Eye gaze tracking for screen controller

Software design

# Webcam video capture

This part of the system should just pass whatever is on the webcam now, preferably without delay and with as less compression as possible, because most of the operations will be done as matrix operations anyway.

# World coordinate calibrator

## Usages:

1. This will get rid of the laboratory environment needed to have sufficiently accurate system for screen controller
2. It will allow to create different setups for different use cases
3. It will allow usage of a single webcam

## Interaction process:

1. The user will need to attach poster to stationary object, so that screen, webcam, user and the poster are relatively stationary to each other
2. Most of the poster should be visible
3. The calibration will take a few seconds to calculate the angle and distance
4. Afterwards it will show sign of being locked on to the poster and the calibration is ready for the next step

## Performance requirements:

* No need to be as fast as possible, but no longer than 15 seconds
* Should work on a computer with moderate gaming GPU available and typical webcam

# Face and eye pupil tracker

## Usages:

1. Track face and eye pupil regardless of what’s on the user or what is the coordinate system currently established

## Interaction process

1. The user at first will be asked to keep the head still and positioned towards monitor
2. After locking on the face and eye pupil, the user will be asked if the result is correct, if yes, then the calibration process will advance to the next step
3. If not, the user will be asked to remove some head clothes or accessories,

## Performance requirements

1. I believe the main problem is the camera resolution and the distance to the user. The limitation will probably be 1.5-2 meters from webcam to user’s eye pupil
2. I believe this step is quite important and it should be given as much time as possible

# Eye pupil direction to screen coordinates mapper

## Usages:

1. Generic geometry system, e.g. doesn’t depend on previous steps whatsoever, just relies on numeric input
2. Purely mathematical, should work anywhere

## Interaction process:

No interaction process is present with a human user. Numbers in from previous step, numbers out.

## Performance requirements

I do not think there will be any requirements, but perhaps for higher throughput a GPU will be needed.

# OS Input pipe

## Usages:

1. Transform eye gaze location into mouse position/movement

## Interaction process:

1. Since eye gaze is usually pretty fast and would like to stay at one point for a time, there will be two modes of interaction
2. The first one is the office or normal usage, e.g. moving the gaze will just set the mouse position directly
3. The second one is oriented for shooter/exploration games where rapid eye movements are required in order to succeed. In that mode, the eye gaze movement will be transferred as pointer movement, not setting pointer position immediately.

## Performance requirements

1. This hopefully will have the same priority in the OS as the input itself, e.g. interrupt
2. Stall events should be flushed or dropped