Time Tunnel Machine

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ABSTRACT

Time Tunnel Machine is an interactive immersive installation that gives people to feel going somewhere through a tunnel. Before I started this project, my curiosity is on interactive media installation. From that point, I researched how to combine the user's interaction and media. According to my tests, light is an effective way to represent the user's response. In terms of the theme - time travel, by acting of riding a bike, users can feel like going somewhere - ideally it was supposed to go to the past - but it's ambiguous to present where(what time) they are. Nevertheless, users can still control the time speed and the light tunnel reflects it. This experience will encourage people to feel time traveling. Personally, through this project, I want to explore how to control sensors and lights - specifically NeoPixel as well as how the immersive media works to audiences' interaction.

Keywords: Physical Computing, Introduction to Computational Media, Interactive Installation, Immersive Space

1. INTRODUCTION AND BACKGROUND

Initially, it was supposed to be a time travel machine, but in terms of 'where we are' or ' what time zone we are around', I need to give some visual resources such as historical photo or indication of years. But I really don't want to show that kinds of visual resources because it is not only too much information but also disturbing an imaginary area of users. The only what I wanted to do is more intuitive experience such as immersive space or engaged environmental art. As a result, I broke down all the parts into initial core concept and more focused on their key aspects and features.

On the other hand, in the Physical Computing class, I went through the basic concept of electricity and interaction. Basically, introduction of electricity such as current, voltage and circuits. Furthermore, in the Introduction of Computational Media class, I learned about the initial concept of code and how to run code based on javascript. Also, at the middle of the semester, I got a synthesis sessions which introduces combining and communication between hardware and software specifically the bridge of Arduino and p5.js.

Figure 1.   A user(a) and the scene of exhibition(b)

2. WORKFLOW

Figure 2.   Agile Methodology

Figure 3.   Project Planning in the Gantt-Chart

3. COMPUTATIONAL METHODS

Figure 4.   Mapping for Computational Interaction Flow. Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board.[1]

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[1] Ahmadi, Mohammad Javad. "What is an Arduino?" LinkedIn. August 22, 2016

3.1 Arduino: circuit
Using a hall effect sensor(3144 hall sensor module) which is sensing magnetic forces for measuring the speed of the user's pedaling. I considered various method such as Kinect, an IR sensor, a rotary encoder and so on. All in all, in terms of spontaneous responds to user's interaction, I chose the hall effect sensor. Specifically, because I used Arduino Uno, the sensor utilizes the interrupt pin 0 (digital pin 2) of it. So, as soon as magnet force interrupts the sensor that attached on the exercise peddler, the microcontroller (Arduino Uno) sends the signal to the Arduino sketch (software). At this point, the noticeable part is that it is without delay because of 'attachInterrupt' function. Then, by comparing previous millis[2] and current millis, rpm is measured.

3.2 Arduino: IDE
Once the microcontroller gets input, it comes into the sketches and the inputs are mapped into 1 to 8 (Table 1). So, basically it placed on the 8-level which affects on the NeoPixels movement. At this point, the interval means the speed of running leds because the system draws a light pattern according to the intervals.

```
changeVal = map(speedval, fastestSpeed, slowestSpeed, 800, 100);
changeVal = changeVal / 100;
```

Table 1. Arduino IDE Sketch: map the sensor value

In terms of the interval, between the previous LED which is lit and the next LED which is lit, I use exponential functions for display a significant gap (Table 2 and figure 5). Furthermore, in terms of the color graduation, I picked 2 colors which is the start color - mostly green - and the ending color - mostly blue. And I divided that color into 64 for gradient which has some pattern. If the speed is under 5, it follows that color formula. but if the speed is over 5, it has another color formula that represents a redshift which occurs whenever a light source moves away from an observer.[3]

```
if (changeVal < 5) {
    for (uint16_t i = 0; i < pixels.numPixels(); i = i + pow(2, changeVal - 1)) {
        pixels.setPixelColor(i, 1 + i * 0.17, 30, 1 + i * 0.46);
                                                    ...
else if (changeVal >= 5) {
    for (uint16_t i = 0; i < pixels.numPixels(); i = i + pow(2, changeVal - 1)) {
        pixels.setPixelColor(i, 1 + i * 0.46, 30, 1 + i * 0.17);
                                                    ...
```

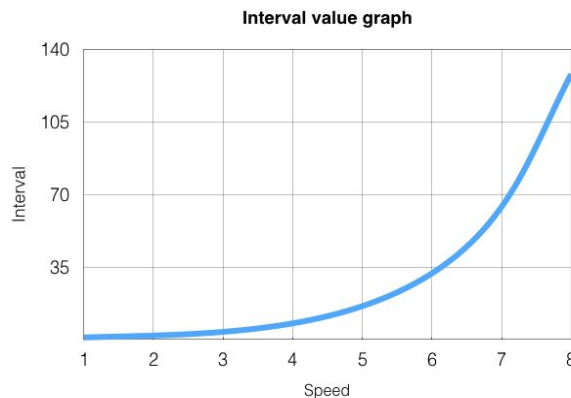Table 2. Arduino IDE Sketch: configure the NeoPixels following the speed

Figure 5. This graph illustrates the relationship between the user's pedaling speed and the turning on interval of NeoPixel which is following this equation $y = 2^{(x-1)}$.

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[2] "millis(). Returns the number of milliseconds since the Arduino board began running the current program." Arduino.
[3] "Redshift" Wikipedia: The Free Encyclopedia. Wikimedia Foundation, Inc. 22 July 2004. Web. January 21, 2017

3.3 p5.js

Once p5.js gets the rpm of user, it changes the sound play speed which I already made. The soundtrack is combined with the dialog from "2001: A Space Odyssey(1968)" by Stanley Kubrick and "Interstellar" by Groove Addicts. Specifically, the dialog is the scene showing Dave deactivating HAL 9000.

4. FABRICATION

4.1 Pedaling

'Going somewhere' is the most important part of traveling. So I wanted to use a real bicycle, but in terms of scale downing, I got the exercise peddler which encourages people to go somewhere. Actually, it was better than a real bike because not only it doesn't need a big space but also everyone can try it no matter they can ride a bike or not.

4.2 Tunnel

My project was inspired by Porta Estel·lar by PlayMID[4](Figure 6). So my first intention was making real tunnel which can offered a room for setting a real bike. However, in terms of searching an effective way, I focused on optical illusion more. Ultimately, 'Tunnel Effect' is based on optical illusion. By that I mean, if an object goes to the backward, a user relatively feels like goes to forward. Plus, when people recognize an object, that is because the vision (although the sonic resource is valid too, but I'm using LEDs). As a result, I targeted the viewing angle, and decided to create the cone that can cover the user's viewing angle. Also, the cone shape builds the perspective itself and allows the LED Strip to attach in the regular curve smoothly.
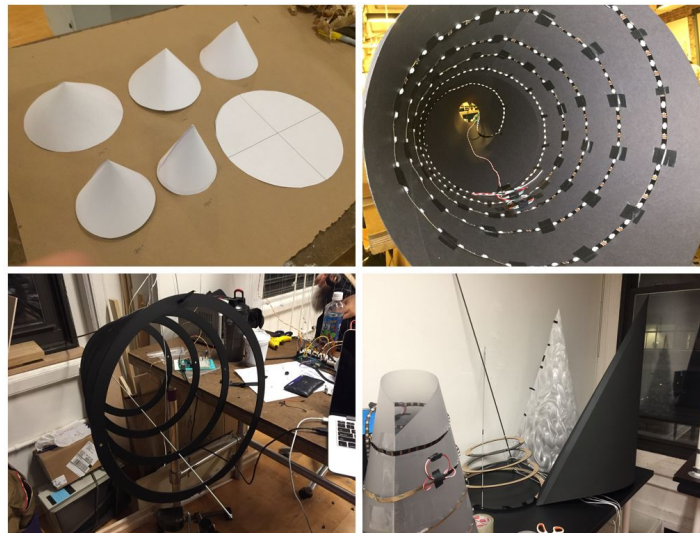

Figure 6.   Process of the cone

Figure 7.   Porta Estel·lar (the catalan for Star Gate), by PlayMID, is an immersive light and sound installation inside a plane.

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[4] PlayMID. "Porta Estel·lar". Playmodes Audiovisual Research. November 2015.

5. INSTALLATION

My exhibition venue is the pillar of main exhibition lounge. So, I use a pole, a rod and supporting rings to hang the cone, and it makes a room for pedaling. In terms of the foot panel, it needs to be fitted and fixed precisely because it has to endure user's pedaling force (Figure 7. (a)).

Figure 8.   The Pedaling panel(a) and the whole installation(b)

6. CONCLUSION

6.1 OVERVIEW

To some, people really loved my project. It was successful. I assumed that is because personal's physical action goes to reaction of the lights intuitively. Also, in terms of the installation, the cone encouraged a user to be engaged more. Not only a user who are experiencing, but also users who are waiting enjoyed the scene of a human who is having a huge beak. Moreover, during the experience public said 'it's trippy and well matched with sound'.

- The User's Point of View
- Exhibition Video

6.2 PRESS

- The Verge. "Enter the LED tunnel". December 19, 2016 at 4:04pm. Facebook. Web. https://www.facebook.com/verge/videos/1290717090964631/
- Crowley, Dennis. "Exploring the ITP winter show. Great projects!". December 19, 2016 at 3:02pm. Twitter. Web. https://twitter.com/dens/status/810983676917977088

6.3 POST-MORTEM

- The installation should've been made adjustable structure because children had a hard time to reach out on the pedal
- The user's speed or the scene of happening inside should've been shown to the people who are waiting

6.4 FUTURE WORK

- Iterate to create variety patterns of NeoPixels on Instagram.com/itp_archive_2017
- Serial communication