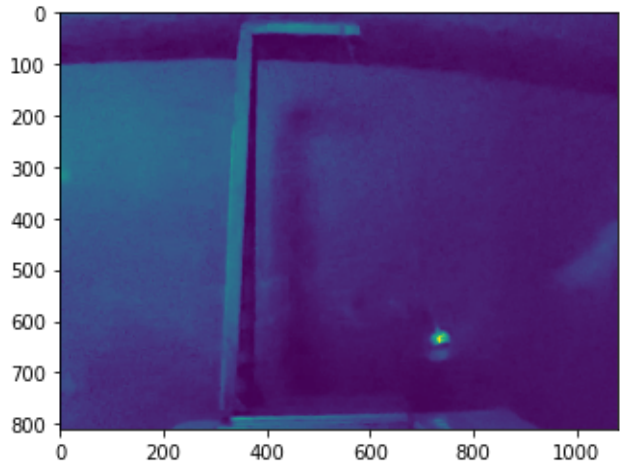
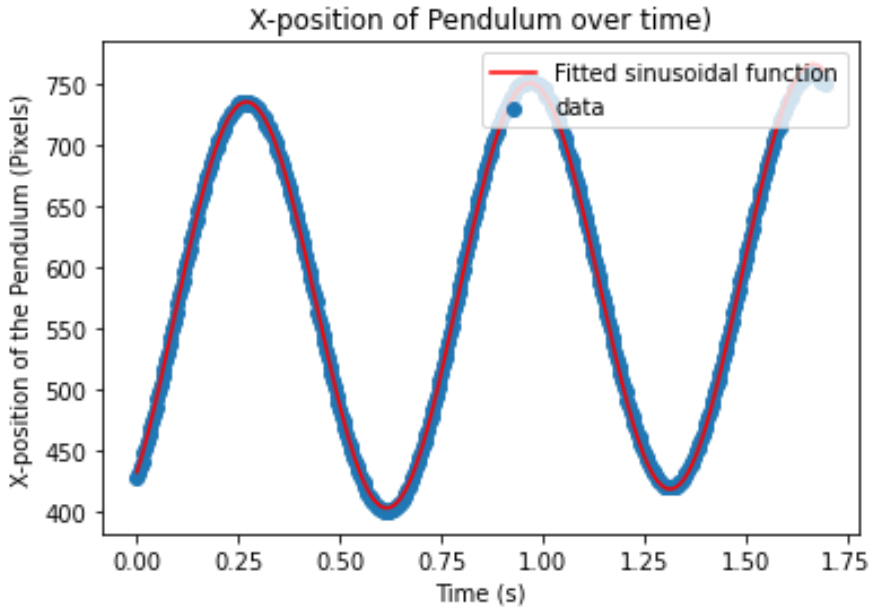
Data

No Magnets

Disclaimer: The distance units used are pixel units, not the SI meter unit, so here is a scale to help relate pixel to the SI system:

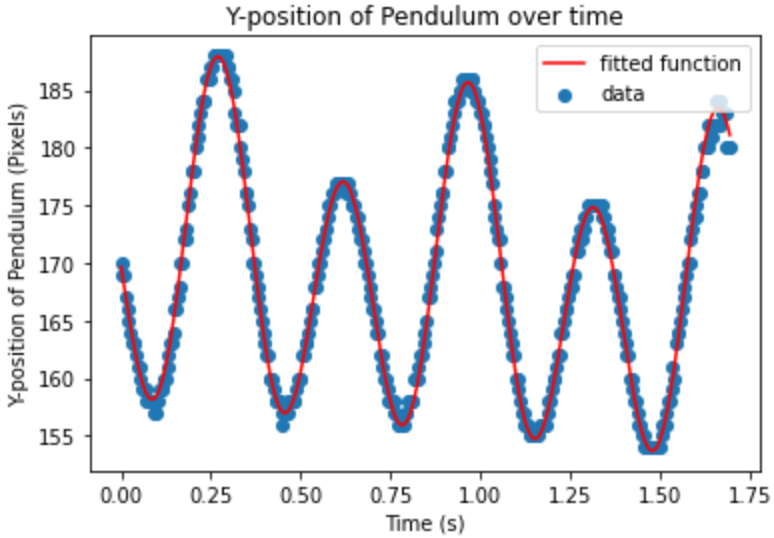


To obtain the scale of this image, I noticed that the pendulum stand is 14.5 centimeters and covers almost the entirety of the height of the image, and I approximated the height of the image frame to be 15cm. So 1 pixel = 15cm/820 = (3/164)cm. THIS SCALE FACTOR WILL ONLY APPLY FOR THE FIRST TWO GRAPHS! Since I expect not to have the exact same camera position both times, I will use a different scale factor for other videos.



Function fit for this curve: x = 169.858847cos(8.99293155(t -0.268220822)) + 22.2386709t + 559.735614. To scale to centimeters, just multiply the first

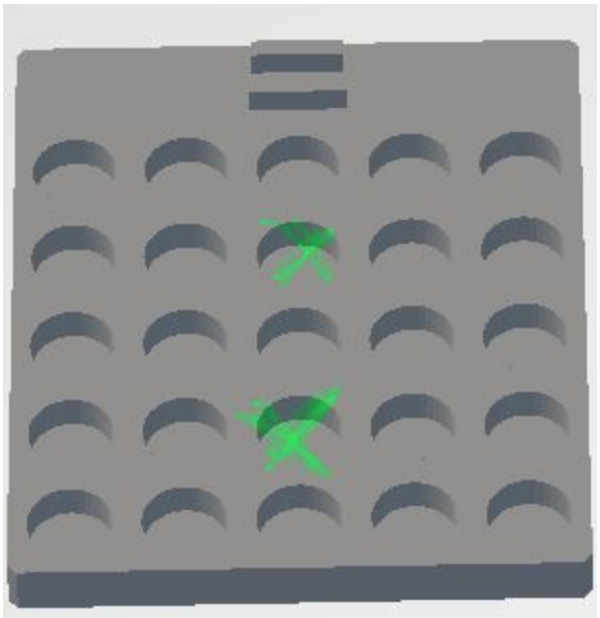
coefficient and the last two coefficients by the scaling factor 3/164. In summary, this function is a standard sinusoidal function with a slightly sloped midline.

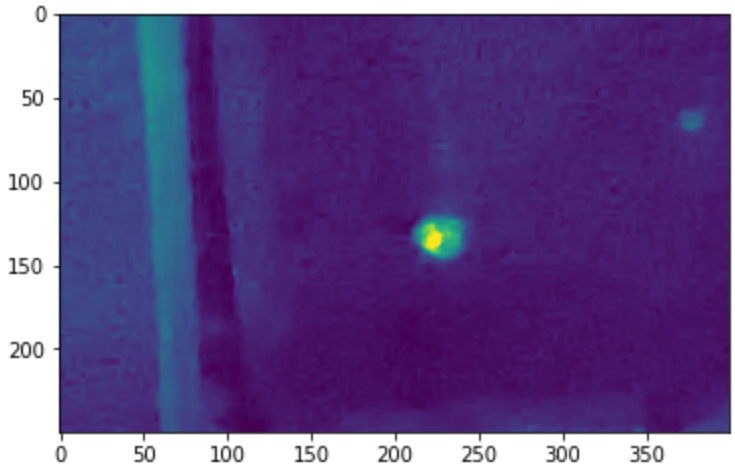


Function Fit for This Curve: y = 25.23242987(sin^2(-9.0183584t - 17.98114801) - 9.73527542sin(-4.5091792t)cos(-4.5091792t - 17.98114801)) - 3.20349434t + 154.9600848 (again, to scale to centimeter multiply the first coefficient and the last two coefficients by the scale factor of 3/164). In summary, it is a sinusoidal function with two different maxima, but the same minima with a slightly sloped midline.

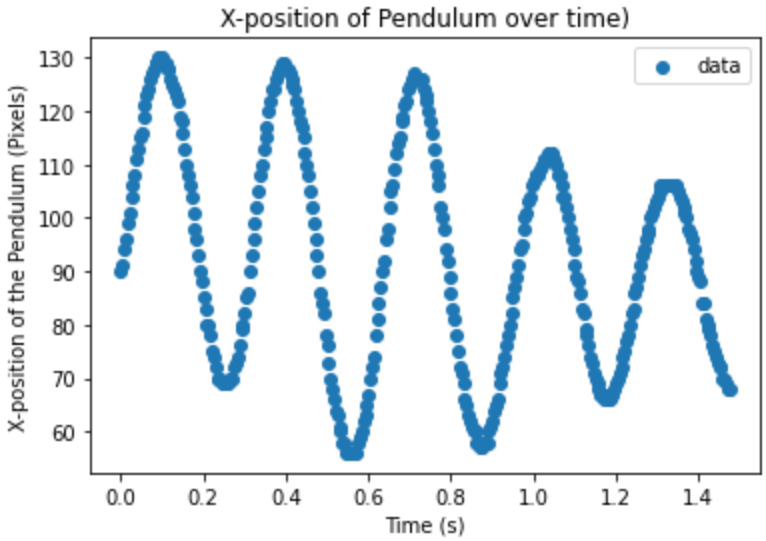
With Magnets

The places I put the magnets are marked with green X's.

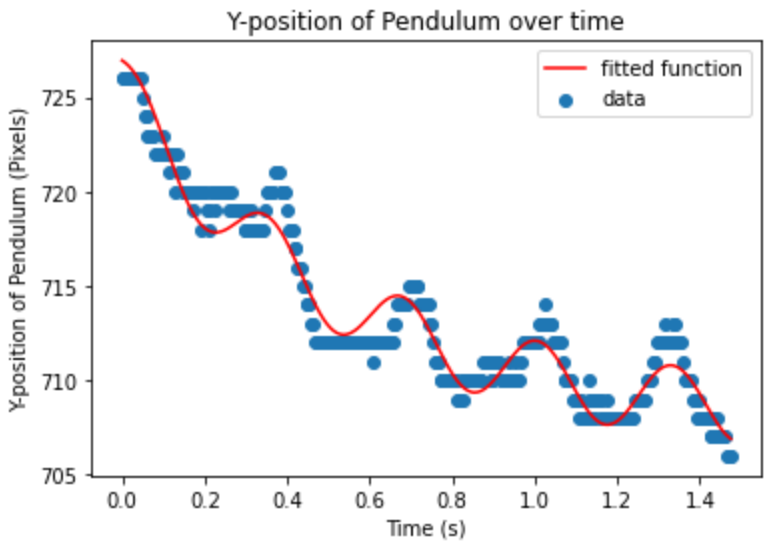




Scale: 1 pixel = 3/100 cm (25 pixels equals about the width of the magnet, which is about ¾ a centimeter, so the scale would be 1 pixel: 0.03 cm)



Summary: A sinusoidal function with an overall decreasing amplitude (no fit function due to the variance of the amplitude of the data) with a slightly sloped midline (can't really tell due to amplitude variance)



Function Fit of y-coordinates: y = -1.84323631sin(19.2880869(t- 0.540074895)) + 18.0485308(6.17866838^(-t)) + 707.358887. In summary, it is a standard sinusoidal function with an exponentially decaying midline.

Analysis of Data

As expected, the amplitude of the pendulum with magnets seems to be a lot less than the amplitude of the pendulum without magnets, as since the pendulum is a magnet, its motion would be mostly stalled by the attractive forces between the magnets in the base and the magnet that is swinging in the pendulum system. This is why the midlines and amplitudes for the with magnet graphs show so much variance as opposed to the midlines of the non-magnet graphs: as the amplitude gets smaller, the more variance one is likely to find with the blob detection data, as the random measurement errors gain more and more significance in the overall data. That's why it makes it harder (and in some cases, impossible) to find a fitting sinusoidal function of the data without using some wacky function to try and mathematically explain midline and local extrema behavior.