leverages Electromyography (EMG) sensors to detect and interpret the electrical activity generated by muscle contractions in the residual limb. These signals are processed to control the prosthetic hand's actuators, enabling natural and intuitive movement. EMG-based control systems provide an opportunity to bridge the gap between the user's intentions and the device's functionality, offering precise and responsive actions that mimic the human hand.

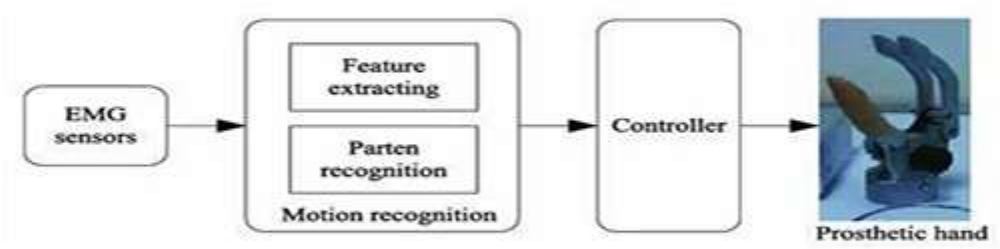

Figure 1: Block Diagram

Objectives:

1. Functional and cost effective.
2. Perform everyday task seamlessly.
3. Light weight, user friendly and ergonomic solution that integrates sensory feedback for enhanced control.

Methodology:

The methodology for developing a bionic hand with EMG sensors involves several key steps. First, identify user needs and conduct research to understand existing solutions and limitations. Design the system by selecting appropriate hardware (e.g., EMG sensors, microcontrollers, and actuators) and developing software for signal processing and control. Prototype the hand using CAD designs and fabricate parts with lightweight materials. Test the system by acquiring and processing EMG signals to control hand movements, followed by user trials for comfort and functionality. Optimize the design based on feedback, validate performance, and document the process for future improvements, including AI integration and advanced feedback systems. Tactile Feedback: Use pressure sensors to provide users with a sense of touch, enabling them to feel objects they grip. Temperature Sensing: Add sensors to detect the temperature of objects and relay the information to the user through haptic feedback.

Result and Conclusion:

The bionic hand with EMG sensors will provide a functional and affordable prosthetic solution for individuals with upper limb disabilities. It will enable users to perform a wide range of daily tasks with improved precision and control by interpreting muscle signals to drive natural and intuitive hand movements. The integration of sensory feedback, such as tactile and force sensing, will enhance user interaction and confidence in handling objects. The project will result in a lightweight, ergonomic, and customizable device that adapts to user needs, incorporating advanced features like gesture recognition, machine learning for personalized control, and potential IoT connectivity for diagnostics and updates. This innovative prosthetic will significantly improve the quality of life for users, offering a practical and technologically advanced alternative to existing solutions.

In conclusion, the integration of EMG sensors with servo motors and microcontrollers, such as Arduino, has opened new possibilities in assistive technology. The ability to detect muscle contractions and translate them into mechanical movements allows the bionic arm to mimic natural limb functions, making it easier for users to perform daily tasks. This innovation bridges the gap between affordability and utility, ensuring that individuals in diverse socio- economic settings can access these solutions. The bionic arm powered by EMG sensors epitomizes a significant leap forward in prosthetic technology, blending affordability, accessibility, and functionality. By harnessing muscle-generated electrical signals, it offers users a practical and intuitive way to control artificial limbs. This innovation has not only transformed the lives of individuals with limb loss but has also pushed the boundaries of what is possible in assistive technology.

Future Scope:

The future scope of this project includes:

1. Enhanced Control and Precision
2. Artificial Intelligence and Machine Learning
3. Power Systems and Durability
4. Neuro prosthetics Integration
5. Affordability and Accessibility