Smart Guidance Helmet

Eslab Final Report

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I. Motivation and Goal :

People sometimes have difficulties getting information about the things that one's interested in, whether it is because lack of information written nearby, shy to ask the information center, lack of guides or because it's not a recognizable language to the user. Our main motivation is to solve problems like that.

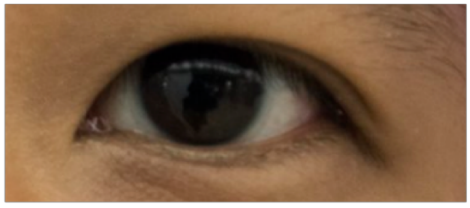
Our main goal is to inform user with the information about the objects or items that the user is interested in through gaze detection, through gaze recognition, we can know where the user is interested in, this way, we can provide the correct data that the user is interested in.

II. Purposed Method and Device Introduction:

a. Infrared Camera:

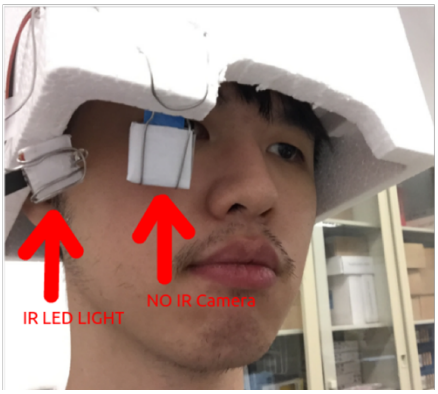
The use of infrared led and camera significantly makes it easly to capture the pupil.
Comparison between Infrared Camera and normal camera:

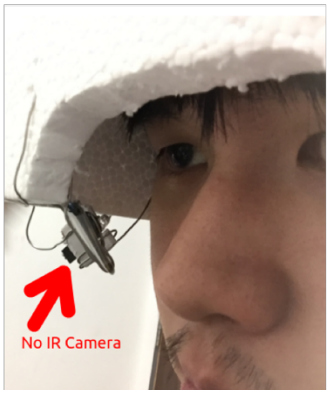
Eye with infrared camera

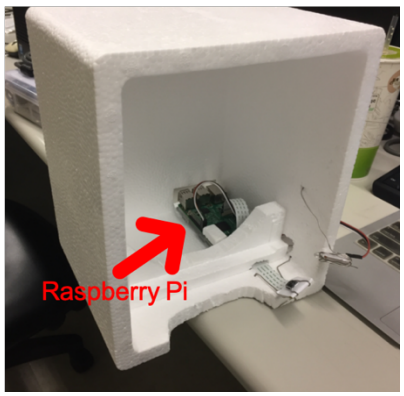


Eye without infrared camera

b. Device Introduction:

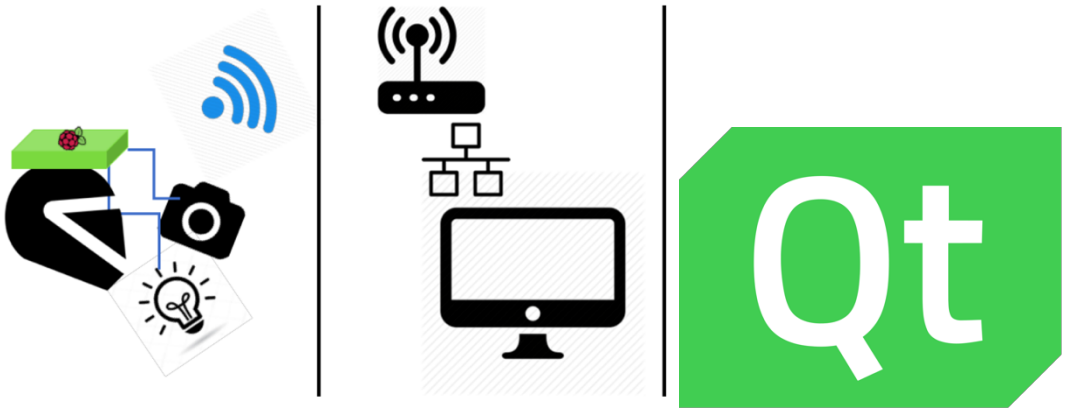






There is a RPI inside the helmet that triggers the LED light and No IR Camera, the light is emitted to the users eye so that the No IR camera can detect the pupil more clearly.

c. Device Structure:



Raspberry Pi:

Manipulate edge device : camera, IR LED

Communication thru internet : raspivid + gstreamer

PC (Ubuntu 16.04):

According to image from camera, calculate the gaze position & correspond target

Show the information of the target where gaze point

III. Challenges

At the very beginning, We found a project from github, however it's windows base project, we solve all the dependency, libraries, and modify the according cmake files for 3 weeks…

We also spend much time to fine tune the position of camera, IR LED, and some parameter to optimize the gaze capture process.

IV. Result

a. We constructed a structure that can identify where the user is looking at.

The device can now successfully detect the pupil with high correctness. We are also able to utilize the data calculated by the pupil recognition program to meet our goal.

b. We transplant a complicated project that was built on Windows to Linux environment.

c. Demonstration video as link: https://youtu.be/5OHSl7S5Nqg

V. Future Work

a. Stabilize the detection of pupil:

Because the position of the led light is up close to user eye, it may sometimes cause dramatically difference in brightness of the image. Due to this reason, the recognition would sometimes detects the corner of the eye as the pupil, and thus affect the construction of 3D eye-ball.

b. Improve sensitivity:

The product can only detect 3 directions right now, and often needs calibration, technically, we can expand the recognition into 4 or 9 directions, but we would need a more stable helmet and camera device.

c. Add an additional camera on the forehead

Combine the camera on the forehead, we can construct a end to end device as an headset. Using object detection technology, it would be a more complete product for user, not limited to fixed place only.

VI. References

3D-Eye-Tracker by Yutaltoh
https://github.com/Yutaltoh/3D-Eye-Tracker

singleeyefitter by LeszekSwirski
https://github.com/LeszekSwirski/singleeyefitter