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Detecting freshness of fruits using carbon dioxide, oxygen and humidity sensors

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ABSTRACT

The quality of edible fruits often depends on their freshness; there is no acceptable mechanism to check the freshness of fruits. A combination of technologies such as Arduino and sensors can detect the freshness of the fruits. Oxygen (O_2) and carbon dioxide (CO_2) gases, and humidity are related to the freshness of the fruits. Thus, this research aims to predict the freshness of fruits by observing CO_2 release, O_2 absorption and water vapour release after harvesting. Papaya and watermelon were selected for this study, and these fruits were categorized into three groups (0.5-1 kg, 1-1.5 kg, and 1.5-2 kg). After the harvest, three freshness factors (CO_2, O_2, and humidity) were measured at the intervals of one and three days and after the first and second weeks. A closed system consisting of CO_2 and O_2 sensors, and a humidity sensor was set up to detect the changes of the above factors of the fruits. Then, a supervised machine learning model was developed using a logistic regression algorithm to predict the freshness of fruits. The collected sensor data was used to train the machine learning model. After entering fruit type, weight, a difference of oxygen and water-vapour constatation as inputs for the model, the model will predict the freshness of the fruit as a percentage. Analyzed results showed, the rate of O_2 absorption gradually increases after harvesting, and water-vapour release gradually decreases. However, it is impossible to get an accurate CO_2 value due to the low sensitivity of the sensor used. Due to the low sensitivity of the sensor used in this research, it took a longer duration ($>$45 minutes) to obtain significant changes in the factors. It is recommended to use sensors with higher sensitivity for better detection abilities fruit freshness.

Keywords: Freshness, Humidity sensor, Water-vapour.