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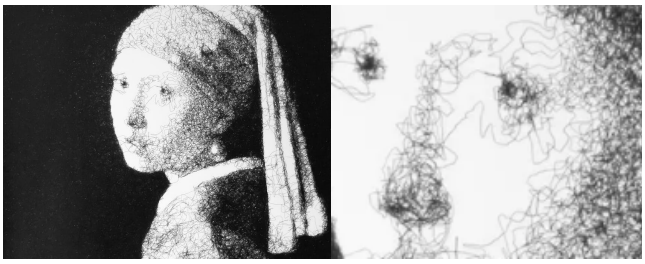
SE101 Proposal

For this lab project, we plan to build a cnc plotter. The are four tiers of difficulty we plan to tackle if time prevails. The simplest version of our project is a cnc plotter that will connect dots inputted as a coordinate to the plotter, followed by: a plotter that only draws as the x and y axis are controlled remotely, a plotter that will draw out simple images (ie. back groundless images), drawing out more complicated images (such as from a photograph), and a plotter that will take an image and output a stylized drawing. The stylized drawing will involve manipulating the path the plotter takes to create shapes (figure 1).



(Figure 1. Inspired from Caravaggio, a Drawing Machine.https://create.arduino.cc/projecthub/michele1993/caravaggio-a-drawing-machine-76136b)

Hardware wise, we require an arduino, breadboard, wires, two optical drives, two motors, a servo, and miscellaneous securing features. The two optical drives need to be disassembled and act as rails to move the plotter in the x and y direction. They will be fastened perpendicularly to that the base, where the image will be drawn on, will move left to right and the upright optical drive will hold the pen and move forwards and backwards. Two motors are required to independently power the movement in the x direction and y direction. The servo is necessary to lift up the pen. A wire or screw will be attached to the pen and servo so that when the servo is in an upright position, the pen will lift up. To attach everything together, we plan to hot glue or super glue parts together, as opposed to drilling and screwing, since it will be faster. If build the remote controlled plotter, we will also use a shield with buttons to control movement.

As for the software, the process is to code the core of our project in c using an input of the image translated into gcode (a numerical control programming language) in the Arduino IDE environment. Image processing through gcode will be outputted to inkscape and we will be converting the coordinates to movement in the x, y, and z directions using c. As for more advanced versions of our project, we will be using OpenCV, a computer vision library compatible with C, which has more functionality than gcode for image processing. For example: to load, grayscale and to adjust properties of the image in terms of intensity values. If the time allows, the generalizing and stylizing of the path of the pen could be done as well. The basics of optimizing the paths would be to assign a number of times to retrace, based on the intensity of the colour. To assure functionality, we plan to make a experimental prototype in python with OpenCV, integrating with the Arduino gcode, using an evolutionary prototype of our hardware.

The biggest challenges we anticipate facing is integrating openCV/gcode with c in the arduino environment, as well as successfully processing more complex images. In our more advanced stages, the most difficult component will be outputting a stylized image. This will require an algorithm to transform the points of the coordinate system (either based on gcode or opencv) into indirect pathways from each coordinate point, if drawn in a similar style as figure 1. If the image is to be stylized in a different fashion, this would also require more complicated algorithms to translate image into unique pathways for our plotter to take. As for the hardware, maintaining the accuracy of the pen such that it moves in sync with the expected paths according to the software would also be a challenge, depending on how detailed we want our end product to be.