Image Alignment & Coordinate

- Tools
  - An image editor that can pinpoint a location of the image in pixel (x,y) coordinates.
    - Microsoft Paint, ImageMagick are a couple of examples.
      - This guide will use Microsoft Paint.
- Rotation
  - Needle Angle is computed by the gasmeter_analyzer but this angle is relative to the camera's sensor and not the meter.
  - It is likely that the camera's sensor is not perfectly horizontal with the meter itself, so a rotation alignment procedure is to be performed.
- Gauge Center Coordinates
  - Once the the image has been rotated properly, the coordinates of each dial/needle's center of rotation needs to be determined. A procedure is to be performed to find each one.
- Dial Radius
  - The needle of each dial has a certain length we'll call the radius (gasmeter_analyzer assumes each dial has the same radius). gasmeter_analyzer needs to know the radius of the needles. A procedure is to be performed to determine this.

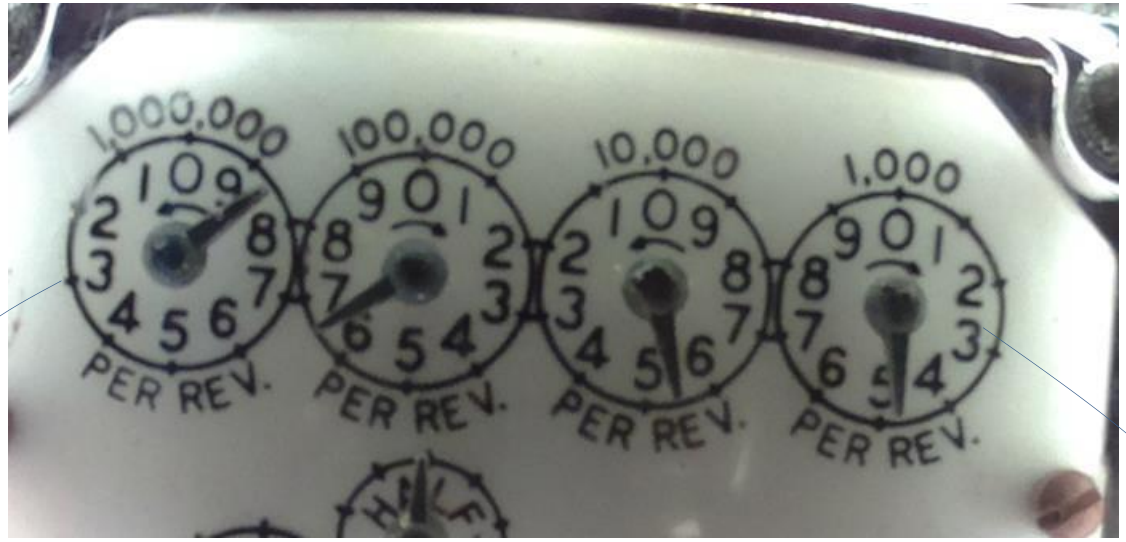
Rotation (1/2)

Here we'll use MicroSoft Paint

Take a picture of the gasmeter, and retrieve the image.

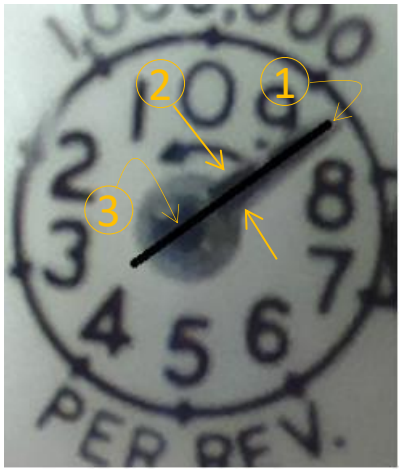
Open up the image with MS Paint.

Note: Steps 1 and 2 are not strictly required, but are helpful.

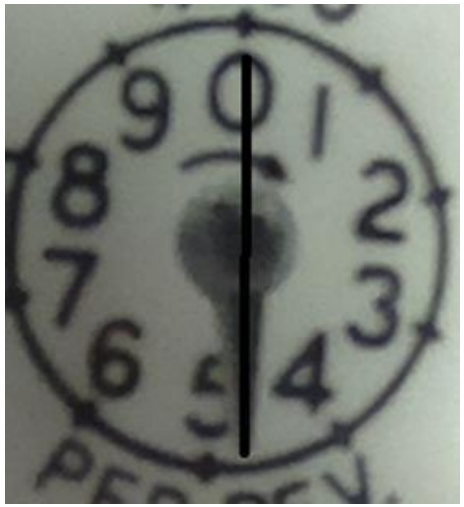


① Start with the Leftmost Dial

1. Start at the tip of the needle and draw a straight line towards the center.
2. Continue drawing...at the bottom of the needle at its widest part, draw the line to be in the middle of this widest part
3. Continue drawing until (and beyond) the center of the needle's rotation axis



② Repeat for the Rightmost Dial

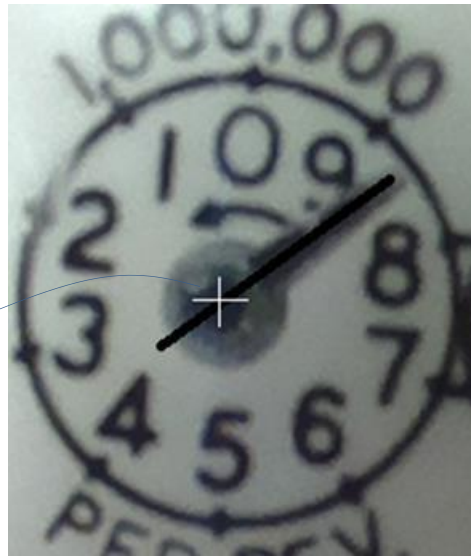


Rotation (2/2)

③

Go back to the Leftmost Dial,

1. Move the Cursor (shown in white) as close as possible to the center of the dial axis and make sure it is on the black line drawn in step 1.
2. Record the cursor's position

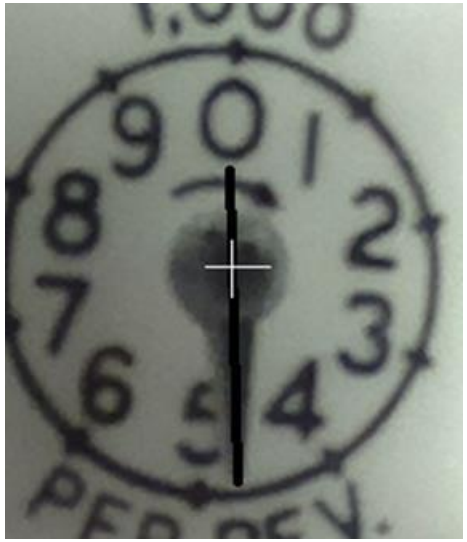


(x1, y1)

Note: These coordinates are relative to the uppermost leftmost corner of the image (0,0)

④

Repeat for the right most dial



(x2, y2)

⑤

With a calculator, compute the rotational angle needed:

Rotation Angle = $\tan^{-1}((y2-y1)/(x2-x1))$

= $\tan^{-1}((920-871)/(1620-919))$

= $\tan^{-1}((49/701))$

= 4^{o}

⑥

In `gasmeter_analyzer.py` you can now set the following:

```
ROTATE_IMAGE = +4.0 #positive values rotate counterclockwise
```

⑦

Now run `gasmeter_analyzer.py` with DEBUG = 1 and CONSOLE =1

When you see the following output:

```
    Rotating Image .....
```

after a second or two, Hit `^C` to stop it.

You should see a file `image2_rotated.jpg` which is the rotated image. Use it in the next steps.

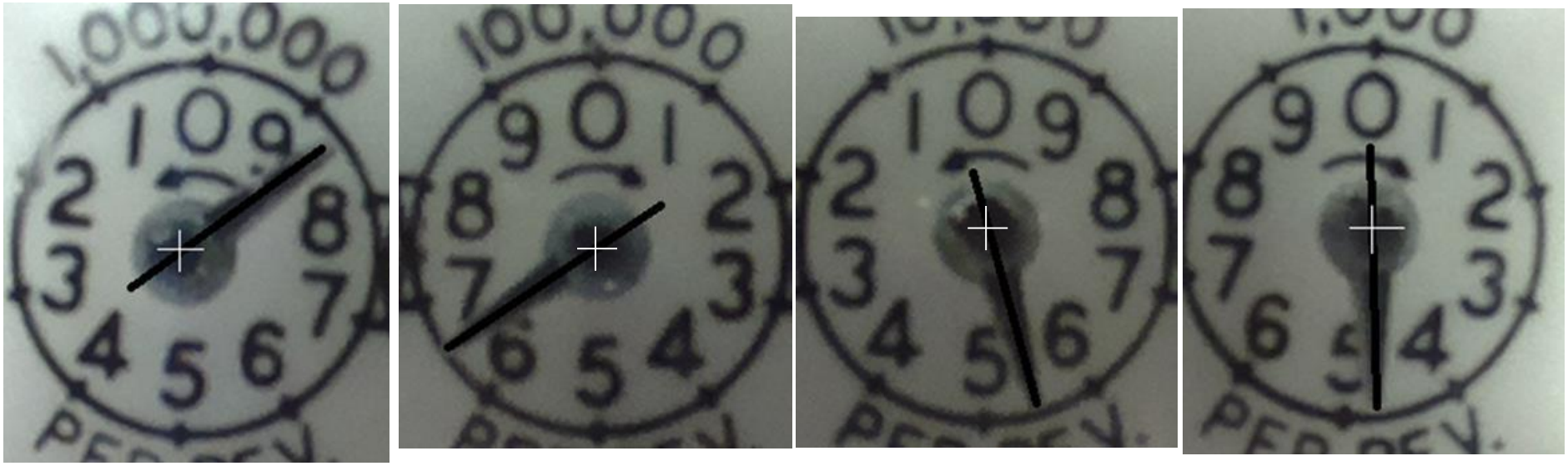
Guage Center Coordinates

After Rotation is performed, use the file `image2_rotated.jpg`

Follow the same steps 1-4 as done in "Rotation" except do all 4 dials. This finds all the dials center coordinates

Left most digit is the most significant of the 4 dials, so give it coordinates x4,y4

Right most digit is the least significant of the 4 dials, so give it coordinates x1,y1



912, 900px
(x4, y4)

1148, 900px
(x3, y3)

1382, 897px
(x2, y2)

1615, 900px
(x1, y1)

In `gasmeter_analyzer.py` set the following (the last two entries are commented out, so can leave them alone)

```
gauge_centers = [
    (1615, 900),    #Least Significant gauge digit
    (1382, 897),
    (1148, 900),
    (912, 900),     #Most Signficant gauge digit
   #(556, 635),
   #(780, 913)
    ]
```

Important Note: All the y values should be nearly the same.

Dial Radius

Select one of the two center dials (dial #2 or #3) as it will be less distorted from a "perspective" view.

Here I picked right center dial (dial #2).

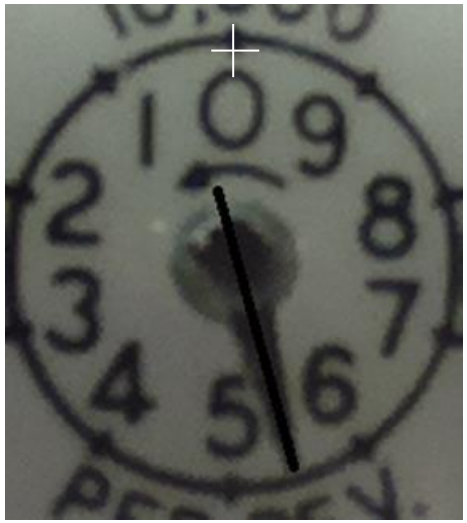
Starting from the dial's center coordinate at (x2=1382,y2=897), move the cursor straight upward until it is just slightly inside the black circle. Adjust slightly so that xr value remains at 1382. Record the y value (here yr is 793).

Calculate the Radius:

Radius = y2 - yr
= 897-793
= 104

(xr, yr)

1382, 793px



1382, 897px
(x2, y2)

in `gasmeter_analyzer.py` set the following

```
CIRCLE_RADIUS = 104
```

Run and Reiterate

In `gasmeter_analyzer.py`, set `CONSOLE=1` and `DEBUG=1` and run it to completion.
It will produce various debug output. It will also provide a file: `image3_pre_subplot.jpg`. Open it up.

The dial centers should look fairly centered and aligned on the horizontal.
It is not a problem if the red circle is not aligned completely with the meter's black circle as this is due to the 3D difference.

If this doesn't look quite correct, tweak the rotation degrees and dial coordinates and repeat.