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

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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

Kick-off Meeting

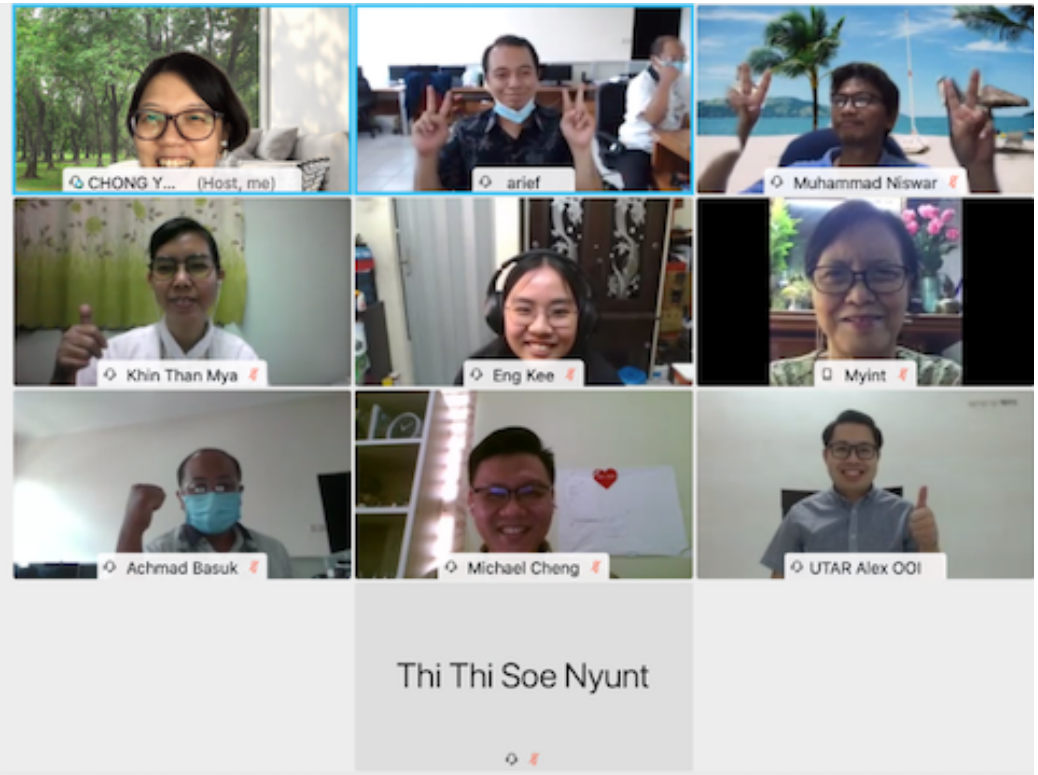
July 2019 at Penang, Malaysia

- 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.

2nd Project Meeting

30 October 2020 at Webex

- Project updates from partners.
- Discussion about the issues and testing results.
- Discussion about the remaining activities.
- Review the output of the project.

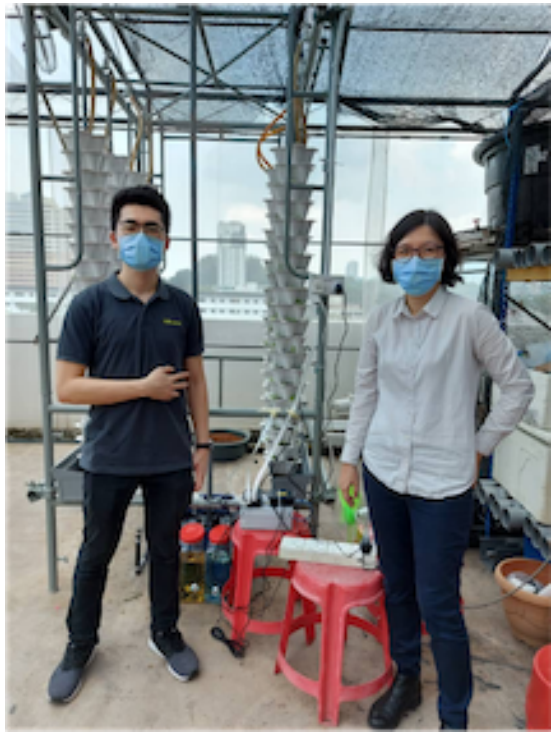


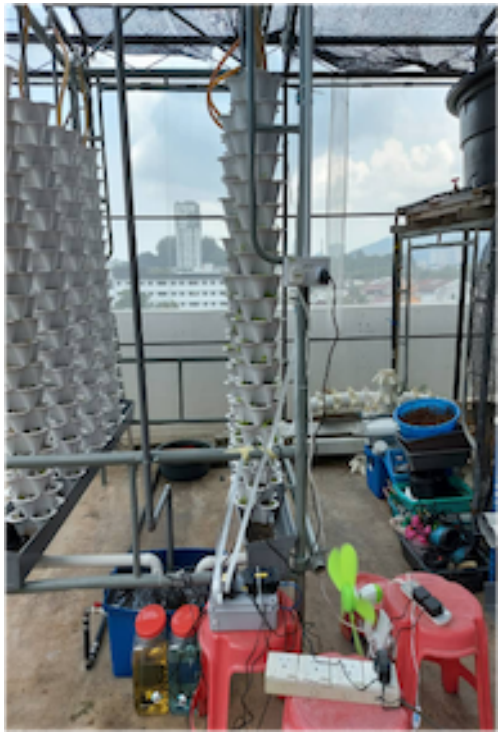
Field Trial – Penang (outdoor vertical farm)

August 2020 at Victory Farm, Penang, Malaysia

- Test the deployment of FARMTAB platform in an outdoor vertical farming environment so that more data can be collected to understand the growth rate based on the automated environment.

After 35 days





Field Trial – Penang (indoor urban farm)

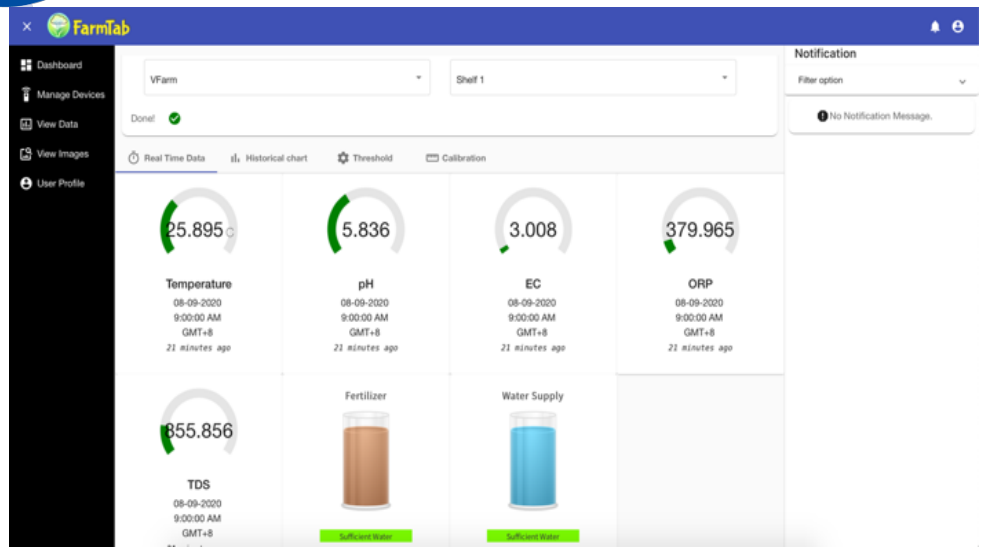
September 2020 at Squareroot Urban Farm, Penang, Malaysia

- Test the deployment of FARMTAB platform in indoor urban farming environment.

Technical Workshop (Universitas Brawijaya)

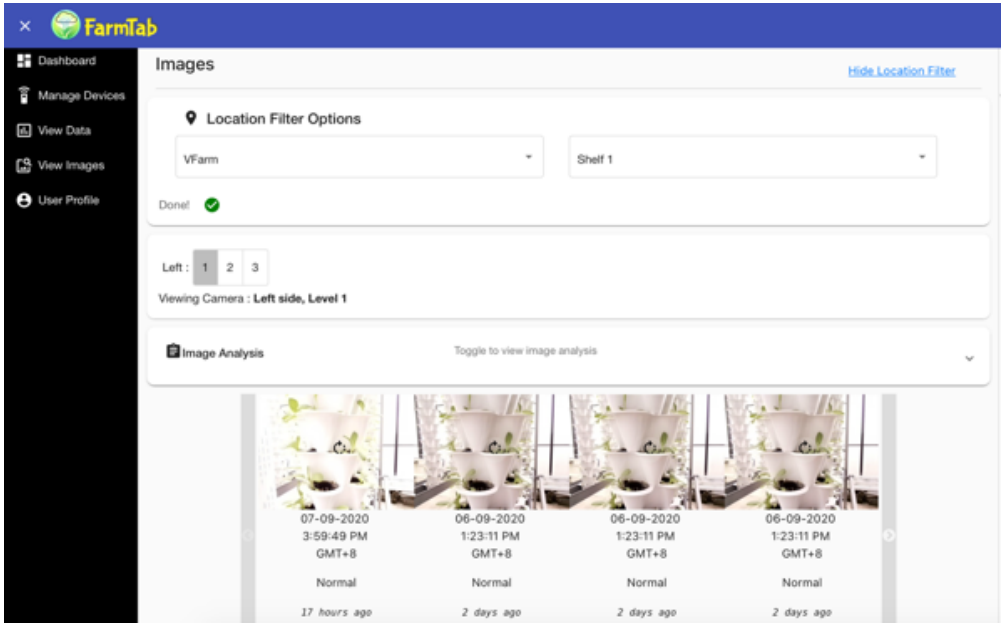
30 participants, majority local millennium farmers
4 trainers – 2 (UB), 2 (UNHAS)

Application Development



The mobile and web application development have been completed. Interested farmers can register online to use the platform.

https://farmtab.ga/home/



Results – Growth rate detection

Results – Growth rate (hydroponic versus soil-based system)

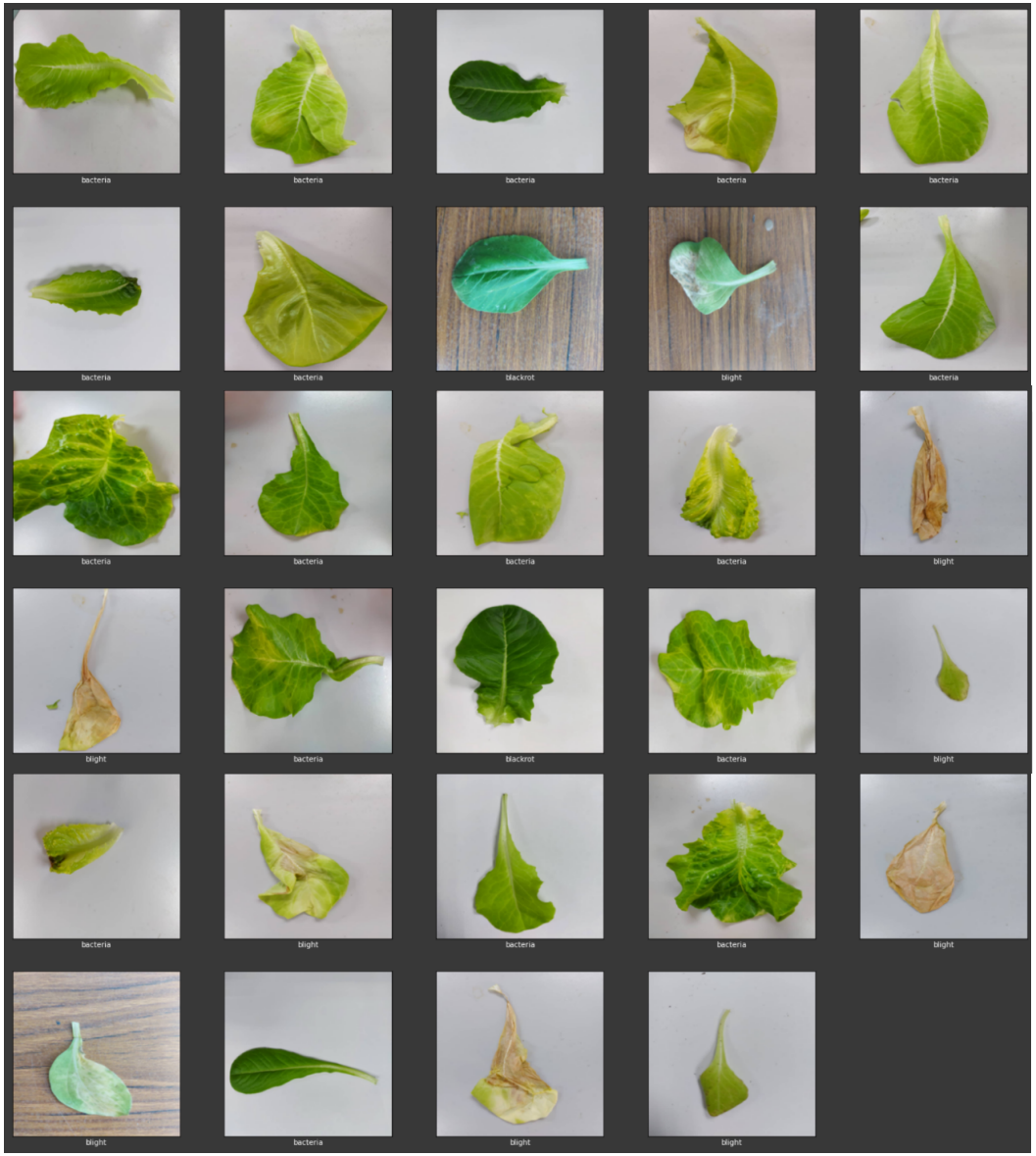
The mean height and p-value of water spinach from hydroponic and soil based system

System	Total water spinach (n)	Mean height (cm) ± SD	P-value
Hydroponic	20	18.598±12.53	0.00867
Soil based	20	7.073±0.87	

The mean leaf length and p-value of water spinach from hydroponic and soil based system

System	Total water spinach (n)	Mean leaf length (cm) ± SD	P-value
Hydroponic	20	6.208±2.59	0.00189
Soil based	20	3.170±0.27	

Results – Deep learning for disease detection



Results – Effect of lighting for indoor farming

5850 lux

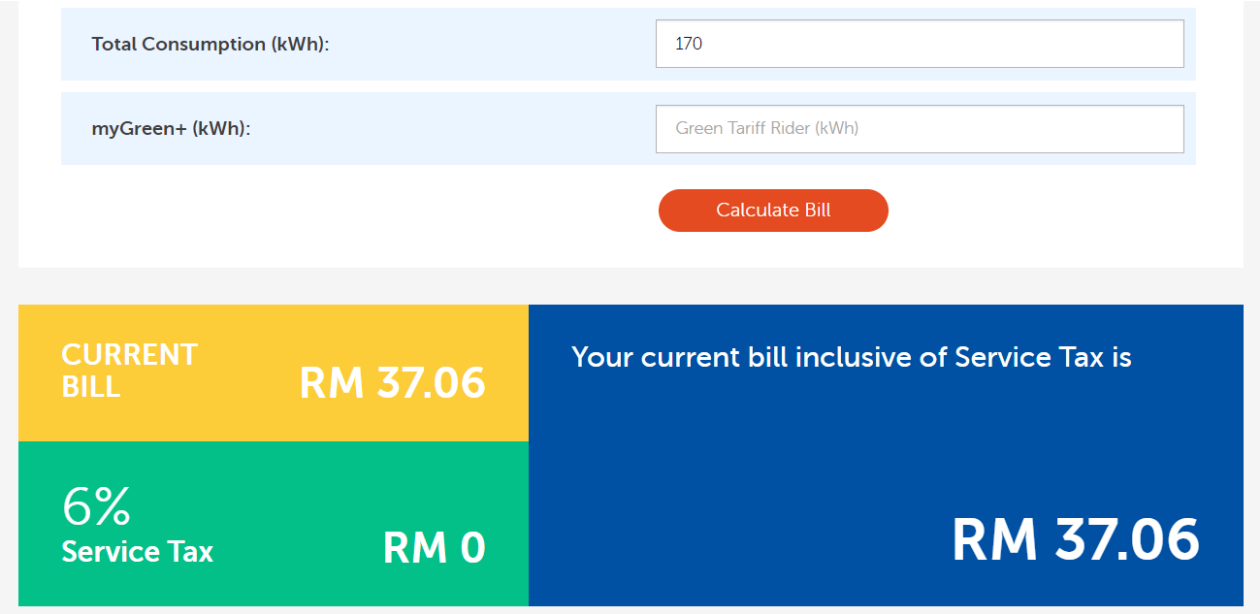
8350 lux

9650 lux

Different light illuminance evokes different photosynthesis responses

Results – Energy costs

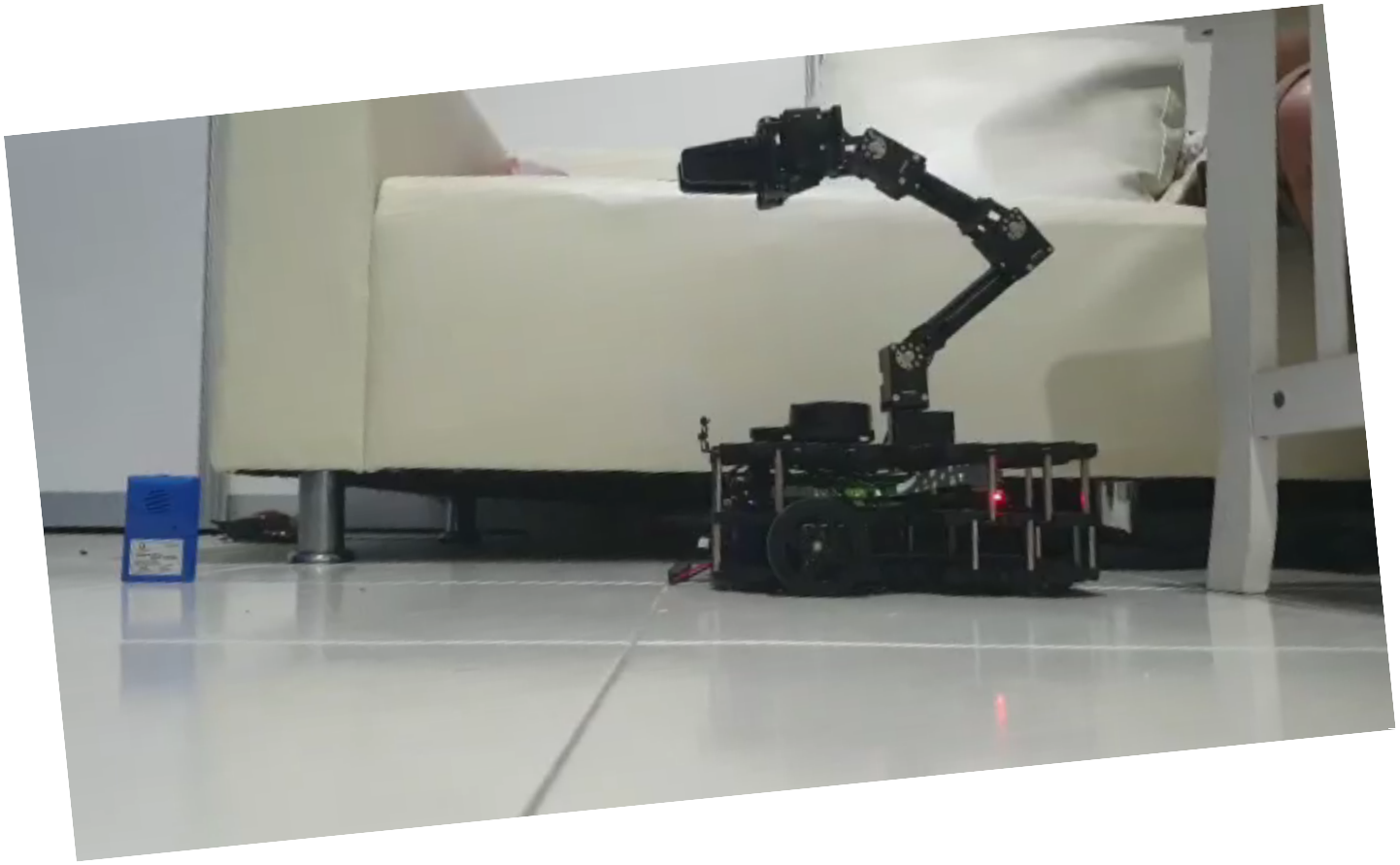
- Energy consumption and cost. (approximately USD8.90 per month) for 48 plants.



- Every unit is approx. RM0.80 more expensive.
- **Ability to harness solar power very important !!!**

Results – Integration of robotic system

- Although the system will automate the fertigation and irrigation in hydroponic, farmers still need to be present to move the net cup of germinated seeds and produce that is ready to be harvested.
- **Integration of robotic system is important to reduce human intervention.**



Scientific Contribution:

Please fill in the following table if your members gave presentations at an international conference or published papers in scientific journals.

The presentations at International Conference:

No:	Paper title:	Author names	Affiliation	Conference name:	The date of the conference	The venue of the conference
1	An IoT Platform for Urban Farming	Eng-Kee Tan, Yung-Wey Chong, Boon-Yaik Ooi, Achmad Basuki, Muhammad Niswar	USM, UTAR, UB, UNHAS	The International Seminar on Intelligent Technology and Its Application (ISITIA).	22-23 July 2020	Surabaya, Indonesia (Online)
2	Machine Vision Based Urban Farming Growth Monitoring System	Raden Arief, Achmad Basuki, Yung-Wey Chong	UB, USM	EECCIS 2020	26-28 August 2020	Malang, Indonesia

Societal Impact:

SOCIETAL IMPACT

Economy

Tested with local urban farmer to increase yield

Environmental Impact

Provides data to local farmers to optimise their environment

Open Data

Making dataset for illness for different crops public