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, Cheng Wai Khuen	UTAR, Malaysia
Muhammad Niswar, Zainal, Zulkifli Tahir, Abdul Azis	UNHAS, Indonesia
Achmad Basuki, Raden Arief Setyawan, Ratno Wahyu Widyanto	UB, Indonesia
Khin Than Mya, Myint Myint Sein, Thi Thi Soe Nyunt	UCSY, Myanmar
Naoki Shinohara	Kyoto University, Japan

Project Duration :

24 months

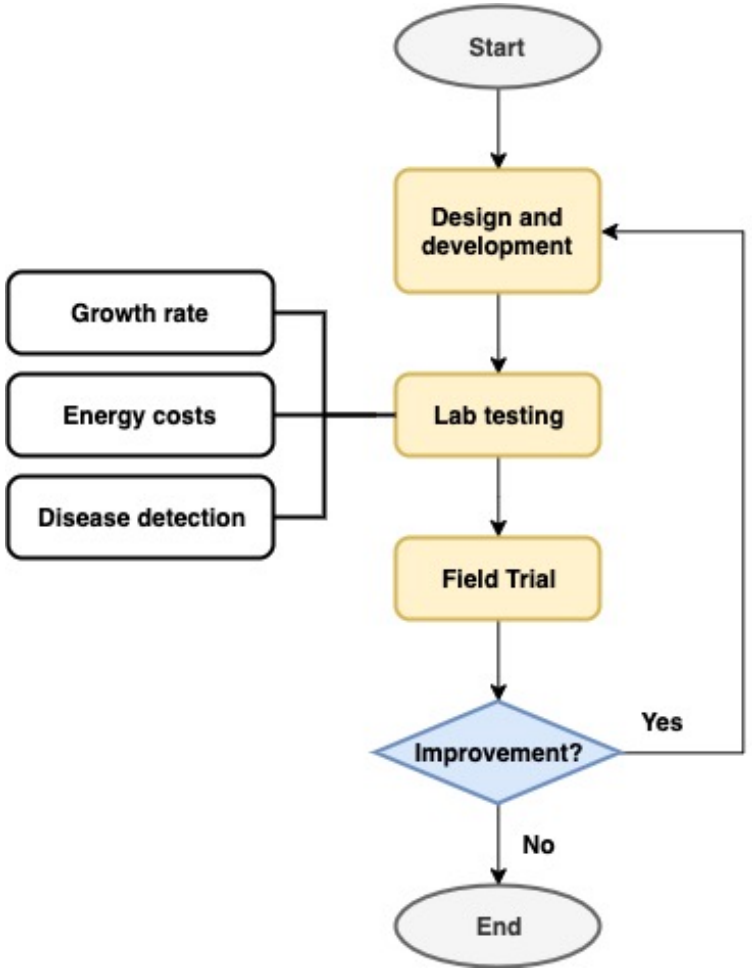
Project Budget:

USD 79,825

Target Countries :

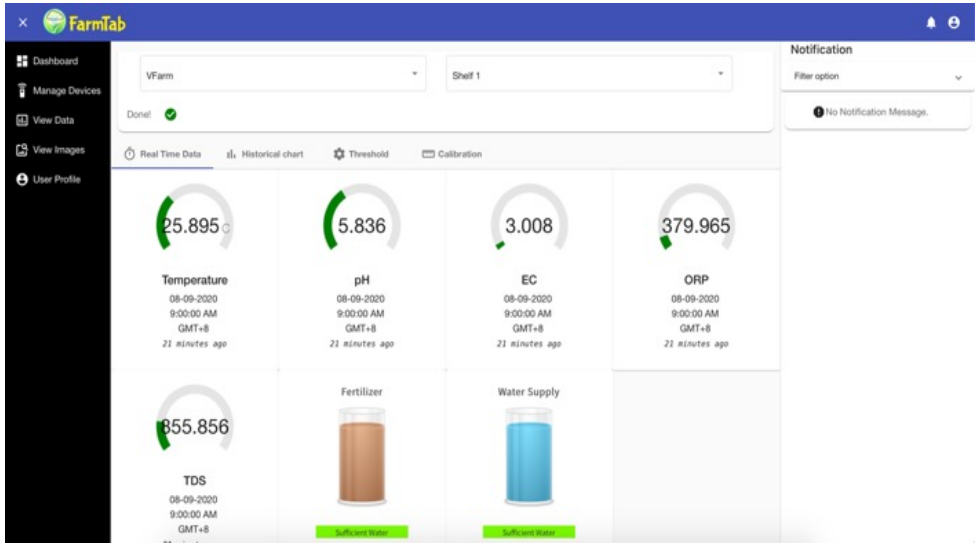
South East Asia

Project Activities:



Application Development

https://farmtab.ga/home/

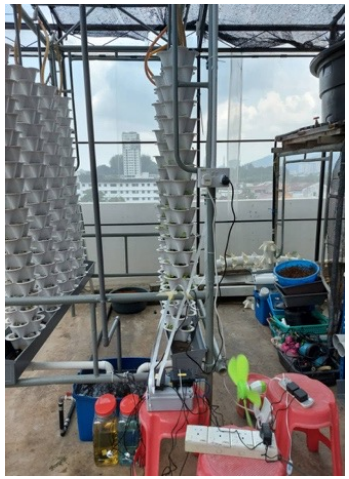


Lab Testing

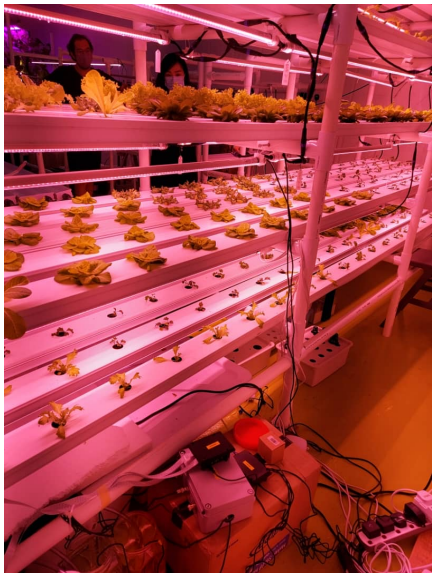
Project Activities:

Field Trials

After 35 days



Victory Farm, Malaysia



Squareroot Urban Farm, Malaysia

Batu, Indonesia

Project Activities:

Workshops to train local farmers

Batu, Indonesia

Makassar, Indonesia

KANJURUHAN-BATU

Dinas Pertanian 3 Kali Surati Kementan

Kendala Kartu Tani Sulitkan Pemilik Kios

Sudah Zona Kuning, Anggaran Bencana Rp 5 M

Project Activities:

Workshops to train local farmers

Yangon, Myanmar

Penang, Malaysia

R&D results:

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

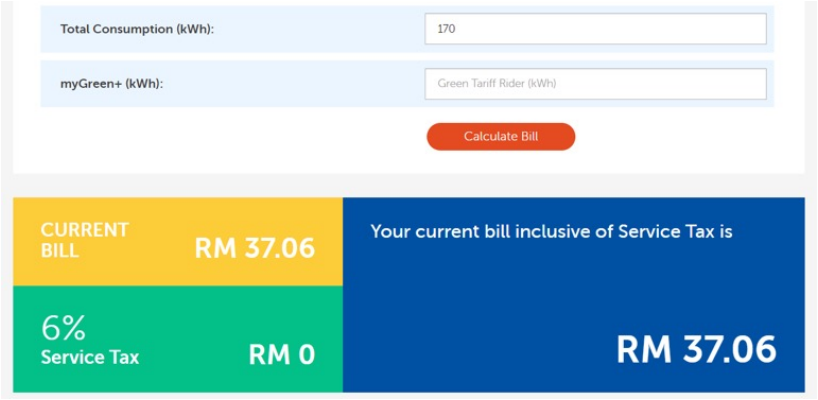
System	Total water spinach (n)	Mean leaf length (cm) ± SD	P-value
Hydroponic	20	6.208±2.59	0.00189
Soil based	20	3.170±0.27	

Findings: Growth rate using hydroponic system is better than soil-based system

R&D results:

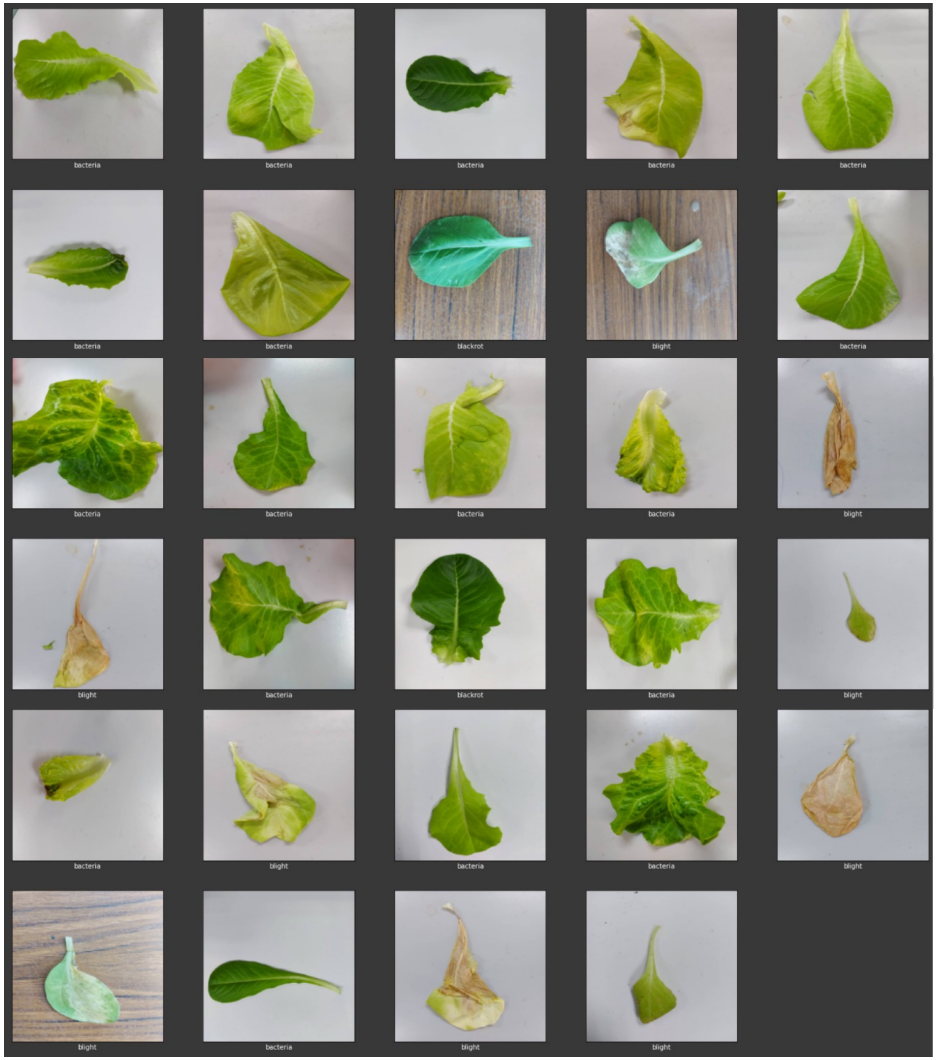
5850 lux	8350 lux	9650 lux
		

Findings: Different illuminance evokes different photosynthesis responses as red. Carotenoids can be visible in red leaf lettuce when the light illuminance is higher.



Findings: The energy cost to grow 1 plant is around USD0.19. The ability to harness solar power for precision agriculture especially urban farms is very important.

R&D results:



Findings: Customized deep learning model can increase the efficiency of disease detection

Scientific Contribution:

Presentations at International Conferences:

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
3	LMM: A lightweight messaging middleware for precision agriculture	Eng-Kee Tan, Yung-Wey Chong, Raden Arief Setyawan, Muhammad Niswar, Khin Than Mya	USM, UB, UNHAS, UCSY	ICOIN 2021	13-16 January 2021	Jeju (Online)
4	Data-driven agriculture system for hydroponic farming	Myint Myint Sein, Thi Thi Soe Nyunt, Chong Yung Wey	UCSY, USM	APIT 2021	15-17 Jan 2021	Bangkok (Online)

Societal Impact:

SOCIETAL IMPACT

Economy

Tested with local urban farmer to increase yield

Environmental Impact

Provides data to local farmers to optimise their environment

Capacity building

Train local farmers to use technology in agriculture

Conclusion:

- Many millennia farmers are interested to explore IoT-based precision agriculture system.
- Lab testing and field trials showed that the system can monitor the growth of the plant and detect abnormalities.
- The system has helped the farmers to grow the plant with minimum attention.

Future works:

- Enhance the system further.
- Conduct more field trials in ASEAN.
- Commercialise the platform.
- Make the datasets available to research communities.