ANALYZING HYDROPONIC RACK SYSTEM FOR APARTMENT HOUSE

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ABSTRACT
The objective of this study is to identify hydroponic system for those who are living in condo and apartment in an urban area. Livings in condo and apartment have limited space to do farming activity. Furthermore the management of condo does not allow people to farming in the corridor area. Space has always been the big problem for those who live in urban areas. Other than that design of the existing hydroponic system is not suitable for the current needs. The aim of this study is, to help people so that they can farm in a small area and have limited space in the urban area; it's also to create awareness how important of planting crop in the living area. Meeting the farmer around Serdang and Terengganu. The surveys in several areas, among them are the MAHA exhibition. Has garnered some agricultural entrepreneurs in Malaysia and abroad. The survey was also done at the condo housing and apartment area around Kuala Lumpur. A set of questions related to the area of research. A total of 100 questionnaires. The entire question totally has 20 questions that question include about the respondent profile, benefits, usability, product, feature opinion and suggestion. Design based on the functionality and practicality of hydroponic system in a small area. The result of the experiment shows that the compact hydroponic system is suitable for the condo and apartment area which are small and compact. Use the suitable function such as rack system, water system, and DIY (do it yourself). The practicality of use this product has been proving when use the prototype for farming. The hydroponic would be give attention to the system. Function and technology that used nowadays will be developed according to the current time. Suggestions for future hydroponic are to design futuristic products affordable by each user. Due to lack of space for plants, this hydroponic system should be extended. Attractive design and sophisticated functions are needed for the user food supply.

Key Words
Hydroponic, Rack System, Vertical, NFT system, food supply

INTRODUCTION
Malaysia is a developing country; many buildings developed and were still in the process to build. It makes big city like Kuala Lumpur become a city that is compact with development and people. Through this study, we find out area or space for farming activity increasing day by day, big scale agricultural project in Kuala Lumpur cannot be implemented following with rapid development. Based on the article that has been written by (Yasmin Matthew. (2004). Malaysian Agriculture for Asean. Malaysia. New Strait's Time), 90% of the Kuala Lumpur area has been used for development projects and its limited this agricultural activity among in the area town. We had committed a study on hydroponic farming to those stay condo and apartment area because of our observation that we are doing and realizing that the Kuala Lumpur area already not suitable to be turned into a place for

agriculture in the future. Hydroponic concept was chosen to be presented to them. Hydroponics is growing plants in water without any type of media and initially this concept involved growing plants directly in water. The home-based hydroponic vegetable production system allows persons to grow lots of plants in small spaces around the house and on patios & balconies, in window boxes. This system can be maximally utilized by families living in crowded city areas with small or no yard space. The size of the garden will be dependent on space available

LITERATURE REVIEWS

In this study, we are using books, journal, website and other method to do research. All methods used to gather information that exists to further strengthen information. Through this method we have read a few journals related to hydroponic crop, it deals with method, method of use and other. Among journal that got our attention is (B.A. Kratky (2002), Hydroponic methods for growing lettuce. *Hydroponic world*: page 78-79) which discussed on another method that is correct and method that is suitable for hydroponic. Through these discussions find out many methods that are suitable that not just crop method in the pot only. Apart from that, information from website also help, for example, is (*My first kit hydroponic* (2012). Available at: https://hydrojournal.wordpress.com/page 3) this website has a lot of information journal related to life cycle, the hydroponics crop cultivation way. Beside that (*12-homemade-indoor-hydroponics* (2010). Available at: theselfsufficientliving.com.21 Jan 2010) on this website, many examples related to current hydroponics design made a reference. From this website we get a lot of information to help us with research through reading on the other hand, we refer to the book (George. V. (2009). *Gardening Indoors with Soil & Hydroponics*. New York) that revolve on hydroponics gardening method in the door. This book is suitable with project topic that we are managing. The entire source we used for this research for hydroponics and do for the right design for those who stay in a condo or apartment. All the information will be good for us.

Apartment house area research

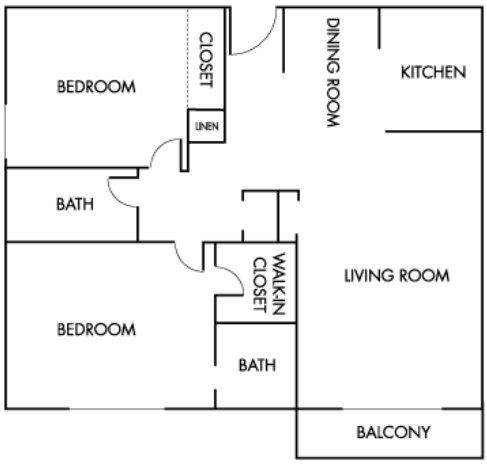
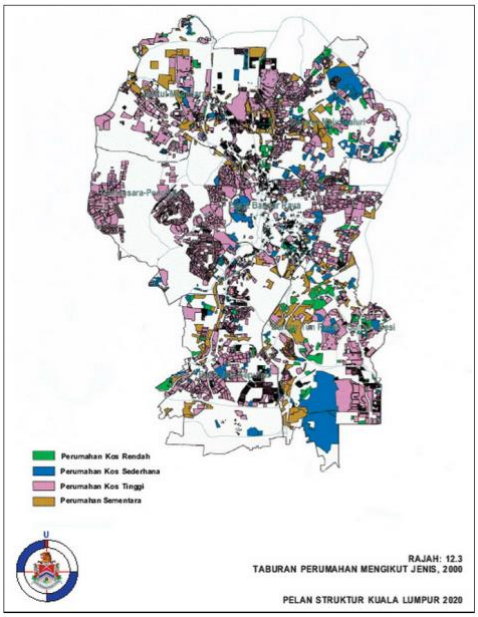


Figure 1 : Apartment interior

Figured 1 show that standard apartment floor plan that usually has been use In city area. That floor plan show on how apartment area has been creates with small space. Most of apartment in city area has a small space (endonthemonthcity.com/site3).



Figured 2 : Apartment site area around Kuala Lumpur (DBKL 2015)

Figured 2 is the data from (DBKL 2015) show apartment area in Kuala Lumpur. Over 75% type of house in Kuala Lumpur is apartment. From 1992 to 1998 there was a reduction of 32.4 per cent of slum dwellers. This reduction results from intensive action by government agencies to build more low-cost housing through programs of privatization and redevelopment. That is the market on this research to been there. (http://www.dbkl.gov.my/pskl2020/malay/perumahan/index.htm).

Product Design Specification (PDS)

Product specification that have been doing for this project, based on existing product then change to be more good product design. All the specification will be used to build this product.

- **Hydroponic system: EBB**

  A system that will be used to design this is the NFT (nutrients Film Technique). It is a system that is popular among practitioners of hydroponic crops. It's an old technique used. Many new users are involved with the hydroponic. This technique is most suitable for use. According to figure 9: water flow systems starting from a special tank will drain water up into the plant. And will be out again after it's full of water, and the water flow into former will continue. This allows water cleanliness and freshness of nutrients from water is not polluted.

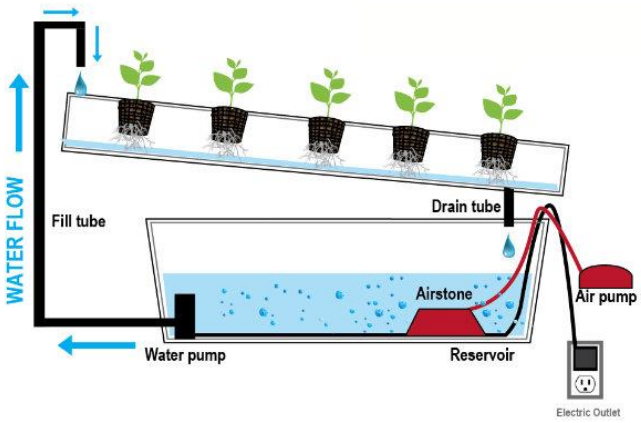


Figure 1: EBB system

The system also does not require a timer to keep the flow of water. Unlike the wicked system and EBT system which requires the timer to keep movement and water flow. This system is very easy to use and easy too guarded. Water flow is always on the move, it is also built with a water line that controls the height of the water in container crops according to desired level. This makes the crops will not sink.

- **Rack System**

The proposed design is a rack system. Such a book rack or rack shirts. It is suitable to be placed anywhere or just anywhere in the garden and backyard. This system also reduces the use of the space will be used to place the product in a place. Arrange them along the walls of your garden will be an ideal proposal. They look like value along the wall. Figure 2 is the example or the existing product that uses rack system for their system:

Figure 2: existing rack design

- **D.I.Y (Do It Yourself)**

One of the new techniques and rarely used in the system hydroponic is a system of DIY. DIY system was planned is separate all the part of component and put into one box. This method is rarely used. This proposal is to enable users to bring in a set of complete hydroponics into their home. Because most hydroponics products set at the market are too large and is difficult to bring at home. In addition, this product is focused on those who live in areas of high housing. And this system is suitable proposals for products that will be built later.

Figured 3: the existing DIY hydroponics product

The diagram shows one example of DIY hydroponics existing products designed for DIY. Installation and manufacturing that made itself at home. This technique would be used in this study. Through study and observation, we found no more existing products in the market using the slot in the system. The system slots in each component and divided into several parts easier users to carry and carry him where it around. It extended to the idea want to keep all the components that was resolved into a container. The former was carrying tanks of water resources to the shelves hydroponic. This method can reduce the use of materials and it is an interesting technique that should be explored.

Figure 4: Example box for storage

- **Water Pump**

Air pumps are optional in hydroponic systems. But using them has benefits, and air pumps are relatively inexpensive. Air pumps can be found anywhere they sell aquarium supplies. Air pumps simply just supply air and oxygen to the water and roots. In water culture systems the air pump helps keep the plant roots from suffocating while they're submerged in the nutrient solution. For any other type of hydroponic system, the air pump is typically used in the reservoir. It helps to increase dissolved oxygen levels in the water up and keep the water oxygenated. Other advantages of using air pumps are that as the air bubbles rise, they keep the water and nutrients moving and circulating, this keeps the nutrients evenly mixed all the time. The circulating oxygenated water also helps reduce pathogens from gaining a foothold in the reservoir.

Figure 5: Existing water pump in market

Proposed Plants

Herbs are any plants used for flavouring, food, medicine, or perfume. Culinary use typically distinguishes herbs as referring to the leafy green parts of a plant (either fresh or dried), from a "spice", a product from another part of the plant (usually dried), including seeds, berries, bark, roots and fruits. Herbs have a variety of uses, including culinary, medicinal, and in some cases spiritual usage. General usage of the term "herb" differs between culinary herbs and medicinal herbs.

Table 1: Example of suitable plants for proposed product

Vegetables' Name	Characteristic / Properties
Caixin green 	• Excellent choice for hydroponic growing. • The simplest of setups • Doesn't need a lot of extra attention. • Generally have a height and spread of 6 to 12 inches (15 to 30 cm) • Generally lives 65–130 days from planting to harvest • Does not have an extensive root system
Bok Choy 	• Produce leaves and add height until they reach 6 inches tall • Ready for harvest at 50 to 60 days after germination or transplanting.
Oregano 	• Oregano usually grows to a height of 12 to 18 inches (30 - 45cm) • Oregano is grown outdoors prefers full sun. • Has a spreading root system

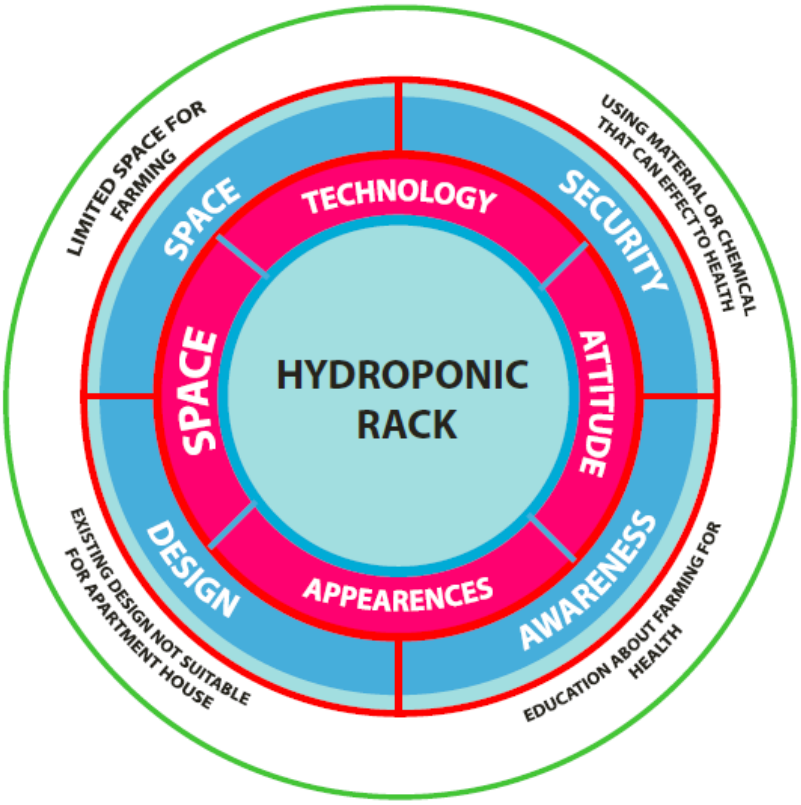
Conceptual Frameworks

From studies that has been made, we got a few keyword that made at the jumping-off point of the study, from this keyword can be divided into a few small groups, namely technology, function and appearance. Every this group there is a keyword that with relate to the problem and what we will do with products.

Table 1: keyword

Function	Technology	Appearances
Durable	Water system	Space
Easy to use	Sunlight	Size
User friendly	Medium (Fertilizer)	Aesthetic
Expandable	Safety	Quantity
Storage	Water flow	Modern design
Ergonomic	Indoor farming	Shape
Adjustable	Sustainable	Lightweight

Table 2: Research framework



PROBLEM STATEMENTS

Through on research, we find out some of the problems that appear following issue that was chosen. This problem focuses on those living in condo, house and apartment. The problem taken into consideration with environmental factor and lifestyle, especially in the area town. The problem is:

Space

People at condo and apartment do not have enough space and suitable place to do farming activity because of limited space and the management of condo not allows people to farming in the corridor area. Limited space that is the main problem faced by a consumer, limited space following accommodation that has no suitable space to do farming activity. Furthermore, there are some places that do not allow residents to do activity plant in the area housing.

Living style

Living style on important of hydroponic system. This system many functions, but many that still do not know the advantage deploy this system. Through research that was carried out at the selected area, almost 86% people still do not know what hydroponic system is. This has become one of the problems that should be solved before designing idea to design product for them. The poison use problem that uncontrolled among vegetable supplier very no good for current lifestyle. So own farming system should start with them for future times

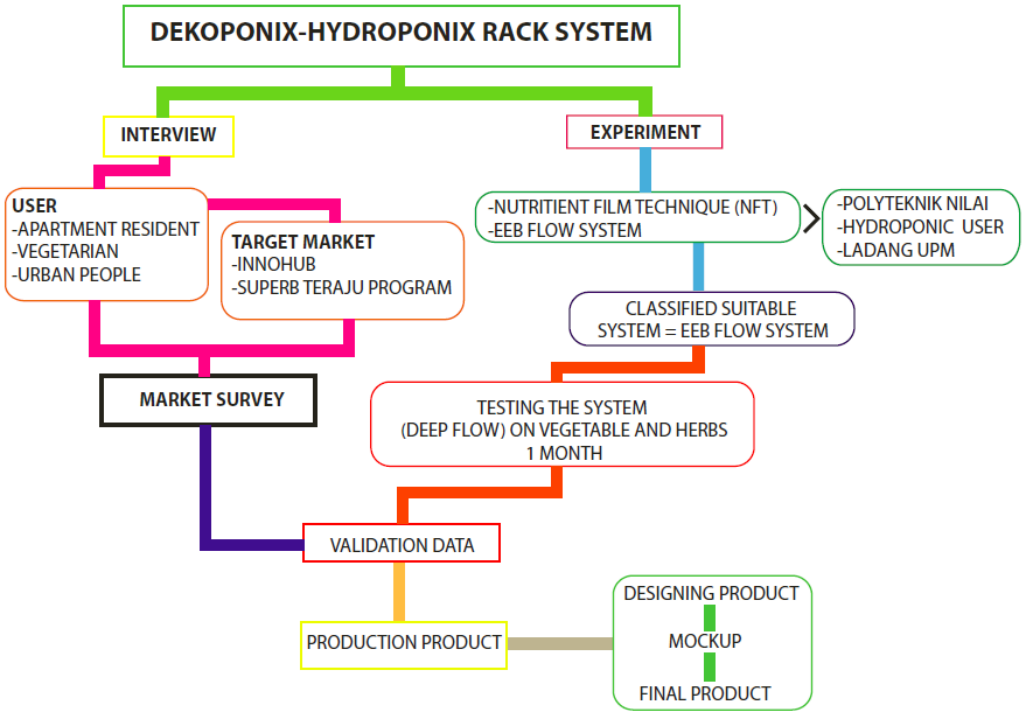
Design

The design of the existing hydroponic system is not suitable. Existing hydroponic design nowadays are not suited for those living in condo and apartment. Furthermore, existing product that too big and too uninteresting to use by those who stay in the area town. The product also has problems to be carried and become problematic when want to bring into the house. This makes it are not suited for those living in the high house area.

METHODOLOGY

The research process describes about the methodology of the study that has been used to achieve the objective of the research. Research involves a few, method that has been specified the target. Data were collected by several methods which are interviews, observation, literature review and questioner. All the data will analysis for use in the design.

Chart 1: Methodology flow



RESULTS & DISCUSSION

In this finding, I was meeting the farmer around Serdang and Terengganu, I get some information and knowledge about the hydroponic farming and type of plant has a good nutrient for soil and also planted. The finding from this date I describe and put into the research of qualitative. Mr. Ahmad Sapawi is one of the respondents meet interviews in this part. The user of hydroponic farming and has a own farm. He gives some advice and information about the garden environment and farming.

Figure 1: Mr. Ahmad Sapawi

Mr. Ahmad Sapawi is an agricultural entrepreneur and using hydroponic plants. Over 10 years of experience in this field. The conversation between us is how to prepare for the launch of this plant material and the basic principle in the plant. Besides that, he also is a seller of goods for planting hydroponics at home. He made his own design and sale it at on-line sales. He has three designs have been patented. He designs received by many of consumer in Malaysia. He designs caught the attention of the agriculture department for extended use.

Figure 2: One of design from Mr Ahmad Sapawi

We also interviewed the residents' condo the area of housing, which is our primary objective to make the design. We met with one of the residents in residential area apartment Setapak Jaya, Mr. Azhar, who is chairman of the residents here. The main topic of our conversation with the representative is hydroponic system design.

Figure 3: En Azhar the chairman of resident community

- **Survey**

In this study we have done the surveys in several areas, among them is the MAHA exhibition complex in Serdang. The exhibition, which took place in December 2014, has garnered some agricultural entrepreneurs in Malaysia and abroad. There are many displays of new technologies in agriculture. Technology and design to hydroponic also introduced. Many attractive designs and systems introduced to the public. It becomes an ideal spot for us to make a survey.

Figure 4: scenery around the MAHA exhibition

The survey also forwarded to the agriculture faculty UPM. The survey was carried out to a nursery and planted there. There has been some research on how to effectively cultivation hydroponics to consumers out there. According to the survey, they still think of a suitable design for users out there, because existing designs too large and difficult to be brought back by the public. They also need ideas and designs of our company to further develop and design in
Malaysia.

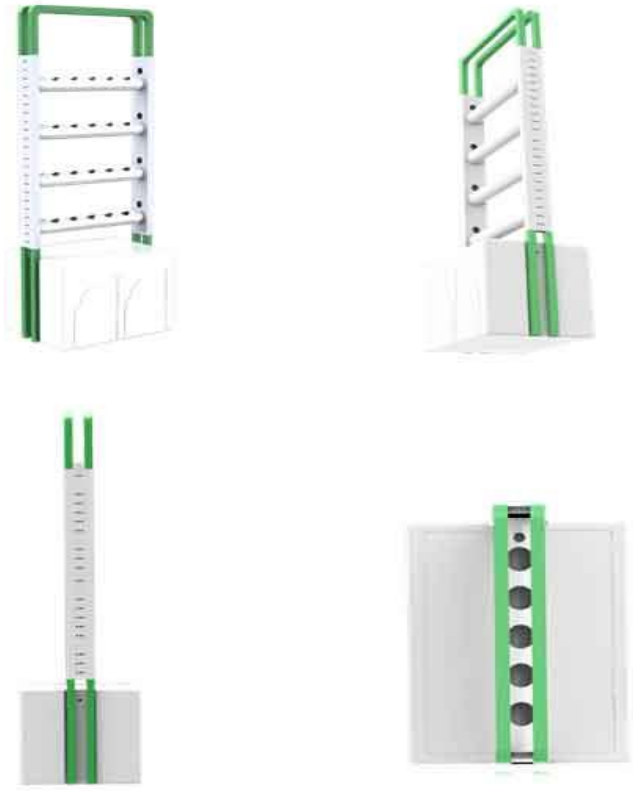
Figure 5: UPM agriculture farm

Figure 6: existing product of UPM that show at BHEP

The survey was also done at the condo housing and apartment area around Kuala Lumpur. A survey is to know suitability of use of this plant to the consumer.

Figure 7: Apartments at Setapak Jaya

FINAL PRODUCT



Figured : final 3D Product

How to use

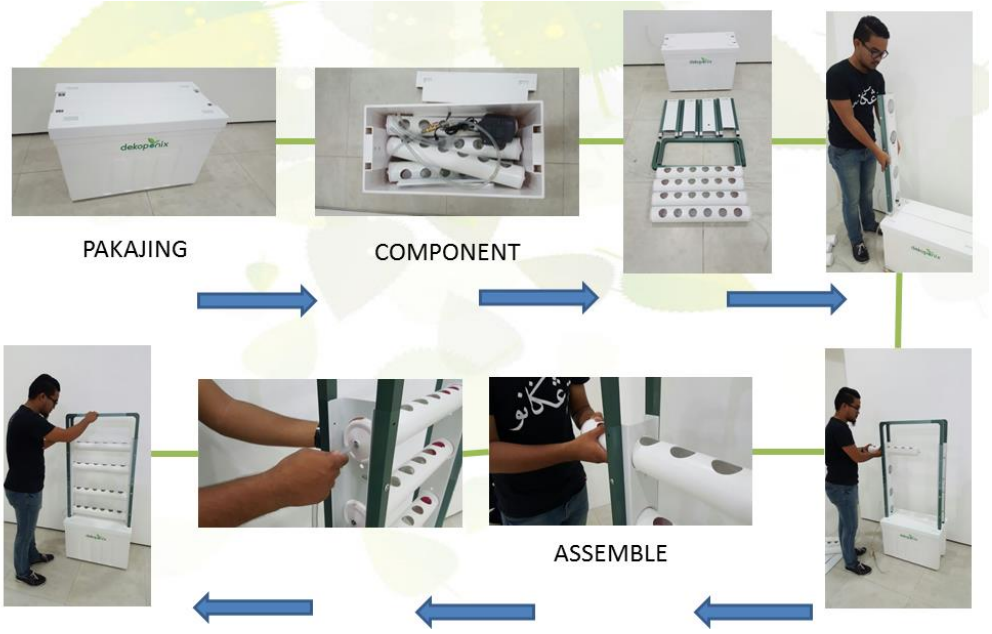


Figure 1: How to use demo

CONCLUSION

Contribution of knowledge

The contribution of knowledge in this study, many research have been made in terms of function, technology and designing that customized nowadays. According to the passage of time, hydroponic is now a widespread response from among the community. Many consumers who are interested in this hydroponic technique because it is a simple system of cultivation can be easily maintained without the need for farms or land for planting. In line with these developments, many new technologies have come and give the biggest impact to the hydroponics field. The study-by-study done to make the success of this project. Research about how to solve problems faced by the apartment people on how wants to farming in their house. Due to limited space and no spaces suitable for planting, then study was carried out to address and repair this problem. Make design shaped like a rack is one of the newer designs used. Coupled to the system rack that can be unplugged and plugged back like bookcase is one of the new designs for the world hydroponic. It is also compact and sized and not too large and suitable home interior design. Each component has an important role in the design. Once the rack design is used and each component separated will be stored in a container, the container is also water storage for the product. The container is also one of the components in the design. This technique is still there, used in existing products in the market.

Future Research

The world today is heading toward a future where wars could break out over food resources. With growing population and industrialization, there is huge pressure on agricultural land. This is leading to deforestation on a large scale. There is only so much land on offer on this planet and with each day seeing many more mouths to feed, there will come a point when cannot increase food production from conventional agriculture anymore. In the future for the hydroponic would be give attention to the system. Function and technology that used nowadays will be developed according to the current time. Suggestions for future hydroponic are to design futuristic products affordable by each user. Due to lack of space for plants, this hydroponic system should be extended. Attractive design and sophisticated functions are needed for the future. Improvement of design towards that fits the present, especially decoration in the home. These can be combined and will become a trend in the future. A lot of the design made by designers who are exemplary, and the design they should be given the opportunity to be featured in the future.

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