Development of a Laboratory Scale Sorting Machine for Mandarin Orange (*Cirtus reticulata* Blanco) Using Machine Vision

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Abstract

Citrus is one of important fruits in Myanmar and its annual production reached 353,050 metric tons in 2015. From 2009 to 2015, Myanmar's average growth rate for the citrus production is 3 % per year. In this study, a laboratory scale sorting machine for mandarin orange was developed. The system consisted of a belt conveyor, a webcam located in a lighting chamber, a feeding channel with receiving tray, and a computer with MSS software.

Results of static test show that the orientation of mandarin orange with respect to the camera did not affect the software's ability to analyze images correctly. The software achieved 93.25 % in sorting accuracy. In addition, the software evaluated mandarin orange's equatorial diameter at 98.81% accuracy, while sphericity was evaluated with an accuracy of 97.00%. The processing time was 0.13 second per fruit.

During dynamic calibration, average system accuracies in terms of classifying mandarin oranges at different conveyor speeds, 10.25 cms^{-1}, 8.36 cms^{-1}, and 7.50 cms^{-1} were 92.67 %, 92.67 %, and 90.67 %, respectively. The capacity of the sorting machine prototype was 1161 fruits per hour at the highest conveyor speed.