

Summer

Research

After observation, I found that in normal games, colour is a very important way to assist the expression of game concepts, but after my observation and research, I found that there is no special assistive device that can help colour blind people to achieve a better gaming experience, although there is a similar product like glasses for colour blind people exists, but it doesn't provide much help for the game, so I wanted to design So I want to design a wearable product that can assist colour blind people to play games and get in a better gaming mood.

In my design, I need two parts, a personal computer and a wearable device part, the personal computer mainly displays the game scene, just like a normal screen to display normal games, the device part is mainly a controller, mainly to achieve the purpose of controlling the game, and to assist colour-blind people to distinguish colours is also done through the controller.

PC:

During the summer holidays I had intended to make a game using PAC-MAN, when I copied the game and processed it I found that PAC-MAN did not run as well as I had initially expected and the game did not rely on colours as much as it should. Therefore, after discussing this with my teacher, I decided to change the game.

Wearable part:

When I started using wearables and trying out handheld wearables, I found it a bit difficult to control the mouse and the colour sensor with one hand at the same time. Therefore, I intend to integrate both functions directly into one wearable, using my right hand to control the rotation, launching and drawing the colours of the launching ball, while my left hand will be responsible for drawing the colours of the moving ball. This way, I can have all the necessary controls on both left and right handed wearables.

Week 1

1. Finding the right new game-zuma

I simply processed the colour tones in Ps and found that zuma's gameplay is very colour dependent. I simply processed the game screenshots (fig 1,2,3) and you can see that after removing all the RGB colours, zuma is very much affected by colour, which basically makes it a very poor gaming experience for colourblind people.

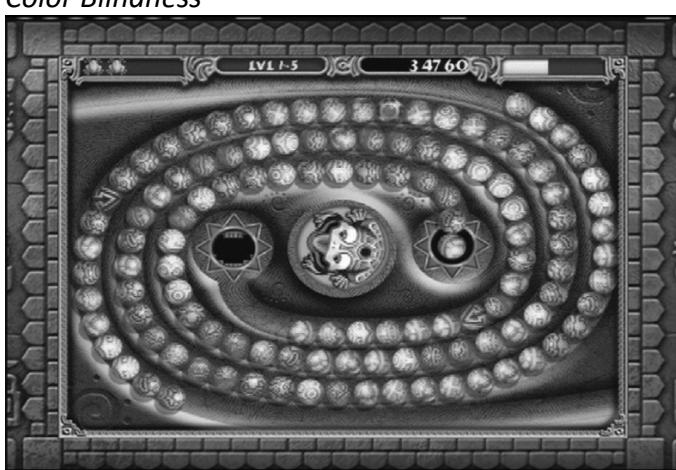
Regular



Red Miss



Color Blindness

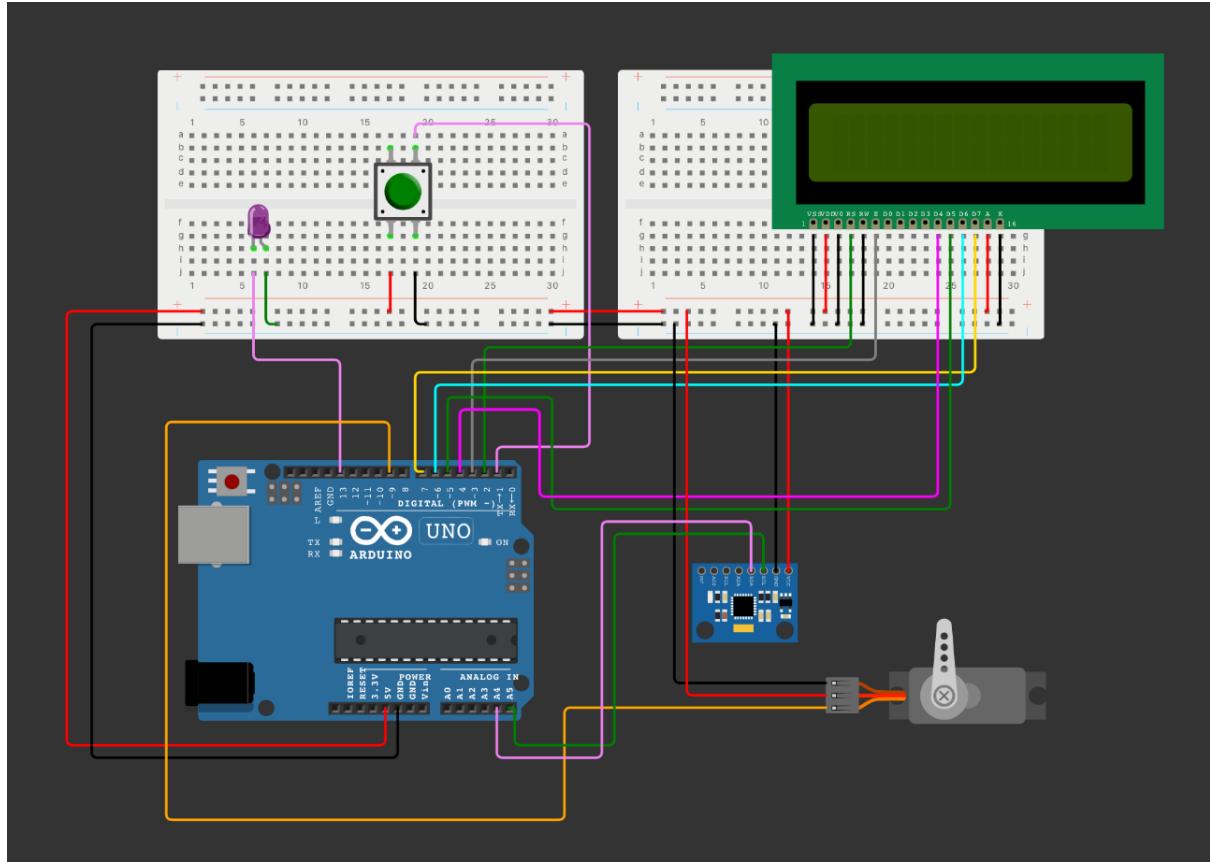


2.Determining the base unit sensors and testing connections

This week I have been working on the electronic connection of the sensing device for the base of the game, for the launch angle control issue

I worked on it using the MPU6050 to solve the problem of detecting the angle of rotation and connecting the button for the purpose of controlling the launcher.

Rotation Connect Fritzing



Week 2

This week, I worked on the open source project to clone the Zuma game. Firstly, I completed the overall copy and then worked on improving the details. In the process, I checked out a few websites for more inspiration and optimisation ideas.

1. <https://leetcode.com/problems/zuma-game/>
2. <https://www.youtube.com/watch?v=3gSiFNR4C-8>
3. <https://github.com/GalaxyShad/Zuma-Deluxe-HD>
4. <https://github.com/CosmicCrash/ZumaBlitzRemake>

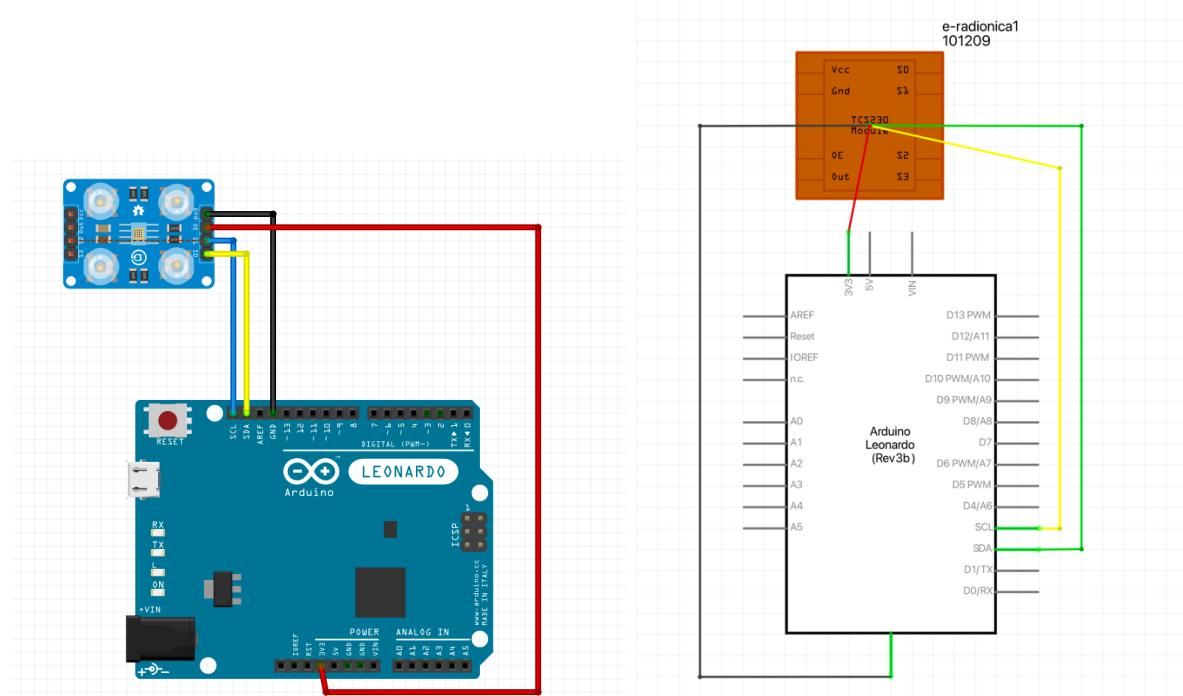
Week 3

This week, my main task was to connect and test colour sensors for wearable devices. Firstly, I scrutinised the information about colour sensors on the website and then carried out a series of simple but effective tests. I try to use the TCS3200 RGB, but its not good for my project.

TCS3200 RGB



TCS3200 RGB Fritzing

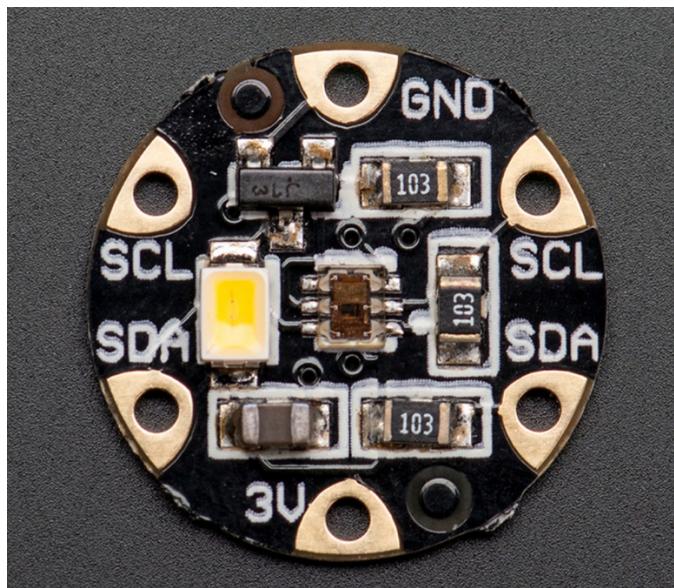


In addition to this, I also took the time to focus on the required research section of the report. Through extensive research, I dug deeper into the information and fleshed out this section to ensure a richer and more detailed report.

Week 4

The problem of rotary control was successfully solved this week by choosing the BNO 055 as the rotary sensor and the Z-axis as the control variable. A single variable allows for better control and data transfer.

After testing the TCS3200 RGB colour sensor, the results were not satisfactory so it was decided to replace it with a different colour sensor. After a number of tests I chose the TCS34725 as the new sensor gave a much better display and although there was still some colour difference in screen recognition this was a significant improvement.



To further enhance the visual impact of the project, I wanted to display the colours extracted by the colour sensor on the screen, with the letters R, G and B corresponding to the colours red, green and blue, which not only allows the user to perceive the control variables more intuitively, but also enriches the whole interactive experience. The visual display of colour information on the screen is certainly an impressive improvement, allowing the user to perceive the feedback from the sensors more intuitively, thus bringing the whole system to a new level of interactivity and user-friendliness.

Week 5

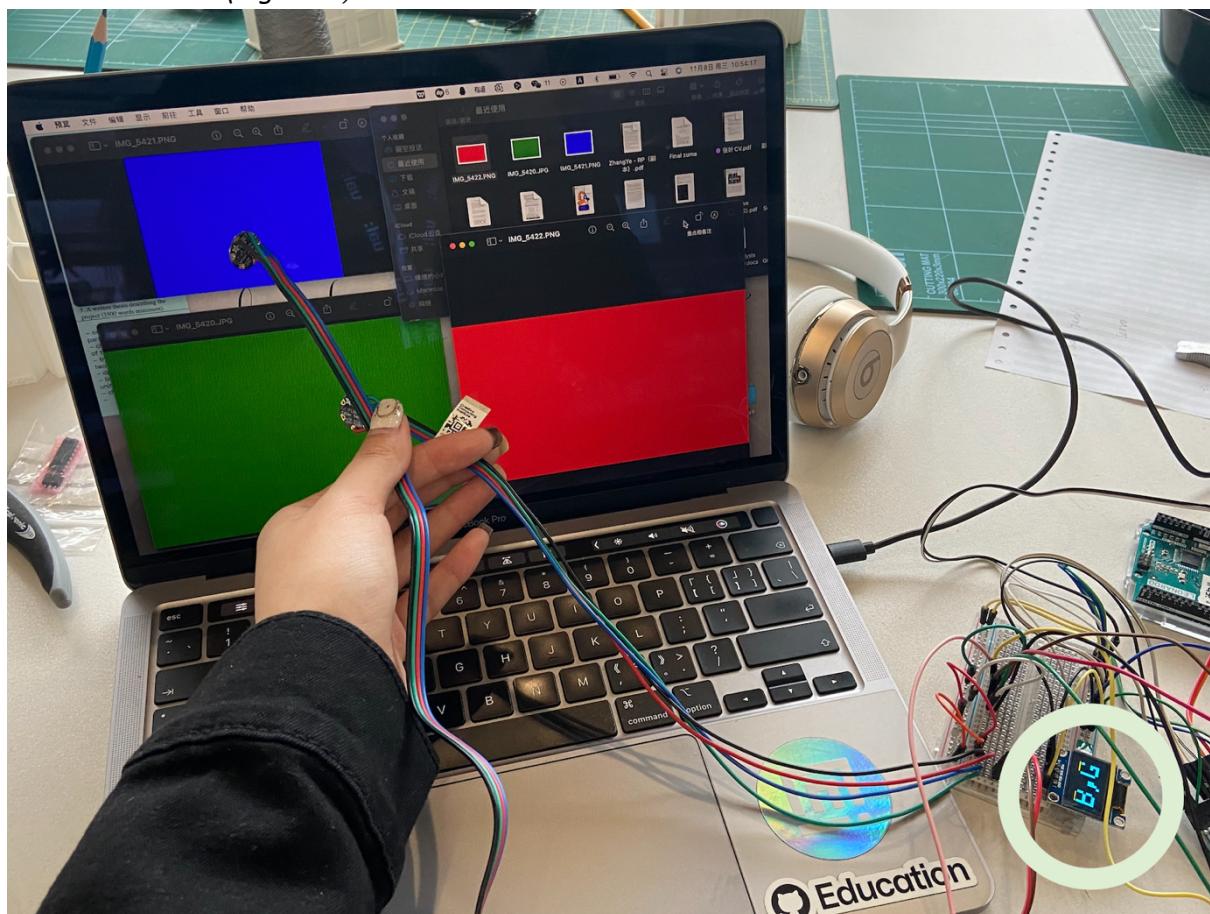
1.The teacher's suggestion sounds interesting! The right hand controls the colour of the spinning and launching ball, while the left hand is responsible for sucking up the colour of the moving ball, so you need both hands to work in tandem to identify the two colours.

2.After testing, the colours of the balls in unity are not pure enough, so I should change the colour values of the balls to make them more recognizable. I changed the colour of the blue ball and the green ball to be easily recognizable by the colour sensor to get the data.

3.Since my device is spread across both left and right handers, Hadeel suggested that I try to use two Arduino boards to control it and try to use Bluetooth for connectivity to transfer the data, and during the week I first did that by figuring out how to use one Arduino board to get the data from the two colour sensors and display it together.

4.Because I want two colour sensors back to be displayed on two screens, at hadeel's suggestion, I'm displaying both colours on one screen. I have implemented this function You can see that using two colour sensors to read the colour data separately in the screen is implemented to read the data from two colour sensors in one screen.

Color Test Result (Figure 9)

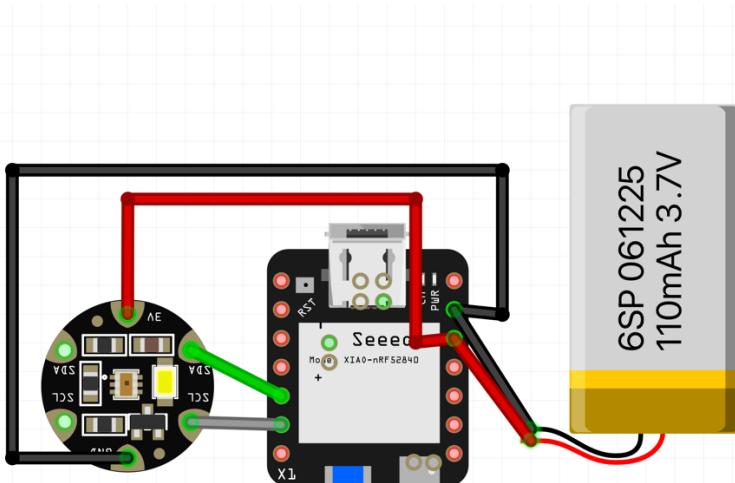


Week 6

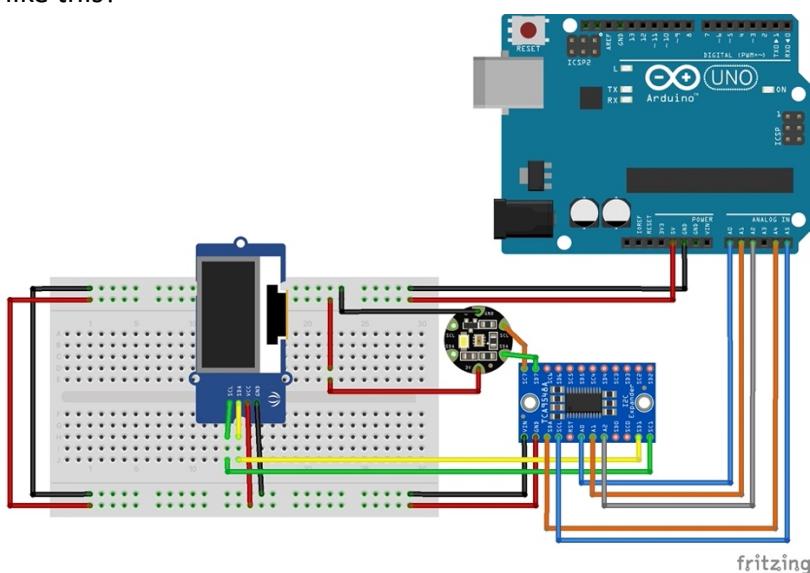
The advice given by my mentor in the technical guide was very helpful, especially recommending this sensor, which will make a noticeable improvement to my project. By using the Seeed Xiao BLE NRF52840 Sense sensor (<https://how2electronics.com/getting-started-with-seeed-xiao-ble-nrf52840-sense/>), you can make an otherwise complex circuit much simpler to understand. This not only improves the overall aesthetics, but also helps reduce system complexity.

With this sensor, you can also change from wired to wireless and use Bluetooth technology for data transfer. This change not only increases the flexibility of the system, but also gives your wearable device more freedom of movement.

Left hand Wearable Fritzing (Figure 10)



When the left-handed wearable is connected to the screen the expected wiring diagram looks like this:



Week7

Wearable Gloves:

At the suggestion of my teacher I, for the sake of the portability of the gloves, I began to study the Bluetooth transmission aspect, in this regard I was not at all before, access to the relevant information found that it can be done and mobile phone transmission.

(<https://how2electronics.com/getting-started-with-seeed-xiao-ble-nrf52840-sense/>)

The Bluetooth transmission test was attempted using a mobile phone to evaluate its performance and reliability in specific contexts. This test is designed to verify the stability of Bluetooth transmissions, including transmission speed and data integrity under different environmental conditions. By conducting this test on a mobile device, we can better understand how Bluetooth technology performs in real-world application scenarios and assess the challenges it may face when transferring data between mobile devices.

The screenshot shows a mobile application interface with two main sections: "Advertised Services" and "Attribute Table".

Advertised Services:

- Unknown Service
UUID: 19B10000-E8F2-537E-4F6C-D104768A1214

Attribute Table:

- Generic Access
UUID: 1800
PRIMARY SERVICE
- Generic Attribute
UUID: 1801
PRIMARY SERVICE
- Unknown Service
UUID: 19B10000-E8F2-537E-4F6C-D104768A1214
PRIMARY SERVICE
- Unknown Characteristic
UUID: 19B10001-E8F2-537E-4F6C-D104768A1214
Properties: Read and Write
Value: R
Value Sent: N/A

At the bottom of the screen are three circular icons: a left arrow, a download icon, and a right arrow.

In the process of mobile phone transmission, found that everything is very stable, so I try to use to my wear device, but in the wear gloves to test the use of the effect, found that the Bluetooth transmission effect is not stable, can only be transmitted once will stop, which will cause a great deal of trouble to my subsequent game, so I began to demand help and research The effect is as follows:

```

22:58:27.332 -> Bluetooth® Low Energy Central - LED control
22:58:36.834 -> Found 5e:75:48:59:a0:53 'Lefthand' 19b10000-e8f2-537e-4f6c-d104768a1214
22:58:36.868 -> Connecting ...
22:58:37.008 -> Connected
22:58:39.291 -> Attributes discovered
22:58:39.685 -> Max Color Received: 2
22:58:42.159 -> Failed to read maxColor value

```

Zuma Game:

I also made changes to the gameplay section, tweaking the color issues previously raised in the Unity section to single and purify the colors of the tricolor spheres, making the color sensors read the values better.



I'm building three game scenarios in the replica Zuma game, set up as three levels each progressed by difficulty, which can make the player feel more at home with the game;



Week8

This week, my main work focused on the "Related Work" part of my dissertation writing. I have carried out extensive literature research and reviewed many related materials to gain a comprehensive understanding of the current research progress and problems in the field. Based on this, I started working on the "Related Work" section, which provides an overview of the existing research results, highlighting the key findings, methods, and limitations of each work.

To better organize my thoughts, I developed a detailed outline of my thesis to ensure that each section was presented in a systematic and clear manner. Below is the outline I developed:

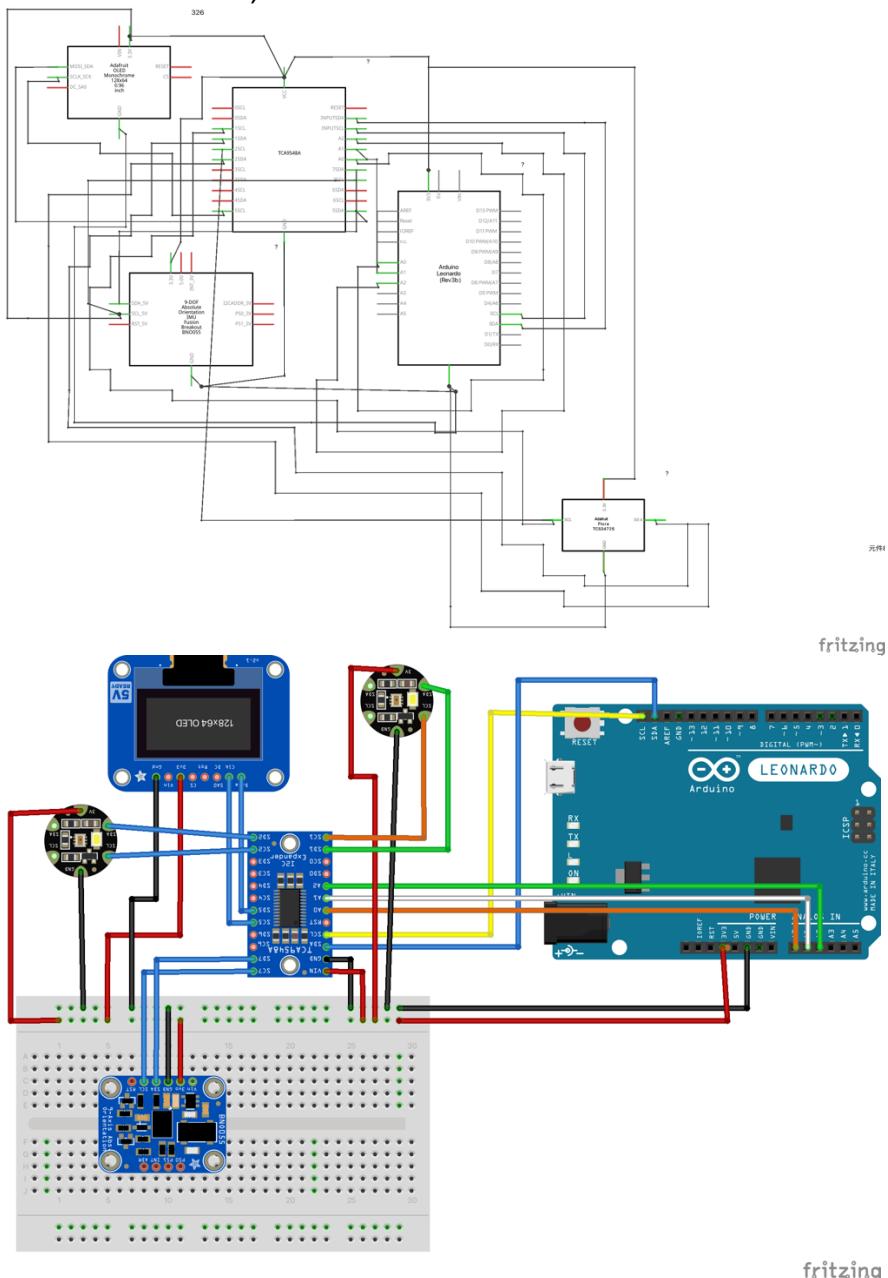
- Abstract:
The abstract provides a comprehensive overview of the entire project, summarizing its key components. It encapsulates the purpose, methodology, and findings, offering a quick glimpse into the significance and outcomes of the research.
- Introduction:
In the introduction, the project's main logic and its potential impact on individuals with color vision deficiencies, particularly those affected by color blindness, are outlined. This section sets the stage for understanding the project's broader context and emphasizes its relevance in addressing challenges faced by individuals with color vision impairments.
- Research Question:
This segment clearly defines the research question, elucidating its origin and significance. It delves into the specific inquiries driving the study and establishes a foundation for the subsequent investigation.
- Related Research:
The exploration of color vision impairments and color-themed games forms the crux of the related research section. A thorough review of existing literature and studies in these domains is presented, shedding light on key findings, methodologies, and gaps in the current understanding.
- Research Method:
The research method section provides an in-depth look at the chosen methodology, detailing the steps taken to investigate the research question. It elucidates the research design, participant selection, data collection tools, and the analytical approach employed in the study.
- Iterative Design Process:
This portion intricately details the iterative design process employed in the project. It expounds on the stages of prototyping, testing, and refinement, illustrating the cyclical nature of design improvements and optimizations throughout the development process.

- Discussion and Future Work:

The discussion and future work section encapsulates the project's conclusions and outlines prospective avenues for further exploration. It not only synthesizes the study's findings but also articulates the implications and potential applications of the research. Additionally, this section serves as a bridge to future research directions, offering insights into areas that merit continued investigation and development.

Project:

As the Bluetooth test was very ineffective and there was really no way to fix the problems that arose last week, there was a time constraint, so the only option was to play the game with a wired transmission, and I reconnected with a wired connection to do so.



#Week9

Project:

This week, I focused on the final assembly stage of the wearable glove to make sure it would be ready for display in its entirety. During this critical stage of fabrication, I assembled the components together with precision to build a fully functional and neat looking wearable glove prototype. During the assembly process, I paid attention to detail and precision to ensure that each element was securely attached while maintaining the dexterity and comfort of the glove. This included cleverly integrating technical parts such as sensors, electronics, and batteries into the glove structure for a seamless integration.

To achieve a complete presentation of the glove, I carefully arranged the layout of the components to highlight the uniqueness and innovation of its design. This not only allows for a clear demonstration of the glove's functionality, but also emphasizes its aesthetics and practicality. The final assembly is not only the culmination of the technical implementation, but also marks the entry of the project into the presentation and demonstration phase.



Other Work:

The main work this week focused on recording the video and revising the paper based on my teacher's suggestions. In revising my thesis, I focused on three key areas: the discussion section, the research methodology and the game's mode of operation.

In the discussion section, I further deepened and clarified the ideas and conclusions in the thesis to ensure that readers could understand my findings more clearly and appreciate their significance in the overall research field. I paid particular attention to issues related to the feedback mentioned by my teacher to ensure that the discussion section was more comprehensive.

For the research methodology, I meticulously examined the description of the entire process, including the experimental design, data collection, and analysis methods. I worked to ensure that the depiction in this section was accurate so that the reader could replicate my research and understand the scientific nature of the methodology I used.

In terms of the game's mode of operation, I focused on my design process and how the game was run. By scrutinising this section, I ensured that the reader had a clear understanding of the game mode I developed, including its features, purpose and user experience.

The week was all about preparing for the final submission.