University of Minnesota Wearable Technology Lab

Smart Wearable Systems to Support and Measure Movement in Children with Mobility Impairments

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Introduction

In the United States, approximately 200,000 children are affected by mobility-limiting conditions [1]. In early childhood, upper extremity function (which involves the ability to reach for and grasp objects) is crucial for exploration and learning. These early milestones serve as the foundation for further perceptual-motor, language, and cognitive development [2]. When mobility is inhibited early in life, the cognitive and physical development of the child may be severely impacted [3, 4]. The University of Minnesota Wearable Technology Lab is collaborating with Virginia Tech and the University of Delaware to develop a wearable system suitable for children that would track and aid upper limb mobility.

Objectives

The goal of this project is to design and develop a closed-loop sensing, monitoring, and actuation system for a specific clinical test-bed application. The proposed work is two-fold:

(1) Actuation technologies for active support
(2) Sensing technologies for feedback, control and monitoring

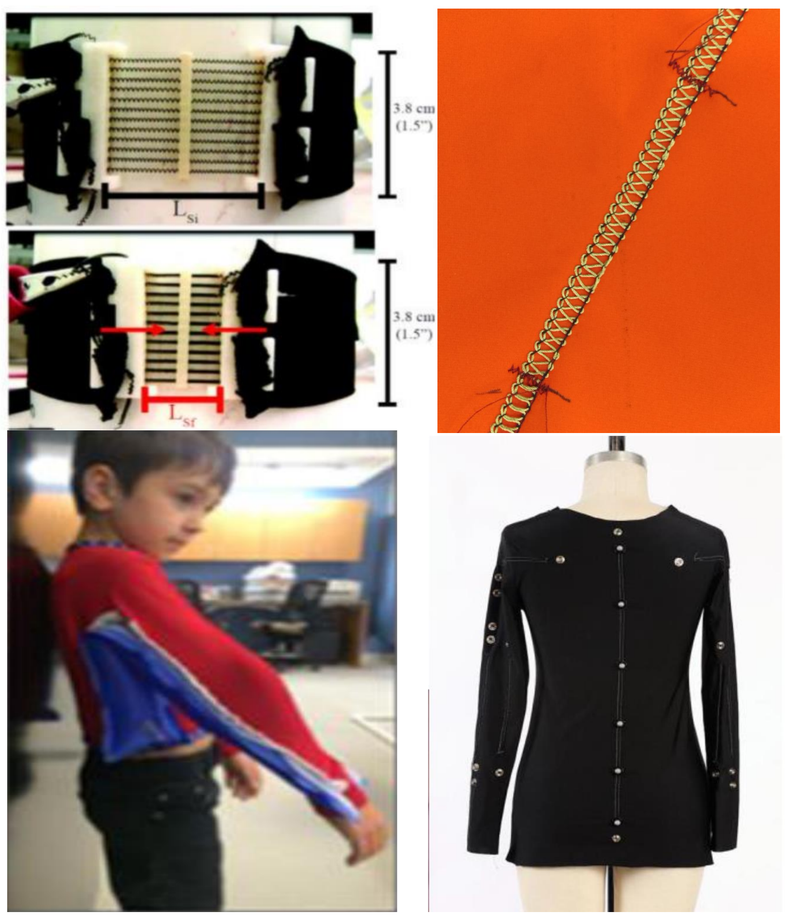
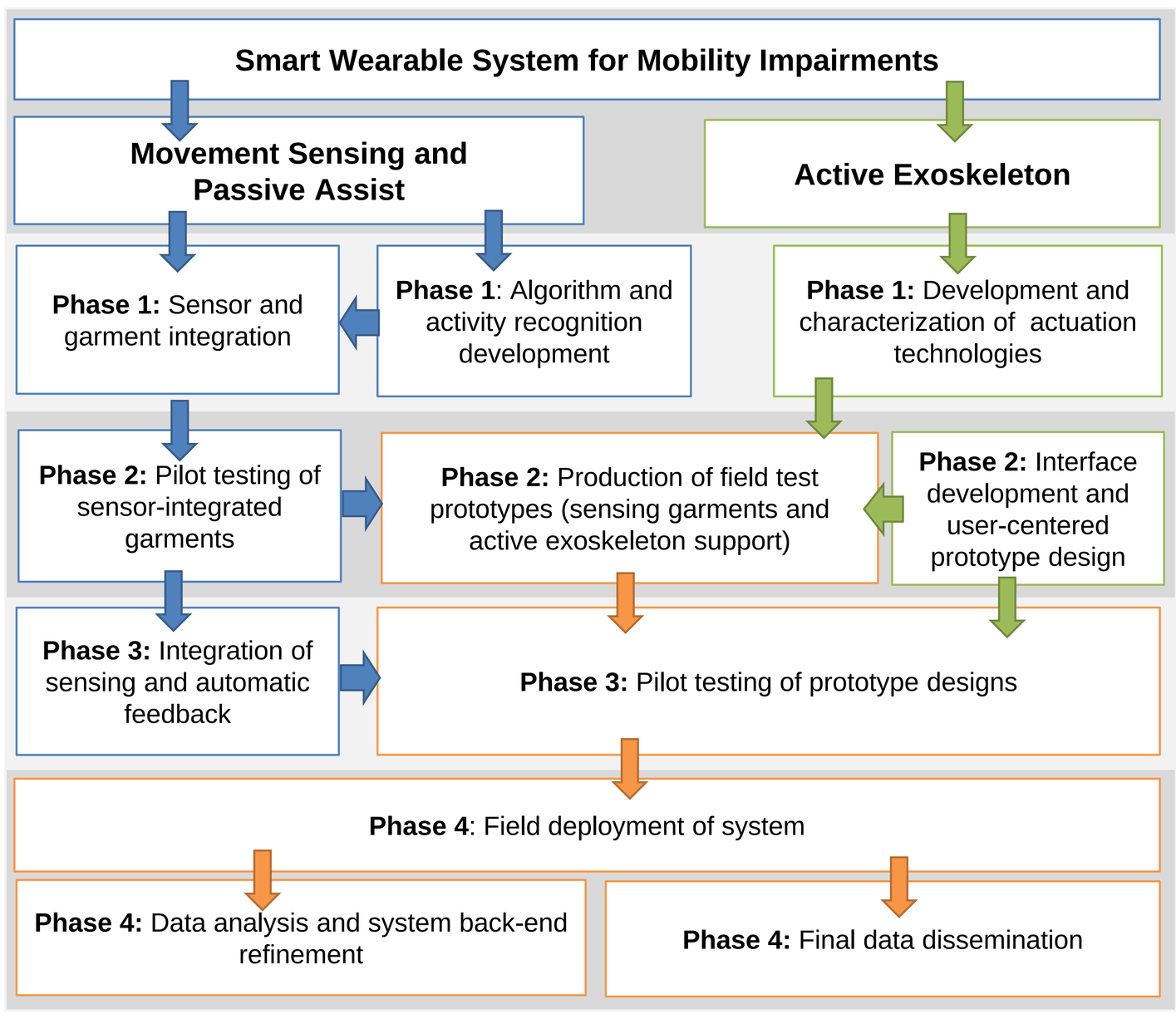


Figure 1: *Row 1 (left): SMA Actuators, (right): textile sensor Row 2 (left) pneumatic garment, (right) sensing garment*

Research Roadmap



Current and Future Work

(1) Actuation Technologies

- Building off of PlaySkin Air, a pneumatic limb support garment that can support a child's shoulder flexion.
- Exploring shape memory alloy (SMA) actuator systems to achieve desired biomechanical joint manipulations.

(2) Sensing Technologies

- Using textile-based bend and stretch sensors to detect joint-movement characteristics.
- Combining sensor data with activity learning algorithms to classify user activity and mobility for clinical test-beds.

Acknowledgements

This research is supported by the National Science Foundation Grant # 1722738.

References

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