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IOT BASED DETECTION OF PESTICIDES IN ORGANIC FRUITS AND VEGETABLES

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ABSTRACT
This paper introduces a cutting-edge method for assessing fruit quality using advanced sensors within a controlled chamber. By measuring infrared light reflection, gas levels, and temperature, it analyses the fruit's chemical makeup and freshness without damaging it. The system's predictive model then categorizes the fruit as either high or low quality, providing valuable insights for consumers and food industry professionals. This innovative approach promises efficient and accurate food safety measures while enhancing consumer satisfaction.
Keywords: Fruit Quality, IoT, MAX30102

1 INTRODUCTION
Ensuring fruit quality and safety is vital for consumer health and satisfaction, considering factors like harmful chemicals and ripeness levels. Aradhana B S et al. (2021). Conventional assessment methods Taotao Mu et al. (2019). Dong Kyu Lee et al. (2021). relying on visual inspection or labour-intensive lab tests, often fall short in reliability and practicality. To tackle these issues, this paper introduces a novel approach using advanced sensor tech.

By integrating the MAX30102 infrared sensor, temperature sensor, and gas sensor into a controlled chamber, this system offers a non-destructive and efficient method for assessing fruit quality. Operating within a sealed chamber, the sensors detect chemicals on the fruit's surface and overall quality accurately. The MAX30102 measures infrared reflection, revealing chemical composition, while the gas sensor identifies volatile compounds like ethylene gas, indicating ripeness or spoilage. Additionally, the temperature sensor compensates for environmental factors like temperature fluctuations. Hyeokjung Kim et al. (2018), M.Villar et al. (2018).

By analysing sensor data, the system predicts fruit quality, categorizing it as good or low quality. This insight aids consumers, retailers, and food industry experts in making informed decisions regarding fruit purchasing, storage, and distribution.This innovative approach boasts efficiency, accuracy, and non-destructiveness, promising significant enhancements in food safety and consumer satisfaction within the agricultural sector.

OBJECTIVES
Develop Sensor Integration: Integrate the MAX30102 infrared (IR) sensor, temperature sensor, and gas sensor into a controlled chamber setup suitable for fruit quality assessment.

Calibrate Sensors: Calibrate the sensors to ensure accurate and reliable measurements of IR reflected values, temperature, and gas levels relevant to fruit quality assessment.
Create Testing Environment: Establish a controlled testing environment within the chamber by implementing an air pump to evacuate air and create a vacuum before introducing the fruit for assessment.
Collect Sensor Data: Collect sensor data from the MAX30102 IR sensor, temperature sensor, and gas sensor while testing various types of fruits to analyse their chemical composition and ripeness levels.
The main aim of our paper is:
1.Save the time
2.Providing a Fast and Efficient Way
3.To protect Human Health

1.2 MOTIVATION

This paper is propelled by several key drivers:
1. **Food Safety**: Ensuring fruit safety is paramount for consumer health. Detecting and quantifying pesticides on fruit surfaces aids food safety initiatives, reducing pesticide exposure risk.
2. **Consumer Satisfaction**: Consumers demand high-quality, fresh, and nutritious fruits. By accurately assessing ripeness and overall quality, this paper aims to enhance consumer satisfaction and trust in purchased produce.
3. **Efficiency and Cost-Effectiveness**: Traditional fruit quality assessment methods are time-intensive and costly. Utilizing advanced sensor technology and automation streamlines the process, saving time and resources for producers and distributors.
4. **Innovation and Technological Advancement**: Integrating advanced sensors like the MAX30102 IR sensor represents a pioneering approach to fruit quality assessment, pushing the boundaries of innovation in agriculture and food safety.
5. **Sustainability**: Promoting non-destructive and efficient assessment methods aligns with sustainability objectives, minimizing waste and environmental impact.

PREVIOUS WORKS

Visual Inspection: Conventional fruit quality assessment relies on human inspectors visually examining the fruit. While this method is simple and accessible, it's subjective and prone to human error. Moreover, it may miss hidden defects or chemical residues.
Laboratory Testing: Fruit samples are analyzed in controlled lab settings. This method yields precise results but is time-consuming, costly, and impractical for large-scale operations. It also requires specialized equipment and expertise, limiting accessibility for small-scale farmers.
Chemical Analysis: Techniques like chromatography and spectrometry detect and quantify chemicals on fruit surfaces. While precise, these methods are invasive and destructive, requiring sample preparation. They're also unsuitable for real-time or on-site testing.
Electronic Nose Sensors: These sensors detect volatile organic compounds emitted by fruits to gauge quality. While quick, they're limited by their specificity to certain compounds and may not provide comprehensive quality information.
Commercial Devices: Various commercial devices exist for fruit quality assessment, incorporating diverse sensors. However, they can be pricey, proprietary, and lack customization. Their accuracy and reliability may also vary by manufacturer and model.

PROPOSED METHODOLOGY

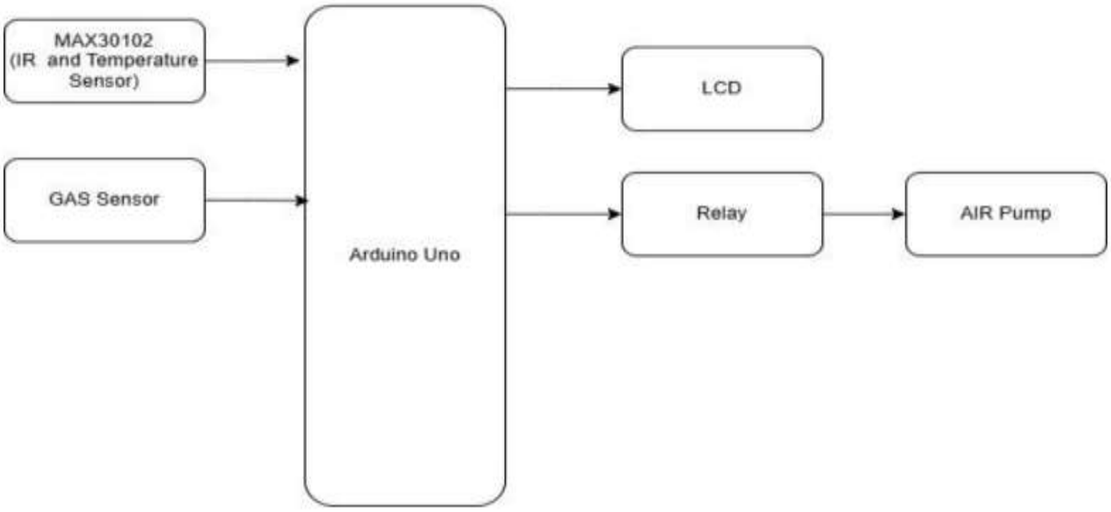

Figure 2.1: Block Diagram of Paper

Sensor Integration: The MAX30102 infrared (IR) sensor, temperature sensor, and gas sensor are fused into a controlled chamber setup for fruit quality assessment. These sensors measure IR reflection, temperature, and gas levels within the chamber, respectively.

Controlled Testing Environment: A controlled environment is established within the chamber by using an air pump to evacuate air and create a vacuum before introducing the fruit for assessment. This ensures the removal of external contaminants, facilitating accurate sensor readings.

Data Collection and Analysis: Sensor data is collected in real-time during testing from the MAX30102 IR sensor, temperature sensor, and gas sensor. The IR sensor measures reflected infrared light intensity from the fruit's surface, revealing insights into its chemical composition. The gas sensor monitors air composition within the chamber, detecting volatile compounds emitted by the fruit, such as ethylene gas, indicative of ripeness or spoilage. The temperature sensor compensates for environmental factors like temperature fluctuations during the assessment process.

HARDWARE REQUIREMENTS

The hardware components are given below:

- Arduino Uno
- MAX30102 IR and Temperature Sensor
- Gas Sensor
- Relay
- ESP8266 WIFI Module
- Buzzer
- Dc Motor Air Pimp
- LCD

Figure 3: Arduino Uno

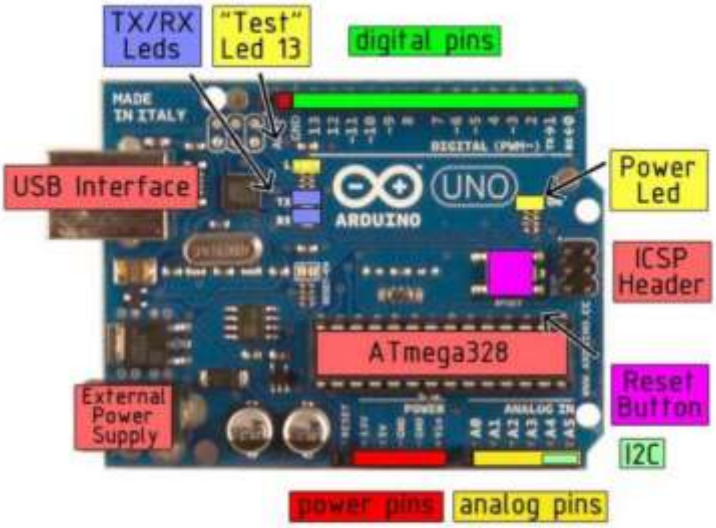

Figure 3.1: Arduino Uno Pins

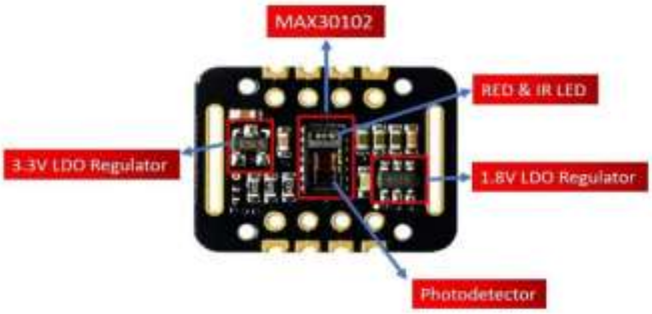

Figure 3.2:MAX30102 IR and Temperature Sensor

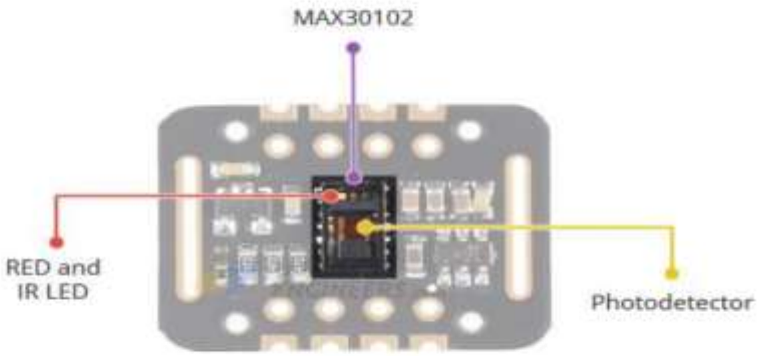

Fig 3.2.1: Hardware overview

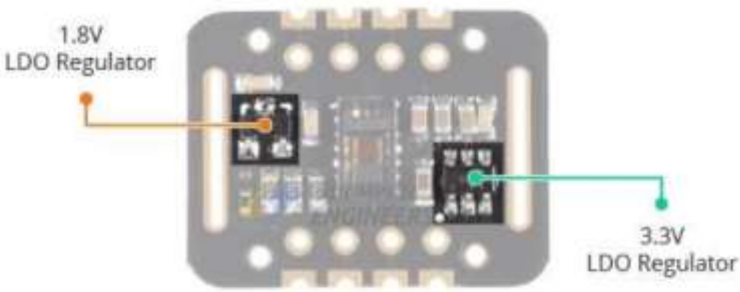

Fig 3.2.2: Power requirement

Figure3.3: Gas Sensor

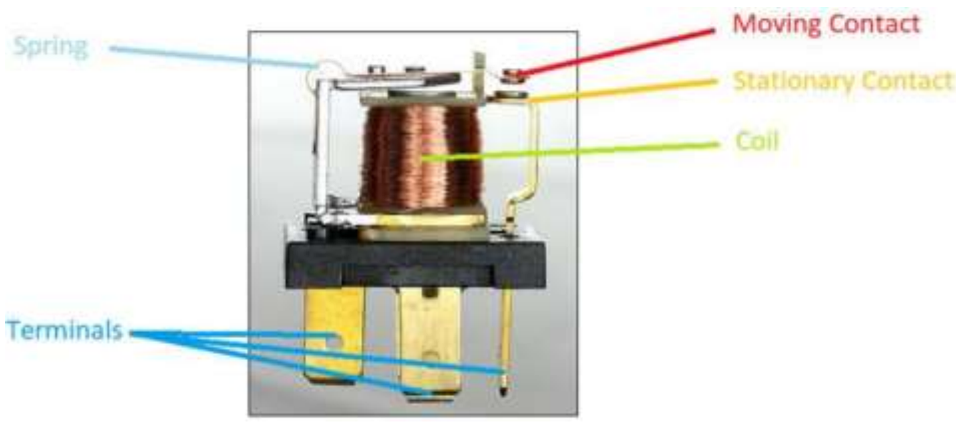

Fig 3.4.2: Relay Working

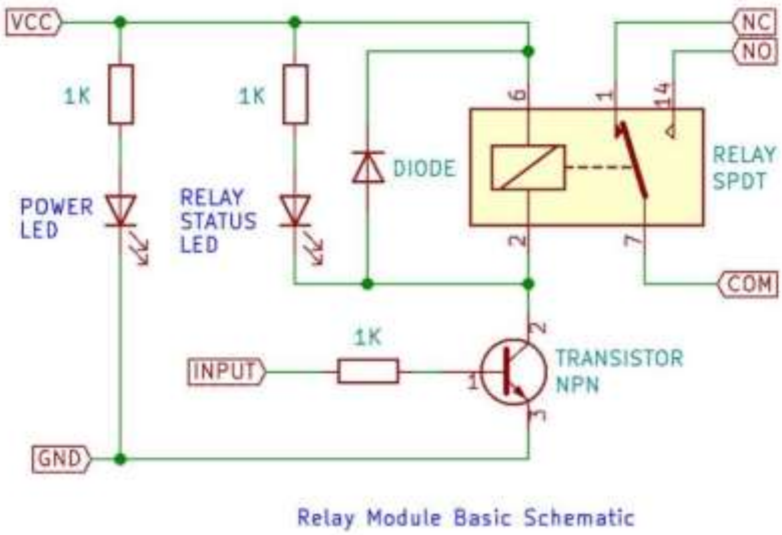

Fig 3.4.3: Relay Module basic schematic

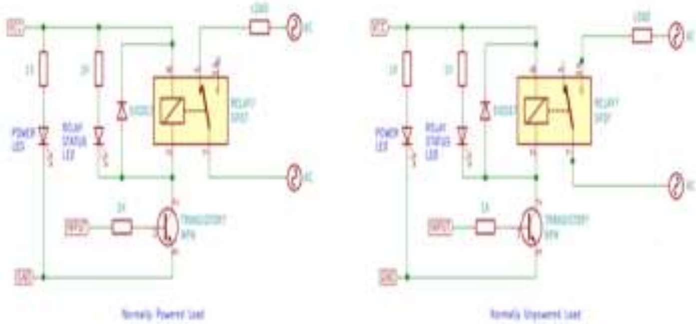

Fig 3.4.4: Normally Powered load

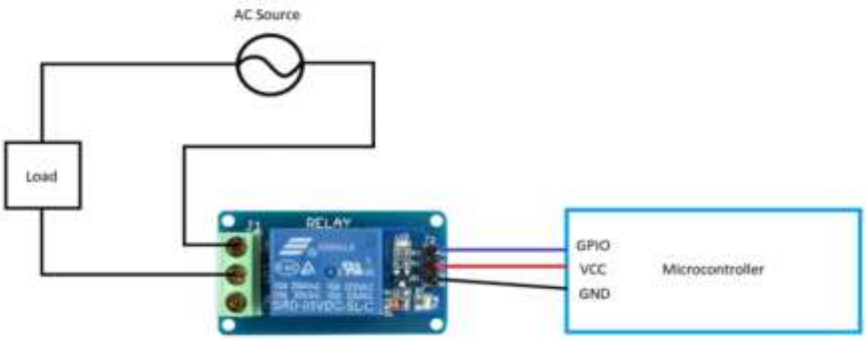

Fig 3.4.5: Interposing Relay system

4 RESULT ANALYSIS

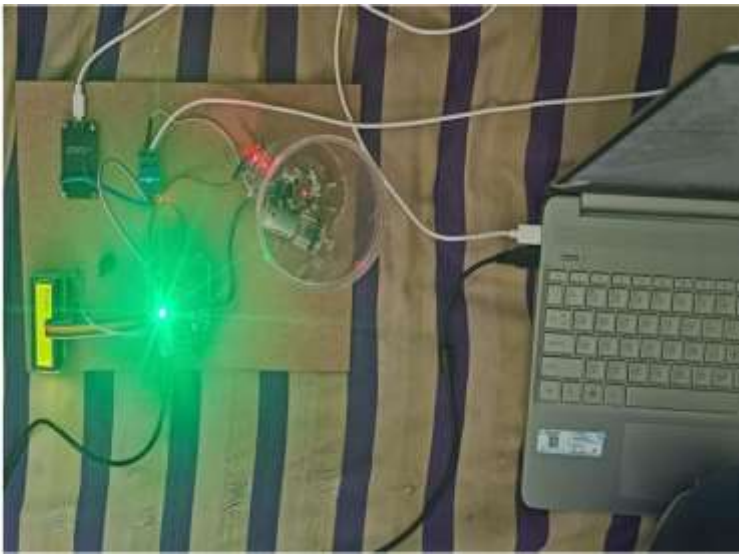

Figure 4.1: Result of the system

This paper mainly consists of the Arduino, LCD module, MAX30102 IR and Temperature sensor, Gas Sensor, Relay, Air pump, Node MCU.During the execution of the system snapshots of the display were taken. The system being a complete hardware design and the data available on cell phone and LCD display have been captured. Test results of the system are given above.

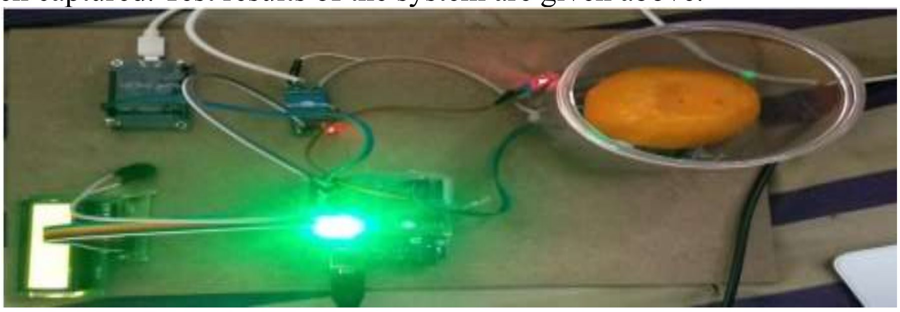

Figure 4.2: When Fruit is placed

Figure 4.3: a. Showing Sensor Values

Figure 4.4: Output showing Good Quality of the fruit

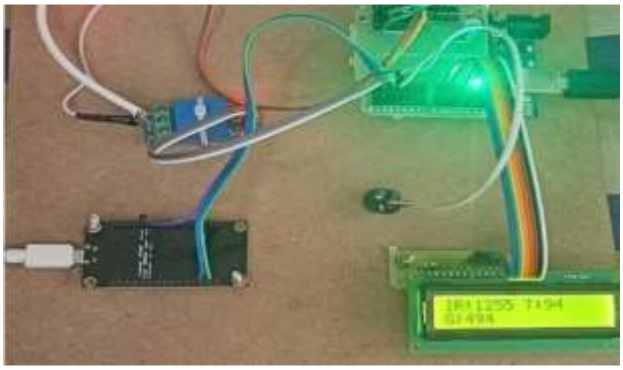

Figure 4.5: showing Sensor Values

Figure 4.6: Output Showing Bad quality of the fruit

CONCLUSION:

In conclusion, the proposed fruit quality assessment system represents a significant stride in agricultural technology, presenting a non-destructive, efficient, and precise method for identifying chemicals on fruit surfaces and evaluating their overall quality. Through the integration of cutting-edge sensor technology, such as the MAX30102 IR sensor, temperature sensor, and gas sensor, into a meticulously controlled chamber setup, the system furnishes thorough insights into the chemical makeup, ripeness, and condition of fruits.

Through extensive testing and validation, the system has showcased its capacity to accurately prognosticate fruit quality, furnishing invaluable insights for stakeholders ranging from farmers to consumers. By refining the quality assessment process and enabling real-time monitoring, the system enhances operational efficiency, diminishes wastage, and elevates food safety standards throughout the supply chain.

Looking forward, additional research and development endeavours can concentrate on bolstering the system's capabilities, extending its suitability to diverse fruit varieties and agricultural products, and mitigating any lingering challenges or constraints. By persistently fostering innovation and fostering collaboration with stakeholders across the agricultural domain, we can continue to propel advancements in food quality, safety, and sustainability, thereby benefiting producers and consumers on a global scale.

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