Packaged Chicken Classification System for Automated and Efficient Production Lines

Automating and increasing the efficiency of production processes in the food industry, improving quality control and reducing human errors are of great importance. In particular, correct classification of packaged chicken products and directing them to the relevant production lines is a critical factor in terms of production efficiency and customer satisfaction. This project aims to automate and improve this process by designing a system that can be used in the production line in the poultry industry. The automated system will accurately classify the packaged chicken products and direct them to the relevant line.

In the project, the conveyor in the production line is fed with a mix of 5 different packaged products: wings, drumsticks, butterflied drumsticks, whole legs (drumsticks & thighs), and breasts as illustrated in Fig. 1. The task is to detect these 5 different types in real-time using a designed imaging system and direct them to separate lines using a designed mechanism. The packaged products and conveyor system will be provided by the customer on the company premises.
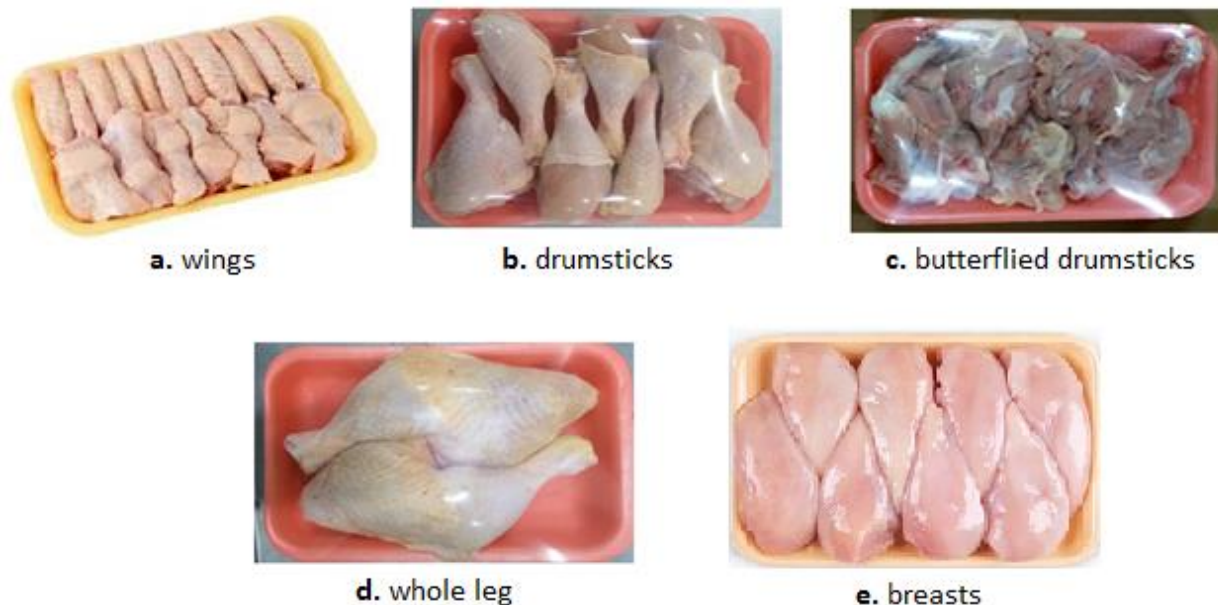

Figure 1 Different packaged products that will be classified

Features of specific parts are listed below.

1. **Production Line Features**:

   a. The speed of the feeding conveyor is 0.5 m/s.
   b. The width of the conveyor belt is between 40 cm and 45 cm. Its length is at least 1 meter.
   c. On an average the system receives 60 packaged products per minute in a mixed order.
   d. The maximum package dimensions are 35 cm x 25 cm. A minimum gap of 20 cm between packaged products will be ensured.
   e. Products can arrive on the production line in any orientation.

2. **Imaging System**:

   a. A lighting system must be used to reliably operate under different illumination conditions.

b. The camera system can be line-scan or area-scan, and if necessary, multiple cameras can be used.

c. The imaging system will be designed and implemented either on or after the feeding conveyor.

3. **Image Analysis Algorithms and Performance Criteria**:

a. The system is expected to operate in real-time and be capable of analyzing at least 2 images per second.

b. The system's classification accuracy is expected to be at least 90%.

c. An optional feature is the ability to label classified packaged products as Grade A (flawless) or Grade B (bloodstain or deformity).

4. **Classification Output and Redirection Mechanism**:

a. The classification system is expected to produce a digital signal output when the classified product reaches the end of the production line.

b. The system must have a mechanism at the end of the production line to direct the packages to the relevant line according to their classification.

c. The system will log each classification output, and provide an analysis report for the production data.