Engineering in Rehabilitation

BE101
Group 47

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Introduction

Rehabilitation refers to giving aid, not necessarily medical, to physically handicapped or physically disabled people with biological impairments to help them achieve the kind of lifestyle they wish to have. Rehabilitation is all about giving mental, emotional, moral and physical support to those in need.

Rehabilitation engineering is when engineering principles are utilized to build devices and other technological solutions to assist the impaired.

Robotics in Rehabilitation
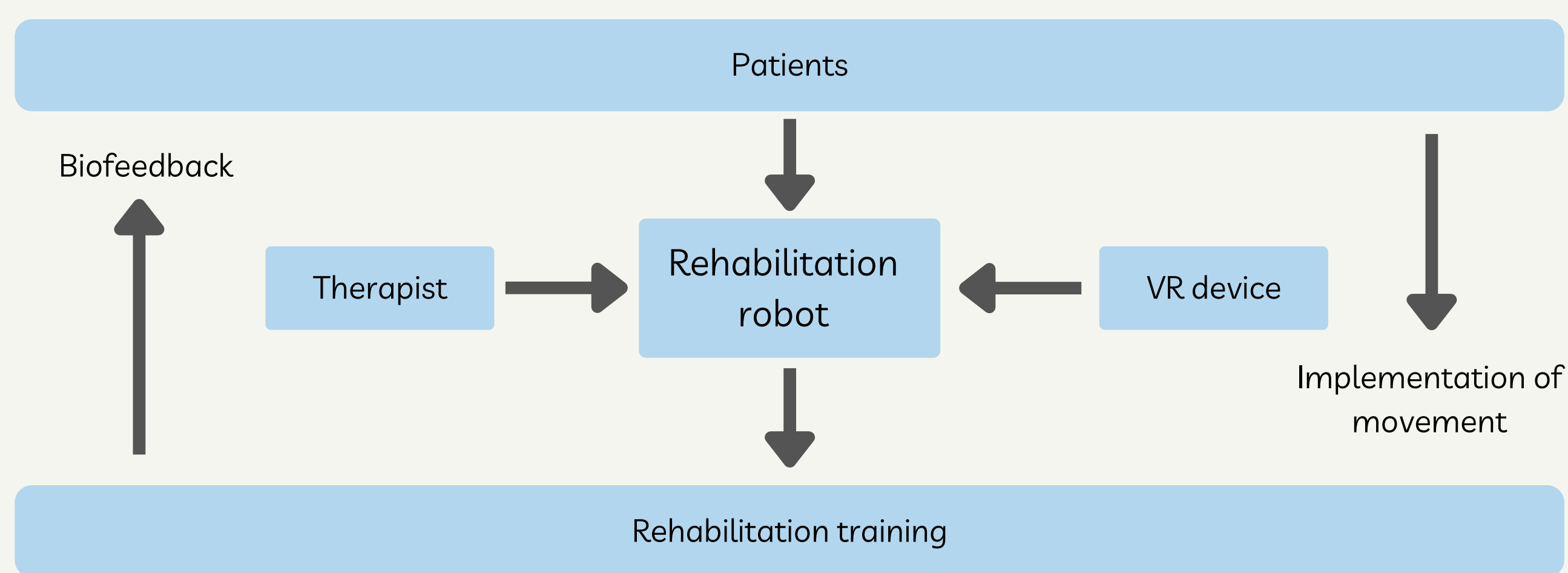
Rehabilitation through robotics involves using new technologies to custom design machinery that can help a person enhance work productivity and the quality of life.

Types of rehabilitation robots :-
- An assistive robot that substitutes for lost limb movements ex: MANUS ARM(assistive robotic manipulator)
- Therapy robot, also called a rehabilitator. Therapy robots are machines or tools for rehabilitation therapists that allow patients to perform practice movements aided by the robot. Ex MIT-Manus, helped stroke patients.
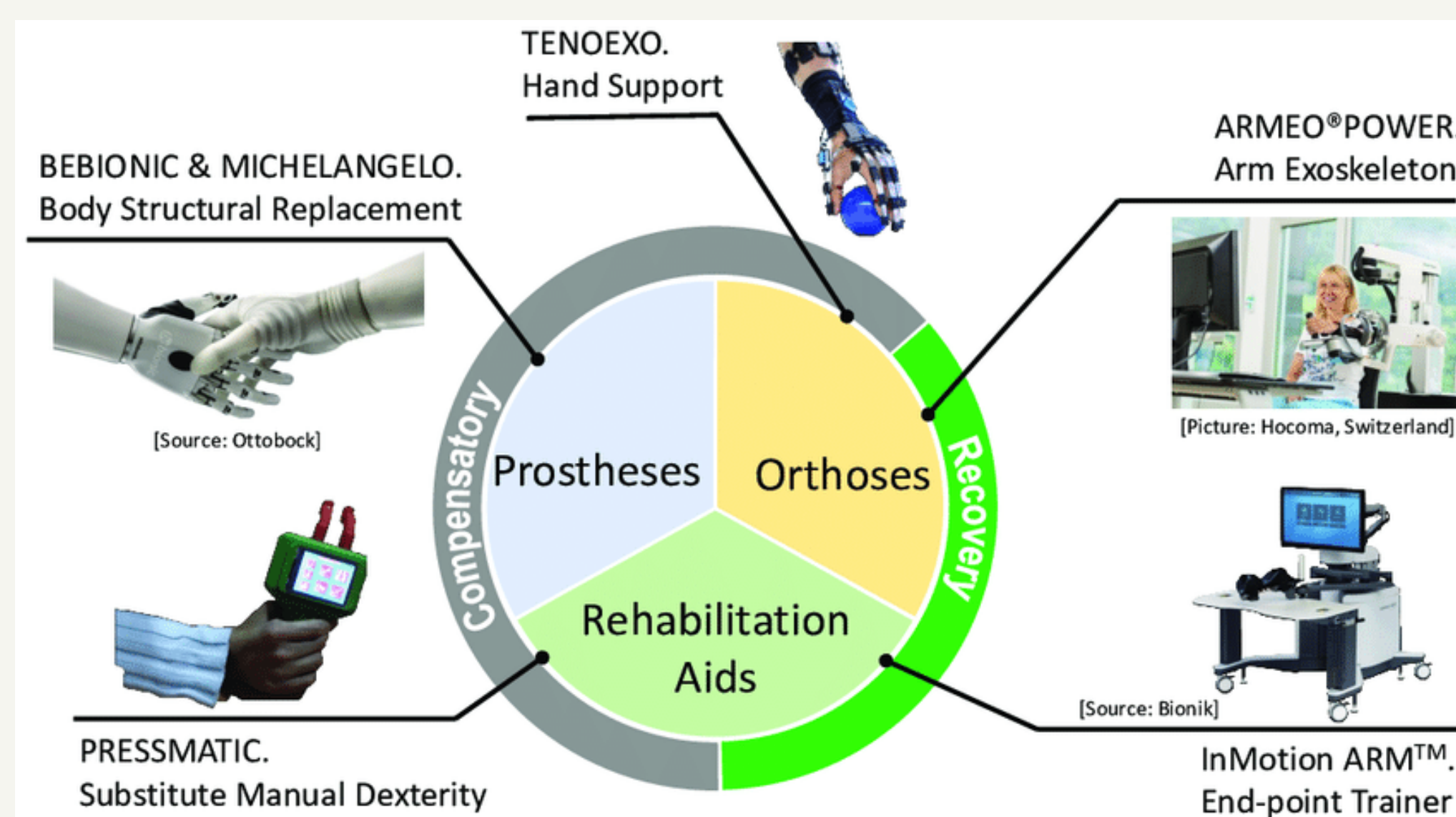

Figure 3: Rehabilitation robotics domain according to device morphology and the expected role it plays

Current State of the Art

A large number of patients are receiving the benefits of rehabilitation due to advancements in technology.
Some current projects under rehabilitation include:
- Functional Near-Infrared Spectroscopy Project: It aims to detect patients' motion intention by measuring levels of oxygen in the brain.
- Virtual Peg Insertion Test: Measures the extent of impairment of arms and hands by measuring the grip force given by the patient.
- Tenoexo: A lightweight exoskeleton made to grab and hold things as per the patient's intention.

A number of projects are currently underway to ensure that patients get more comfortable and these devices get more affordable.

Figure 4: Tenoexo

Figure 5: Virtual Peg Insertion Test Device
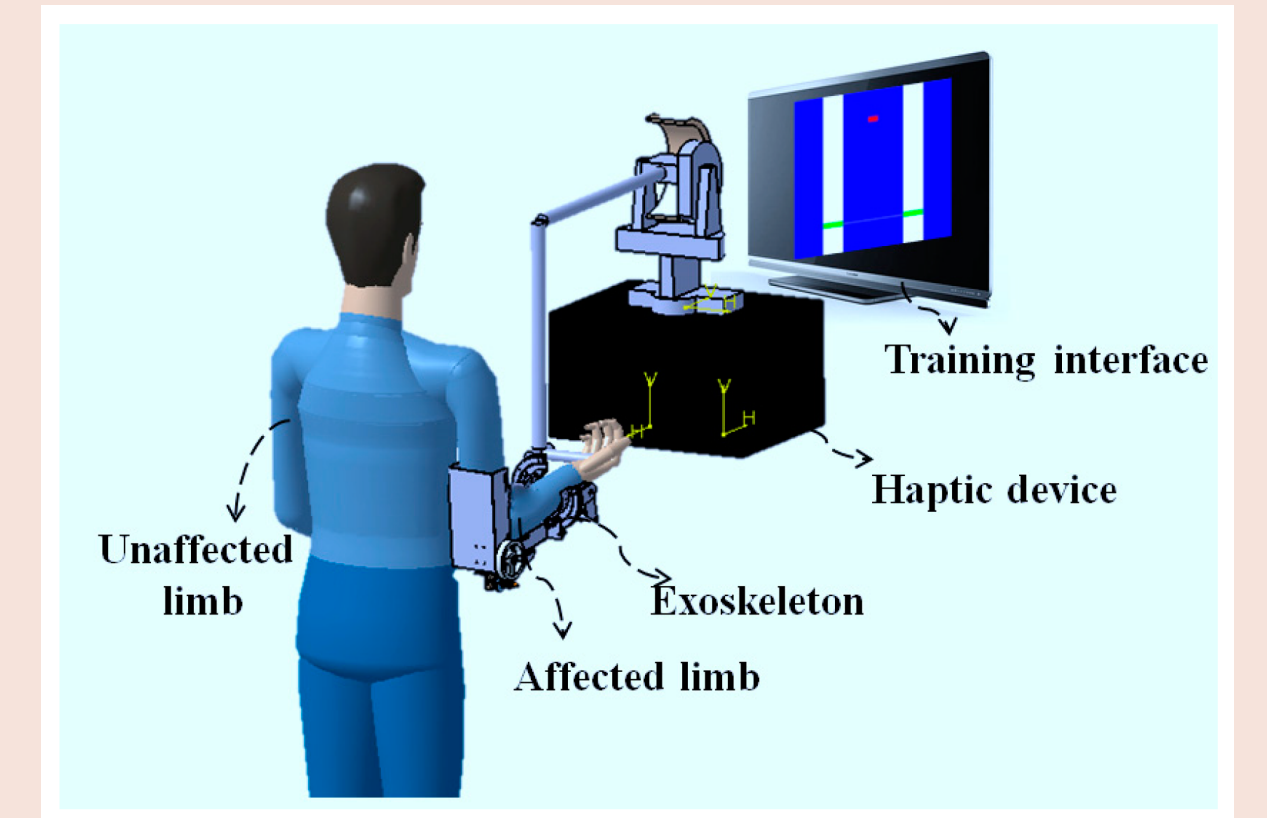

Figure 1: Assistive robot

Figure 2: Therapy robot

Limitations

- Accessibility, ease of usage, and comfort are not up to the mark.
- Relatively fewer and slower advancements occur in this discipline. So not everyone is aware of these technologies. Few people with disabilities are educated and trained.
- Generally, engineers work apart from disabled people and thus not the best assistive devices are created.
- Rehabilitation devices are expensive and not affordable by everyone.
- Assistive robots can be quite bulky (figure 1).

Future Prospects

Over the past few decades, there has been a breakthrough in rehabilitation engineering with advances in technologies made to create advances prosthetic limbs, brain controlled robotics etc. to help them regain as much physical and cognitive functions. The advancements include :

- Rehabilitation Robotics
- Virtual Rehabilitation
- Physical Prosthetics
- Sensory Prosthetics
- Brain Computer Interface
- Modulation of Organ Function
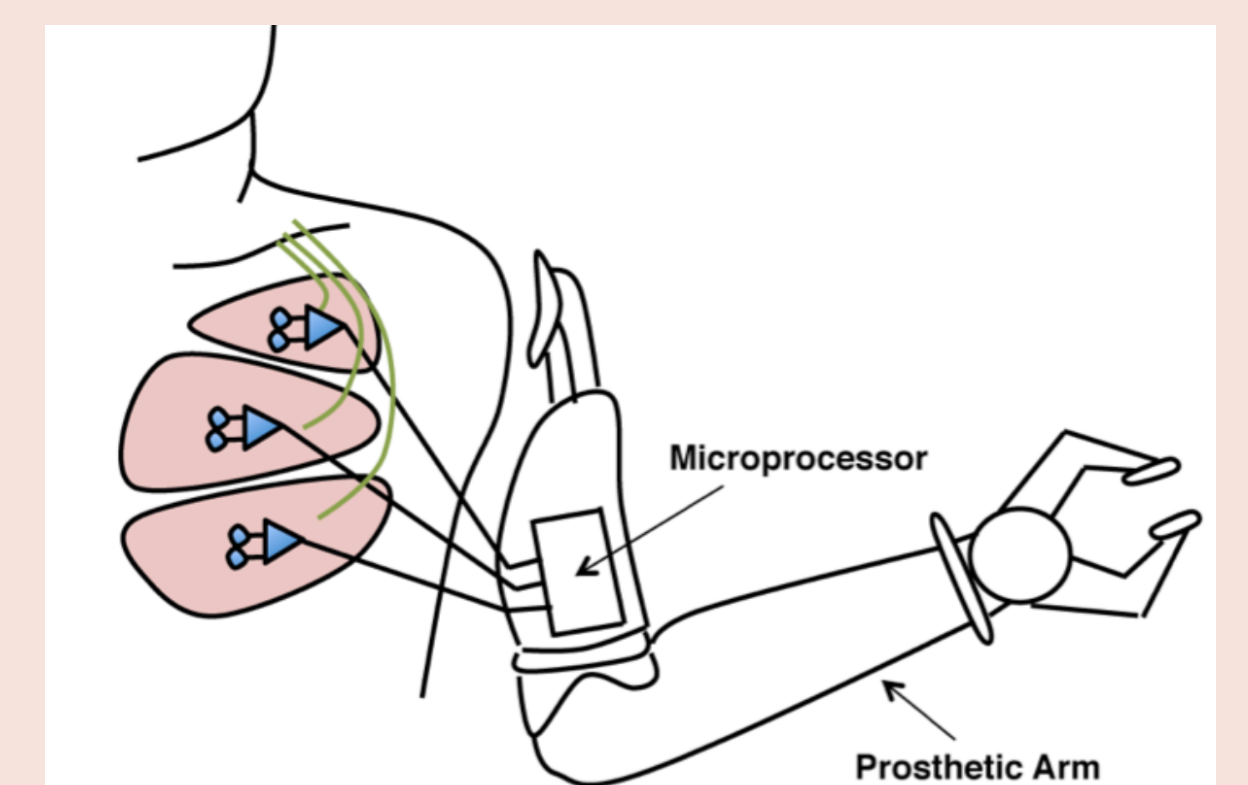- Secondary Disorder Treatment

Figure 6: Each nerve ending connected from muscle to arm to control the prosthetic

Summary

Rehabilitation engineering involves developing devices and technology in rehabilitative care. Although rehabilitation has been a boon to many, its accessibility and affordability limits itself from reaching the hands of the deserved. Even so, the future of rehabilitation is bright.

References

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