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Banana Quality Managing System

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Abstract: This research is aims to investigate the manner in which the quality of specific food can be maintained while prolonging its shelf life by studying the effects of the environment on the physical attributes of the food, which in this case is a banana. The research is done using banana which are observed for 72 hours in different temperatures. The device to determine the environmental factors was set up using an Arduino microcontroller, DHT11 Sensor, MQ3 Sensor. The sensors were connected to the microcontroller and a coding sequence has been written in order to make the circuit function successfully. For the banana that was placed in the cooler temperature was in good condition. For the second banana that was placed in a room temperature, at the end of the experiment, the fruit was inedible and in bad condition. The study finds that the cooler temperature is much more suited in preserving the quality and condition of the banana.

Keywords: Food Quality, Food Safety, Environments Factor

1. Introduction

Quality has long been a factor in the success of food trade transactions, but recent food safety issues have brought quality management to the forefront of international trade issues. Food quality is also becoming a factor in domestic markets now with the growing globalization of trade, as quality and variety compete for the attention of a customer and regulatory bodies aim to better monitor possible risks. In order to ensure food safety, various quality management systems are in place to assist [1].

Quality is first addressed in terms of conformity with certain market criteria, such as the perceptible dominance of favorable features or characteristics such as size, coloration or organoleptic properties. The second approach is quality as a synonym for food safety, which can also be used in countries with high food safety standards as a marketing tool for moving products [2].

In this research the quality of food will be tested using a prototype that allows the user to monitor the environmental factors such as the temperature, air humidity, alcohol content and light intensity. These factors play a huge role is maintaining the quality of food that is bought and stored in household premises. This research studies the ways food could be preserved and kept in storage in household places. Most households generate some sort of raw food waste each time they have bought raw food.

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This research can help to maintain the surrounding for food to be optimally kept. It also will help to have an eye over the state of food in real time [3]. The real time objective is necessary in order to improve the efficiency of the prototype.

The aim of the project is to see how an optimum environment can be made in order to prolong the shelf life of food along with the quality of it as well. This will enable consumers to have a better way of consuming their respective food as well as storing it well without compromising the quality of food. This is essential for the new normal as food products need to be lasting longer before consumption.

2. Methodology

2.1 Project Overview

A food quality sensor is a device that responds to some properties of the food and transforms the response into an electric signal. Unpleasant smells and toxic substances may be caused by bacterial contamination of food and beverages. Casalinuovo and et al describe chemical sensors that detect bacteria inside the food [4].

In this study, a prototype was built and used to carry out the experimentation. The main parts that make up the prototype consist of WEMOS D1 R1 WI-FI ESP8266 Development Board Arduino Compatible, DTH11 Sensor , MQ3 Sensor, Liquid Crystal Display and Blynk Application.

2.2 Flowchart of the Experiment

The flowchart shows how the experiment was conducted. The prototype was built around the Arduino microprocessor with the DHT 11 Sensor reading the surrounding temperature and humidity with the MQ3 sensor reading the ethylene gas concentration released by the respective bananas. The readings can be seen using the LCD display as well as in real time through the Blynk Applications.

The flowchart in Figure 1 shows how the experiment was conducted. The prototype was built around the Arduino microprocessor with the DHT 11 Sensor reading the surrounding temperature and humidity with the MQ3 sensor reading the ethylene gas concentration released by the respective bananas. The readings can be seen using the LCD display as well as in real time through the Blynk App. As the food quality degrades due to the increase in the humidity inside the food package the sensor detects these changes and transfers the increase in humidity into the electric signals [5].

Food quality can be defined as the combination of those characteristics which distinguish between the individual units of a product and which are important for determining the degree of acceptability of that unit to the consumer [6]. There are some correlations between textural qualities, in particular juiciness and taste, and fruit and vegetable colour and nutritional composition [7].Evaluating color can be subjective or objective: Subjective: The human eye is used to evaluate color. Through the sense of touch, textural parameters of fruits and vegetables are interpreted, either when the product is picked up by hand or held and chewed in the mouth. A mixed but unitary experience involving sensations of taste, smell, and pressure, and often cutaneous sensations such as warmth, colour, or mild pain, has been described as flavour[8].

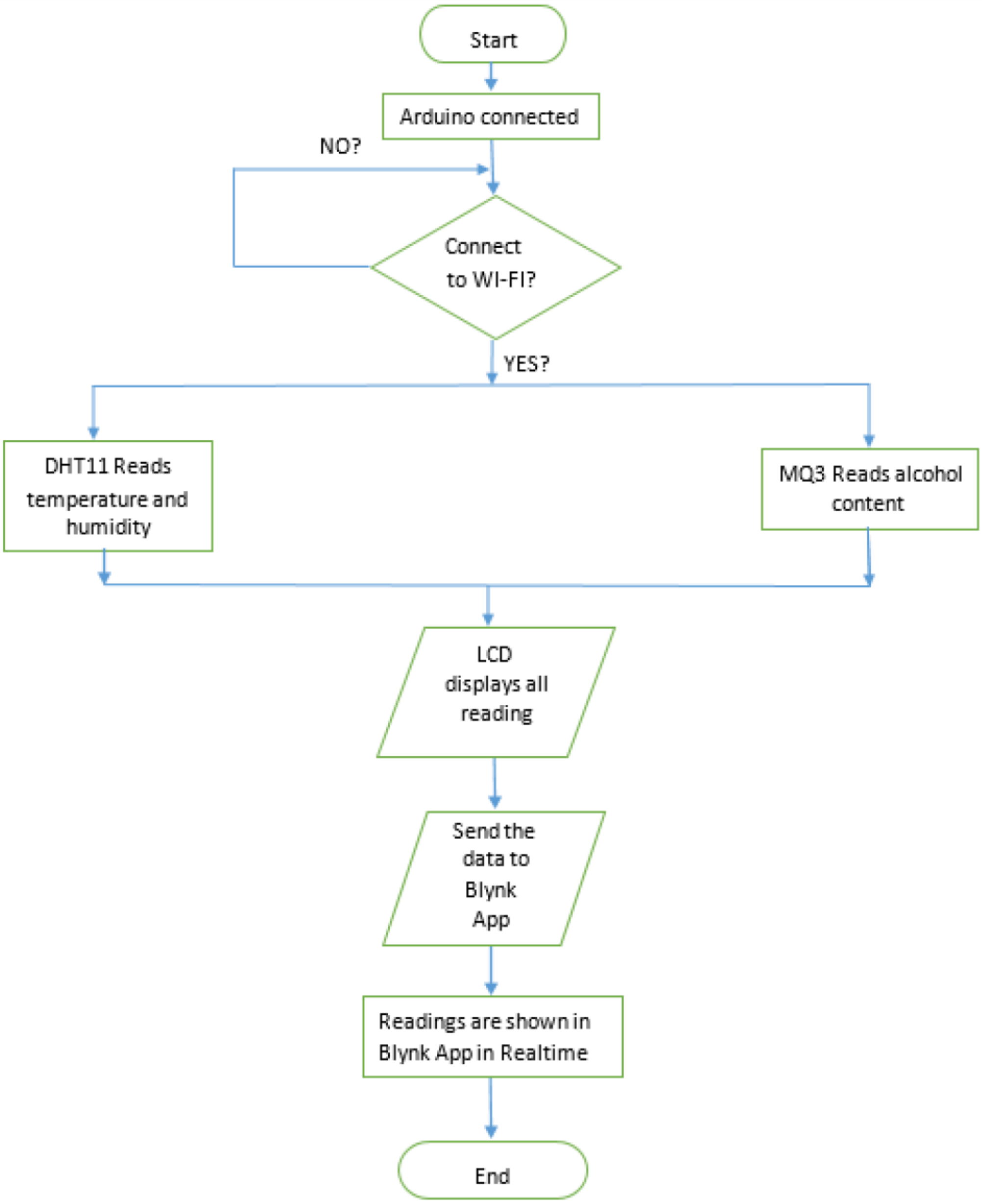

Figure 1: Flowchart of the food quality management system

3. Results and Discussion

3.1 Results

Banana A and Banana B had different outcomes at the end of each respective experiment. At the end of the experiment, Banana A which was placed in a col environment had not been through significant change which inadvertently decrease the quality of the fruit. The fruit had extra black spots or sugar spot on the skin. The aroma of the fruit was still good and the overall texture of the fruit was still firm without any soft spots around. But the flesh was still fresh and edible. The taste was good as well.

Banana B on the other hand which was placed in the room temperature had gone through significant change which had severe impacts on the quality of the fruit. Primarily, the skin of the banana had visibly turned black ant the aroma of the fruit was off putting. The texture of the fruit had also suffered as it was no more firm as well. The flesh of the fruit was inedible as well as being bland with no flavour. The quality of the banana had drastically dropped compared to Banana A.

Figure 2 shows how the experiment was setup. The prototype was placed in a half-closed container to allow a closer distance between the MQ3 sensor and the banana in order to get a more accurate reading

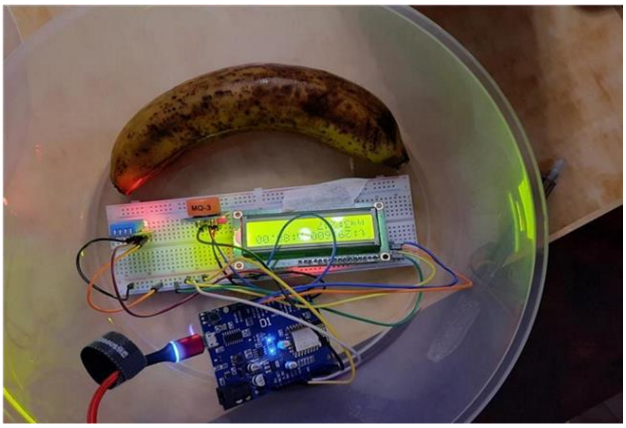

Figure 2: Experiment Setup

Figure 3 shows the Blynk app interface that was linked to the prototype. This allowed the prototype to send the readings in real time to the Blynk app with an interval of 10 seconds.

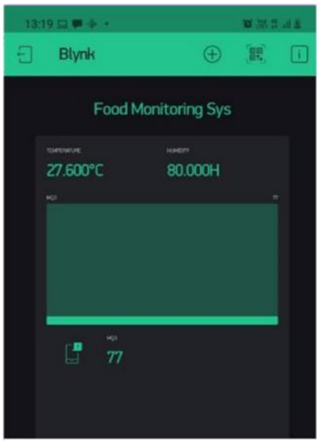

Figure 3: Blynk App Interface

Figure 4 shows the condition of Banana A from Day 1 until Day 3 and the end of the experiment. As we can clearly see, the quality and condition of the fruit is preserved and in good condition. It is edible.

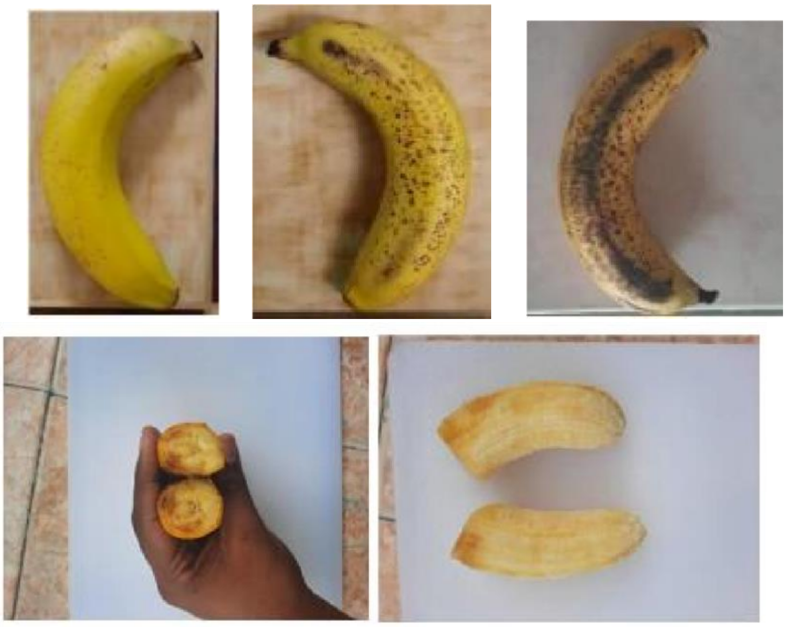

Figure 4: The cross section and the flesh of Banana A

Figure 5 shows the condition of Banana B from day 1 until day 3 with the end of the experiment as well. As we can clearly see, the quality and condition of the fruit is degraded and the in bad condition. It is inedible.

Figure 5: The cross section and the flesh of Banana

Figure 6 shows the temperature that were recorded for Banana A and Banana B across 72 hours. As it can be seen, Banana A was kept below room temperature and Banana A was kept at room temperature. The average temperature was cold for storing Banana A whereas it was almost a tropical average temperature for Banana B.

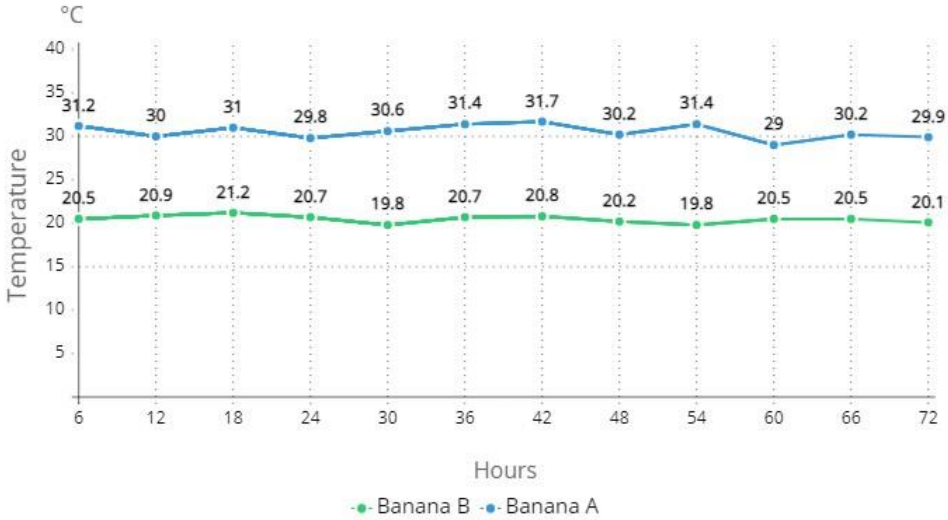

Figure 6: The temperatures that were observed through the 3 days for Banana A and Banana B

Figure 7 shows the differing humidities that was observed for Banana A and Banana B. Naturally, the humidity for each banana was affected by the surrounding temperature that the bananas were placed in.

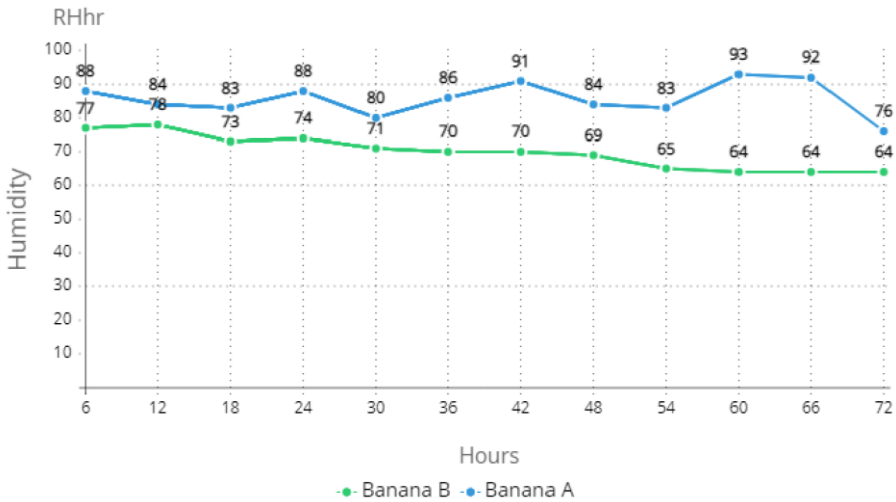

Figure 7: The humidity that was observed through the 3 days for Banana A and Banana B

Figure 8 show the gas concentration of ethylene that were recorded for Banana A and Banana B across 72 hours. As it can be seen, Banana A had released a substantially lower amount of ethylene which slowed the ripening process. Whereas Banana B released almost the double amount of ethylene which is return accelerated the ripening process. This made the quality of Banana B decrease more compared to Banana A.

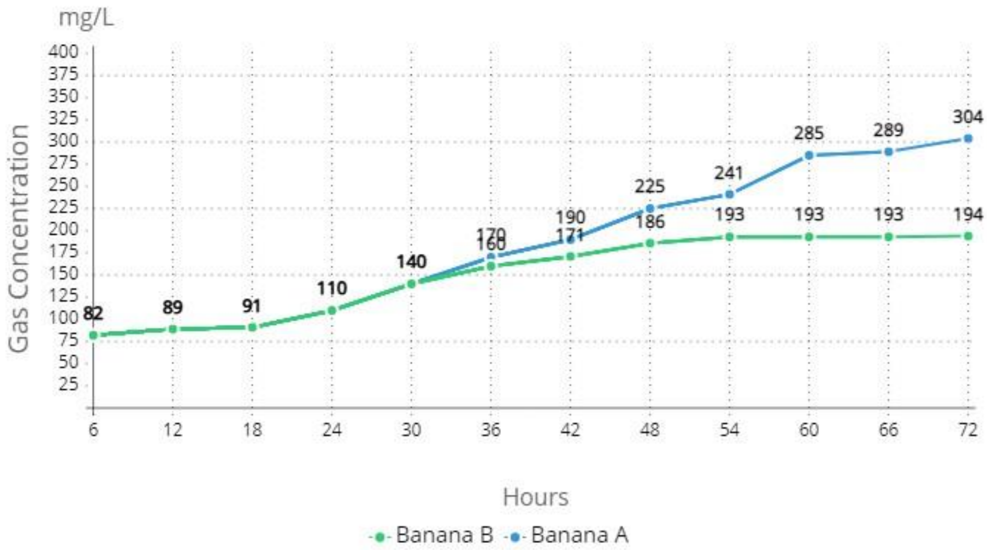

Figure 8: The gas concentration that was observed through the 3 days for Banana A and Banana B

3.2 Discussions

The ripening of fruits is associated with the basically associated with the usage of ethylene gas as a catalyst to make the ripening process of most tropical fruits faster. Bananas on the other hand emit ethylene gas as a natural process from ripening. Ethylene is associated in the production of ethanol as well. This is why the ethanol part of the fruit produces black spots in the fruit upon the ripening process. This is the most basic principle of the ripening process of most tropical fruit. As for the surrounding factors, the ripening process can either be accelerated or slowed down depending on the usage and needs of the consumers.

For the first banana, Banana A, it is placed in a controlled environment where the temperature of the room is controlled using the air conditioner, the temperature is set at 20℃. For the set temperature, the relative humidity is lower than the usual room temperature. This is due to the surrounding temperature freezing the water content in the air, subsequently decreasing the humidity. This in turn affects the ripening process of the banana. As the days progressed, the ripening of the fruit happens gradually at a slower pace.

Now as for Banana B, the fruit is placed under normal room temperatures with the temperatures ranging between 31.20 at its highest and 29.00 at its lowest. The higher temp affects the air humidity in a way the humidity is higher as well as more water molecules are evaporated into the surrounding environment. These factors help accelerate the ripening process of the banana.

4. Conclusion

The whole prototype measured the environmental readings of temperature and relative humidity with an error margin or ±5% with the MQ3 sensor reading the ethylene gas released by the banana with an error margin of ±5% as well. The banana was observed under same conditions except for varying temperatures and studied for its physical attributes.

The physical attributes of the fruit were clearly showing differences when kept in varying conditions. The reasoning behind the findings is also discussed as to the impact of the environmental factors around the fruit. It can be concluded that, at a lower temperature, the fruit ripens at a slower rate without losing the quality of the food. For the future works, the following progress can be made such as incorporating the prototype to a smart home model, the prototype can control the light intensity surrounding the food as well with the addition of a LDR sensor.

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