Hey CHEF!

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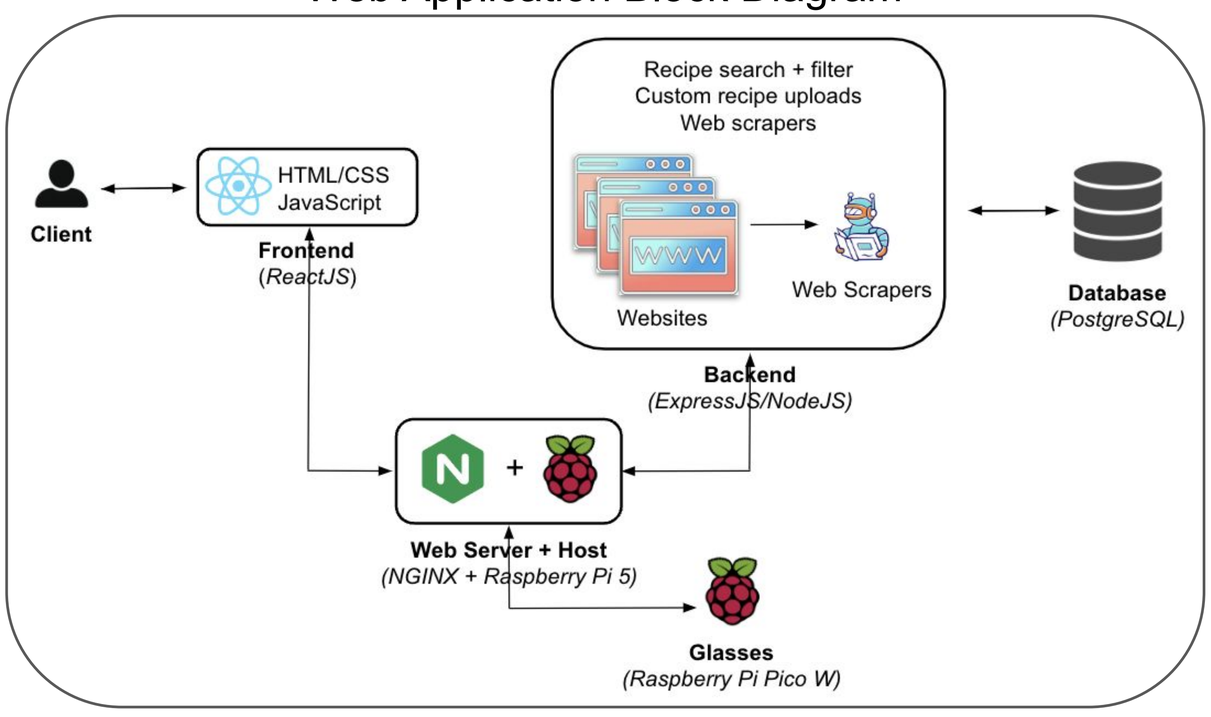
Product Pitch

Hey CHEF! is a hands-free cooking assistant aimed to make the cooking process simpler and more accessible for beginner and home cooks. Comprising smart glasses controlled by voice commands and a web application, the system provides custom recipe recommendations as well as convenient recipe reference via text and audio output instructions while cooking, all completely hands-free. Hey CHEF! streamlines the cooking process for amateur chefs, from dish ideation to recipe execution while reducing cross-contamination for healthier homes and lifestyles overall.

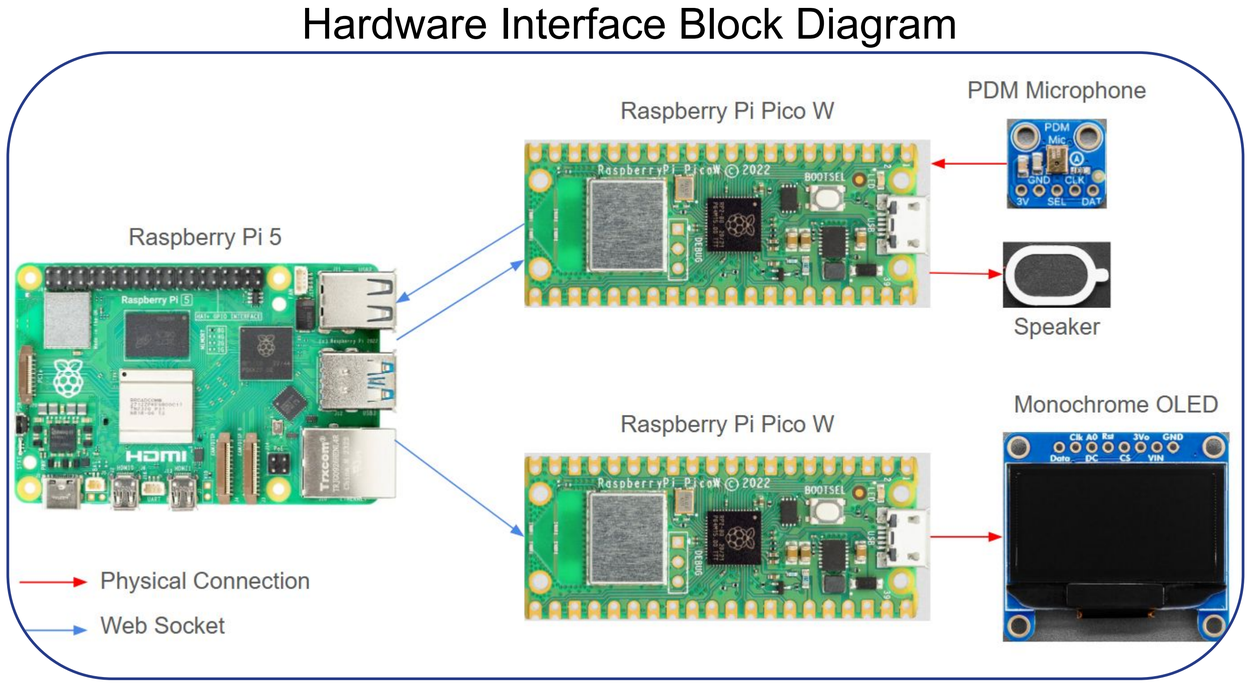
Our physical design meets the user requirements by ensuring comfort during use by maintaining a weight and battery life within our specifications. The voice command algorithm and web application subsystems also meet our desired latency and accuracy requirements, all of which ensure an easy-to-use product for users of any level of cooking experience.

System Architecture

Web Application Block Diagram



Hardware Interface Block Diagram



Conclusions & Additional Information

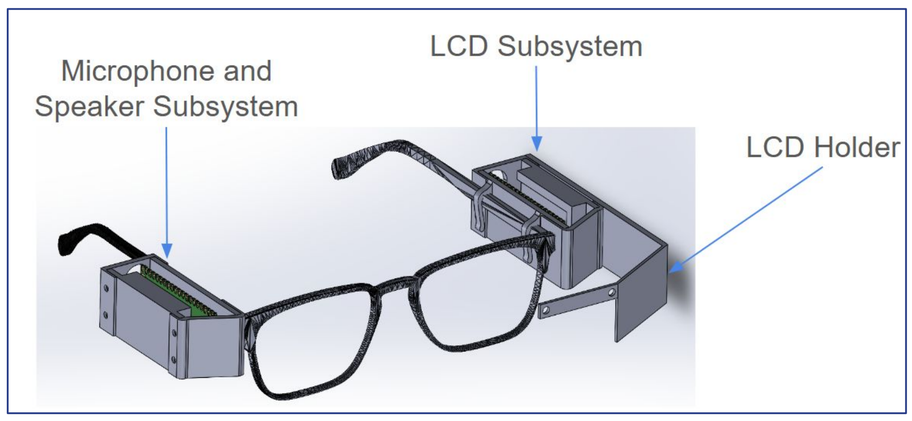
The system implementation met the original use case and requirements that we determined at the beginning of the project. The system, like we desired, met our technical requirements and also met our overall standard of being entirely hands-free.
We learned a few lessons about hardware-software integration and device-to-device communication, both in technical implementation and team-wide collaboration.
Future possibilities for this project could include condensed hardware integration by reducing the physical size of the components that were used to make the design more comfortable and even more lightweight. Additionally, the web application could be expanded to support recipe scraping from various websites and recipe blogs rather than just one website.

System Description

Hardware Description

The physical design consists of two subsystems – one for the Monochrome OLED and the other for the speaker and microphone. Both sides contain one Raspberry Pi Pico W, one Pimoroni Pico LiPo Power SHIM, and one 3.7V, 350mAh LiPo battery. The subsystems do not rely on a wired connection to the Raspberry Pi 5 due to the battery, SHIM, and web sockets used to communicate information.

Physical Design CAD Model



Software Description

The web application frontend provides a user interface for users to browse, select, and upload recipes. All recipes are are stored in the database. The backend uses web scrapers to retrieve recipe data from the Internet to store in the database and also contains APIs which allow users to access recipes from the database and receive recipe recommendations.
The voice command algorithm allows users to input a command, such as making a recipe, going to the next step, listing out ingredients, etc. and is activated with the “Hey Chef!” wake word. It consists of 7 different states so that invalid inputs are not considered in different stages, and integrates the SpeechRecognition library with the Google Web API for input processing.

System Evaluation

Physical Design Requirements

Metric	Target	Actual
Battery Life	≥ 1 hour	≥ 1 hour
Weight	< 150 grams	~110 grams

Accuracy Requirements

Metric	Target	Actual
Voice Commands	4 second input processing	2.5 seconds
OLED	4 second output generation	< 2 seconds
Web App	3 second output generation	2.5± 0.2 seconds

Latency Requirements

Metric	Target	Actual
Voice Commands	95% input processing	94%
OLED	95% display accuracy	≥ 95%
Web App	95% relevant suggestions	≥ 95%

Design Tradeoffs:
The main design tradeoffs on the software side included microphone types, web APIs for input detection, and mode of wireless comms (BLE, bluetooth classic, and TCP). We decided on a PDM mic over BT classic for low power usage, and to meet our power requirements.
In terms of the hardware, we decided that having 2 RPi picos would help balance the structure of the glasses, and help ease system integration.

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