Final Project - Farming Containers

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Functional Overview

Our app will allow users to either track and manage the security of their fleet of container farms, or monitor the growing conditions within them. Users signed in as a farming technician will be able to monitor growing conditions using their dashboard, while the fleet manager's dashboard will be more security oriented. Both types of users will also be able to see historical data represented in graphs, and set specific conditions to notify them.

Design Overview

SHFT is a comprehensive IoT solution designed for container farms. It offers a user-friendly interface for both container owners and technicians in the shipping container greenhouse. Users can easily monitor their farming system and the plants grown inside them by logging into the application. When opening the app, a loading screen with the application's name appears. Once loaded, users are directed to the login page where they can either sign up as a new user or log in using their email and password. The application provides a "forgot password" link for users who need to reset their password. After authentication, users are directed to a custom page based on their role either as a "fleet owner" or "farm technician". Users who choose to sign up are directed to a signup page where they can select their role and are asked to provide their email, password, and password confirmation. After clicking the "sign up" button, users are registered and redirected to their appropriate view. The application also includes a "back to login" button on the signup page for users to return to the login page.

When you login or sign up as a fleet owner, you'll go to the "select container" screen. That screen will show you all the containers that are registered to your name. If you can't see your container(s), there is a link at the bottom of the screen that will redirect you to the right resources. Once you have selected a container, it will take you to the "Dashboard" screen. To go back to the login page, just click on the back arrow.

On the Dashboard screen, it will show the name of the container you are monitoring, its temperature, noise level, roll angle, and pitch angle. Every reading has a label and gauge which gives clarity and context to determine whether it is good or bad. At the bottom of the screen, you can find a navigation bar that lets you switch between the dashboard, switches screen, geolocation screen, and historical data screen. Each option has a logo, making it easy to navigate through the app. The switches screen provides a list of items that can be toggled on or off, such as the buzzer, door lock, and motion sensors. The geolocation screen shows the container's current location and the radius in which the container should remain. Lastly, the historical data screen offers a dropdown menu with every IOT reading. Choosing a specific reading like temperature, will update the graph below, showing the corresponding values over time.

As a farm technician, when you login or sign up, you'll be navigated to the "dashboard" screen. On this screen, you will see the container name you are working in, and also the temperature, general humidity level, soil moisture, and water level of the container. Every value has a label, gauge, and warnings to let you know whether it's good or bad, and warn you of any problems. If you click on any of the gauges, it will display a prompt to set a maximum and/or minimum range for the value. If the value goes beyond the given range, the technician will get an alert. In this screen, you can also find toggles to control the fan and lighting, and there's a navigation bar at the bottom of the screen, allowing you to navigate back to the dashboard or access the "historical data" screen.

The one exception is when you click on the soil moisture level, it will take you to the "soil moisture per plant" screen. The "soil moisture per plant" screen shows the name of the monitored container and the soil moisture of each crop individually, including labels and gauges to help understand the values.

The "historical data" screen gives you a drop-down menu that contains all the available IOT readings. If you select an option, like temperature, it'll show the values of that reading over time in a graph below.

We have designed our app's layout to prioritize simplicity and ease of use, taking inspiration from car insurance applications that present complex data to non-technical users. We have chosen a modern, clean, and minimalist design, with intuitive navigation and icons. We used simple layouts, subtle colors, and clear typography to reduce clutter and make the interface more user-friendly. Our color palette consists of three app colors and two font colors, ensuring consistency and contrast. The chosen colors generate a sense of energy and excitement, evoking freshness and growth, and are in line with our farming theme. We made sure that all necessary elements are available on each screen, and navigation between screens is straightforward throughout the app.

App Prototype

Screen Analysis

Loading Screen

- The loading screen has no user interaction. It simply presents a gif of our smile-themed logo spinning to indicate that the app is loading. It will also have the name of our team / fake company - SHFT (Super Happy Fun Time). The screen would be shown when the app starts up.

Login Screen

- The login screen will allow users to login to their account. If they enter a valid username and password combination, they are signed in and moved either to the container select screen if they are a fleet manager, or to the growing conditions dashboard if they are a farming technician.

Sign Up Screen

- The sign up screen will allow users to create an account. They will enter a username, a password, and will have to select whether they are a fleet manager or a farming technician. If the username is not already taken, they are signed in when they make their account.

Container Select Screen

- Since fleet managers often manage multiple farming containers, before they can monitor one, they are presented with a list of containers to choose from. This screen will present a list of buttons with container names inside them. Once a container is selected, the fleet manager will navigate to the security dashboard.

Security Dashboard Screen

- The security dashboard presents the following data; whether the current temperature is at a safe level, whether the buzzer is on, whether the door is locked, whether the motion sensor is currently alerting, the luminosity level, the noise level, the roll angle of the container, and the pitch angle of the container. In addition, the door and buzzer can manually be toggled on or off by clicking on the appropriate switch.

Container Location Screen

- The container location screen can be navigated to using the tab at the bottom of the screen. It shows the current container location on a map.

Historical Security Data Screen

- The historical security data screen can be navigated to using the tab on the bottom of the screen when signed in as a fleet owner. There is a chart which displays historical data for the selected data point. The data point can be selected using a picker. The luminosity, noise levels, pitch angle and roll angle are all options for the user to select. The user can also click on the share icon to share the graph as an image.

Growing Conditions Dashboard Screen

- If a user logs in as a farming technician, they automatically navigate to the growing conditions dashboard. This screen presents the current temperature, humidity, and water level in a gauge. It also displays whether the soil moisture is okay with a checkmark if all plants' soil moistures are okay, or an "X" if one or more plants' soil moistures is at a bad level. It also shows the current state of the fan and lights, and allows the user to toggle them remotely.

Historical Growing Conditions Screen

- The historical growing conditions screen can be navigated to using the tab on the bottom of the screen. There is a chart which displays historical data for the selected data point. The data point can be selected using a picker. Only the temperature, humidity, and water levels can be shown historically. The user can also click on the share icon to share the graph as an image.

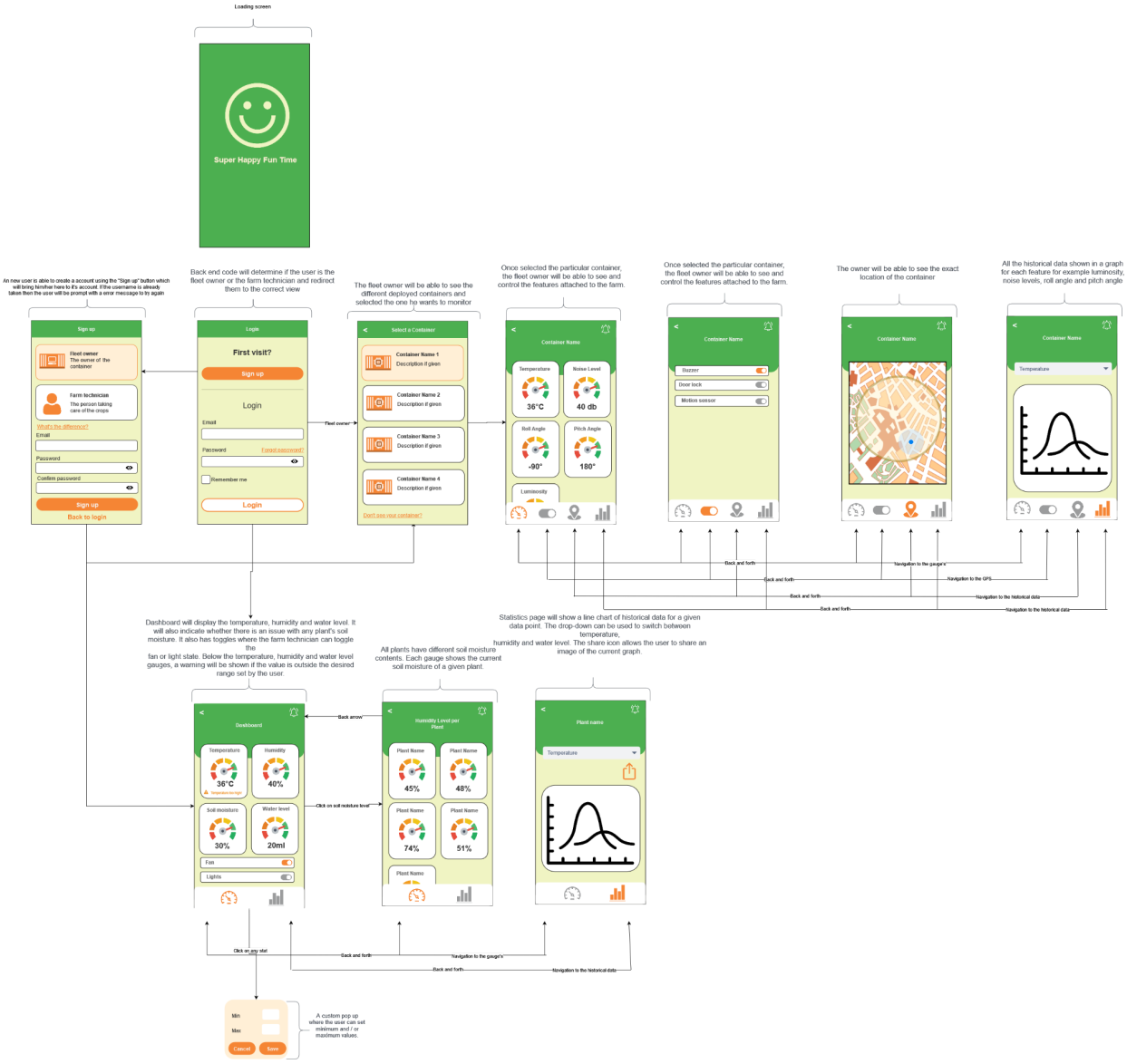
Growing Conditions Restrictions Setting Pop Up

- If the user clicks on a temperature, humidity, water level, or soil moisture gauge, a custom popup appears. This popup asks the user for a minimum and maximum value for the selected data point. This will allow the app to send push notifications or display warnings if the data goes out of bounds.

Soil Moisture Screen

- Since each plant can have its own soil moisture, the soil moisture values can not be displayed on the main growing conditions dashboard. Instead, if the user clicks on the moisture checkmark or "X" in the dashboard, they navigate to the soil moisture screen. This screen displays the current soil moisture for each plant in the container farm.

Screen Design



App Features

In our app, we will limit the access to features depending on the user role. See the breakdown of features associated with each type of user below.

Must develop

- Fleet owner can read the noise levels of the container
- Fleet owner has the ability to read the luminosity level of a container
- Fleet owner has the ability to read the motion sensor state
- Fleet owner is able to monitor the door-lock state
- Fleet owner can control the door-lock state
- Fleet owner has the ability to monitor the buzzer state
- Fleet owner has the ability to control the buzzer state
- Fleet owner can monitor the door state of the container
- Fleet owner can monitor the temperature of the container
- Fleet owner can monitor the humidity of the container
- Fleet owner can monitor the roll angle
- Fleet owner can monitor the pitch angle
- Fleet owner has a GPS to locate the container in a different tab
- Fleet owner will be provided with historical graphs, these graphs will display the following information
    - Luminosity levels
    - Noise levels
    - Roll angle
    - Pitch angle
- New users can select their role to access different app features.
- Farming technicians can use the app to monitor the temperature of their container farm.
- Farming technicians can use the app to monitor the humidity of their container farm.
- Farming technicians can use the app to monitor the water level of their container farm.
- Farming technicians can use the app to monitor the soil moisture of each plant in their container farm.
- Farming technicians can use the app to monitor the fan state of their container farm.
- Farming technicians can use the app to see whether the lights are on in their container farm.
- Farming technicians can use the app to control the fan state.
- Farming technicians can use the app to turn the lights on or off.

Would like to develop

- Fleet owner can choose from the different containers to see its information

- Fleet owners can share historical security data.
- Farming technicians can use the app to set a minimum and maximum humidity level and be notified when levels surpass it.
- Farming technicians can use the app to set a minimum and maximum temperature and be notified when levels surpass it.
- Farming technicians can use the app to set a minimum water level and be notified when levels surpass it.
- Farming technicians can use the app to set a minimum and maximum soil moisture level and be notified when levels surpass it.
- Farming technicians can see historical data about temperature.
- Farming technicians can see historical data about humidity.
- Farming technicians can see historical data about water levels.
- Farming technicians can share historical data charts.

Could develop if time permits.

- New users can create an account with a username and password.
- Existing users can login.
- Farming technicians can set a “sleep” time where the lights automatically turn off.
- Farming technicians can set a “wake up” time where the lights automatically turn on
- The app has a custom logo.
- The user can ask the app to remember them so they can avoid signing in every time the app opens.

Likely would not develop because of lack time or knowledge.

- The app shows a loading animation when the app is loading.
- Users can select between dark and light mode.

Stories

Epic - As a farming technician, I want to be able to monitor the growing environment in my assigned container farm so that I know what I need to alter or fix.

- As a farm technician, I want to see the temperature of my container farm on my mobile app so that I can adjust it accordingly.
- As a farm technician, I want to see the humidity of my container farm on my mobile app so that I can adjust it accordingly.

- As a farm technician, I want to see the water levels of my container farm on my mobile app so that I know when they need replenishing.
- As a farm technician, I want to see the soil moisture levels of each plant on my mobile app so that I know whether they are getting the right amount of water.
- As a farm technician, I want to see whether my container farm's fan is on or off from my mobile app so that I know what adjustments I can make to influence the growing environment, and to get feedback when I alter the fan state.
- As a farm technician, I want to be able to see whether the container farm's light is on or off from my mobile app so that I know what adjustments I can make to the lights, and to get feedback when I alter the light's state remotely.
- As a farm technician, I want to be able to set a minimum and maximum humidity level so that I can be warned when my farm container's humidity reaches an undesirable level.
- As a farm technician, I want to be able to set a minimum and maximum temperature level so that I can be warned when my farm container's temperature reaches an undesirable level.
- As a farm technician, I want to be able to set a minimum water level so that I can be warned when my farm container's water level is too low.
- As a farm technician, I want to be able to set a minimum and maximum soil moisture level so that I can be warned when a plant's soil moisture reaches an undesirable level.
- As a farm technician, I want to receive a notification when the farm container's temperature reaches an undesirable level so that I don't have to constantly monitor my mobile app.
- As a farm technician, I want to receive a notification when the farm container's humidity reaches an undesirable level so that I don't have to constantly monitor my mobile app.
- As a farm technician, I want to receive a notification when the farm container's water level is too low so that I don't have to constantly monitor my mobile app.
- As a farm technician, I want to receive a notification when a plant's soil moisture reaches an undesirable level so that I don't have to constantly monitor my mobile app.

Epic - As a farming technician, I want to be able to control the lights and fan in my assigned container farm so that I can respond appropriately to the growing environment that I will monitor on my web app

- As a farm technician, I want to be able to turn the fan on or off from my mobile app so that I can influence the temperature and humidity of the container farm remotely.
- As a farm technician, I want to be able to turn the farm container's light on or off from my mobile app so that I can adjust the growing conditions manually and remotely.
- As a farm technician, I want to be able to set a "wake up" time when the lights automatically turn on so that I don't have to manually turn the lights on every morning.

- As a farm technician, I want to be able to set a "sleep" time when the lights automatically turn off so that I don't have to manually turn the lights off every evening.

Epic - As a farming technician, I want to be able to see historical data regarding the growing environment of my assigned container farm so that I can identify trends or irregularities.

- As a farming technician, I want to be able to see historical temperature data so that I can see that I can identify trends about when temperatures get too high or too low.
- As a farming technician, I want to be able to see historical humidity data so that I can see that I can identify trends about when humidity levels get too high or too low.
- As a farming technician, I want to be able to see historical water level data so that I can see that I can see how long it normally takes until my water needs to be refilled.
- As a farming technician, I want to be able to share historical data graphs, so that I can easily share data with my coworkers.

Epic - As a user, I want to be able to make an account as a fleet manager or a farming technician, and later login to that account to access data and tools specific to my work.

- As a new user, I want to have the option to create an account as a fleet manager or a farming technician, so I can access data and tools specific to my role.
- As a new user, I want to have a unique username, so there's no confusion between two different users.
- As a new user, I want to have the option to login to my account as a fleet manager or a farming technician, so I can access data and tools specific to my role.

Epic - As a fleet owner, I want to be able to monitor the security features of the farm so that I can ensure the well being of my product.

- As a fleet owner, I want to read noise levels, so I can monitor any disturbance at the farm
- As a fleet owner, I want to read luminosity levels, so I can monitor the built in light system.
- As a fleet owner, I want to read the motion sensor state, so I can be alerted of any intruders
- As a fleet owner, I want to read the door-lock state, so I can make sure the farm is safe
- As a fleet owner, I want to read the door state, so I can know if any doors were opened in case of a emergency

- As a fleet owner, I want to monitor the temperature, so I can know if there's any hazards happening
- As a fleet owner, I want to collect GPS location data for all containers so that I can track their movement and location history.
- As a fleet owner, I want to be notified when any of my containers leave a specified radius, so that I can track their movement and location history, and respond promptly in case of any unexpected movements or missing containers.
- As a fleet owner, I want to be able to read the pitch angles of every container so that I can monitor any potential issues with container stability.
- As a fleet owner, I want to be able to read the roll angles of every container so that I can monitor any potential issues with container stability.
- As a fleet owner, I want to monitor the historical data of the luminosity levels, noise level, roll and pitch angles, so I can know of any problem that may come and re-track from the data
- As a fleet owner, I want to read the buzzer state (on/off) so that I can determine if there are any alarm conditions or issues with the equipment.

Epic - As a fleet owner, I want to control some of the equipment, so I can override the states if the farm technician is not able to take care of the equipment.

- As a fleet owner, I want to control the door-lock state, so I set "open" or "close", which allows me to have full control over the access of my fleet.
- As a fleet owner, I want to control the buzzer state (on/off) so that I can toggle the buzzer remotely if necessary to alert the farm technician or farmer of an issue with the equipment or the crops.

Epic - As a user, I want a visually appealing User Interface to ensure a seamless and enjoyable user experience, thus alleviating any inconvenience that may arise during app usage.

- As a user, I want a dynamic logo feature that enables me to visually verify the app's loading status, ensuring that it is not frozen during the loading process, and thus reducing the frustration and inconvenience associated with extended waiting periods.
- As a user, I would appreciate a dark mode feature to facilitate comfortable use of the app at night or in low-light conditions, mitigating eye strain and discomfort associated with prolonged exposure to bright screens.
- As a user, I would like to have an app logo representative of the app so I can easily distinguish and launch it.

- As a user, I want to be able to select a “remember me” button on the login screen and automatically sign in on subsequent app openings, so that I don’t need to enter my login information every time I open the app.

Showstoppers and Open Questions

Questions:

- Which is a better option for data storage, SQLite3 or Microsoft SQL Server?
- How are we storing user data for authentication?
- What is the process for assigning containers to a fleet owner?
- How will we authorize users?
- What happens when a user forgets their password?
- What is the process when a fleet owner acquires a new container?