

Sorting Mechanism using Artificial Intelligence for Chili Fertigation Industries

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ABSTRACT: An automated process is necessary in the agricultural industry namely chili fertigation for image recognition and classification based on their color, shape, and texture. The goal of this study was to review the development of a portable sorting machine that will be able to segregate chili based on their color. The Digital Image Processing (DIP), which is a crucial part to perform the feature extraction process was discussed with the elaboration of steps to execute the DIP process. Besides, the analysis of different methods to extract the chili color based on the RGB color component was included. This paper focused on the Machine Learning (ML) technique, which is the main component of Artificial Intelligence, image data taken from chili samples can be trained by using Learning Algorithm in the MATLAB program. The performance of the trained network then evaluated using the Confusion Matrix technique. The methods that have been reviewed in this paper were general enough to be used in the agricultural industry that requires a high volume of chili and with other differentiating features to be processed at the same time. The result for the Plot Confusion Matrix of 90 percent and above indicated that the system is able to classify chili accurately. Improvements can be made to the sorting system but will come at a higher price.

Keywords: *Sorting Mechanism; Artificial Intelligent; Chili Fertigation Industry*

1. INTRODUCTION

A sorting process that is automated with the use of a control system will not only make the process simple and precise but also reliable to be used as a machine [1]. This is because an automatic sorting machine has the purpose to replace the basic function of the human vision, thinking, and actuate for sorting operation [2]. It has many possible uses in the food processing industry especially fruits and vegetable products such as chili to be sorted based on their differentiating features such as color, shape, and texture [3]. However, to automatically inspect and classify the chili accurately, the normal use of simple controllers and sensors without the ability to learn and predict the outcome will not be effective enough to handle the required task [4]. One way to automatically classify chili and to achieve an accurate result is to use artificial intelligence with the help of machine vision [5]-[7]. Chili can be classified based on

their color by using Artificial Neural Network (ANN) and the image captured simply by using a smartphone camera [8]. Other studies also decided to use ANN as the fruits and vegetable classifier having a variety of colors [9]-[11]. However, past studies only focus on the segregation process of dried red chili and the maturity level of the chili. Few studies have been made for the classification of fresh chili and in real-time application. This study presents a design for the classification of fresh chili based on color for real-time application and implementation of the system by using a sorting machine. By using the image processing technique for the preparation of feature extraction, the data can be trained using ANN in MATLAB and tested.

2. HARDWARE IMPLEMENTATION

The design for this project will be using a conveyor belt that will be able to transfer and move chili products to be monitored and classified by using a CCD camera interfacing with MATLAB software for further process that was products sorting based on their color. The type of drive system chosen for this design was a chain drive system. This drive system was responsible for driving the conveyor belt using a Direct Current (DC) motor that was attached to the shaft of the driver shaft of the conveyor. Fig. 3a shows the tensional concept for using a belt drive. The slack side is on the upper side of the conveyor while the tight side at the bottom part. This kind of setup has the risk of getting an error due to the upper slack side will move objects in a non-uniform way.

2.1 *Sorting Mechanism and Controller*

Based on previous studies, there are many ways to sort different objects for the classification process by using a suitable sorting mechanism. For the control system, there are various methods for controlling a sorting machine system. The most common basic controller for this purpose can be by using ARDUINO controller, Peripheral Interface Controller (PIC) microcontroller, Raspberry Pi, or even Programmable Logic Controller (PLC). ARDUINO has been used for many various purposes such as robotic contest implementation, robotic devices control system with the implementation of Pulse Width Modulation (PWM), and complicated tasks such as controlling various types of sensors monitoring and vision modules. For automation of sorting system, ARDUINO controller can be used to control three conveyor system that consists of dc motor, stepper motor and servo motor. Besides that, another

study suggested that a sorting system based on color by using the ARDUINO microcontroller will prove high efficiency with low cost. Figure 1 showed the block diagram of the sorting mechanism process.

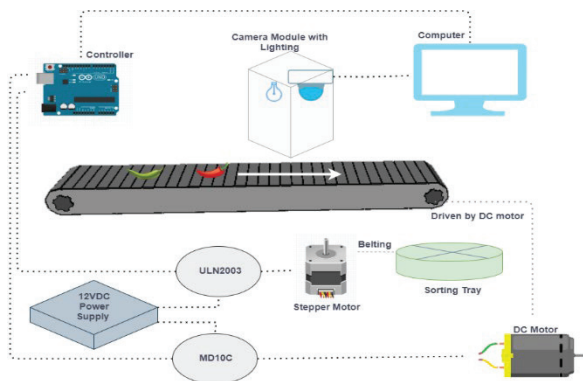


Figure 1 Block diagram of the sorting mechanism

3. ARTIFICIAL INTELLIGENCE

Artificial intelligence (AI) is a field in computer science for making a machine with the intelligence that has the computational ability in a similar way of human brain works. Some of the applications of AI include computer vision, speech recognition, understanding the natural language, and also heuristic classification. Machine learning (ML) is one of the branches of AI. ML had already grown quickly in almost all technical fields that utilized the usage of computer science and statistics for commercial use as well as in industries. The most common four types of learning in this field are Supervised Learning, Unsupervised Learning, Semi-Supervised Learning, and Reinforcement Learning.

4. CONCLUSION

This paper presented a comprehensive development of a sorting machine which requires ARDUINO Uno microcontroller for automation purpose. The suitable methods for processing the image to enhance and to improve the image for the feature extraction process will be discussed in the next paper that included image cropping, resizing, sharpening, and segmentation by color. Color analysis, GLCM, and Regionprops technique were the chosen methods to extract specific features of chili images. The classification method that used ANN will also be discussed further as well as Plot Confusion to test the performance of the system.

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