EDL Project : OpenBCI

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TUES-06
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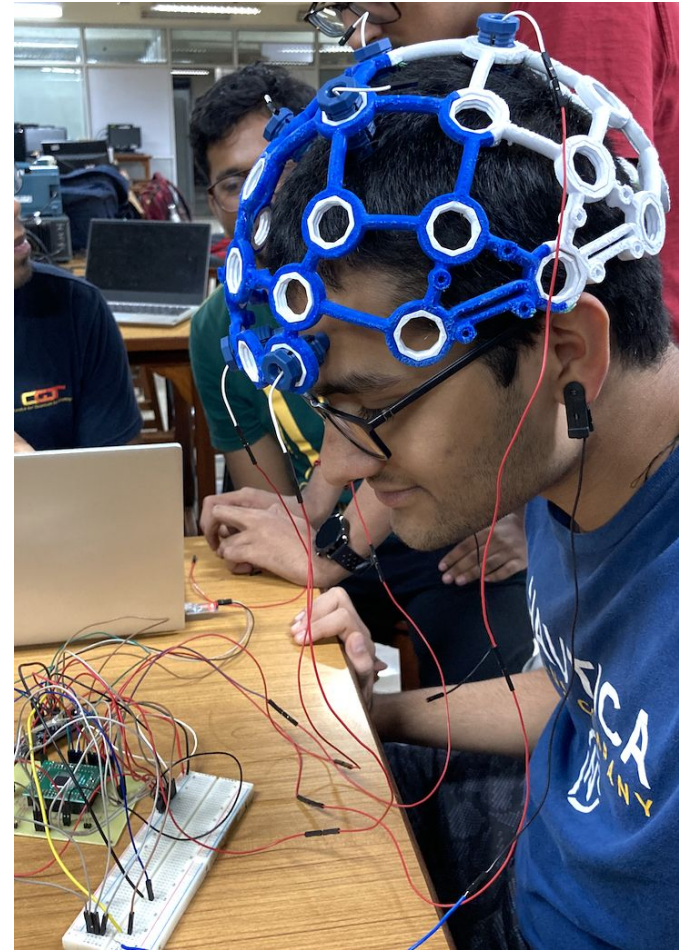Shivam Patel (200070077)

TUES-18
Ankith R (200070006)
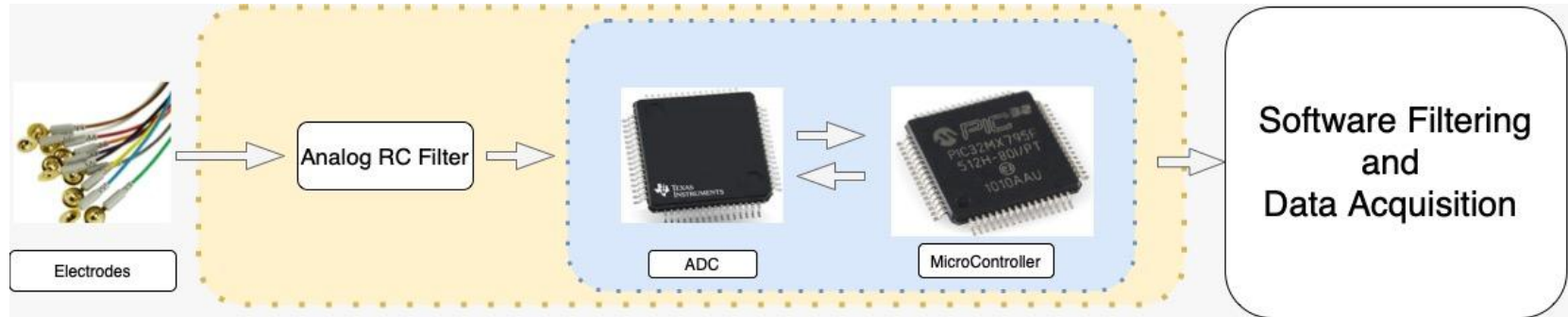Anubhav Bhatla (200070008)
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About our project : BCI

- Brain Computer Interfacing (BCI) module developed for tapping electrical signals of our brain
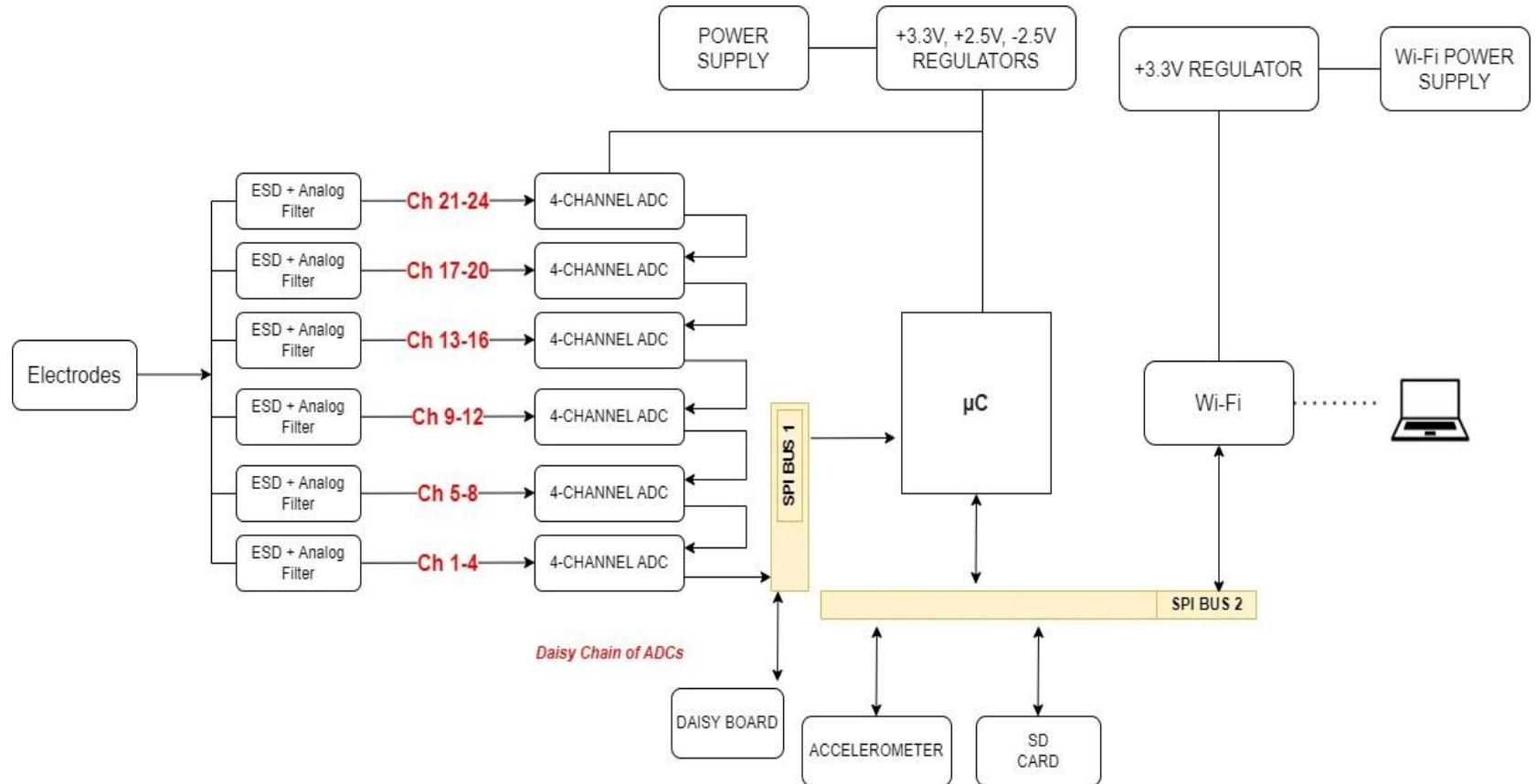- We would like to observe EEG signals under specific stimuli

Basic Approach

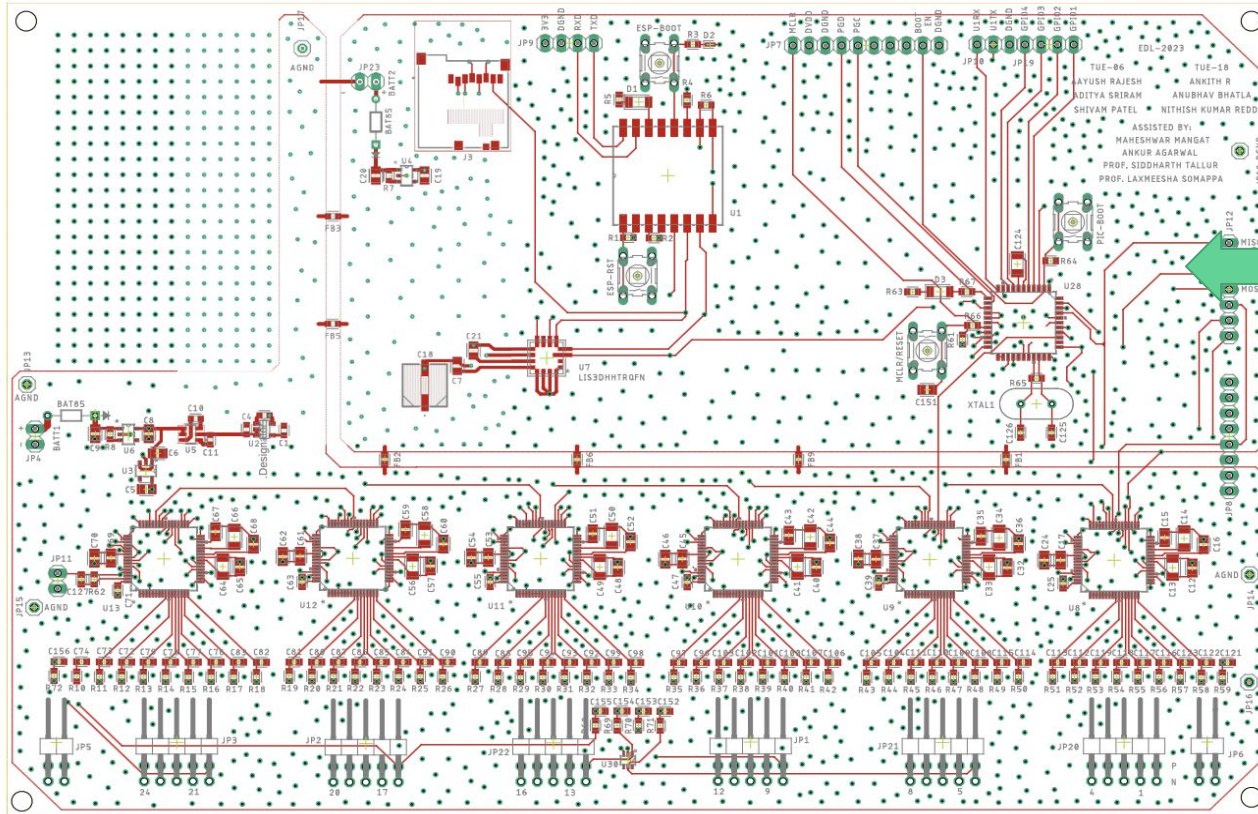- Three aspects - Terminal Headgear, Acquisition Hardware, Interfacing Software
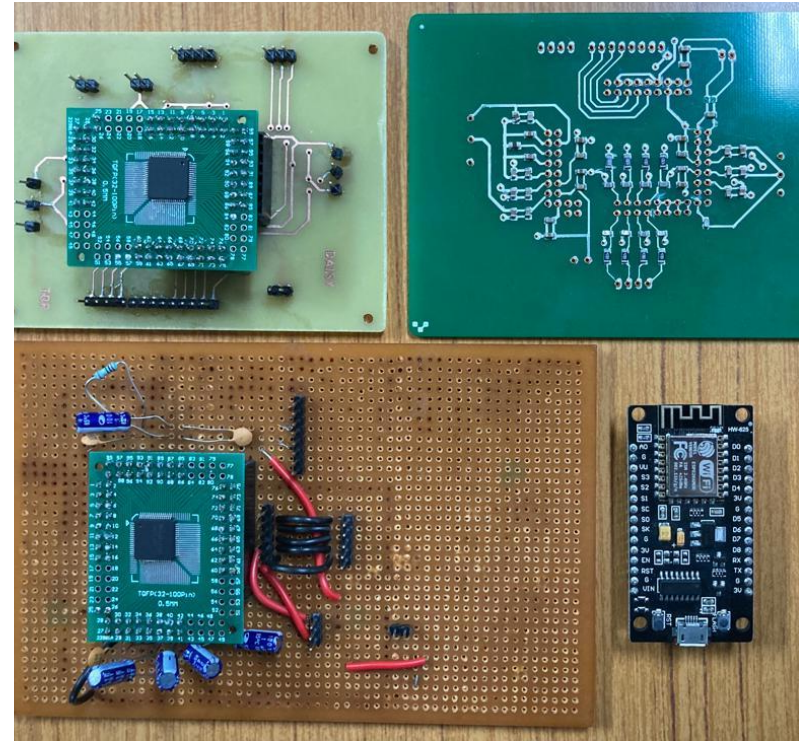
Design Overview: Main PCB

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4-layer PCB
19 cm x 13 cm

Design Overview: Demo PCB

- Modular Design for demo purposes
- Easy-to-replicate PCBs to house the ADC with all requisite circuitry, communication pins, and electrode connectors
- Interface this 4-channel model with 3D printed electrode headgear

Evolution of the demo PCB. From top left clockwise: the final modular PCB, a Voltera printed ADC test PCB, and a prototyping board for initial design tests

Difficulties Faced: Daisy Chain

- Daisy chain is a way of chaining multiple ADCs to act like a shift register - allows efficient communication of data across SPI
- We are able to get the chain running, but since it is highly sensitive to timing, data streams interfere with each other.
- Possible fixes: Tuning SPI timing. Minor differences in SPI clocks seen by each ADC can cause the shift register values to undergo interference.
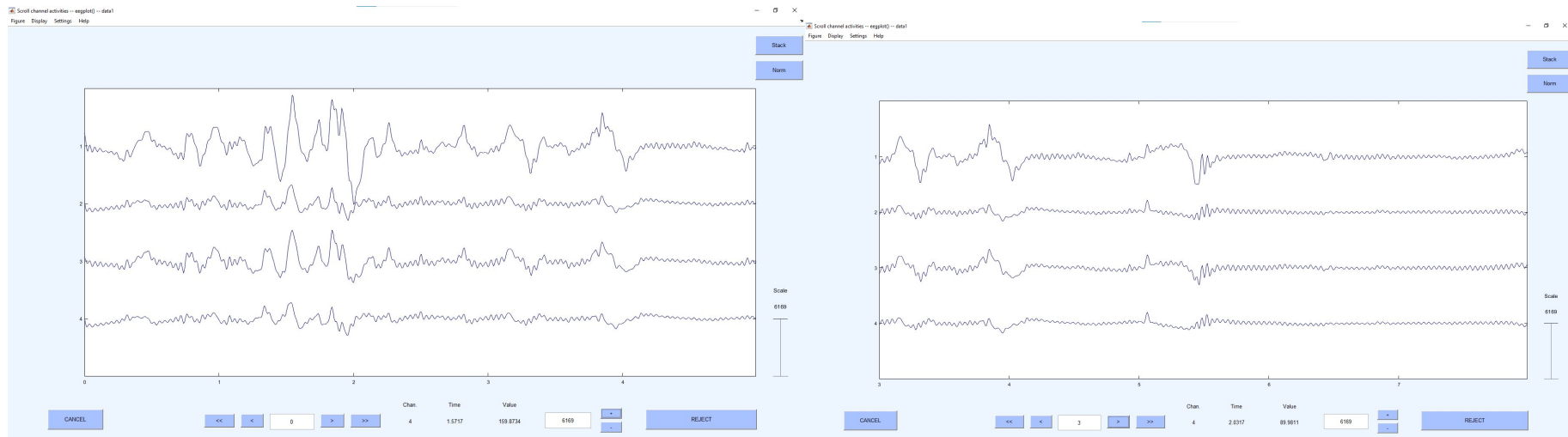
DEMO

Results

- Data from ADC digitally filtered between 1-30 Hz (typical range of EEG signals)
- Spikes visible across all channels whenever subject blinks eye
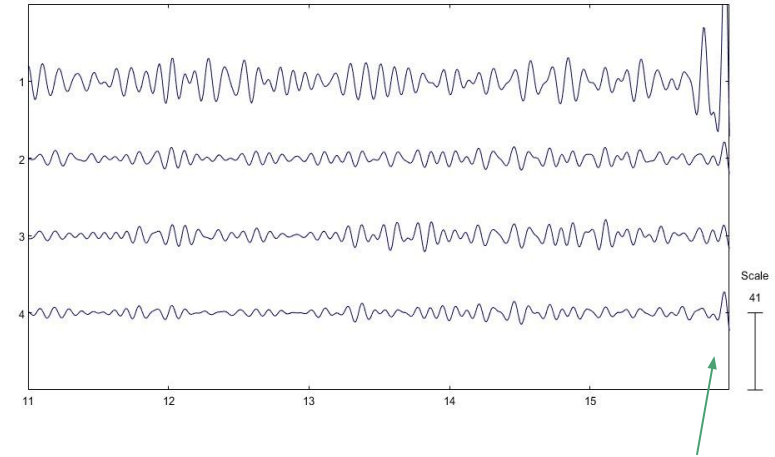- More evident on channels 1 and 3 (connected to forehead electrodes)

Results

- Data from ADC digitally filtered between 8-12 Hz for Alpha wave
- Subject blinks eyes, meditates for 10 seconds, and blinks eyes again
- Alpha rhythm evident when subject is meditating

Alpha Waves
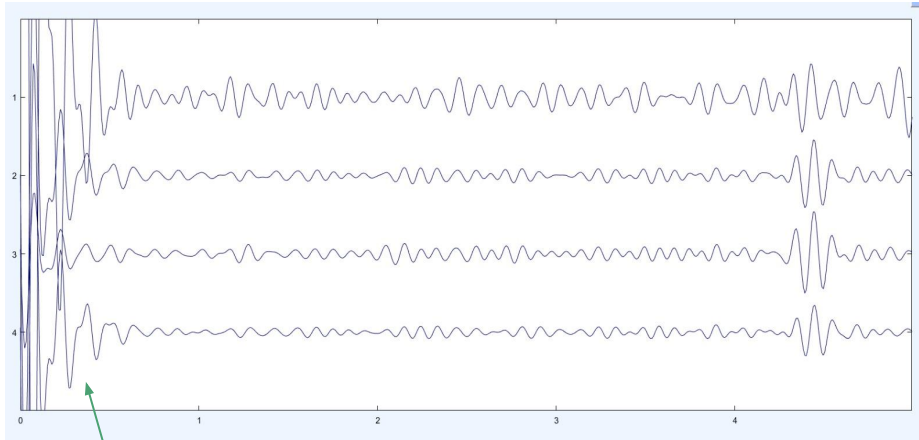
Blink marker

Blink marker

Conclusions

Goals Achieved:

- Acquired EEG data through 4 filtered channels
- Analyzed obtained data for subject response to stimuli - we can observe the response for different placements of electrodes on headgear

Further Advancements:

- Unify components with main PCB - soldering, testing, validating
- Migrate and tune codebase for timing restrictions on main PCB
- Modular design allows for stackable Daisy-chained PCBs - efficient way of increasing channel count

Thank You!