# The Freshness of Food Detection using the Internet of Things and Android App

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## ABSTRACT

*Abstract— One-third of the food produced globally is wasted and that equates to 1.3 billion tons of food we eat. Excess food waste is something that regularly occurs at hotels, family functions, parties, etc. To gain an understanding of the scale of the problem, the excess food we waste has a large impact on various environmental factors. Freshness is a significant indicator of the quality of seafood and other food products. Food processing, storage, and marketing of food and edible products all heavily rely on the rapid detection of their freshness. In this study, a rapid and nondestructive food freshness detection method is proposed in response to the drawbacks of current food freshness detection approaches. This IoT-based system aims to detect the quality and freshness of food using various sensors and algorithms. We first retrieved the VOC gases of the food product and down sampled them before obtaining features. Finally, freshness detection is carried out using the Machine learning algorithm. An application is proposed to display the results of checking food items by the device*.

**Keywords**— *food safety, machine learning, IoT, food freshness detection, food industries*

## 1. INTRODUCTION

India has a population of more than 1.3 billion people and feeding such a large population is a major challenge. Despite being one of the largest producers of fruits and vegetables in the world, 40% of food is wasted. Every year, food worth INR 50,000 crores is wasted, according to the agriculture ministry. The total amount of food wasted is equal to the total amount of food consumed by the U.K. Such a situation is concerning in a country where millions of people still sleep hungry on the streets. This type of loss is caused by minute temperature and humidity changes, or when one or two spoiled vegetables or fruits spoil the entire barrel. Most of the time, farmers or restaurant owners are unaware of such changes because they are not easily visible. Regular updates on the progress of such changes are sufficient to save the entire barrel of fruits and vegetables.

As a result, to avoid such situations, IoT-based food freshness detection is an effective solution. With the help of IoT, one can build a low-cost testing system to assist farmers and restaurant owners in keeping track of the amount of food in storage as well as the quality of food. Real-time updates can also be sent, allowing for immediate action to be taken to prevent food loss. Monitoring environmental factors such as temperature, humidity, and gases released by fruits and vegetables as they degrade aids in monitoring the quality of fruits and vegetables. In this paper, we propose a model that focuses on three parameters: TVOC, Methane, and Ammonia, and we will show how modern IoT-based technology can be used to prevent food loss and ensure food availability all year.

## 2. LITERATURE SURVEY

Authors of [1] proposed a versatile solution based on the Internet of Things. To demonstrate this concept, a set of Apples (Malus Domestica) was used in this study. The apples are numbered in order of ripening (i.e., a measure of good taste and quality). Later, an Arduino-based microcontroller board performs an analog read operation, after which the ripening index is compared to a pre-calibrated indexing table. This data is instantly transmitted to a cloud platform based on the Internet of Things for storage and real-time knowledge processing.

the author[2] presented the crucial technology of constructing the platform and relevant implementation, including the associated matching algorithms between the RFID tags and one-dimensional code, building methods of food quality model by the theory of ontology-based context modeling, and the combination and presentation methods of service functions for the different users. The platform presented in this paper can basically satisfy the requirements of food quality supervision through the test.

The authors[3] developed an Android application based on the Internet of Things to monitor environmental elements such as ammonia, methane, alcohol percentage, and TVOC. The ESP32, a well-known and popular development board, serves as the device's brain. Sensors such as the MQ135, MQ3, CCS811, and 162 LCD are connected to the Microcontroller board. ML is used to analyze the app's image and predict the condition of the food. The app includes a chatbot that provides food quality information. The app will recommend nearby organic stores based on the user's location.

## 3. SYSTEM ARCHITECTURE AND METHODOLOGY

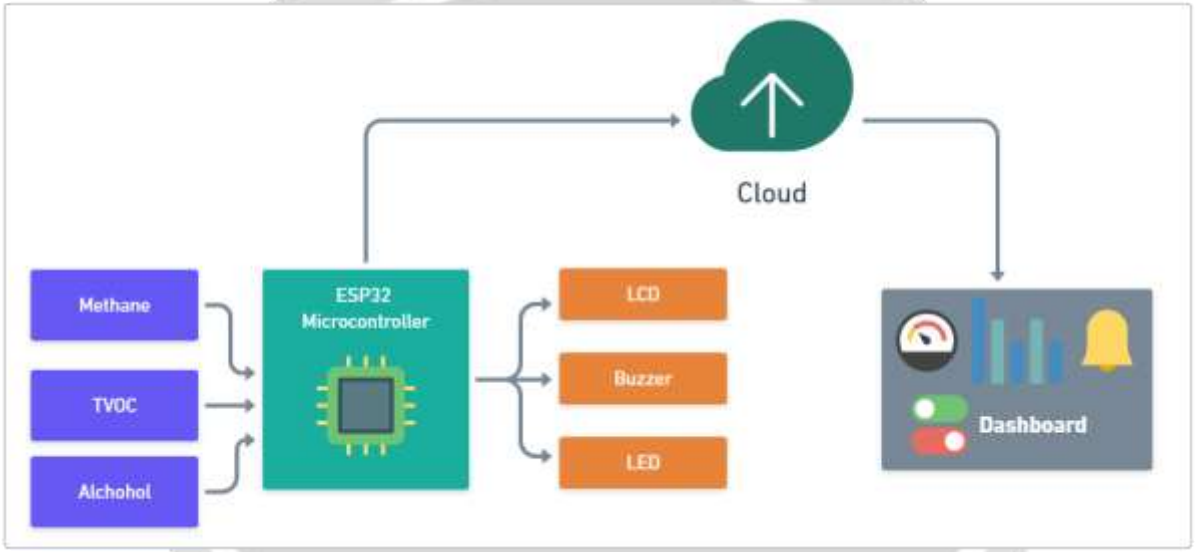


**Fig -1:** System Architecture

The hardware block diagram of the system has been shown in the system architecture diagram. It consists of ESP32, LCD Screen, buzzer, and different TVOC gas sensors. To classify the data into three different categories fresh (0), semi-fresh (1), and spoiled (2), further making the model and predicting the food quality for future sensor data, data analytics & machine learning techniques have been used. The recorded data has missing values therefore to sort out this problem median imputation technique has been employed. In the second section, the Naïve bays technique has been used to classify the data into three groups. This data will be sent to the cloud and displayed on the mobile application. To build the algorithm we will take three main steps –

1. Collect manually classified data, also known as our training set.
2. Using Bayes' Theorem, estimate the probabilities of new entries based on that training set.
3. Based on the probability values, classify a new entry. If the likelihood of spoilage is high, label the food as having begun to spoil. Otherwise, mark it as "Not spoiling."

## 4. CONCLUSIONS

To reduce and avoid illness caused by food poisoning, we are using various sensors that determine the freshness of food items such as dairy products, fruits, and foods. Food spoilage can be detected by detecting naturally emitted gases such as ethanol, ammonia, and methane as food decay. The ESP32 with sensors can detect gas emissions and other important constituents such as volatile organic compounds and moisture levels in food before any visible signs of spoilage appear. Using sensors to detect the presence of these values in foods can aid in the early detection of food spoilage and the avoidance of the consumption of spoiled food. To improve the sensitivity of such detection methods, these techniques can be expanded to include other types of gas sensors and foods. This system consists of a hardware device and a web application for determining food quality and freshness.

## 5. REFERENCES


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