H.E.L.I.O.S

(Health Equipment Logistics & Inventory for Orbital Systems)

Medical Inventory System

- **Team Members**
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Objective

- **Objective Statement:**

  Design, Code, and Create a medical inventory system that tracks access to medication and medical supplies while keeping the system easy to access in both everyday and emergency use. Additionally the system must send automated reports back to a control center on earth and request resupplies if needed.

Problem Statement

- **Problem Description:** On a space station, such as the ISS, it is very easy for astronauts to take medication or medical supplies from their medical kits and not record what was taken, leading to discrepancies

between what either astronauts or staff on earth think they still have and possibly causing supply problems down the line. In order to fix this NASA wants us to design an inventory system that keeps all medications and medical supplies and track what supplies are remaining. With this information automated reports can be sent to earth and resupplies can be sent with what the astronauts need. This system needs to be easy to access so that astronauts can continue to use it on a daily basis and access it in a hurry if needed.

- **Why This Problem Matters:** A reliable medical inventory system will be vital for longer space missions or a permanent base as it prevents small errors accumulating over time and allows for astronauts to focus on other things, while not having to worry about having medical supply, or on a longer term mission will help to ration the medical supplies over the whole trip and make sure that astronauts know what they still have available.

Success Metrics

- **SMART Metrics (Specific, Measurable, Achievable, Relevant, Time-bound):**

1.
Specific: The system must automatically log medication/supply removal events with user ID, timestamp, and item details.
Measurable: At least **95% of all interactions** are correctly logged without manual intervention.
Achievable: By integrating RFID tagging and face-recognition sign-in for users.
Relevant: Prevents discrepancies between actual stock and reported inventory.
Time-bound: Must be functional and tested on prototype by **October 15, 2025**

2.
Specific: The system must automatically generate inventory status reports and send them to Earth.

Measurable: Reports must be successfully transmitted with 100% success rate during weekly tests.
Achievable: Using ISS JSL (Joint Station LAN) communication protocols for downlink.
Relevant: Ensures NASA ground teams always have real-time supply data for resupply planning.
Time-bound: First working version implemented and tested by November 1, 2025.

User Personas

- **John Smith:**
    - **Background:** John is an astronaut on the new lunar base and a resident doctor. John is used to working on the earth where everything is easy to access and is organized how he wants it to be.
    - **Motivations:** John wants to prove his skills in an unfamiliar environment and provide care to any that need it on the lunar base.
    - **Needs/Challenges:** John might need to access the system with gloved hands, or need to get exactly what he wants to get in a quick and efficient manner to be able to treat his patient.
- **Courtney Praskovia**
    - **Background:** Courtney is an astronaut on the ISS, and is on the space station to test a new medication that was developed to

combat the muscle atrophy and bone loss problems that come with living in a zero gravity environment.

    - **Motivations:** Courtney wants to prove that this medication works over a long period of time, and if she does that it would be a huge step toward longer space missions, possible to other planets.

    - **Needs/Challenges:** Courtney needs to take her medication daily, and because she is going to be up in the ISS for so long she will not be able to keep track of how much of the medication is left. She also has to take the medication early in the morning when she is tired, and because of this might not have the presence of mind to enter what she took every morning
- **Stefan Gibbons**
    - **Background:** Stefan is one of the first civilians to be let onto the lunar base, however because he has had less training than some of the astronauts, when he gets to the moon he has a hard time adjusting to the lower gravity environment and constantly wakes up with headaches.

    - **Motivations:** In order to combat the headaches Stefan often grabs a couple tylenols in the morning. Stafan wants to get the tylenol quickly and efficiently as too much thinking or moving is difficult.

    - **Needs/Challenges:** Because Stefan is a visiting civilian he doesn't know how to operate all the systems in the best way yet, so he needs the system to be easy to use and not a lot of hands on. Stefan is taking a lot of tylenol, and possibly not telling anyone about it, so the system needs to keep track of it itself.

Features & User Stories

- **Feature 1 - Voice activated dispension:**
    - User Story(John Smith): As a doctor on the lunar base, I want voice activated dispensation of medications so that I can continue working on my patient and not get the inventory system covered in bodily fluids.
- **Feature 2 - Record who took pills using face activation:**
    - **Feature: User Story(John Smith):** As a doctor on the lunar base, I want the inventory system to track who takes what type of medication so that I can see people who might have a condition that needs treating.
- **Feature 3 - Automated inventory and resupply requests:**
    - **User Story(Courtney Praskovia)**: As a long test subject on the ISS, I want the inventory system to inventory how much supply is left and request more if needed so that I don't have to keep track of it myself and possibly forget a day or two, and so that if I can count on more medication if we are close to running out and the test hasn't been completed.
- **Feature 4 - Automated inventory and resupply requests:**
    - **User Story(Stefan Gibbons)**: As a civilian on the lunar base who often needs tylenol to combat my headaches, I want the inventory system to be easy to access and intuitive so that I don't have to learn another complicated system that I will probably

mess up using.

Functional Requirements

- **Requirement 1:** The system must be able to complete all tasks in both zero gravity and a gravity environment.

- **Requirement 2:** The system must log every access, the person who accessed the system, and when they accessed it, and what they took. Eg. Stefan Gibbons took 2 Tylenol pills on September 17 at 8:58AM.

- **Requirement 3:** The system must send automated reports down to earth to request resupplies via ISS JSL

Non-Functional Requirements

- **Performance:**
    - Face identification must detect faces in a timely manner - 1 second
    - The system does not take up too much digital space - fits on a raspberry pi

- **Usability:**
    - Interface must be simplistic and easy to use for stressful situations and not not creating a hassle during everyday use
    - Accessible with both fully manual input and with only grabbing the medication after it is dispensed.

- **Reliability:**
    - 99.9% uptime required as astronauts might need to access the system at all times of day

- **Other NFRs:**
    - Prototype must be relatively cheap, can build it with the budget that we have

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Constraints & Out of Scope

- **Constraints:**

    - Must function in electronically noisy places such as the ISS
    - Must function in zero gravity and lunar gravity

- **Out of Scope:**

    - Security - access from unwanted people as people should be vetted before arriving at ISS or lunar base
    - Diagnosing possible illness based on medication access

Timeline

- Design plan - 9/25
- Preliminary face identification software - 10/2
- Create preliminary prototype using materials like cardboard - 10/9
- Create project display before preliminary design review - 10/16
- First prototype by preliminary design review - TBD