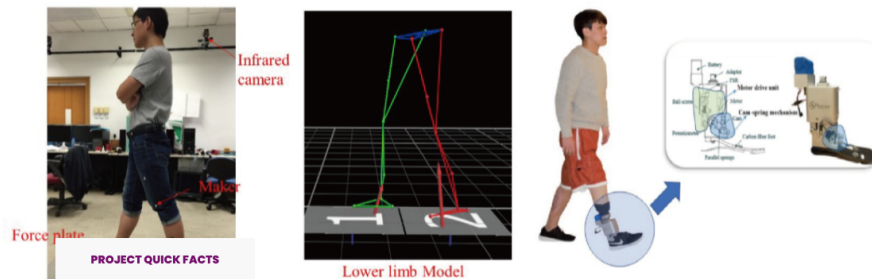




Self-Powered Smart Prosthetic Knee

#Rehabilitation



PROJECT QUICK FACTS

Principal Investigator

Prof. LIAO Wei Hsin

DEPARTMENT OF MECHANICAL AND AUTOMATION
ENGINEERING

Funding

Innovation and Technology Commission

Collaboration

Tai Po Hospital and Prince of Wales Hospital

Patent

Ankle-foot prosthesis has been filed as 1 US patent (granted) and 1 China patent application

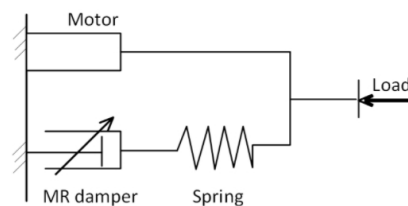
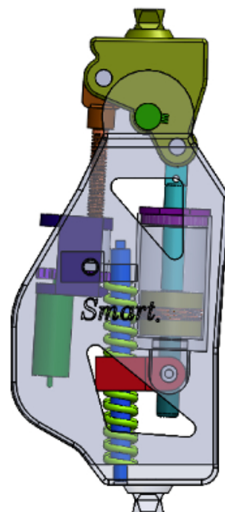
Award

Gold Medal, 46th International Exhibition of Inventions of Geneva
Champion, Prof. Charles K. Kao Student Creativity Awards
(Postgraduate Group)

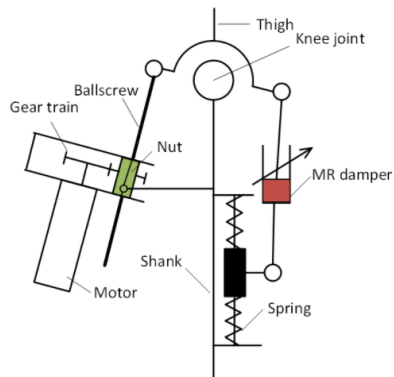
Prosthetic knees are the devices for helping trans-femoral amputees to regain locomotion ability. When compared with passive prosthetic knees, quasi-passive and powered prosthetic knees with the ability to govern the motion of prostheses can significantly improve the stability and safety, at the same time enable exceptionally natural and effortless gait, even on difficult terrains. However, the mobile power source constrains the development and widespread use of these type of prostheses in terms of limited endurance and inconvenient daily charging. In this project, to handle the power source issue, we propose a self-powered smart prosthetic knee. In another project targeting the needs of below-knee amputee, experimental results indicated that our powered ankle-foot prosthesis when compared with widely used passive prostheses can reduce users' metabolic cost by 15% and improve the symmetry of users' gait, reducing the users' effort required for walking.

Uniqueness and Competitive Advantages:

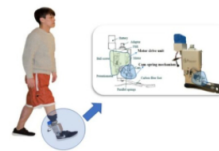
- Design with the consideration of motion and biomechanics
- An actuator consisting of smart materials, a DC motor, a MR damper, and springs is designed for driving the prosthesis, in which the energy consumption can be reduced significantly
- Energy harvesting technologies are employed in the prosthetic knee, solving the limitation of batteries and inconvenient daily charging



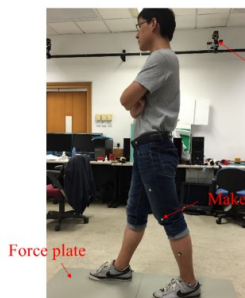
Model of the actuator in the smart prosthetic knee



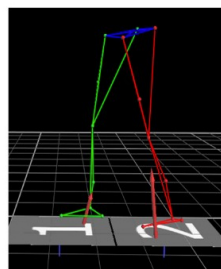
Geometric configuration of the prosthesis



Below-knee amputee walking with the powered ankle-foot prosthesis



Infrared camera



Lower limb Model

Measurement of human knee dynamics by a motion capture system

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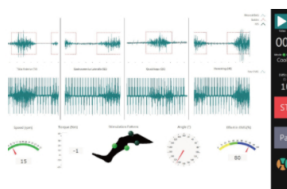
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