

PORTFOLIO

Xiaoyan Wu

Contents

· Recollecting

An AR tourism map of urban historical protection building

----- 1

· Undeserved-ocean

A 3D puzzle game about marine environment protection

----- 5

· Plant Crush

An AR app of plant micro-classroom for popular science

----- 8

· Fate

A shooting VR music game utilizing HTC Vive

----- 11

Recollecting

Group Project

An AR tourism map of urban historical protection building



Basic Information

It is an APP that focuses on historical protection buildings in modern cities like Shanghai, integrating the different forms of spot introductions and shareable travel records.

My role

Doing researches with one other person
Constructing prototypes of the AR introduction module

Developing AR introduction module and travel records function individually

Also contributed to brainstorming, ideation and testing

Type

Group project with other 4 classmates

Timeline

08/2018-10/2018

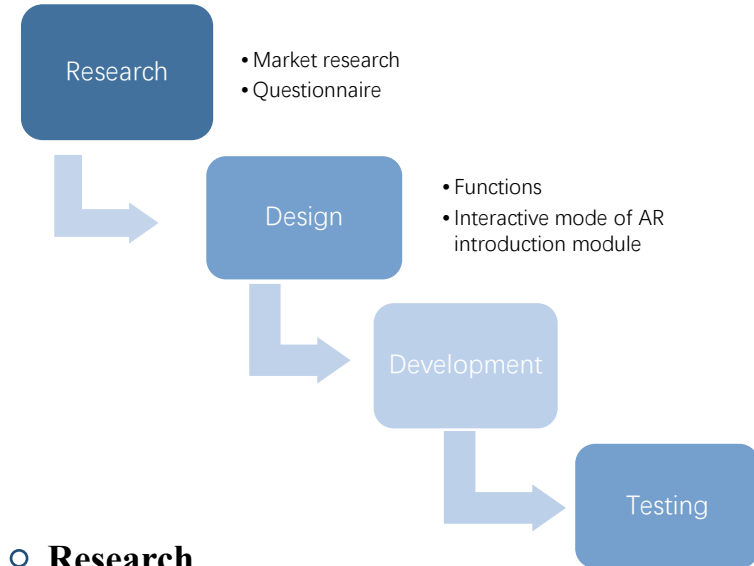
The Problem

Most travelers are not familiar with those beautiful historical architectures and the stories behind them in Shanghai. How to attract travelers to visit these spots is the main question.

We set out to solve the following questions:

- What kind of functions should be included in the app, navigation, tour map, introduction or etc.?
- How to make the introductions of the architectures more interesting and attractive?

The steps of solving those problems:



Research

In order to design the functions of our APP, we conducted the market research and user research.

Market Research

We analyzed characteristics of different tour APPs by searching information and comparing 5 tour APPs.



Navigation
Map
5/5



Audio Tour
4/5



Recommendations
Discounts for tickets
4/5



Communications
3/5



Offered spots information

Sichuan Province, Hangzhou, famous spots of different cities

Results

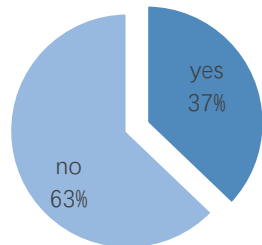
- All of them have the map and navigation function
- The introduction form is simple and boring offering only Audio Tour
- None of them put emphasis on historical architectures of a city

Questionnaire

We also want to know about the reason travelers chose to visit or not to visit historical architectures, what information travelers want to know when visiting historical architectures and preferences to social media sharing.

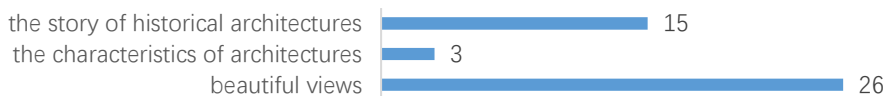
- Have you visited historic architectures before?⁴²
☐ Yes ☐ No⁴²
- If you choose 'Yes', what is the reason?⁴²
☐ beautiful views ☐ want to know the story of these architectures⁴²
☐ want to know the characteristics of these architectures⁴²
☐ other _____⁴²
- If you choose 'No', what is the reason?⁴²
☐ not interested ☐ have no way to know the location of these architectures⁴²
☐ there are restrictions on visiting⁴²
☐ other _____⁴²
- If you have the chance to visit historic architectures, what kind of information do you mostly want to get?⁴²
☐ characteristics of building appearance (textures of the walls, the design of windows)⁴²
☐ details of building interior ☐ the story of the architecture⁴²
☐ other _____⁴²
- Do you share your travel experiences, like photos, travel guides?⁴²
☐ Yes, I share them on the social platform ☐ Yes, I share them on online travel forums⁴²
☐ Yes, I only share them with close friends ☐ No⁴²

Have visited historical architectures

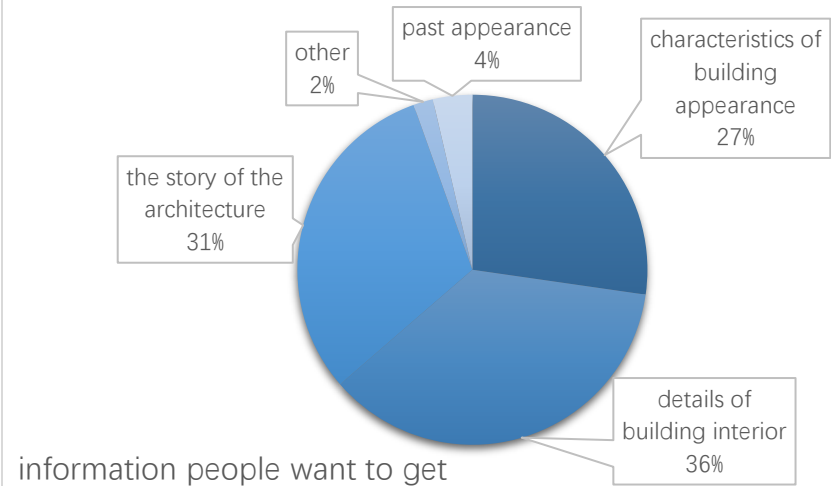


Results

Reasons for visiting historical architectures



Reasons for not visiting historical architectures



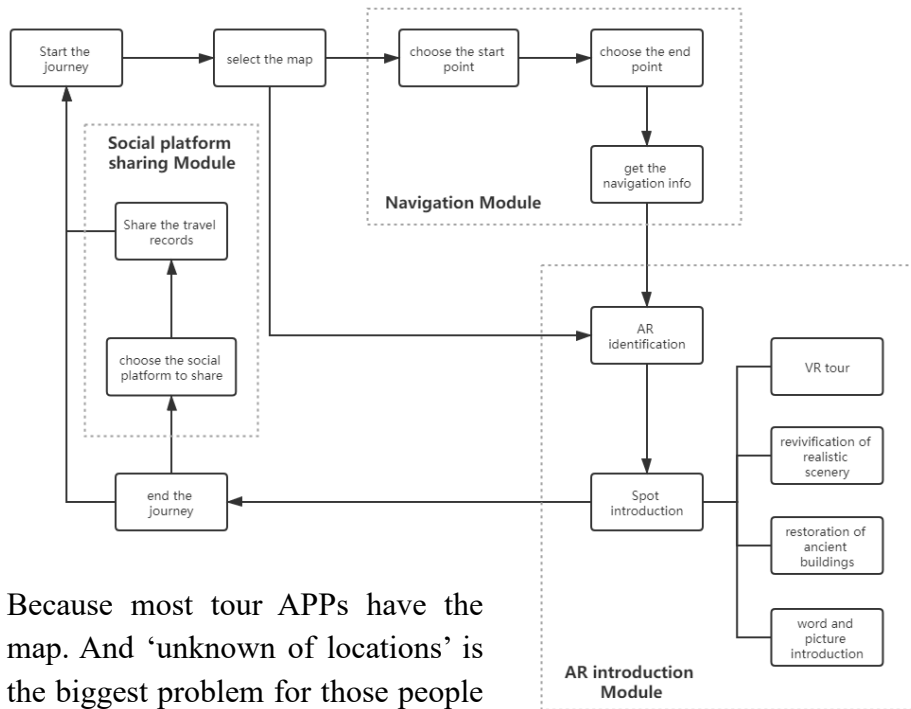
sharing habits



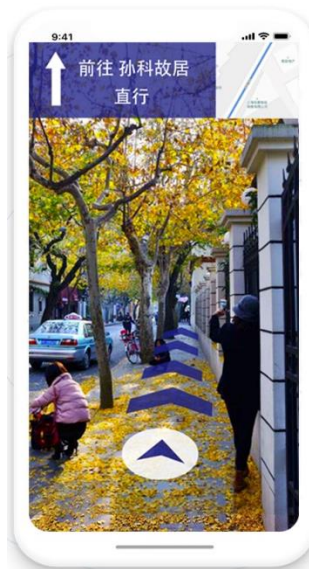
Design

Functions

According to the results of the researches, we brainstormed and designed function modules of this APP. As there are too many historical architectures in Shanghai, we chose a small region of historical architecture as an example.



Because most tour APPs have the map. And 'unknown of locations' is the biggest problem for those people didn't choose to visit historical architectures, we designed the navigation module. It contains a hand-drawn map of historical architectures in Shanghai and navigation information.

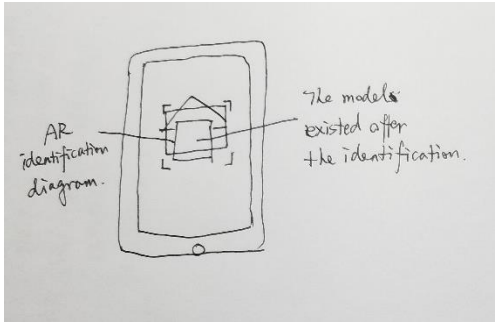


By AR identification, people can get the introductions and details of this spot by scanning the plaque outside the historical architectures even if there are restrictions on step-in visiting. There are four introduction forms, VR tour, the revivification of realistic scenery, restoration of ancient buildings and word and picture introduction, according to the data collected from the questionnaire.

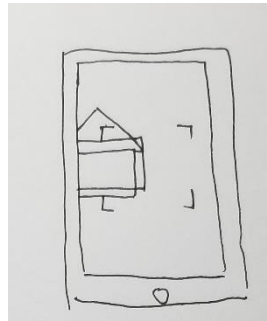


To meet people's preferences of taking the perfect WeChat Moments snaps at an internet-famous site, we designed a shareable poster, recording the travel time and the place a person visited.

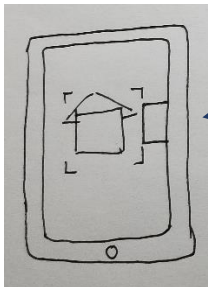
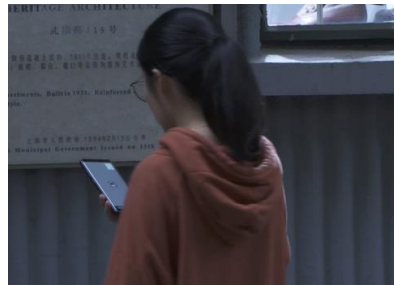
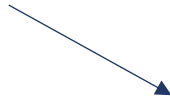
Interactive methods of AR introduction



I made a prototype of two different interactive methods and invited some people to experience to find out what kind of interactive method is more suitable.

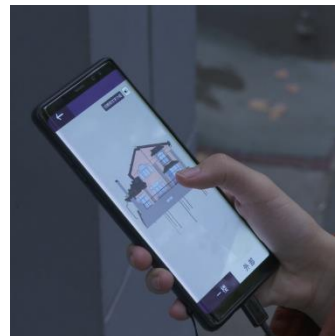


In real usage scenario, people will raise their cell phones to scan the plaque on the wall, and then drop their cell phones. This leads to that the interaction models will be out of the screen.



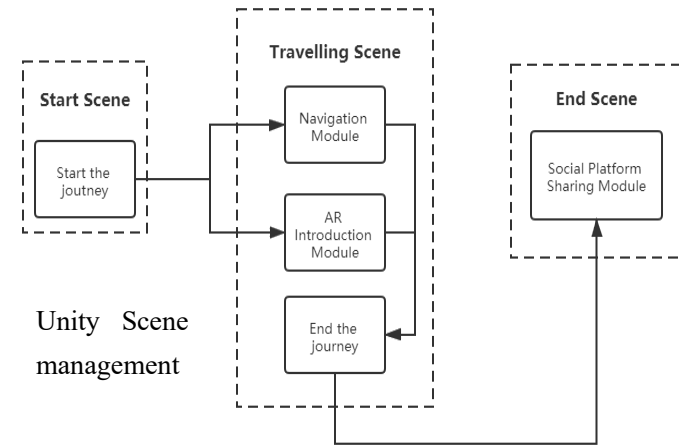
Finally, I chose this method.

In this mode, however people put their mobile phone, the model will always be in the center of the screen.

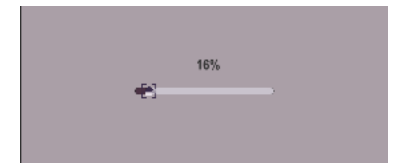


Development & Testing

We used Unity to develop the APP and the Vuforia platform to realize AR identification. Because of the limited information and technology problem, finally, the AR introduction part includes VR tour, words and pictures descriptions and revivification of realistic scenery.



During the testing, because the traveling scene contains too many resources, it needs a long loading time which will make people feel pressing the button is invalid. Also, a loading scene can visualize the waiting time. So, I added a loading scene between the two scenes.



Final Thoughts

Inspirations burst out in a flash of time, but turning inspirations into reality is hard and complicated. I was quite confused at the beginning. Not until after researches did I start to know what people really need and then conduct the design work. It was definitely a satisfying project for me.

Undeserved-Ocean

Group Project

A 3D puzzle game about marine environment protection



Basic Information

It is a first-person perspective 3D puzzle game. The story happens in 2091 when the marine environment is extremely deteriorated. Every game level stands for a way to improve the environment. If players pass through all the game levels before the countdown ends, the marine environment will be restored, otherwise, the ocean will remain deteriorated.

My role

Game planning with one other person

Developing the puzzle game level

Conducting interface design and UI design

Type

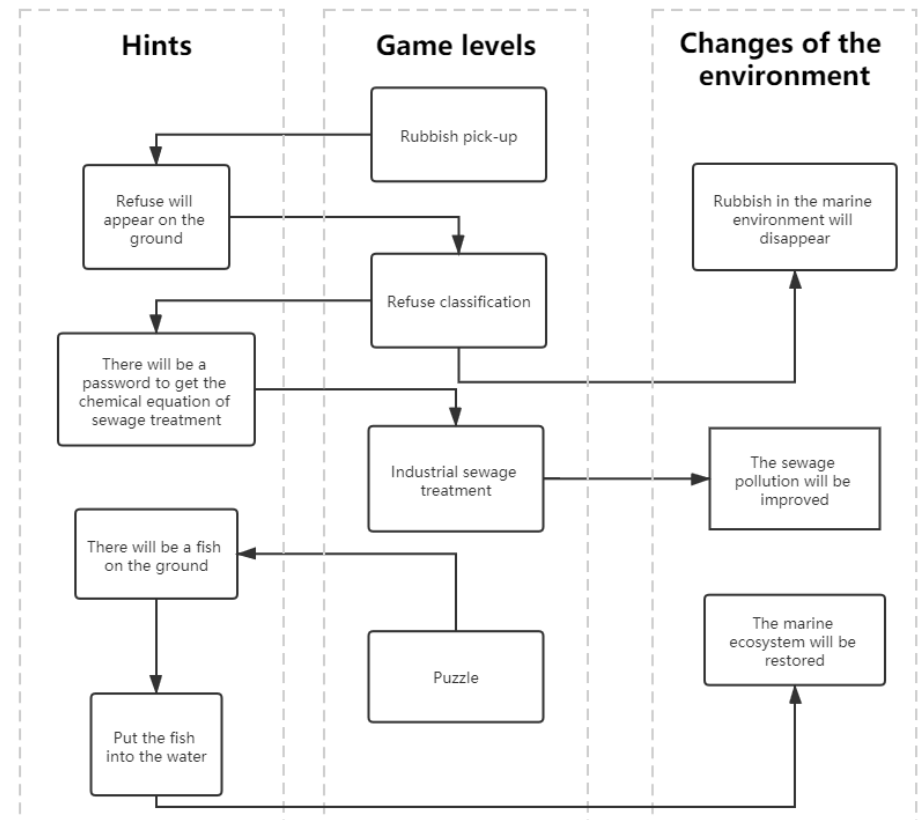
Group project with other 4 classmates

Timeline

12/2018-02/2019,
05/2019-06/2019

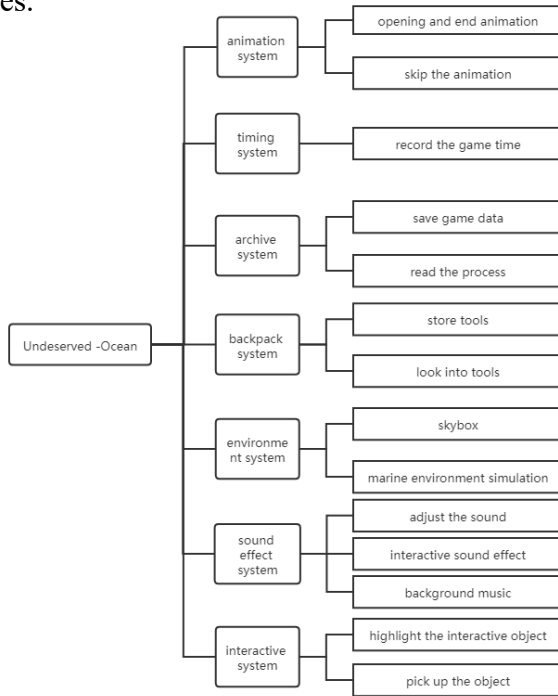
Game Planning

To awaken people's awareness of protecting the marine environment, they should both be impacted by the bad result of deterioration of the marine environment and know ways of how to protect the ocean. So, the game will have different game levels referring to different ways of protection. Once players pass through this game level, the environment of the ocean will be improved a little. Meanwhile, there will be hints between two game levels to make the game more complete.

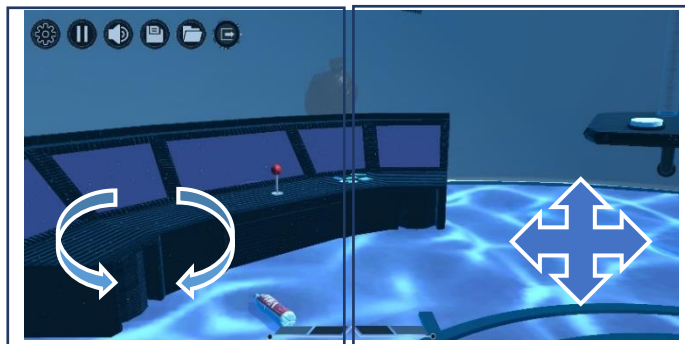


Modules

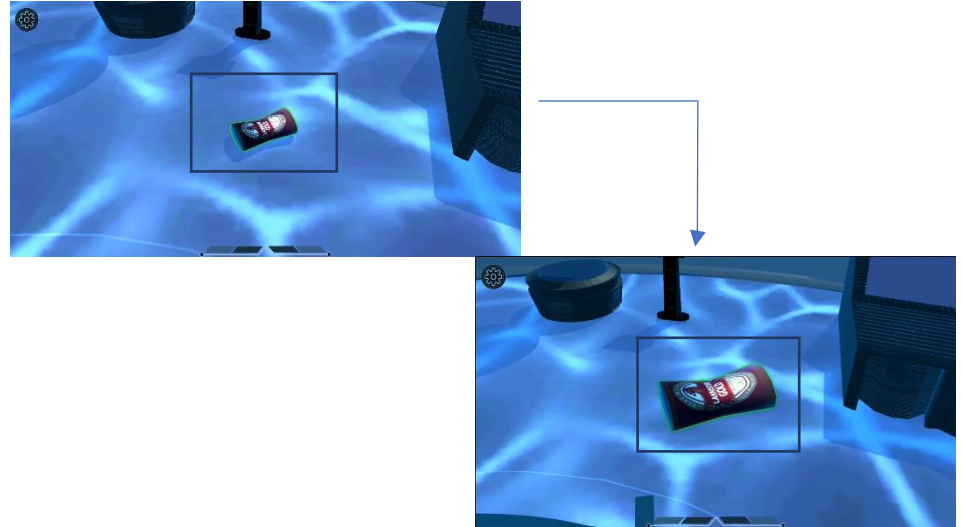
We designed several systems to manage different functions and modules.



The interactive system is mainly for players' operations in the game and interacting with objects in the game scene. Like most of the one-person perspective games, the left part of the screen is designed to be the area of scrolling the view, and the right part of the screen is the area of controlling the movement of the character. All the buttons are set transparent.



To differentiate interactive objects and non-interactive ones, we set the interactive objects highlighted if it goes into players' operative area. Touch the object, and it can be picked up.



Game levels

Rubbish pick-up

This game level mimics *Gold Miner*. The hook is fixed on the bottom of the screen, rotating by 180 degrees. When players touch the screen, the hook will stop rotating and start grabbing the rubbish.

Password

After passing through the refuse classification, the password will be shown. By putting in the password, players will get a scroll with a chemistry equation on it.

Refuse classification

Pick up the refuse on the ground and put them into the correct rubbish bin.

Industrial sewage treatment

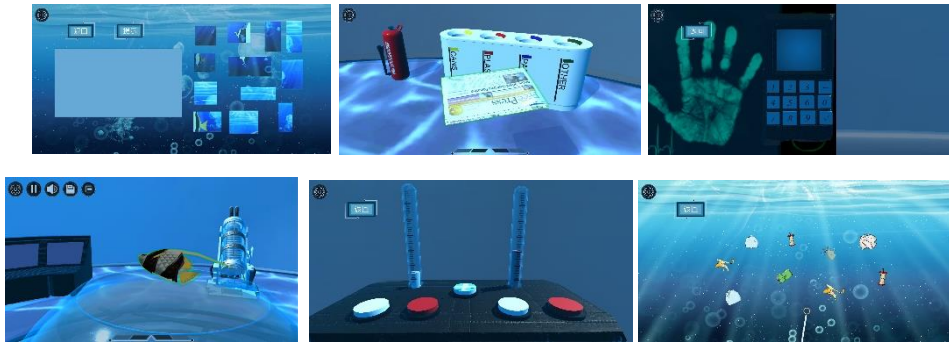
According to the chemical equation on the scroll, press +/- buttons to make the liquid in two tubes increase or decrease.

Puzzle

Do the puzzle, and players will get a fish the same on the puzzle.

Put the fish into the water

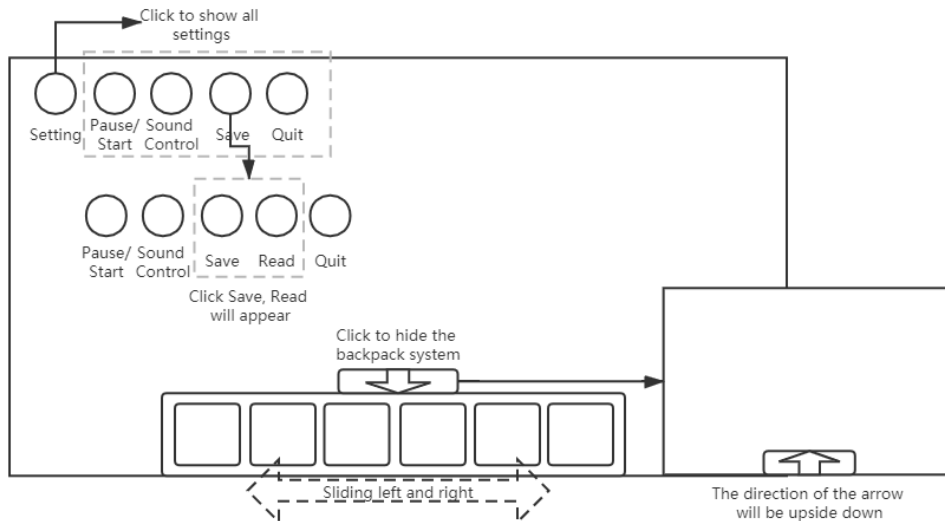
Pick up the fish and put it into the water.



Design

Interface design

I designed the position and interaction of each system in the interface.



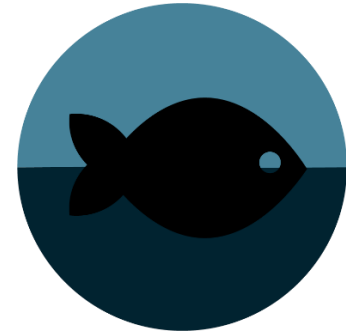
UI design

Because the game scene is an abandoned laboratory on the seafloor, I chose the dark blue as the main color of all the buttons. And the use of lines and angular shapes adds a sense of technology.



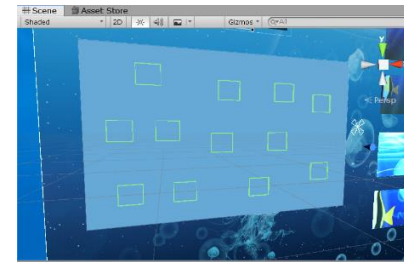
Logo design

The background of the logo contains two colors, lighter blue, and deeper blue. The two colors not only stand for the sky and the ocean but also mean the comparison between the clean and the polluted ocean. The fish is in the center of the logo, half of it in the lower part and half in the upper part, standing for its struggle and desire to live in the clean ocean.



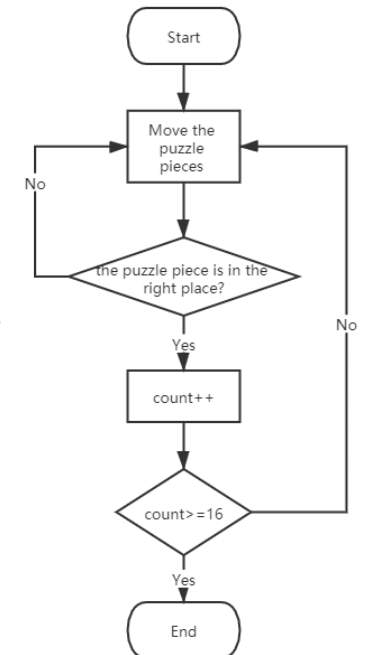
Development

I used Unity to develop one game level 'puzzle'. The collision detection detects whether the puzzle pieces are moved into the right place. When one piece is in the right place, the counter will plus one. Finally, compare the counter with the number of puzzle pieces. If the counter equals the number, it means all the puzzle pieces are in the right place, that is to say, the puzzle is completed.



These are collision detection boxes used to detect whether something enters. Then use the function 'OnTriggerEnter()' to trigger the counter.

```
void OnTriggerEnter(Collider other)
{
    if (Drag.IsDrag == true)
    {
        if (other.gameObject.tag == "puzzle")
        {
            if (other.gameObject.name == position.gameObject.name)
            {
                Count.flag.Add(IsStay);
                //AudioController.PuzzleRight(CameraChange.audio);
                StartCoroutine(WaitAndPrint(0.1f));
            }
        }
    }
}
```



Plant Crush

An AR app of plant micro-classroom
for popular science



○ Basic Information

It is an app combining learning cards and AR technology to popularize plant science. This combination takes the use of virtual buttons to improve the interactions and learning effects. It further encourages initiative study with a manor system where the recognized plants can be displayed and studied, and the element of the game reward mechanism of beautiful shareable recording cards.

My role

Designing the system with another person
Conducting interface design
Developing AR learning part
Also contributed to market research

Type

Group project with
other 2 classmates

Timeline

02/2019-04/2019

○ The Problem

Our target users are 7-year-old to 9-year-old children.
They face such problems in plant science learning.

Group Project

- There are no courses about plant science provided in the school.
- The ways to learn knowledge about plants are limited in books, museums, and websites. Those books and websites usually contain many professional words that may confuse the children, and it may also be a very time-consuming way to visit plant museums.

○ Research

AR plant recognition is very popular these days that many apps and mobile phones support this function.



A link to the
information of
this plant

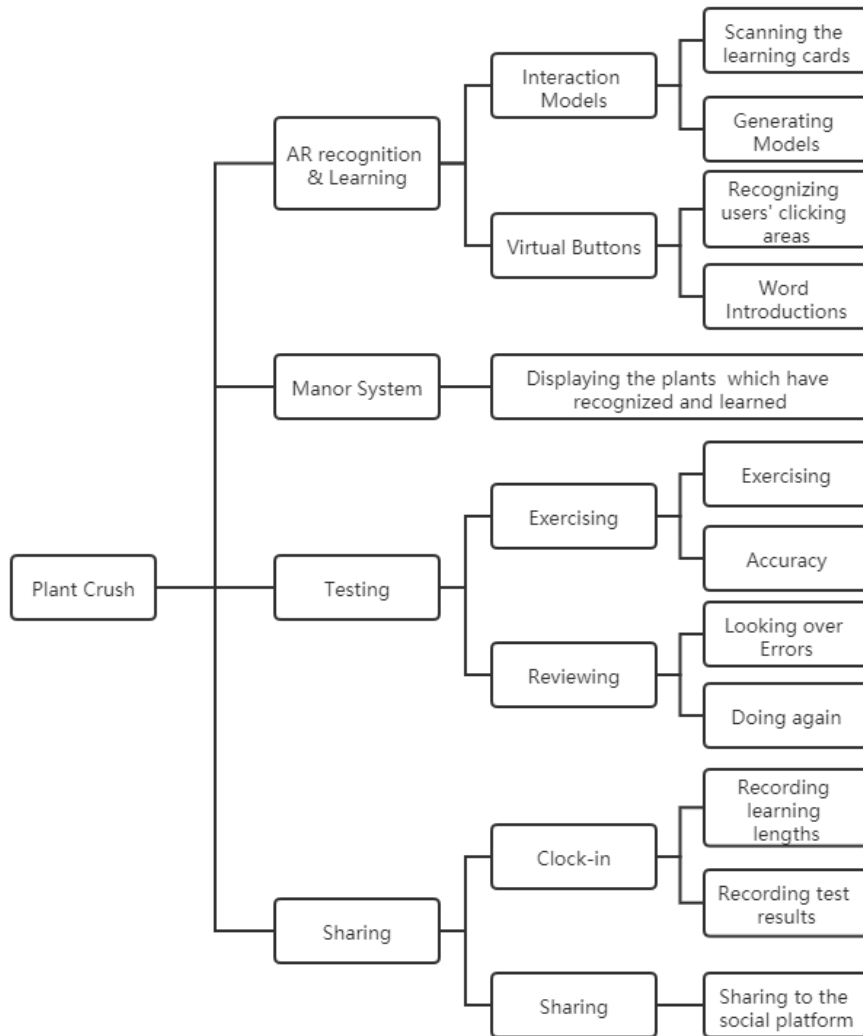
The name of the plant
with an ancient Chinese
poem

Generating a beautiful
picture and sharing to
the social platform

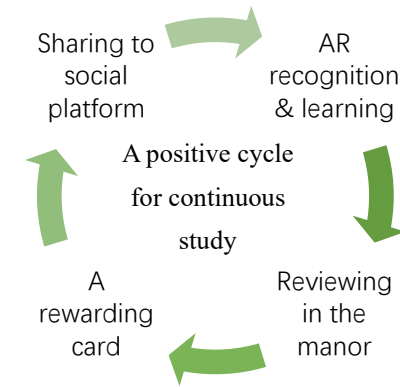
Results

- AR recognition is convenient and easily used in the mobile phone.
- There can be more interactions through AR technology to make the APP more appealing.
- Links to words and pictures introductions may not be necessary to stimulate children's interests in learning.
- Sharing to the social platform can satisfy children's desire to post new things with their friends on different social platforms.

Design



The whole APP simulates the process of adventures. By AR recognition, children discover different plants and interact with them. After that, their discoveries will be displayed in the manor and can be reviewed at any time anywhere. Finally, after finishing one learning process, they will receive the adventure reward with a beautiful rewarding card to be shared to the social communication platform. This is a positive cycle for continuous study.

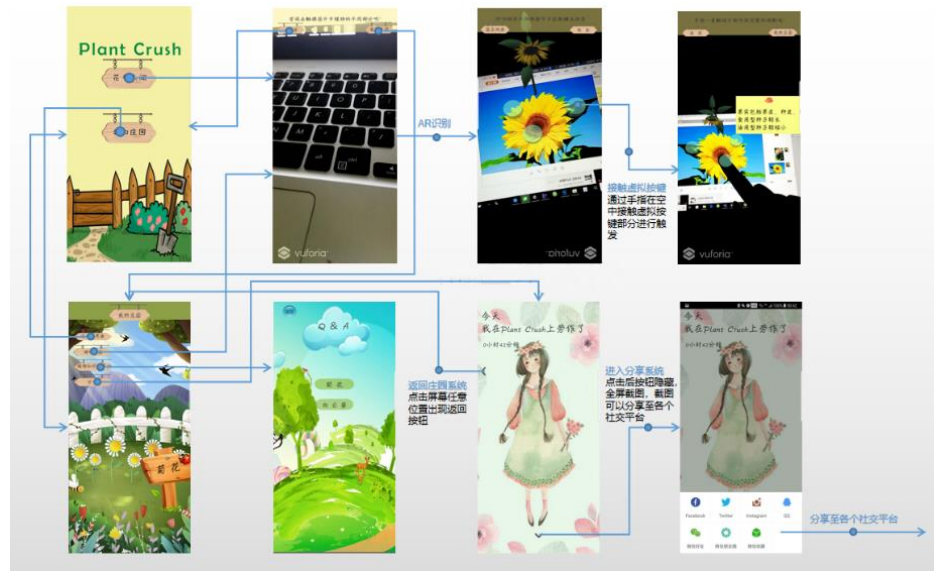


For more interactions, we took the use of the virtual buttons placed on different segments of the plant. In reality, once children touch those segments, detailed explanations and extensive materials will be presented on the screen. This may give children a sense of communicating with plants, contributing to the initiative study.

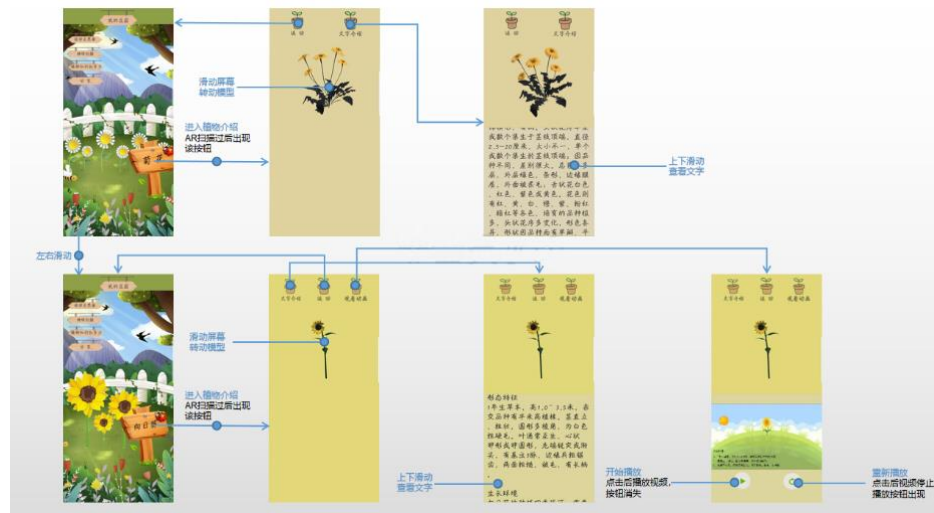
When users haven't touched the virtual buttons, it will remind them to try touching them.

After touching buttons, it will remind you of the instructions which is to keep touching them to show details.

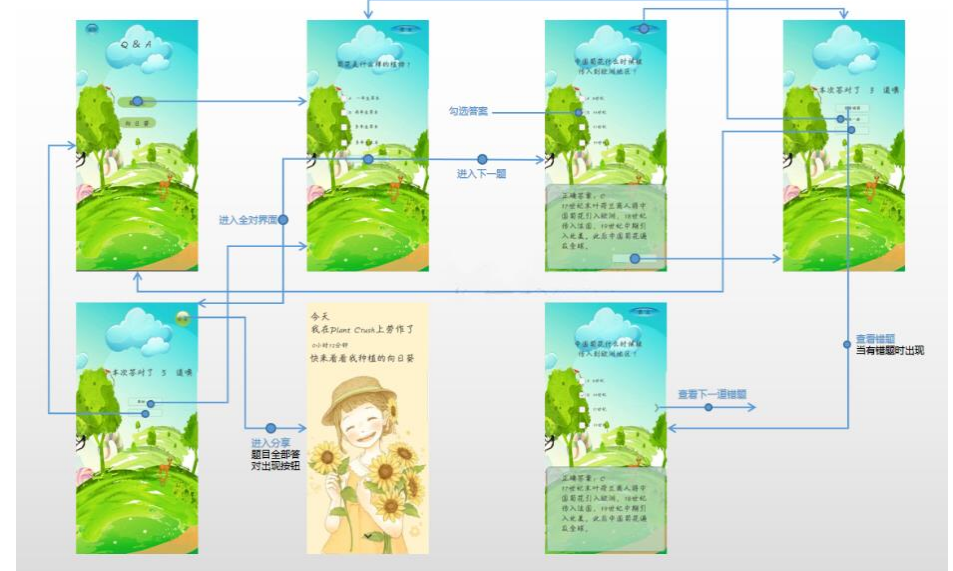




The general flowchart



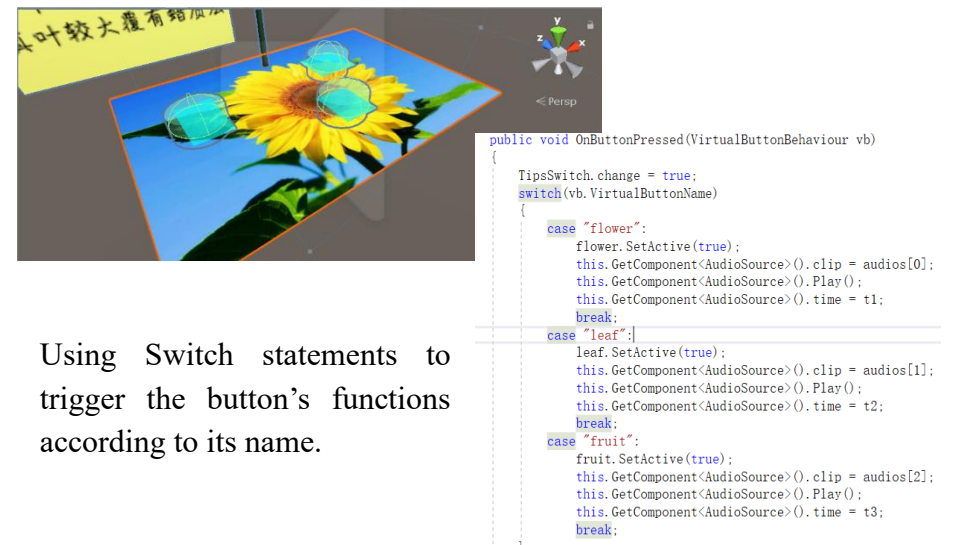
Manor system flowchart



Testing and Sharing system flowchart

Development

We used Unity to develop the APP and the Vuforia platform to realize AR recognition and virtual buttons.

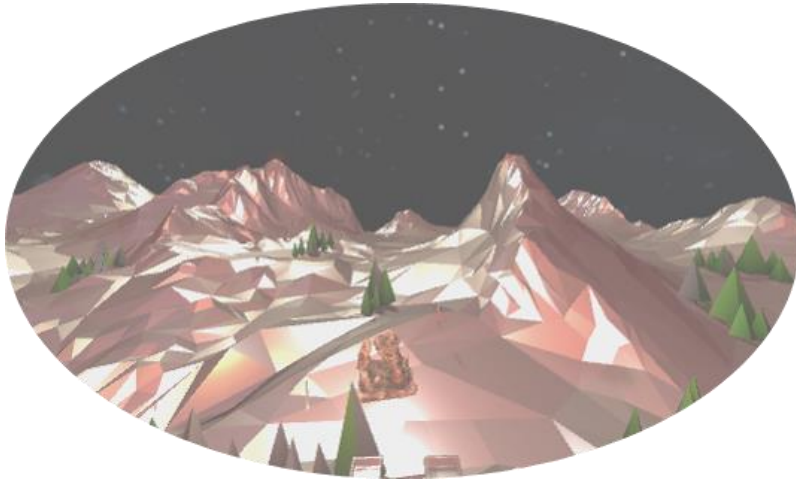


Using Switch statements to trigger the button's functions according to its name.

Fate

Group Project

A shooting VR music game utilizing
HTC Vive



Basic Information

It is a VR music game developing on Unity and HTC Vive with some play methods referring to *Audica*. In a completely immersive scene, players raise the gun in their hands and shoot the flying marker according to the music rhythm. There are plenty forms of interactions combining splendid scene effects with dynamic music.

My role

Designing the game modules with one other member

Designing interactive patterns of shooting

Developing music game system, including generating rhythm marker, shooting accuracy judgement

Type

Group project with other 3 classmates

Timeline

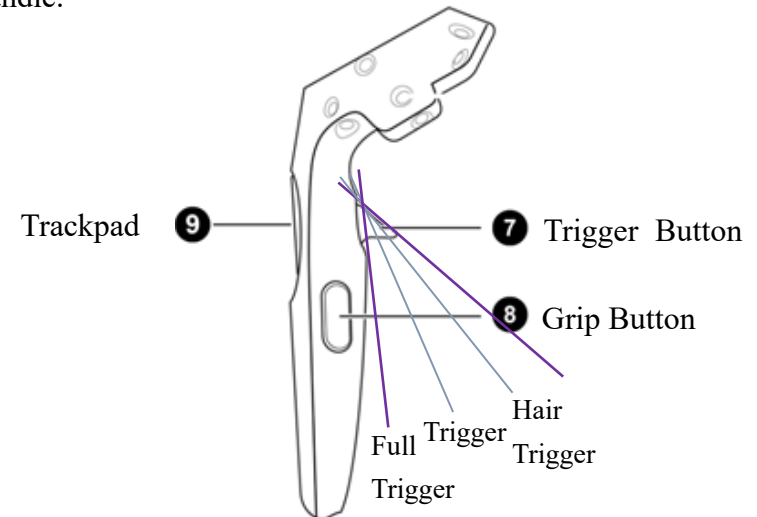
04/2019-06/2019

Game Modules Designing

Interactive manners module

- Hitting manners and styles of rhythm marker

We conducted the design work according to the characteristics of the handle.



When using the handle, people usually use Trackpad with the thumbs to select the menu. And the Grip Buttons are not easy or comfortable to press. So, in the game, Trigger Button is mostly used for shooting. There are three different states of Trigger Button according to the pressing force. In order to simulate the real shooting, when the Trigger Button is in 'Trigger' condition, there will be a ray ejecting from the front of the handle to help aim at the marker.

We designed three hitting manners with Trigger Button.

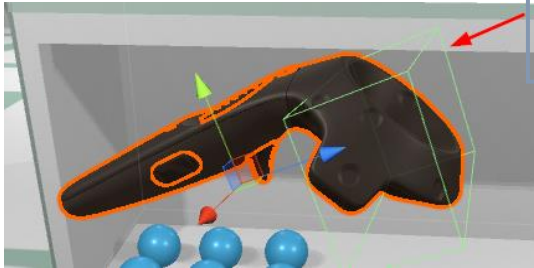


Clicking: Pressing the Trigger Button to 'Full Trigger'

Fixed angle shooting: Rotating the handle 90° clockwise or anticlockwise, and pressing the 'Trigger' button



Long press shooting: Long pressing the 'Trigger' button with the vibration feedback of the handle



Putting a Collision Box in the front of the handle



Knock: Using the front of the handle to hit the flying meteorites.

And we utilized different colors to differentiate the left and the right hand (one can only hit green markers and the other can only hit red markers). It further increases the diversity and interests of the game.

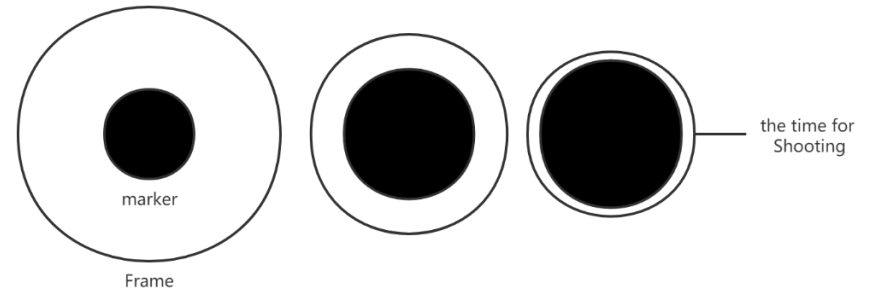


- Displays of rhythm markers

The rhythm marker contains two parts, the frame and the marker to shoot. The frame will exist in front of the player, and meanwhile, a marker will fly towards the player from afar.

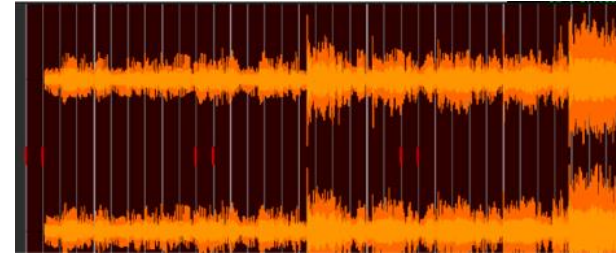


We set up the process of the frame's reduction from large to small, so when the marker passes through the frame, the frame will be reduced to the size matching the marker, at which is the best time for shooting.



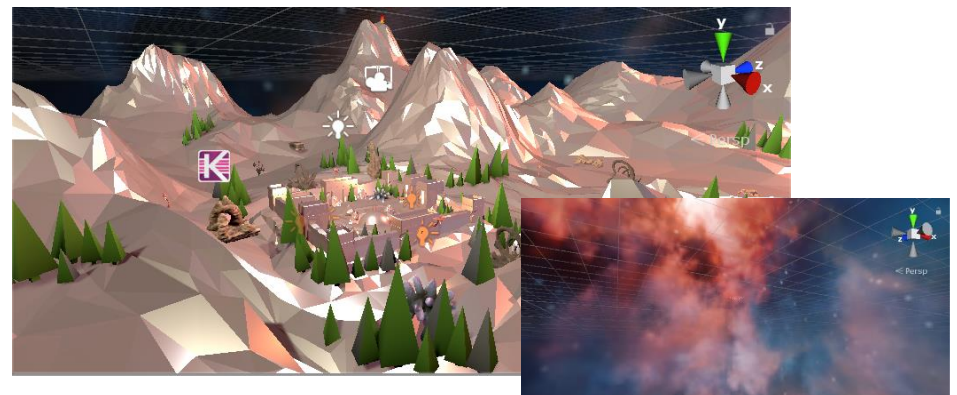
Music rhythm module

We used a Unity plugin *Koreographer* to visualize the rhythm information of the song. And according to the music rhythm, insert the point of time for shooting and triggering the marker to generate.



Animation & effects module

We used a spherical skybox to build the scene, creating a vast effect of stars in the universe. All the models in the scene are adjusted with metal reflective texture to add a sense of Technology. The meteorite uses bump mapping to increase the three-dimensional sense of reality.



Development

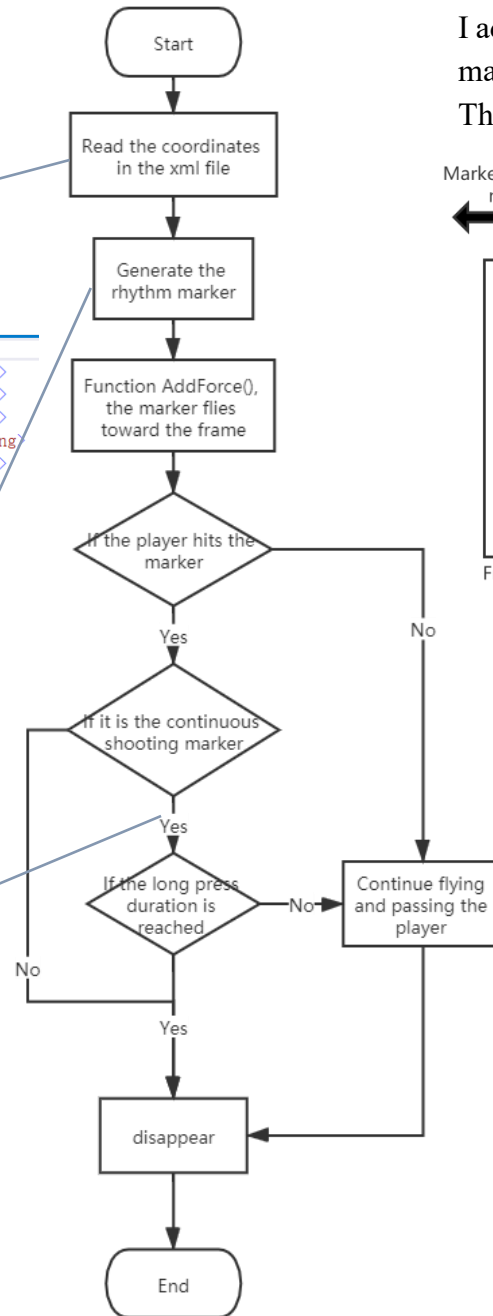
Generation of rhythm markers

I stored X and Y coordinates of the marker in XML sequence file. For long press shooting marker, I added a 't' to store long press duration. Then write a function to read the xml file to get the coordinates.

```
1 <LongTempoConfig>
2 <long id="0" x="3" y="-46" t="4"/>
3 <long id="1" x="2" y="-44" t="1"/>
4 <long id="2" x="3" y="-46" t="1"/>
5 <long id="3" x="1.4" y="-46" t="2"/>
6 <long id="4" x="2" y="-44" t="2"/>
7 </LongTempoConfig>
```

The *Koreographer* will return a special ID to each marker. I wrote a script to trigger the generation according to the IDs.

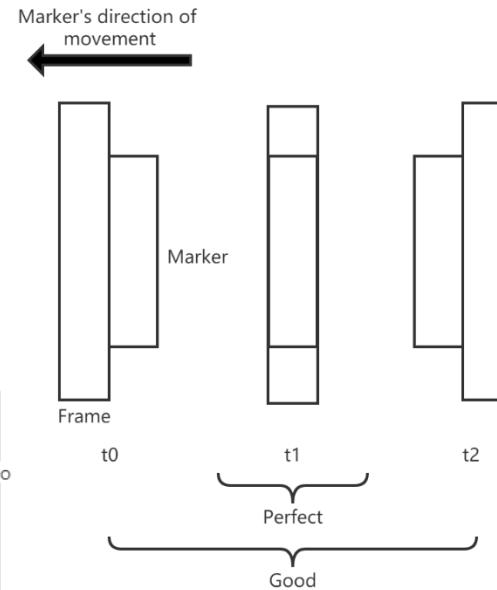
When long press shooting markers enter the frame, it will trigger a coroutine to slow down the marker, if the player hits the marker, it will stop and then if the player reaches the long press duration, the marker will disappear.



Shooting accuracy judgement

I added a collision box around the player ensuring that only when the marker enters this collision box can it be hit by the player.

There are collision boxes on each of the marker and the frame.



For the clicking, fixed angle shooting and knocking, I recorded three time points and did some calculations to judge the accuracy.

If the marker is hit around t1, it gets a Perfect. If the marker is hit between t0 and t2, it gets a Good. Otherwise, it gets a Miss.

t0 is the point when the marker is going to enter the frame.
t1 is the most accurate hit point.
t2 is the point when the marker leaves the frame.

The accuracy of the long press shooting is judged by **long press duration**, and the **start point of shooting**. The start point judgement is the same as other three shooting methods, while the duration is judged by the time 't' achieved from the xml file. If the shooting duration is more than half of 't', it gets a Perfect or Good. Otherwise, it gets a Miss.