



# TRANSITIONING A RESEARCH TOOL INTO A CONSUMER PRODUCT: THE WHEELCHAIR IN-SEAT ACTIVITY TRACKER

Stephen Sprigle , Sharon Sonenblum, JJ O'Brien

## Introduction

Pressure ulcers are a significant secondary complication for many wheelchair users. Wheelchair users are taught a weight shift regimen. Technology was developed to study users weight shifting behaviors. Results showed that persons do not perform weight shifts regularly. This served as motivation to develop a consumer product to inform users of their activities. The transition from a research tool to a consumer product is endowed with challenges. Specific design challenges included attention to usability and device engagement and the need for near real-time data management and analysis to inform users of their in-seat movements.

## WHEELCHAIR IN-SEAT ACTIVITY TRACKER



### 1) Hardware

- Seat sensor placed underneath the wheelchair cushion
- Data acquisition & communication module

2) Classification algorithms use Machine Learning to classify in-seat activity into weight-shifts and in-seat movements

3) Mobile phone app manages all data & communication with hardware and end user

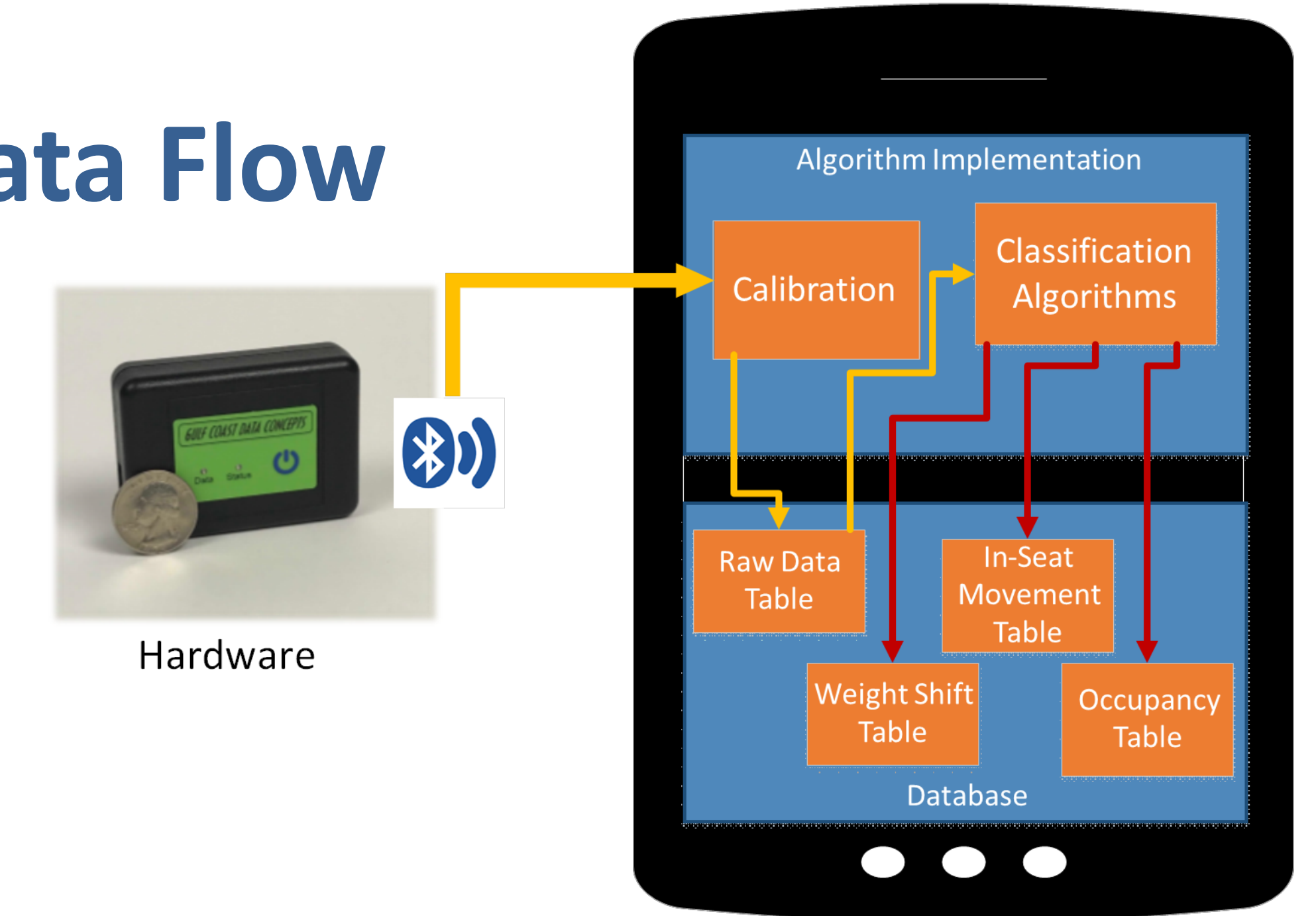
## Consumer product development

	Research	Consumer
App	Does not exist	<ul style="list-style-type: none"> <li>• Accept raw signals from hardware;</li> <li>• classify into weight shifts &amp; in-seat movement parameters; manage initialization; monitor hardware;</li> <li>• User-interface for accessing activity and managing WiSAT</li> <li>• Dual modes: passive and active (push notifications to provide feedback)</li> </ul>
Algorithm	<ul style="list-style-type: none"> <li>• Researcher-led initialization</li> <li>• Post processing to calculate activity</li> </ul>	<ul style="list-style-type: none"> <li>• Near real-time processing</li> <li>• Simple user initialization to inform machine learning</li> </ul>
Hardware	<ul style="list-style-type: none"> <li>• Stores data for 2 weeks</li> <li>• Hand-assembled seat sensor</li> </ul>	<ul style="list-style-type: none"> <li>• Inductive charging</li> <li>• Bluetooth communication</li> <li>• Production-quality seat sensor</li> <li>• Stores data for 6+ months</li> </ul>

### Next up:

70 person pre-clinical trial  
4 ½ month WiSAT deployment

## Algorithm Data Flow



## Home screen



## Detail screens



## Acknowledgements

This work was supported by the Office of the Assistant Secretary of Defense for Health Affairs, through the Spinal Cord Injury Research Program under Award No. W81XWH-17-1-0221 and the National Institute of Aging of the National Institutes of Health under Award Number 1R01AG056255.