AR EEG

Bachelor Thesis Mid-Term Presentation

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About Me

- Yannik Bocksch
- B.Sc. Software Engineering

Motivation

- Preparation of gel EEG caps is tedious
- Repeatedly
  - Looking at monitor
  - Locating electrodes on the cap

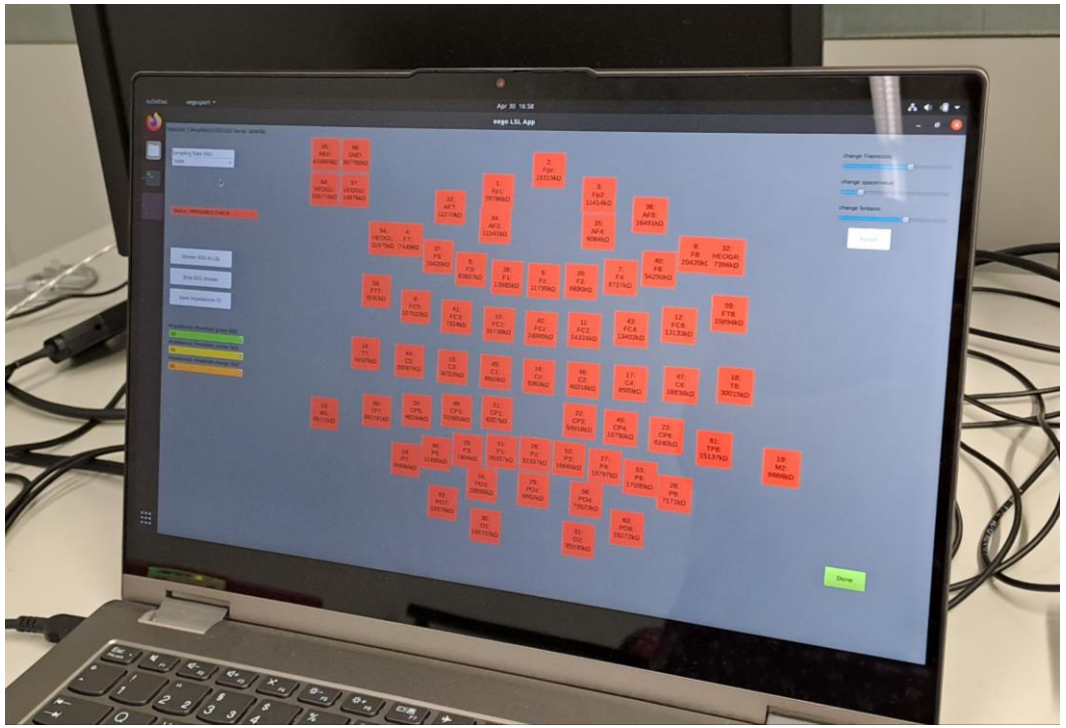

Image by Maanik Marathe

My Goal

- Create an AR Application using HoloLens 2
  - Displays impedances in AR on the real cap
- Improve preparation time
  - No need to look at the monitor
  - No need to search for the electrodes

Related Work

- Help aligning the cap on the head in the first place
- Markers used to track EEG cap and head
- External camera tracks markers

Song C. et al., 2018

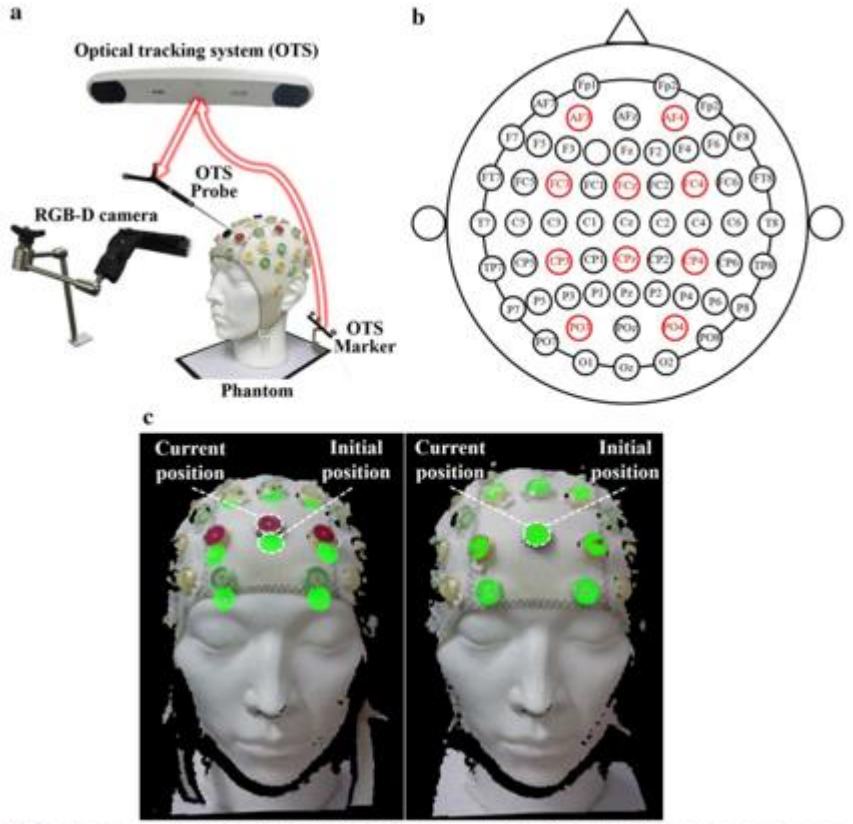

Fig. 3 **a** Experimental setup for the electrode positioning evaluation. **b** Labelled red target electrodes on an EEG cap. **c** Electrode guidance display (left) during and (right) after the positioning

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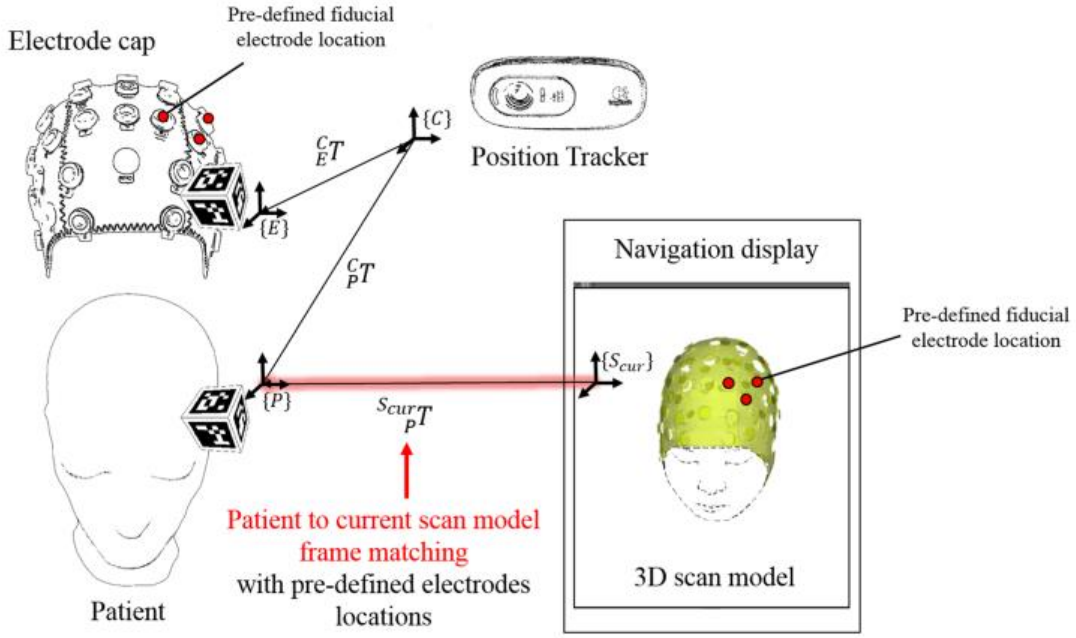

Fig. 3 Patient-to-current scan model frame matching. Image coordinates of pre-defined fiducial electrode locations are acquired from the scan image and corresponding patient coordinates are obtained using a stylus tracked by the webcam localizer. Paired point registration is performed using the fiducial coordinate pair to determine a transformation from the coordinate system of the tracking information into that of the scan image

Jeon S. et al., 2018

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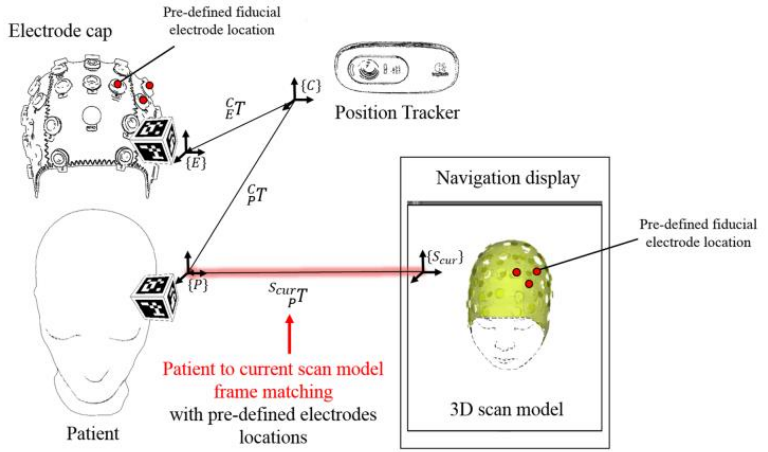
- I also need detection of electrodes
- I need marker-less tracking of electrodes



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Current State

- QR Code attached to back side of EEG cap
- QR Code tracking by the HoloLens
  - Application knows relative position of cap
  - Rough: QR Code visibility, different head shapes

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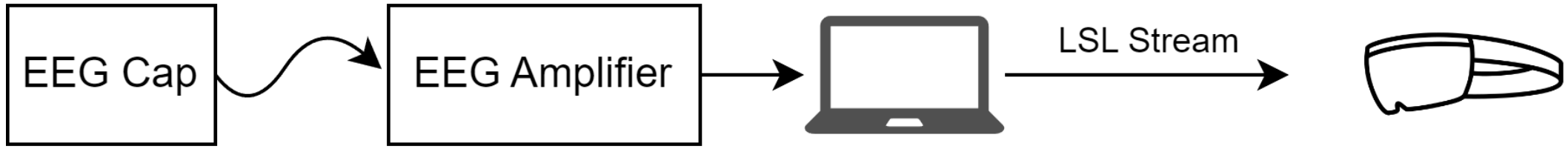
- QR Code attached to back side of EEG cap
- QR Code tracking by the HoloLens
  - Application knows relative position of cap
  - Rough: QR Code visibility, different head shapes
- Manual fine-adjustment by the user using sliders
  - Can be adjusted to the head shape
  - Still not perfect

Current State

- Receiving impedance Lab Streaming Layer stream
  - Amplifier laptop sends stream to HoloLens
- Displaying impedance values as colored circles

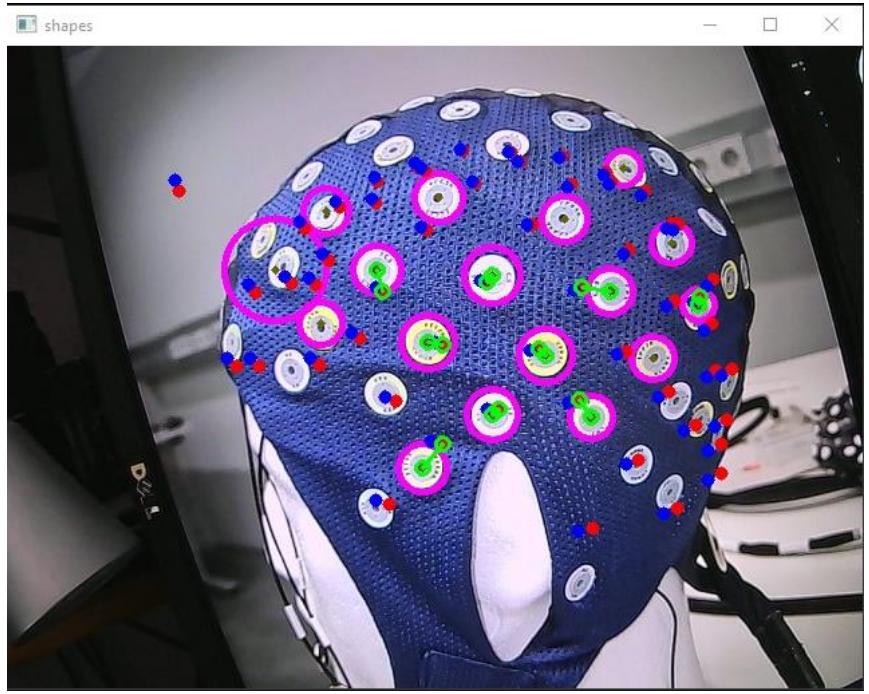


Live Demo

Next Steps

Electrode Alignment

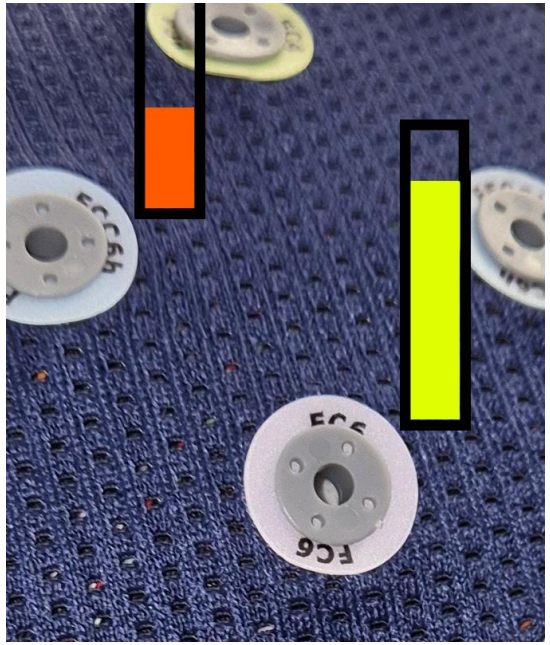
- Manual electrode alignment is laborious
- Needs to be automatic / more user friendly
- Possibilities:
  - Selecting some electrodes by hand
  - Computer Vision



Next Steps

Visualizations

- Test different types of visualizations
- Need to be informative
- Not distracting or obstructive



Next Steps

User Study

- Test the usability of this project
- Record preparation time of EEG cap
  - Users with different experience
  - With and without the HoloLens

Questions

Do you have any questions?

References

[1] Song, Chanho, et al. "Augmented reality-based electrode guidance system for reliable electroencephalography." BioMedical Engineering OnLine 17 (2018): 1-10. Available: https://doi.org/ 10.1186/s12938-018-0500-x

[2] Jeon, Sangseo, et al. "A preliminary study on precision image guidance for electrode placement in an EEG study." Brain Topography 31 (2018): 174-185. Available: https://doi.org/10.1007/s10548-017-0610-y

[3] “Lab Streaming Layer” https://labstreaminglayer.org/#/

[4] “Microsoft Hololens” https://www.microsoft.com/de-de/hololens