

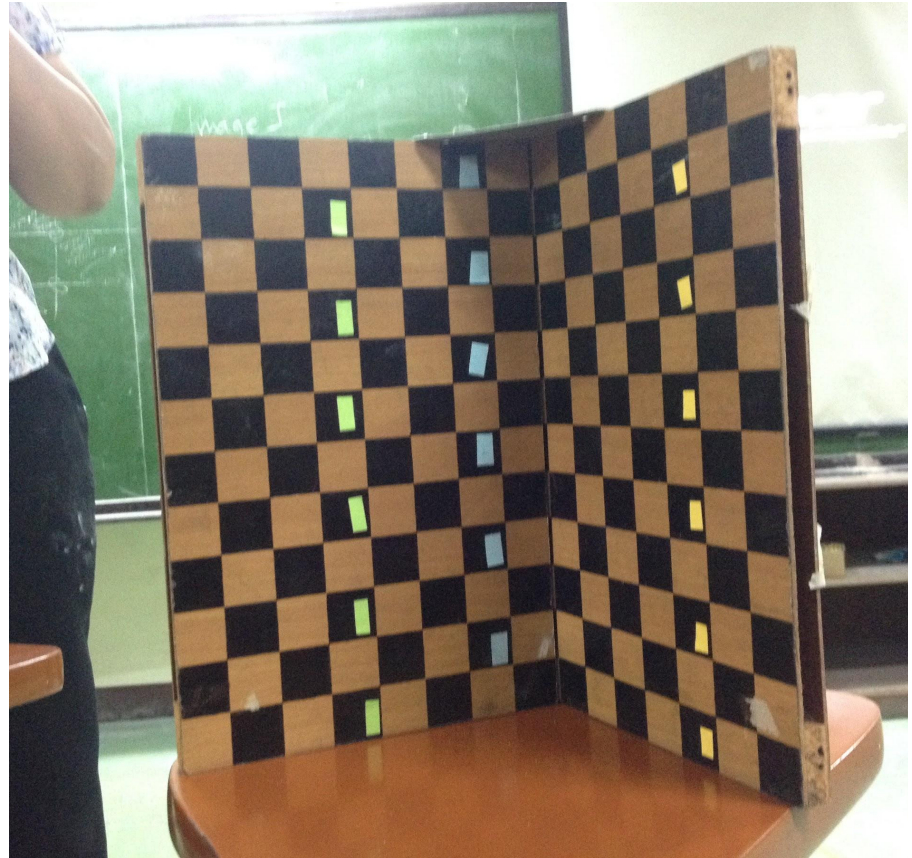
Camera Calibration

App Physics 167

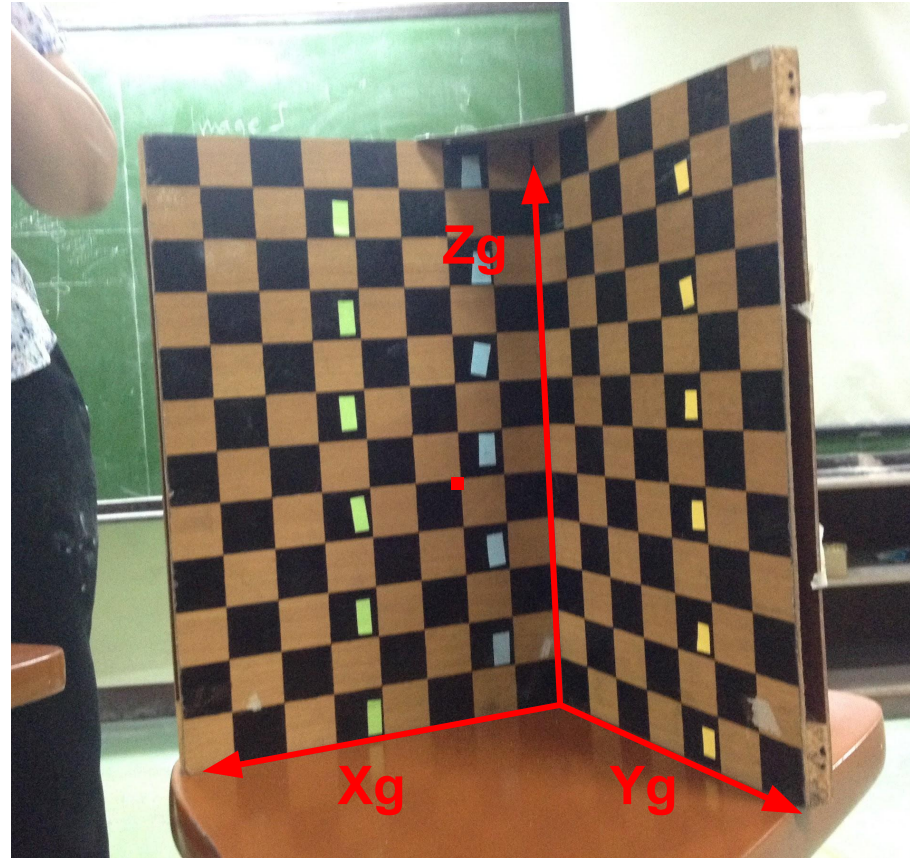
1. Construct a Tsai grid for camera calibration. It is made of two perpendicular flat surfaces with a checkerboard pattern on each.

Take note of the size of each square.

In this example each square is 1in x 1in (2.54cm x 2.54cm).



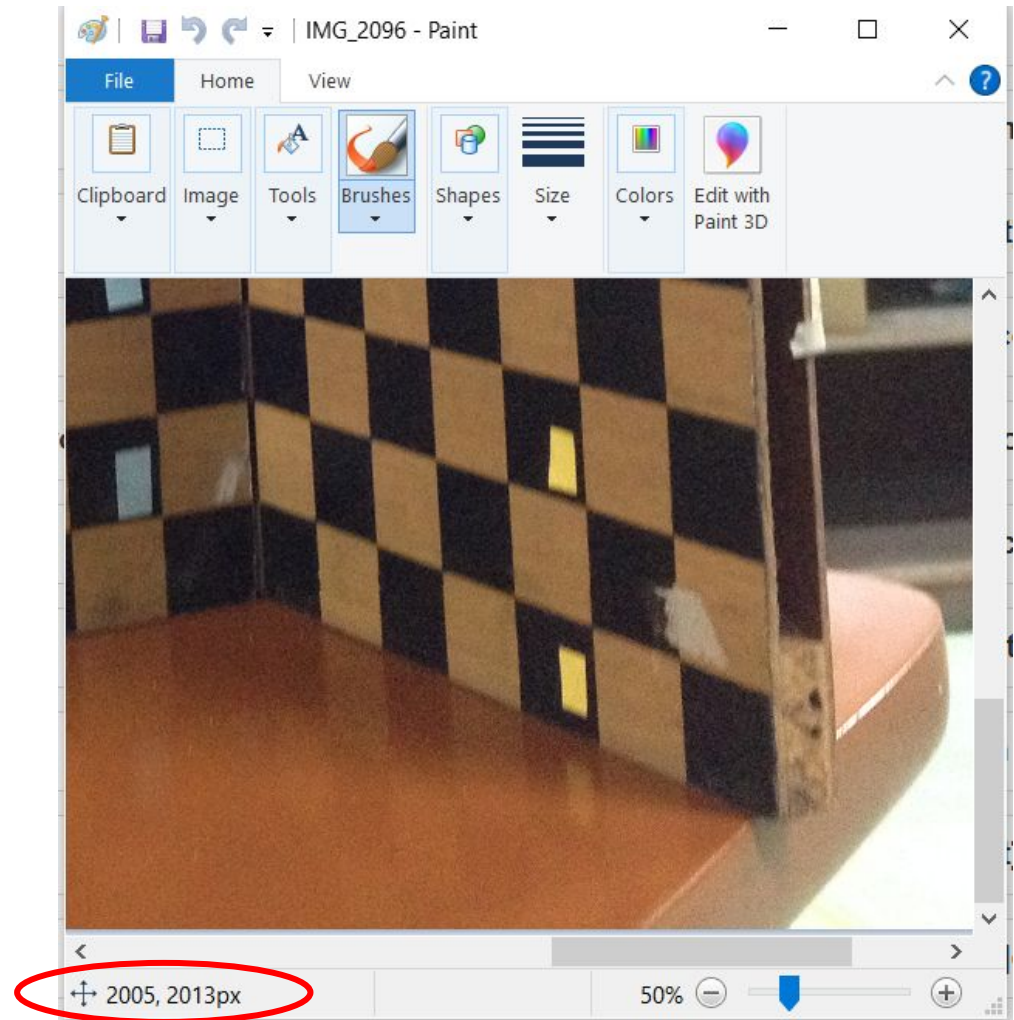
2. Pick a global, Cartesian coordinate system on the board. For example, I choose the x-y-z axes shown with the origin at the bottom-most intersection of the plates. The position of red dot in terms of (X_g, Y_g, Z_g) can now be expressed as $(2,0,5)$ in inches.



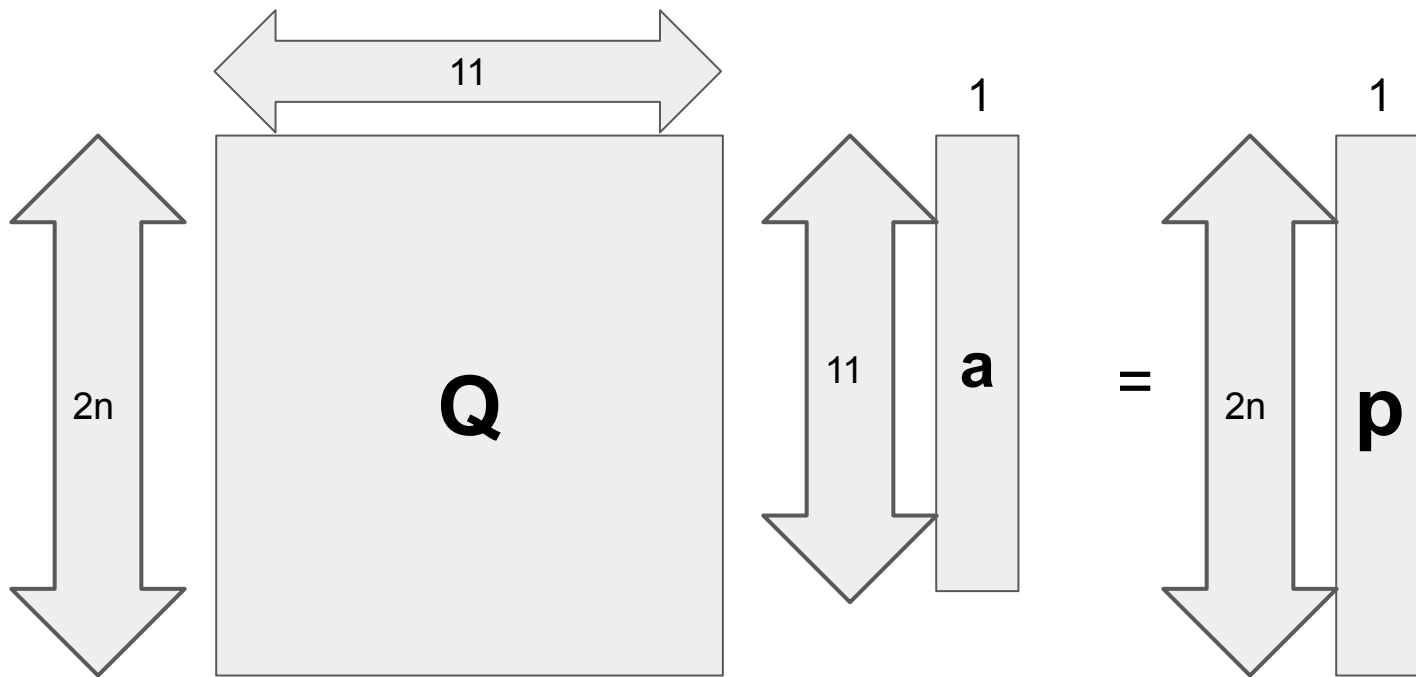
3. Take a picture of your Tsai grid using the camera you want to calibrate.

Open the image using Paint or any photo software that can show you the pixel coordinates when you hover the mouse over it.

Pick 11 to 25 corner points on the grid and tabulate their global coordinates $(X_g, Y_g, Z_g)^T$ and their corresponding image coordinates $(x_i, y_i)^T$.



4. Using all the points you've selected, set up matrices \mathbf{Q} and \mathbf{p} in Equation 31 of the lecture notes. Compute the elements of the calibration matrix \mathbf{a}_{ij} using Equation 33. If you picked n corner points, your \mathbf{Q} should have matrix dimension $2n \times 11$ and \mathbf{p} $2n \times 1$.



5. To verify if you got the calibration correctly, predict the image coordinates of some corner points of the checkerboard which were not used in the calibration. Use Equation 29 and 30 to get their image coordinates given the global coordinates. Overlay the predicted corner points on the image. Comment on the accuracy of your prediction.