Biomechanical Effect of a Novel Designed Passive Knee Exoskeleton for Human Augmentation

Noh, Brayden (School: Auburn High School)

The human knees are the largest and the most complex joints in the human body. However due to its actives and the way it is formed, it is also the most injured joint with over 6 million patients over past 9 years. Injury to the knees are especially common in the field of military, laborer jobs, and sports due to the greater muscle stress intensity that these jobs have to endure. Strong and healthy knees are crucial for everyday movement, however the current solution, the knee brace does not meet the expectation and lead to decline of people who uses them. By creating a novel knee exoskeleton that can outperform the knee brace by terms of comfort, price and function, it can lead to increase in sales in knee protective device, which decreases knee injury. Unlike a traditional knee brace, the newly design exoskeleton returns elastic energy to the user by the passive mechanism during physical activities thereby assisting leg muscle strength, reducing fatigue, and enhancing performance while protecting the knee. Also, the elastic hinge help reduces pain while redirecting compressive forces away from the knee joints and give the boost the user might need in a situation of lifting heavy objects or simply standing up from a chair. With several designs of the exoskeleton, and with various technologies and innovations along the way of the project, it was verified that wearing the knee exoskeleton can not only reduce knee injury, but also enhance the user's physical performance and reduce the muscle usage which allows people with knee pains and injuries to rehabilitate. The knee exoskeleton has the potential to be a successful, marketable product and can outperform current knee braces in the market.

Awards Won: