

**ACCURACY ANALYSIS OF INTEGRATED INTERNET OF THINGS-BASED
SMART SCALES FOR CRYSTAL GUAVA FRUIT**

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ABSTRACT

The agricultural sector for crystal guava commodities requires a precise weighing instrument because the harvest mass directly determines its market value however, the scales commonly used by farmers often experience a decline in accuracy due to deviations when the load is unevenly distributed. Therefore, this study aims to design and analyze the accuracy of an Internet of Things (IoT)-based integrated Smart Scales instrument utilizing four load cell sensors synchronized via a summing board. This study applies a quantitative experimental method by testing the device's accuracy against a national standard calibrated scale using sand-modified dumbbell weights ranging from 4 kg to 20 kg. Data evaluation was calculated using Mean Absolute Percentage Error (MAPE), Root Mean Square Error (RMSE), and the Linear Regression Coefficient of Determination (R^2), while the reading consistency was validated using actual crystal guava objects with a mass of 10 kg through three repetitions analyzed via Standard Deviation. The test results demonstrate that the Smart Scales possesses high accuracy, yielding a MAPE value of 0.053% under centric loading and 0.064% under eccentric loading positions. The RMSE or absolute deviation values were also remarkably low, at 0.005 kg (centric) and 0.008 kg (eccentric), with a highly optimal instrument linearity indicated by an (R^2) value of >0.999 . Consistency testing using actual crystal guava objects proved to be highly consistent, with a Standard Deviation of 0.006 kg. The IoT functionality was validated through the successful execution of physical receipt printing. Overall, the Smart Scales is metrologically proven to be highly feasible for implementation in the post-harvest management of crystal guava.

Keywords: *Crystal Guava, Smart Scales, Load Cell, MAPE, RMSE, Standard Deviation.*