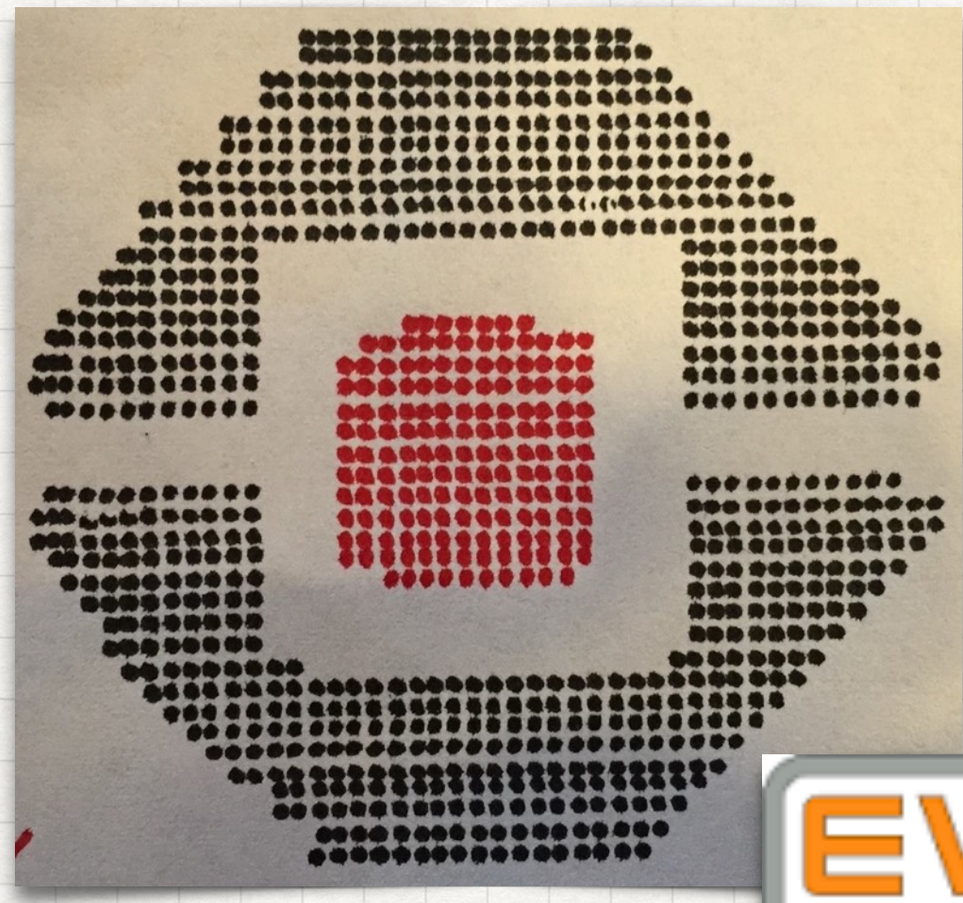
THE MAKING OF PIX3L PLOTT3R

LINKS

FOR UPDATES, BUILD INSTRUCTIONS & SOURCE CODE

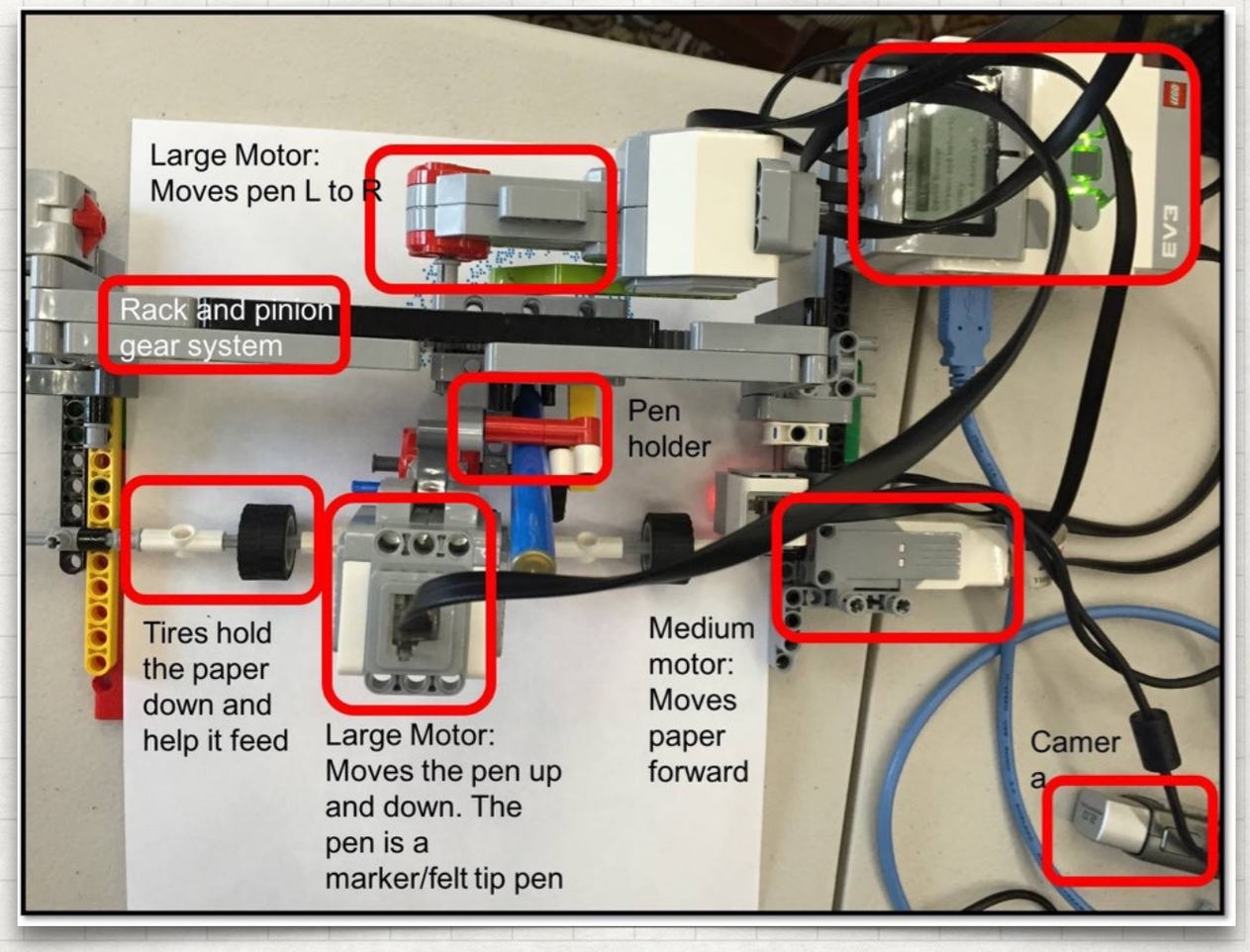
- **PIX3L PLOTT3R Facebook Page:**
  - https://www.facebook.com/PIX3LPLOTT3R/
- **PIX3L PLOTT3R ev3dev Page:**
  - http://www.ev3dev.org/projects/2016/02/26/PIX3L-PLOTT3R/



Made with LEGO MINDSTORMS & EV3DEV

VERSION 1

- Parts:
  - 2 L Motors, 1 Medium
  - Only 1 set of rollers
  - Color & touch not used



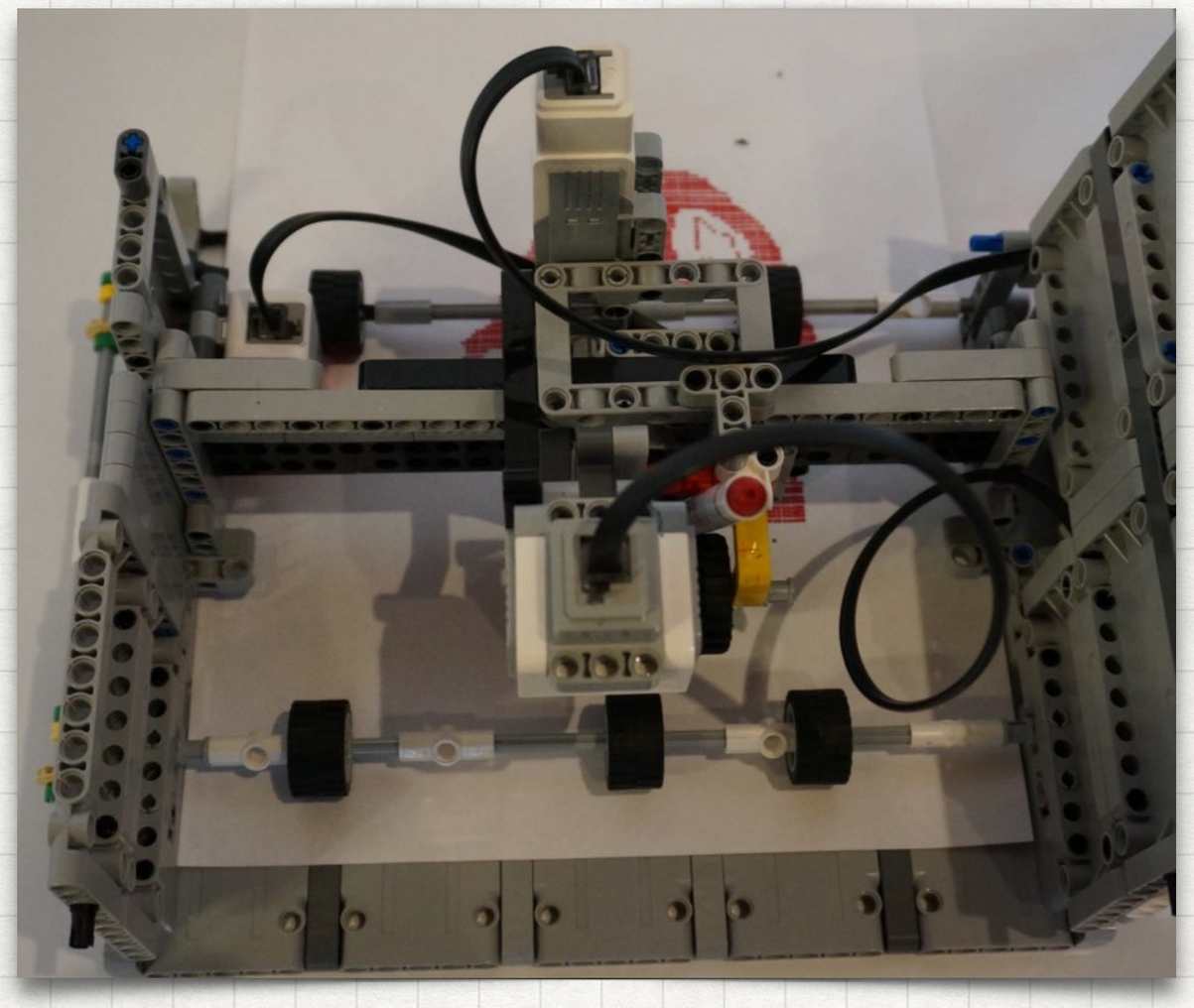
- Problems
  - Scaling off
  - Errors in pixels
  - Inverted image
  - Once past feeder, nothing to hold paper and move it along

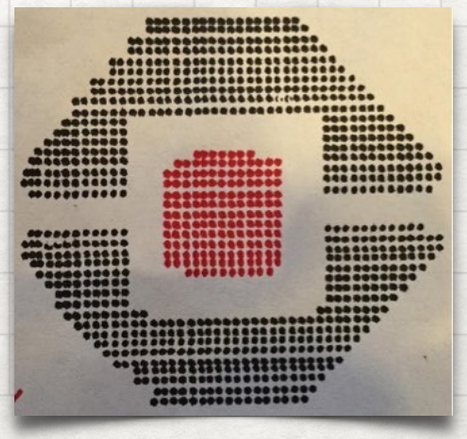
VERSION 2

HARDWARE

- Hardware changes:
  - 1 L Motors, 2 Medium
  - 2 sets of rollers
  - Color sensor used
  - Boxed (removable sides)

Problems:
- Paper movement varied
- Tire wearing off on printer head





VERSION 3

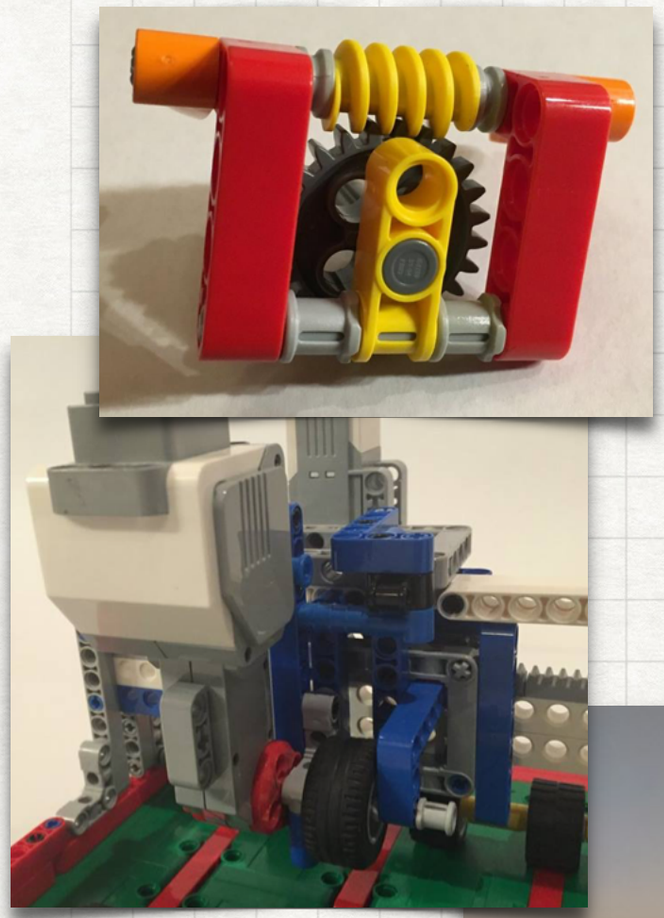
RESOLUTION & ACCURACY IMPROVEMENTS

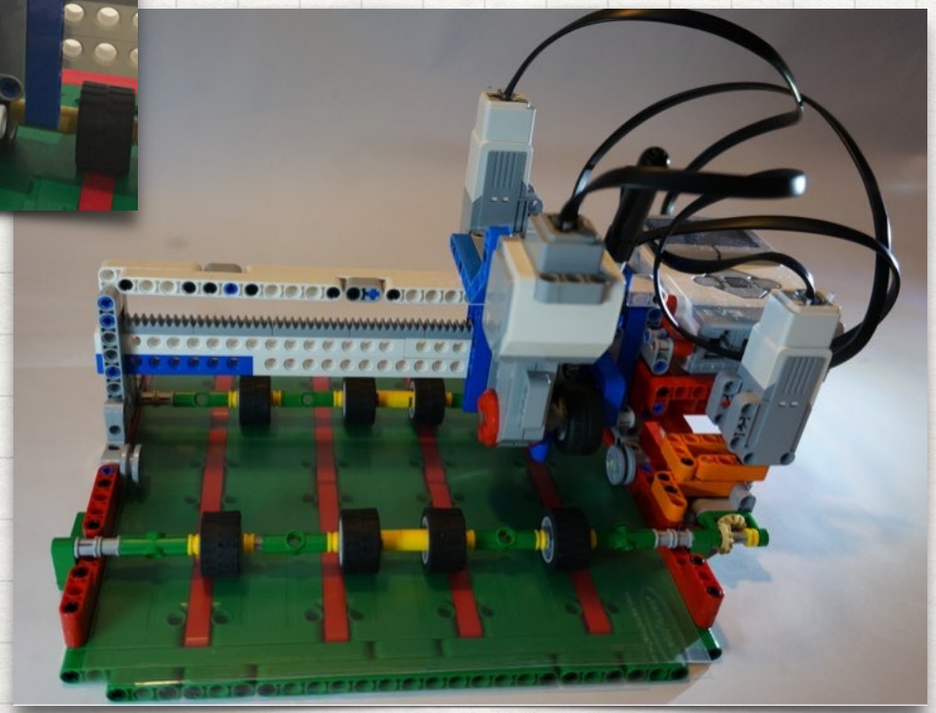
Medium Motor (controls paper feeder): Increased gear ratio to 1:24 so that we can make the motor move in smaller increments

Printing Head: changed tire

Problems:

Paper getting caught in LEGO holes
—> added a plastic sheet

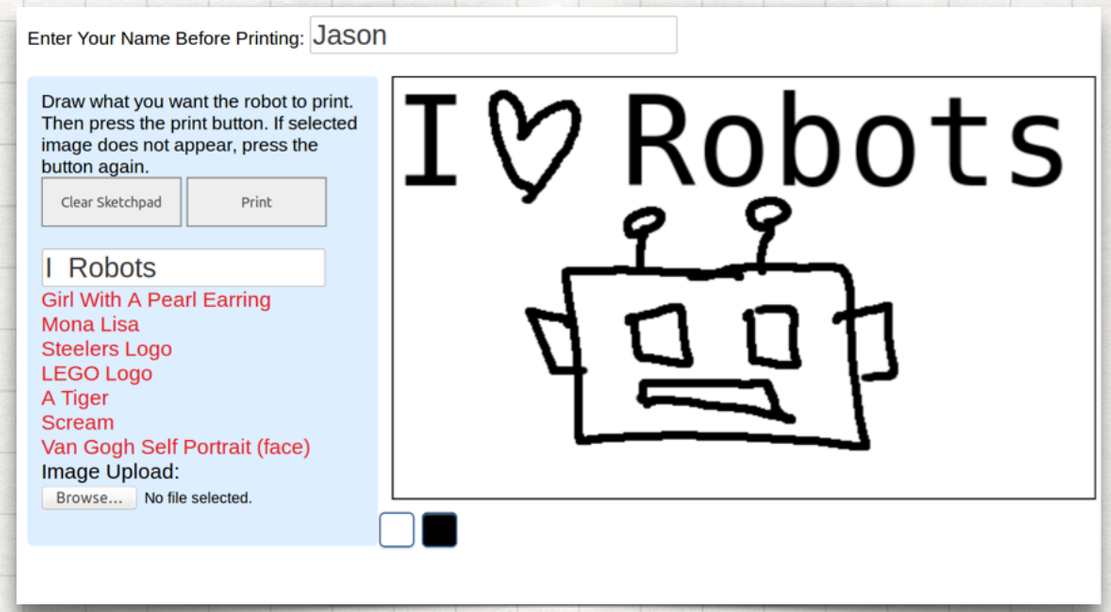




CODE FEATURES

USER INTERFACE & IMAGE PROCESSING

- UI
  - A HTML interface was made to allow people to type their name, text, and draw what they desire
  - A php program was made to upload the sketch to the apache server
  - When a new file is detected, the png file is uploaded to the EV3 then the python program is set to use the image



- Image Processing:
  - Image is flipped and resized to satisfy the printer
  - Python lets you analyze all the pixels in an image and then save the pixels to an array
  - Greyscale/B&W images return 0-255
  - RGBA/RGB images return 0-255 (r,g,b,a)/(r,g,b)
  - A preview of the printout will appear on the screen and then a progress preview as the image is printer

CODE

FEEDER AND PRINT HEAD

- Feeder:
  - Paper is automatically fed until color sensor
  - Paper moves back a set amount page to not waste the top of the sheet
  - Paper is moved up every time one row is finished
  - Paper is ejected at the end of the job
- Print Head:
  - Pen is moved proportionally to each black pixel saved in the array
  - Pen is lowered and raised to create a marking

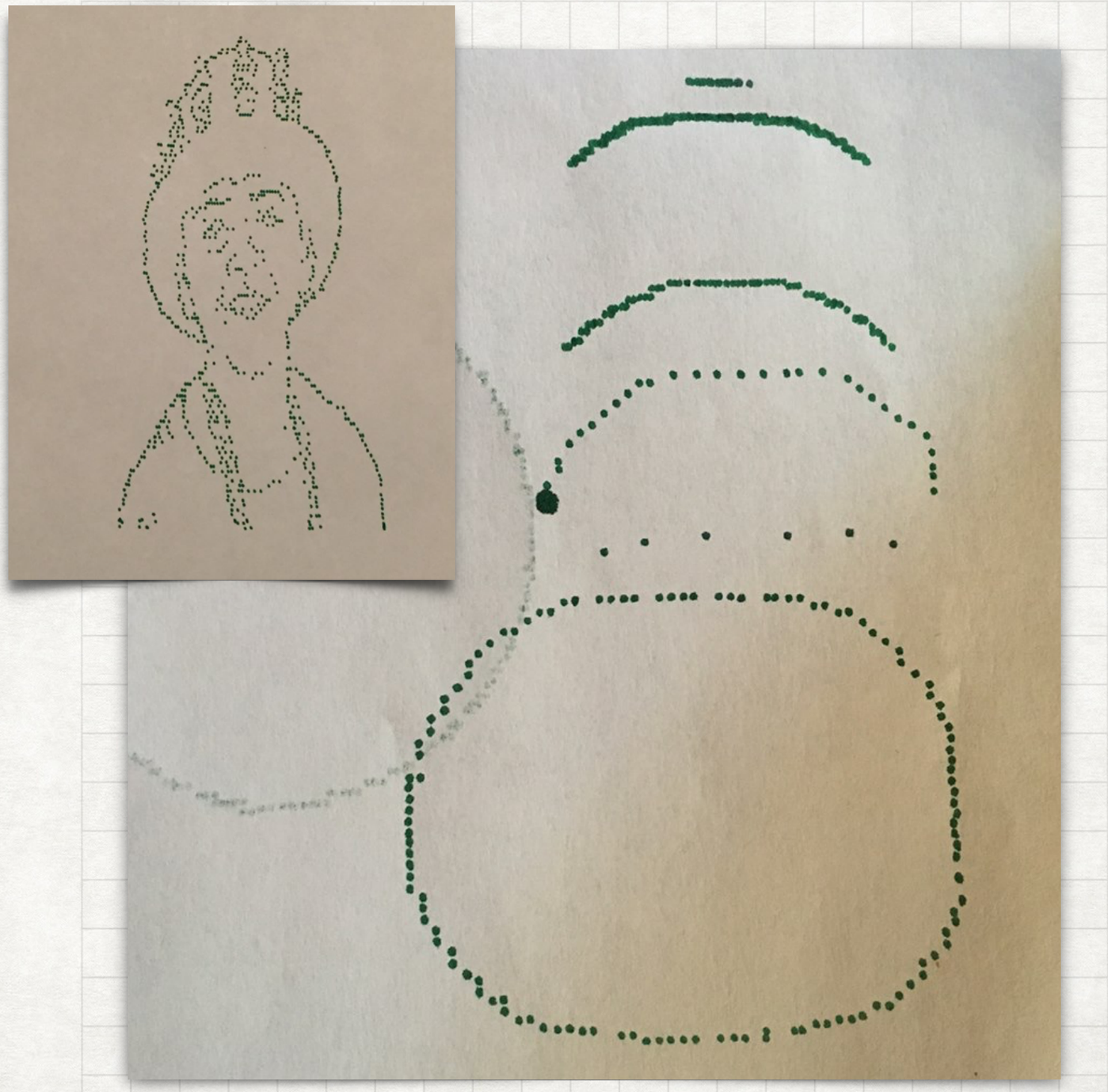
WHY EV3DEV?

- The normal EV3 software does not allow you to analyze images, but python on ev3dev allows image analysis

IMPROVING THE SCALING

DEGREES PER PIXEL CALCULATION

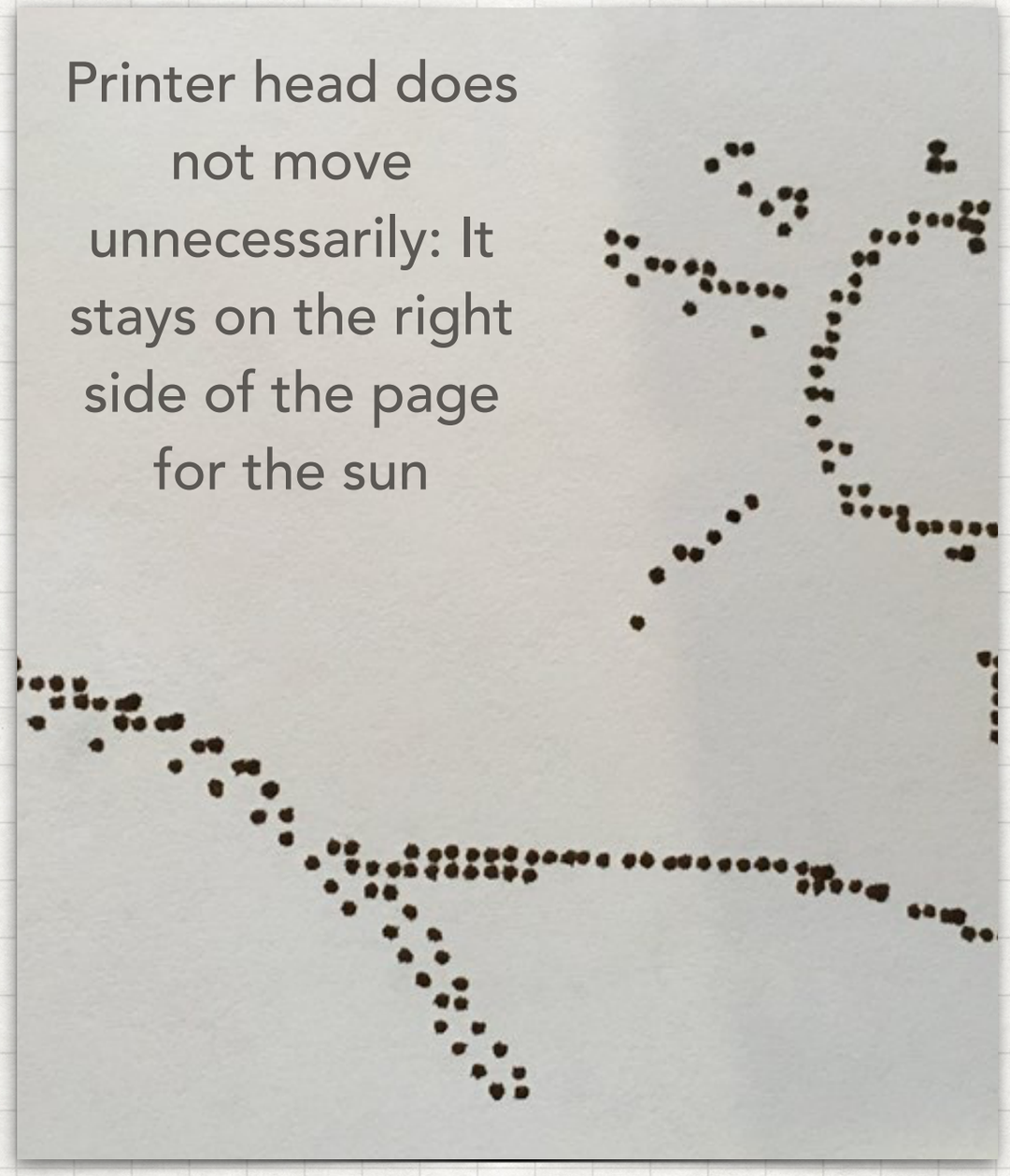
- Early images were long and thin
- We had to calculate and fix the how the medium motor should move per pixel (degrees per pixel)



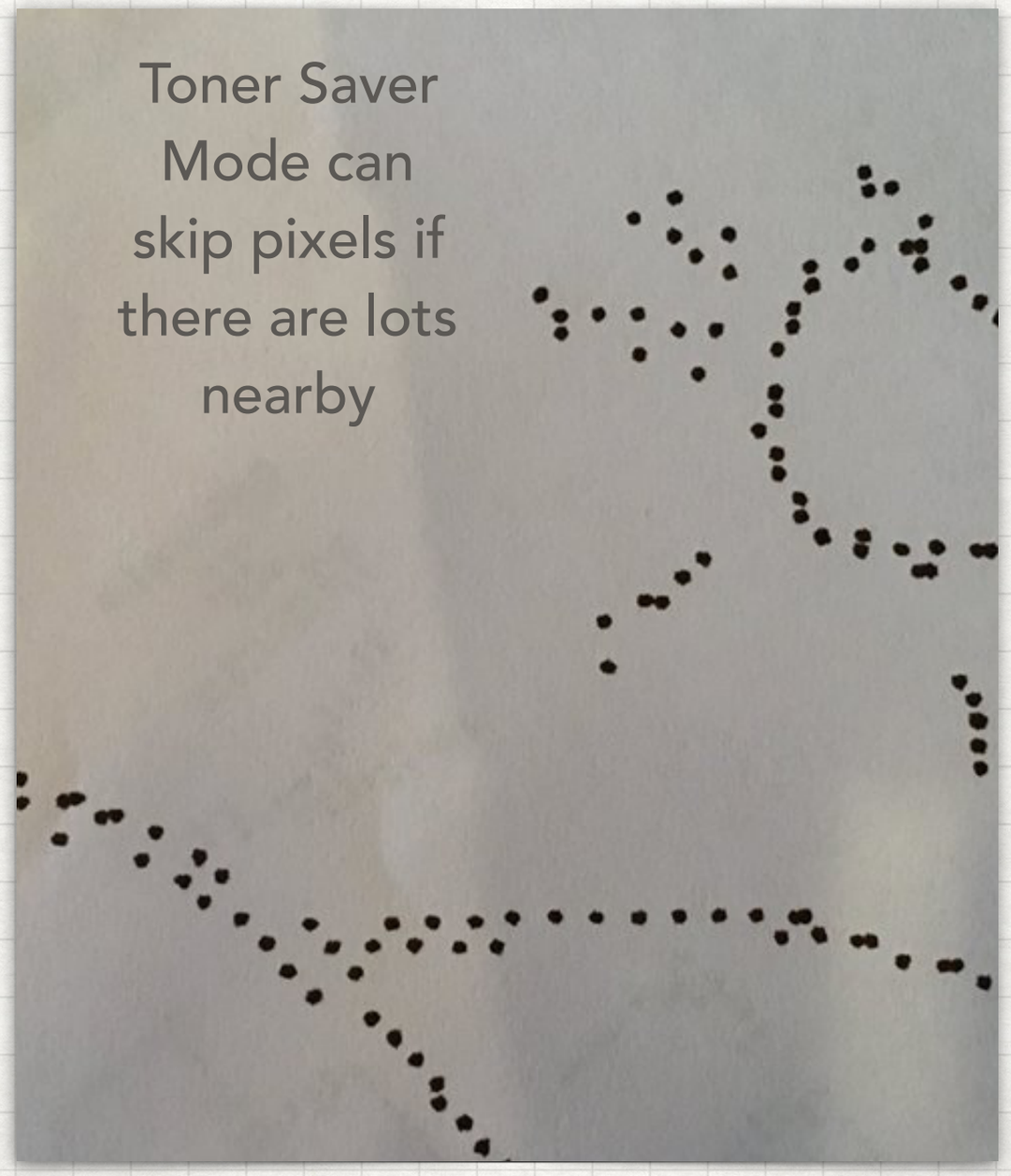
INCREASING THE EFFICIENCY

PRINTER HEAD MOVEMENT & TONER SAVER

Printer head does not move unnecessarily: It stays on the right side of the page for the sun



Toner Saver Mode can skip pixels if there are lots nearby



GEARING OF THE MEDIUM MOTOR