

# AI Based Real-Time Video Analysis of **Molding Ejection**



# Mold Injection and Ejection



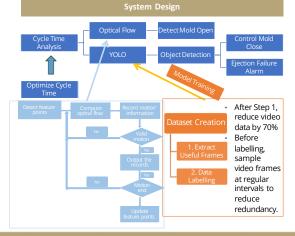
Molding Machine Molded Part Open Status

Close Status

- Mold ejection happens between mold opens and closes and the ejection cycle time is determined by mold opening time and mold closing time
- Objectives:
- 1). Optimize ejection cycle time to the theoretical minimum
- 2). Achieve real-time (inference speed 60+ FPS) control in case ejection failures happen
- 3). A standardized model training and prediction pipeline • Current solution (Problem): Manual observation (not accurate and

time-consuming

 Our approach: Using Optical Flow and object detection algorithms (YOLO) to precisely capture mold opens and determine the mold close time



# **Determine Mold Open - Optical Flow** Innovative Design:

- · Automatic update of feature points
- · Filter valid motion based on the duration

### Application Value:

- · Intelligent recognition of molds open
- Save computational resources
- Adapt to different detection tasks(automatic detection)

#### Determine Mold Close and Ejection Failures - YOLO Detection

- Training costumed YOLO model
- Mean average precision (mAP) 98.8% at 0.5 confidence
- Two-factor detection for election failure Judgment conditions for mold close:
- All molded parts are ejected and molded region is clear





- Factor 1: When the mold is fully opened, count the total number of molded parts detected (to ensure no parts are embedded into the molding machine)
- Factor 2: Check if one or more objects can be detected consistently



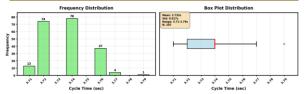
## **Real-Time Control - User Interface**

- · Upload any video to monitor
- Left: video display | Right: detection results
- Color-coded: Green = normal. Red = error





# Results - Statistical Analysis and Business Value



- In this project, we implemented the algorithm for two part numbers, and statistically analyzed the calculated cycle time.
- The above charts can help workers make decisions about selecting suitable election cycle time for molding machines.
- We also compared the election cycle time before and after applying the proposed solution. The comparison table is shown below.



- The data showed that the proposed solution significantly reduced the total . cycle time, including injection time, by 5%,, enabling over 320+hours of production.
- By a conservative estimate, the proposed approach will enable an annual revenue of \$160,000, which is calculated by the following formula:



### Future Work

- Use high-speed camera instead of regular camera to better capture the molded parts falling process
- Add Multiple Object Tracking (MOT) algorithm to help analyze the trajectory of each molded part
- · Consider introducing perspective transformations to improve MOT

ADVISERS: Jeng-Neng Hwang, Shu Wang, Alexander Brong, Robert Swart

**SPONSOR: TE Connectivity** 

