The Implementation of an Augmented Reality Display and a Virtual Reality Controller on Glasses

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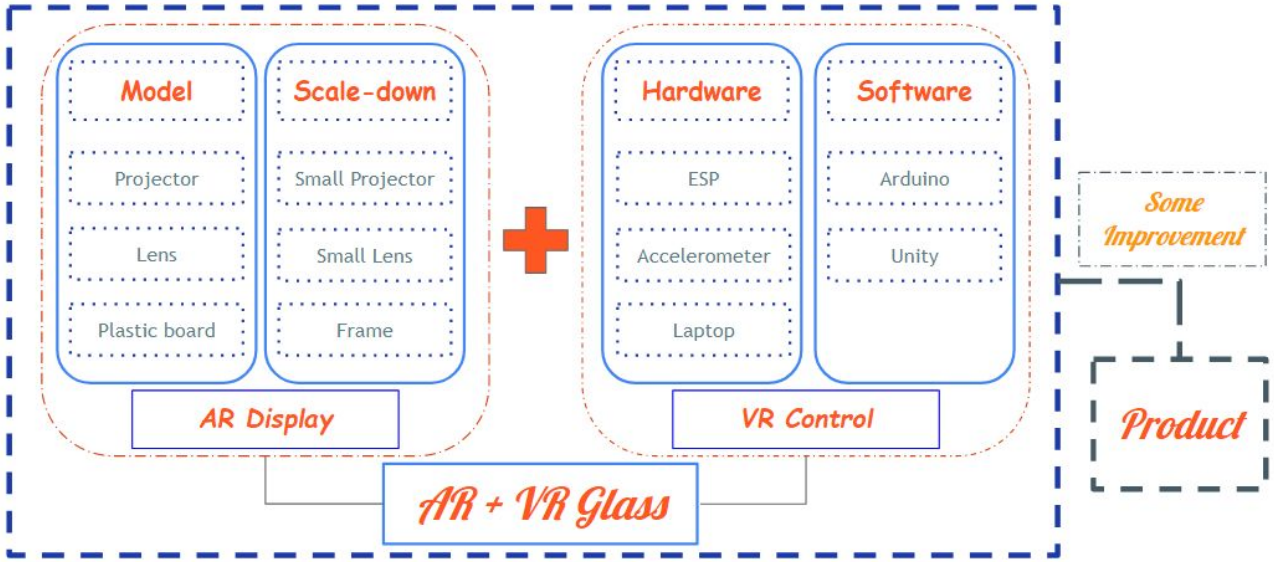
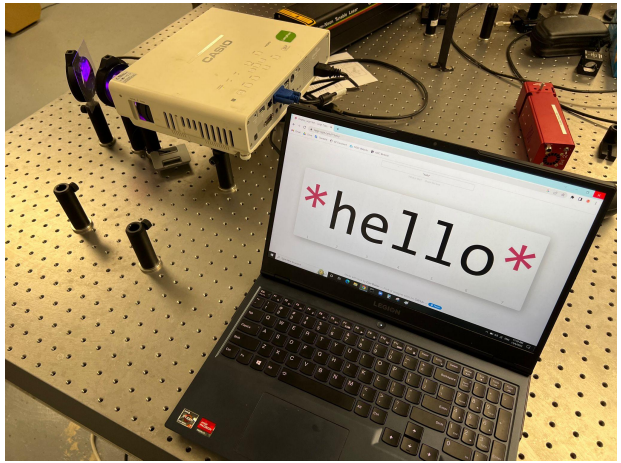


Basic Information - AR Display Model

The plastic board reflects the information from the projector

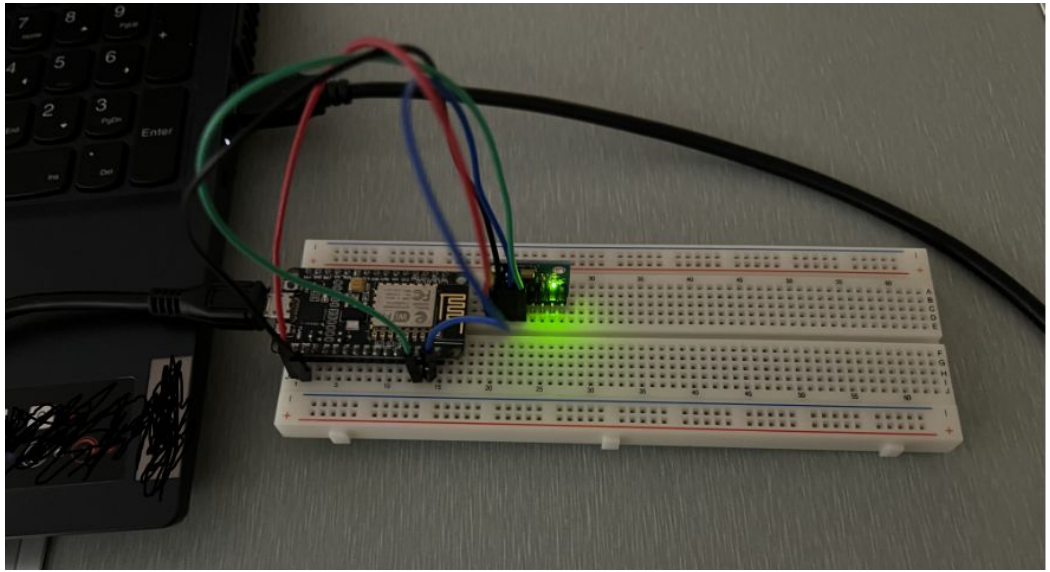
The overview of the AR display model



The laptop screen

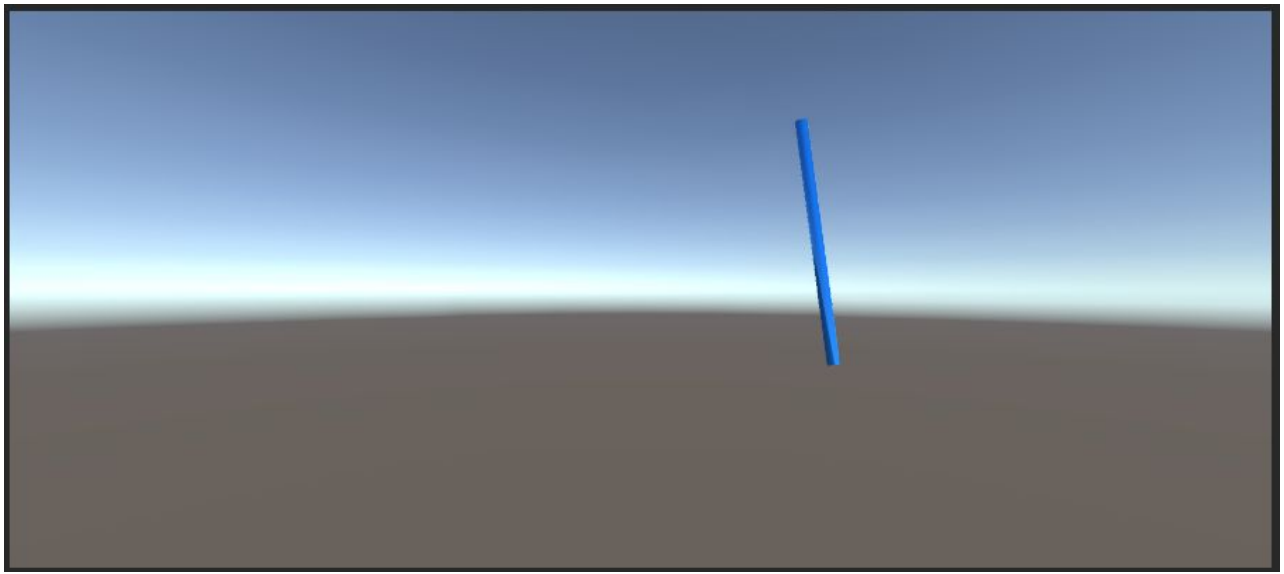
(compare with the first image)

Basic Information - VR Controller Model



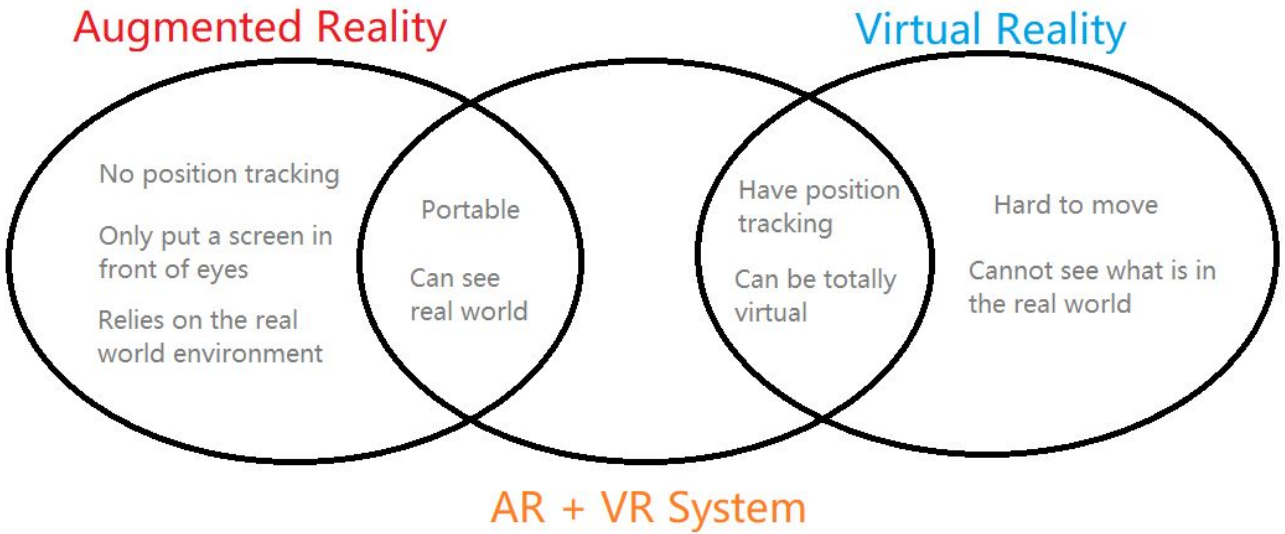
The VR controller model includes a breadboard, an ESP8266 processor, and a MPU6050 accelerometer. The model is currently sending information to the laptop in the image.

Basic Information - Position Tracking



Screenshot of the Unity project, the blue bar shows the rotation and position information of the VR controller model. (could have a live demonstration here)

Application - Ideas



The diagram shows the logic relationship among AR, VR, and my AR + VR project. The AR + VR system integrates advantages of AR and VR, to use in broader areas

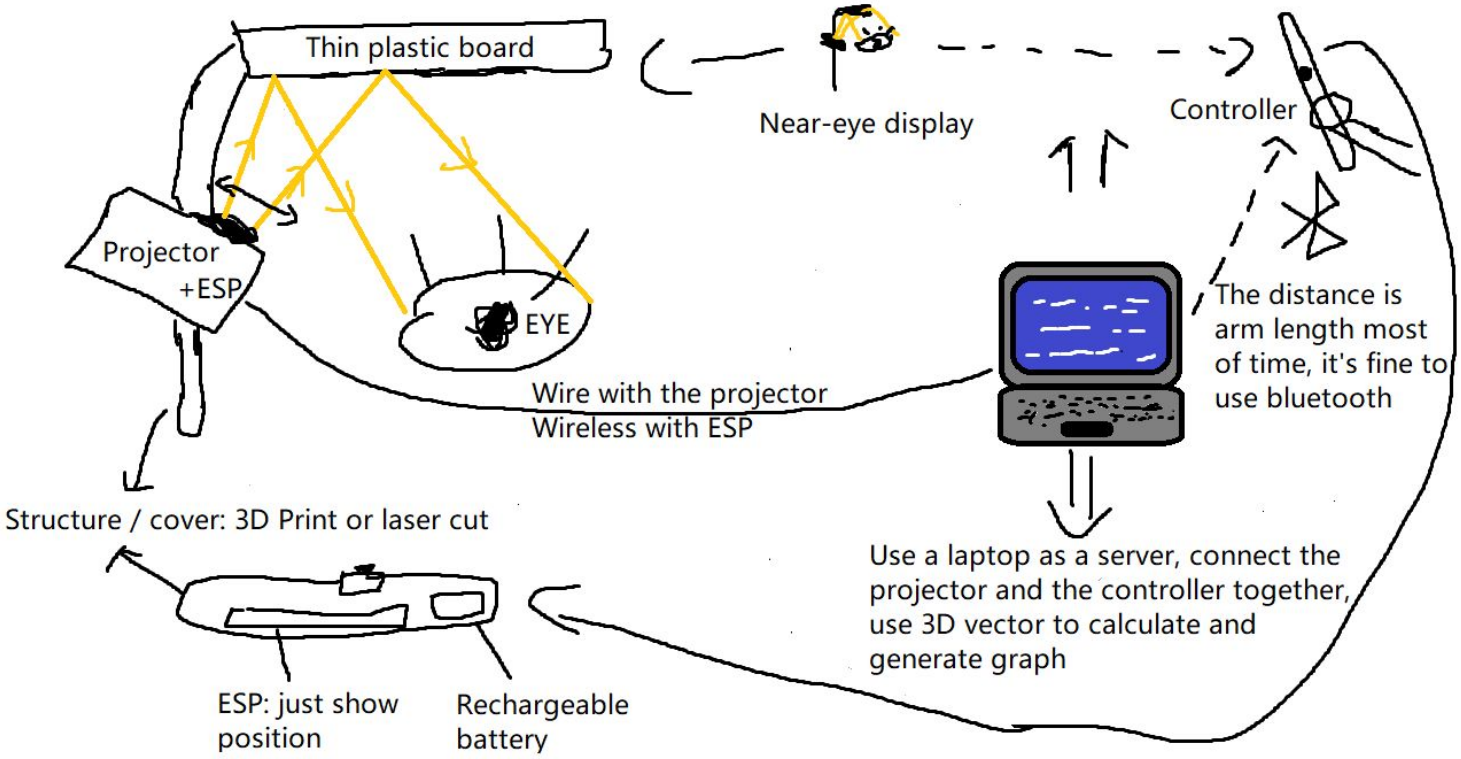
Application - Applicable Areas

The project could be used in long-distance control.

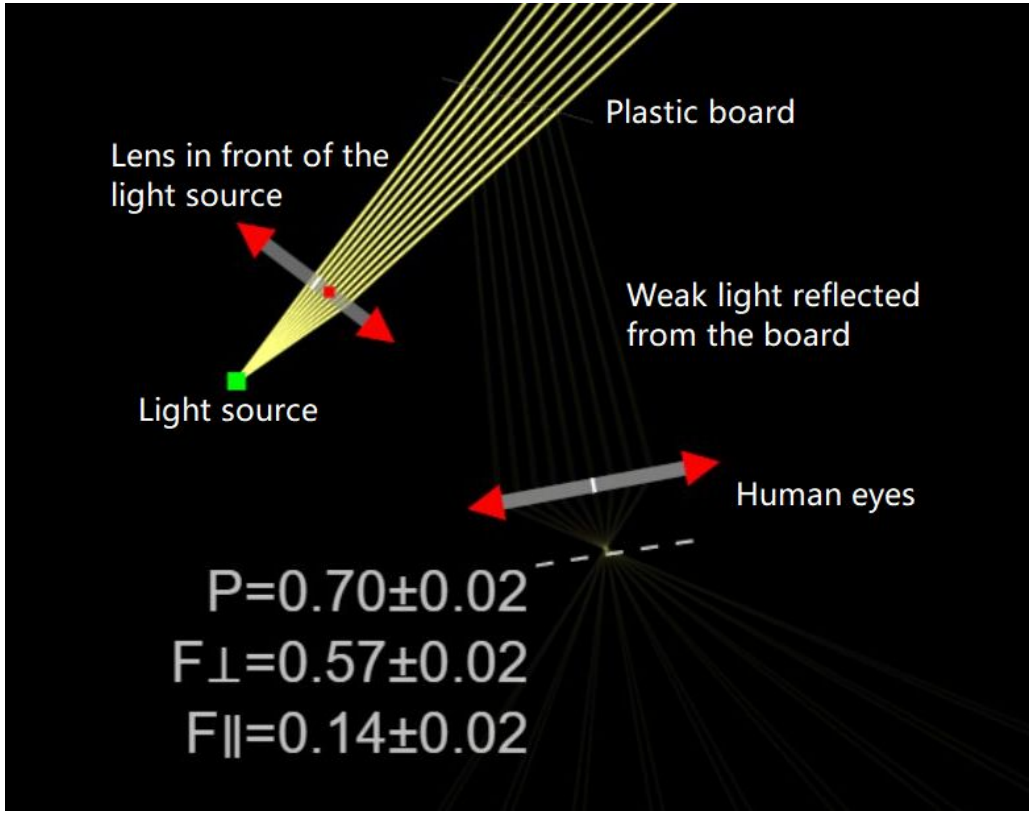
The controller records human action, and send to a server. The server could then control robots far away to do the same action as people does. (E.g. long distance online surgery, star exploration)

The controlling could also be zoomed in or out proportionally by changing the robot size, which could also enable people operate robots to do gigantic or tiny works.

Approach - Design Draft



Approach - AR Near-eye Display



The screenshot of optics simulator shows how the light from the projector is going to be transmitted to human eye.

Approach - VR Position Tracking

General idea: add up short time displacement with short time acceleration

Calculate displacement x from acceleration a with integration.

$$v = \int a dt, \qquad (1)$$

$$x = \int v dt, \qquad (2)$$

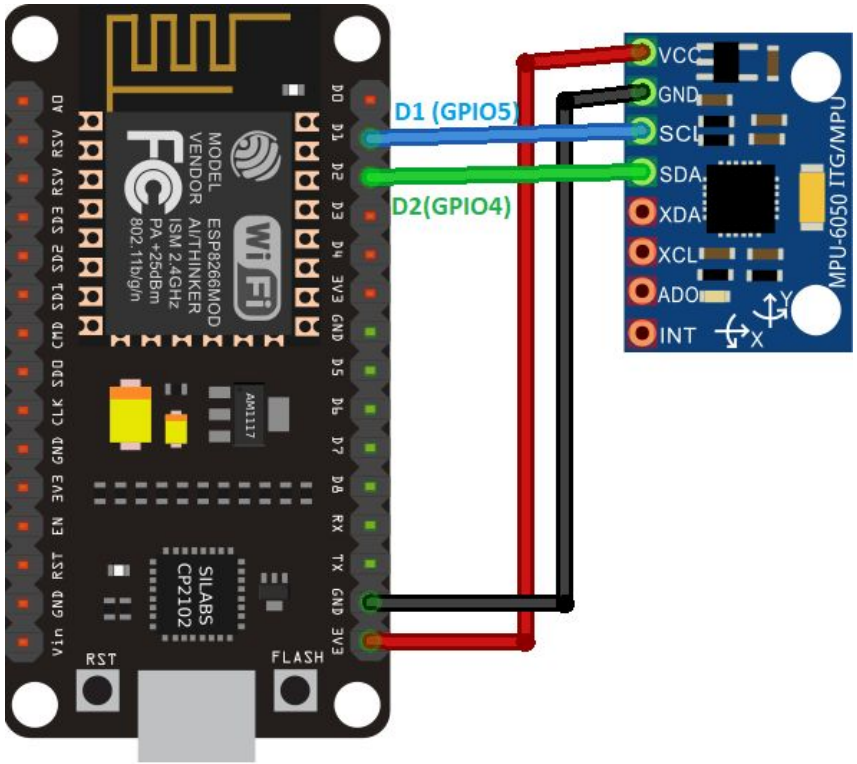
When $\Delta t \to 0$, we can express (1) and (2) as

$$\lim_{\Delta t \to 0} \sum_{i=0}^{n} \frac{1}{2} \overline{a}_i \Delta t^2 \qquad (3)$$

$$where\ \overline{a}_i = \frac{a_i + a_{i+1}}{2}$$

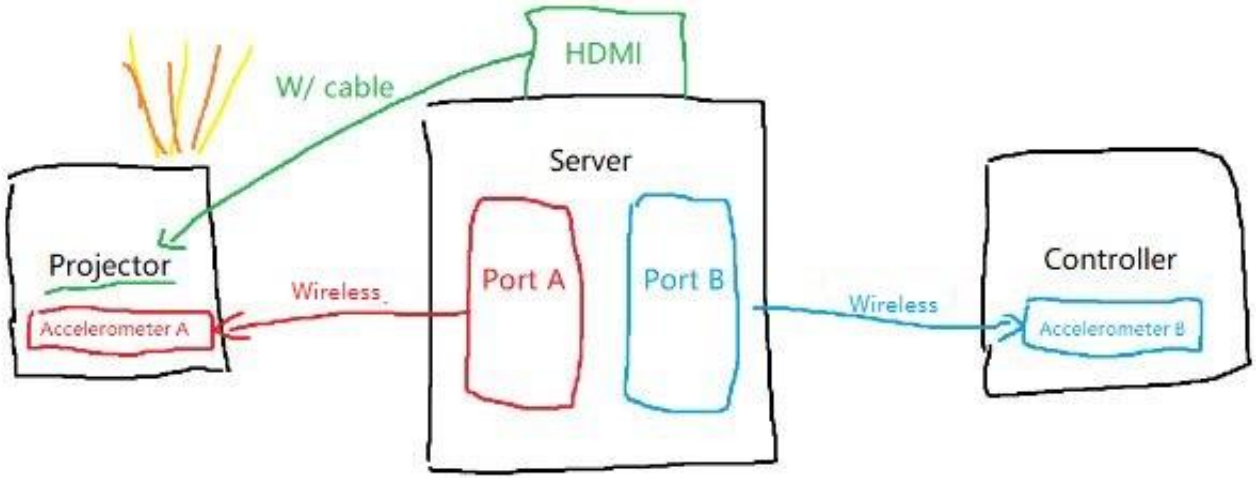
With formula (3), the displacement information can be calculated from the acceleration data sent from the accelerometer.

Approach - Connection Setup



The graph shows how the ESP8266 is connected with the MPU6050 accelerometer. Link: https://randomnerdtutorials.com/esp8266-nodemcu-mpu-6050-accelerometer-gyroscope-arduino/

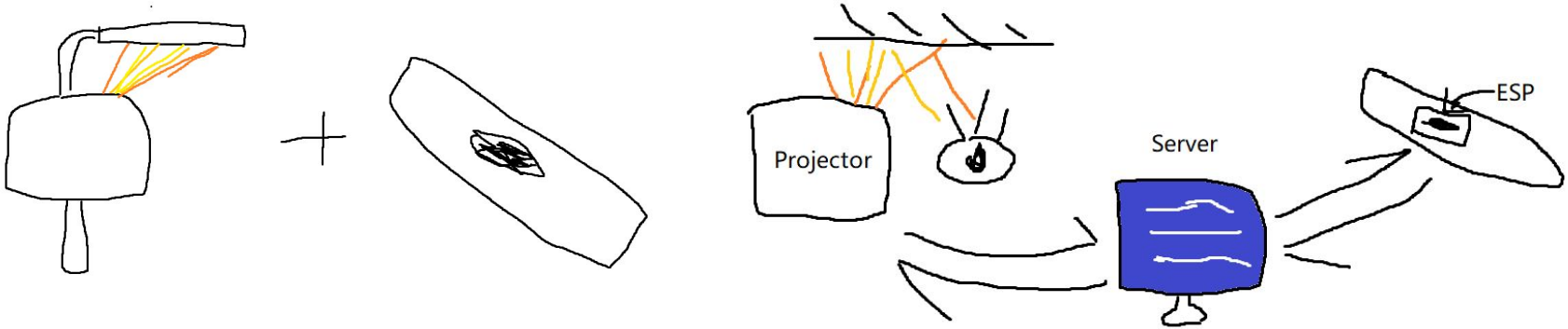
Approach - Connection Setup (cont'd)



The graph above shows how the final product will be like. Two accelerometers will connect with the server on different ports, and The projector will display what the server shows about the accelerometer data

Conclusion

- What to make: an AR glass with VR position tracking
- Why to make: to build a glasses which integrates the advantages of AR and VR
- How to make: use optics for display, an accelerometer for positioning, and a laptop as a server



Thanks for Listening

March 2023

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