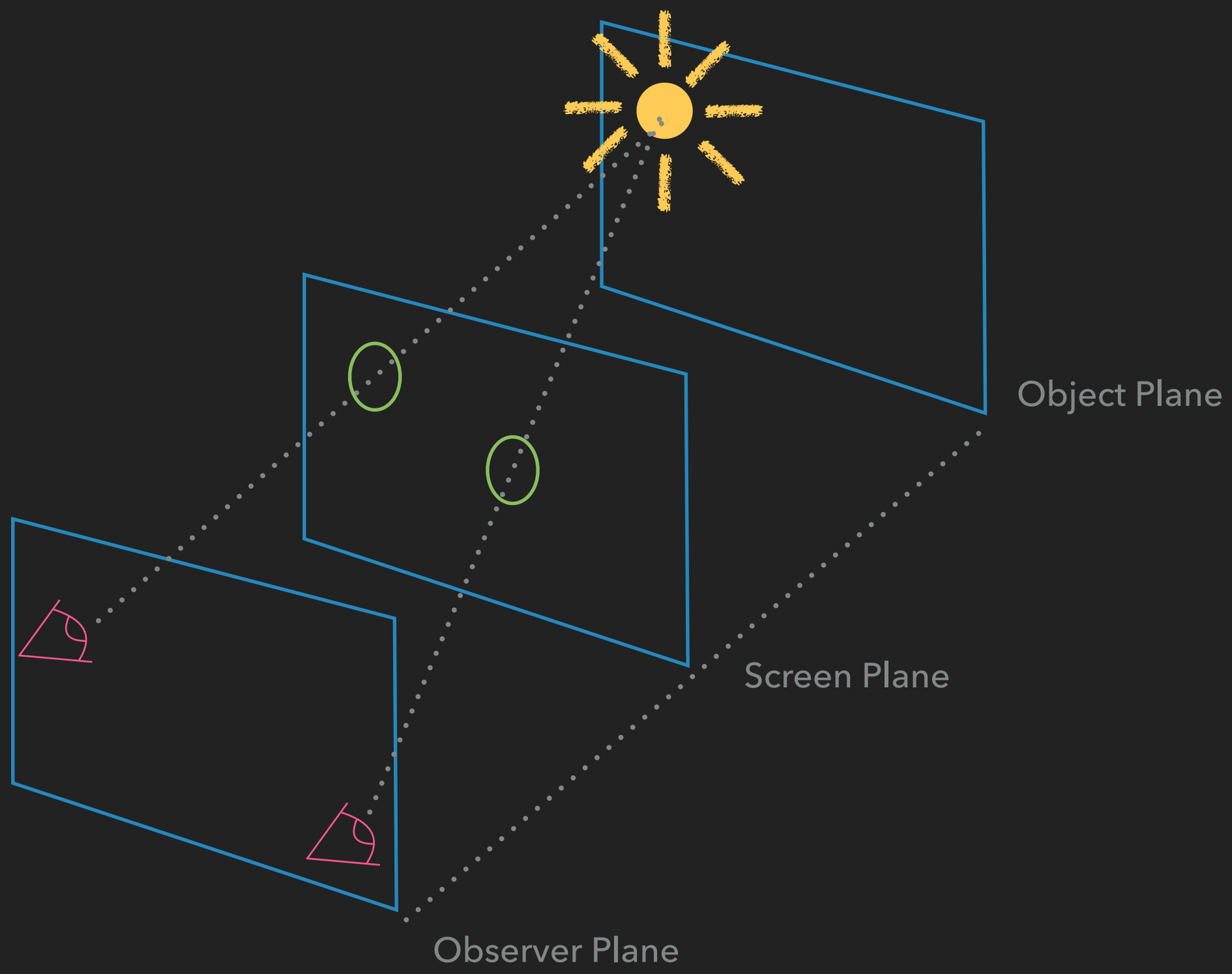
THERE WAS A LOT OF MATH…

OBSERVER SENSITIVE TRANSPARENT HEADS UP DISPLAY

DAY AND NIGHT DRIVING SAFETY WITH DYNAMIC DISPLAY

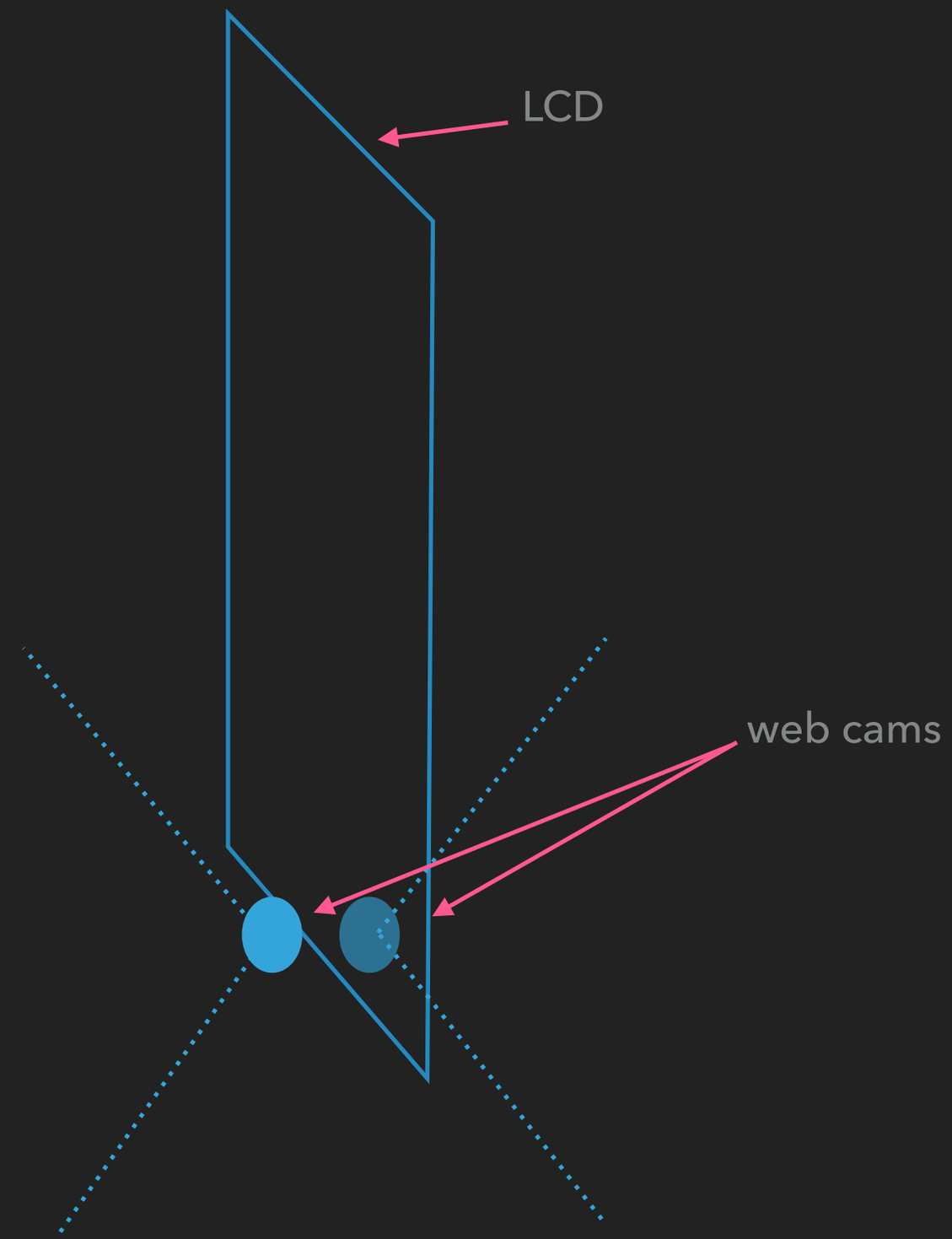
- The sun can make daytime driving very unsafe when it cant be covered properly.
- At night, oncoming headlights can blind drivers.
- Imagine a system that can actively block bright lights no matter where they or you are located with respect to the car.

POSITIONAL AWARENESS



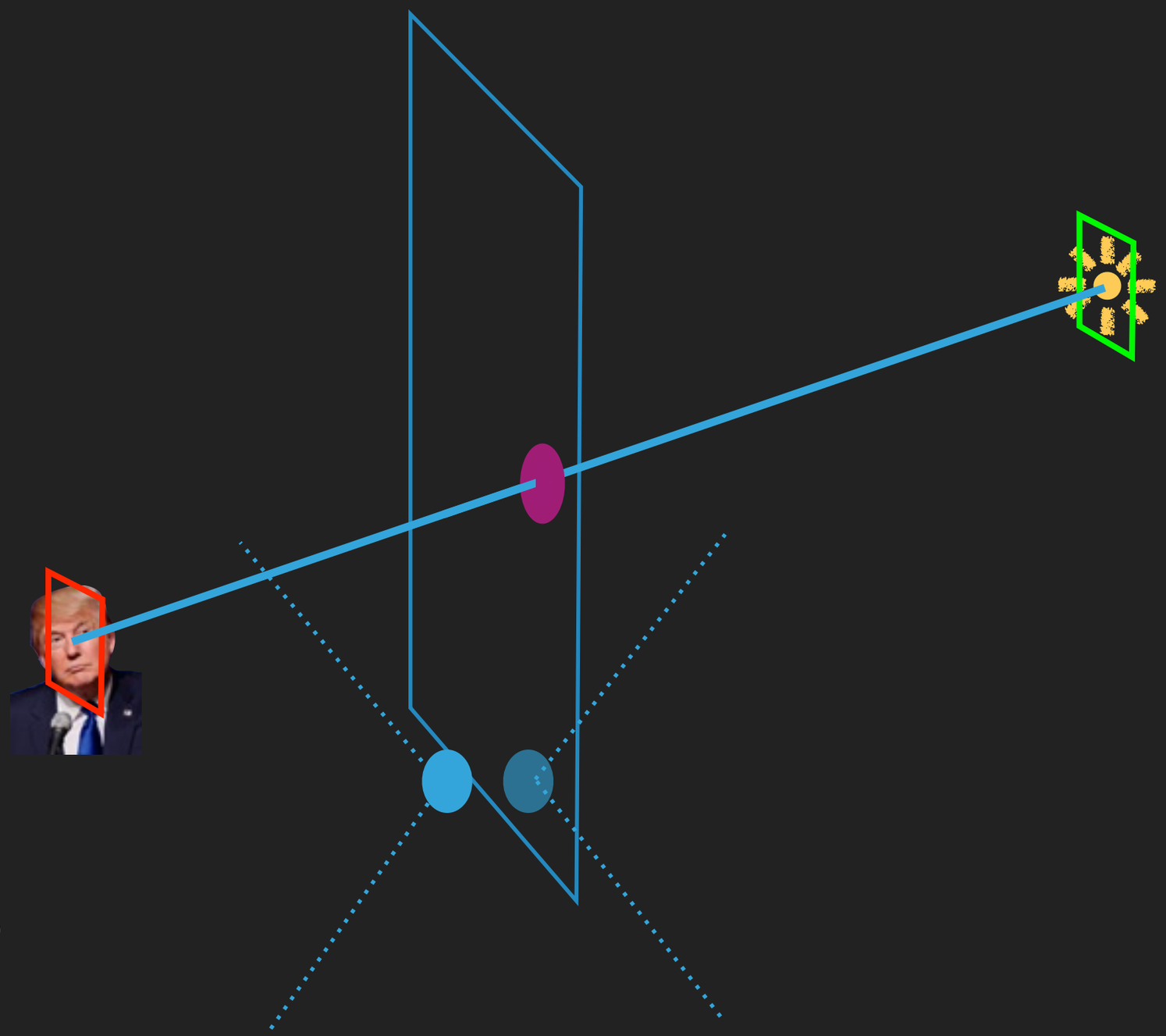
HARDWARE

- Two webcams on either side of the LCD screen
- One pointed into the world, one pointed at your face.



WHAT ITS DOING

- Real time face tracking and outward object tracking.
- Converts positions of objects into real space.
- Draws a line between two objects.
- Finds intersection of line in LCD plane.

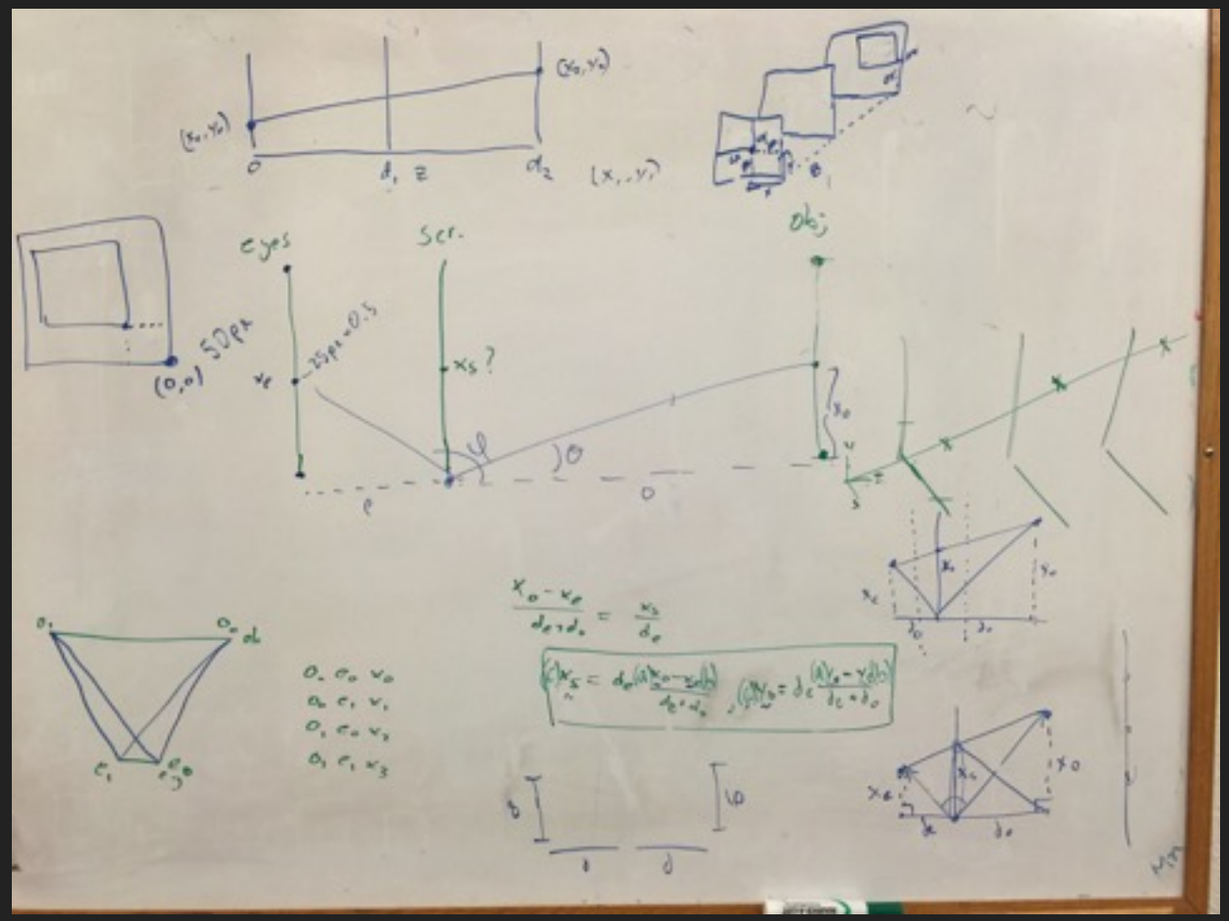


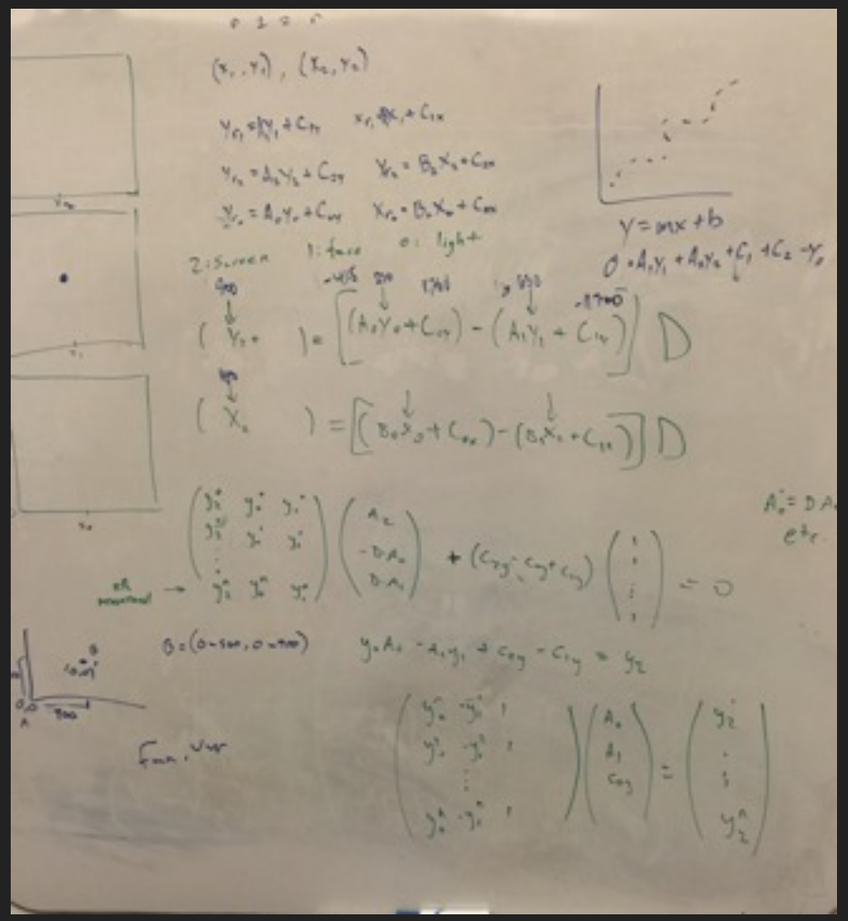
FACE AND LIGHT SOURCE TRACKING

- Face detection is done by using a cascade classifier with openCV library.
- Light source is identified using an intensity cut followed by a gaussian convolution that is fed into openCV blob detection.

CALIBRATION

- Step 1: Draw lots of pictures





CALIBRATION

- Step 1: Draw lots of pictures
- Step 2: Think really hard

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CALIBRATION

- Step 1: Draw lots of pictures
- Step 2: Think really hard
- Step 3: Struggle
- Step 4: Feel ashamed that we can’t write down the equation of a line that intersects 3 planes.
- Figure it out! WOOOOOOOOOooooo

CALIBRATION

- Assume objects of interest are confined to a plane in real space (no movement in depth from cameras).
- Write down constraint equations on three points lying on the same line in real space, taking into account the possible shifted coordinate system in each digital space plane (LCD, face, Sun)

$$x_2 = A_0 x_0 - A_1 x_1 + C_x$$

$$y_2 = B_0 y_0 - B_1 y_1 + D_y$$

CALIBRATION

- Implies a four dimensional vector space of undetermined parameters.
- The calibration procedure we came up with is to do a four dimensional least squares fit.
- At least 4 measurements needed in order to constrain the calibration parameters (we actually do like 9).
- Move both face and

RUNNING EVERYTHING FOR REAL

- Plugging in the scale coefficients and translation values determined from the calibration procedure back into the line constraining equations, we can now run the full process.
- Taking in x and y values from each camera in real time a real time position on the LCD screen is calculated, where a dot is placed.
- The dot will now place itself between you and the light in real time.