

Title Development of multi-product grading system  
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### **Abstract**

It is anticipated that grading system of agricultural product, which gives us many kinds of information such as size, color, shape, defect, and internal quality, will be important from the view point of traceability in future. Many grading systems have been developed and practically used for fruits and vegetables in Japan. They play roles to be substituting for human labor with precision by use of machine vision, NIR analysis, and automation technologies. Japanese farmers often produce various agricultural products in small quantity for short seasons annually, while the high capacity grading systems are used for specific products therefore the annual operating period is very less. It is becoming obvious that the multi-product grading system is needed.

In this paper, a multi-product grading system is developed. Initially, fruits or vegetables such as tomato and orange will be arriving randomly through the conveyor up-to a CCD color camera fixed at a height of 80 cm. Based on the Information through this camera robot will move to pick the object by using suction pad. Then, robot carries the fruit to grade it by using two CCD color cameras. One is positioned horizontally and the other one vertically upside-down. The horizontal camera is used to predict the color percentage, bruise and other defects on the surface of the fruit. Whereas bottom camera does the processing for the bottom part of the fruit, such as calyx and any defect affecting the grade of the products. Surface and bottom information of fruit will be given as input to the developed neural network. Three grading levels i.e., grade A grade B and grade C are assigned as output to the neural network. Thus three boxes were kept in specific order to place the fruits. This paper shows that neural network can be applied as a tool to grade the fruits with good accuracy. Future study is needed to improve the proposed grading model, to develop the grading methods for eggplant and process the information to implement the traceability of fruits in the system.