

# Machine Vision Project – 3

The objective of this project is to develop a system for automatic detection and classification of objects based on their area, as they move along a conveyor belt, using a Basler industrial camera and the OpenCV library.

The system analyzes each image frame captured from the camera, detects the presence of objects, calculates their area, and classifies them as small or large based on predefined area thresholds.

The project was implemented in C++, using the following components:

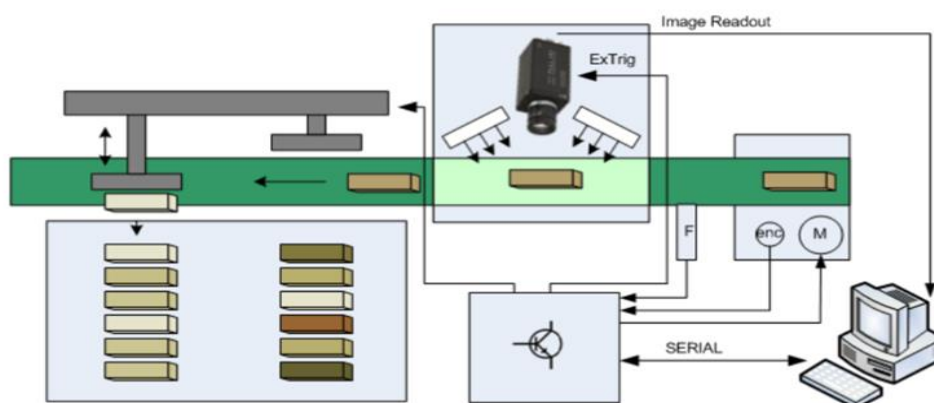
- Basler industrial camera for capturing the real conveyor belt process
- OpenCV library for image processing (filtering, binarization, morphological operations, contour detection)
- A computer for real-time processing and visualization of results

## Algorithm Structure

The algorithm consists of the following stages:

1. Real-time image acquisition from the Basler camera.
2. Conversion of the image to grayscale and noise reduction using a Gaussian filter.
3. Definition of a mask that represents the conveyor belt region of interest (ROI).
4. Image binarization using Otsu's method, followed by morphological closing to fill holes inside detected objects.
5. Detection of object contours in the image.
6. Calculation of the area for each detected object and classification as small or large depending on its area.
7. Display of results and object labels directly on the image.

## System architecture



## Hardware System Description

The hardware architecture of the system, shown in the figure, consists of the following components:

- The sorting line controller manages the conveyor system and triggers the camera.
- The PC receives information via serial communication from the controller indicating that the camera has been triggered and that an image is ready for acquisition.
- The controller monitors the object length, precise trigger positions, and conveyor belt speed modulation.