

HelpMeRecall

Project Proposal

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1. Introduction

- Problem: One to two paragraphs detailing the problem statement. Include any relevant references to justify the existence or importance of the problem.

Short-term memory loss is a problem in people, particularly as people age. Many individuals have difficulty remembering recent activities throughout the day and in some cases people may forget routine tasks like eating or taking medication. According to the Alzheimer's Association, 7.2 million Americans aged 65 and older suffer from Alzheimer's in 2025 and is expected to grow in coming years.

Although the younger population generally don't have Alzheimer's, students and professors can be forgetful. Under the pressures of academia and constant deadlines, it's easy to forget self-care. However, these issues can begin to be resolved with a person who can also care for others or more simply, a device that can log your activities as you go on with your day.

- Solution: One to two paragraphs describing the solution. Give a high-level idea of what your solution is, then delve into detail as to how it is implemented. You do not have to commit to a particular implementation at this point, but your description should be explicit and concrete.

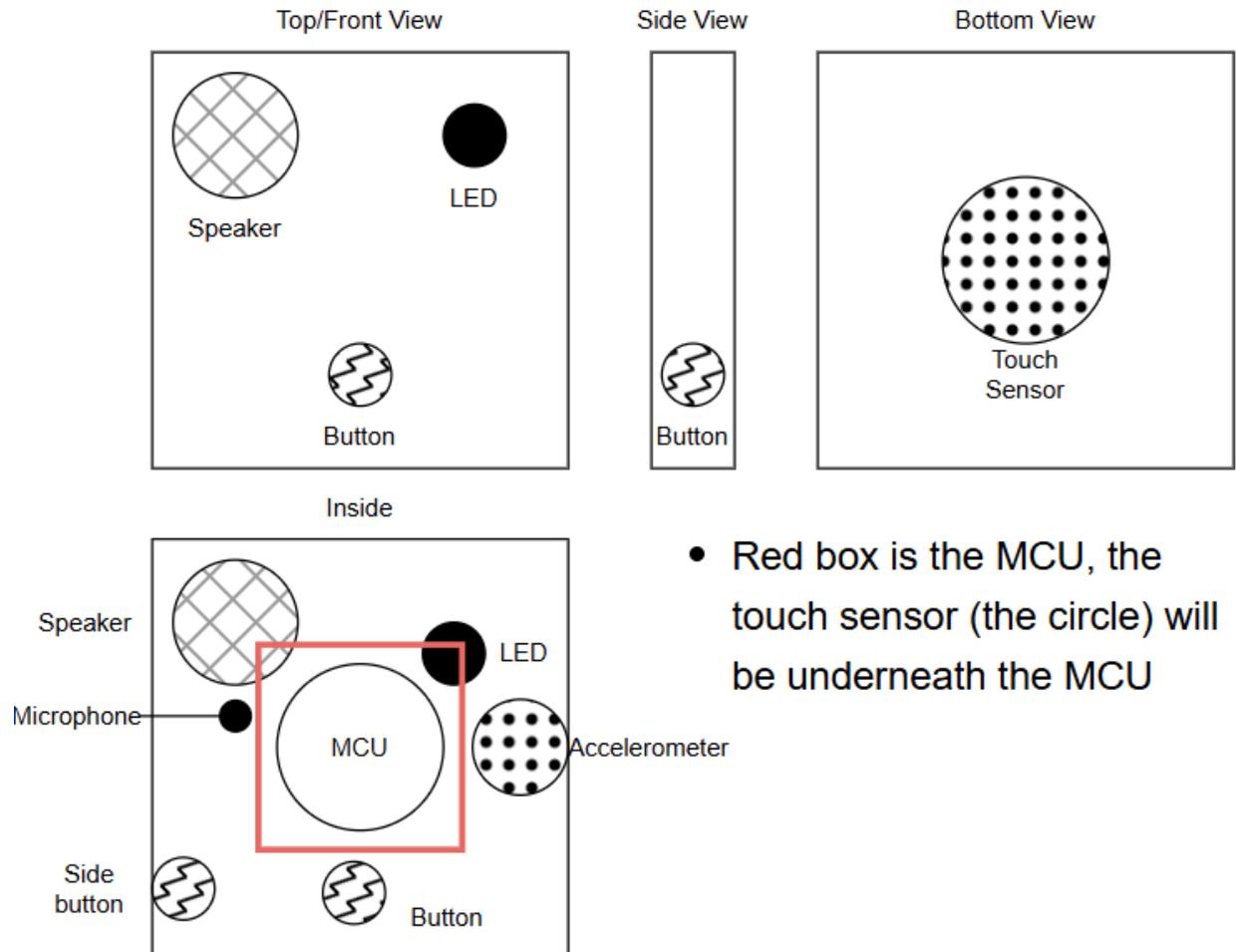
A standalone assistive device that supports activity logging and recollection using sensor-gated voice interaction. Users will be able to verbally log activities they have completed and later query if a specific activity has been performed. The device is always on and will be verifiable with an LED and voice input will be accepted only if a capacitive touch sensor detects the user.

The device will use an onboard microphone and on-device audio processing via the microcontroller to perform keyword detection. To increase detection of supported keywords, there will be various keywords for a specific activity. In the case of taking medicine, it might be medicine, medication, pill, drug, and prescription. To validate the logged action, the action is only logged if an accelerometer detects physical movement around the time of logging in order to reduce false logging. When a log is accepted, the device will provide haptic feedback via a vibrating motor. Logs will also be timestamped and stored in local memory. When the user queries through their activities, an integrated speaker on the device will note the activity as well as its timestamp. Logs will reset automatically at midnight but there will be a reset button to clear all logs and a separate button to delete the latest log in case of accidental logging.

- Visual Aid: A pictorial representation of your project that puts your solution in context. Include other external systems relevant to your project (e.g. if your solution connects to a phone via

Bluetooth, draw a dotted line between your device and the phone). Note that this is not a block diagram and should explain how the solution is used, not a breakdown of inner components.

The device will not communicate with other external systems and everything will be enclosed in the box with peripherals as shown below. On the outside users will be a speaker, LED, 2 buttons, and a touch sensor. On the inside you will also be able to see the MCU, accelerometer, and a microphone. The inside of the box will use subsections to divide up the box as needed, such as a small subsection for the speaker to help it stay in place.

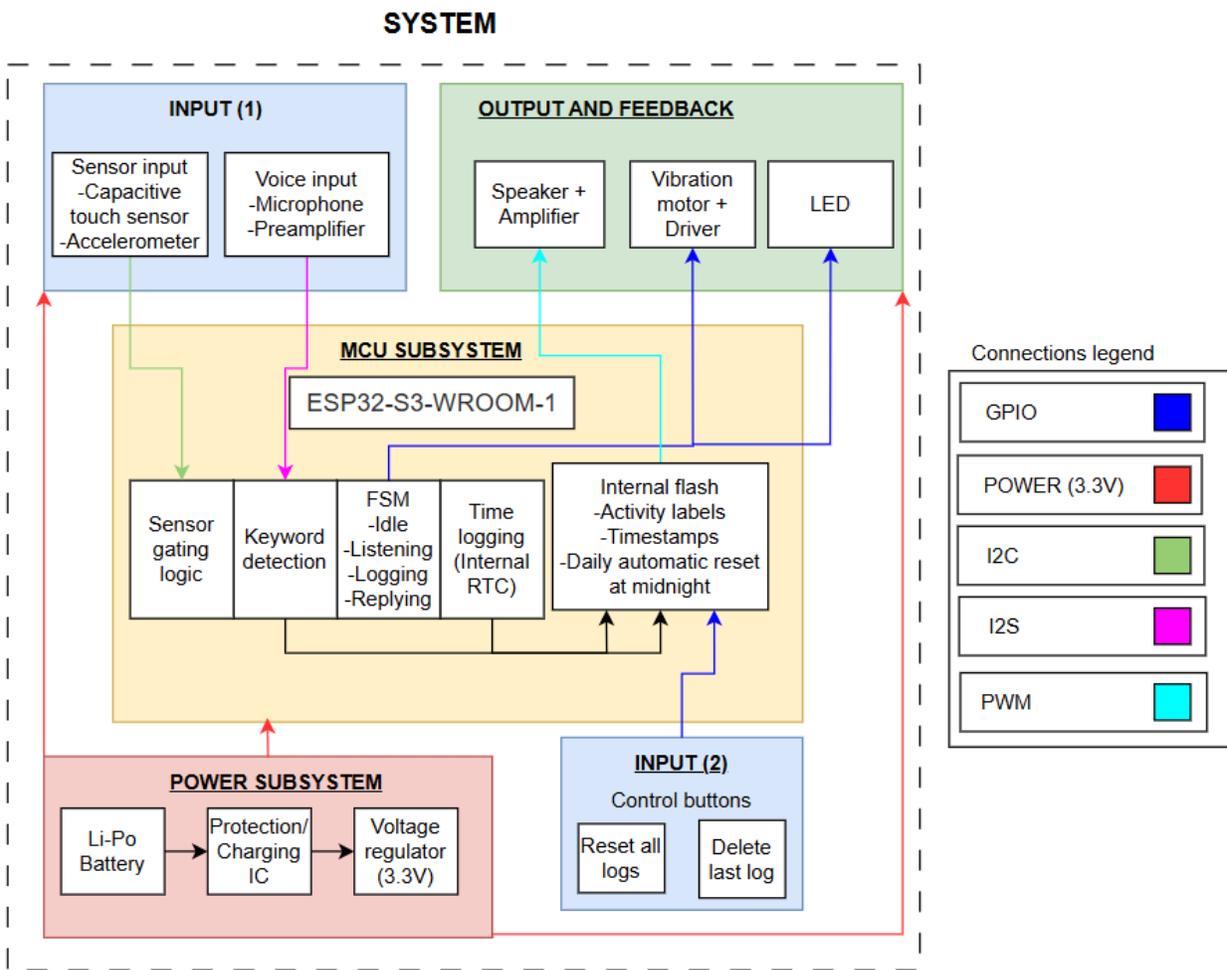


- Red box is the MCU, the touch sensor (the circle) will be underneath the MCU

- High-level requirements list: A list of three quantitative characteristics that this project must exhibit in order to solve the problem. Each high-level requirement must be stated in complete sentences and displayed as a bulleted list. Avoid mentioning "cost" as a high level requirement.
1. Correctly detects supported keywords with an accuracy of at least 80% in a quiet environment, measured as the ratio of correct detections to intentional logging attempts within the listening windows with a false log rate < 2 unintended logs per hour in normal conversation when the device is worn.
 2. Upon successful logging, haptic feedback can be felt by the user within 2 seconds through a vibration of 2 seconds and properly updates the activity log.
 3. When the user asks a question about an activity being completed/not, the device audibly outputs the correct answer along with the registered timestamp by referring to the stored activity logs.

2 Design

- Block Diagram



- Subsystem Requirements: For each subsystem in your block diagram, you should include a highly detailed block description. Each description must include a statement indicating how the block contributes to the overall design dictated by the high-level requirements. Any interfaces with other blocks must be defined clearly and quantitatively. Include a list of requirements where if any of these requirements were removed, the subsystem would fail to function. Good example: Power Subsystem must be able to supply at least 500mA to the rest of the system continuously at 5V +/- 0.1V.

Subsystem 1: Microcontroller Unit

Acts as the central unit for logic. Manages the sensor inputs, and executes a finite state machine. The FSM states are start, idle, listening, logging, and replying. The MCU also is responsible for storing the activity voice logs along with timestamps. Allows automatic reset at midnight to support daily repetitive tasks. Timekeeping is done using ESP32's internal RTC.

Subsystem 2: Input processing unit

Voice input processing: Captures the voice input from the user and performs keyword detection on a limited vocabulary, where each action can be mapped to multiple set keywords to improve detection.

Sensor gating and activity validation: Uses a capacitive touch sensor and an accelerometer to detect motion, which ensures that voice input is only received and accepted if the device is worn and recent movement is detected by the accelerometer instead of continuous voice recognition. A "cooldown" period is enforced where the microphone will be disabled for 10 seconds if there's motion but no logging during the listening period multiple times in a row to help conserve some battery.

Subsystem 3: Output and Feedback

Uses a speaker for audio feedback as a response to the user's query. This subsystem also provides haptic feedback as an indication of an accepted user voice log. To indicate if the device is on, the LED is green. If the device is listening, the LED is yellow. If the device is low on power, the LED will be red.

Subsystem 5: Power subsystem

A Li-Po battery supplies power to the device.

The power system block will power the MCU subsystem, which will handle the inputs and outputs of the device. The input subsystem consists of the sensor input and voice input. This goes into the MCU for processing via the sensor gating logic, keyword detection, and FSM. The MCU then leads to the output subsystem where the speaker and vibration motor are.

- Tolerance Analysis: Identify an aspect of your design that poses a risk to successful completion of the project. Demonstrate the feasibility of this component through mathematical analysis or simulation.

An aspect of our design that has a potential big feasibility issue is to be able to make the activity log trustworthy without being extremely power hungry. We hope to get the battery life to 10 hours of logging without recharging.

3.0 [Ethics, safety and societal impact]

A possible ethics issue is using this device as a replacement for caretakers at a nursery home for patients with Alzheimer's. A safety issue may arise if the battery short-circuits/ leaks from prolonged exposure to water or if the device is submerged in water (IEEE 1625). The device will have a positive impact on society for those looking to recall activities they've done throughout the day while being safe as to keep safety paramount as noted in the IEEE Code of Ethics. This can be particularly useful for people who recently started medication regularly but tend to forget since the habit hasn't developed yet. HelpMeRecall also uses a rechargeable lithium battery, which introduces safety and compliance requirements related to charging, transport, and end-user exposure to heat/fire risk.