FRESHIST

FooMinder

Team 6: Freshist

Xiaoyan Zhang, Yixin Hu, Wei Liang, Ruihong Gong

August 14th, 2019

Outline

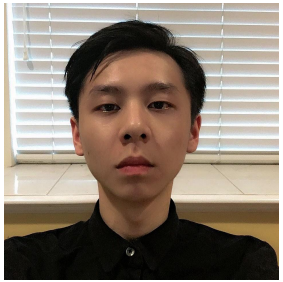
- Team Introduction
- Project Introduction
- Background & Motivation
- Business & Research
- Technical Details
- Risk Analysis & Management
- Self Reflection
- Schedule & Plan for 440
- Demo
- Conclusion

FRESHIST

The team at Freshist

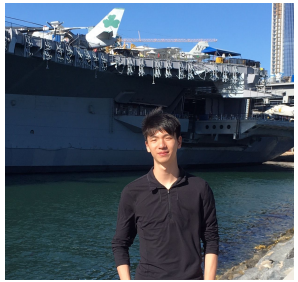
Xiaoyan Zhang
Gloria
CEO

Responsibility:
Detector Design



Ruihong Gong
Harry
CTO

Responsibility:
Text Recognition



Wei Liang
Victor
CPO

Responsibility:
Detector Testing

Yixin Hu
Laura
CIO

Responsibility:
Database & UI

Introduction/Background

General Description:

- **Product Name:** FooMinder
- **Main Component:**
  - Android App
    - Record receipts from grocery stores
    - Scan and extract grocery from the receipt
    - Set up reminder based on expiry date
  - Fridge Detector
    - Make sure the environment of storage is desirable
    - Built-in sensors continuously detect chemicals inside the fridge
    - Monitor environment inside the fridge

Basic Purpose:

- Keep track of the groceries and organizing them at the same time
- Thus reduce food waste

Background/Motivation

- Roughly **one-third** of all food produced globally is **either lost or wasted** [1]
  - Less food waste would have positive influences on climate change and sustainability [2]
- Similar products in the market
  - Alpha Mos
  - Scensive Ltd
  - Smiths Detection
    - Be used **strictly as a laboratory instrument**
    - Need to be individually calibrated for **specific applications** [3]
  - Our choice of **targeting families** has strong potentials in the market

[4]

FRESHIST

Background/Motivation

- People tend to **buy a lot** of vegetables, fruits and meat at once and use the refrigerator as a place to **store food for a long time**
  - Nutrition loss
  - Tend to forget
  - Lead to food waste
- If we can **reduce such food waste**
  - Save money on buying groceries
  - Help accomplish the world's sustainable goal
- Provide an **accurate and effective** solution to this problem

[5]

Business Case & Costs

Current Market

1. Smart home automation for food management and fridge is not popularized.
2. The smart fridge is not affordable for most people.
3. The most common way to test freshness level is to sample and use needle detector (“stab-in”).
4. Such mobile application which can acquire food information at any time that is not commonly used.

FRESHIST

Business Case & Costs

Finance:

We will be funded and supported by Engineering Science, Faculty of Applied Science, Simon Fraser University. And the funding will be mainly used in buying some hardware parts to construct our sensor array.

Cost List

Equipment List	Quantity	Estimated Cost
LCD 16x2 Display Module	2	$1.98
KCD1-101 Rocker Switch	2	$0.32
Battery Holder Case	5	$0.56
Breadboard Wire Jumper	65	$0.90
DHT-22 Temperature and Humidity Module	1	$5.23
MQ-3 Alcohol Module	2	$1.50
MH-Z14 CO2 Module	1	$37.65
HC-05 Bluetooth Module	1	$5.25
Arduino Uno Microcontroller	1	$27.05
Total		$80.44

Business Case & Costs

Potential Improvement And Competition

Four main factors:

1. Cost issue
2. Functionality and experience of mobile application
3. Accuracy of results
4. Size of sensor array

FRESHIST

Ideal Customer

Main targets

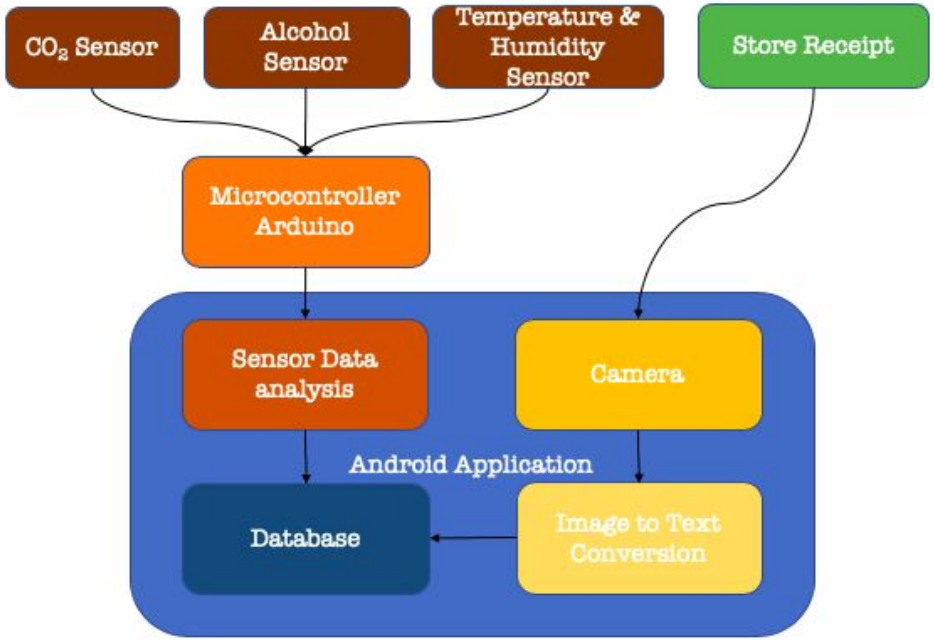
1. Suitable for families.
2. Useful for most restaurants or catering industry.

[6]

[7]

FRESHIST

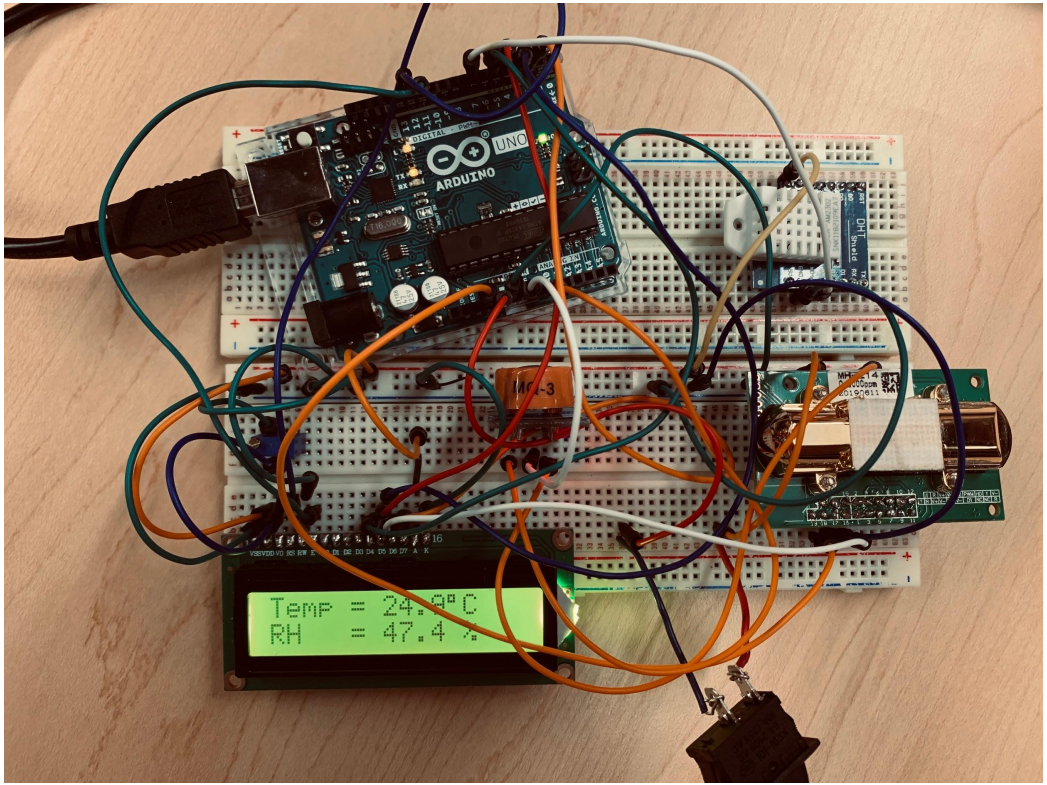
Technical Case

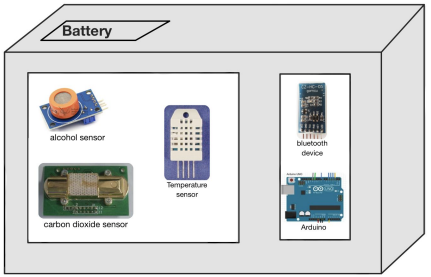


System Overview

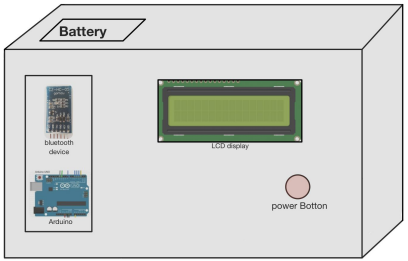
- Designed to consist of a APP and a detector.
- The detector built with three sensors
- Detector will send data to APP through Bluetooth. (440)
- The APP can recognizes different layouts of receipts
- Sustainability: cradle-to-cradle design principle. Ecology, Economy and Equity.

Detector-system overview





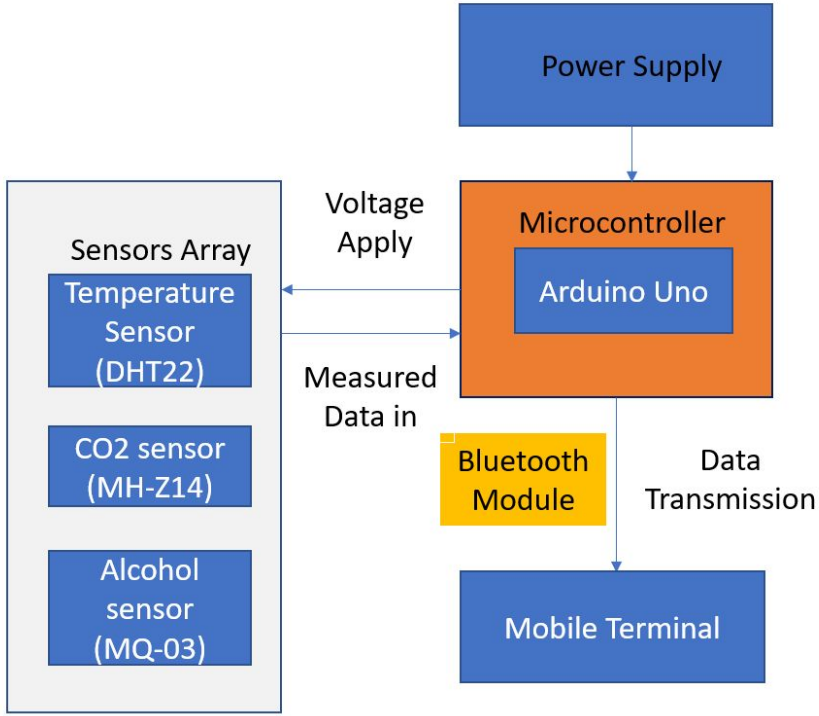
Detector Inside View



Detector Front View

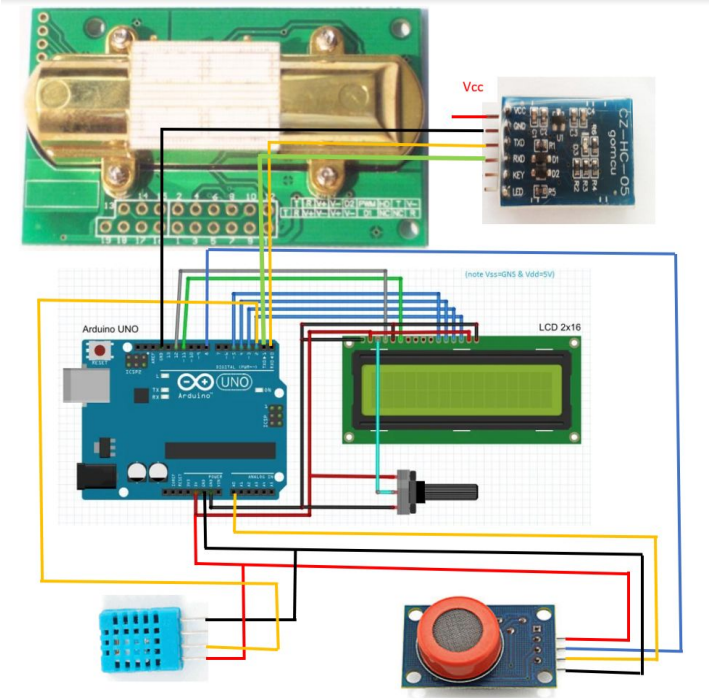
Detector-Materials

- **power supply** provides a voltage of 6V, which is supplied to each unit by a DC-DC converter.
- **Sensor array** unit consists of a CO_2 sensor, an alcohol sensor and a temperature /humidity sensor. We can get the chemical concentration, temperature and humidity.
- **Arduino** process the result from sensor array and passes the signal to the Bluetooth module
- **LCD Display** feedback information and results
- **Bluetooth(440)**



Detector-Arduino

- The CO2 sensor uses the analog pins A0 and A1 in conjugation with the Software serial library to run the UART protocol.
- The Alcohol sensor uses analog pins on the Arduino.
- Temperature sensor connect with the Arduino over a serial bus.
- The LCD screen uses SDA and SCL to connect with the Arduino using the I2C protocol.
- The switch is connected to the breadboard



Detector-sensor standard

- Most papers mentioned studies that when foods like apples are getting spoiled, the concentration of **CO2 is 0-5%VOL**
- The ranges for **alcohol are around 20-100 ppm** for rotten meat
- The **temperature** in the fridge is between **0°C to 10°C**
- In the refrigerator, the optimal average relative **humidity is within a range of 70-80%**.

Ex: if the concentration of alcohol is over than 100 ppm, according to the table as shown, we can determine whether a particular type of fruit is spoiling.

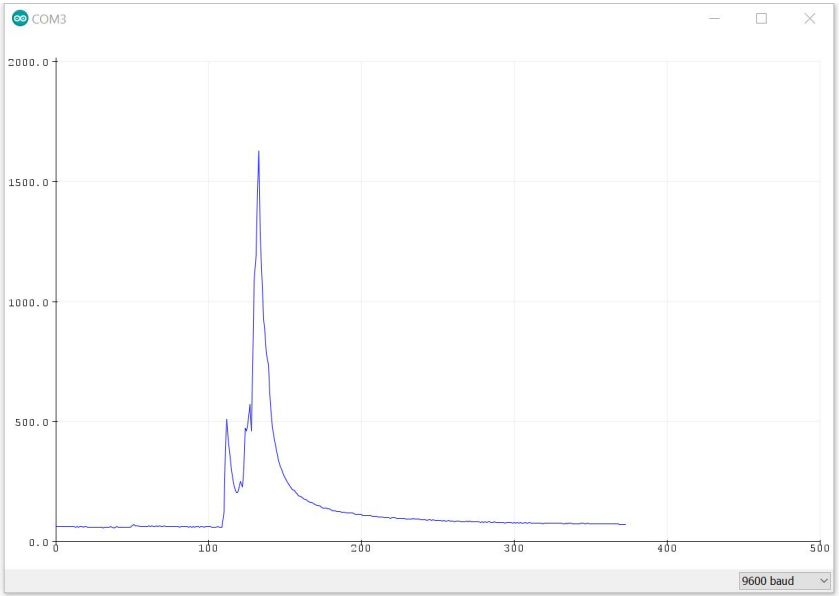
TABLE 1

CONCURRENT VALUES FOR ETHYLENE AND CARBON DIOXIDE PRODUCTION

FRUIT	VARIETY	TEMP. °C	C_2H_4 ML/KG · HR × 10^6	CO_2 ML/KG · HR	$\frac{C_2H_4}{CO_2} \times 10^6$
Tropical					
Banana	Gros Michel	20	4	80	0.05
Mango	Haden	20	0	65	0.0
Papaya	.....	25	37	44	0.84
Pineapple	.....	25	0	42	0.0
Subtropical					
Avocado	Fuerte	20	88	156	0.56
Cherimoya	Booth	20	186	129	1.44
Feijoa	Coolidge	20	50	73	0.69
Lemon	Eureka	25	0	6	0.0
Orange	Valencia	25	0	8	0.0
Orange	W. Navel	20	0	8	0.0
Persimmon	Hachiya	20	2	17	0.12
Sapote	Pike	20	129	43	3.0
Temperate					
Apple	McIntosh	20	112	12	9.3
Pear	Bartlett	20	122	42	2.9
Pear	Bosc	20	29	14	2.1
Peach	Hale	20	36	37	0.97

[8]

Detector-alcohol sensor

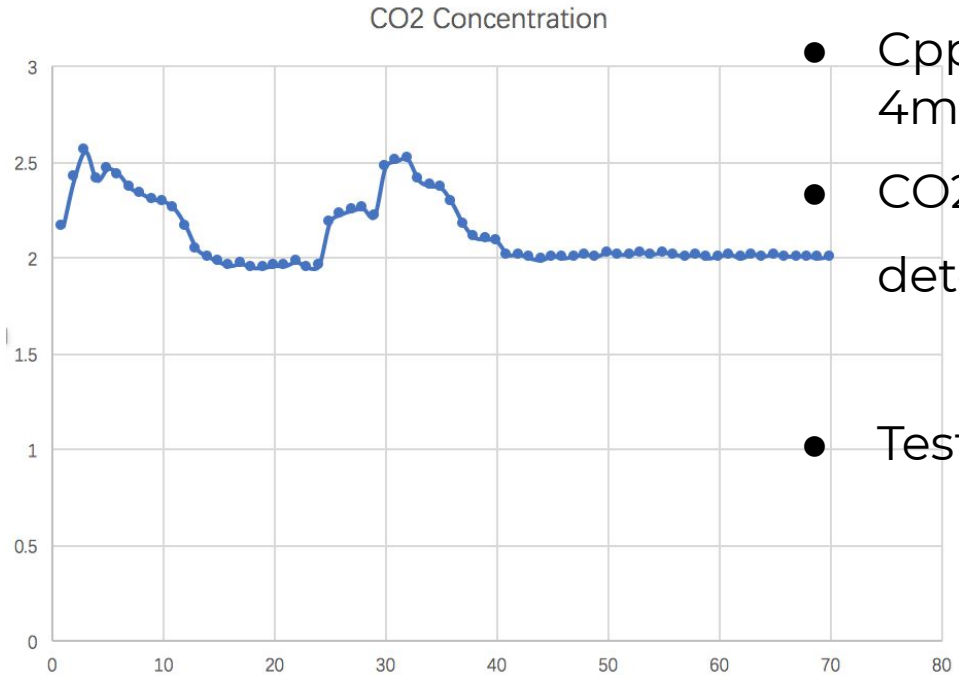


Alcohol Sensor: MQ-03

- Alcohol sensor should be able to detect in the range 20-100 ppm.
- Test: Perfume

FRESHIST

Detector-co2 sensor



CO2 SENSOR: MH-Z14

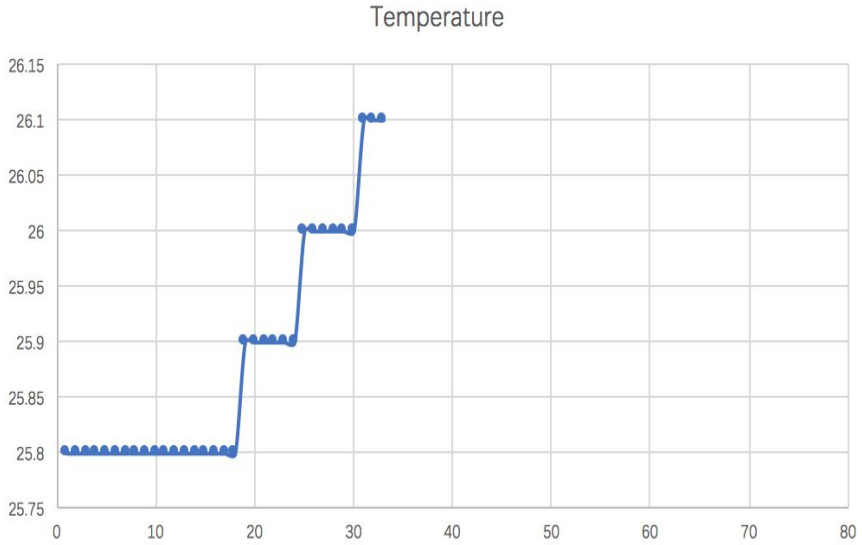
- Cppm = 2000 × (TH − 2ms) / (TH + TL − 4ms) [9]
- CO2 sensor should be able to detect in the range 0-5% VOL
- Test: Breathe on it

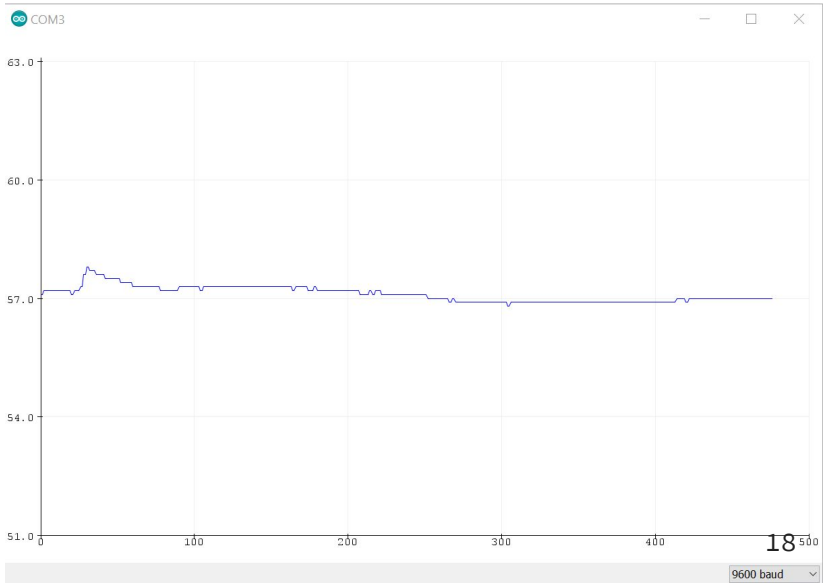
FRESHIST

Detector-Temperature & Humidity Sensor

Temperature & Humidity SENSOR: DHT-22

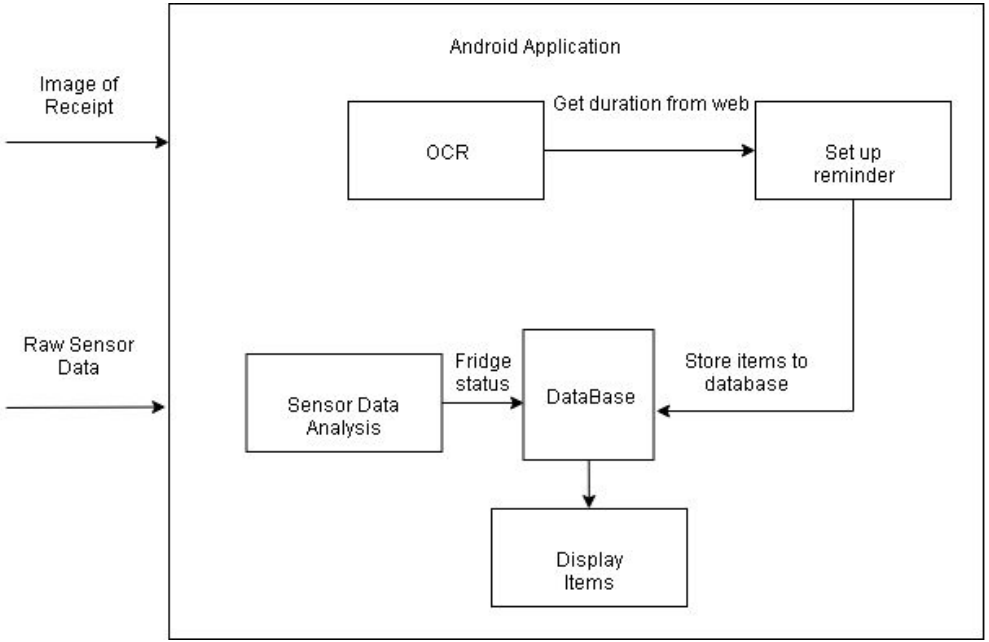
- Temperature Range: 0°C - 10°C
- Humidity Range: 70-80% at 4°C





Android App

Designed to help the users to keep track of items they have in the fridge



- Recognize receipt and output all items for users
- Pull fruit/vegetable duration data from web
- Store items into database
- Get the concentration of fruits/vegetable in the fridge

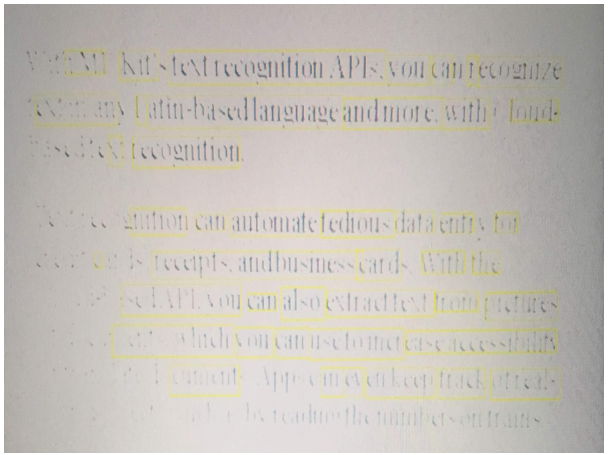
FRESHIST

Risk analysis & Management

Potential project risks and remediation:

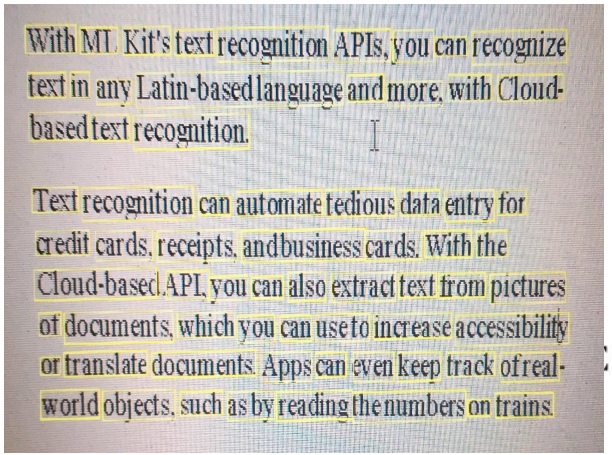
Product Risks:

- Unable to recognize faint text



Remediation:

- Increase contrast/dark areas of image



Risk analysis & Management

Potential project risks and remediation:

Product Risks:

- Small, long and densely spaced receipts
- Failing to recognize text entirely

Remediation:

- Scan receipts in blocks and recognize them individually
- Partially recognized words can use spell check correction
- Option for users to manually entering items

FRESHIST

Risk analysis & Management

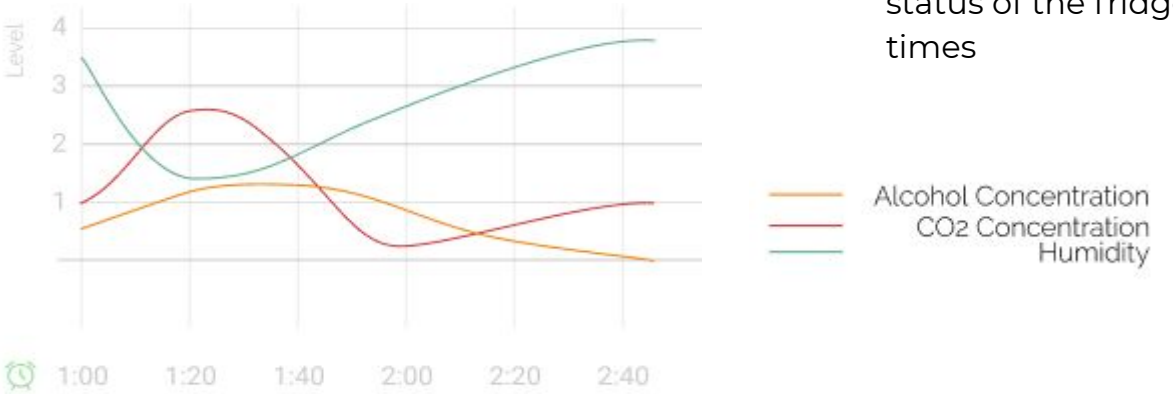
Potential project risks and remediation:

Product Risks:

- Sudden concentration droppage when opening fridge door resulting in incorrect readings of fridge environment

Remediation:

- The concentration levels acquired from our detector can be periodically fetched and transmitted to our application, letting users monitor the status of the fridge environment at all times



FRESHIST

Risk analysis & Management

Potential project risks and remediation:

Schedule Risks:

- Unable to meet deadlines
- Integration of hardware and software
- Testing/debugging and rewriting code

Remediation:

- Decide whether or not deadline can be pushed back
- Focus on core functionalities of our project
- A consensus on the time needed to complete a task for each team member

FRESHIST

Adherence to Standards

- Meeting certain standards is important
- Source: Organizations like IEC, IEEE and CSA
  - Help standardize requirements for electrical appliances, Ingress Protection (IP) rating, communication protocols etc.
  - Protect users from misuse of the device and help with compatibility.
- Follow these standards during our design procedure can lead to success

Adherence to Standards

Standard ID	Description
IEC 61558-1:2017	Safety of transformers, reactors, power supply units and combinations thereof - Part 1: General requirements and tests [10]
IEC 60086-1:2015	Primary batteries - Part 1: General [11]
IEC 60050-904:2014	International Electrotechnical Vocabulary (IEV) - Part 904: Environmental standardization for electrical and electronic products and systems [12]
CAN/CSA-ISO/TR 14062-03 (R2013)	Environmental Management - Integrating Environmental Aspects into Product Design and Development (Adopted ISO/TR 14062:2002, first edition, 2002-11- 01) [13]
IEEE 1621-2004	IEEE Standard for User Interface Elements in Power Control of Electronic Devices Employed in Office/Consumer Environments [14]

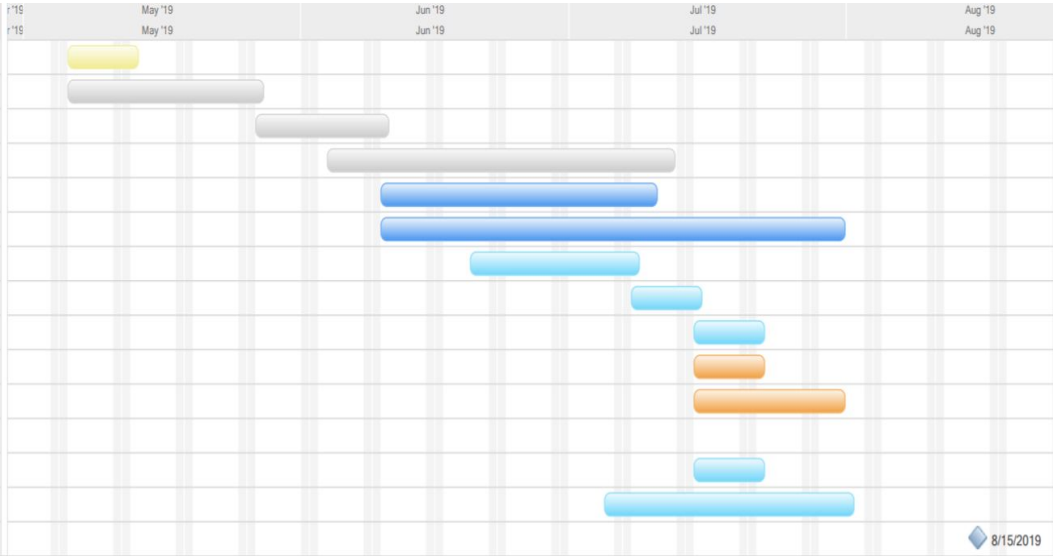
Self-Reflection

- The key to teamwork is communication
- Weekly internal meeting to make sure everything is working well
- Time management and task management are crucial
- Open discussion and let every member bring something unique
- Continue with overall positive reflections and motivate each other into 440
- Will meet more often and involve more testing for 440
- Let every member get to the core design specifications of both hardware and software side to get experience and different perspectives

FRESHIST

Current Progress

	Task Name	Duration	Planned Start Date	Planned Finish Date
1	Brainstorming	6 days	5/6/2019	5/13/2019
2	Feasibility of ideas	16 days	5/6/2019	5/27/2019
3	Hardware specifications	11 days	5/27/2019	6/10/2019
4	Research 3 (Image processing, sensor data analysis)	29 days	6/4/2019	7/12/2019
5	Hardware preparation	23 days	6/10/2019	7/10/2019
6	Software preparation	38 days	6/10/2019	7/31/2019
7	Separate sensor results displaying	13 days	6/20/2019	7/8/2019
8	All sensor results displaying	6 days	7/8/2019	7/15/2019
9	Data transmission by Bluetooth module	6 days	7/15/2019	7/22/2019
10	Image to text recognition	6 days	7/15/2019	7/22/2019
11	Database	13 days	7/15/2019	7/31/2019
12	Bluetooth module	76 days	9/2/2019	12/16/2019
13	Feasibility of UI design	6 days	7/15/2019	7/22/2019
14	Debugging system and prototype modification	20 days	7/5/2019	8/1/2019
15	Presentation Demo	1 day	8/15/2019	8/15/2019



FRESHIST

Current Progress

	Estimated	Actual-to-Date
Proof-of-Concept	Aug 14, 2019	Partially realized
Beta Prototype	Late October	Expect main functions completed
Final Product	Early December	Expect satisfactory main function performance

FRESHIST

Brief Plan For 440

To-do List:

- Hardware:
  - Replace LCD screen with a tri-color LED
  - Establish Bluetooth on board
  - Design own PCB board
  - Enclosure for the detector
- Software:
  - Improve text convertor
  - Establish Bluetooth connection with the detector
  - Set up data transmission
  - Implement UI

FRESHIST

Demo

- Image to Text Convertor
- User Interface
- Detector Prototype

Conclusion

- **In progress**
  - Detector can detect the temperature, humidity and chemical concentration
  - The current state of the android application can recognize most of the words in a receipt, saving values into the database, and connect to website for pulling fruit/vegetable durations
- **Uncertainty**
  - Keep working on the Image Processing
  - Establish Bluetooth on the detector and send data to APP

FRESHIST

Acknowledgements

We would like to give special thanks to Dr. Craig Scratchley, our TA, Mohammad, and Andrew Rawicz for providing constructive feedback on our Capstone project.

FRESHIST

Question?

FRESHIST

Reference

[1] M. Grosso and L. Falasconi, “Addressing Food Wastage in The Framework of The UN Sustainable Development Goals,” Waste Management & Research, vol. 36, no. 2, pp. 97–98, 2018. [Online]. Available: https://journals.sagepub.com/doi/pdf/10.1177/0734242X17751968. [Accessed: 19-Jul-2019].

[2] A. Usubiaga, I. Butnar, and P. Schepelmann, “Wasting Food, Wasting Resources: Potential Environmental Savings Through Food Waste Reductions,” Journal of Industrial Ecology, vol. 22, no. 3, pp. 574–584, 2017. [Online]. Available: https://onlinelibrary.wiley.com/doi/epdf/10.1111/jiec.12695. [Accessed: 19-Jul-2019].

[3] A. Berna, “Metal oxide sensors for electronic noses and their application to food analysis,” *Sensors (Basel, Switzerland)*, 2010. [Online]. Available: https://www.ncbi.nlm.nih.gov/pubmed/22319332. [Accessed: 14-Aug-2019].

[4] “HERACLES - Fast gc electronic nose by Alpha MOS: DirectIndustry,” *The Online Industrial Exhibition*. [Online]. Available: http://www.directindustry.com/prod/alpha-mos/product-39513-1633972.html. [Accessed: 14-Aug-2019].

FRESHIST

Reference

[5] "Melissa's Tips for A Clean & Organised Fridge," *HEMSLEY HEMSLEY - healthy food and living*, 27-Sep-2018. [Online]. Available: http://www.hemsleyandhemsley.com/melissas-tips-clean-organised-fridge/. [Accessed: 14-Aug-2019].

[6] "Refrigerate - The Basics," *EatRight*. [Online]. Available: https://www.eatright.org/homefoodsafety/four-steps/refrigerate/refrigerate---the-basics. [Accessed: 14-Aug-2019].

[7] "Restaurant - MU LUXEMBOURG - LUXEMBOURG," *Restaurants by AccorHotels.com*. [Online]. Available: https://restaurants.accorhotels.com/gb/restaurant-5555_R001-mu-luxembourg-luxembourg.shtml. [Accessed: 14-Aug-2019].

[8] Bruinsma, Paull, and R.e., "Respiration and ethylene production in post-harvest soursop fruit (Annona muricata L.)," *AGRIS*, 01-Jan-1985. [Online]. Available: http://agris.fao.org/agris-search/search.do?recordID=NL2012061953. [Accessed: 14-Aug-2019].

[9] "MH-Z14 CO2 Module". (n.d). Futurlec [PDF file]. Retrieved from https://www.futurlec.com/Datasheet/Sensor/MH-Z14.pdf

FRESHIST

Reference

[10] “IEC 60086-1:2015 Primary batteries - Part 1: General”. International Electrotechnical Commission (2015). Retrieved from https://webstore.iec.ch/publication/23002
[11] “IEC 61558-1:2017 Safety of transformers, reactors, power supply units and combinations thereof - Part 1: General requirements and tests”. International Electrotechnical Commission (2017). Retrieved from https://webstore.iec.ch/publication/26261
[12] “IEC 60050-904:2014 International Electrotechnical Vocabulary (IEV) - Part 904: Environmental standardization for electrical and electronic products and systems”. International Electrotechnical Commission (2014). Retrieved from https://webstore.iec.ch/publication/22029
[13] CSA Group (2013). “CAN/CSA-ISO/TR 14062-03 (R2013) - Environmental Management - Integrating Environmental Aspects into Product Design and Development (Adopted ISO/TR 14062:2002, first edition, 2002-11-01)”. CSA, Mississauga.
[14] IEEE. (2004). “IEEE Standard for User Interface Elements in Power Control of Electronic Devices Employed in Office/Consumer Environments”. Retrieved from https://standards.ieee.org/standard/1621-2004.html#Additional