EchoView.ai

Preliminary Design Review

Team 03:
Nicholas Hardy, Hassan Hijazi, Marybel Boujaoude, Riya Deokar, Jazmyn Walker

Problem Statement:

- About 2 to 4 of every 1,000 people in the United States are “functionally deaf”
  - more than half became deaf relatively late in life;
- 90-95% of deaf children are born to hearing parents who don’t often know sign language
  - There is no one size fits all sign language for people to learn
- Existing solutions lack a universal, practical, and affordable fit for the Deaf and hard of hearing community

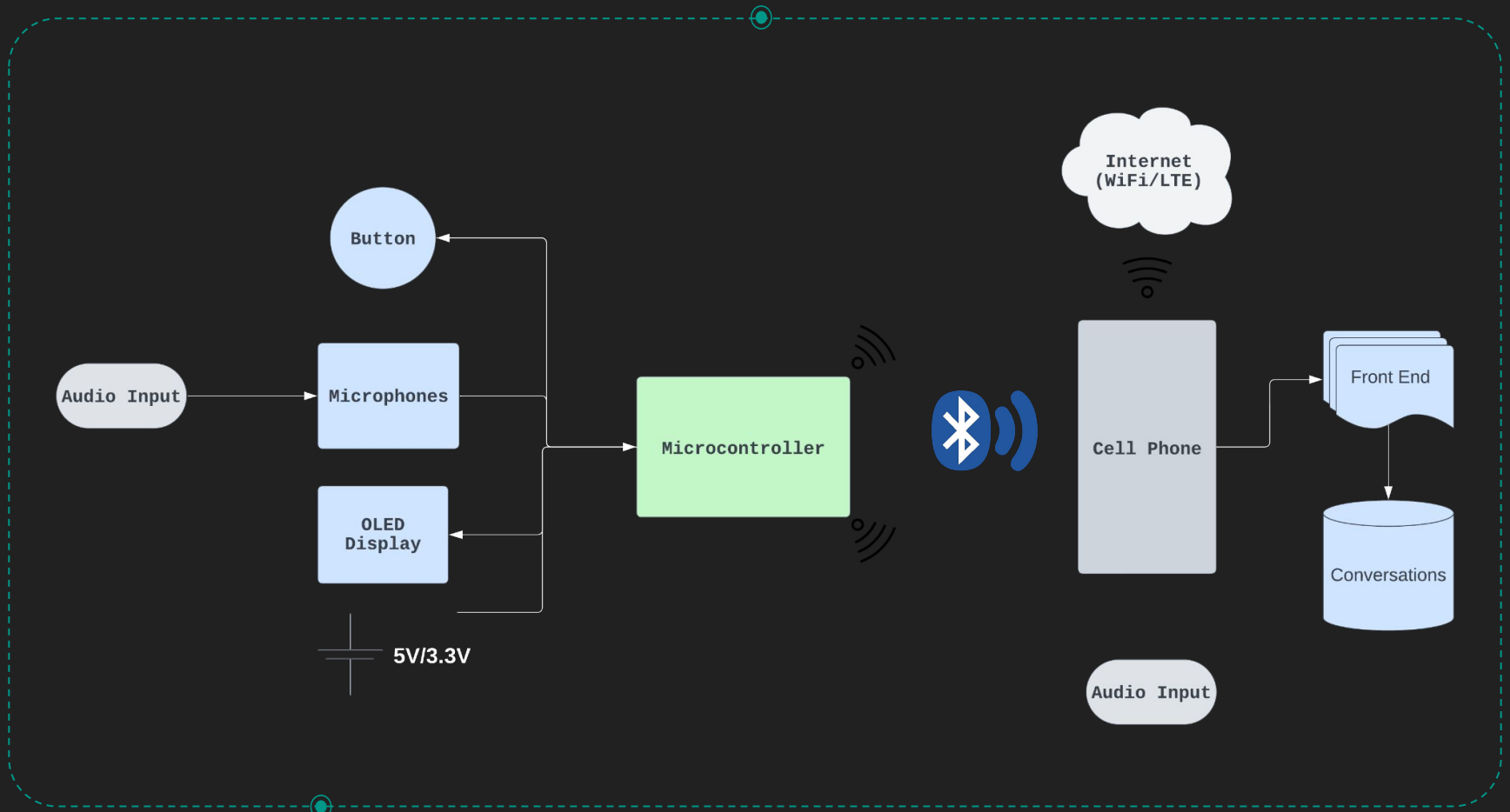
Solution:

Design a device capable of real-time speech-to-text transcription with a built-in display system that shows the user the text in the form of glasses.

Final Deliverables:

- Real-time speech-to-text transcription, integrating AI driven language processing
- Displaying transcribed text into user’s field of vision in a readable manner
- Transparent lens with magnification of display and anti-reflective coating
- Seamlessly pair with an iOS compatible mobile application through BLE
- Store transcription data on the app to allow users to reference previous conversations up to 48 hours
- Minimum of 2-3 hours battery life

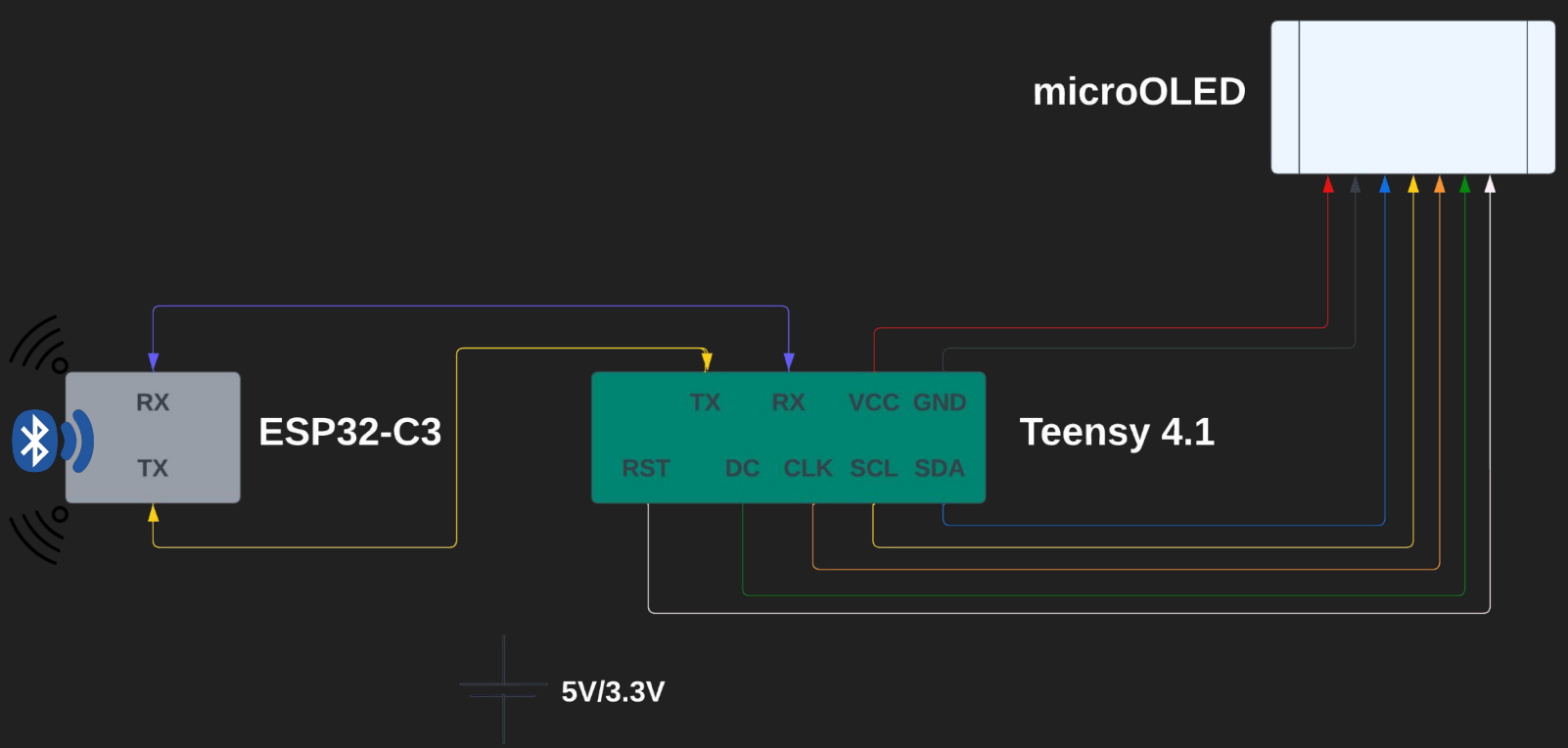
System Block Diagram:



Hardware:

- **Adafruit ESP32 C3 QTPY:**
  - WiFi, BLE, UART, GPIO
- **Teensy 4.1:**
  - ARM Cortex-M7, GPIO, UART, I2C, I2S
- **WaveShare 1.5in Transparent OLED**
  - Display text through I2C
- **Bifocal lens:**
  - scale the text on the display for readability
- **Dual MEMs microphones:**
  - Great directional capabilities and audio quality, in addition to being very small and lightweight.

Glasses Hardware:



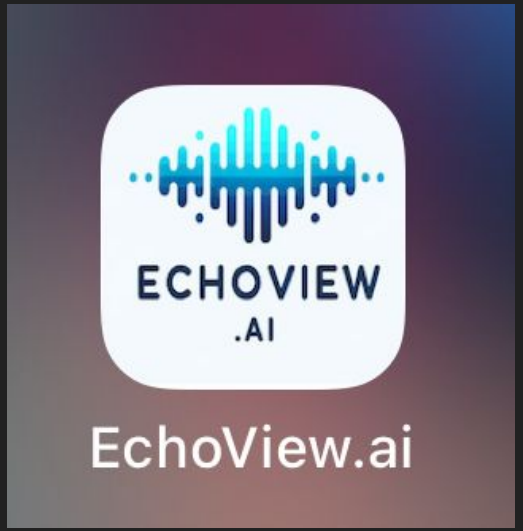
Glasses Firmware:

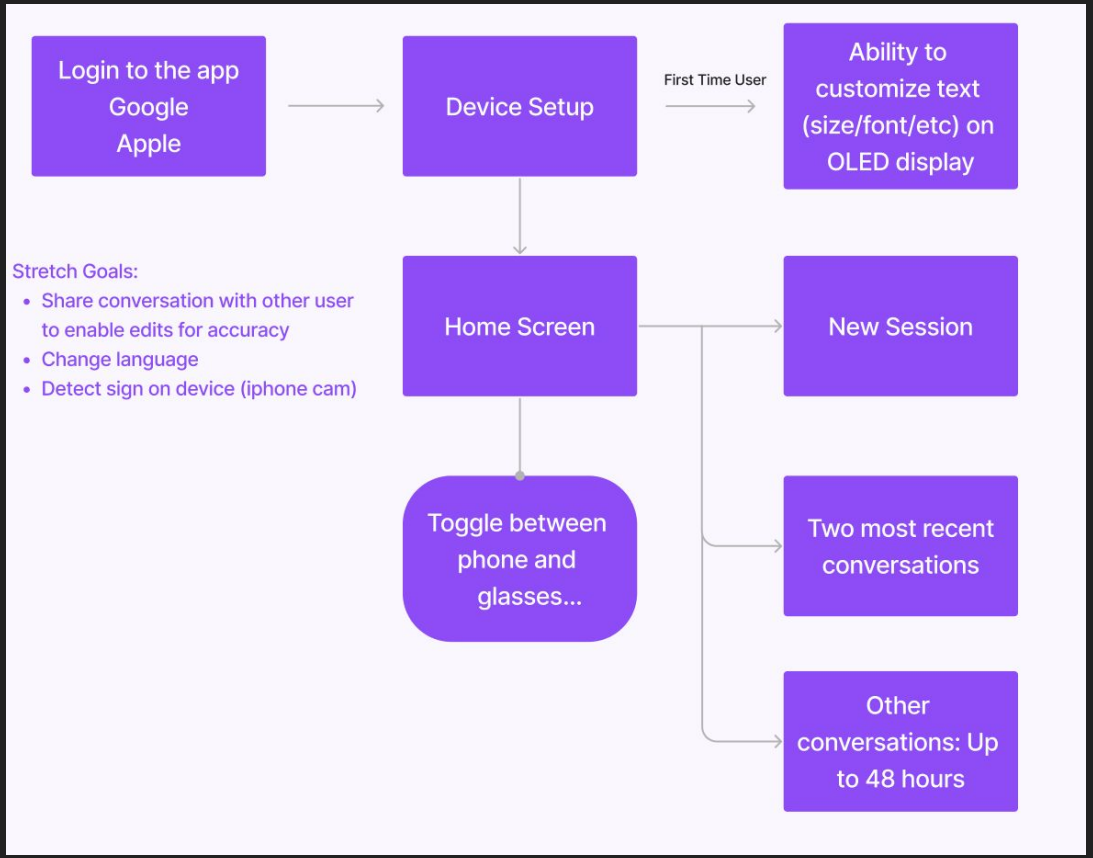
Open Source!

Software: Front End

- We will be using IOS frameworks in order to do live transcription, as it is very lightweight and powerful.
- Phone application will be coded completely in Swift, as this goes hand-in-hand with the IOS frameworks used.

User Flow


ECHOVIEW
.AI
EchoView.ai


Login to the app
Google
Apple
Device Setup
First Time User
Ability to customize text (size/font/etc) on OLED display
Stretch Goals:
Share conversation with other user to enable edits for accuracy
Change language
Detect sign on device (iphone cam)
Home Screen
New Session
Toggle between phone and glasses...
Two most recent conversations
Other conversations: Up to 48 hours

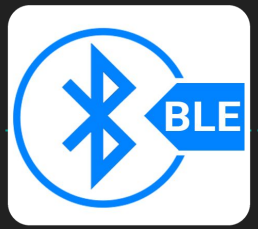
Software: Embedded Systems

- ESP32-C3 functionality will be implemented using C as this is the native language for the microcontroller.
- ESPRESSIF libraries will also be used in order to program our ESP32-C3 microcontroller, and the interacting microphones.

ESPRESSIF

Software Backend:

- For our back end we elected to use Cloud Firestore for its scalability to accommodate a growing user base, and its seamless integration with swift code. Additionally it has real time synchronization and powerful offline capabilities making it a perfect fit for storing transcription history.
- In order to connect the phone to the ESP32-C3 we will use B.L.E connections as it is made for low power devices designed to last for a long time.
- The server logic for the B.L.E connections will be done in C



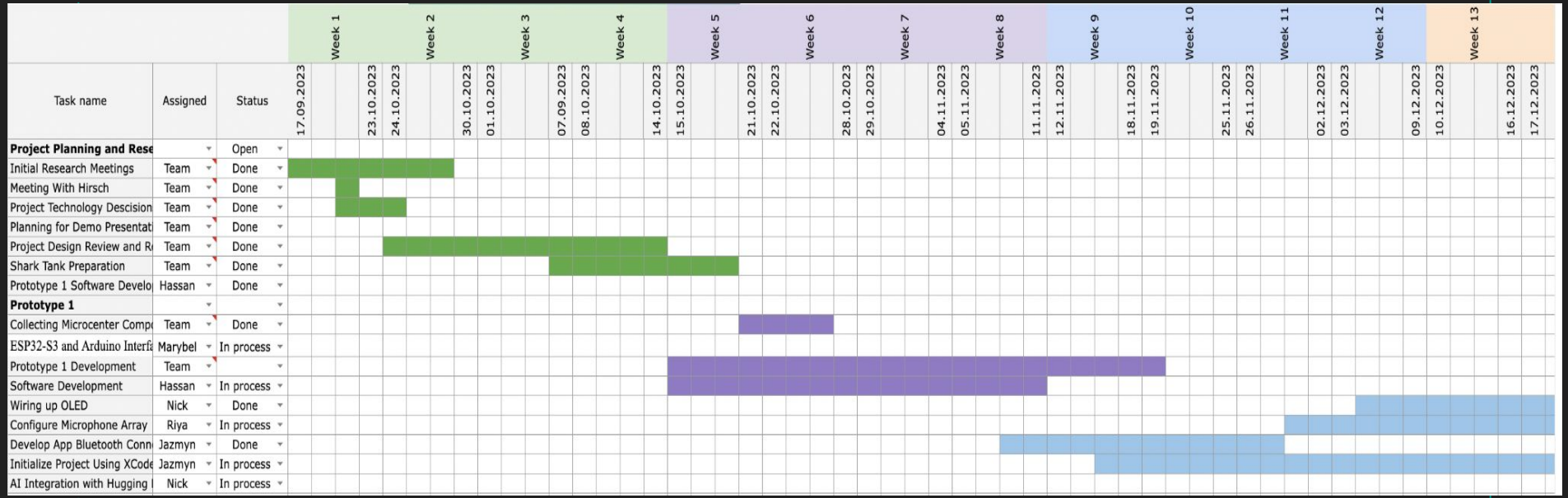
Testing:

- Tests for live transcription was done using a 100 word paragraph that contained numbers, homophones, uncommon words, and proper nouns.
- Results are based on the accuracy of the live transcription app, in outputting the correct transcription out of 100.
- We ran the same test in a silent room, and in a consistently loud environment of 70 decibels which is the average noise of a crowded room.

Testing:

Testing Round:	Quiet Room:	Noisy Room (~70 Decibels)
1	98%	96%
2	100%	98%
3	100%	95%
4	99%	93%
5	100%	95%
Average:	99.4%	95.4

Gantt Chart:



Task name	Assigned	Status
Project Planning and Rese		Open
Initial Research Meetings	Team	Done
Meeting With Hirsch	Team	Done
Project Technology Descision	Team	Done
Planning for Demo Presentati	Team	Done
Project Design Review and R	Team	Done
Shark Tank Preparation	Team	Done
Prototype 1 Software Develo	Hassan	Done
Prototype 1		
Collecting Microcenter Compo	Team	Done
ESP32-S3 and Arduino Interfa	Marybel	In process
Prototype 1 Development	Team	
Software Development	Hassan	In process
Wiring up OLED	Nick	Done
Configure Microphone Array	Riya	In process
Develop App Bluetooth Conn	Jazmyn	Done
Initialize Project Using XCode	Jazmyn	In process
AI Integration with Hugging	Nick	In process

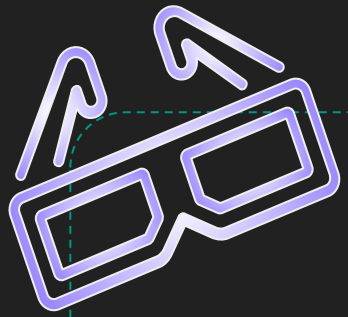
Week 1 | Week 2 | Week 3 | Week 4 | Week 5 | Week 6 | Week 7 | Week 8 | Week 9 | Week 10 | Week 11 | Week 12 | Week 13

17.09.2023 | 23.10.2023 | 24.10.2023 | 30.10.2023 | 01.10.2023 | 07.09.2023 | 08.10.2023 | 14.10.2023 | 15.10.2023 | 21.10.2023 | 22.10.2023 | 28.10.2023 | 29.10.2023 | 04.11.2023 | 05.11.2023 | 11.11.2023 | 12.11.2023 | 18.11.2023 | 19.11.2023 | 25.11.2023 | 26.11.2023 | 02.12.2023 | 03.12.2023 | 09.12.2023 | 10.12.2023 | 16.12.2023 | 17.12.2023

https://docs.google.com/spreadsheets/d/1p4gv2rEuFxZHB539TNdgT8H865Gg2BvP1Qfjbd2tv70/edit#gid=0

Future Progress

- Testing magnification lens for optimal readability.
- Continued development of AI-driven language processing for enhanced transcription and translation accuracy.
- Testing of directional microphones to ensure effective noise reduction in noisy environments.
- Minimum 2-3 hours of battery life.
- Touch on stretch goals such as ability to respond to transcribed conversations, gesture recognition for hands-free control and exploring multi-language translation.



Thank You

Comments/Questions?