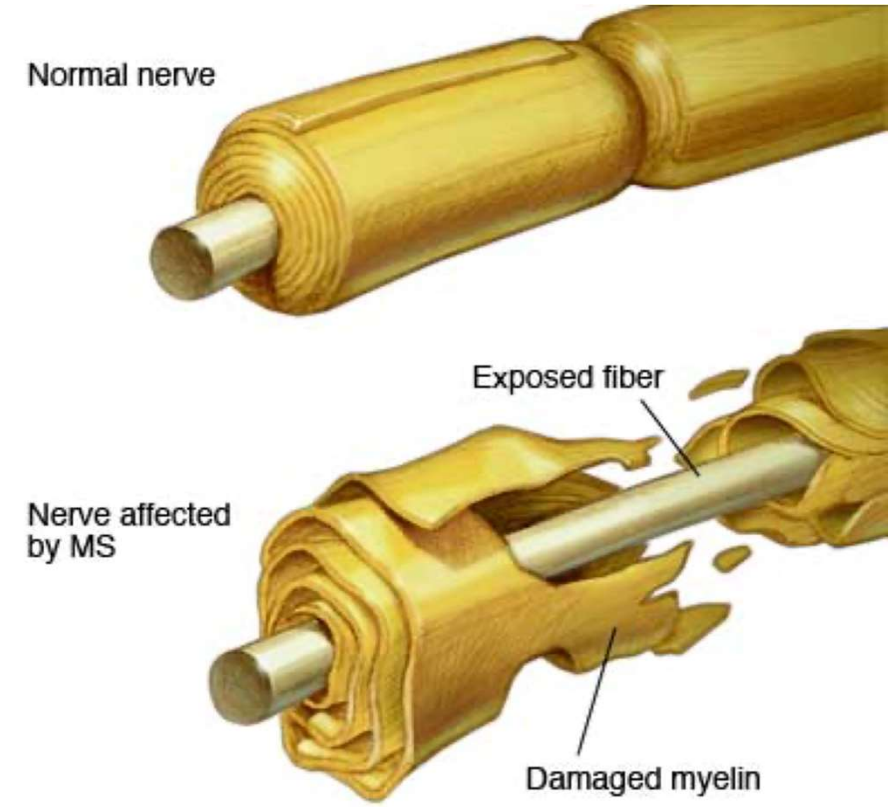
Towards a Smart Home for Older Adults with Multiple Sclerosis

Dr. Manuel Hernandez
mhernand@illinois.edu

Multiple Sclerosis (MS)

- Autoimmune disease affecting nerve-insulating myelin
- 2+ Million people affected worldwide
- Typically diagnosed between 20-50 years of age
- Peak prevalence of MS shifting to older age groups[1]



1. Marrie, et al., 2011.

MS-related declines

- Attention and executive function are crucial for cognitive control of mobility in persons with MS[2]
- Declines in balance, mobility, strength, sensory, cognitive, and mental health function expected from MS[3]

2. Motl, et al., 2014. 3. Compston and Coles, 2008.

Barriers to engagement with physical activity

- Despite benefits, exercise participation remains in low in persons with MS[4]
- Lack of physical activity could be due to **personal, environmental,** and **societal barriers**[5]

4. Kinnet-Hopkins et al., 2017. 5. Learmonth and Motl, 2016

The good news…

Intelligent Home Exercise System for Motor-Cognitive Rehabilitation

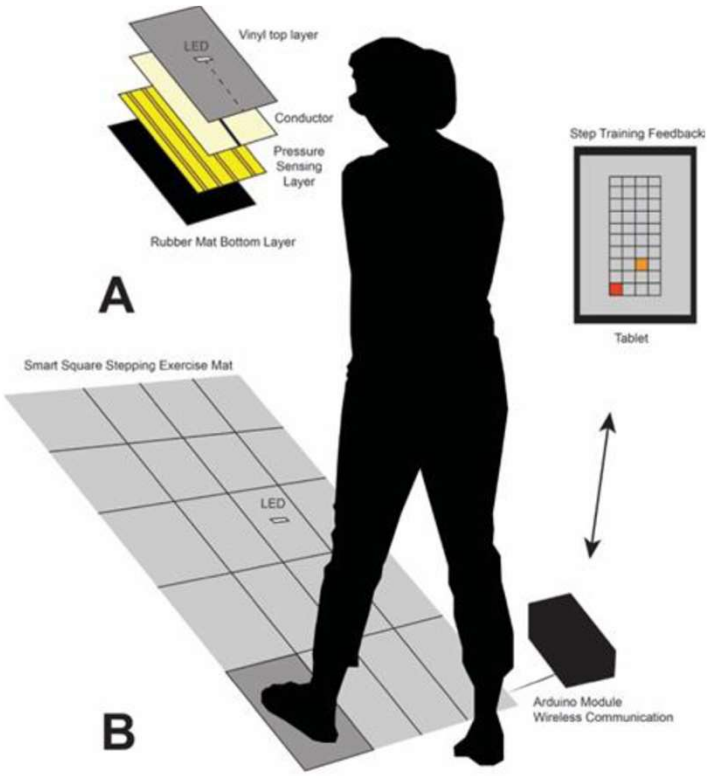
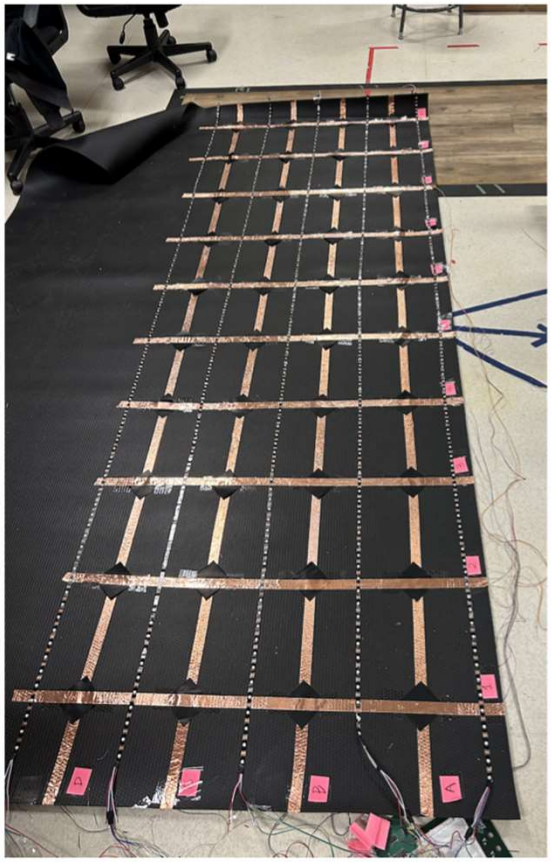
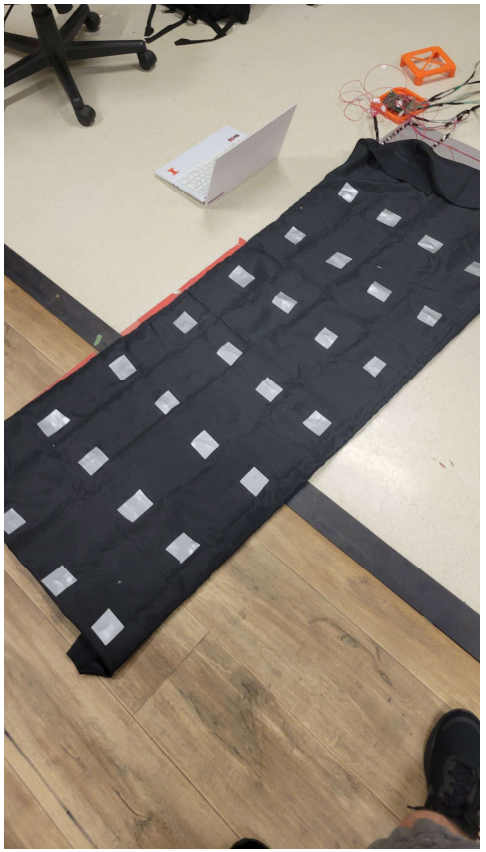


Figure 1. A) Cross-section of sensing mat, and B) Smart Square Stepping Exercise Mat (s-SSE) system.





Smart Insoles for Fall Risk and Frailty Prediction

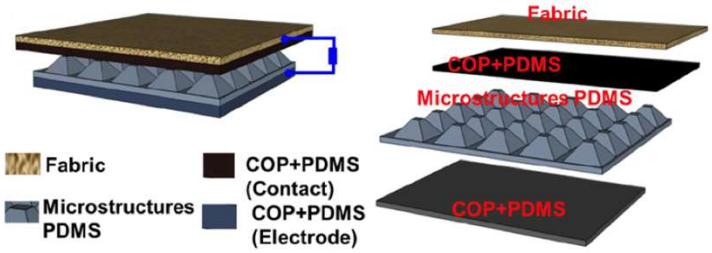


FIGURE 1: OVERVIEW OF THE CARBONIZED ORANGE PEEL TRIBOELECTRIC SENSOR

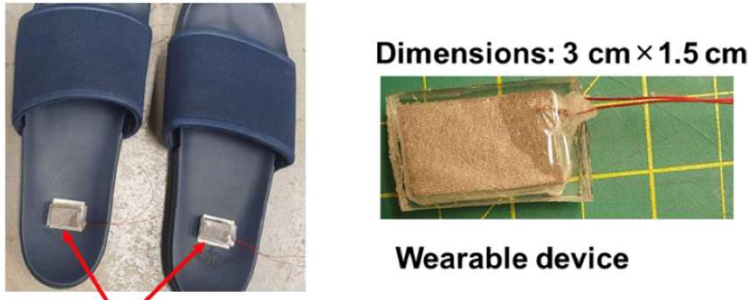


FIGURE 2: PROTOTYPE OF THE CARBONIZED ORANGE PEEL TRIBOELECTRIC SENSOR

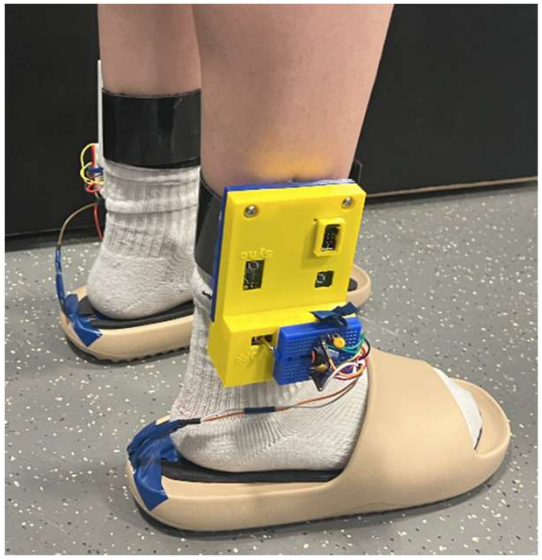
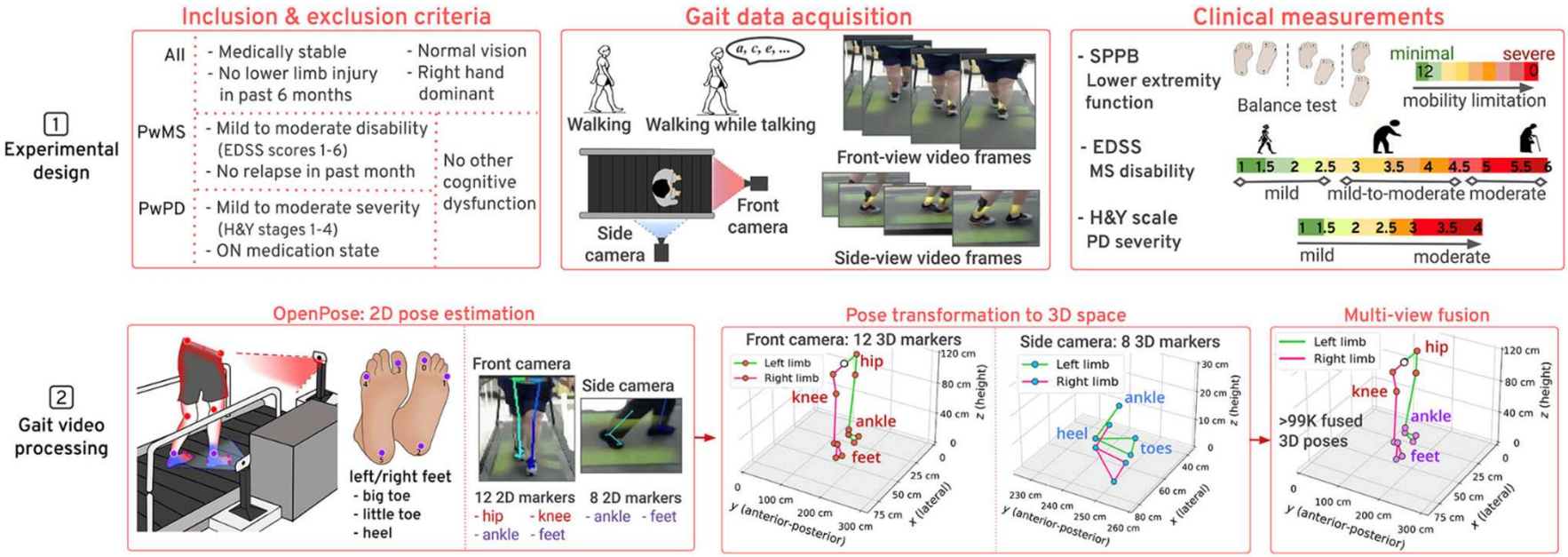


FIGURE 3: FINAL DEVICE ASSEMBLY ON USER

Computer Vision for Gait Impairment Identification



Next steps

- **Goal 1**: Evaluate prior work and refine system specifications, sensor selection, and system design.
- **Goal 2**: Build a (robust and reliable) hardware prototype.
- **Goal 3**: Evaluate user feedback.

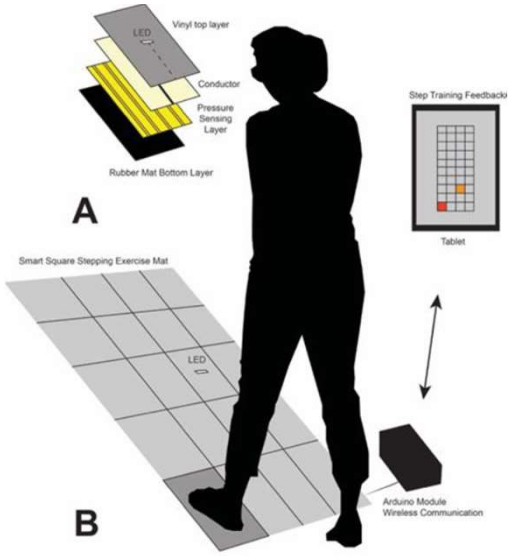


Figure 1. A) Cross-section of sensing mat, and B) Smart Square Stepping Exercise Mat (s-SSE) system.

Emerson Sebastiao

Robert Motl

ProtoKinetics
The New Standard in Gait Analysis

Towards a Smart Home for Older Adults with Multiple Sclerosis