Reading Glove

Berkeley | EECS
Electrical Engineering and Computer Sciences
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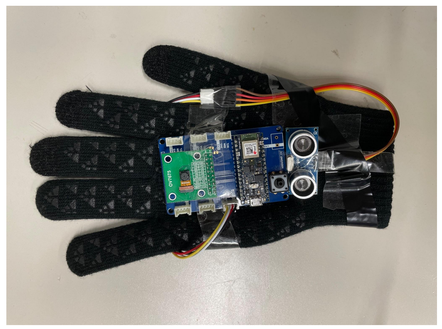
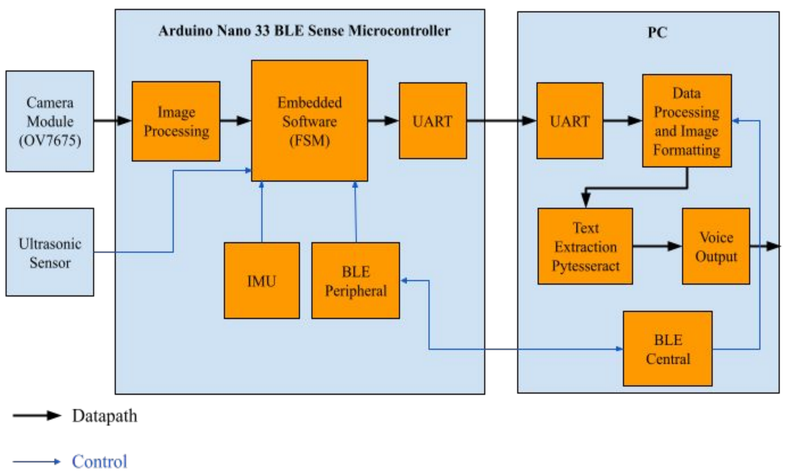
Goal

- Currently, **visually-impaired individuals** rely on alternatives like Braille to read text
- We want to offer an alternative for all visual text-based media, such that the individual can empower themselves, as opposed to relying on others
- Design a glove with an Arduino and a camera mounted to the palm such that they can be hovered over text to have the **text read out** to them via a speaker or headphones



The reading glove product. The user can wear it, facing the palm downwards to read the text.

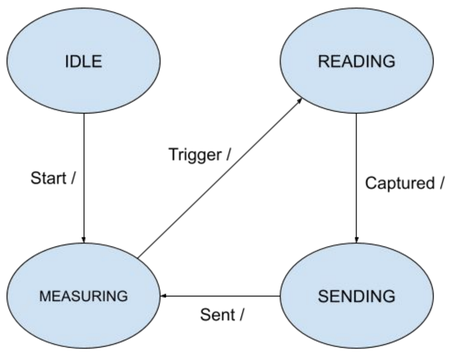
Design



System block diagram

Implementation - Hardware

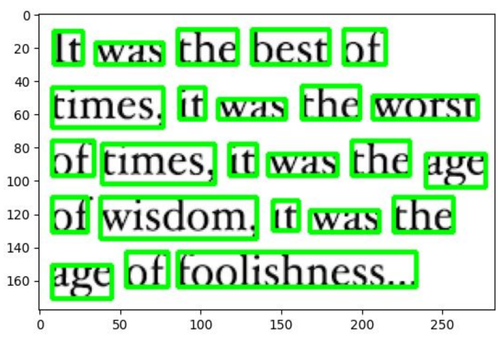
- **Arduino Nano 33 BLE Sense**
  - **IMU** — detect the movement and orientation
  - **BLE** — configure camera setting (control and status)
  - **UART** — image transmission (baud rate: 115200 bps)
- **Camera OV7675** — image capturing
- **Ultrasonic sensor** — distance measurement



Finite state machine that is running on the Arduino to control the reading glove logic.

Implementation - Software

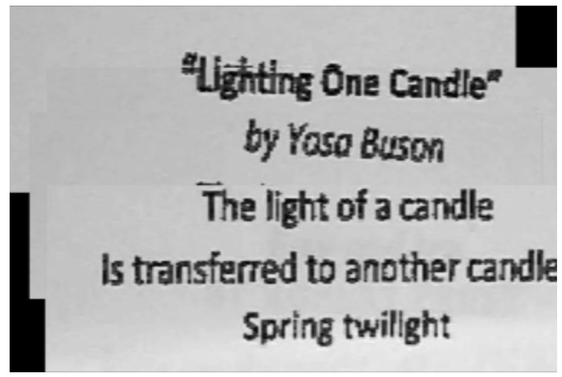
- **Image Preprocessing** — receive raw data from the UART and format the images
- **Image Stitching** — stitch multiple images if there is overlapping
- **Text Extraction** — extract text from the images
- **Voice Output** — convert the text to speech



Text extraction bounding boxes.

Result

The reading glove takes 4 images, sends over UART to the PC. The software stitches the image and reads out the poem.



Challenges

- The OV7675 camera is very sensitive to lighting and movement
  - Solution: use IMU to decide a good time for image capturing and BLE to configure the camera settings
- Unable to send large image data over BLE (packet drop and hang) as originally planned
  - Solution: use UART to send image data

Key Course Concepts

- Finite State Machine
- Sensors
- BLE

Implication

- Reading Gloves empower individuals so that they don't need to rely on infrastructure like Braille, which often isn't even available unless completely necessary
- Definite areas of improvement, but huge potential to help visually-impaired individuals