

STUDENTS: Mohamed Al-Hamad, Helen Lai, Samantha Oung, Chenhan Dai, Ananth Nair, Arielle Fernandez

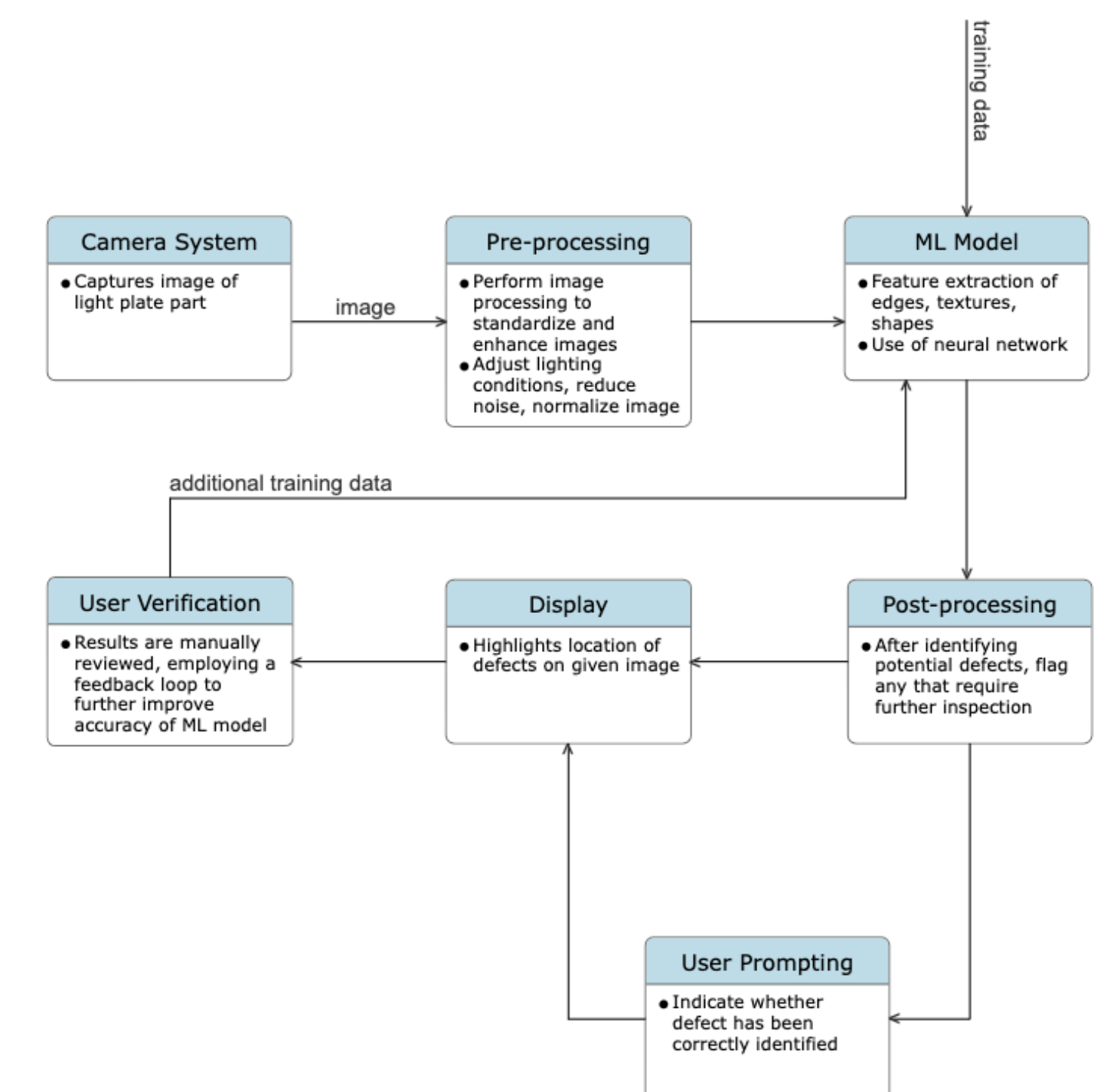
Motivation/Objective

MOTIVATION

- IDD Aerospace is ramping up production of Light Plates due to demand from aerospace manufacturers. Current quality control measures won't be able to keep up with production.

OBJECTIVE

- Design and build a system for IDD Aerospace which:
 - Improves quality control accuracy for manufacturing of light plates.
 - Automates quality control to speed up inspection.
 - Assist Quality Control Technicians in conducting inspections.
 - Allows for increased factory throughput via a scalable design.



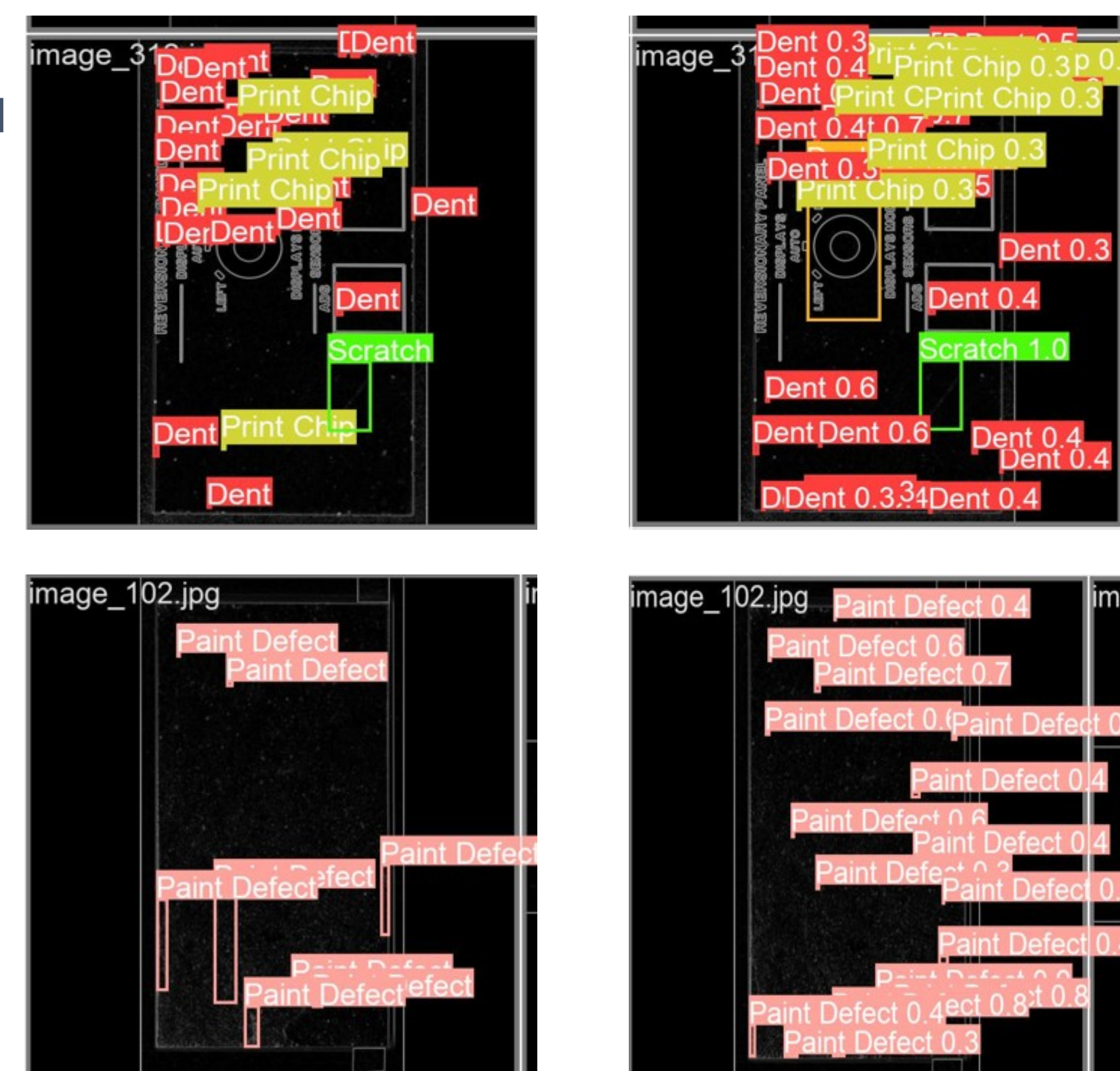
Our project uses computer vision to detect non-conformities on light plates of various sizes, meeting Safran's current inspection criteria and requirements. A block diagram of how we plan to execute and achieve this is shown in the block diagram.

Hardware: Lighting & Motor

- Lighting used for system are 12V SK6812 individually addressable LED strip with installed lighting diffusers to evenly disperse harsh lighting (color temp: ~6500K).
- Motorized turntable designed with NEMA 23 stepper motor and paired with TB6600 motor driver for microstepping.
- 0.5 " L Series timing belt and press-fit mount with set screw pulley used for turntable.
- Arduino UNO R3 microcontroller used for both lighting and motor system and controlled through graphical user interface (GUI).
- 12V power source connected through AC/DC power adapter.

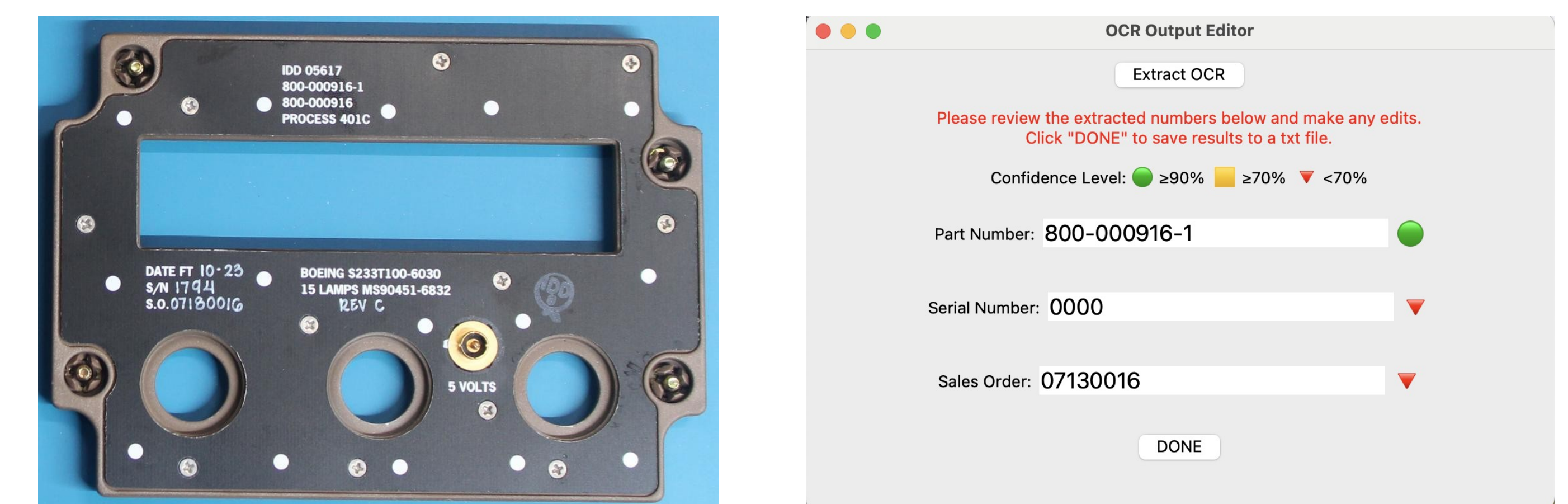
Machine Learning

- Dataset was provided by IDD Aerospace Corp. The dataset consisted of 273 images of front view and 176 images of edge view after augmentation.
- The defects were divided into 5 classes - laser burns, scratches, dents, paint defects, double print and paint chip. The distribution of instances between is really unbalanced.
- The model used for object detection is YOLOv8.
- Utilized transfer learning where the model trained on colour images was trained on sobel filtered images.

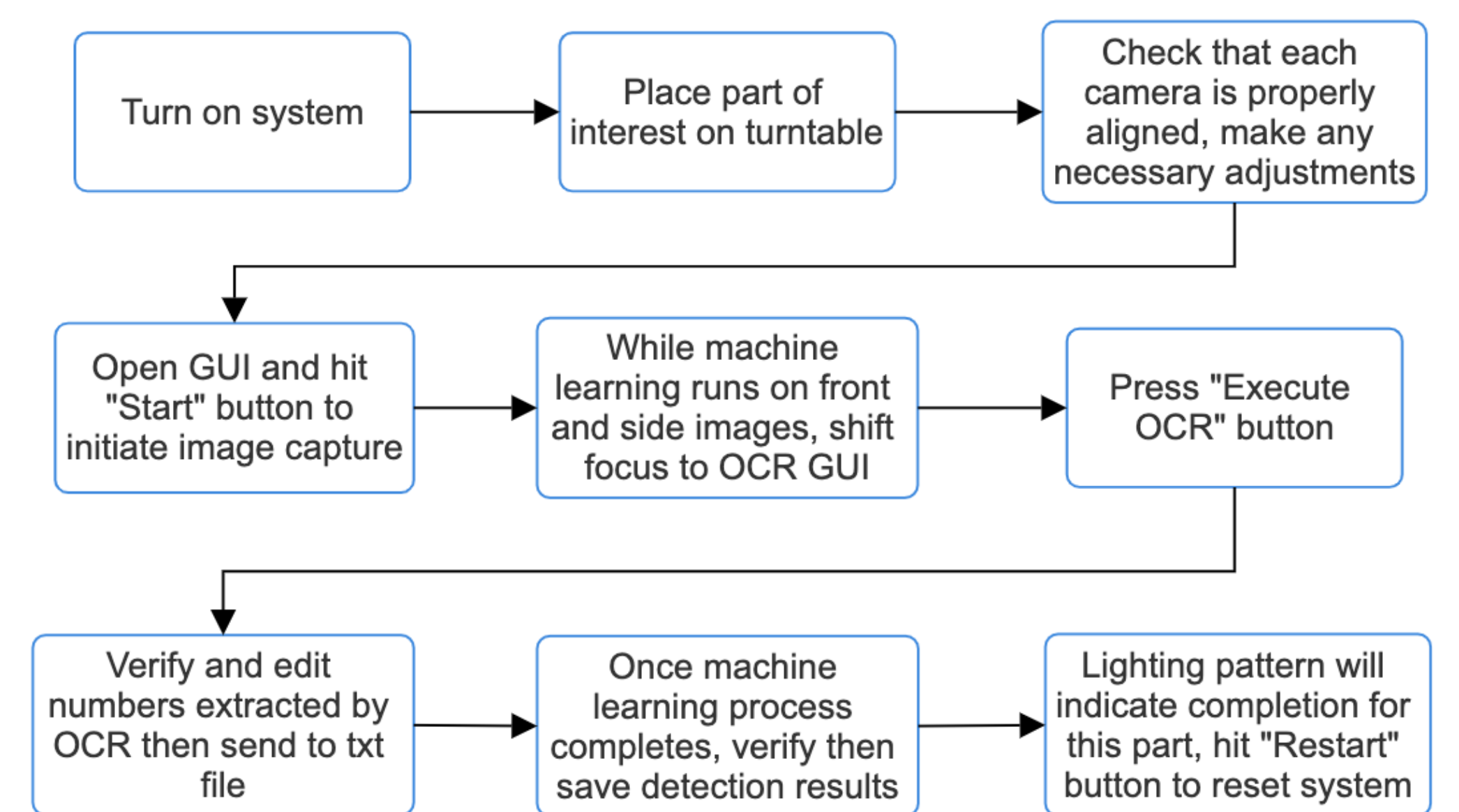


Optical Character Recognition (OCR)

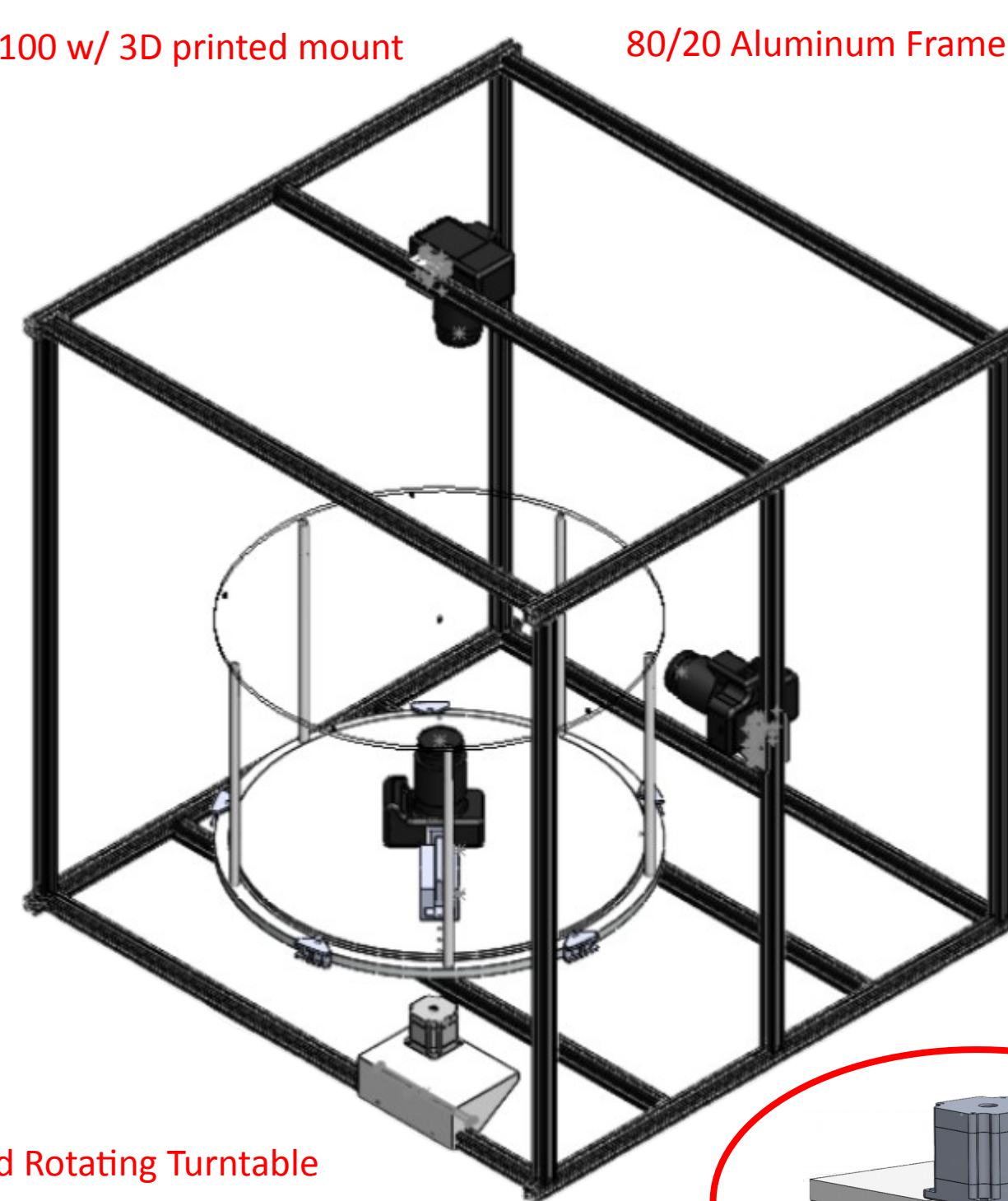
- EasyOCR library used.
- Bottom camera takes picture of backside of part, on which OCR is used to extract three numbers (part, serial and sales order number) that are important to identifying the part.
- To improve accuracy, image pre-processing techniques are used. Most importantly is resizing to over 300 DPI.
- Designed GUI allowing operator to review and edit any incorrectly extracted numbers. Colored symbols used to indicate confidence level of each detection.



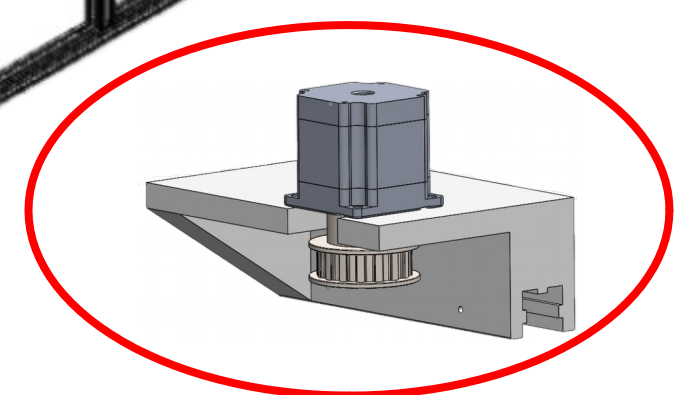
User Experience



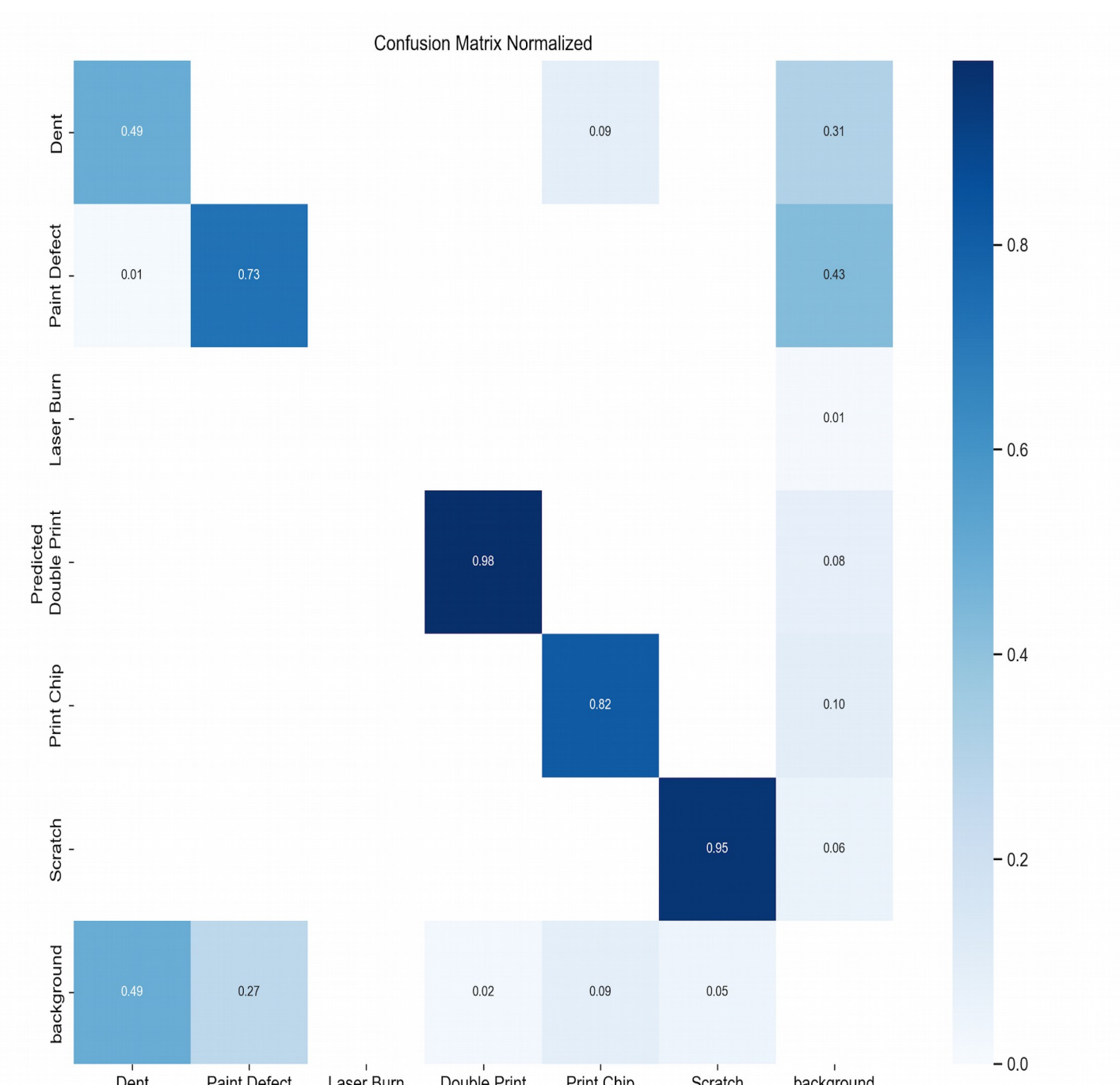
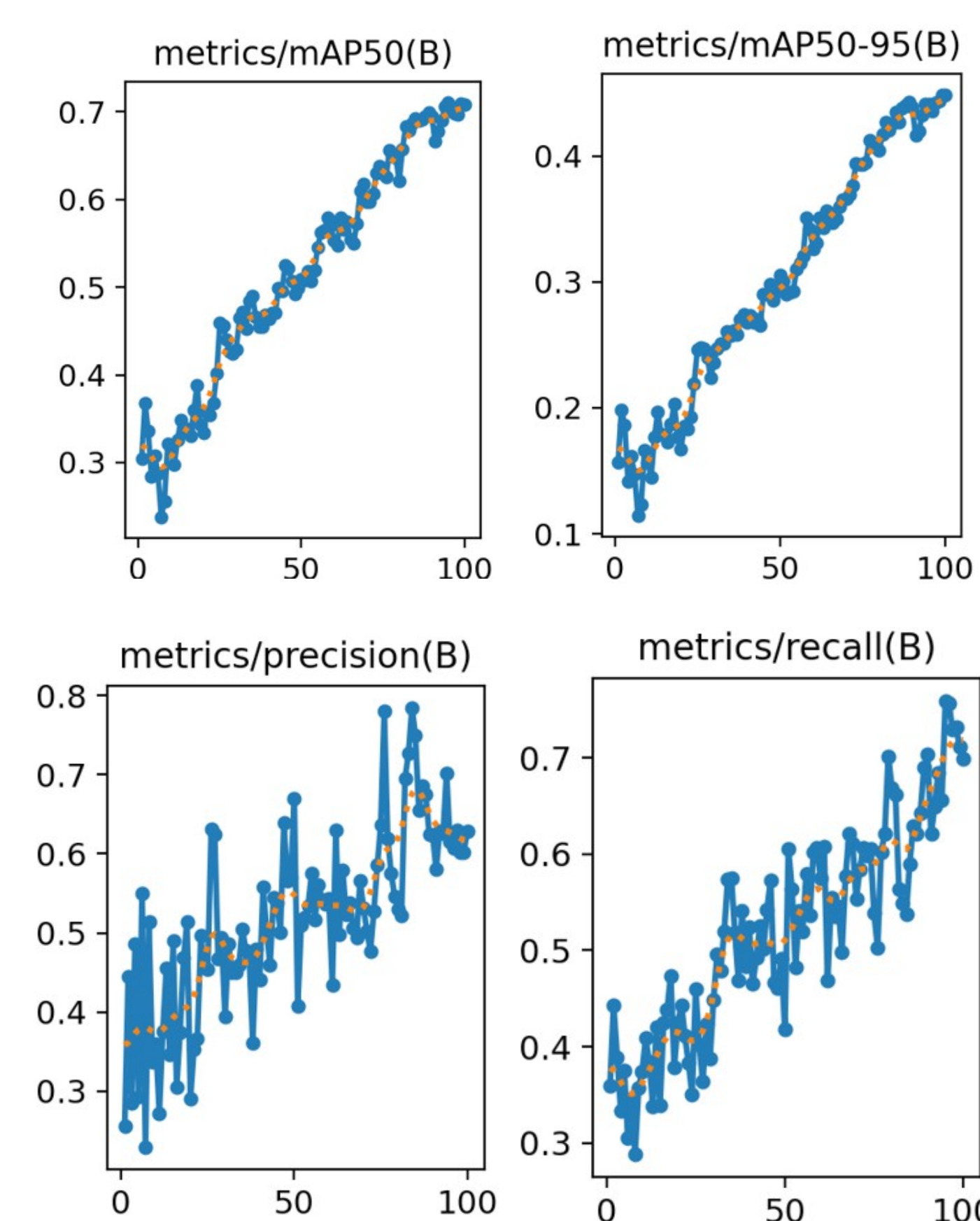
Hardware: Physical Architecture



- The design utilizes 80/20 aluminum extrusions for the 3ft x 3ft x 3ft frame. A motorized turntable made from aluminum and Plexiglass for displaying and rotating light plates to capture all sides.
- 3 Canon R100 mirrorless cameras are used to capture all sides of the light plate.



3D Motor Mount w/ NEMA 23 Stepper motor



Future Work, References, and Acknowledgments

- Improve hardware design to fit and integrate into Safran's production desk.
- Improve OCR & machine learning detection accuracy.
- Improve live view feed GUI with camera control system.
- Improve automation of system.

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