NANOPACK

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BACKGROUND:

→ **Who is NanoView?**

They make a machine capable of measuring markers on exosomes and extracellular vesicles using silicon chips.

→ **What do we provide them?**

NanoView manually moves its chips from a container called a "traveler" to a container called a "clamshell".
We automate this process by providing:

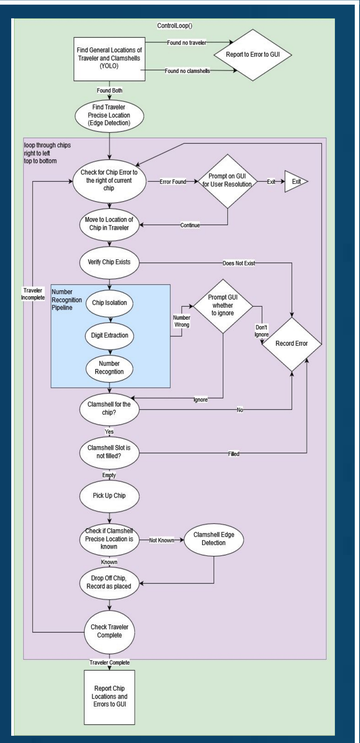
- High throughput
- Error Checking

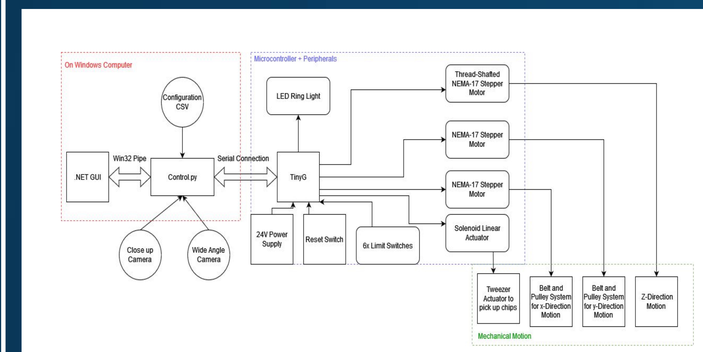
→ **How do we do it?**

Object detection finds the traveler and clamshells' general locations.
Number recognition is used to check for errors in the traveler packing process.
Chips are picked up using either a vacuum tweezer or a mechanical tweezer.
Controlled by a user from a .NET GUI

THE MACHINE:

- CNC-style machine using parts from the Liteplacer Pick&Place
- Control Loop in python orchestrates everything.
- TinyG control board used to receive G-Code commands and translate those to movement in mm based on configuration.





OBJECT DETECTION:

What it does:
The object detection locates the clamshell and traveler it then allows the machine to move to where they are located.

How it works:

→ Data Augmentation:
Added to the dataset by taking existing images and labels and altering images to increase datasets.

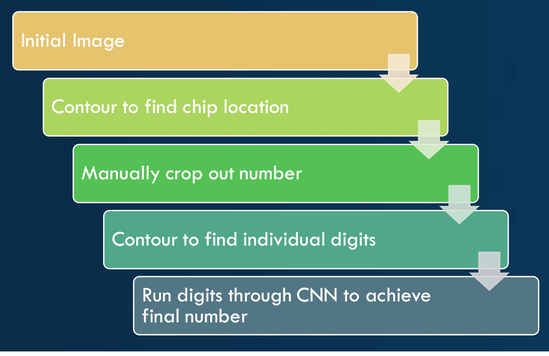
→ Retraining Weights:
We re-trained the YoloV5 model on our data using the existing model weights.

→ Scaling images:
Translated image position to machine bed position based on camera location

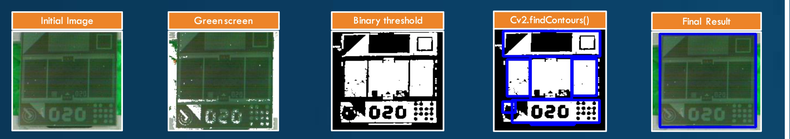
→ YoloV5:
An open-source object detection model based on a CNN.

NUMBER RECOGNITION:

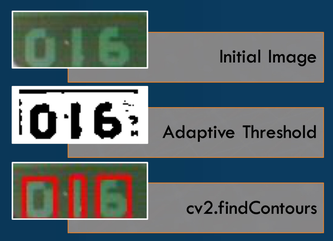
→ Number recognition is used to verify that chip locations match the position file



Chip Contouring:



Digit Extraction:

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The model will be running on cpu device
For epoch 1 the test accuracy over the whole test set is 96 %
For epoch 2 the test accuracy over the whole test set is 98 %
For epoch 3 the test accuracy over the whole test set is 93 %
For epoch 4 the test accuracy over the whole test set is 96 %
For epoch 5 the test accuracy over the whole test set is 100 %
For epoch 6 the test accuracy over the whole test set is 100 %
For epoch 7 the test accuracy over the whole test set is 100 %
For epoch 8 the test accuracy over the whole test set is 100 %
For epoch 9 the test accuracy over the whole test set is 100 %
For epoch 10 the test accuracy over the whole test set is 100 %
Finished Training
Predicted:    zero    four    two
Real label:    zero    four    two
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GRAPHICAL USER INTERFACE: