

Proposal of a project

Proposal for Development of Microprocessor-Controlled Efficient Prosthetic Device

Brief description of the project

The Orthotic & Prosthetic Section at King Faisal Specialist Hospital is embarking on an ambitious project to develop a low-cost, microprocessor-controlled prosthetic knee and arm. This initiative is driven by the belief that advanced prosthetic devices should be accessible to all individuals who have lost limbs due to disease or trauma, not just a privileged few. By leveraging local manufacturing and innovative technology, we aim to transform the lives of amputees, enabling them to lead more active, fulfilling, and independent lives. .Current trend dictates all such limbs to be either imported at an exuberant cost to end user with unacceptable time taken for procurement. The service of such devices often requires them to be sent to manufacturing country leaving patient without limb for long period of time. King Faisal Specialist Hospital and Orthotic & prosthetic services has experience and work force capable of overseeing such project in collaboration with research and deployment services here at the hospital.

Microprocessor controlled Prosthetic limb:

A microprocessor-controlled prosthetic limb is an advanced type of prosthetic limb that uses computerized systems, sensors, and hydraulics to closely mimic the natural movement of a human limb. Here's a breakdown of its key components and benefits:

Key Components

1. **Microprocessor:** Acts as the brain of the prosthetic, processing data from sensors in real-time to adjust the movement of the leg.
2. **Sensors:** Detect various parameters such as the angle of the knee, the speed of walking, and the type of terrain. These sensors provide feedback to the microprocessor.
3. **Hydraulics and Motors:** Work together to control the movement of the knee and ankle joints, providing a smooth and natural gait.

Core Functionalities

1. **Microprocessor-Controlled Movement:**
 - **Advanced Technology:** The prosthetic devices will incorporate state-of-the-art microprocessors that enhance movement efficiency and adaptability. This technology will allow users to perform a wide range of activities, from walking and running to more complex movements, with greater ease and precision.
 - **Adaptive Responses:** The microprocessors will enable the prosthetics to adapt in real-time to the user's movements and the environment, providing a more natural and intuitive experience.

Demands-Supply Gap

A study that extracted data from a 2016 Saudi National Demographic Survey showed that out of 20,064,970 citizens, 667,280 reported having disabilities. Rehabilitation services for such people are provided by the ministry of health rehabilitation centers, other governmental sectors, and the private sector. The management of amputee patients requires a comprehensive, coordinated, interdisciplinary program throughout the continuum of care. The latest practices in prosthetic and rehabilitation interventions allow them to achieve the highest level of function. But according to another study only 52% out of 412 patients were enrolled in an amputation rehabilitation program over a year after their amputation. Based on a study done more than 7,000 people of Saudi Arabia live with upper limb loss and require prosthetic help. The number of lower limb amputees is many folds more.

Imports vs. Indigenous Production

Based on a study - about 100% of the functional Hi End upper limbs prostheses installed in KSA are imported from countries like Germany, Island and others. The higher is the functionality of the prostheses - the higher is the end-user price, therefore there are less installations with focus on 2nd generation prostheses, not the latest generations, low penetration of upper limb devices by patients requiring it to improve quality of life being active with their labor and social activities.

2. Local Manufacturing:

- **Cost Efficiency:** By producing the prosthetics locally, we can significantly reduce production and distribution costs. This approach ensures that high-quality prosthetic devices are affordable and accessible to a larger population.
- **Timely Availability:** Local manufacturing will also reduce lead times, ensuring that patients receive their prosthetic devices more quickly.

3. Custom Fit and Comfort:

- **Personalized Design:** Each prosthetic device will be custom-fitted to the individual user, ensuring maximum comfort and functionality. This personalized approach reduces the risk of complications and enhances the overall user experience.
- **Ergonomic Features:** The design will prioritize ergonomic features that mimic natural limb movement, providing users with a more comfortable and seamless integration into their daily lives.

4. Data Recording and Monitoring:

- **Integrated Sensors:** The prosthetics will be equipped with sensors that record usage data, such as movement patterns and pressure points. This data can be used to monitor the device's performance and the user's progress.

- **Continuous Improvement:** The collected data will inform ongoing improvements to the prosthetic devices, ensuring they remain at the cutting edge of technology and user needs.

Benefits

1. Enhanced Quality of Life:

- **Increased Activity Levels:** Users will be able to engage in a wider range of activities, from sports to everyday tasks, leading to improved physical health and psychological well-being.
- **Social Integration:** By enabling greater mobility and independence, the prosthetics will help users integrate more fully into their communities and lead normal family lives.

2. Cost Reduction:

- **Affordable Solutions:** The focus on local manufacturing and cost-efficient production methods will make advanced prosthetic devices more affordable, reducing the financial burden on patients and healthcare systems.
- **Economic Impact:** Lower costs will also make it feasible for healthcare providers to offer these devices to a larger number of patients, enhancing overall public health outcomes.

3. Local Servicing:

- **Quick Maintenance:** The ability to service the prosthetic devices locally will ensure that any issues can be addressed promptly, minimizing downtime for users.
- **Sustainable Support:** Local servicing capabilities will also support the long-term sustainability of the prosthetic devices, ensuring they remain functional and effective over time.

4. Mutual Benefits for Healthcare Providers:

- **Knowledge Sharing:** Collaboration between healthcare providers in different countries will facilitate the exchange of knowledge and best practices, leading to improved patient care and outcomes.
- **Global Impact:** This project has the potential to set a new standard for prosthetic care worldwide, benefiting patients and healthcare systems across the globe.

Cost Considerations

- **Development Costs:** Initial investment will be required for research and development, including the design, testing, and refinement of prototypes. This phase is crucial to ensure the prosthetic devices meet the highest standards of quality and functionality.
- **Manufacturing Costs:** Setting up local manufacturing facilities and producing the prosthetic devices will involve significant costs. However, these costs will be offset by the long-term benefits of reduced production and distribution expenses.
- **Maintenance and Servicing:** Ongoing costs will be associated with servicing and maintaining the prosthetic devices to ensure they remain in optimal condition. This includes training local technicians and establishing service centers.

- **Training and Support:** Healthcare providers and users will need training on the proper use and maintenance of the prosthetic devices. This will involve initial training sessions as well as ongoing support to address any issues that arise.

Conclusion

The development of a low-cost, microprocessor-controlled prosthetic knee and arm represents a transformative step towards making advanced prosthetic technology accessible to all. By focusing on local manufacturing, personalized design, and continuous improvement, this project will significantly enhance the quality of life for amputees, promoting good health and preventing other physical and psychological disorders. This initiative not only benefits individual users but also has the potential to revolutionize prosthetic care globally, setting a new standard for accessibility, affordability, and innovation. The project will also help generate local employment.