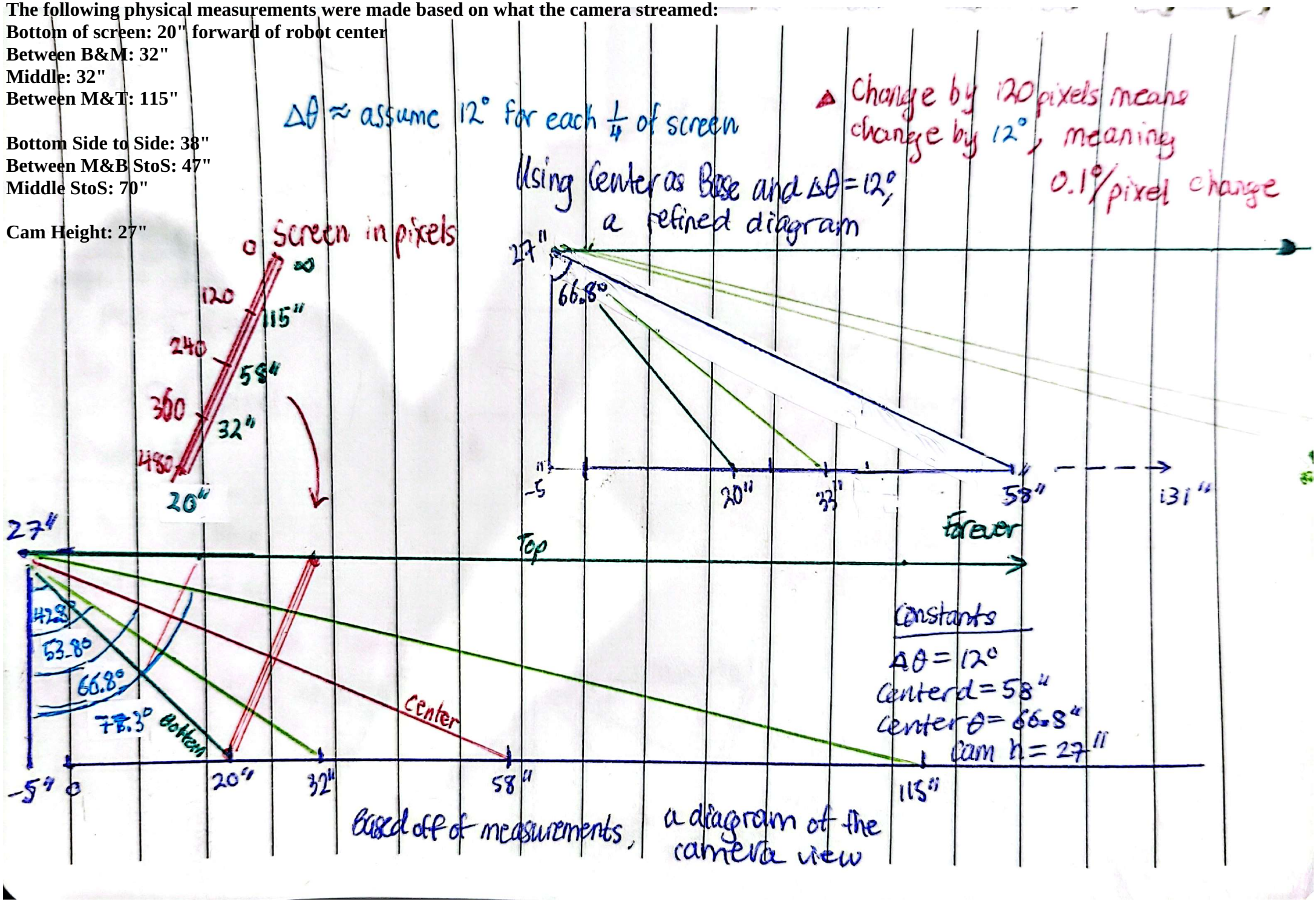
The following physical measurements were made based on what the camera streamed:
Bottom of screen: 20" forward of robot center
Between B&M: 32"
Middle: 32"
Between M&T: 115"

Bottom Side to Side: 38"
Between M&B StoS: 47"
Middle StoS: 70"

Cam Height: 27"



Constants

Cam height = 27"

Center distance = 58" ★

Center angle = 66.8°

Change in angle per $\frac{1}{4}$ screen = 12°

↳ 0.1°/pixel

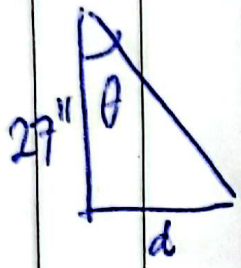
Converted

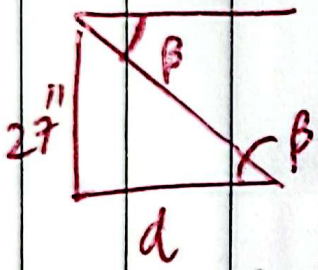
Cam h = 0.686 m

Center d = 1.473 m

Bottom d = 20" OR 0.508 m

Bottom θ = 42.8° → 47.2°





$\tan\theta = \frac{d}{27"}$

You are given pixel information

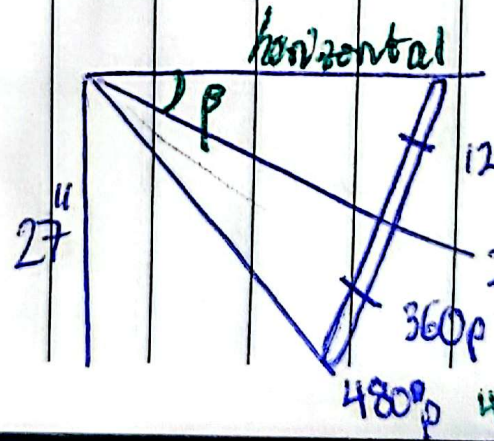
★ setting center as base means we'll have ± change θ when coordinates are > or < than center of screen, 240 pixels.

» should set bottom as base

» Additionally, to simplify eqn, assume camera is center of bot

» set horizontal as 0° and vertical as 90°

Therefore



Thus, ±1 pixel = ±0.1°

$\frac{27"}{d} = \tan\beta$

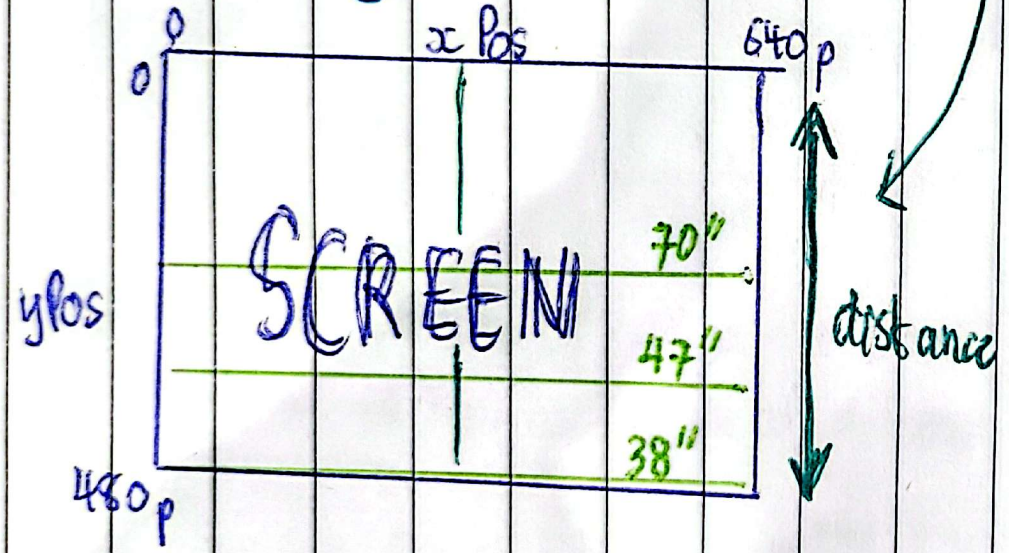
From $\frac{27''}{d} = \tan\beta \Leftrightarrow \frac{27''}{d} = \tan(0.1^\circ \times \text{pixel}) \Leftrightarrow \frac{27''}{\tan(0.1\,\text{pixel})} = d$

$\Leftrightarrow \frac{0.686\,m}{\tan(yPos/10)} = d_{\text{in meters}}$

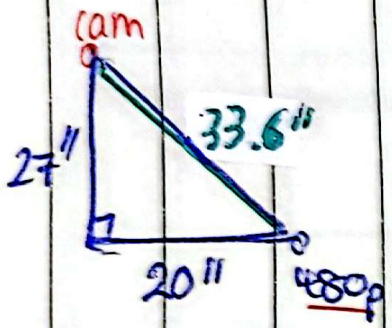
$\text{distance} = 0.686 / (\tan(yPos/10))$

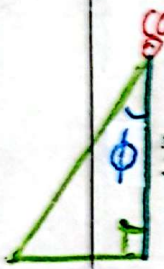
angle in °

confirm that this is in ° OR change to radians

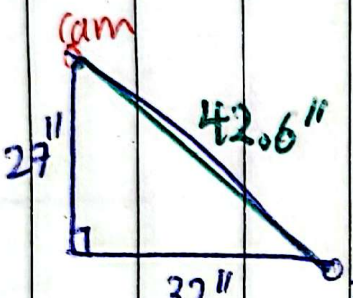


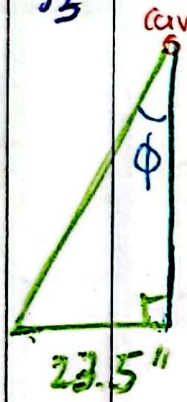
You can use a simulation to represent visually your calculations – if only solid works didn't freaking expire



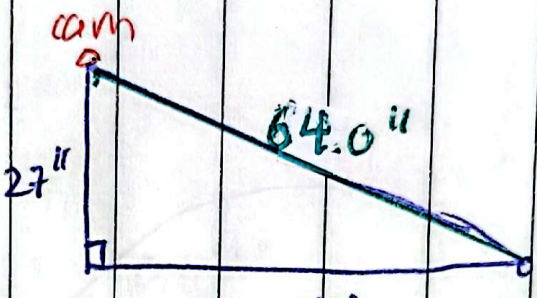


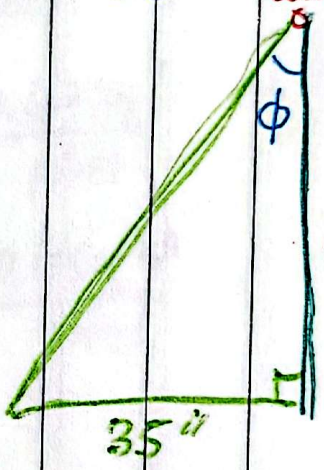
$\phi = 29.5°$



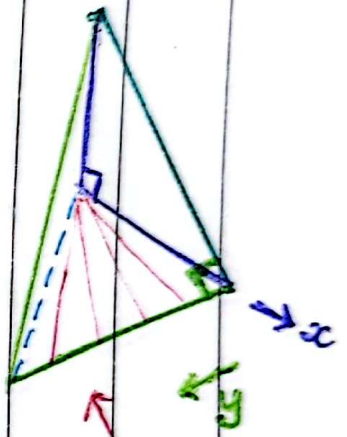


$\phi = 28.9°$



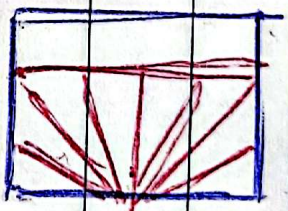


$\phi = 28.67°$

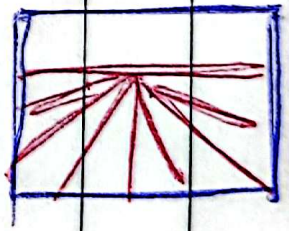


red line do NOT represent same y value

☆ the issue with finding y is that the same $\Delta\phi$ gives different Δy at different x distance

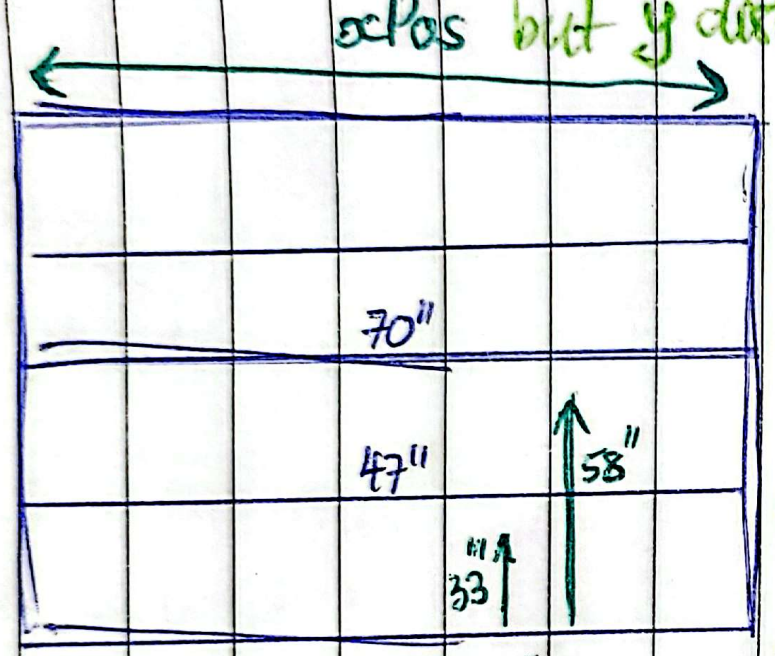


×



✓

Am I looking at this problem wrong?



← must have a relation to yPos pixels

y distance = f(yPos)
↑ pixels

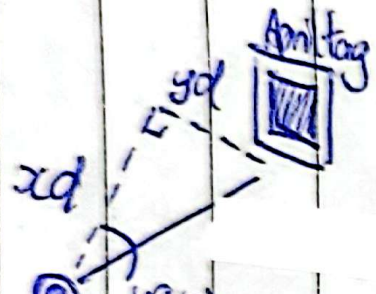
$\frac{70''}{640p} = \frac{0.109''}{pixel}$

$\frac{47''}{640p} = \frac{0.0734''}{pixel}$

$\frac{38''}{640p} = \frac{0.0594''}{pixel}$

Think about how you calculated the ~~math~~ for april tags, you need to make a shortcut to simplify the problem,

ASSUME CAMERA ~~IS NO~~ ANGLE FROM HORIZONTAL ~~DOES~~ NOT IMPACT Y DISTANCE PERCEIVED ← as in, use



$$\frac{x\text{-distance}}{x\text{-distance}} = \tan(\text{yaw})$$

$$x\text{-distance} \cdot \tan(\text{yaw}) = y\text{-distance}$$

☆ since we are using x-distance, which was calculated via the angle β/deviation from horizontal

↑ y-distance calculated from this manner should also have considered the angle deviation

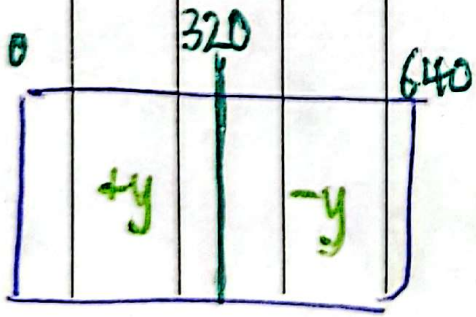
∴, we can use ϕ as yaw.

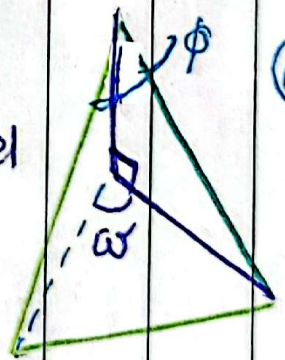
Since it is shown that $\phi \approx 29°$ ☆ an assumption must be made here

As such, for a max of 640 pixels,

$$\frac{2 \times 29°}{640 \text{ pixels}} = \frac{0.0906°}{\text{pixel}}$$

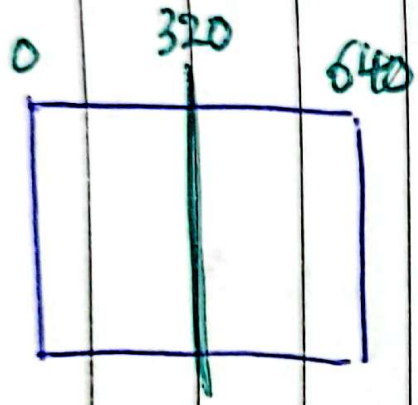
← you must set base to center, 320 pixel





$\phi = \omega$

THIS IS NOT OKAY, ERROR IS TOO LARGE



$\Delta xPos = (\text{current Pos}) + \text{base} \Rightarrow \text{deltaXPos} = 320 - xPos$

$\Delta \Phi / yaw = \Delta xPos \cdot 0.0906^\circ$

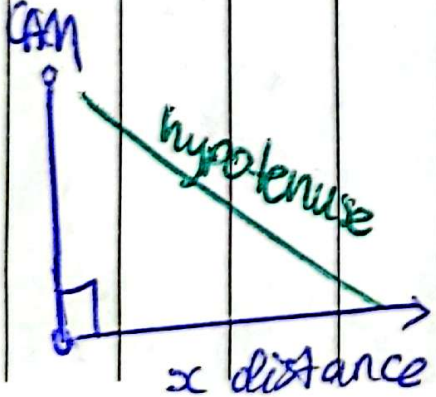
$yaw = \text{deltaXPos} * 0.0906^\circ$

$= (\text{base} - xPos) * (\text{degressPerPixel})$

(base − xPos): pixel

(degressPerPixel): $\frac{\text{degrees}}{\text{pixel}}$

$ydistance = xdistance * \tan(yaw)$



↑ cannot use this because yaw angle is for the hypotenuse, difference from xdistance ↔ hypotenuse is too big!

← change to $c = \sqrt{a^2 + b^2}$