2023

Design Document

CONNECTED TRACTORS

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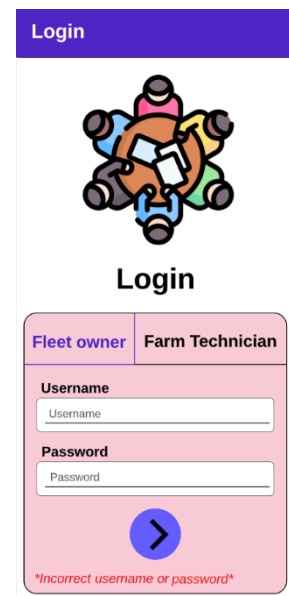# Contents

Functional Overview

Connected Tractors is a mobile app designed to allow a farmer to control the environment and measure data in their container farm. The app can control the state of the actuators in the farm container (i.e., lights, fans), and can measure data tracked from the farm container (i.e., temperature & humidity, soil moisture levels, water levels).

Design Overview

Login Page

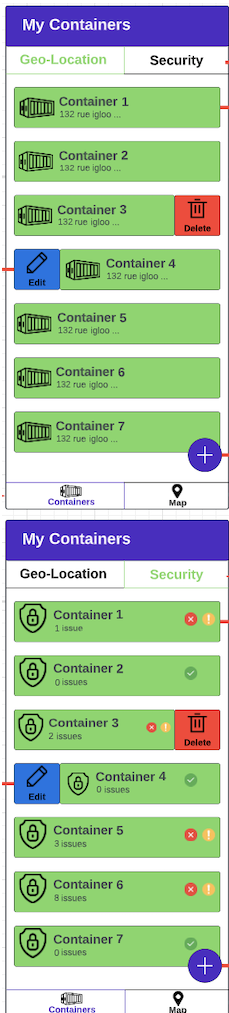The login page is used to login a fleet owner or farm technician to the app. The user has the option to switch between a 'Fleet Owner' and a 'Farm Technician' tab to either login as a Fleet Owner or a Farm Technician. The user would have to enter a username and password to login.

Once successfully logged in, the page would navigate to either the Fleet Owner or Farm Technician page depending on the tab used to login.

Fleet Owner Page

The Fleet Owner page is used to display a list of the containers the owner owns, and to show relevant information about the containers. The fleet owner will have the option to switch between a 'Geo-Location' and 'Security' tab to display information on the Geo-Location and Security of the containers.

On the Geo-Location tab, a container would display a container icon, the name of the container next to the icon, and the address of the container at the end of the container list item.

On the Security tab, a container would display a security icon, the name of the container next to the icon, a text displaying the number of issues with the container under the container name. Also, a status icon of the container at the right of the list item indicates green if everything is working properly, yellow if some issues, and red if nothing is working properly. Also, if there's some issues or nothing is working properly, an information icon will appear on the right of the status icon that the fleet owner can click to view a list of the problems wrong with the container.

The fleet owner will be able to click on a container and the app will navigate to the container's information page.

The fleet owner can swipe left on the container item to delete the specific container farm and swipe right to edit it.

The fleet owner will be able to click on an 'add' floating icon on the bottom right of the screen in both tabs to add a new container.

Container's Information Page

The Container information page will be a page with 2 tabs; "Geo-Location" and "Security", each page will contain the appropriate information.

In the Geo-Location tab, the address, pitch, roll angle, vibration levels, and buzzer control will be available. There will also be a button on the bottom of the page with "Show on map" which will open the map page when clicked.

The other tab will be the "Security" tab which will display security related information. Noise levels, luminosity, motion information, door status and door control. The buzzer control will also be available on this page as well. The bottom of the page will have the same "Show on map" button which will open the map and show the location of the container

Add Container Farm Page – Would like to develop

The adding a container farm page is used by a fleet owner to add a new container farm to their fleet. The fleet owner must enter a name, an address for the new container farm and the connection string to connect to azure.

The fleet owner will be able to cancel adding a new container farm, which they will be asked if they're sure they want to cancel. If not, they'll continue adding the container farm page, however if yes, the fleet owner will be navigated back to the list of containers on the tab they chose.

The fleet owner will be able to click an 'Add' button to add the new container farm. Once clicked, the fleet owner will be navigated back to the list of containers on the tab they chose, displaying the newly added container farm in the list.

Edit Container Farm Page – Would like to develop

The edit a container farm page is used by a fleet owner to edit the details of a container farm. The fleet owner will see the name and address of the container farm already input in the fields.

The fleet owner will be able to cancel editing the new container farm, which they will be asked if they're sure they want to cancel. If not, they'll stay on editing the container farm page, however if yes, the fleet owner will be navigated back to the list of containers on the tab they chose.

The fleet owner will be able to click a 'Save' button to save the container farm details. Once clicked, the fleet owner will be navigated back to the list of containers on the tab they chose.

Farm Technician Page
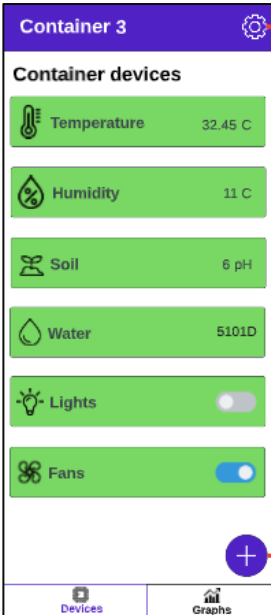
The farm technician page is used to display the readings from the sensors of the plant's subsystem (water levels, soil levels, temperature and humidity readings), view the statuses of the actuators (light and fan) and change the status of those actuators.

The technician will be able to change the behavior of the actuators with an on/off switch and there will also be an icon displaying the status of the fan and light on the right side of the actuators (connected or disconnected).

The technician will also be able to add other sensors and actuators by clicking on an add button. They can also delete them by swiping left on the item and a confirmation message will be shown if it is properly disconnected from Azure.

The technician can navigate to the "danger zone" settings page by clicking on button.

Add a container device Page – Would like to develop

This page will allow technicians to add a sensor or actuator to the technician's page. A dropdown list of available sensors or actuators will be displayed. An add button will be displayed where the technician will click to confirm the addition of the sensor or actuator, and they will be redirected back to the technician's page.

Fleet Owner Maps Page

The fleet owner will be able to navigate to the map view using the tab which will display a map with the locations of the fleets highlighted. It will be using the "Microsoft.Maui.Controls.Maps" NuGet package which uses built in apps such as google maps and apple maps so the displayed map will be one that the user is already familiar with.

Farm Technician Charts Page
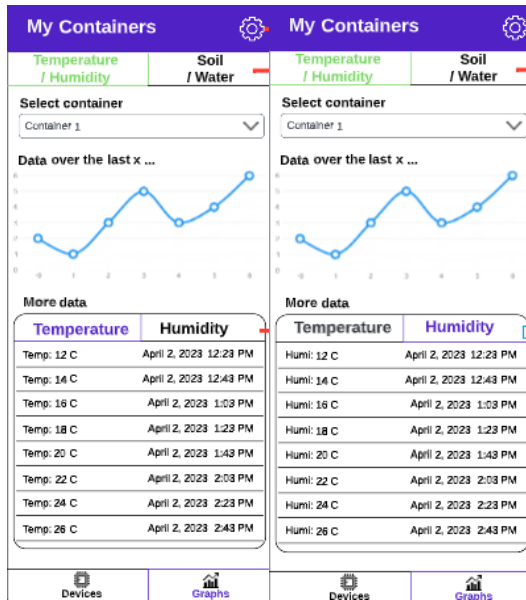
The technician charts page will display the different sensor readings over time. For example, the pH level will be tracked over time and a line chart will have a visual representation of the value. A line graph will be used to display the information gathered from the other sensors. This page will be accessed by tapping the collection views displaying the current sensor reading.

Settings Page – Could develop if time permits

The settings page will allow the farm technician to set or update the "danger zone" for the temperature and humidity. There will be a save button at the bottom of the page to save the settings. Once saved, the page will be redirected to the container's page.

App Prototype

Fleet Owner
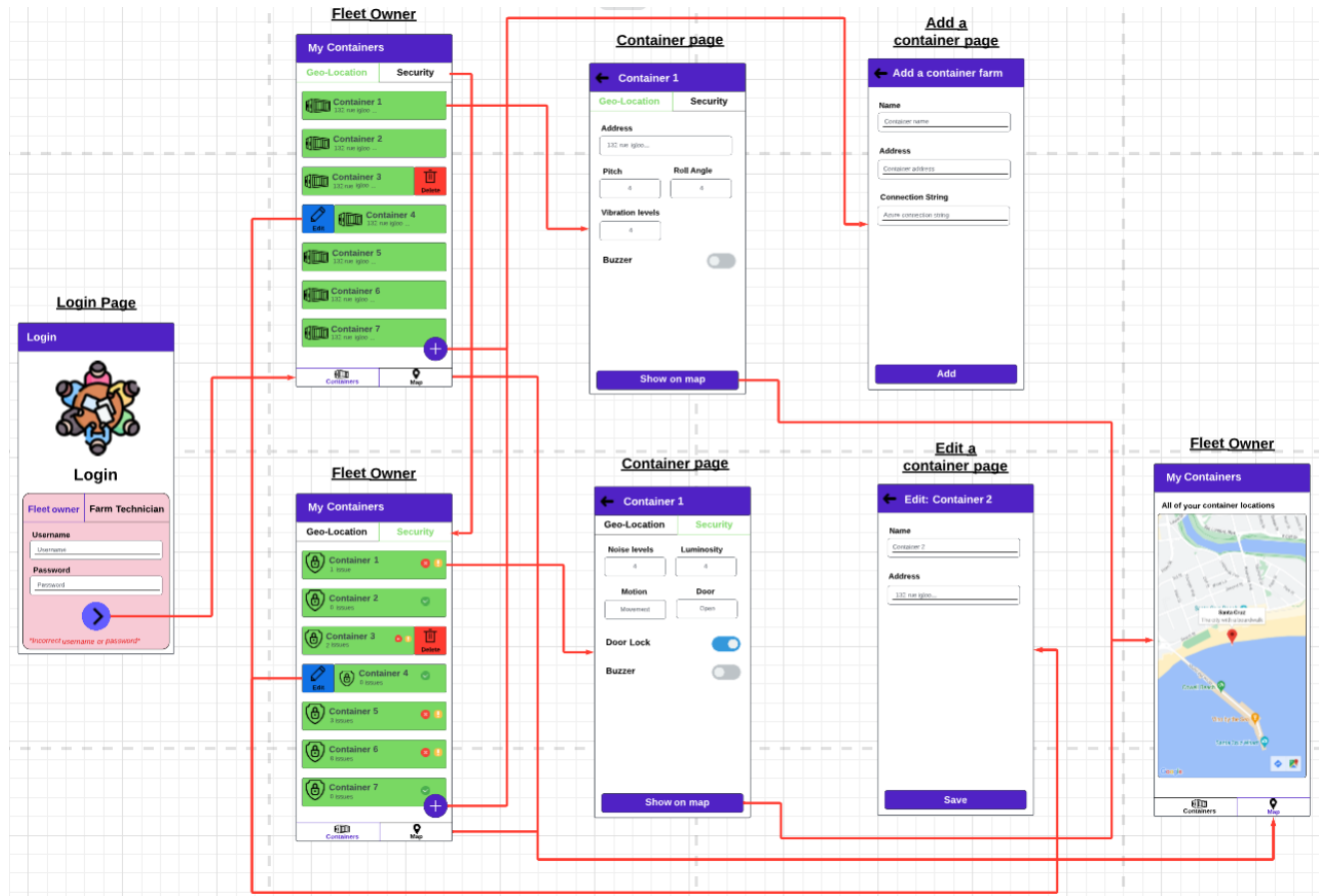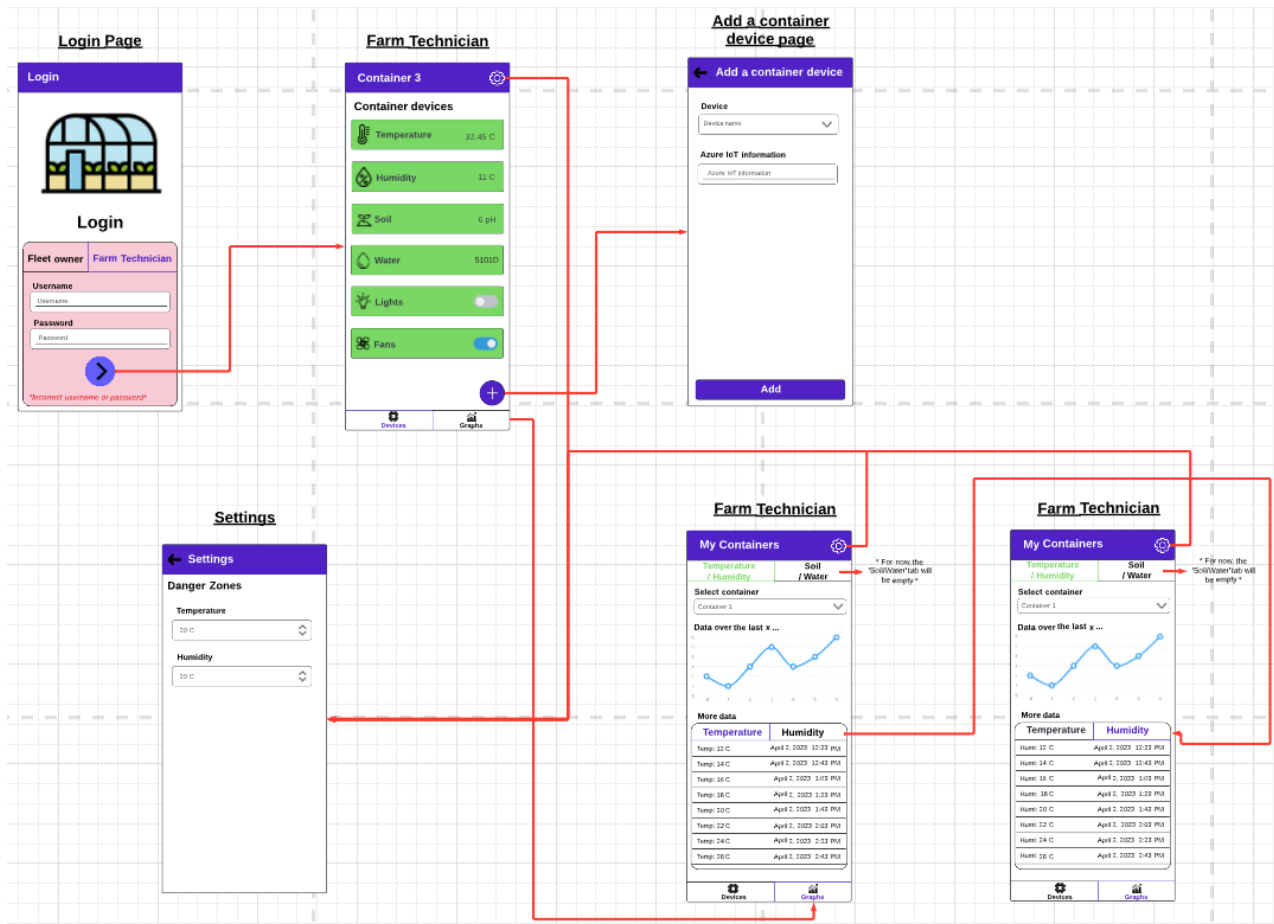
App Features – User Stories

Must develop

Farm Technician

1. As the farm technician, I want to be able to login by entering a username and password so that I can manage all the plants inside a container from seed to harvest.
   a. Farm technician can enter username and password in separate fields.
   b. An error is provided for wrong inputs.
   c. Once successfully logged in, the page will navigate to the container's page.
2. As the farm technician I would like to see all the readings from the sensors (temperature, humidity, soil and water) so I can keep track of the conditions of the plants.
   a. All the sensors would be listed in the container's page with the sensor's name and an icon representing the type of sensor.
   b. Get the readings of the devices from the IoT Hub.

  c. The readings will be displayed with the appropriate unit.
3. As a farm technician I would like to be able to see the current state of the fan so I can keep track of its current behavior.
  a. The fan would be displayed on the container's page with its name and an icon of the fan.
  b. Get the current state of the fan from IoT Hub
  c. The switch where the state of the fan is shown (on/off) would depend on the current state of the fan in the container farm.
4. As a farm technician I would like to be able to see the current state of the light so I can keep track of its current behavior.
  a. The light would be displayed on the container's page with its name and an icon of the light.
  b. Get the current state of the light from IoT Hub
  c. The switch where the state of the light is shown (on/off) would depend on the current state of the light in the container farm.
5. As a farm technician, I would like to know if the device is properly connected to azure and has no errors, so I know if the changes I make to the actuators and the readings from the sensors are correct.
  a. Check the connection of the device from IoT Hub.
  b. Get an error message, if any, from IoT Hub
  c. An icon pops up beside the actuator/sensor name if the device is not properly connected or if there is an error.
  d. When the icon is clicked, an error message shows what the issue is.
  e. The switch for the actuators is disabled.
6. As a farm technician I would like to be able to change the state of the fan and light if needed so I can make the necessary changes to keep the plants healthy.
  a. Get the current state of the fan and light from IoT Hub.
  b. There will be a switch on the right side of each actuator's name where the user can toggle between on and off.
  c. The state of the fan or light will change in the container farm once the changes are made.

Fleet Owner

1. As the fleet owner, I want to be able to login by entering a username and password, so that I can manage my container farms.
  a. Fleet owner can enter username and password in separate fields.
  b. An error message is provided for wrong input.
  c. The page navigates to the Geo-Location tab on the 'My Containers' page upon successful login.

2. As the fleet owner, I want to see two tabs on the 'My Containers' page, Geo-Location, and Security so that I can easily switch between seeing the placement of my container farms and seeing any possible security issues.
   a. The two tabs are located at the top of the 'My Containers' page.
   b. Each tab displays different data for each container.
3. As the fleet owner, I want to see a list of my containers in the Geo-Location tab, containing the container name and the container location, so that I can easily track the locations of my container farms.
   a. Get the location of the container from azure
   b. The container item displays the container name, the address below it, and a container farm icon on the left. The container item has a green background color.
   c. The container farms are displayed in a list format.
4. As the fleet owner, I want to see a list of my containers in the Security tab, containing the container name, a text displaying the number of issues, and a status icon, so that I can easily track any security issues with my container farms.
   a. Receive any issues from azure.
   b. The container item displays the container name, the number of issues below it, either a green status icon if everything is ok, or a red status icon if there's issues, followed by an information icon to display security issues, and a security icon on the left. The container item has a green background color.
   c. The container farms are displayed in a list format.
5. As the fleet owner I would like to see all the security information (noise levels, luminosity, motion, buzzer and door readings) so I can keep track of any abnormal security issues.
   a. Navigate to "Container Page" when a container in the security tab is clicked.
   b. Get the readings from IoT Hub
   c. Display the readings received in the fields.
6. As the fleet owner I would like to see all the geo-location information (pitch, roll angle, buzzer and vibration levels) so I can keep track of any abnormal environmental issues.
   a. Navigate to "Container Page" when a container in the geo-location tab is clicked.
   b. Get the readings from IoT Hub
   c. Display the readings received in the fields.

Would like to develop

1. As the fleet owner, on the Security tab of the 'My Containers' page, I want to be able to click on an add button to add a new container farm so that I can expand the number of container farms I own.
    a. The button is displayed as a floating action button on the bottom right of the page.
    b. When clicked, the button navigates to the 'Add a container farm' page.
    c. Once the user clicks save on the "Add a container farm" page, the container is added to the list of containers.
    d. The page redirects to the fleet owner page with the newly added container displayed.
2. As the fleet owner, on the Geo-Location tab of the 'My Containers' page, I want to be able to click an add button to add a new container farm so that I can expand the number of container farms I own.
    a. The button is displayed as a floating action button on the bottom right of the page.
    b. When clicked, the button navigates to the 'Add a container farm' page.
    c. Once the user clicks save on the "Add a container farm" page, the container is added to the list of containers.
    d. The page redirects to the fleet owner page with the newly added container displayed.
3. As the fleet owner, I want to be able to swipe left on a container farm in the Geo-Location tab on the 'My Containers' page and see a delete button, so that I can easily delete a container farm.
    a. The button has a red background color, with a trashcan icon and the word 'Delete'.
    b. When clicked, the fleet owner is displayed a prompt to verify deleting the container farm. If yes, the container farm is deleted from the list of my containers, if no, the container farm remains in the list.
4. As the fleet owner, I want to be able to swipe left on a container farm in the Security tab on the 'My Containers' page and see a delete button, so that I can easily delete a container farm.
    a. The button has a red background color, with a trashcan icon and the word 'Delete'.
    b. When clicked, the fleet owner is displayed a prompt to verify deleting the container farm. If yes, the container farm is deleted from the list of my containers, if no, the container farm remains in the list.

5. As the fleet owner, I want to be able to swipe right on a container farm in the Geo-Location tab on the 'My Containers' page and see an edit button, so that I can easily edit a container farm.
    a. The button has a blue background color, with a pencil/pen icon and the word Edit.
    b. When clicked, the page navigates to the 'Edit container farm' page.
    c. Once the user confirms the modification, all the changes are saved to the container.
    d. The page redirects to the fleet owner page with the newly added container displayed.
6. As the fleet owner, I want to be able to swipe right on a container farm in the Security tab on the 'My Containers' page and see an edit button, so that I can easily edit a container farm.
    a. The button has a blue background color, with a pencil/pen icon and the word Edit.
    b. When clicked, the page navigates to the 'Edit container farm' page.
    c. Once the user confirms the modification, all the changes are saved to the container.
    d. The page redirects to the fleet owner page with the newly added container displayed.
7. As a farm technician I would like to add additional sensors or actuators on my container's page so I can keep track of newly added sensors or actuators in the container farm.
    a. An add button will be displayed at the bottom right of the page to be able to add sensors or actuators.
    b. The page will be redirected to "Add a container device" page when I click on the button.
    c. I can choose the sensor or actuator I would like to add from the list of devices shown (pick list)
    d. The device will be added once the add button is clicked.
    e. A pop-up message will be shown to confirm the addition of the device.
    f. The page will be redirected to the container's page.
8. As a farm technician I would like to delete sensors or actuators from the page so I can remove any unused devices.
    d. A delete option will be shown when I swipe left on an actuator or sensor.
    e. A confirmation message will be shown before deleting the device to make sure there's no accidental deletion.
    f. A message will be shown to confirm the device has been deleted.
    g. If the user confirms the deletion, the device is deleted.

Could develop if time permits

1. As a farm technician, I would like to be able to set a "danger" zone for the sensors (temperature and humidity) so I can keep track of any abnormal environmental status.
    a. Set a default danger zone.
    b. Get the current danger zone values and display it in the field.
    c. Arrows will be shown for each field to increase or decrease the "danger zone".
    d. A button on the farm technician's page will allow the user to navigate to the settings page.
    e. The text color of the readings for the sensors will be red if the readings received from the sensor are in the danger zone.

Likely would not develop because of lack time or knowledge

1. As a fleet owner, I would want to click on a container and see its location so I can visually keep track of its location on a map.
    a. Get the current location of the container from the GPS.
    b. Clicking on a container on the geo-location tab would open a map indicating its current location.

Potential Showstoppers & Open Questions

Questions

Concerns

1. We are a little worried about the time constraint as we feel, especially with the ice storm, we don't have enough time to be able to accomplish everything in the Must Develop section.