



Smart Agriculture Management System for Local Perennial Herbs in Vertical Farming

M. Hanafi¹, S. Mashohor¹, S. M. Shafie¹, T. Kozai²

R. Kassim³, N. Arsad⁴, J. D. Cruz⁵

¹Universiti Putra Malaysia, ²Chiba University, ³Malaysian Agriculture Research and Development Institute
, ⁴Universiti Kebangsaan Malaysia, ⁵Mapua University



Issues in Food Security..

- *Availability* - sufficient food supply and on a consistent basis.
- *Access* - people able to regularly acquire adequate quantities of food through purchase, home production, borrowing or food aid.
- *Utilization* - consumed safe and nutritious food

Mitigation in Malaysia..

Strengthening the management of food resources to improve role and function of food resources via increasing self-sufficiency in food commodities, which means that each individual need to grow their own food either by planting at their own home or community gardens (*3rd National Physical Plan of Malaysia by Federal Department Town and Country Planning Malaysia*).



Food Production in Urban Area

However, the effort of producing own food in conventional way by individual is difficult to be implemented in urban areas due to time constraint, busy lifestyle and lack of agricultural land, which is the result from rapid urban development. To overcome this problem, **vertical farming in a residential area** is the best alternative that can encourage every individual to **produce their own food source**.

Vertical Farming

- Plants grown on stackable racks
- Indoor farming require greater energy consumption
 - Air circulation, water pumps and sensors
- Expensive materials and implementation cost
- Uneven distribution of water whereby the top layer plants tend to be dryer than the bottom layer



Vertical Farming Systems Scenario in Malaysia

- Management system is still executed in conventional way which involved closely monitoring by human.
- Irrigation is operated based on timer.
- Non-adaptive to microclimate.
- Lots of energy consumption for indoor farming.



http://www.farmtech-mart.com/environment_control



<http://www.cityfarmer.info/2014/11/18/vegetable-farm-in-the-sky-in-malaysia/>



<http://www.cwca.com.my/2017/05/14/behind-scene-farm-operates-cameron-highlands/>

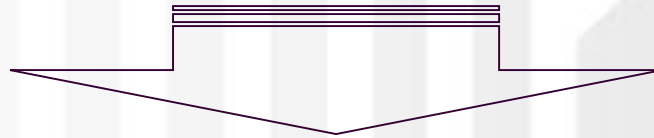
How to tackle the problems?

To propose a smart management system for vertical farming that is adaptive to microclimate in Malaysia.



The issues need to be addressed..

- The issue related to irrigation and fertigation schedule that adaptive to microclimate in Selangor, Malaysia.
- The issue related to pest control for outdoor vertical farming.
- The problem related to system design and development, where it is crucial to identify an economical design that able to minimize the operation cost.



Local Perennial Herbs

Why local perennial herbs?

- Great potential in pharmaceutical industry due to medicinal value.
- Easy to grow but have not been focused for commercialization [1].
- The herbs are also consumed by Malaysians as a source of vegetable for daily meals



Country Borage



Vietnamese Coriander



Longevity Spinach

[1] Farizah Ahmad, Mohd Azlan Shah Zaidi, Noorasiah Sulaiman, Fadzilah Adibah Abdul Majid . "Issues and Challenges in the Development of the Herbal Industry in Malaysia", Persidangan Kebangsaan Ekonomi Malaysia ke-10 (PERKEM 10), Kekayaan Terangkum Teras Pembangunan Lestari, Melaka Bandaraya Bersejarah, 18 – 20 September 2015.

The Herbal Industry in Malaysia

- The herbal local market to expand by 15% a year from RM7 billion in 2010 to around RM29 billion by 2020 - **The Ministry of the Natural Resources and Environment**
- Households in Malaysia consuming herbal products were estimated at 73% - **Forest Research and Institute Malaysia (FRIM), 2012**
- The herb products have shown increasing trends since the 1990s, reported to reach 8,550 in 2000 and has more than doubled by 2013 - **Ministry of Agriculture and Agro-based Industries Malaysia**





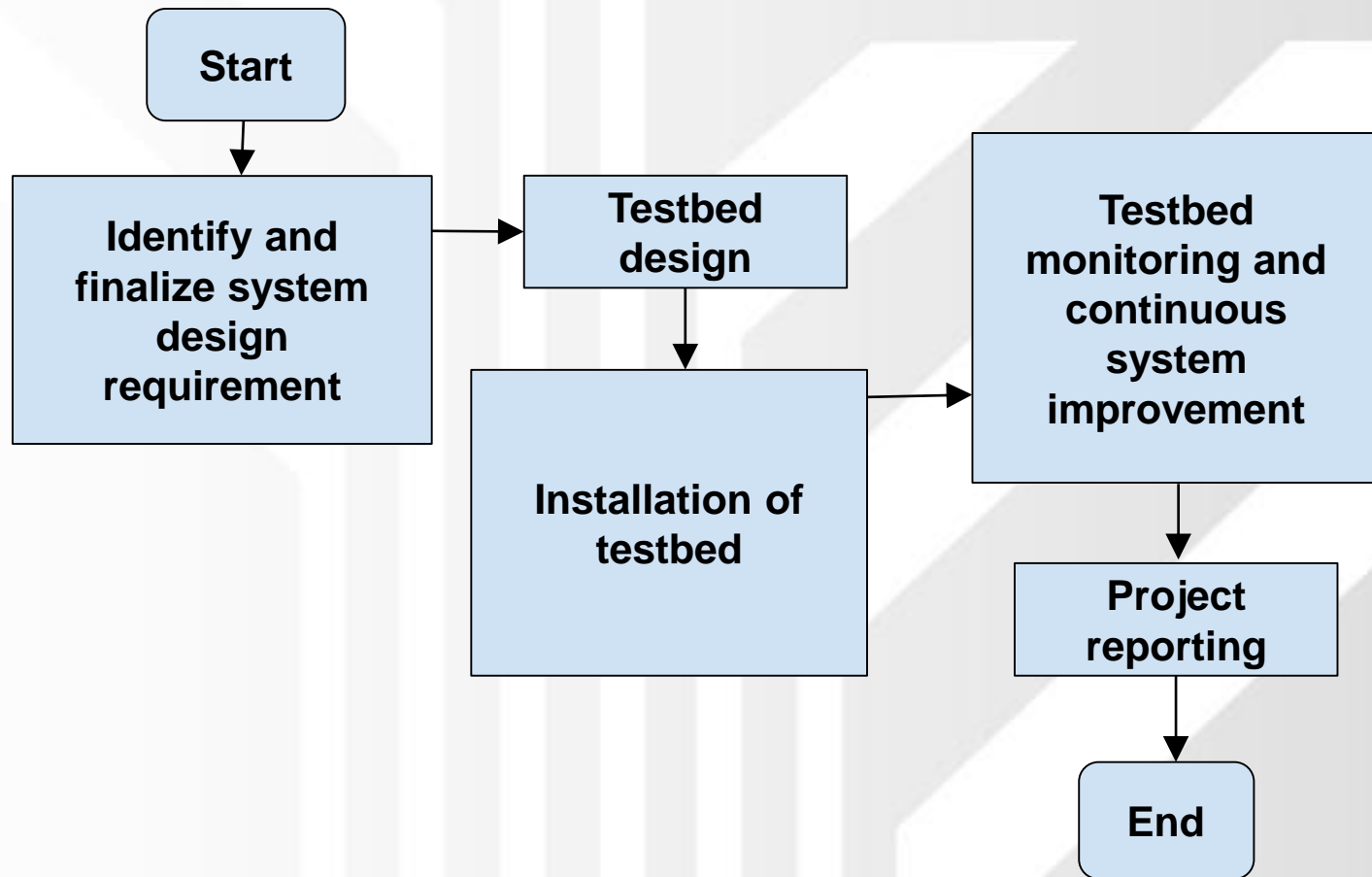
Our Aim

To identify important attributes for developing a smart agriculture management system for local perennial herbs in vertical farming.

The objectives...

1. To identify the relationship between irrigation, fertilization and pest control in relation to microclimate for vertical farming in order to boost local perennial herbs production.
2. To design a system that adaptive to microclimate and simplify farming activities using identified devices, algorithm and materials.
3. To develop the proposed design for smart agriculture management system.

Work Plan



Scientific / Commercial Expected Impact

- Smart agriculture management system for vertical farming
- Local perennial herbs setup on vertical farming
- Photonics fence and advanced imaging system for pest control
- Decision making method to automate the agriculture activities



Beneficial Impact on Society

- The project will contribute to food safety and the selected local perennial herbs are known to give benefits to health.
- The proposed system helps to reduce energy consumption by introducing a system that adaptive to microclimate.
- Improve the income generation of society as the good supplies of local perennial herbs will support the medicinal product manufacturing.
- The proposed pest control and decision making methods are also applicable for other farming setups which utilize the electronic sensors.

Conclusion

A smart management of agriculture activities will bring more benefits in terms of:

- Economic - increase in entrepreneurial activities and job vacancy, as well as reducing food costs and improving quality.
- Environment - reduce carbon foot print where transportation can be optimised.
- Social - improved overall social and emotional well-being, improved health and nutrition, increased income, employment, food security within the household, and community social life.



Thank You!