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Kitchen Design for Water Recycling and Building New Family Relationships

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Acknowledgment

This design has a very special meaning to me. I have struggled many times in this process, and I am also happy for the progress I have made. A big thank you for my professors and classmates for their advice and encouragement during this process. You helped me find my direction.

In the two years of RIT, I have met many new friends and saw many different sceneries. When I flew to the United States, I would not know that I could make such a big progress. These are all inseparable from the friends around me.

RIT provided a great help to the completion of my design. I used the skills I learned in the Furniture Design class and Metal& Jewelry class to improve and enrich many details of the model. With the help of professional photography equipment, my design seems to be one step closer to perfection. The completion of this design is not my personal contribution. Without their help, I would not be able to make this step.

Soon, I will fly back to China to start the next phase of my life, but I will never forget my days at RIT. Everyone I meet here makes me feel more unwilling to RIT. I will take the memories of me with friends when I leave and go to the next stop.

Thank you everyone, we will meet again.
Abstract

Air and water are the most important resource for mankind. Water conservation is a concept that everyone knows, but how many water conservation products can we see in our life? Kitchen water is one of the most important parts of domestic water use, and its life cycle in the kitchen should be given more attention. Making good use of kitchen water will bring environmental benefits to our future generations. This article will first discuss the current situation of kitchen water and the need for reuse of water resources, and then discuss the ways of reusing kitchen water. This article will discuss the new relationships between family members in future in helping to preserve and reuse water in the kitchen. This article will also discuss a kitchen layout that builds a closer relationship between family members in our future life, creates a variety of life scenes through the design of space and user movements, and explores the relationship between different shapes to achieve the most effective way of using space. At the same time, it satisfies the user's daily behavior when using the kitchen. Then, this article will discuss a kitchen design that can reuse water resources and build more life scenarios. At last, this article will show the potential of this design in the future.

Keywords: kitchen design, water conservation, family relationship, space design
Introduction

Chinese cooking tends to produce a lot of smoke, so traditional Chinese kitchens are generally located in a separate room. But now the eating habits of urban families have changed a lot, so the design of the kitchen should be changed too.

The kitchen is one of the core places in a house, where the division of labor and cooperation between family members occurs most, so a good kitchen can better strengthen the communication between people.

This kitchen also has a system to help to reuse the water twice in hydroponic system and the dishwasher.
Literature Review

1. What problems does current kitchen have?

In today's Chinese houses, closed kitchens occupy the vast majority. The reasons are as follows:

(1) Traditional Chinese cooking is prone to produce large oil fumes, and closed kitchens can prevent oil fumes from polluting the living space.

(2) Some families have their own decoration styles, and independent kitchens can allow these families to try different decoration styles to create another style and make life more fun.

(3) A lot of dirty dishes and kitchen waste are easy to accumulate in the kitchen. The enclosed kitchen can make the whole home look cleaner visually.

But at the same time, the enclosed kitchen has some shortcomings: the kitchen temperature is too high, especially in summer, the cooking experience can be very bad, so some families choose to install air conditioning in the kitchen. The enclosed kitchen divides the family space, so visually, the family space is reduced and it will appear very crowded. Closed kitchens have a certain impact on family relationships. Usually, one person completes all the work in the kitchen. During the period, because that person cannot see his family, they rarely communicate with their family. The entire cooking process lacks the fun of family life.

Disadvantages of open kitchens

1. The oily smoke problem

Because it is open, so the cooking fumes are easy to spread to other spaces, easy to make our furniture, electrical appliances, walls and doors stick to the oil fume stains,
it is very inconvenient to clean. This is also the main reason why many people do not choose an open kitchen.

2. The oil fumes can be removed but the taste is not

Most of the oily fumes can be removed when cooking, but the taste of cooking can’t be removed. When you fry chilis, you can smell the spiciness all over the room.

3. Difficult to coordinate the overall style

The kitchen utensils and tableware in the open kitchen can be seen as soon as you enter the door. If they are not placed properly, it is easy to give people a feeling that your home is really messy. When decorating, pay attention to the overall style matching of the kitchen and living room. If the matching is not coordinated, it will also affect the appearance.

1. In terms of appearance

Since the open kitchen is not blocked by doors, it can be directly connected to the space outside, and from the perspective of a restaurant, it is effective and atmospheric.

Closed kitchen, because the dining room and the kitchen are separated by a door, if the room size is small, it can produce a sense of depression. Because of the obstruction of the door, the interior decoration of the kitchen can be appropriately different from the dining room and living room outside.

2. In terms of practicality

If there are frequent fires in the home and there are too many fumes, a closed kitchen is still very practical for the convenience of cleaning.

But if the young couple live alone, only occasionally cook, and want to enjoy the atmosphere and cooking event, they might as well use an open kitchen.
3. In terms of house structure

If the kitchen is in the upwind position, the smell of oily smoke will be blown into the house, and it is generally not recommended to use an open style. If the kitchen, dining room, and living room are connected in a line, it is better to use a closed kitchen or a semi-open kitchen, otherwise the oily smoke will enter the living room and affect the family.

2. The current state of the earth's water resources.

Water is essential for all life on our fragile blue-green planet, and without water nothing can survive. Only 2.5% of the world’s water is fresh & drinkable, and only 1% of the freshwater is accessible. It is our responsibility to reduce our own water wastage and preserve every last precious drop.

According to “Hudson Reed”¹:

(1) Only 1% of world’s water is drinkable.
(2) 20% of world’s unfrozen fresh water is in a single lake: Russia’s Lake Baikal.
(3) By 2025, half of world’s population will be living in water-stressed areas.
(4) By 2025, water scarcity is expected to affect more than 1.8 billion people-hunting agriculture workers and poor farmers the most.

Kitchen water occupies a large part of the total domestic water consumption. Saving water in the kitchen is an important way to achieve sustainable development. Therefore, it is very necessary to redesign the kitchen to make it more in line with future human needs for a better life.

¹ https://usa.hudsonreed.com/info/blog/the-truth-about-new-yorks-water-usage/
3. What should a kitchen look like in the future?

The kitchen of the future should use resources in a more intensive manner. Taking into account the lifestyle of young urban residents, takeaway occupies most of the catering work, and the number of cooking in the family is less. Therefore, the problem of kitchen fumes is not as serious as before. Therefore, it is not necessary to isolate the kitchen from other spaces, so more and more families choose open kitchens. At the same time, today's products are all based on user experience. Therefore, in the future home furnishing industry, user experience will inevitably be valued. Compared with a closed kitchen, an open kitchen can significantly enhance the opportunities for people to communicate with each other, and it will not form a high-temperature closed space, and the cooking environment is more user-friendly.


There are many different designs of kitchens on the market today, but you can find many similarities. Since the design of the kitchen has a strong correlation with the layout of the house, the design of these kitchens is basically an L-shaped layout, and the setting of the various functional modules (washing, cutting, and cooking) in the kitchen of this layout must be considered to the kitchen triangle, their location is also determined. The survey found that residents can adjust the location of each functional zone, but this process needs to be approved by the developer and gas company, and it takes too long. Therefore, it is possible to redesign the kitchens of urban residents in today's society. Therefore, we might as well focus on a more obscure time to discuss the future development direction of the kitchen. According to the survey, the future kitchen should be able to provide a more comfortable cooking environment, increase opportunities for family communication, and make full use of resources.
**Design Solutions**

**1. Target User**

The target users of this design are young people living in urban houses around 2050 AD. They have just started their own family a few years ago. They work during the day or work in a company or take their children full-time at home, but at night, when the family stay together and enjoy family life, this kitchen design allows them to see each other no matter in the living room or in the kitchen.

**2. Design Processes**

1. Ideation

![Figure (1): Ideations about the different kitchen layouts](image)

Initially I wanted to explore a new kitchen layout that could use the kitchen space more efficiently. However, as the investigation progressed, I found a large number of
similar products and restrictions, and could not find a more suitable solution, so this Thoughts are gradually obliterated.

Beyond the limitation of time, set the use scene in the future, began to study and explore the characteristics that the future kitchen should have, and expressed the idea.

2. Water recycling system

![Figure (2): How the water recycle system works.](image)

From a functional point of view, I noticed that many families used an area on the balcony to grow vegetables. This not only allows people living in reinforced concrete to see more green plants, but also relieves food safety issues. Based on my research, I combined the behavior of growing vegetables with recycling kitchen water to build an ecofriendly and user-centric kitchen, and designed a water recycling system as shown in the picture above. Kitchen water can not only be used for irrigation, after being filtered and cleaned, it can also be reused by the dishwasher.

![Figure (3): Water recycle system](image)
Figure (4): “I”-shape kitchen with water recycle system

Figure (5): “O”-shape kitchen with water recycle system

Figure (6): Hexagon module in kitchen
Figure (7): “Hexagon” kitchen rendering

Figure (8): “Hexagon” kitchen layout
3. Layout

Through the investigation of the living habits of young people living in the city, I found that their cooking methods no longer produce too many fumes like traditional Chinese cooking. Therefore, with the help of a range hood, a small amount of oil fume will not affect the entire living environment. So the problem of oil and smoke is not a problem for an open kitchen in this case. Also, based on my research, open kitchen is also good for communication, therefore, the layout for an open kitchen should be considered.

I began to explore the combination of various functional partitions in the kitchen in a more open space. The functional areas I want to keep are: stove, sink, vegetable preparation area, dishwasher.

The layout should help the kitchen to achieve its function (water recycle) better. Since the water for cleaning vegetables in the sink will be collected and reused in the dishwasher and the hydroponic system, these 3 areas should be closer and look like a organized station. Also this station should fit in the way how people use the kitchen.

I started from the top view, observed the relationship between the various shapes, and made adjustments. I found that there are multiple combinations of hexagons, but for dishwashers, square is the most efficient shape, so I started to think about the relationship between square and polygon, how to add a square to the polygon? The result is shown in the figure above.
4. Full scale

Then I need to determine the specific size. In order to understand more intuitively, I used tape to draw the outline of the kitchen on the ground:

![Figure (9): 2 different “Hexagon” kitchen layouts in full scale](image)

This method is very effective. When I stand on it and simulate myself cooking, I feel that this design covers an area too large and I need to remove some of the extra space. By adjusting the angle of the inner corners of the polygon, I can not only reserve the space of the dishwasher, but also reduce the overall footprint a lot, as shown in the following figure:
5. Adjustment

The complete shape adjustment process is as follows: (the black part is the counter for storage)

Figure (10): Processes of “Hexagon” kitchen layout’s adjustment
6. Design in 3D

After the floor plan was determined, I began to design the vertical space, because different functional partitions have different heights that are most suitable for users, but most designs set these modules to the same height. After making a choice, in order to ensure visual consistency, I also designed the counter to be the same height. The only difference is that I raised the counter of the hydroponic system for vegetable cultivation by 9 to 10 inches. The effect is that this counter can be used as a bar counter, providing users with more ways to use it.

Figure (11): Built 3D model based on the chosen layout
7. User Testing

Full scale model helped people who took the survey to understand my design better. It also helped in adjusting the size of different parts in this design.

Figure (12): Full scale model

In order to help users to understand my design better, a 10 min video was made to help that.

Figure (13): I made a video to explain my design to users.²

3. Final Design

² https://www.bilibili.com/video/BV1CN411R7mm
In order to increase the visual interest and create a more suitable environment for plant growth, I set up several windows around the hydroponic tank. The upper part of the cabinet is very precious space, so I adjusted the position of the dishwasher: from the top to the side.

![Figure (14): Rendering of the final design](image)

Since this is a kitchen located in an open space, this product needs to be attractive from all angles:

![Figure (15): Back view of the final design with different visual style](image)
Figure (16): Physical model’s photo shoot
4. Future improvements or new products

The design provides a reference for the design and planning of future residential buildings, and people living in cities have more choices for house types when buying houses.

The design makes the relationship between people and people close, and proposes a way for the development of interpersonal relationships in the future.

The design also breaks the conventional form of the kitchen, makes more changes in the shape of household products, and makes future life more interesting.

The design proposes a way to reuse water, and at the same time combines the user's daily behavior habits, creating a water-saving mode that conforms to the user's behavior, and proposes a possible solution for the future research on the efficient use of resources.
5. Research Summary

Judging from the results of user tests, users who have a little life experience or are parents are more concerned with the storage space. Although they support the concept of recycled water, they still believe that the storage problem is the most critical issue. Some younger users think that the concept of recycled water is the most important innovation.

All the respondents said that the overall shape of this design is very attractive. In this design, there is no tall cabinet. For this point, everyone said that too many cabinets will hinder people’s sight. This is because the design promotes the relationship between people. The development is contrary to, so you don’t need to consider setting up too many cabinets.

Respondents expressed their support for the multiple usage methods and diverse user behaviors brought about by this design. This product has solved the problem of lack of communication with family members during cooking.

A small number of interviewees expressed their willingness to make their kitchens like this.
References


