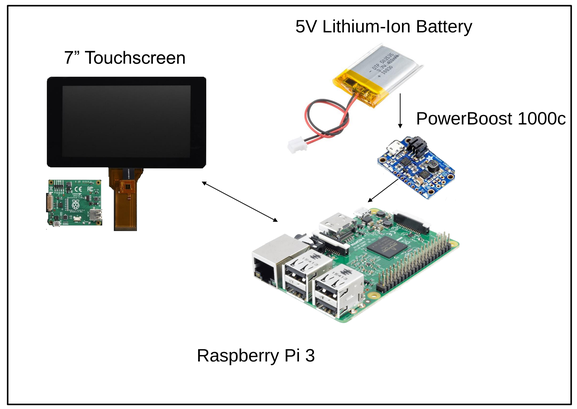
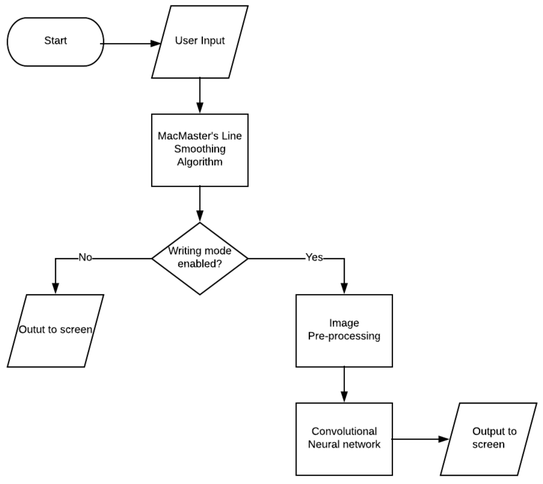
Input-Corrective Drawing Pad

INTRODUCTION

The Input-Corrective Drawing Pad is a drawing tablet that takes shaky input data and corrects it. It is designed for those with fine motor skill disabilities. The system takes an input (either writing or drawing) drawn by pressure-sensitive stylus and then outputs a “corrected” version. If in writing mode, text is output to the screen. Otherwise, simple shapes such as lines and curves are output to the screen on a drawing canvas. It accomplishes this goal by first eliminating obvious shakes in the input. Then, the shake-corrected input is fed into a neural network. If classifying text, the learning software classifies the input into a character from the English alphabet. Otherwise, the corrected input is output to the screen..

MATERIALS AND METHODS





Drawing Pad

- A Raspberry Pi 3 is used for the processing of the Drawing Pad.
- An 7” capacitive touchscreen is used to collect user input.
- A 5V Rechargeable Lithium-Ion Battery is used to power the Arduino.
- A PowerBoost 1000c boost converter is used as the power supply and battery charger.

Software Design

- The user inputs to the Drawing Pad in the form of handwriting or drawing.
- The input is processed with MacMaster’s line smoothing algorithm.

Writing Mode

- The input is cropped (with padding) and saved as an image (.png). The image is then pre-processed to be classified in the neural network. This processing includes stretching or shrinking the saved image into a 28x28 pixel dimension, converting the handwritten and background colors into black and white, and removing outlying pixels
- A convolutional neural network model six layers deep and trained with the EMNIST dataset is used to classify the processed image. The tensorflow model uses a softmax cross entropy loss function, the Adam Optimizer, and a Rectified Linera Unit (ReLU) activation function. Neuron Dropout is also used to prevent overfitting.

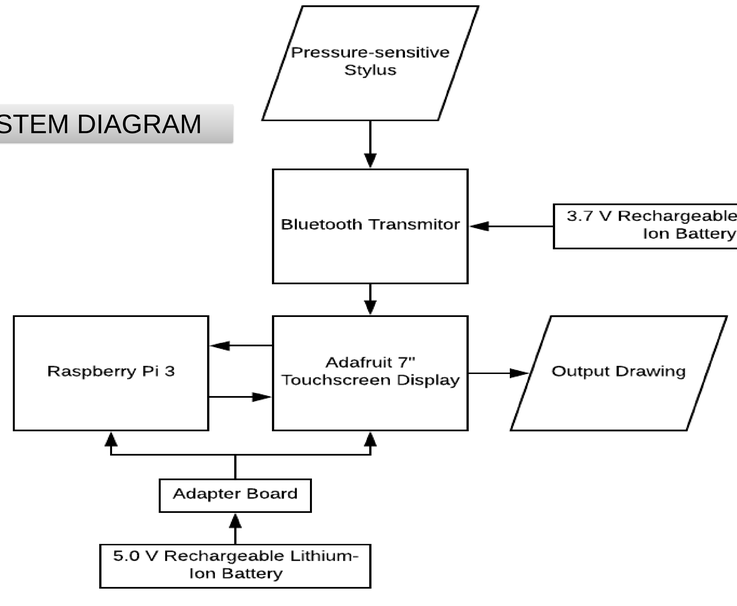
RESULTS

Input to Touchscreen

Corrected Output

Recognized Character

SYSTEM DIAGRAM



CONCLUSIONS

The final prototype has proven to produce corrected data and classify handwriting. Shaky input is corrected and are recognized by the neural network. The results are output to the screen. Digits 0 through 9 are successfully recognized with an accuracy of 92 percent. Alphabetical characters were only recognized with an accuracy of approximately 40% from user input. The user can draw any RGB color to the screen. The device is compact and battery powered, making it portable. For an individual with fine motor impairment, this is a useful product to aid in their drawing and writing of digits. Further work will need to be done to enable handwriting recognition for all alphabetical characters.

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