
# Software development for iblink

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# 目录 Contents

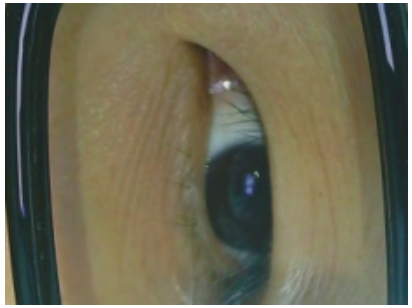
https://learn.adafruit.com/diy-wearable-pi-near-eye-kopin-video-glasses

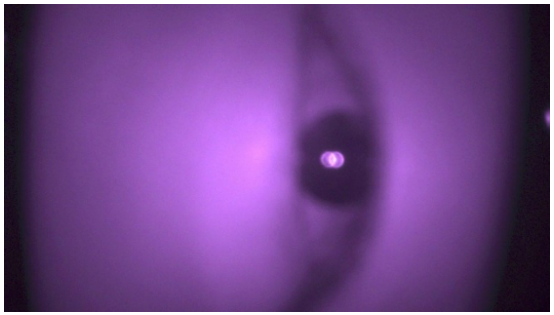
# Iblink

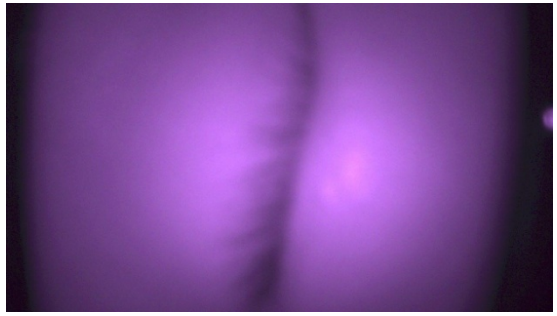
Our 3D Printed design turns a pair of 'private display glasses' into a "google glass"-like form factor. It easily clips to your prescription glasses, and can display any kind of device with Composite Video like a Raspberry Pi.

A pair of these wearable video glasses sets you back about 100 bucks, and the 3d printed parts are a free download on thingiverse. This display uses composite video to connect to the Raspberry Pi  its very plug and play.

# Acquired Image







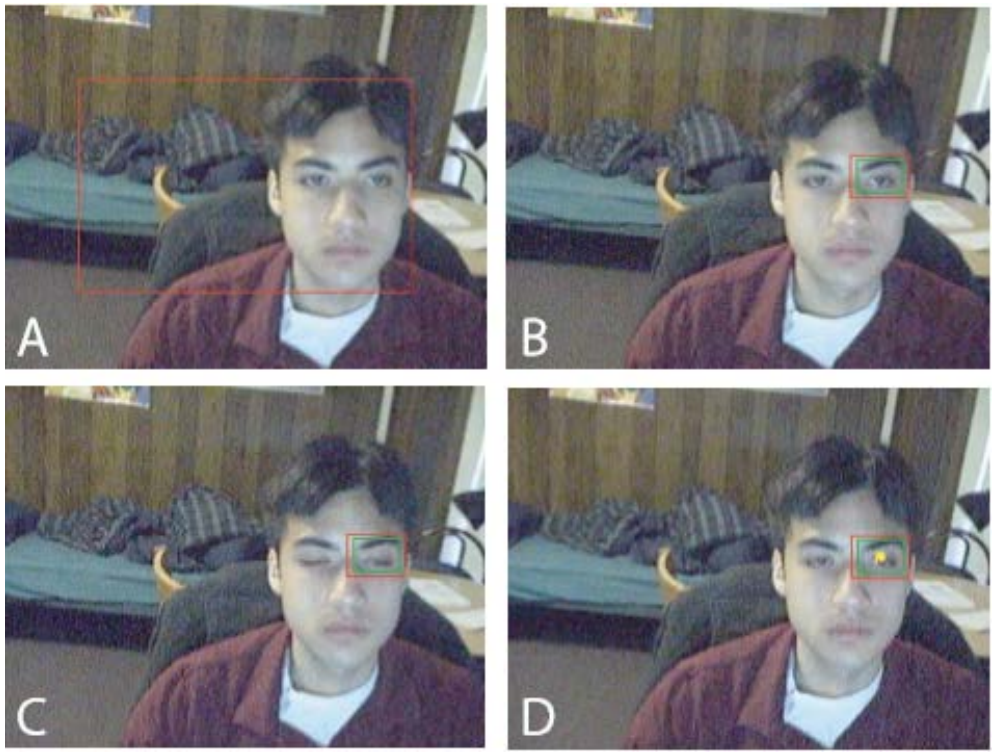
# Existing program

1、initialization

2、template creation

3、eye tracking

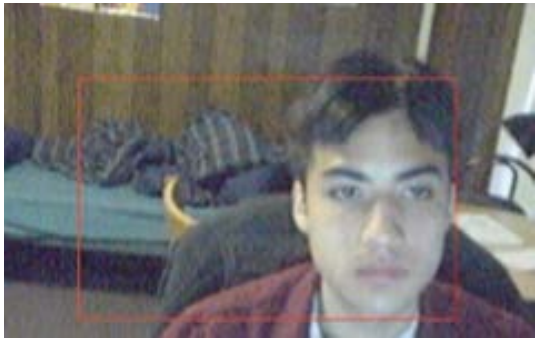
4、blink detection



# Promblems

- Extra steps

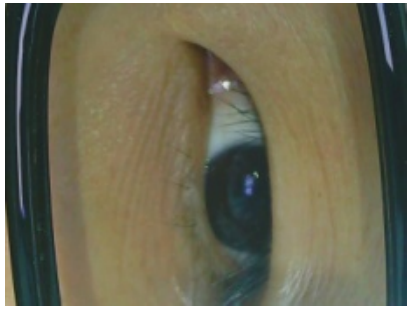
  The image we get is not adapted to existing facial recognition programs



VS

- Hardware waste

  Facial recognition wastes a lot of computing resources



# Advanced design

**Template algorithm**

- Sampling in advance
- Create templates
- Real-time contrast

# Template algorithm

## Sampling in advance

- load a number of eye images which we have already known if they're open or closed

## Create templates

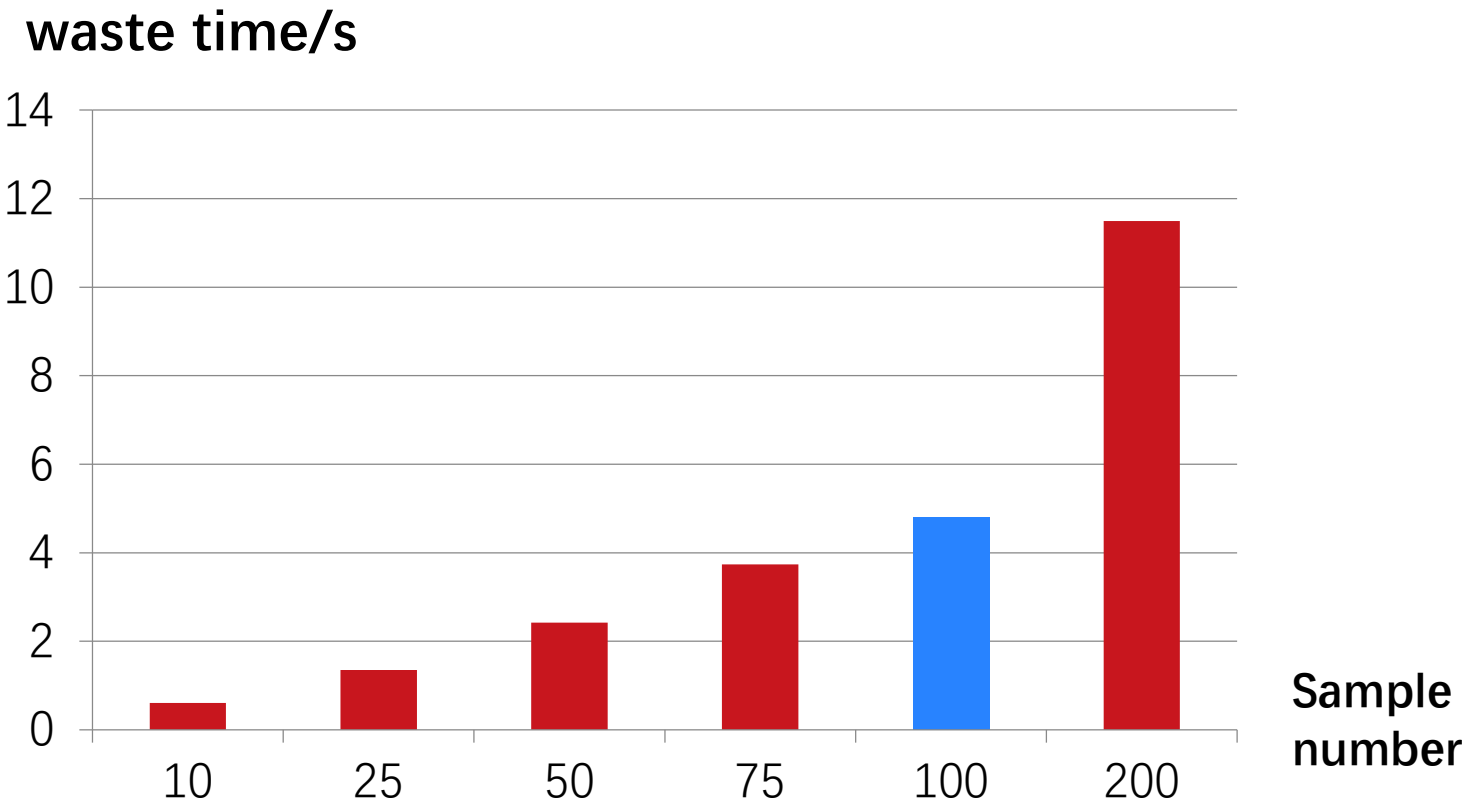
- convert them into grayscale images and create an array to save the average value of samples

## Real-time contrast

- Use the formula to measure the similarity to judge open or closed

# Sampling in advance

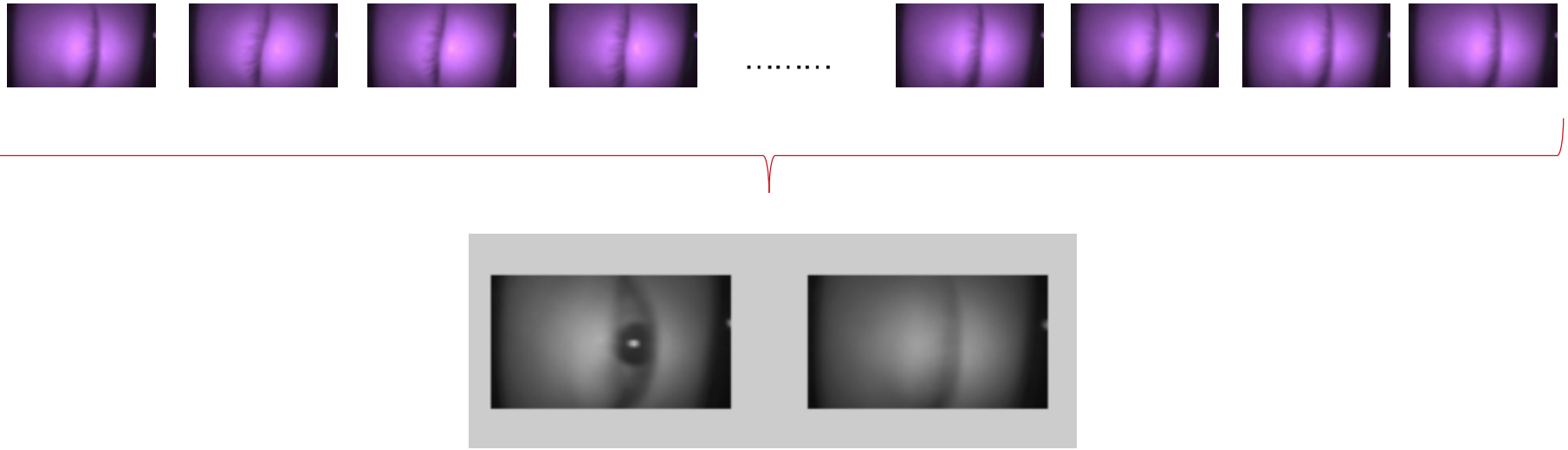
- load one hundred open-eye images and the same number closed-eye images



# Create templates

1. convert samples into grayscale images
2. create an array to save the average value of one hundred samples
3. the two arrays we get will be the templates

# Create templates



# Create templates

Templates:
Array1: stdopen(i,j)
Array2: stdclosed(i,j)
Nearly 15Mb each to memory for 1024X720 image；

stdopen

720x1280 double

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 18.2300 | 18.6700 | 18.7900 | 17.9100 | 17.3000 | 17.3300 | 18.0700 | 18.5900 | 18.3400 | 18.2900 |
| 2 | 18.4300 | 18.9900 | 19.2100 | 18.6200 | 18.0600 | 17.9000 | 18.5000 | 18.8700 | 19.5200 | 18.9400 |
| 3 | 18.0200 | 18.5200 | 19.0400 | 18.7300 | 18.4400 | 18.1800 | 18.6000 | 18.9900 | 19.2000 | 18.5300 |
| 4 | 17.8500 | 18.2700 | 18.6400 | 18.3300 | 17.9300 | 17.7200 | 18.0700 | 18.2500 | 17.8100 | 17.5700 |
| 5 | 18.4500 | 18.7200 | 18.7800 | 18.1400 | 17.6900 | 17.5300 | 17.8400 | 17.7900 | 17.8300 | 18.2000 |
| 6 | 18.0400 | 18.4700 | 18.6000 | 18.0400 | 17.7400 | 17.8300 | 18.1800 | 18.2700 | 18.7900 | 19.1800 |
| 7 | 17.3900 | 18 | 18.4900 | 18.2500 | 18.0500 | 18 | 18.3100 | 18.4900 | 18.7700 | 19.0600 |
| 8 | 17.9600 | 18.6100 | 19.3000 | 19.0100 | 18.5700 | 18.0600 | 18.0900 | 18.1900 | 18.5000 | 18.7500 |
| 9 | 19.4300 | 19.1000 | 18.6600 | 18.4900 | 18.6600 | 18.6200 | 18.6000 | 18.8300 | 18.7800 | 19.4000 |
| 10 | 18.4000 | 17.9600 | 17.4000 | 17.5400 | 18.3800 | 18.8900 | 19.0900 | 19.1800 | 18.2900 | 18.7000 |

# Real-time contrast

The image to be measured should be input as grayscale information in array as well.

To calculate easily, we should do a histogram equalization.

Then we get the array img(i,j) containing each pixel points' grayscale information.

Using following formula will give us the similarity between the image to be measured and the standards.

$$sim = \frac{\sum img(i,j) * std(i,j)}{\sum img^2(i,j) + \sum std^2(i,j)}$$

# Real-time contrast

sim1 and sim2 which is about the similarity of open-eye standard and closed-eye standard.
By comparing them, we can easily know if the eye image we get is open.

| 函数名称 | 调用 | 总时间 | 自用时间* | 总时间图 (深色条带 = 自用时间) |
|---|---|---|---|---|
| blinkdetect | 1 | 63.791 s | 58.586 s | |

20 samples need near 60s for 1024X720 image
If we have template already, each decision takes 3s

# Advanced design

- **Advantages**
- Give up the face recognition part.
- Reduces the complexity of the software part and the use of resources. However, the
- More suited to hardware design

- **Disadvantages**
- Template section needs pre-added
- Need stable photo sources
- Extra memory for template storage

# Future work

- Solving standards storage issues
- Translating existing matlab program into c++ program
- Test programs on hardware and solving stability problems

# Q&A