SaTC: CORE: Small: Authentication Solutions for Individuals with Upper Extremity Impairment

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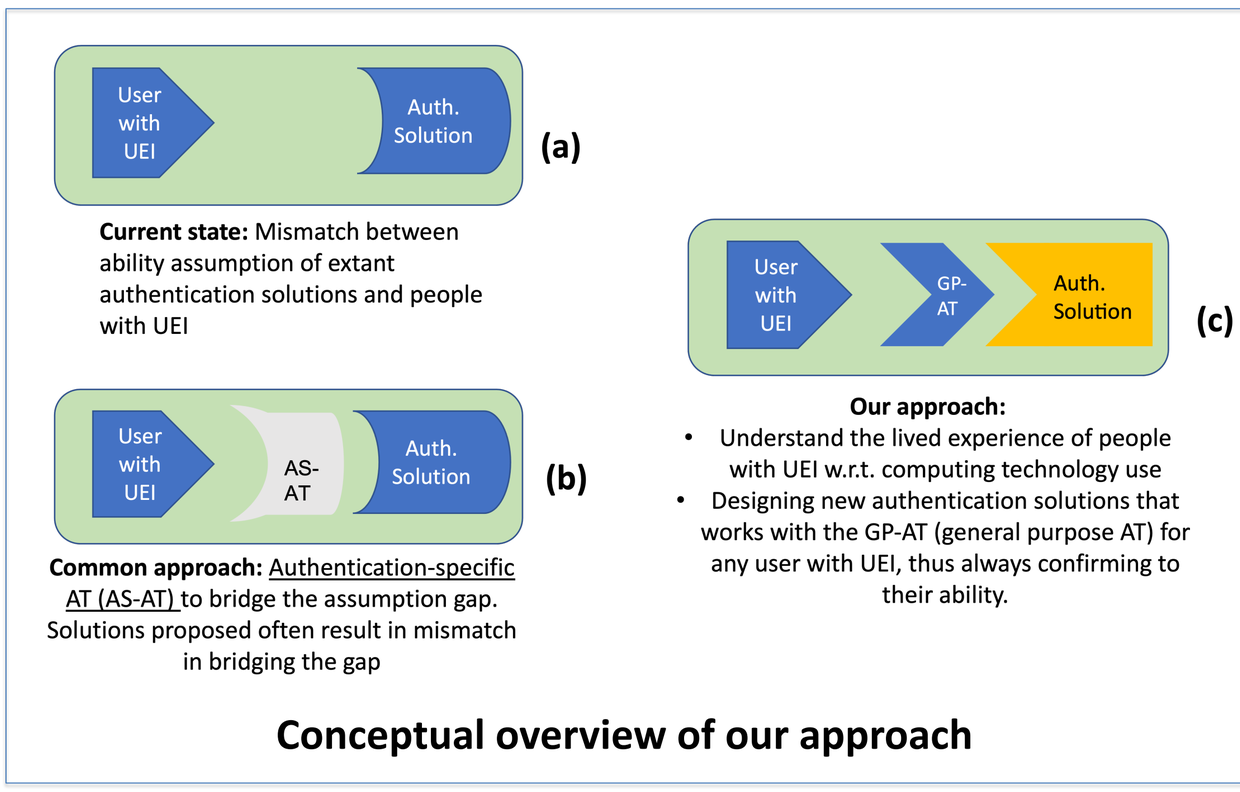
https://kven.me/asset/asset-uei.html

Challenges

- Authentication has become increasingly ubiquitous for controlling access to personal computing devices.
- Current ways of authenticating on personal computing devices typically require users to perform complex actions with their arms, hands, and fingers.
- This creates barriers for people with upper extremity impairment (UEI) who cannot use extant authentication systems well.



Conceptual overview of our approach

Scientific Impact

- This project allows for the development of new authentication solutions that work for people with upper body mobility impairment.
- This work focuses on making essential security artifacts (in this case, authenticating to one's computing devices) accessible and therefore available to marginalized groups in our society.
- With the advent of COVID-19 we have also looked into how the pandemic has affected the lives of people with UEI in terms of authentication use as well as the broader computing use.

Solutions

- Our approach takes a *user-focused view to security artifacts design*.
- In this regard, we spent time understanding the lived *experience of people with UEI w.r.t. the difficulties they face in authenticating* to their devices. We found: (1) People with UEI face problems at all stages of authentication from credential registration to credential recovery. (2) All forms of extant authentication from passwords to biometrics present significant problems for people with UEI. (3) People with UEI rely on caregivers to access their device for them from time to time.
- To further broadly understand the lives of people with disabilities more broadly, we conducted research understand how people with disabilities use other security-focused systems. In this regard we looked at *security-focused smart home devices (SSHDs) are used by and for people with disabilities*.
- In addition, we have also looked at the *effect of COVID-19 on people with UEI* in terms of their use of computing devices including authentication.
- Based on the understanding gained from these initial studies we have been designing authentication solutions for people with UEI based upon the ideas of *ability-based design.* Some of our work in this regard include:
  - Developing a solution that **authenticate a person using ballistocardiogram** measured using IMUs in a head-mounted display. All the person has to do is sit still for a few seconds
  - Exploring the use of a **proximity-based authentication solution** that allows a caregiver to access a person's device when in proximity to them. But lose access when they move away
  - Exploring the use of a **recognition-based authentication solution** that (1) that authenticates based on clicking/tapping images of people they know; (2) clicking/tapping is the most basic feature that all assistive technologies for people with UEI provide

Societal Broader Impact

- In addition to people with UEI, other vulnerable individuals such as those with developmental (e.g., Rett's syndrome) and progressive (e.g., ALS) disabilities may also benefit from this work.
- This work has been featured in both the print and online version of **The Boston Globe** in Jan 2021.

Educational Broader Impact

- Ideas on accessibility and design from this project have been used to bolster courses taught by the PI. This has included module in both grad and undergrad courses in human-computer interaction (HCI).
- In another course on social issues on computing, work from this proposal has lead to the discussion of marginalized groups in terms technology and the ability of accessibility technologies to lead innovation.
- The COVID-19 pandemic got in the way of our outreach plans. With the pandemic restrictions being lifted we plan to work on organizing outreach efforts in the coming year. We are currently in the planning process.