

Cognix: Cognition Consciousness

A seamless monitoring and early advisory system for Alzheimer's

STUDENTS: Aakash Neve, Bole Yi, Eugene Ngo, Linh Truong, Lucas Wang, Nathanael Hartanto, Sabrina Hwang

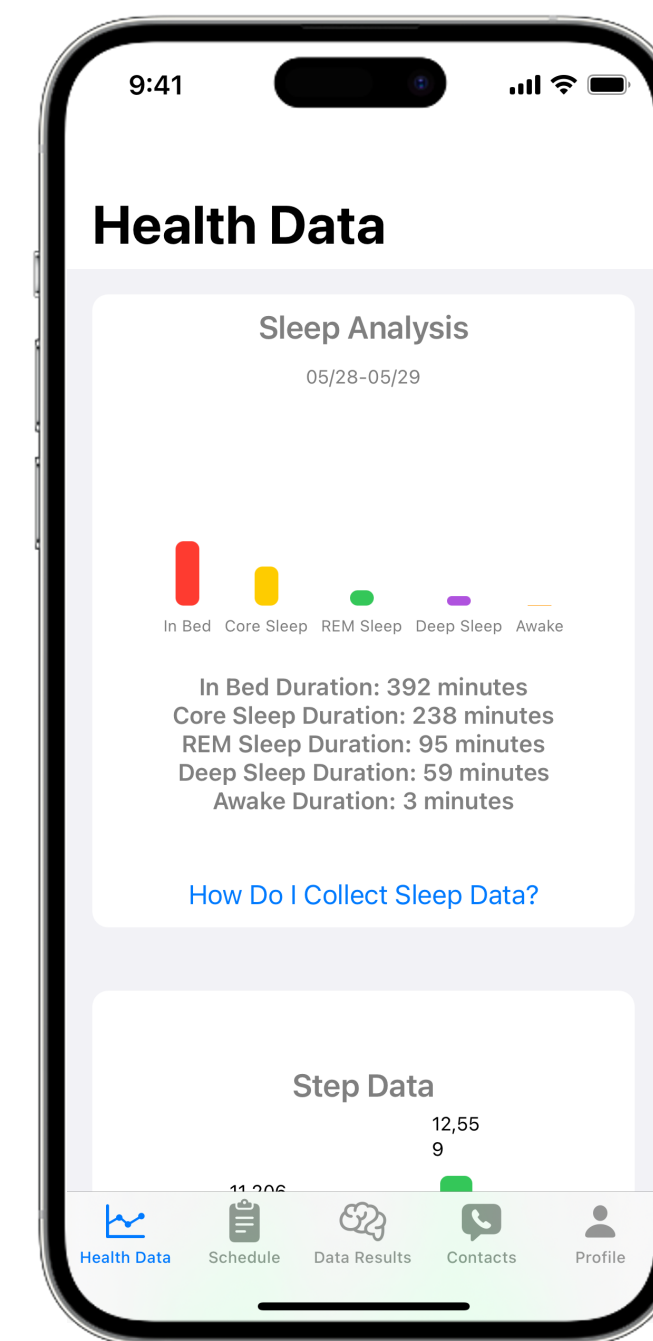


Alzheimer's - A Beautiful Mind

- Alzheimer's is a neurodegenerative condition affecting over 55 million individuals worldwide. Despite research advancements, imaging technologies used in early detection, such as CT, MRI, and PET scans, remain inaccessible to the general public.
- Therefore, we developed Cognix: a cutting-edge digital tool leveraging smartphones and smartwatches to identify early signs of Alzheimer's and give personalized recommendations based on biomarkers such as gait, sleep, and steps [1].

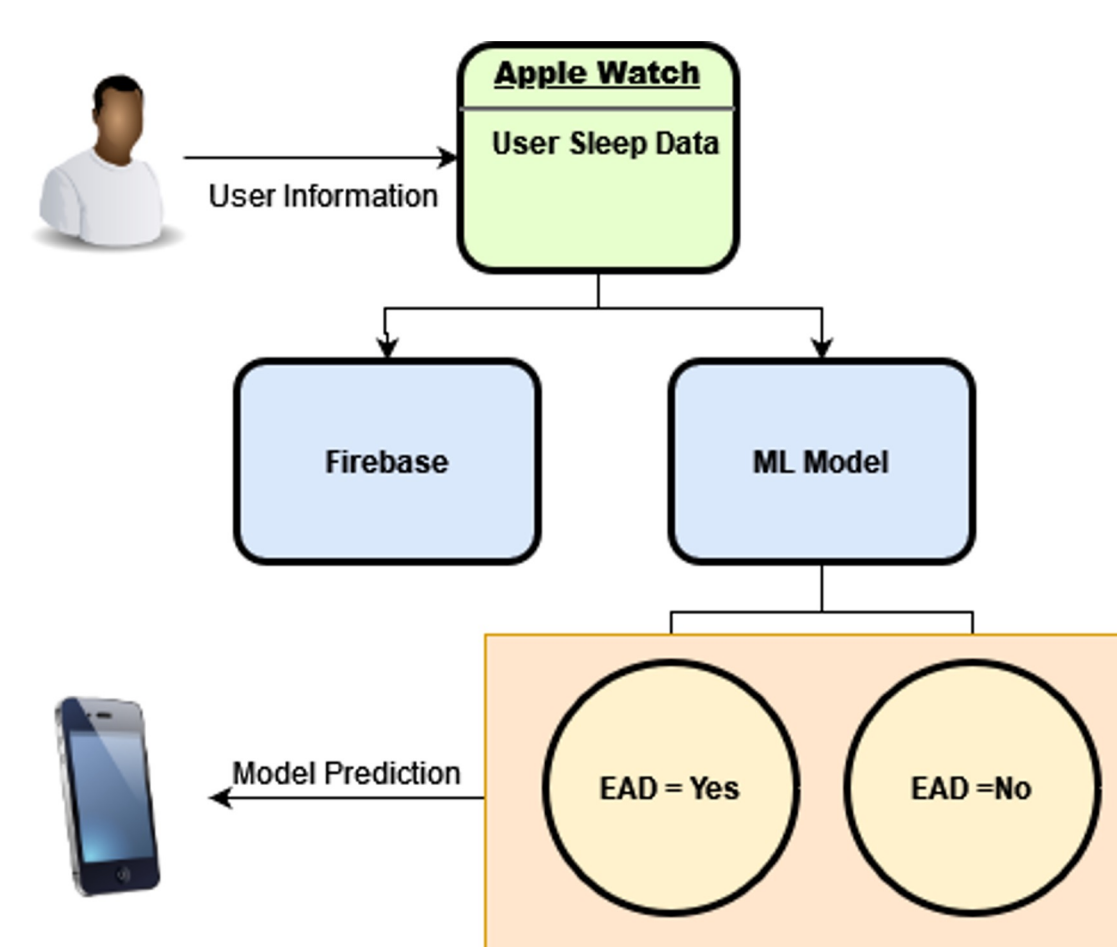
Apple Watch & HealthKit Integration

- To show the vitals and data we are implementing in our machine learning model, we are querying from the Apple Watch through HealthKit.
- The vitals we are querying are steps (count), step length (in inches), and sleeping states (such as REM sleep, core sleep, and light sleep in seconds).
- The sleep data in particular is then put up against the model that we have to see how much it trends with data from Alzheimer's patients.
- The data from the Apple Watch is queried from HealthKit and protected by HIPAA.
- The data is displayed in a bar graph to display the data in relation to other values.



Machine Learning Integration

- One of our main goals in the EAD project is to classify if a patient has Alzheimer's or not.
- To do that we have trained our classification model on the sleep data obtained from Dem@care.
- Sleep data of the patients are queried from Apple Watch and stored on Google Firebase and processed in the ML model.
- The ML model uses Random Forest Classification to classify the patients into having either AD or not AD based on the model.
- Our model is a baseline model and needs to be refined in future iterations of the product.

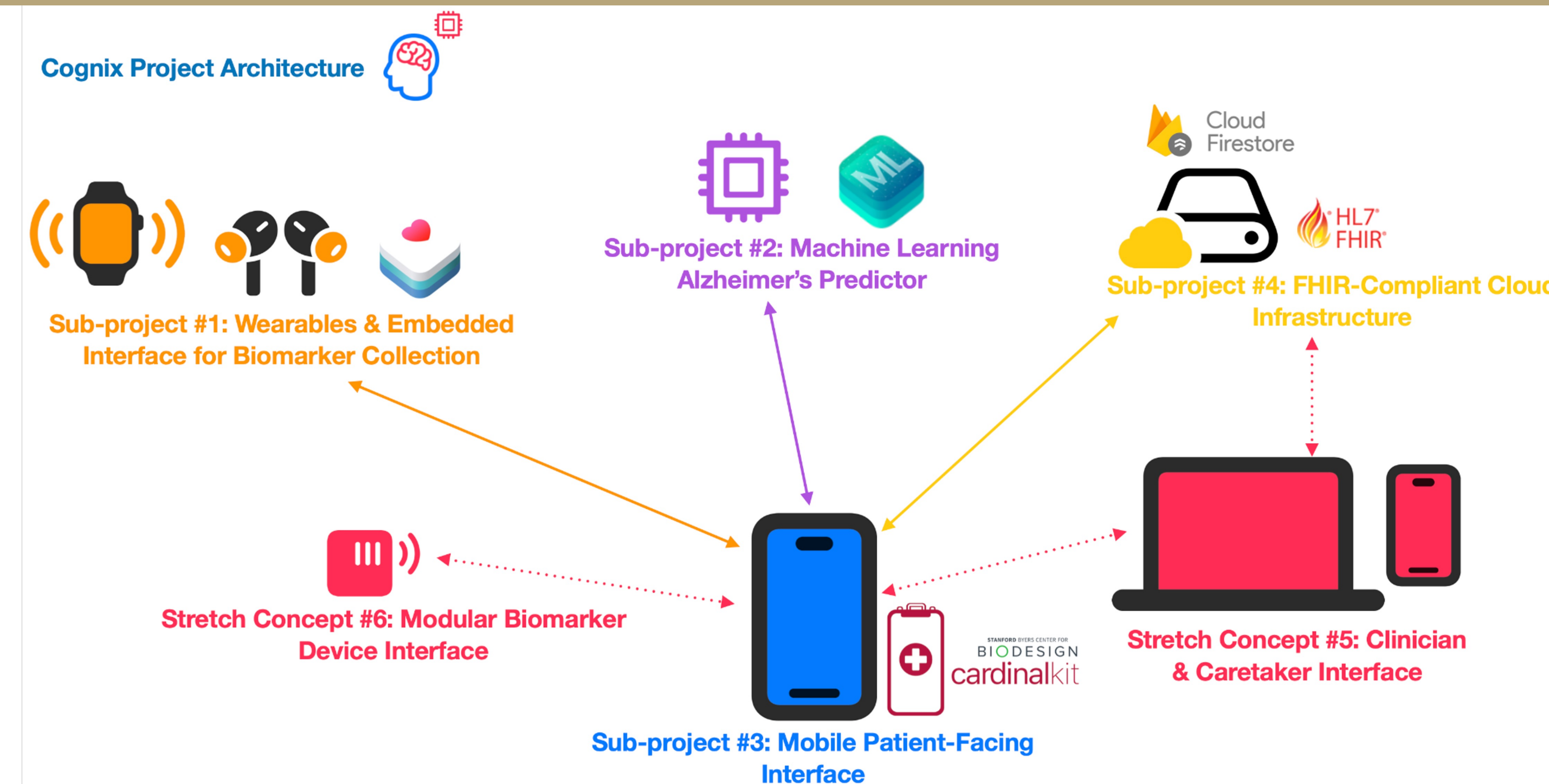


App Experience & Interface



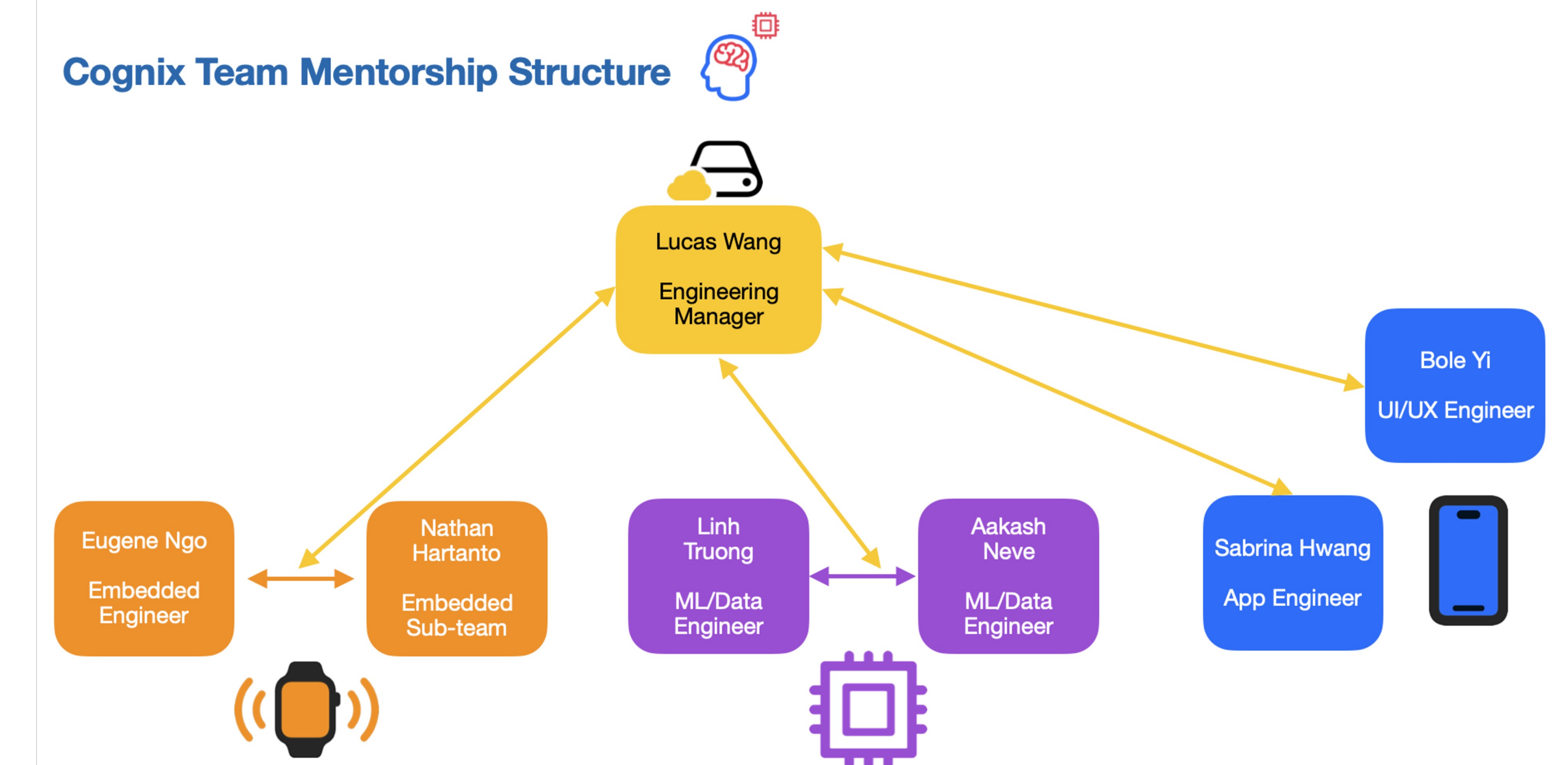
- The patient is greeted with an onboarding screen to create an account in the HIPAA-compliant backend of Cognix.
- The patient has one-touch access to all of their critical contacts within the app.
- Through an intuitive, pie-chart interface, the user could visualize and understand the correlation value between their biomarkers and how they related to Alzheimer's
- User account information and configuration can be done directly through the app.

Goals & Architecture



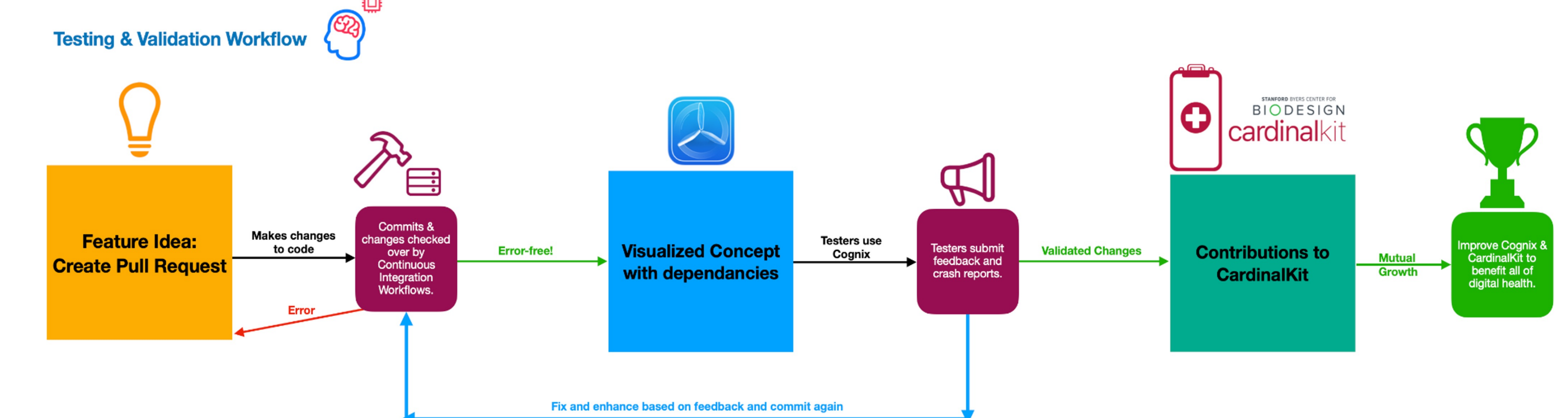
- Given the limitations of current research on the Alzheimer's biomarker correlation, we do not intend on building a perfect predictor of Alzheimer's [2].
- But rather a comprehensive, modular platform where the only gap between now and an excellent predictor is an external factor: the clarity of the training dataset.
- With support from the CardinalKit/Spezi Team at Stanford University, we developed Cognix with four Minimum-Viable-Product Goals and two stretch Goals. A comprehensive user experience that is fully compliant with the FL7 FHIR digital health record standards.

Mentorship, Empathy, and Leadership



- We developed our mentorship structure to curate a positive learning environment.
- Engineering Manager Lucas Wang handles administration, technical integration, and one-on-one peer mentoring, allowing each sub-team to grow as experts in their specific sub-project domain.
- We structured "ambition behind time" to account for life circumstances in our team to deliver a truly interpersonal, empathy-based leadership structure.

Validation & Future Concepts



- Github: a standardized engineering workflow to support the structured addition of new ideas and features (github.com/uwece-engine-novo-aed).
- Continuous integration validates all changes and fixes errors before merging.
- Test Flight: Built-in user testing and feedback platform to continuously optimize.

Summary, References, & Attributions

- Final proof-of-concept developed to demonstrate foundational feasibility
- Identified areas of further development as stretch goals.
- Continue contributions to CardinalKit/Spezi to power innovation in digital health!

[1] Lehrner, J., Lalonde, F., Somers, C., & Wagner, S. (2019). Feasibility of using a wearable biosensor device in patients at risk for Alzheimer's disease dementia. *Frontiers in Aging Neuroscience*, 11, 51.

[2] Jessen, F., Amariglio, R. E., van Boxtel, M., Breteler, M., Ceccaldi, M., Chételat, G., ... & Dubois, B. (2014). Clinical diagnosis of Alzheimer's disease: recommendations of the International Working Group. *The Lancet Neurology*, 13(6), 614-629.