DESIGN AND FABRICATION OF A ROBOTIC KNEE EXOSKELETON

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INTRODUCTION

• Wearable robotic exoskeletons augment human joint motion
• Exoskeletons can be passive or active
• Can be single or multiple joint systems
INTRODUCTION

• Applications:
  • Work environments
  • Military use
  • Restoring loss of mobility
  • Space environments
  • Physical Therapy

https://gizmodo.com/i-understand-this-is-an-early-version-but-i-can-see-one-1756999672

https://www.nasa.gov/offices/oct/home/feature_exoskeleton.html

PROJECT FOCUS

• Cerebral palsy
  • Often results in motor impairments
  • Reduce mobility and stability
  • Increase the energy cost of transport

• Crouch gait
  • Excessive knee flexion
  • Can lead to knee pain and degradation

https://jamanetwork.com/journals/jamaneurology/fullarticle/1151825
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Need a way to extend the knee during walking
PROJECT GOALS

• To provide resistance/assistance about the knee joint

• To design, build, assemble, and test a knee exoskeleton:
  • Compact/light weight
  • Incorporate sensor to retrieve knee flexion
  • Customizable orthotics
METHODS

• SolidWorks
• Rapid prototyping using 3D printing

Lulzbot Mini
METHODS

• Other prototyping methods
• Tested using Vicon motion capture system
RESULTS

• Fully functioning exoskeleton
• Lighter and more compact
• Testing proved that the system functions as intended
RESULTS

• Integrated potentiometer
• Chain cover
• Customizable orthotics

![Diagram of robotic components including Chain, Motor, Potentiometer, Torque Sensor, Thigh Orthotic, Calf Orthotic, Foot Plate, Thigh Upright, Calf Upright, Chain Cover, and Force Sensor.]
CONCLUSION

• This system will be used in future exoskeleton studies
  • Biofeedback
  • Adaptive control
  • Long term use
• Will assist in exoskeleton development
ACKNOWLEDGMENTS

• Dr. Zachary Lerner
• The NASA Space Grant Internship Program
• Northern Arizona University
REFERENCES


QUESTIONS?