THE UNIVERSITY OF BRITISH COLUMBIA

IoT Monitoring of Aquaponic and Hydroponic Food Production

USER MANUAL

UBC Electrical and Computer Engineering Capstone 121

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Contents

1 Change Log

The change log documents changes made to the document.

Table 1: Change Log of Document

Date	Author	Sections	Change
2021-01-23	CB	1.0 - 4.0	Creation of document skeleton
2021-04-11	LC	5.1	added pH calibration
2021-04-11	CB	5.2	Part Replacement Policies
2021-04-13	MD	4.0	Mobile Application Operation

2 Introduction

This User Manual is designed to walk a person unfamiliar with wireless technology through the steps of setting up, using, and maintaining a monitoring and control system for their pre-existing aquaponic or hydroponic growing system.

3 Installation

For installation instructions, please refer to the Installation Guide Document.

4 Operation

To control the actuators and view the sensor values of the PiPonic system, the user would have to use the companion mobile application. The PiPonic application is a mobile application that, in conjunction with a raspberry pi, sensors, and actuators, monitors an aquaponic/hydroponic system. In the PiPonic application, the user is able to create an account and is able to view and manipulate the aquaponic/hydroponic systems associated with that account. The application also allows users to add existing aquaponic/hydroponic systems to their account granted they know the existing aquaponic/hydroponic's unique identification.

4.1 Launching Mobile Application

In the application drawer of the mobile device, the PiPonic application should be within the already downloaded applications. The application icon should be the same as the image below in Figure 1.

4.2 Splash Screen

After selecting the PiPonic application, the application's splash screen will appear as seen in the image below in figure 2. The user's credential, if the user has previously

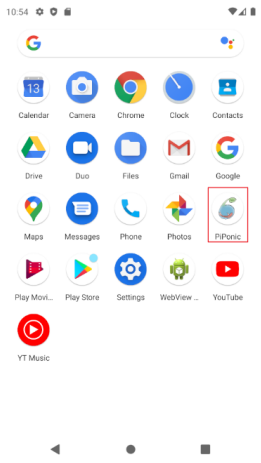

Figure 1: PiPonic application in application drawer

logged into the application, will be loading in the background of this screen. The splash screen should be visible for approximately a couple of seconds. After the splash screen finishes loading, the application would then take the to different screens depending on if the user has previously logged in the application or not. If the user has not previously logged in the application, then the user will be brought to the sign in and sign up screen. If the user has previously logged in the application, the application will bring the user to the home screen.

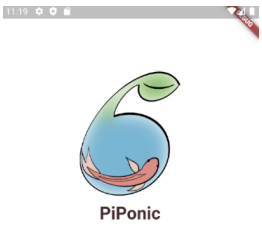

Figure 2: PiPonic splash screen

4.3 Sign In and Sign Up Screen

The sign in and sign up options screen will be presented to users who aren't previously authenticated on the application. The sign in and sign up options screen will give the user the option to either sign up for an account or login to an existing account. The user can sign up with the application by providing an email and password or by signing in using an existing account. An image of the application's sign in and sign up options screen can be seen below in figure 3.

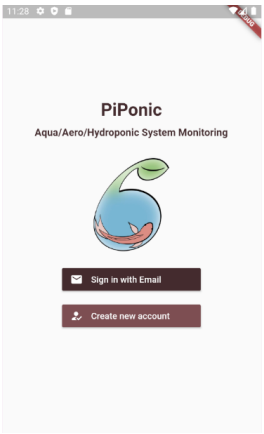

Figure 3: PiPonic sign-in and sign-up screen

4.4 Sign In Screen

The sign in screen is presented when the user taps on the "Sign in with Email" option in the sign in and sign up options screen. This page contains two input fields for the email address and password. Unsuccessful authentication submissions won't let the user into the application whereas successful authentication submission will direct users to the application's home screen. The email input box verifies that it's a valid email address by checking if the '@' character is present within the email submission. Similarly password input box verifies that the password is sufficient by the password length is at least 6 characters. An image of the sign in screen can be seen below in figure 4.

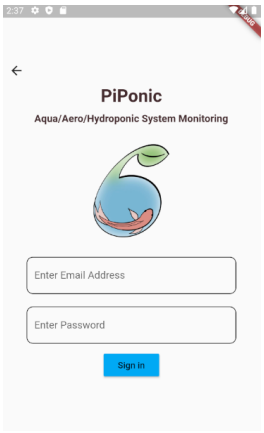

Figure 4: PiPonic sign in screen

4.5 Sign Up Screen

The sign up screen is presented when the user taps on the "Create new account" option in the sign in and sign up options screen. This page contains two input fields for the email address and password. Unsuccessful sign up submissions won't let the user into the application whereas successful sign up submission will direct users to the application's home screen. The email input box veries that it's a valid email address by checking if the '@' character is present within the email submission. Similarly password input box veries that the password is sucient by the password length is at least 6 characters. An image of the sign up screen can be seen below in figure 5.

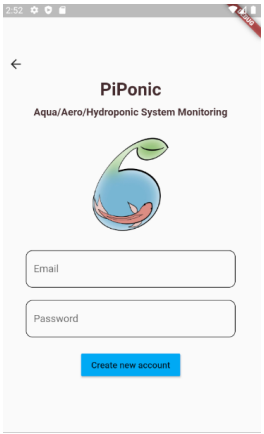

Figure 5: PiPonic sign up screen

4.6 Home Screen

The home screen is presented when the user successfully authenticates with the application. The home screen will differ in appearance depending on whether or not the user has any existing aquaponic/hydroponic system(s) associated with their account.

4.6.1 No Existing Aquaponic/Hydroponic System(s)

If there are no existing aquaponic/hydroponic system(s) associated with the users account, the home screen (and every subsequent tab in the bottom navigation bar) will just show a page where the user is able to enter an aquaponic/hydroponic ID. Here the user is able to enter the unique identification of an existing aquaponic/hydroponic to their account. An image of the screen where the user can add an existing aquaponic/hydroponic system to their account can be seen below in figure 6.

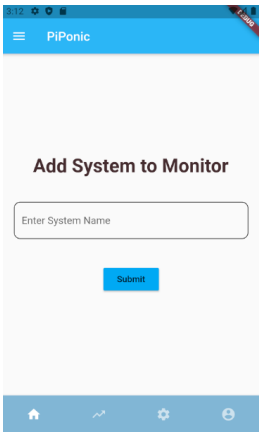

Figure 6: No existing aquaponic/hydroponic system(s)

4.6.2 Existing Aquaponic/Hydroponic System(s)

If there are existing aquaponic/hydroponic system(s) associated with the users account, the home screen will show a summary of one of the existing systems. The home page would show a summary of the chosen system including the name of the system, the status of the system, last time the information was updated, the warnings for the system, and a list of all the sensors and it's measured values. An image of the home screen with the summary of an aquaponic/hydroponic system can be seen below in figure 7.

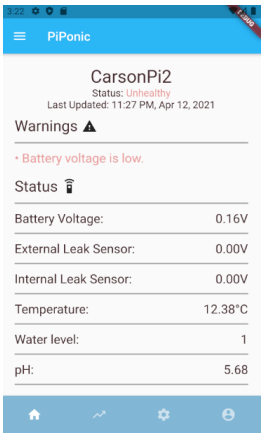

Figure 7: Home screen with existing aquaponic/hydroponic system(s)

4.7 Aquaponic/Hydroponic List

Taping on the hamburger menu button on the top left of the application, the list of the user's aquaponic/hydroponic systems will slide out. Here the user is able to switch between the different aquaponic/hydroponic systems associated with their account. An image with the location of the hamburger menu button and the list of the user's aquaponic/hydroponic systems is shown below in figure 8.

4.8 Chart Screen

Tapping on the rising trend icon in the bottom navigation bar brings the user to the chart screen where the user is able to see a chart of their sensor values and the time at which they were measured. Here the user is able to change the different sensors

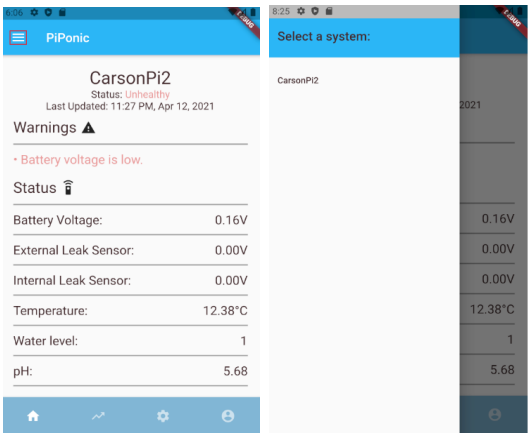

Figure 8: Location of the hamburger menu button and the list of the user's aquaponic/hydroponic systems

that they want to see and are also able to change the range of time for which the measurements were taken. A screenshot of the charts screen can be seen below in figure 9.

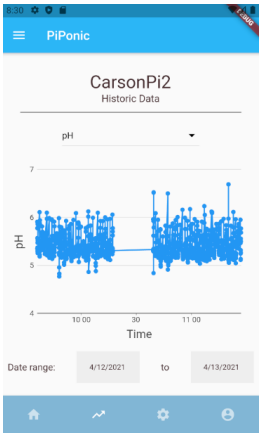

Figure 9: PiPonic Chart Screen

4.9 System Settings Screen

Tapping on the gear icon in the bottom navigation bar brings the user to the aquaponic/hydroponic system setting page. Here the user can set the range of acceptable values for the aquaponic/hydroponic sensors and well as calibrate the pH sensor. The user can also change the sensor measurement interval by clicking on the "General" tab on the screen. A screenshot of the aquaponic/hydroponic settings screen can be seen below in figure 10.

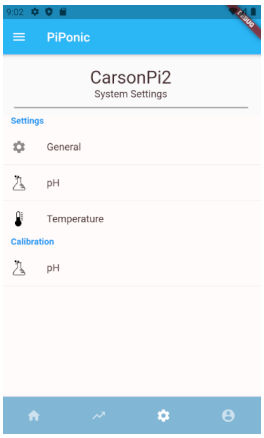

Figure 10: PiPonic system settings screen

4.10 User Settings Screen

Tapping on the user icon in the bottom navigation bar brings the user to the user settings page. Here the user can add additional aquaponic/hydroponic systems to their account to monitor and control. The user can also logout of their account and delete their account. A screenshot of the user settings screen can be seen below in figure 11.

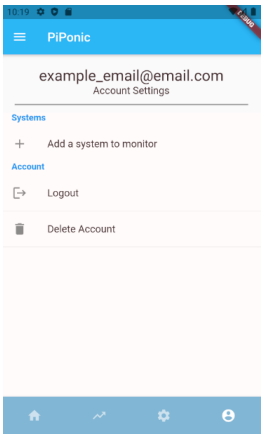

Figure 11: PiPonic user settings screen

5 Maintenance

5.1 pH Calibration

The pH sensors must be calibrated every month. Before calibration, the user must have 2 solution with distinctively different pH values. The most common solutions that can be bought are solutions with pH of 4,6, or 7. Navigate through the app to reach the pH calibration screen.

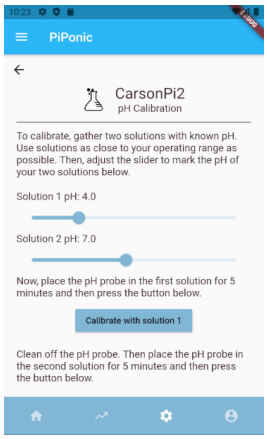

Figure 12: pH Calibration Screen

There are 2 pH sliders for the 2 solutions the user has. Make sure that the pH values match the pH for the solutions being used. Place the pH probe in solution 1 and mix it around for a few seconds. Then press the "Calibrate with solution 1" button on the app. Wait for 5 minutes, then take the pH probe, clean it, then place the pH

probe in solution 2. Press the "Calibrate with solution 2" button the app and wait for 5 minutes.

Once this process is finished, the user has successfully calibrated the pH sensor.

5.2 pH Solution

We recommend alternating between potassium hydroxide (KOH) and calcium hydroxide (CaOH) as a basic solution to add to your system. This can be done in 1 gallon increments, which should last about a week.

5.3 Part Replacement

Some items have limited lifespans, such as the back-up batteries and the pH-sensor.

The back-up batteries should be replaced after their combined voltage drops below 1V.

The pH sensor should be replaced after 1 year of use, or if the user notices that it is no longer maintaining stable measurements, or accurately measuring pH.