

Sense and Accessibility



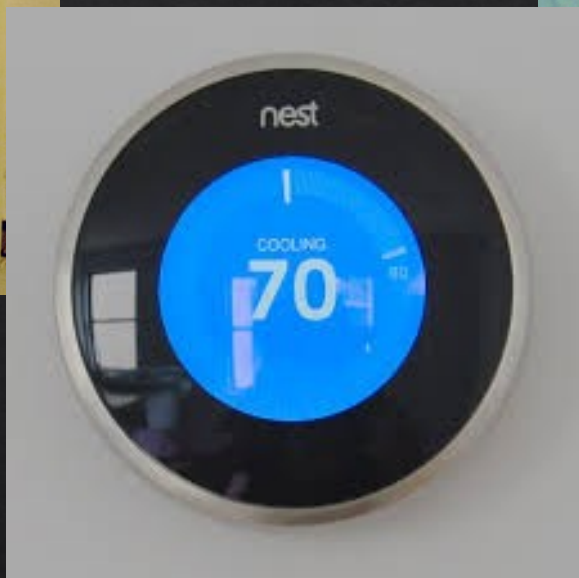
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Understanding People with Physical Disabilities' Experiences with Sensing Systems



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/sensea11y>

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