Group J
Phase 5 Presentation

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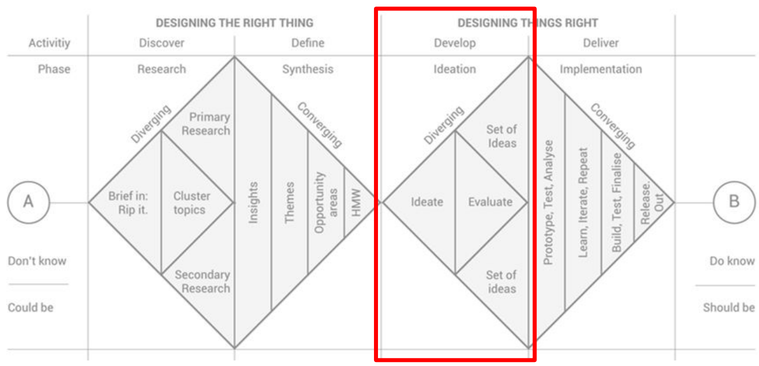
1.

Design Brief

In the Beginning

Phase 1

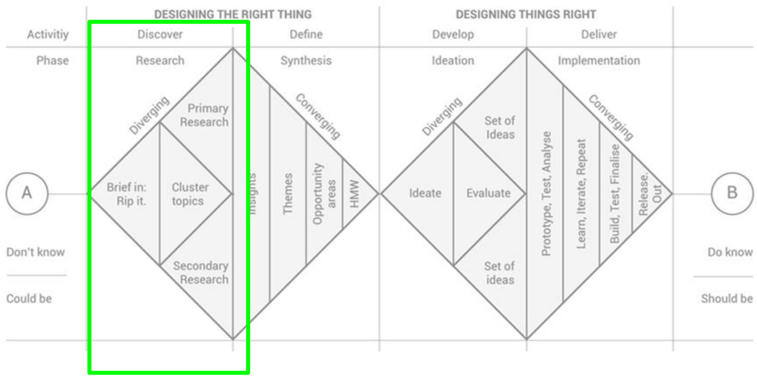


Initially focused heavily on “Develop” phase

Unknowingly, we focused heavily on the “Develop” phase of the double-diamond model, brainstorming ideas for a non-existential problem.

The prototype ideas we generated lacked inspiration and insight relative to the phase we were working on.

Phase 2



We took a step back, only to realize that many of our ideas could be part of the **assistive technology** design domain.

After our realization, we took a step back, only to realize that many of our ideas could be part of the assistive technology design domain.

Assistive Technology

Assistive Technology

- Any piece of technology that helps an individual with/without a disability increase their level of functioning.

- Significant progress has been made in terms of help disabled individuals gain independence.

- However, since it is such a niche market, **not every assistive device exists for every task**.
  - Too expensive to make/maintain.
  - Funding may or may not exist to cover these costs.

https://www.teachspeced.ca/assistive-technology for definition

Unfortunately, cost and maintainability are the two main issues that hinder the development of new assistive technologies. It costs companies too much to perform market research and produce prototypes when the product is going to be bought by so few people.

1.1

Problem Statement

> "
>
> The accessibility-first approach is hardly undertaken by companies when designing products. As a result, people with disabilities usually take a backburner to their goals. This makes for products that offer a subpar user experience for people with disabilities.

As shown in the textbook for 3461, most companies, when designing a product for the masses only add accessibility features to meet guidelines. They usually do not solely focus on a product from an accessibility standpoint. As a result, the product exhibits a subpar user experience for people with disabilities. Organizations should make the effort to fix such an approach so that everyone is included in the designing of a new product.

Companies these days focus mostly on normal people’s needs when designing for a product. As a result, people with disabilities get left out.

An **Example**

Opening a Locked Door

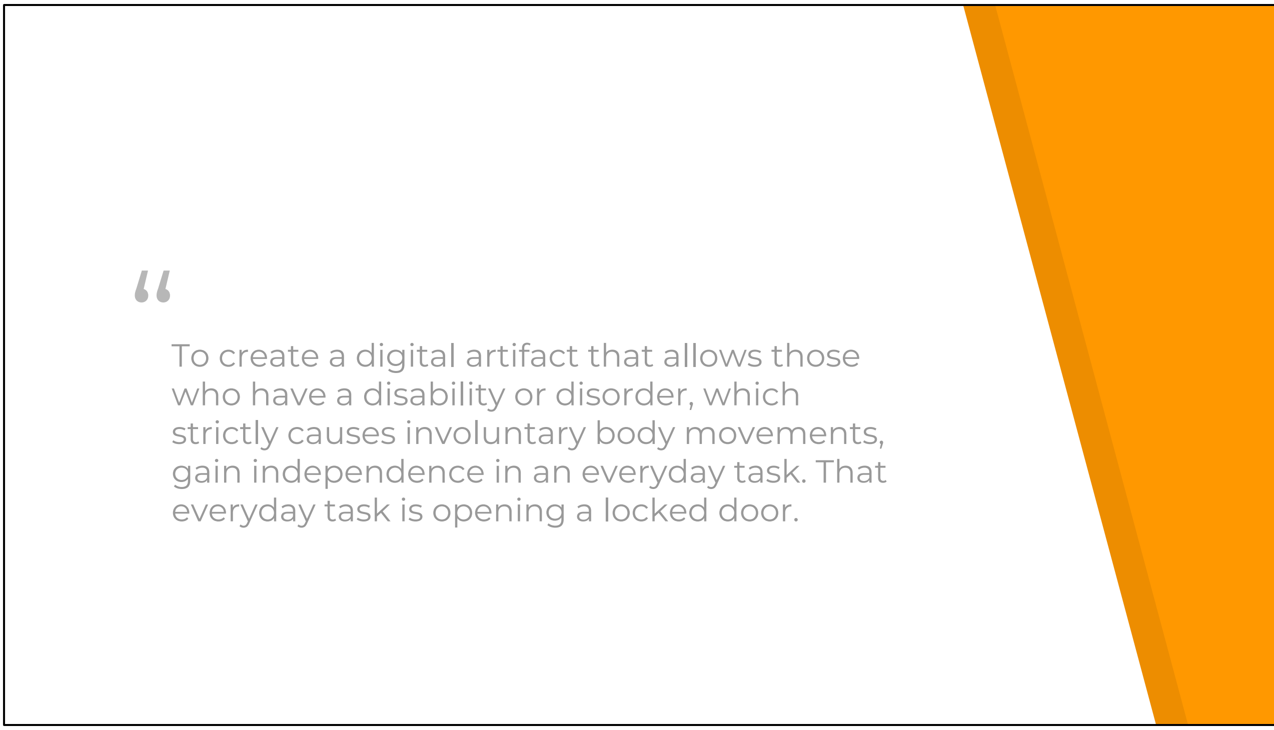
- Traditional method:
  - Sticking a key in a keyhole and twisting the key to unlock the door
- Alternative methods:
  - RFID lock
  - PIN number
- Alternative methods were meant to ease the process of unlocking doors
- Only considered how it would benefit regular users

An example of this would be with opening locked doors. The traditional method would be to stick a key in a keyhole and thereafter twist the key to unlock the door. Other methods include using an RFID card and even a PIN lock. These alternative methods were designed to ease the process of unlocking a door for normal users, yet did not consider the difficulties that users with involuntary hand movements endured.

https://www.teachspeced.ca/assistive-technology

1.2

Objective



Our objective is to create a digital artifact that allows those who have a disability or disorder, which strictly causes involuntary body movements, gain independence in an everyday task. That everyday task is opening a locked door.ple's needs when designing for a product. As a result, people with disabilities get left out.

1.3

Success Criteria

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As decided during Phase 2:

- Solution would be an intuitive, efficient and automated device that has a small learning curve.
- Operable under stressful conditions and be readily available.

This solution would be an intuitive, efficient and automated device that has a small learning curve.
This solution would also be able to operate under stressful conditions and be readily available.

Success Criteria

Evaluation Type: Controlled Setting

- Good at revealing usability problems
- Results can be generalized to the wider population

Success Criteria

Method: Usability Testing

- Involves investigating how users perform on typical tasks
- High level of control over what gets tested
- Semi-structured interviews will be used to elicit users' opinions

Success Criteria

Quantitative Performance Measures

- Time to complete a task. (Efficiency)
- Number and type of SYSTEM errors. (Effectiveness)
- Number of users completing a task successfully. (Utility)

Our focus is mostly going to be on the performance measures mentioned above. Our system is relatively easy to use due to the screen prompts that are shown, so it safe to assume that people will be able to follow instructions and not run into errors. The only errors that the system will run into is from factors outside of their scope. They do not interact with the system on a physical level, hence it is safe to assume the statement mentioned above.

2.

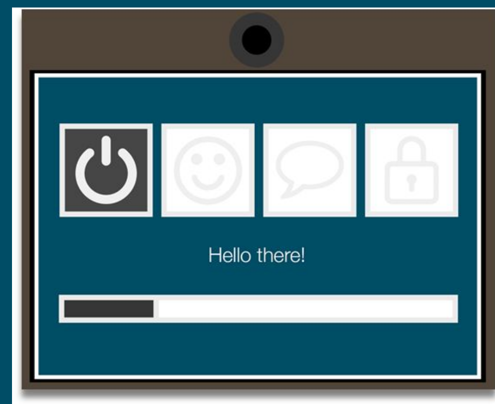
Proposed Solution

The Preface

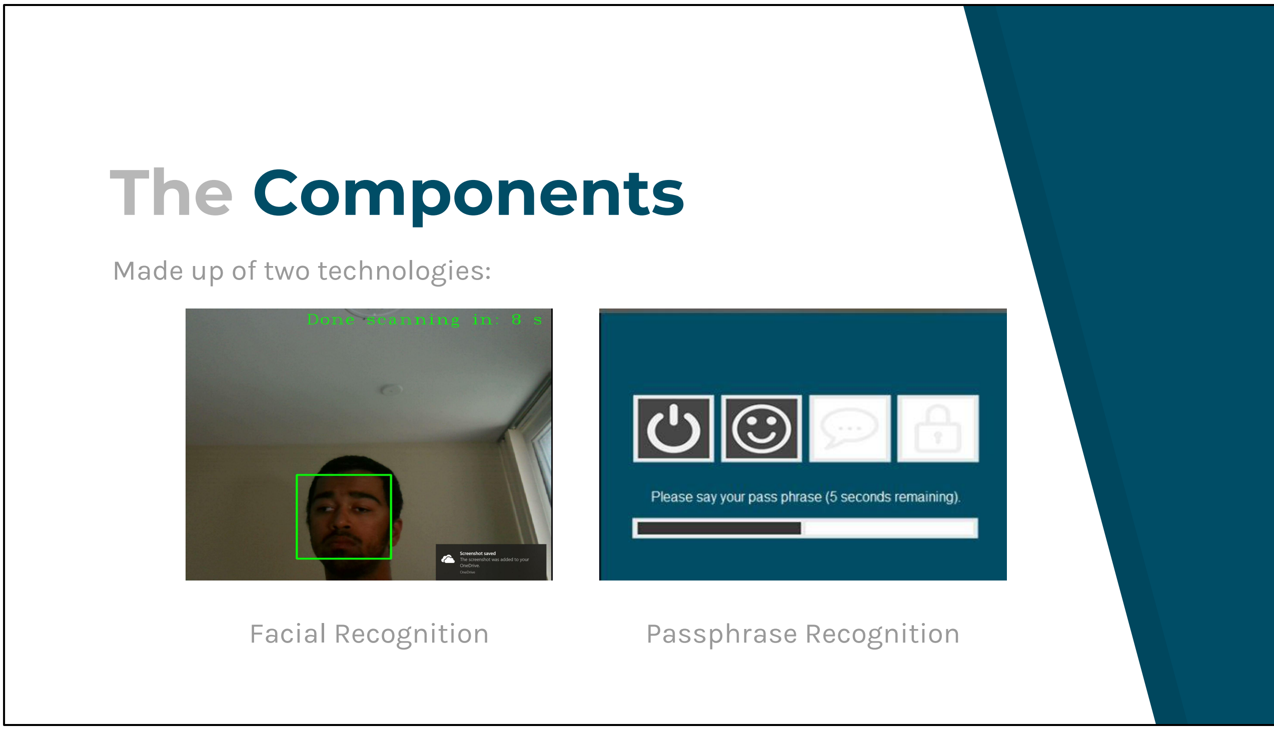
The solution should:

- Reduce cognitive and physical work for some task
- Prioritize the needs of users with involuntary hand movements

TWO-STEP VERIFICATION SYSTEM



GUI



Facial Recognition

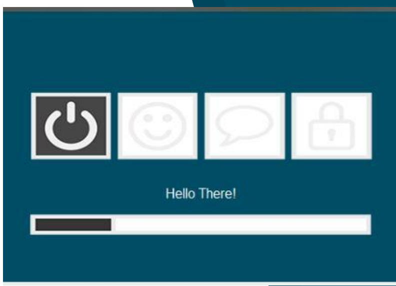
-implemented using the OpenCV Computer Vision library and Python 3+.
-project divided into three steps: dataset creation, training, and face detection.

- the dataset creation phase: the user puts their face in front of the camera so that pictures can be taken for the purposes of building a dataset from which the program can train on
- pictures are processed by the algorithm and an training file is created
- The training file is utilized in the last step: detection. This is the main step used to recognize and verify faces based on the training data in the previous step.
    - If the program is able to recognize the face from the training file, it accesses the person’s name from a database and displays it as a way to indicate that a match was found.
    - the user is now authorized to proceed to the next phase. If the user’s face does not exist in the training file, the word ‘Unknown’ is displayed.
    - The user has to put their face in front of the camera for eight seconds before the algorithm makes a decision whether or not the person is a

    - verified user.

Passphrase Recognition

- Implemented using a custom-made sound recorder class and Microsoft's Bing Speech API
- Name of the verified face is passed to this module and the module retrieves the correct passphrase from the system storage
- Custom sound recorder class is then used to record the passphrase of the active user
- .wav file is created and is sent to the Microsoft Azure server using the Bing Speech API
- Server then returns the text that was parsed from the .wav file. Both texts are compared, and if they match then the user may proceed with the system



State of the GUI as someone approaches a door.

OUR **PROCESS** IS EASY

User approaches system

↓

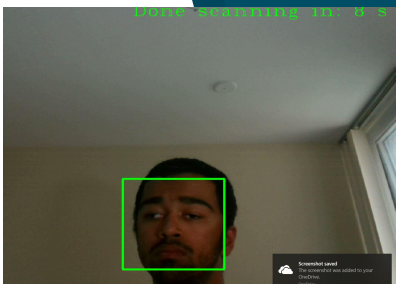
User's face is scanned in 8 seconds and then verified

↓

User's passphrase is captured for 5 seconds, then parsed, then verified

↓

Door is unlocked



The system scanning the face for a potential match

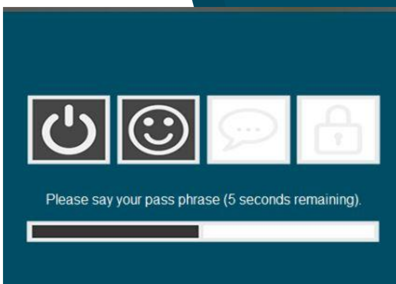
OUR **PROCESS** IS EASY

User approaches system

User’s face is scanned in 8 seconds and then verified

User’s passphrase is captured for 5 seconds, then parsed, then verified

Door is unlocked



Prompts user to say their pass-phrase

OUR **PROCESS** IS EASY

User approaches system

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User's face is scanned in 8 seconds and then verified

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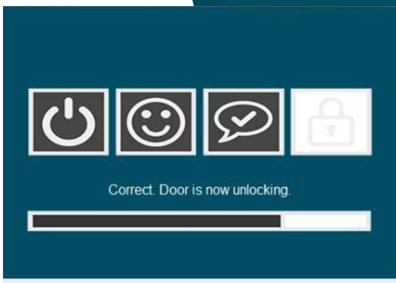
User's passphrase is captured in 5 seconds, then parsed, then verified

↓

Door is unlocked



State of the system once everything is verified

OUR **PROCESS** IS EASY

User approaches system

↓

User's face is scanned in 8 seconds and then verified

↓

User's passphrase is captured for 5 seconds, then parsed, then verified

↓

Door is unlocked

The Benefits

- No need of hand-eye coordination
- No need to:
  - Remember to carry around a physical key
  - Search through your bag for a key
- No physical interaction with the system
  - User just has to approach the system
  - System takes care of the rest

Video
Demonstration

https://youtu.be/s7ngS4GIqaI

4.

Empirical Question

"

For people with involuntary hand movements, is the two-step verification system a quicker way of unlocking a door when compared to the traditional method of using a key?

4.1
Answer and Analysis

The data used to answer the empirical question was collected through a semi-structured interview. A list of predetermined questions were asked and the interviewee had a chance to expand on the answers (see appendix for a list of questions that were asked). Given the fact that the system was classified as an assistive device, we had a hard time finding participants that suited our test population. In the end, we were only able to find one person that was able to fit our participant criteria. For testing purposes, we had the participant undergo three pairs of usability tests (a pair is defined as unlocking a door with a key and our device). The same door was used for the duration of the usability test and times were recorded for a successful unlock.

Analysis

- Things to notice
  - Average unlocking time using key: 82.67 seconds. Median: 86 seconds.
    - Variance because of the participants lack of control in hand movements (nature of disability came into play).
  - Average unlocking time using our system: 40 seconds. Median: 42 seconds.
    - Consistent data because everything went ideally.
    - Required half the time to open a door when compared with using a key.

Iteration	Time to unlock using a key (seconds)	Time to unlock using the proposed system (seconds)
1	72	40
2	86	42
3	90	38

As one can clearly see, the participant's disability significantly hindered his ability to unlock the door using a key. Furthermore, this explains the significant variance in time for each iteration. The average unlocking time using a key was 82.67 seconds with a median of 86 seconds. On the other hand, the time to unlock the door using our device was significantly lower than with a key and nearly consistent between iterations. This is due to the fact that each iteration ran under optimal conditions (i.e. the facial recognition module recognized the participants face and the voice recognition module was able to parse the participants voice correctly). In light of all this, the average unlock time for our device was 40 seconds with a median of 42 seconds.

***Our system was tested on a Surface Pro 3 tablet, which is a very fast machine. Testing times will vary from machine-to-machine. A slowdown is to be expected on a less-powerful PC such as a Raspberry PI.**

Participant's Reaction

Likes :)

- Waiting time was faster than expected for facial recognition
- Icons for GUI were effective in explaining what to do
- Found the system to be an effective solution
- "I don't have to worry about bringing a key with me anymore."

Dislikes :(

- Waiting time was unpredictable for passphrase recognition

-Mostly positive verdict
-benefits people as promised on slide 19

Answer

- Yes, our system is faster, but
    - Only one person participated (small sample size)
    - Different disabilities affect people differently
        - Time to use a key can vary significantly
    - Everything went as expected when it came to facial and speech-to-text recognition.
        - Data doesn't account for failure
    - Testing times are system-dependent
        - Testing was done on a powerful computer.
        - Will vary on different types of machines

Final Answer:
Inconclusive given the reasons mentioned above.
However, data collected thus far does support the claim.

-On average, our system was approximately twice as fast when compared with the participant's data for using a key.
-Given the lack of participants in our study, it is still a bit inconclusive to say that our system is faster for people with involuntary hand movements. However, the results gathered in our usability study do support this claim.

THANKS!

Any questions?

CREDITS

Special thanks to all the people who made and released these awesome resources for free:

- Presentation template by SlidesCarnival
- Photographs by Death to the Stock Photo (license)