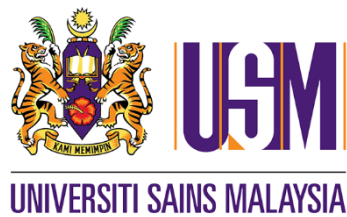




FARMTAB: Precision Agriculture System using Internet of Things and Artificial Intelligence for Urban Farming



Introduction :

The objective of FarmTab is to boost the productivity of urban farming by automating the farming process by embedment of Internet of Things (IoT) and Artificial Intelligence (AI) technologies into one platform. FarmTab is designed to enable seamless data collection from various sensors such as temperature, pH level, Electrical Conductivity (EC) and Oxidation-Reduction Potential (ORP) in urban farm condition. The AI models track and predict various environment impacts on crop yield for urban farm.

Project Members :

Name	Affiliation
Chong Yung Wey, Widad Ismail, Tan Eng Kee, Hasnuri Mat Hassan	USM, Malaysia
Ooi Boon Yaik, Lee Wai Kong	UTAR, Malaysia
Muhammad Niswar, Zainal, Zulkifli Tahir, Abdul Azis	UNHAS, Indonesia
Achmad Basuki, Raden Arief Setyawan	UB, Indonesia
Naoki Shinohara	Kyoto University, Japan

Project Duration :

24 months

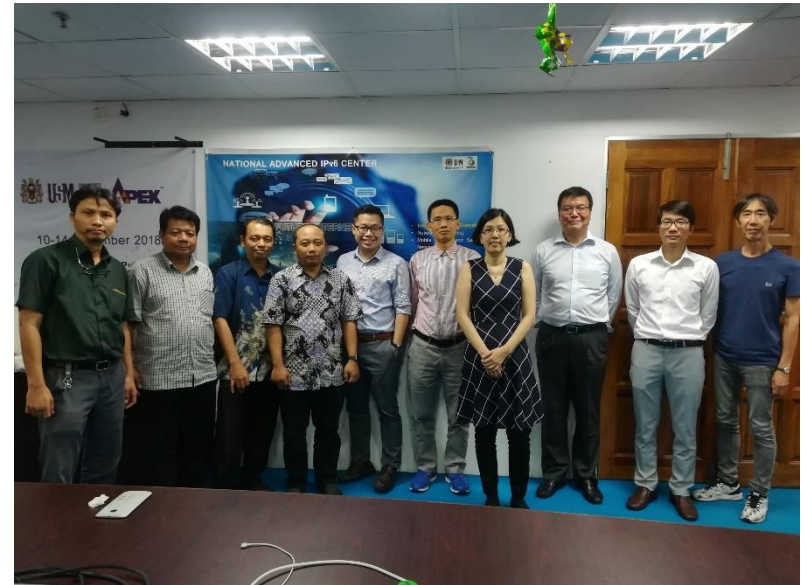
Target Countries :

South East Asia

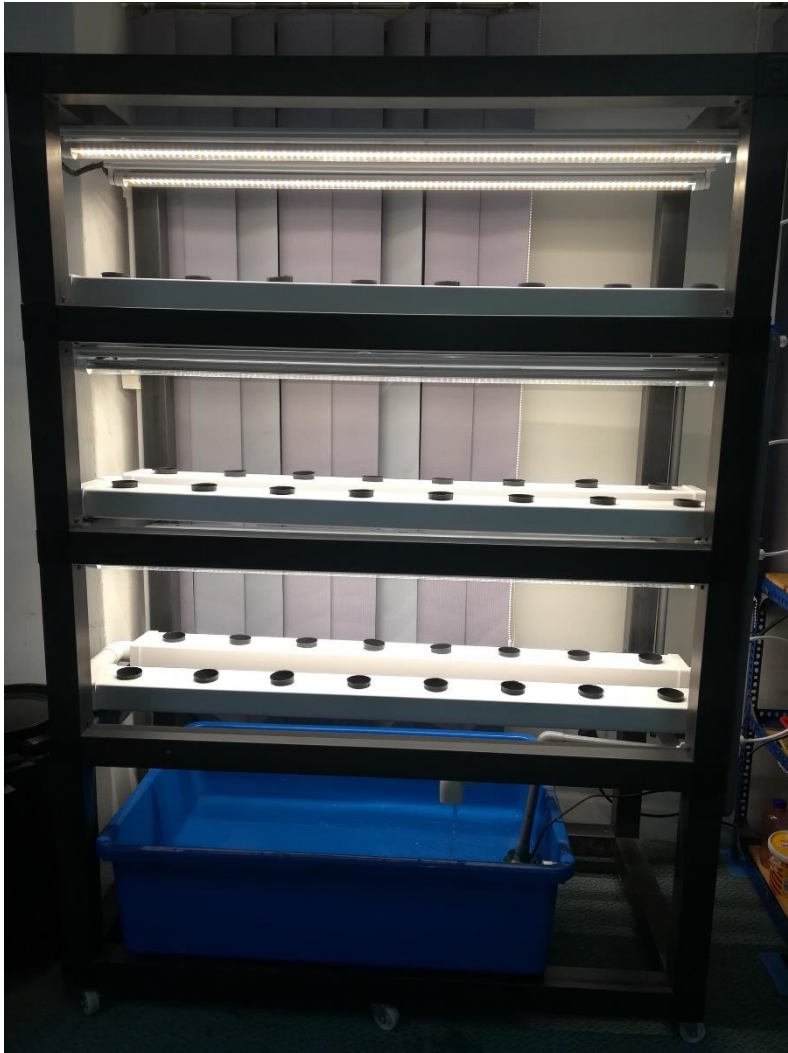


July 2019 at Penang, Malaysia

- Discussed strategic and operational issues of the project implementation.
- Refined the project methodology, exchanged ideas and discussed the approach for research and development collaboration.
- Testbed will be setup at USM, UTAR, UB and UNHAS.



Vertical shelving system



Crops that will be grown and analysed at each institution:



Lettuce

USM + UTAR



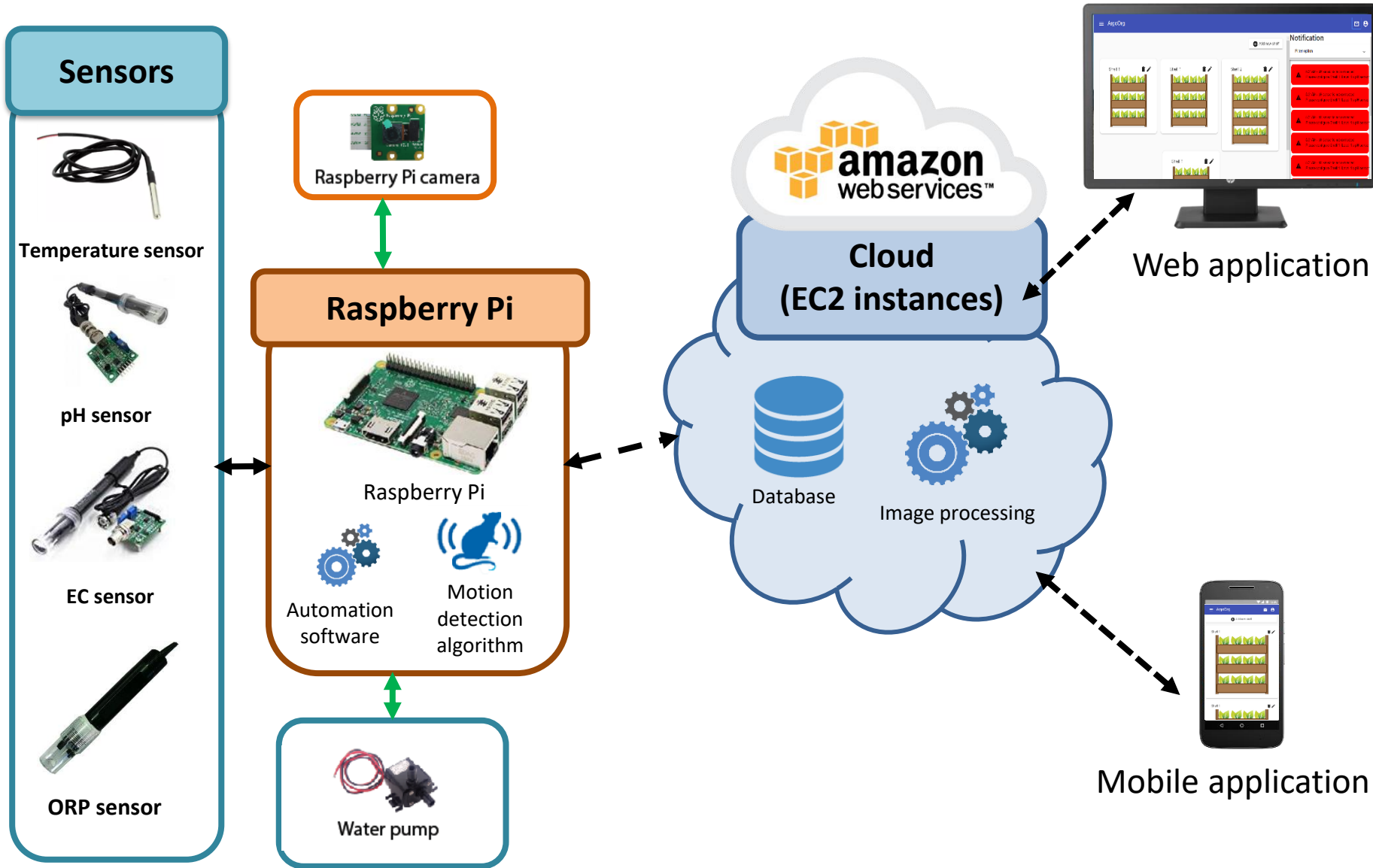
Red Spinach

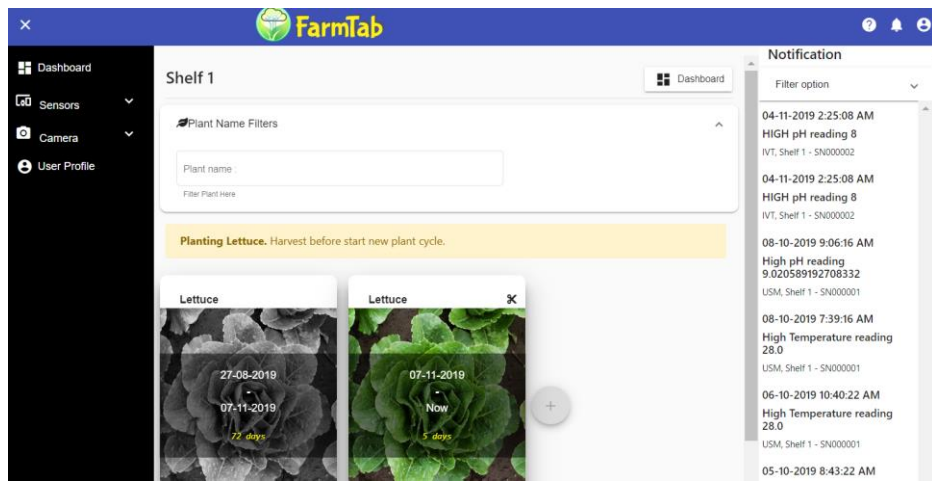
UNHAS



Bak Choy

UB

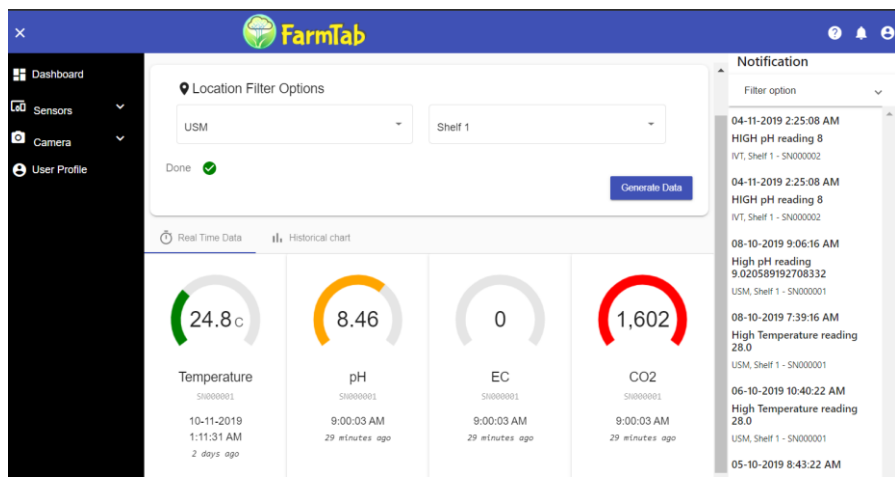




Dashboard



Historical sensor data



Real time sensor data

Live View

Location Filter Options: USM, Shelf 1

Notification Log:

- 04-11-2019 2:25:08 AM: HIGH pH reading 8
- 04-11-2019 2:25:08 AM: HIGH pH reading 8
- 08-10-2019 9:06:16 AM: High pH reading 9.020589192708332
- 08-10-2019 7:39:16 AM: High Temperature reading 28.0
- 06-10-2019 10:40:22 AM: High Temperature reading 28.0
- 05-10-2019 8:43:22 AM: High Temperature reading 28.0
- 05-10-2019 2:22:22 AM: High pH reading 8.25439453125
- 05-10-2019 2:09:22 AM: High pH reading 8.681640625
- 05-10-2019 12:29:22 AM: High pH reading 8.946533203125
- 04-10-2019 8:20:34 AM: High pH reading 8.581949669791668
- 04-10-2019 3:06:34 AM: High pH reading 8.306668591919

Live view

Image Processing

Line Graph: pH reading over time (Nov 08 to Nov 12). Y-axis ranges from 40,000 to 130,000.

Date/Time	High pH reading	High Temperature reading
08-10-2019 9:06:16 AM	9.020589192708332	28.0
08-10-2019 7:39:16 AM	-	28.0
06-10-2019 10:40:22 AM	-	28.0
05-10-2019 8:43:22 AM	-	28.0
05-10-2019 2:22:22 AM	8.25439453125	-
05-10-2019 2:09:22 AM	8.681640625	-
05-10-2019 12:29:22 AM	8.946533203125	-
04-10-2019 8:20:34 AM	8.581949669791668	-
04-10-2019 3:06:34 AM	8.306668591919	-

Image Grid:

Date/Time	Age	Value
08-11-2019 12:33:27 PM	4 days age	6129
08-11-2019 4:09:24 AM	4 days age	29362
07-11-2019 3:57:30 PM	5 days age	63202
07-11-2019 3:03:36 PM	5 days age	122926

Image Processing

All the data is captured in AWS cloud server. The data format is standardised so that every partner uses the same platform for data gathering. The frequency of the data that is captured:

- Sensors: every 1 hour
- Image: every 3 hours

The screenshot shows the FarmTab dashboard with a sidebar menu containing: Dashboard, Sensors, View Data, Manage Devices, Camera, Live View, Images, and User Profile. The main area displays four circular gauges for Temperature (24.8c), pH (8.46), EC (0), and ORP (1,590). Below these is a historical chart for Temperature from Nov 08 to Nov 1. A notification panel on the right lists events such as 'HIGH pH reading 8' and 'High Temperature reading'.

This screenshot shows a live camera view of a plant in a pot. Below it is a data table with columns for date, time, and various readings. The table includes entries for pH readings and temperature readings, with some values highlighted in green or red. A legend at the bottom indicates 'Original Image' and 'Processed Image'.

Date	Time	Reading	Change
11-11-2019	9:49:48 PM	Normal	5 hours ago
11-11-2019	6:49:48 PM	Normal	8 hours ago
11-11-2019	3:49:48 PM	Normal	11 hours ago
11-11-2019	12:49:48 PM	Normal	14 hours ago
		165700	-29005
		194705	112232
		82473	733
		81740	=0



Research and Development Description	Activities	Completion Date
A: Design and develop solar-powered shelving system	a: Mechanical design of shelving with lighting b: Design of solar energy harvester	Month 4
B. Design and implement the precision agriculture control system	a: Develop sensor nodes b: Develop software for real-time monitoring of sensor data c: Algorithm for control system	Month 8
	d: Obtain dataset for illness for different crops	Month 12
	e: Develop image processing algorithm in detecting illness in crops	Month 15
	f: Develop monitoring solution for agriculture control system using mobile sensor nodes	Month 18
C. Field trial and validation	a: Field test and implementation of proof of concept in ASEAN region b: Data analysis and visualization of precision agriculture system	Month 24

- Purchase of experimental equipment (remaining)
- Meeting and demonstration of experiment in Makassar (Indonesia), Malang (Indonesia) and Kuala Lumpur (Malaysia)
- Presentations at International Conferences
- Journal papers publications



SOCIETAL IMPACT

Economy

Testing with a local urban farmer to increase yield

Environmental Impact

Providing data to biologist to develop new fertiliser that is environmental friendly

Open Data

Making dataset for illness for different crops public

Thank you for your attention!

Yung-Wey Chong
Universiti Sains Malaysia