

Low-Cost Interactive Prosthetic Arm for Enhanced Mobility

Yousef Buali, Ali Alsalman, Mohammed Almubarak, Hassan Alobaid, Ali Al Nasser, Abdullah Bokhmseen
Coach: Shihab Uddin



Introduction

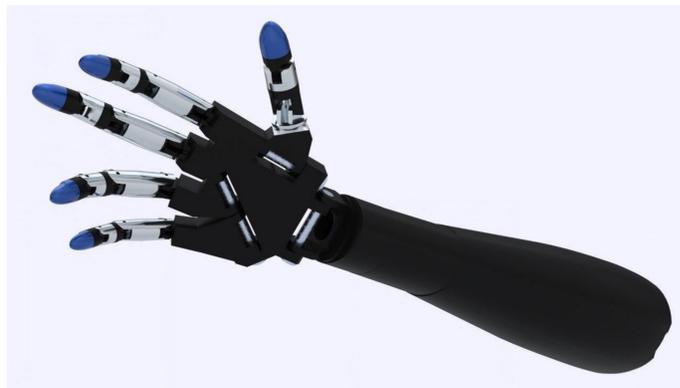
- The Saudi amputee community faces a problem with limited access to prosthetics and their high cost. This project aims to develop an affordable and interactive prosthetic arm that addresses these challenges, enabling better integration and functionality.

Constraints and Specifications

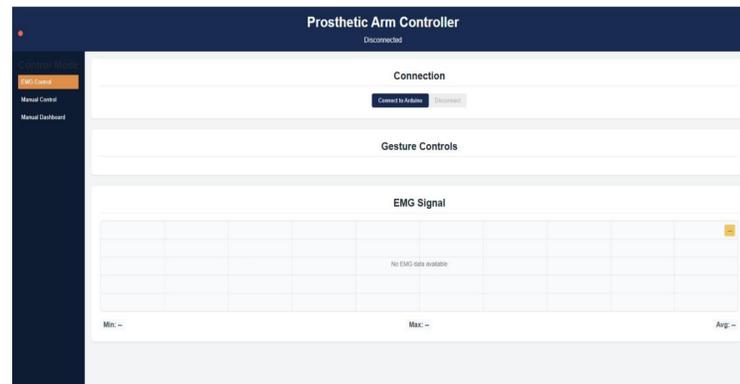
- Satisfy Essential Principles of Safety and Performance (EPSP)
- Volume of the Arm 375.65 cm³
- Eight Working hours
- Weighs less than 1.2 kg
- Costs less than 8000 SAR
- Five grip patterns
- Response time is less than 0.5 s
- Power consumption of 7 Watts
- Load Capacity of 8 kg

Prototype Design

- Simple and effective design where the structure is made of PLA by 3D printing. It has 5 motors, each one of them controls a finger and a Micro control unit along with an EMG sensor to read muscle signals, which are collected and used to control the finger movements.



- Moreover, a convenient dashboard that allows users to control gestures and shows EMG signals.



Validation

- The prototype underwent verification testing across all engineering disciplines. The **Computer Engineering** team validated hardware limits, working hours, and battery life. **Computer Science** verified that the AI model could classify five hand gestures with over 75% accuracy and tested the response time of the dashboard interface. **Bioengineering** confirmed medical safety and that the prosthetic arm met ergonomic dimensions. **Material Science** validated the use of safe, food-grade materials and confirmed their durability. Lastly, the **Mechanical Engineering** team ensured that the design met mechanical requirements such as load capacity, temperature tolerance, and structural lifespan.

Conclusion

- In conclusion, the development of the Low-Cost Interactive Prosthetic Limb successfully addressed critical issues such as affordability, functionality, and user comfort, specifically tailored to meet the needs of amputees in Saudi Arabia.

