Caption Mask

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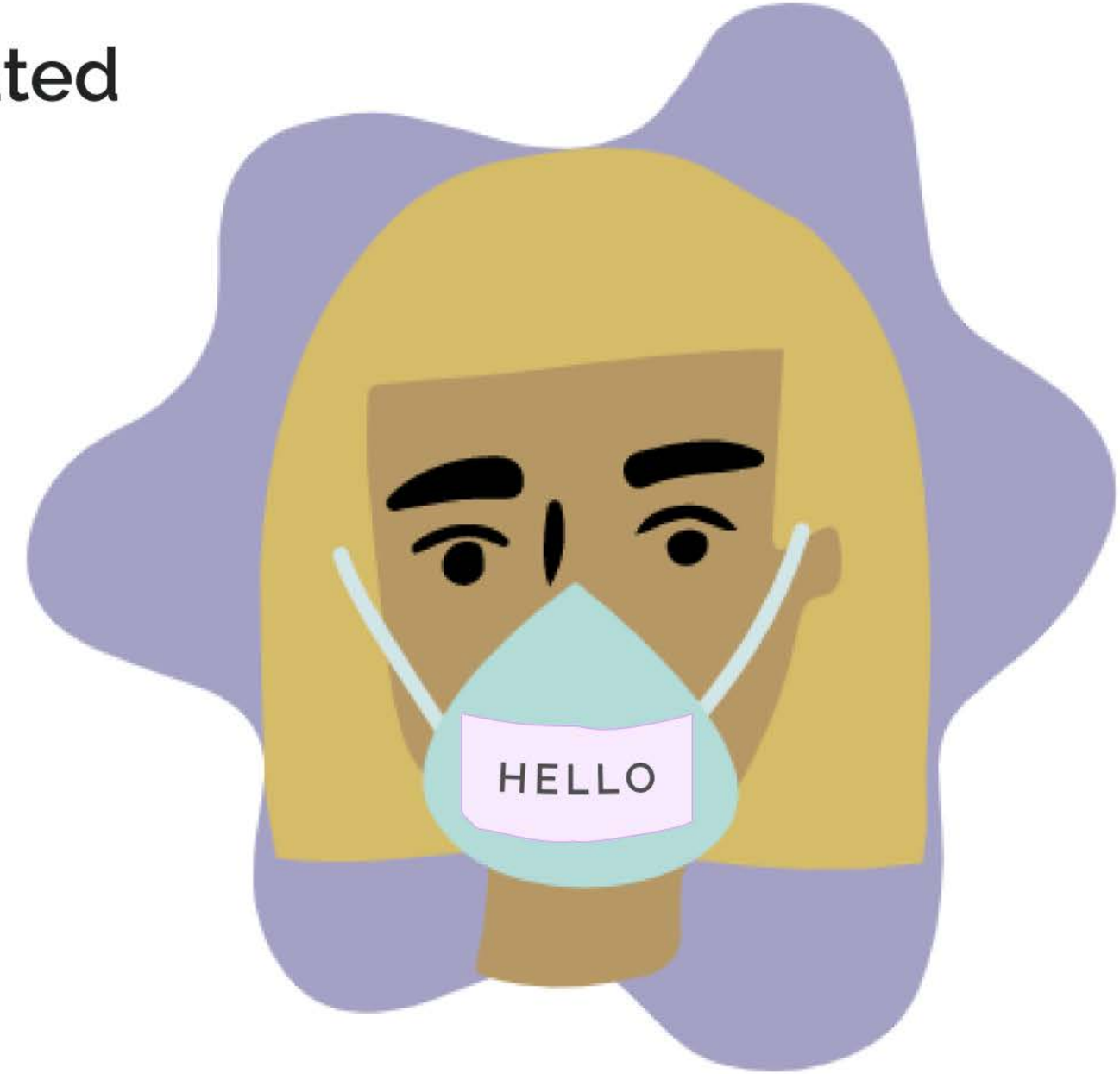
Motivation (Recap)

- COVID-19 has necessitated the daily use of masks that cover the user's mouth.
- Masks are a barrier for deaf people who use lipreading to understand speech.

Proposed Solution - Updated

- A face mask with an inbuilt LCD that uses Automatic Speech Recognition (ASR) to capture and display the speaker's words.

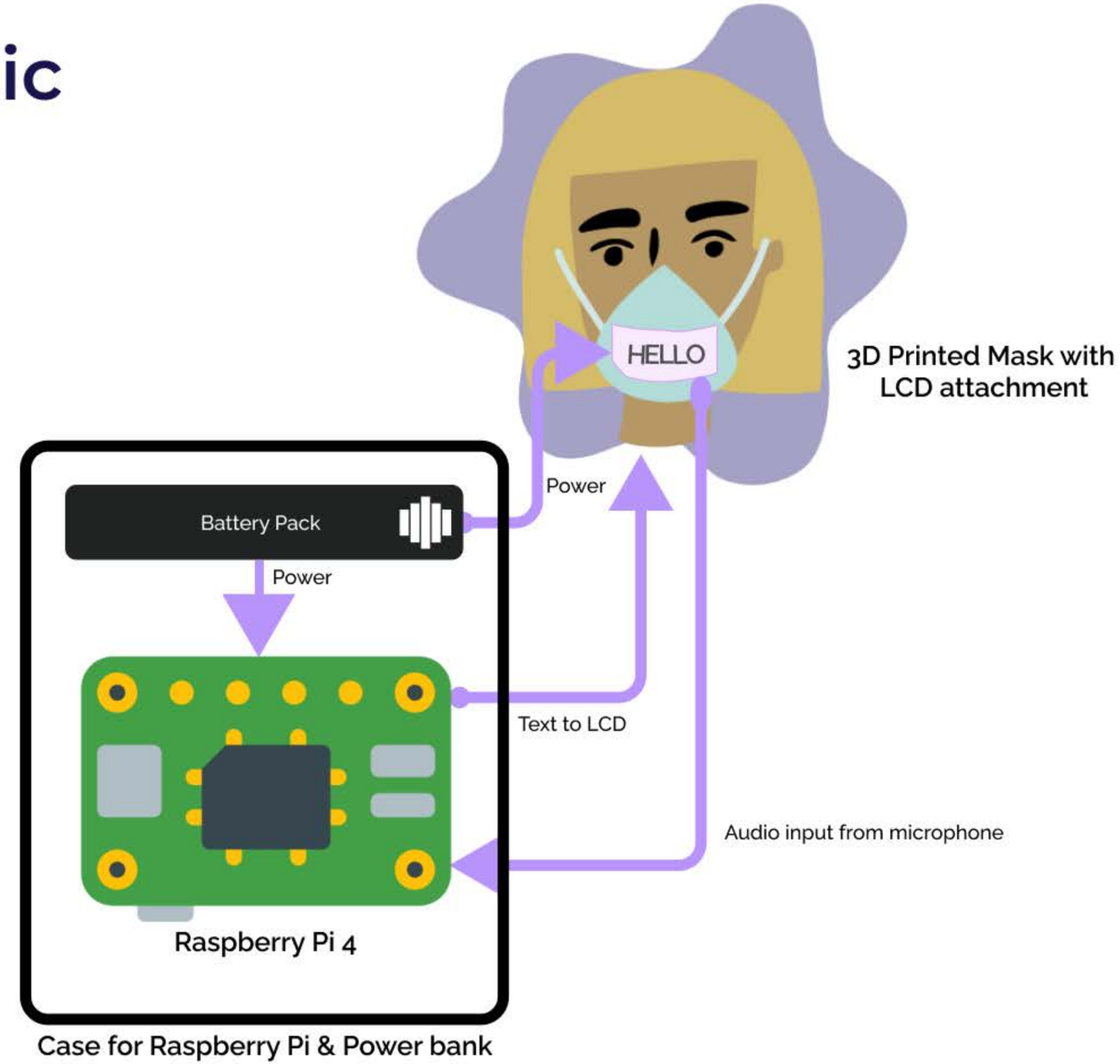
- The wearable solution will be comprised of:
  - 3D Printed mask with attachments
  - Raspberry Pi 4 (swapped out Micro:bit)
  - Battery pack
  - Microphone
  - LCD



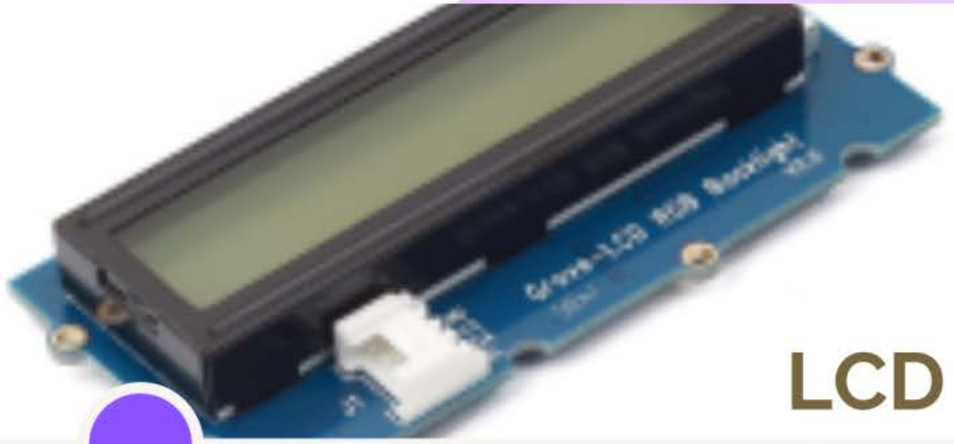
Concept

- Microphone attached to 3D printed mask picks up the user's speech
- Speech data is input to the Raspberyy Pi from the microphone via a wire.
- Raspberyy Pi and battery pack are clipped onto the user's clothing away from breath moisture.
- Raspberyy Pi parses speech data into text using ASR and outputs text to the LCD

Schematic


HELLO
3D Printed Mask with
LCD attachment
Power
Battery Pack
Power
Text to LCD
Audio input from microphone
Raspberry Pi 4
Case for Raspberry Pi & Power bank

Parts List

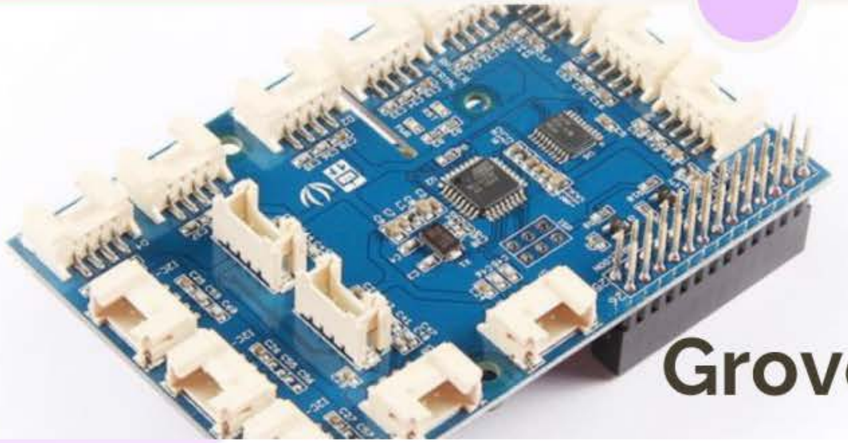


LCD

Microphone

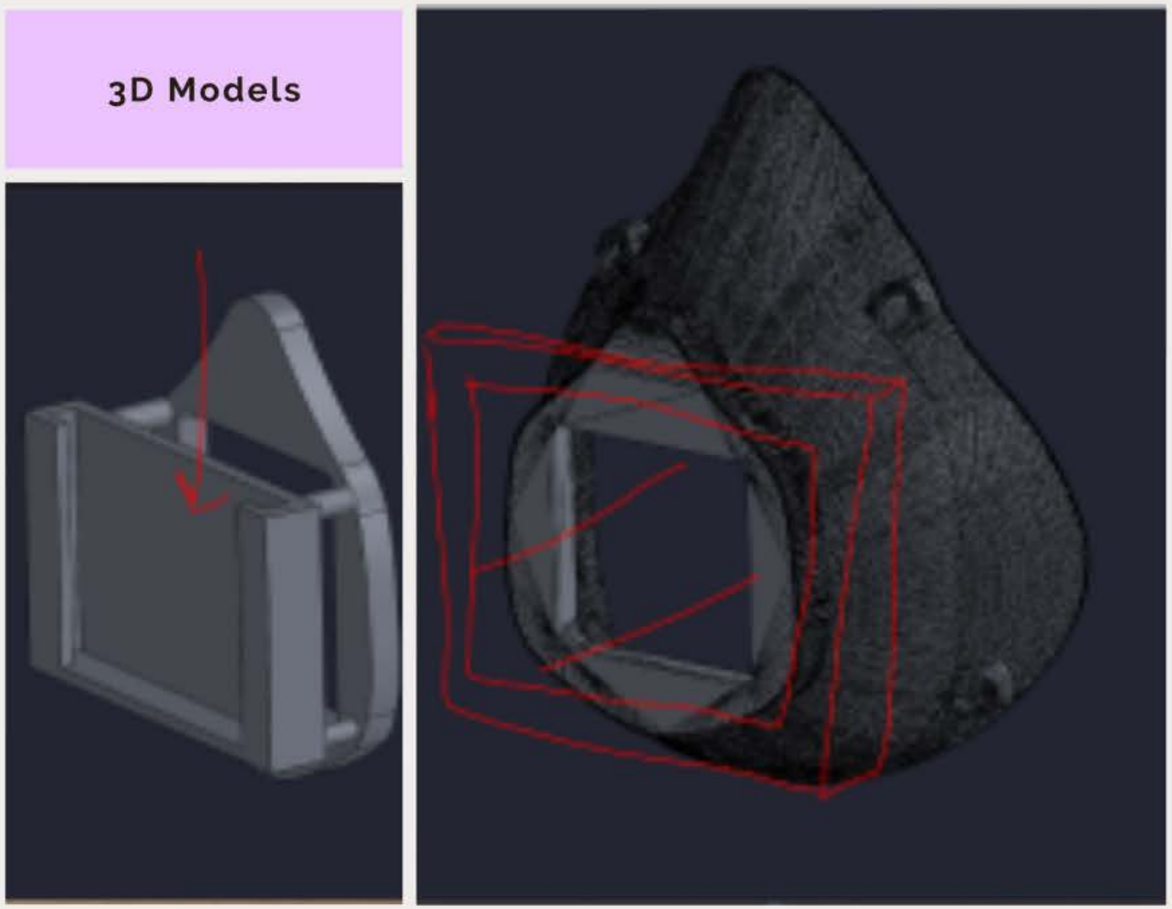
Power Bank

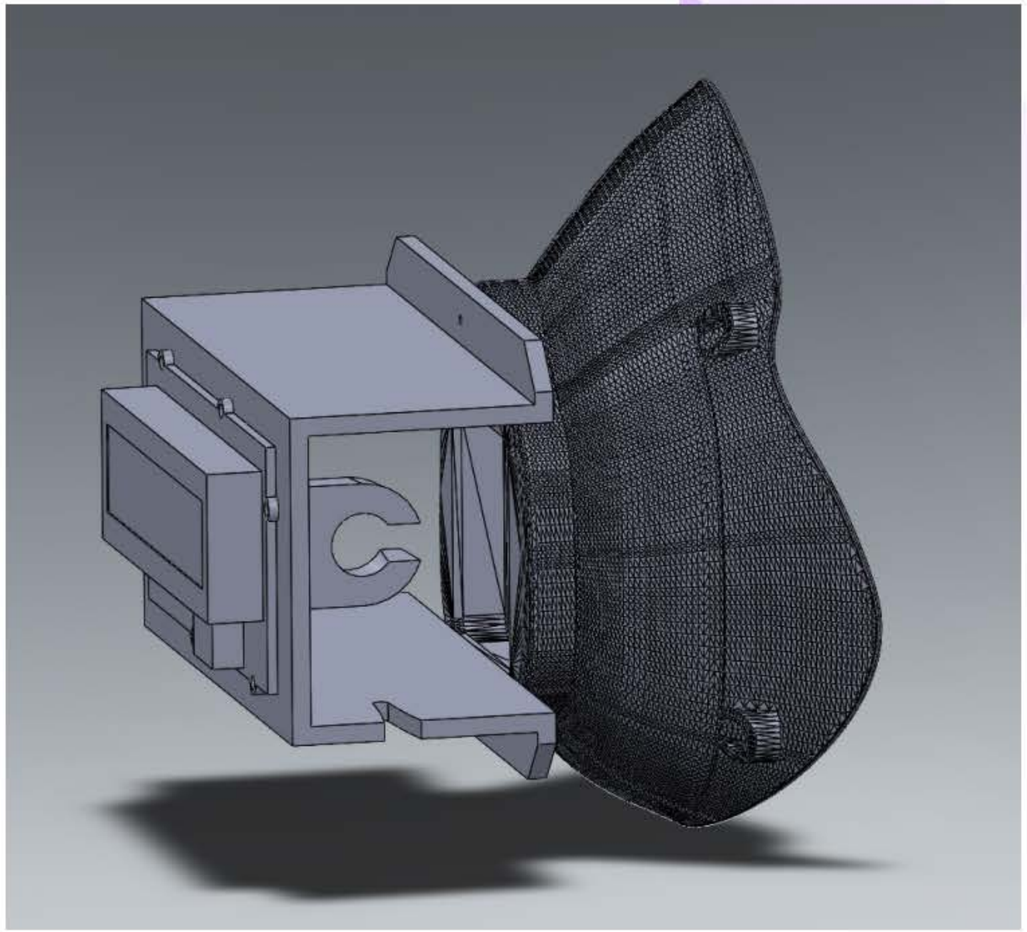
RPi4



GrovePi

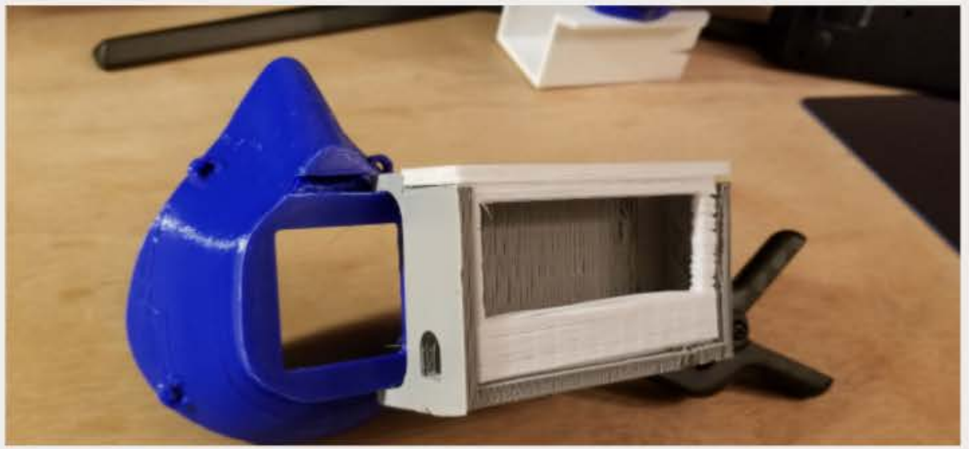
3D Models





3D Prints

3D Printed Components



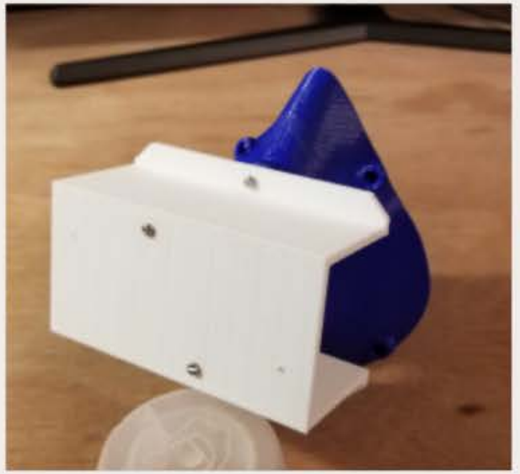
V1

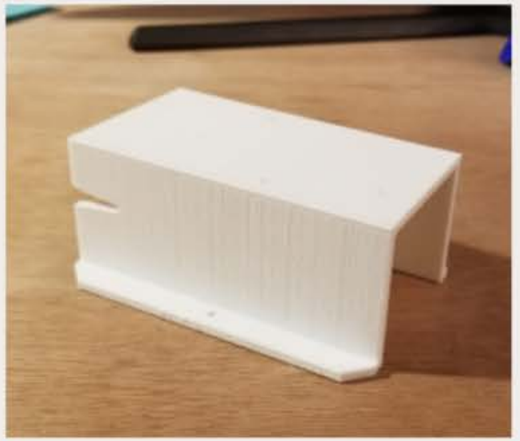
3D Print V1 Limitations

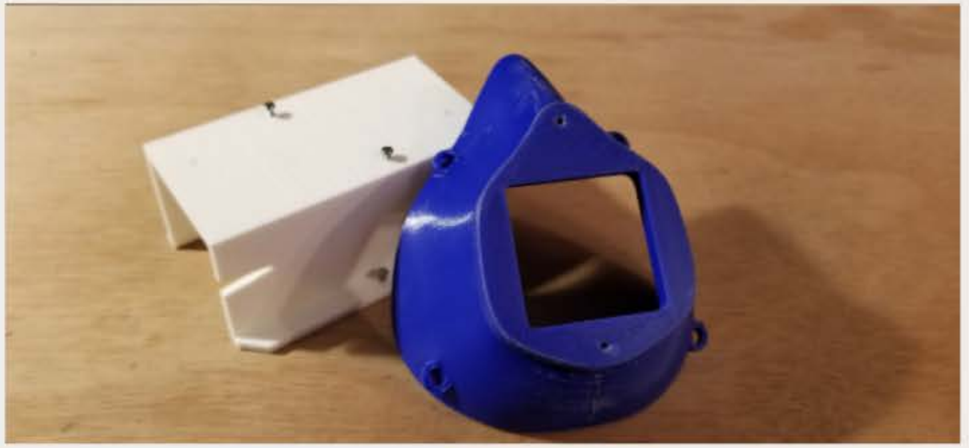
- There wasn't enough clearance for fitting the microphone in without restricting air flow.
- Print resolution was too low to provide good structural stability and was difigured in some places (0.4mm layer height, 15% infill density).
- The parts didn't slide together as expected, tolerances were difficult to hold to an acceptable level without excessively long print times

3D Prints

3D Printed Components







V2

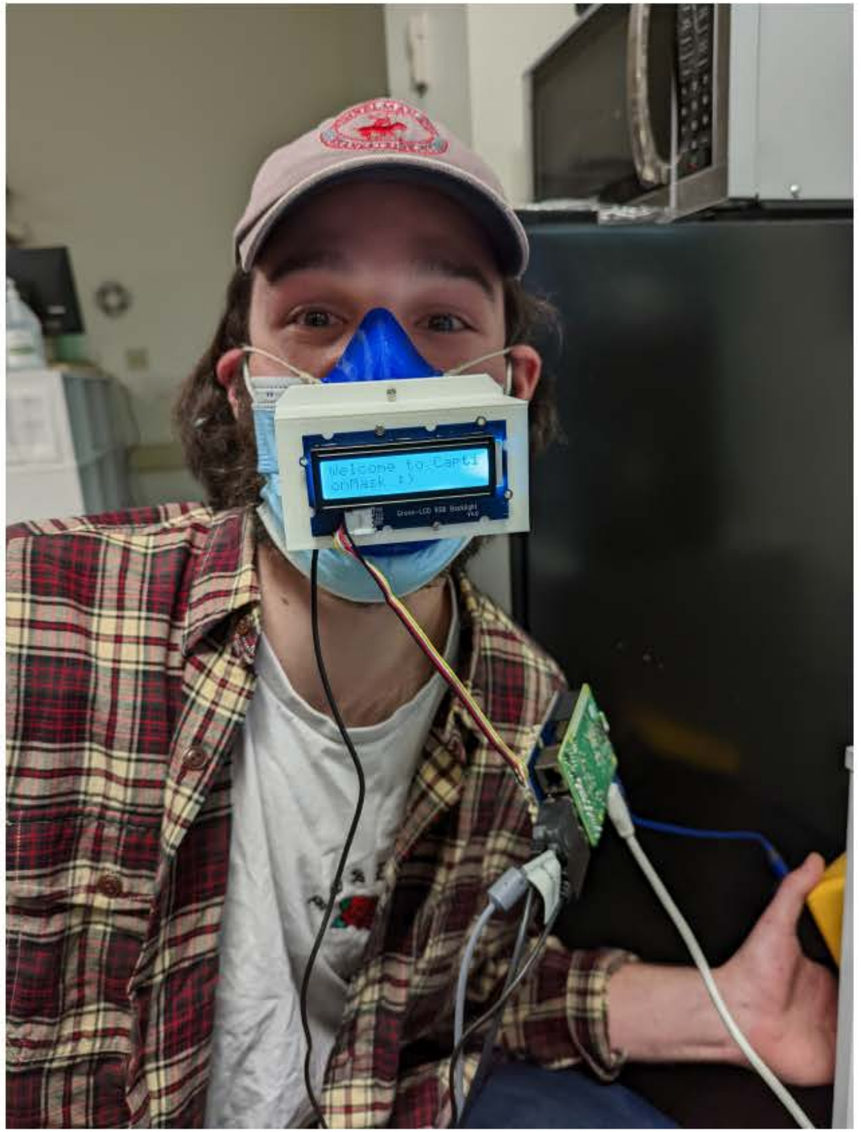
3D Print V2 Considerations

- Added extra pace between mask and display plate for better air flow and easier microphone attachment.

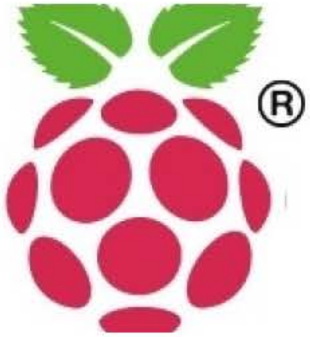
- Prints achieved an acceptable resolution (0.15mm layer height, 40% infill density).

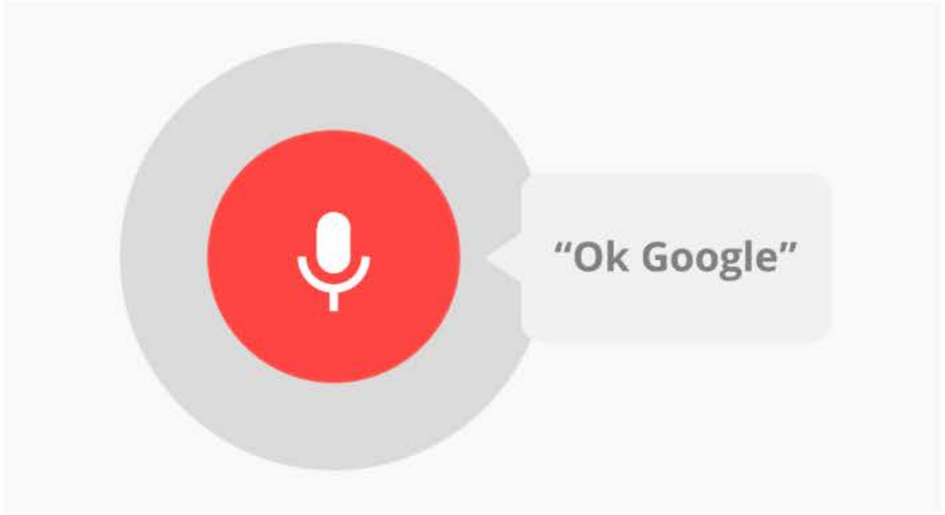
- Eliminated sliding joints between parts, opted for bolting parts together for easier assembly- not including wait time at construct when the shop attendant broke a key off in the lock of a drawer containing the drill bit needed. We destroyed the drawer but got the drill bit!

Final Assembly



Software/Code





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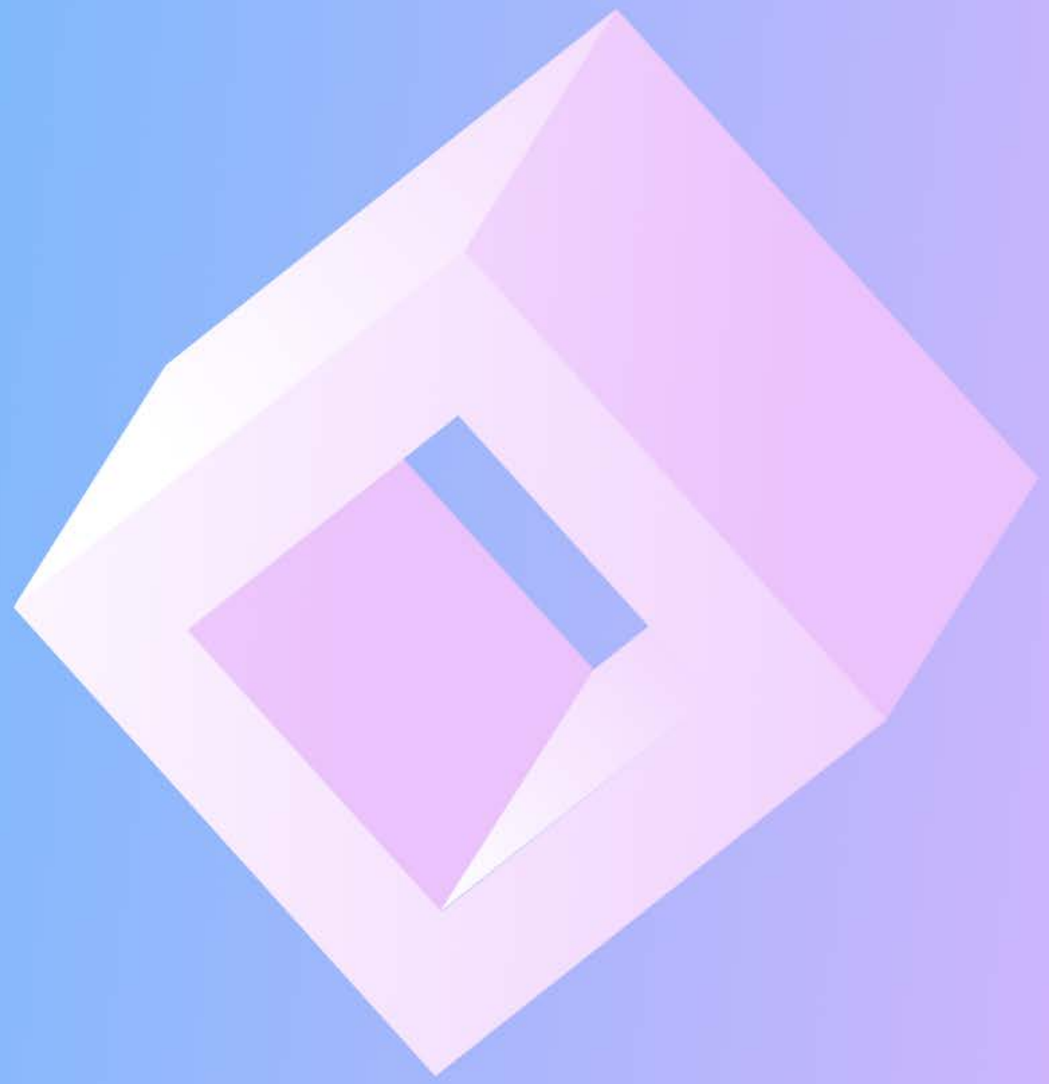
Demo



Challenges & Limitations

Challenges

Mixed team of online & In-person students

- Unable to meet in person weekly
- Only one person could keep the parts at a time which made cooperative work difficult.

ASR Software

- Free ASR APIs are inefficient
- Settings: Color, Brightness, Scroll Speed
- Android vs IOS

Face mask design

Designing a face mask that is a universal fit.

Limitations

Short project timeline

- Short time-frame insufficient to get parts shipped.

3D Printers & print times

- Limited availability of 3D printers.
- Long print times reduced the number of design iterations and testing we had time for 3D printing tolerances and print times varied across machines.

Future Work

- Design an all-in-one unit to avoid multiple parts and components.
- Use injection molding instead of 3D printing.
- Test different microcontrollers with higher processing power and smaller form factor.
- Test different rechargeable batteries that are less bulky.
- Eliminate wires and use Bluetooth/WiFi for data transmission.
- Develop proprietary ASR software rather than adapting current technology to meet our needs.

Thank you!

Questions?