TinyCare documentation

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1. Roles and Responsibilities

Kwa Li Ying

Android Programmer

- Program both the front-end and back-end of the User Interface
- Link functions of the self-care system to the Android app through Firebase
- Work closely with Jeremy

Heng Jing Han

Hardware Builder

- Build the hardware with the components attached to it
- Work closely with Jeremy

Chew Wen Jie, Jeremy

Raspberry Pi Programmer

- Wire up and program the hardware components through the Raspberry Pi
- Test the components
- Work closely with Li Ying and Jing Han

** Note that each team member is not solely confined to his own role; he/she may help another teammate in the event that his/her job is done or the latter is facing issues in that area.

2. Items required

No.	Items	Price (S$)	Place of purchase and remarks
1	2 X RPI 3 B bundle	140	https://www.aliexpress.com/item/4000066043319.html?spm=a2g0o.productlist.0.0.2512737308Sc8F&s=p&algo_pvid=9b4f389f-e1b9-41a3-9d28-6ae51da73d48&algo_expid=9b4f389f-e1b9-41a3-9d28-6ae51da73d48-0&btsid=9234d2c9-2d87-42e3-9464-b1afd09e5807&ws_ab_test=searchweb0_0,searchweb201602_2,searchweb201603_53 Remember to get the whole bundle instead of just the Rpi as you will require the power plug and sd card as well
2	RPI 5 inch display	56	https://www.aliexpress.com/item/32340381318.html?spm=a2g0o.productlist.0.0.728d2523fRAdVN&algo_pvid=d0560c95-4b33-4670-a90d-6faf60b90e59&algo_expid=d0560c95-4b33-4670-a90d-6faf60b90e59-29&btsid=1319695a-f486-4ad5-afa8-c4ee72dba238&ws_ab_test=searchweb0_0,searchweb201602_2,searchweb201603_53
3	2 X RPI camera	7.50	https://www.aliexpress.com/item/32946093276.html?mb=mylGLzQ0XklJ6Zg&srcSns=Telegram&tid=white_backgroup_101&tt=sns_Other&rdtUrl=https://www.aliexpress.com/item/32946093276/32946093276.html?mb=mylGLzQ0XklJ6Zg&srcSns=Telegram&tid=white_backgroup_101&aff_platform=default&cpt=1573395378974&sk=NzQIN7j6&aff_trace_key=2e1d00f1fcf94cb88c2b552a3dd19e1f-1573395378974-08351-NzQIN7j6&businessType=ProductDetail&templateId=white_backgroup_101&platform=AE&terminal_id=5e84dce5029044ffad208bda46b49c20 Rpi built-in camera, very useful and easy to learn. Do not over bent or stretch the wires, they can be very sensitive and can affect image quality
4	2 X Stepper motor	4.50	https://www.aliexpress.com/item/33017488245.html?spm=a2g0o.productlist.0.0.699f411bLBMtlc&algo_pvid=10d917a1-6784-4423-b21e-fd738

			995fead&algo_expid=10d917a1-6784-4423-b21e-fd738995fead-8&btsid=6e738064-a8f8-4dc6-9be5-0a76319b4705&ws_ab_test=searchweb0_0,searchweb201602_2,searchweb201603_53 Use this instead of servo as it allows continuous rotation to turn the cereal dispenser to dispense the food.
5	PCF8591 AD/DA Converter Module Analog-to-digital/Digital-to-analog Conversion Module	8.89	https://www.lazada.sg/products/weekw-pcf8591-adda-converter-module-analog-to-digitaldigital-to-analog-conversion-module-i327992364-s695728018.html?exlaz=d_1:mm_150050845_51350205_2010350205::12:1025267241!54483208270!!!pla-297963845945!c!297963845945!695728018!136971809&gclid=Cj0KCQiApaXxBRDNARIsAGFdaB9yA37oAA0C8JkYH5LQVwmxkaNoeTIgdIEXc9EOoO1XWJo5wZo7CtMaAuE3EALw_wcB Required for the turbidity sensor to convert digital signals to analog signals.
6	Turbidity Sensor Water Turbidity Module Mixed Water Detection Module	16.65	https://www.lazada.sg/products/turbidity-sensor-water-turbidity-module-mixed-water-detection-module-i515406706-s1438644995.html?exlaz=d_1:mm_150050845_51350205_2010350205::12:1025267241!54483208270!!!pla-762460417326!c!762460417326!1438644995!138204052&gclid=Cj0KCQiApaXxBRDNARIsAGFdaB88bdOLIk7xqvCkO0igBur0qS4hnFyfFLrFsnbJXFCP7BaK3dVHpToaAgMPEALw_wcB Used to measure water pollution level
7	Cereal dispenser	15.20	https://www.lazada.sg/products/weekw-pcf8591-adda-converter-module-analog-to-digitaldigital-to-analog-conversion-module-i327992364-s695728018.html?exlaz=d_1:mm_150050845_51350205_2010350205::12:1025267241!54483208270!!!pla-297963845945!c!297963845945!695728018!136971809&gclid=Cj0KCQiApaXxBRDNARIsAGFdaB9yA37oAA0C8JkYH5LQVwmxkaNoeTIgdIEXc9EOoO1XWJo5wZo7CtMaAuE3EALw_wcB To dispense pet food downwards, used in conjunction with stepper motor
8	Water tube	1	Sim Lim Tower

9	Gravity: Photoelectric Water / Liquid Level Sensor For Arduino	20	https://www.dfrobot.com/product-1470.html?search=Gravity%3A%20Photoelectric%20Water%20%2F%20Liquid%20Level%20Sensor%20For%20Arduino&description=true
10	Solenoid Valve	2.99	https://www.aliexpress.com/item/32810701087.html?spm=a2g0o.productlist.0.0.46e3651aeSOmj5&algo_pvid=42bef818-56e6-4003-b044-72a5f1b185b8&algo_expid=42bef818-56e6-4003-b044-72a5f1b185b8-2&btsid=87ad5e2c-d6ef-4433-bb0c-00d083bc78af&ws_ab_test=searchweb0_0%252Csearchweb201602_10%252Csearchweb201603_55&dp=4875f4d40d3a7ed6ad7b490739327886&af=531775&cv=47843&afref=https%253A%252F%252Fwww.aliexpress.com%252Fitem%252F32810701087.html%253Fspm%253Da2g0o.productlist.0.0.46e3651aeSOmj5%2526algo_pvid%253D42bef818-56e6-4003-b044-72a5f1b185b8%2526algo_expid%253D42bef818-56e6-4003-b044-72a5f1&mall_affr=pr3&dp=4875f4d40d3a7ed6ad7b490739327886&af=531775&cv=47843&afref=https%253A%252F%252Fwww.aliexpress.com%252Fitem%252F32810701087.html%253Fspm%253Da2g0o.productlist.0.0.46e3651aeSOmj5%2526algo_pvid%253D42bef818-56e6-4003-b044-72a5f1b185b8%2526algo_expid%253D42bef818-56e6-4003-b044-72a5f1&mall_affr=pr3&aff_request_id=3e695cb7d31a464cb7f6ff38c49e231c-1579772524650-08233-VnYZvQVf&aff_platform=aaf&cpt=1579772524650&sk=VnYZvQVf&aff_trace_key=3e695cb7d31a464cb7f6ff38c49e231c-1579772524650-08233-VnYZvQVf&terminal_id=87d18dcb8d0141259c71ff99fac0e731 Works differently from water pump It's like a tap, either stops water from flowing, or not. It cannot do work on the water.
11	Fish tank	12.00	Pet lovers centre
12	Acrylic	34.05	Dama Trading Pte Ltd Get pieces of transparent acrylic that can envelop the top of the fish tank to be made into a customizable cover.
13	Water Pump (x4)	6.40	https://shopee.sg/1Pcs-Ultra-quiet-Mini-DC-3-6V-120L-H-Brushless-Motor-Submersible-Water-Pump-Top-i.60317321.1262672785 Works differently from the valve, it doesn't stop

			water from flowing through it but it does work on the water to push it up against gravity.
14	Moisture sensor (x2)	4.13	https://shopee.sg/Soil-Humidity-Hygrometer-Moisture-Detection-Sensor-Module-For-Arduino-i.50203676.1279852868?gclid=Cj0KCQiAr8bwBRD4ARIsAHa4YyLgZRtxvR9HEhpcVnZArH9sjlwjq5D6YGeZInZ2nqVEQGq8WSi2eVsaAswBEALw_wcB
15	PB S/Tape	1	Horme Hardware
16	Fastening tape (Velcro)	5.20	Horme Hardware Turns out to be very useful
17	MISC(UHU glue, tape, velcro, pen knife, black tape)	25.81	Horme Hardware
18	Cable tie	4.35	Horme Hardware
19	Heat shrink 3mm	12.85	Horme Hardware
20	Fake plant	3.50	Japan Home
21	Transparent cups for soil	1.60	Hardware shop
22	Glue sticks	6.00	Hardware shop
23	Wood board	16.00	Daiso Acts as base for our product and prototype
24	Skittles	11.80	Value dollar shop Used as mock pet food We do not use real pet food to demonstrate due to hygiene purposes
25	Velcro	3.90	Popular Turns out to be very useful
26	Pipe	1.50	Hardware shop
27	3 Socket Soap Bar	11.90	Hardware shop
28	Cup to act as water tank	2.60	Hardware shop

3. Overall project view

User Interface Design

New features to be added to the App:

- Main screen is empty, pets are added manually to it by an ID
- Every set of hardware has their own id (for that hardware & pet)
  → To add in a pet self-care system to the main page, the user have to key in id
- FishCare UI
  → Feed Tab is same as that in HamsterCare, but have 3 tabs - Feed, Turbidity(Pollution), and Water Level + AutoFeed
- PlantCare UI
  → Feed Tab is same as that in HamsterCare, but have only 2 tabs -Water plant and Soil moisture Level + AutoFeed

FishCare System

Features

1. Feeder
   → No way to sense the weight of the existing food in the tank
   → Feed at regular intervals daily
   → App will notify when user forgets to feed at scheduled timing daily or more than 24 hours
2. Turbidity sensor
   → Measure how polluted the water is from the algae and other sediments
   →Inform user to clean up the tank
3. Water level sensor
   → Measure the water level and inform the user
   →If the water level is too low(Eg. Due to evaporation), the user is able to top up the water in the fish tank through the App.

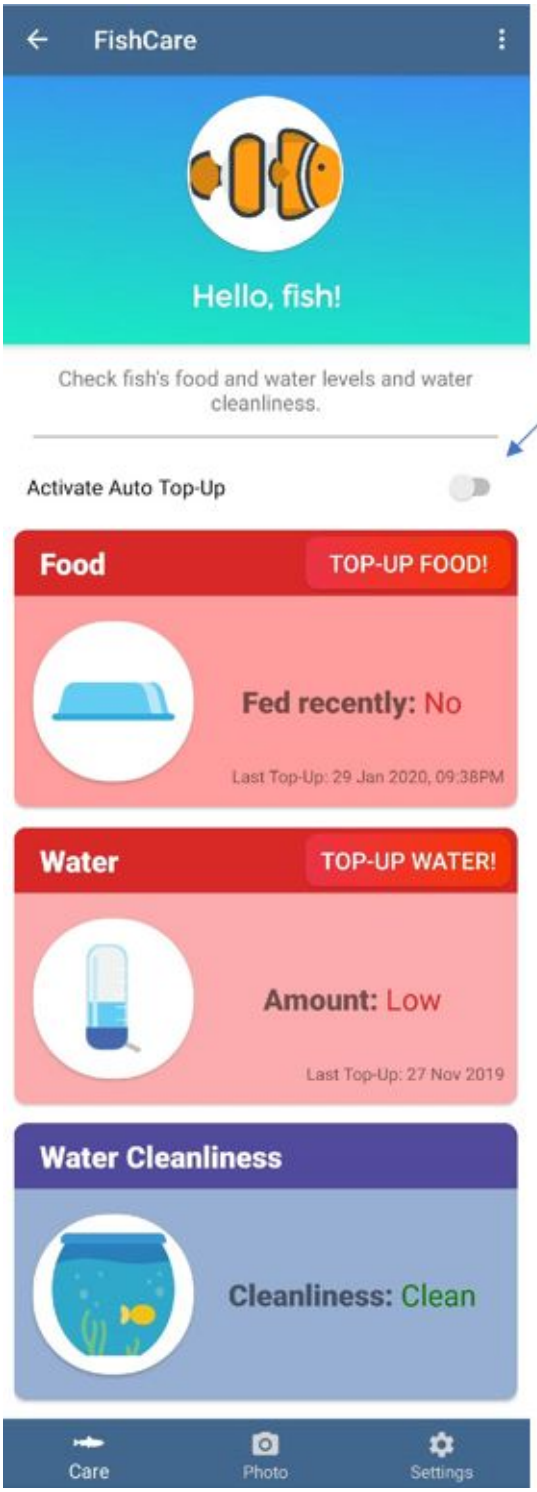
PlantCare System

Features

1. Soil moisture sensor
   →Used to monitor the moisture level in the soil
2. Water pump
   → Enable the App user to water the plant remotely when the soil is too dry

4. User interface

FishCare



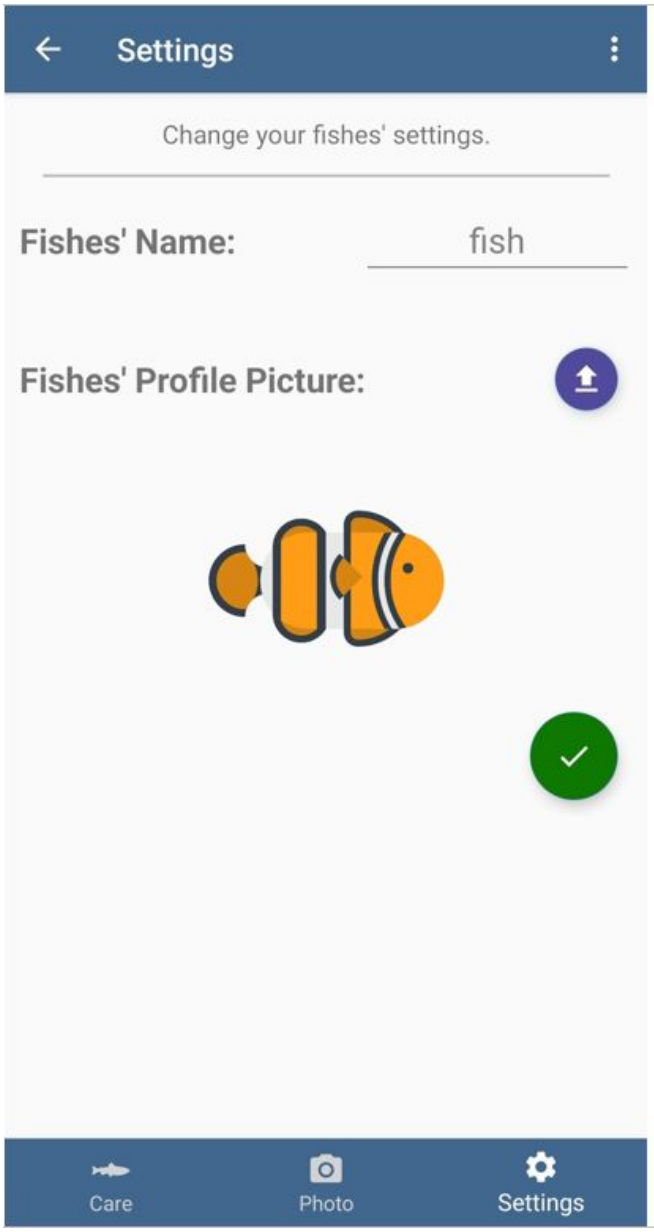
Fish's display picture and name will be shown here, it is customizable in the settings tab.

Auto Top-Up function.

Food section where the last/previous top-up date and time is shown. If too much time have passed and user does not take action, the app's safety feature will kick it and automatically top up food. Top-up food button is at the top right corner.

Water section where the last/previous top-up date and time is shown. When there is insufficient water in the tank, the user will be notified. Top-up water button is at the top right corner.

This section shows the cleanliness of the water in the tank and notify users when it gets too polluted.



To change the fish's name.

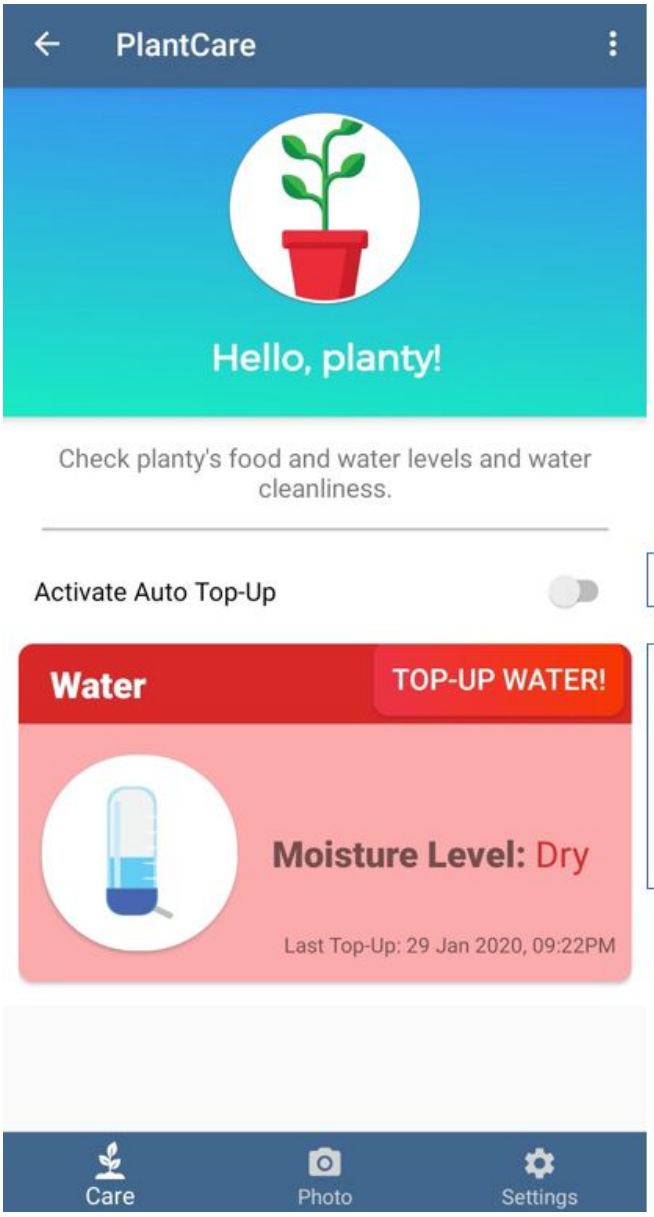
To change the fish's profile picture, it has a variety of options available. To choose from own image gallery or to take a new photo etc.

To confirm the change.

Shows image of the fish tank in realtime.

Button to request an image of the fish tank.

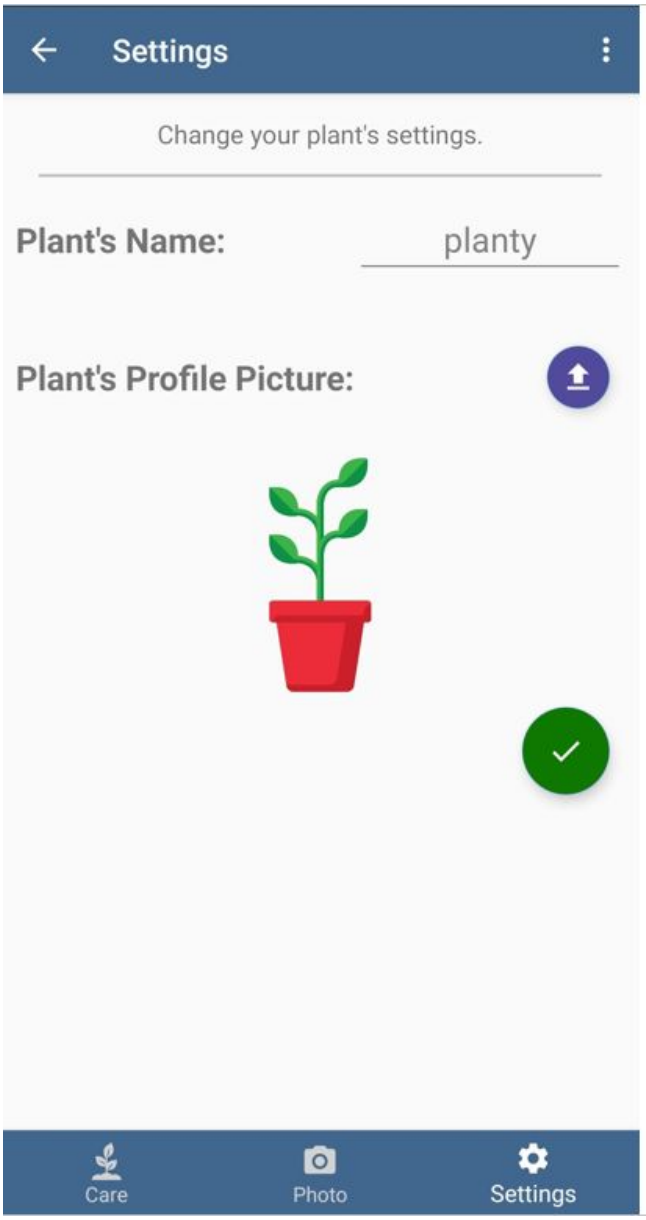
PlantCare



Plant's display picture and name will be shown here, it is customizable in the settings tab.

Auto Top-Up function.

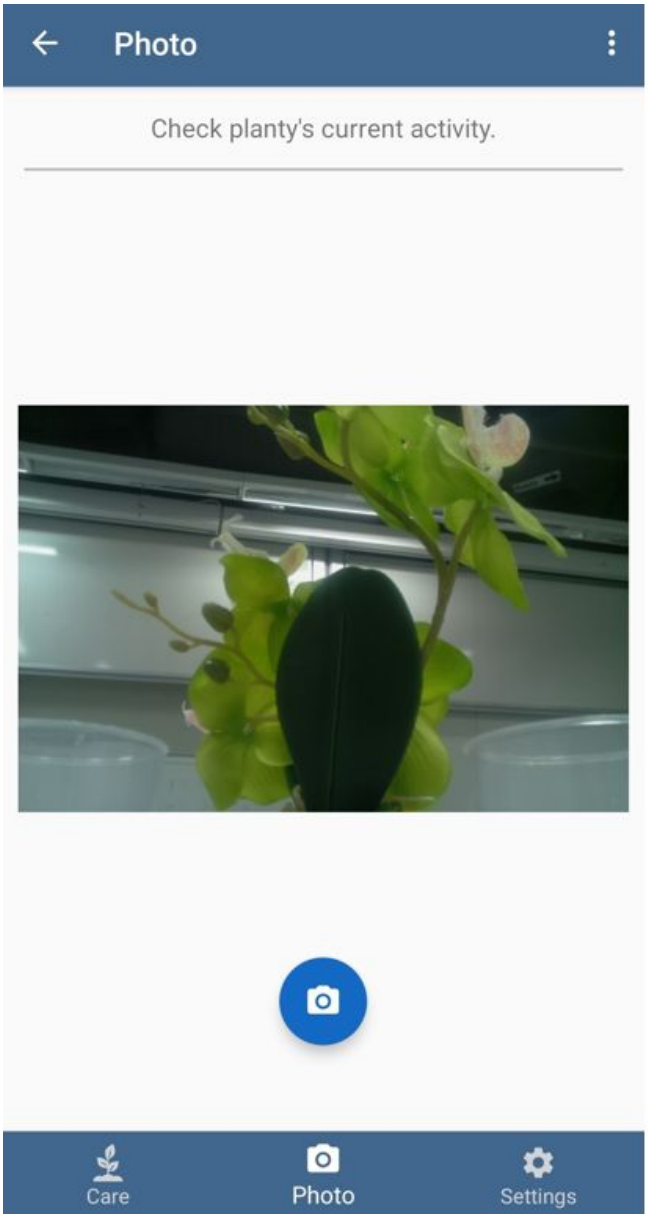
This section shows the soil moisture level and notify users when it gets too dry. The last/previous water top-up date and time is also shown. Top-up water button is at the top right corner.



To change the plant’s name.

To change the plant’s profile picture, it has a variety of options available. To choose from own image gallery or to take a new photo etc.

To confirm the change.



Shows image of the plant in realtime.

Button to request an image of the plant.

5. Hardware

FishCare

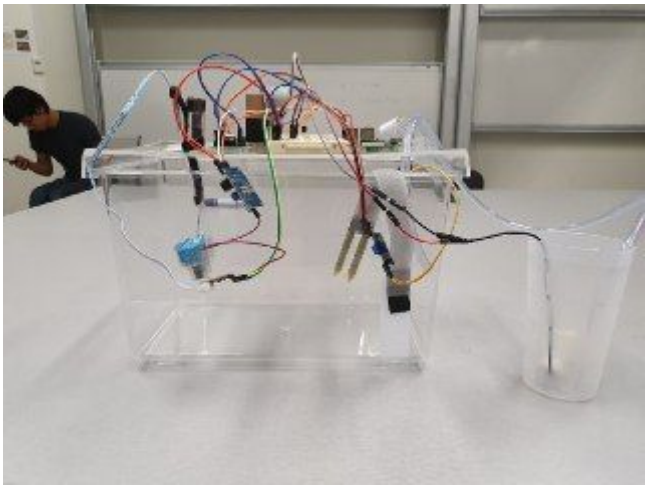


Figure 1: Overall view of Fishcare system

Figure 1 shows the overall view of the Fishcare system where I will explain the individual components further on.

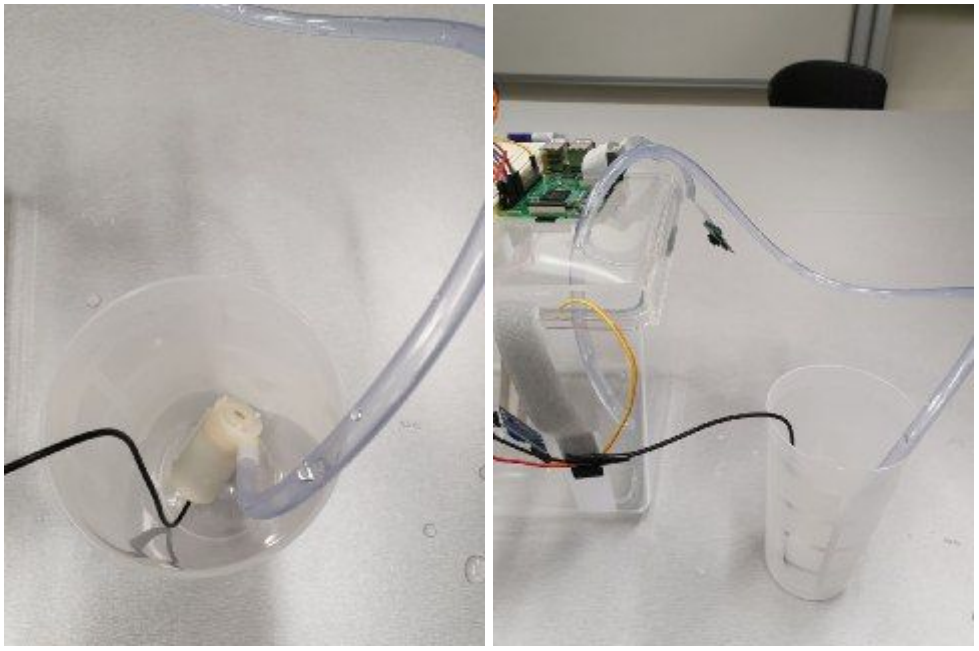


Figure 2: Water pump system

Figure 2 shows the water pump system on the right side of the tank. The cup of water is meant to simulate a water tank where there is a large amount of water stored. When the water pump is turned on, it will do work on the water against gravity and pushes the water upwards into the pipe and flow into the fish tank. Take note that the cup has to be either on

the same elevation level as the fish tank or lower than it. If the cup is on a higher elevation than the fishtank, the water will flow continuously and uncontrollably.

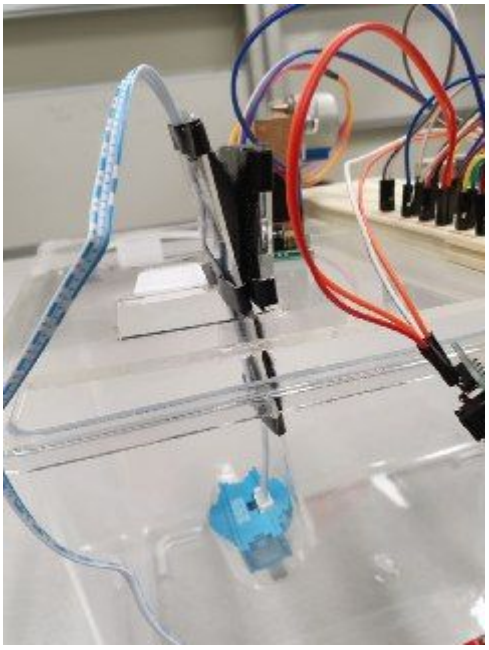


Figure 3: Turbidity sensor

Figure 3 shows the turbidity sensor installment. It measures the water pollution level and send notifications to the Android app where appropriate. It is attached to the tank by a velcro to ensure stable installment that is also flexible as the velcro is hard but removable. This allows us to pull out the sensor and put it in clean and dirty water for demonstration purposes easily.

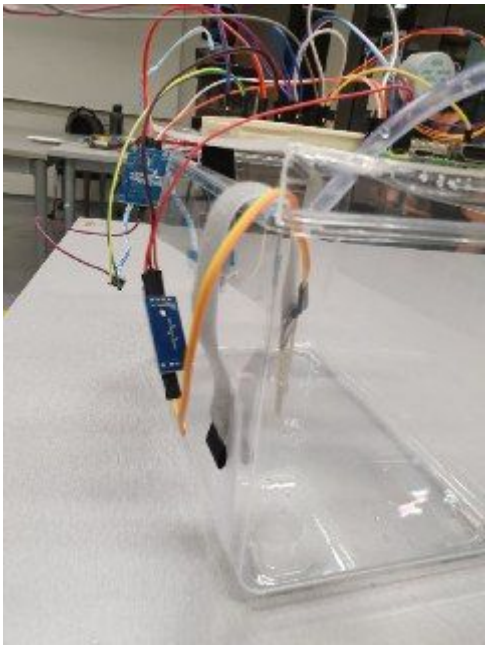


Figure 4: Water level sensor

Figure 4 shows the water level sensor installment. It looks similar to 2 pronged fork that is also attached to a velcro strip. When water touches the sensor, it will detect the water and update in the app that water level is sufficient. When too much water evaporated and thus there is inadequate water in the fish tank, the sensor will detect no water and send a notification to the Android app that there is insufficient water. The velcro installment allows the component to be both removable and adjustable, allowing the user to set different water level or to demonstrate its functionality.

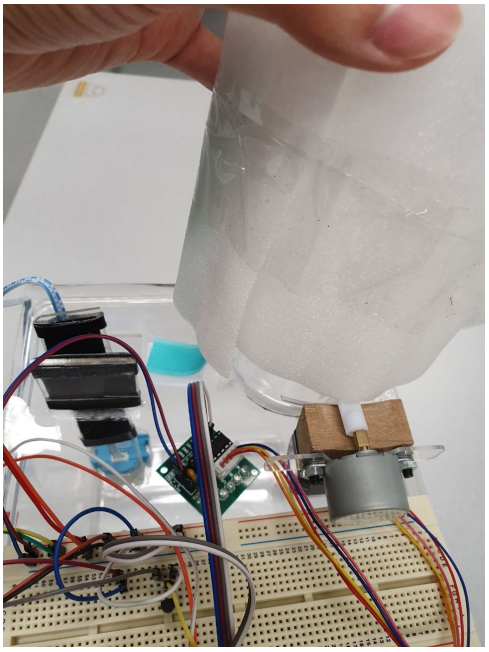


Figure 5: Food dispenser

Figure 5 shows the fish food dispenser on the top left side of the fish tank. The container is a modified cereal dispenser which can be operated by a stepper motor that is attached to it. When the user presses the “top up food” button, the motor will rotate and thus dispensing fish food downwards.

PlantCare

Figure 6: Overall view of PlantCare system

Figure 6 shows the overall view of the PlantCare system which I will explain the individual components in the next few pictures.

Figure 7: Soil moisture level sensor

Figure 7 shows the installment of the sensor to measure soil moisture level. Similar to the water level sensor for FishCare, it uses the “2 pronged fork” which is stuck into the soil to measure the soil moisture level and update the Android app as appropriate. It can be forcibly removed from the soil and placed back in, meaning it is not a permanent installment.

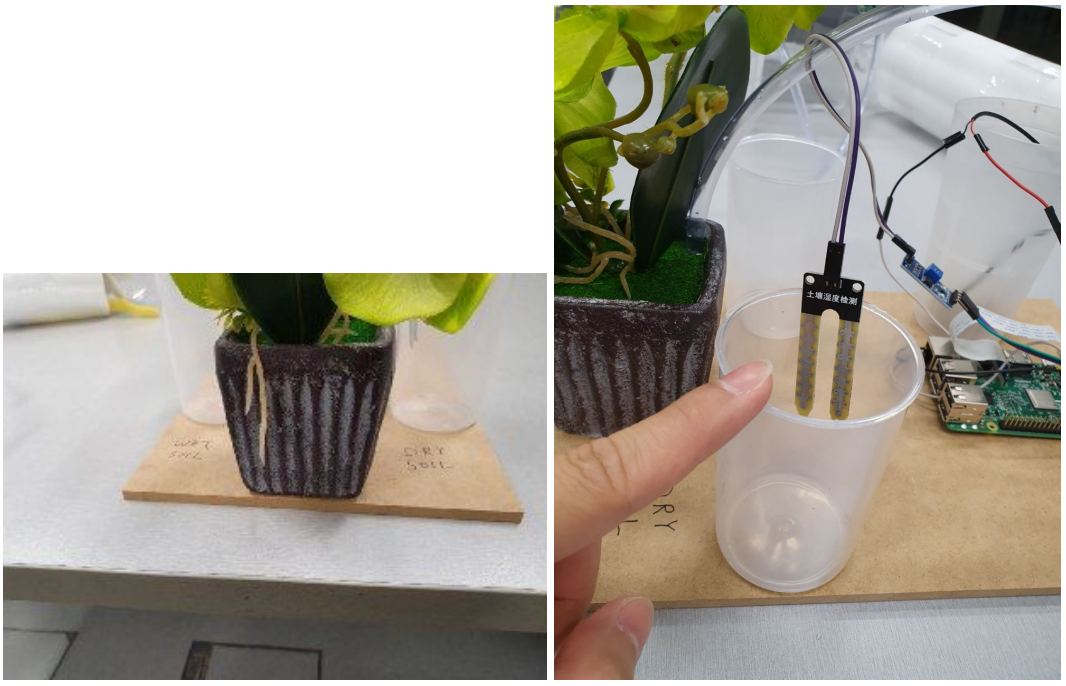


Figure 8: Wet and dry soil

Figure 8 shows the wet and dry soil cup on both sides of the plant. The cups' purpose is to contain wet and dry soil for demonstrating the moisture level sensor's functionality. Simply pull out the "2 pronged fork" and place it into the 2 cups one by one and observe the interface change in the Android app.

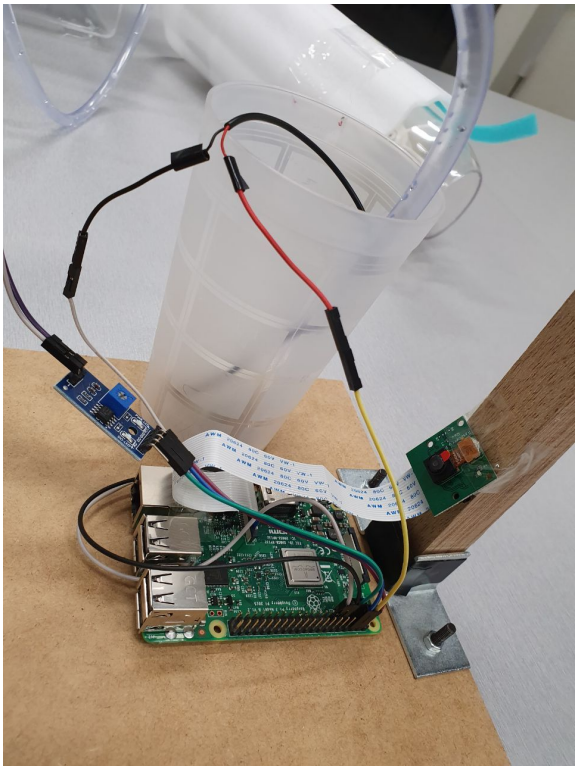


Figure 9: Water pump and camera

Figure 9 shows the water pump and camera set up. For the camera, it has been position to be able to have a full view of the plant when a photo is captured, try not to re-position it. Also, do not over-twist camera's wire strip as it will affect the image quality badly. For the water pump, it acts the same way as in the FishCare system where the cup acts as a water tank with a large amount of water and the pump should not be positioned above the plant, but rather on the same level or below it.

6. Code

For Android app: https://github.com/liying-kwa/TinyCare

For Raspberry Pi: https://github.com/liying-kwa/TinyCare (in the *rpi_files* folder)

7. Overall

The project started with aims to relieve the stress and constraints of care for common tiny pets and plants at home. It can effectively reduce neglect and abuse cases due to the basic needs of the pets and plants being reliably accounted for. Keeping pets and plants come with emotional and mental benefits and my team is here to enhance the gain and relieve the pain.

We would like to acknowledge and thank ISTD for giving us this opportunity to make this project and supporting us with funds and technical knowledge.