Sense and Accessibility

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Understanding People with Physical Disabilities’ Experiences with Sensing Systems
Method

- 40 adults in the U.S. with physical disabilities (aged 18 – 75)
- Online questionnaire with 76 questions
  - Multiple choice questions about experience with various sensor types
  - Free-response questions for qualitative data about those experiences
- Affinity Diagramming for qualitative analysis to identify themes in the data
  - 10 challenges with sensor systems
  - 4 mitigation strategies
Challenges with Sensor Systems

- Premature Timeouts
- Poor Positioning
- Being “Invisible”
- Mismatched Range of Motion
- Variability of Abilities
- Setup Difficulties
- Biometric Failures
- Security Vulnerabilities
- Incorrect Inferences
- Data Validation Problems
Timeouts

- “Automatic doors close before I can walk to them because I am very slow.” – P9
- “I have been disconnected by automation on phone if I didn’t answer quickly enough.” – P3
- “Sometimes I take longer in the bathroom due to disability-related issues and I’ve had the lights turn off on me because I was still in the stall.” – P22
- “I specifically have encountered this with timers for locks in automatic doors that require a key-card or pass code. By the time I’m able to put back the key-card or grab my belongings, the door has re-locked.” – P19
Positioning

◊ “Courthouses frequently have interior door-open buttons placed too high so I ask for assistance.” – P3 (attorney)

◊ “... sometimes I can’t reach the button because it’s in a corner or awkward angle that I can’t pull my wheelchair up to.” – P22

◊ “I’ve had issues where at airports and train stations where the security scanner uses an eye retina and it’s too high and can’t be lowered further to reach me.” – P19

◊ “In my own home due to the height placement of my thermostat connections, the activity sensors in my thermostat often do not detect me.” – P39
Invisibility

✧ “Doorbell cameras... cannot see a wheelchair person.” –P20
✧ “At my work, there are cameras to be buzzed into a secure area; however, the cameras are too high and I have to lift myself up or back far away enough that the camera can see my face.” –P30
✧ “I definitely had lights in bathrooms not recognize me, so I have to keep moving my wheelchair to try to get to turn the lights on.” –P15
Biometrics

“Because I use a ventilator, my voice does not naturally come across to answering services or things of that nature like in instances of calling a bank or some other service and using automated voice prompts.” – P13

“I know people with ventilators that cover their noses which could cause a problem with [face] recognition.” – P8

“Because I can’t always put my finger on my iPhone button the same exact way depending on my position, it often won’t open my phone.” – P15
Mitigation Strategies

- Seeking assistance from others
- Developing custom adaptations to make tech work
- Avoidance of sensing technologies
- Tech abandonment
Assistance

✧ “I often try to time it where I’m entering the [automatic door] same time as someone else, sometimes I’ve had to just wait hoping someone comes along or if I have a peer or friend available inside I will call them on my cell to help me get access inside.” –P19

✧ “waited till a walking person entered [to trigger automatic lights]” –P8

✧ “[I have] reached out and complained to the manufacturers [of smart devices]” –P39
Adaptation

◊ “I have to wave in the air for motion sensors when I am too short to activate it.” –P28
◊ “[I] had to raise [my] chair using its controls [to be seen by door sensor]. The seat rises vertically till I’m about 5’ tall.” –P16
◊ “my husband cut down a dressing stick that I keep on my wheelchair so I can use it to hit the buttons [in public places]” –P14
Avoidance

◊ “Recently there was a game I tried to play but couldn’t because it required motion controls... I can’t do much to work around these problems except avoid those games.” –P22

◊ “[I] avoid having to use said door [that doesn’t recognize me, so I use another building entrance]” –P30

◊ “I have never considered buying any health monitoring device because of the exact notion that I doubt it will track my body correctly.” –P13
Abandonment

- “I usually become frustrated/irritated and give up [when touchscreens don’t recognize my gesture input]” – P12
- “can’t do anything about these issues [with the fingerprint scanner] unfortunately [so I use an alternate log-in method]” – P22
Summary

- Survey of 40 people w/ physical disabilities to understand challenges with sensing systems
- 10 Challenges: Timeouts, Positioning, Invisibility, Range of motion, Variable abilities, Setup, Biometrics, Security, Incorrect inferences, Data validation
- 4 Mitigation Strategies: Assistance, Adaptation, Avoidance, Abandonment
- Reflections and Future Work – details in paper at http://aka.ms/senseally
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