

Lesson 7 Introduction to Product Prototype Design

Discover Requirements

Empathy Game

Forming a Product Plan

Product definition

Functional implementation

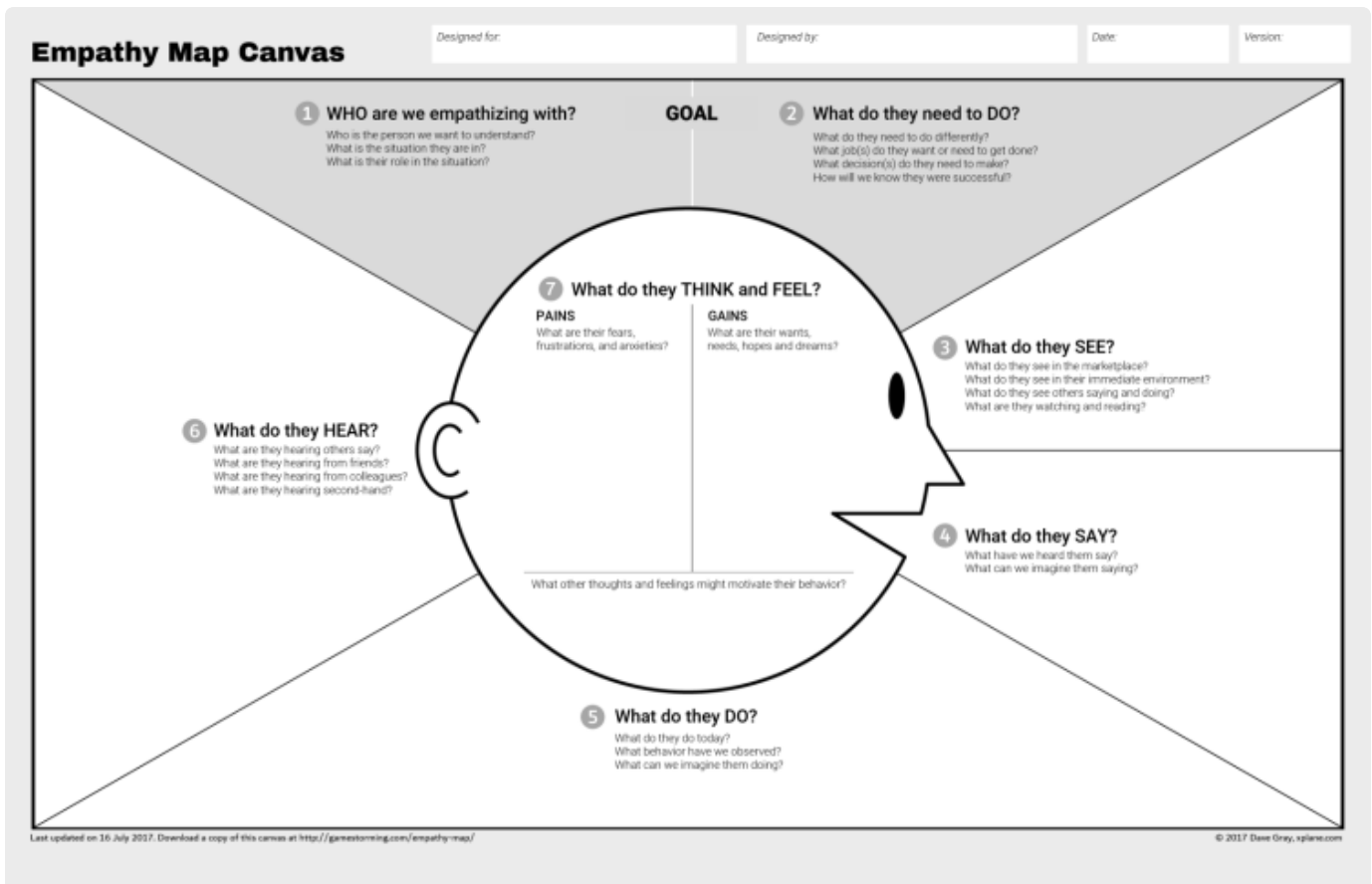
Product appearance

Prototyping, Testing and Optimizing

In the first unit, we walked through the gates of electronic hardware and programming, and learned how to control electronic hardware through codes to achieve a desired effect, such as controlling LED lights, controlling buzzers, OLED display text and so on in various ways. This lesson will help us to realize an idea into a prototype, and then into a product. When you master the knowledge, you will have entered the world of product prototype design.

Discover Requirements

When we were young, although we wanted to give gifts in Mother's Day. We will make a greeting card with warm greetings or fold some lovely ornaments with colored paper according to our mother's preference. In the future, I plan to design an automatic sweeping robot and an automatic dish washing robot to relieve my mother's tiredness caused by housework. This is an unintentional product creator who inadvertently thinks about "the needs of users". Of course, "user demand" is not simple, so we should think more comprehensively and design products that really meet them. Here's a good way to do it—the empathy map. We can find the demand by the way of empathy map. In a nutshell, the empathy map intuitively depicts the users' thoughts, feelings, what they see, say, do and hear through the way of drawing, which helps us to think with the users in different scenes, open our minds, explore the users' deep motivation, and help us to discover the real needs.



It is suggested that many people participate in using the empathy map to brainstorm. It is mainly divided into the following steps:

- Identify and refine the subject, age, education, health, income, occupation, etc.;
- Filling a plurality of modules in the diagram through observation or inquiry, and pasting the convenience notes in corresponding positions, wherein each convenience note only writes one thing or one content;
- Summarize and dig out similar or identical sticky notes, focus on controversial sticky notes, analyze words, situations, actions and feelings, and sort out the key contents of each part;
- Check, replay, and refine. You can invite others to check your empathy map, make suggestions, and finally summarize the object's problems and identify the ones you want to solve most.

Empathy Game

Divide the participants into different groups. Each group determines an object, which can be "pet", "old man", "programmer", "police", "cleaner" and so on. Then focus on the problem through the empathy map and find out the method of demand. Fill in the form below.

What did she/he see/hear	Feelings	What did she/he say	Agonies	What did she/he want
Requirement definition				

Example:

Clear target: white-collar workers who lives alone in cities with pets at home, busy at work and often on business trips.

What did she/he see/hear	Feelings	What did she/he say	Agonies	What did she/he want
Because he worked overtime at night or forgot to feed the cat on time, his cat was starving all the time. When he got home, he found that the cat had eaten all the food and was sitting at the gate.	He felt very guilty when he saw that the cat was starving. Long term starvation and irregular diet will affect the cat's health	He wants the cat to eat on time and develop good eating habits, which is good for the cat's health	The cat's illness will make him feel guilty, and he needs to take a leave of absence to see a doctor. However, pet medical treatment is expensive, and the cat's constant barking will also affect the neighbors.	If only there was a machine that could remind cats regularly, it could feed them automatically even if they forgot to feed the cats or were not at home.
Requirement definition	Need a pet feeder that can remind feeding regularly and can feed automatically			

Forming a Product Plan

Product definition

According to the final user's needs, it is clear what problems can be solved, what functions it has and how to realize it. For example, pet feeders, how to remind them? How to time? How to feed automatically? Reminder function is usually realized by sound and lighting. Because people don't stare at the machine all the time, it may be better to choose audible reminders. How to realize the function of automatic feeding by timing through the program? We can use the rotatable module and some structural design. In the end, our pet feeder is initially defined as an intelligent pet feeder that can sound to remind the owner to feed at a fixed time every day. If the owner is not at home, it can be automatically fed at a fixed time.

Functional implementation

After the product definition is completed, relevant hardware needs to be prepared, which the two cores of the product can be realized that including timed reminder feeding and automatic feeding. XIAO+ expansion board is a good choice. There is a passive buzzer on the expansion board, which can meet the demand for audible reminder. We can control it to emit music through the program and solve various demands for time through the RTC clock module. This is also a common and low-cost solution. Regarding the function of automatic feeding, food can flow out automatically through the rotation and angle setting of the servo module and the design of some structures. Then set a suitable time for the servo to return to its original position and the feeding will be finished. If we want to control the pet's appetite, we can add a servo to XIAO and the expansion board to solve this demand. The next stage is software programming, the angle of rotation of the servo, the notes emitted by the buzzer, and how to time, all need to be debugged, which will not be described in more detail here. The complete prototype product is based on realization of function and design of appearance.

Product appearance

In the design of product appearance, three aspects need to be conceived:

- Material and tech knowledge

It can be corrugated paper made by hand, wood structure carved by laser cutting machine, or 3D printing. Of course, combination of various materials is also possible.

- Color matching

The reasonable application of color can not only beautify the work, but also convey the theme of the work through vision.

- Product form

Product form should consider the user's physical condition, living habits, psychological characteristics, etc.

In design, hand-drawing is a good choice. As shown in the figure, even if you are not good at drawing, you can draw the outline of the work and mark the key parts.

Xadow 串绳



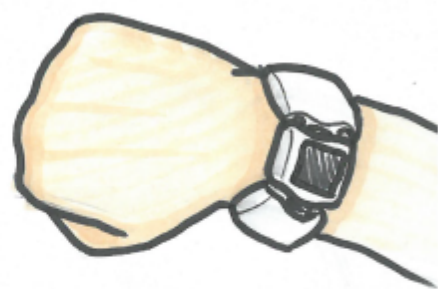
Xadow的各个模块制作完成后安装后，FPC折叠藏于外壳底部。



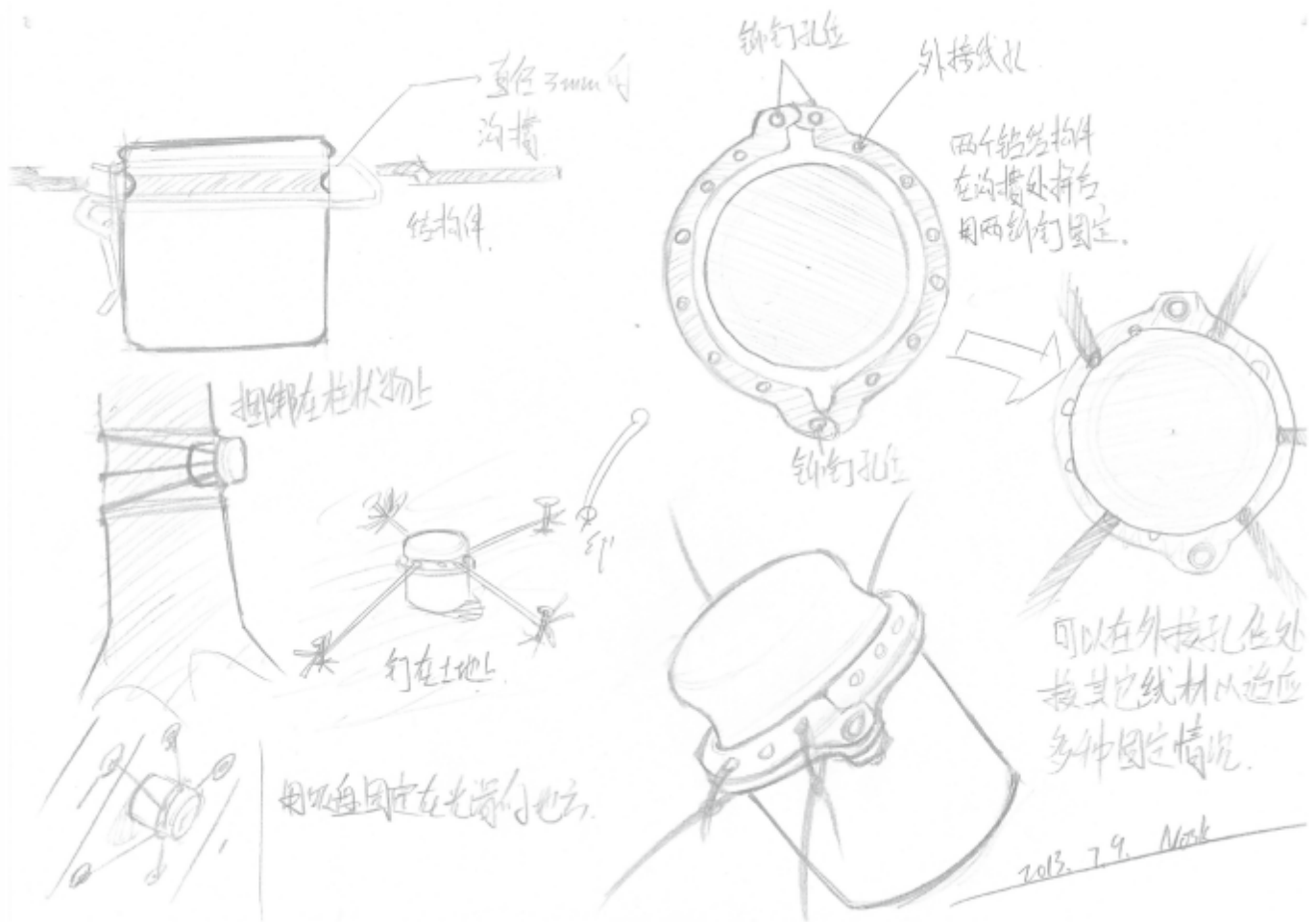
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类似用将凉席用2根松果绳将各个Xadow串起来



2019.7.5 Nusk



Prototyping, Testing and Optimizing

After the product scheme is determined, we will enter the prototyping stage, which the process may not be a linear process, we need to re-scrutiny in the process or may modify the scheme on account of inexperienced prototyping. The intelligent pet feeder needs to continuously adjust the rotation angle and duration of the servo and the structure for controlling the grain falling by combining with the program. After the prototype is completed, it will enter the stage of testing and optimization, check whether the product meets the expectations and confirm where it can be optimized and improved. Every product needs to be tested by the market, optimized with feedback and innovated. Of course, we only introduced how to make a prototype work personally. If you want to put it on the market, there are still many aspects to consider, and it is not something that an individual can accomplish, but requires the cooperation and efforts of a team.

At the end of this lesson, please try to complete a simple product plan based on the results of the empathy map mini-game.

Product name	
Product functions	
Hardware equipment	
Materials	
Appearance draft	
Presentation	