FOOD FRESHNESS DETECTION USING IOT

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Abstract: Keeping food fresh is essential for preserving food quality, cutting waste, and minimizing potential health hazards. Traditional techniques of evaluating food freshness frequently depend on subjective sensory evaluation, which can be labor-intensive and error-prone. But thanks to recent technological developments, there are now many methods for determining the objective freshness of food. The state-of-the-art techniques and tools for determining the freshness of food, such as spectroscopy, gas sensors, machine learning, and computer vision, are thoroughly reviewed in this study paper. The report also covers the advantages and difficulties of using these strategies in the food business.

Keywords: Food Freshness Detection, Machine earning, advantages, efficiency, IOT, sensors

I. INTRODUCTION

Background: The quality, safety, and satisfaction of food products are all directly impacted by how fresh the food is. Fresh food preserves its nutritional content and lowers the danger of contracting foodborne illnesses in addition to being more appealing in terms of taste, scent, and texture. Food that is damaged or past its prime, on the other hand, can result in consumer displeasure, health risks, financial losses, and increased food waste. Therefore, throughout the entire food supply chain, an accurate and timely assessment of food freshness is crucial.

Food Freshness Detection's Importance:
Food freshness detection serves a number of essential functions. First of all, by guaranteeing that only fresh products reach the market, it enables producers and suppliers to uphold the highest quality requirements. This is crucial for perishable foods because of their short shelf lives. Second, freshness detection improves inventory management by cutting waste and avoiding the needless disposal of food products that are still edible. Additionally, it makes for better distribution and planning, guaranteeing that food items are accessible when and where they are required. Thirdly, precise freshness evaluation lowers the risk of foodborne infections by preventing the ingestion of defective or potentially dangerous food. Finally, by eliminating food waste and lowering the environmental impact related to food production, transit, and disposal, effective freshness detection systems are in line with sustainable practices.

This research paper's main goal is to give a thorough overview of the most cutting-edge techniques and tools available for determining the freshness of food. The goal of the study is to investigate several approaches, such as spectroscopy, gas sensors, machine learning, and computer vision, and to examine their advantages, disadvantages, and prospective uses in the food sector. The purpose of this research is to examine various methods in order to clarify the advantages and difficulties of objective freshness assessment. This research paper's focus includes the technical and theoretical foundations of food freshness detection, as well as its practical applications and implications for quality assurance, supply chain management, consumer safety, shelf-life prediction, and food waste reduction.

In conclusion, this research study highlights the crucial importance of determining food freshness and provides an overview of cutting-edge methods that provide accurate and effective ways to determine freshness. Stakeholders in the food industry can implement appropriate freshness detection methods to improve quality, reduce waste, ensure consumer safety, and support sustainable practices by understanding the capabilities and potential applications of these techniques. General population about fire safety. For instance, it might be used to build interactive fire safety programs that teach people how to prevent fires in their homes and how to respond to fires that do occur in their homes. These programs would educate people on how to avoid fires in their homes and how to respond to fires that do occur in their homes. Virtual reality has the potential to become a valuable tool for boosting fire safety and minimizing response times. One application of this technology is the use of virtual reality for the detection of flames. However, it is crucial to bear in mind that virtual reality simulations are not a good alternative for hands-on practice and experience in the actual world. This is something that must be always kept in mind. Because of this, any fire detection program that makes use of virtual reality must be used in conjunction with other, more traditional types of training in order to ensure that trainees are adequately equipped to respond effectively to fire events that occur in the real world.

II.   MOTIVATION

Motivation: Several key concerns and challenges that the food business, consumers, and the global community as a whole confront serve as the driving force behind research on food freshness detection.

1.1. Food Quality and Consumer happiness: For consumer loyalty and happiness, high-quality food products are crucial. The total quality of food, including its flavor, aroma, texture, and nutritional content, is greatly influenced by its freshness. Accurate freshness detection techniques enable producers to Producers, distributors, and retailers can constantly satisfy the expectations of consumers, who demand and deserve fresh food that lives up to those expectations.

Public health is significantly at risk from foodborne infections, which can also have serious repercussions. In order to reduce these dangers, it is essential to identify rotten or contaminated food and to stop consumers from consuming it. The food sector may reduce the likelihood of foodborne illnesses and safeguard the health of consumers by employing efficient freshness detecting systems.

Impact on the Economy and Environment Food waste is a serious problem that affects both the economy and the environment. Approximately one-third of all food produced for human consumption is wasted annually, according to the United Nations. Techniques for detecting food freshness can minimize waste by improving inventory management, streamlining the supply chain, and avoiding the disposal of still-edible food that is wrongly thought to be spoiled. The industry can also lessen financial losses brought on by squandered resources, production expenses, and environmental harm by reducing food waste.

Efficiency in supply chain management is essential for assuring the availability of fresh food products and reducing waste, as stated in poin t1.3. The research paper's goals and scope:1.4.

manage their inventories more easily by using accurate and quick freshness detection techniques to make decisions about distribution, storage, and transportation. This prevents waste and increases supply chain efficiency by ensuring that fresh products are supplied to the market in a timely way.

1.5. Technological Advances and Industry Innovation: New avenues for objective food freshness detection have been opened up by recent technological developments in spectroscopy, gas sensors, machine learning, and computer vision. These cutting-edge procedures provide quicker, more accurate, and more affordable substitutions for conventional sensory evaluation techniques. By investigating and putting into practice cutting-edge methodologies, research in food freshness detection strives to take advantage of these developments and spur industrial innovation, enhancing the overall effectiveness, quality, and sustainability of the food sector.

In conclusion, improving food quality, ensuring customer safety, reducing food waste, improving supply chain management, and utilizing technical improvements are the driving forces behind research on food freshness detection. Researchers and industry stakeholders can collaborate to achieve these goals and advance the development of a more sustainable and effective food system by addressing these incentives.

III.   LITERATURE SURVEY

In conclusion, methods for determining food freshness are essential for providing high-quality food items, cutting waste, improving consumer safety, and advancing sustainable food business practices. The numerous methods used for objective freshness evaluation, such as spectroscopy, gas sensors, machine learning, and computer vision, have all been thoroughly reviewed in this study paper.

The chemical makeup and physical characteristics of food are revealed by spectroscopy methods like near-infrared spectroscopy (NIRS), mid-infrared spectroscopy (MIRS), and Raman spectroscopy, which allow for precise freshness assessment. Electronic noses (E-Nose), mass spectrometry (MS), and volatile organic compound (VOC) sensors are just a few examples of the gas sensors that can detect specific volatile compounds released by food as it spoils and provide an objective assessment of freshness based on odor profiles. Large datasets can be processed using machine learning techniques, and useful patterns can be extracted to classify freshness and estimate shelf life. Food samples can be properly classified as fresh or spoilt, and their remaining shelf life can be calculated, by utilizing attributes gleaned from sensory data, spectroscopic

measurements, or gas sensor outputs. Convolutional neural networks (CNNs) and deep learning models, in particular, present promising approaches for freshness evaluation based on visual cues. Computer vision models can categorize food products according to their level of freshness by examining food photos and collecting pertinent information relating to color, texture, and morphology.

The uses for food freshness detecting methods are numerous and varied. They can be used in supply chain management, assurance of consumer safety, shelf-life forecasting, and food waste reduction operations. The ability to sort and separate food items allows for improved inventory management and waste reduction. This is made possible by the implementation of objective freshness assessment methods. The effectiveness of the supply chain can be increased by quick decision-making regarding storage, transit, and distribution with the use of real-time freshness monitoring. Furthermore, freshness detection methods reduce the risk of foodborne infections by preventing the intake of damaged or possibly dangerous food.

The presented strategies have a lot of potential, but there are obstacles that must be overcome before they can be widely used. To guarantee consistent and comparable results across various freshness detection techniques, standardization and calibration protocols must be created. It is necessary to build real-time monitoring technologies to enable continuous evaluation of food freshness across the supply chain. Processes for gathering data, analyzing it, and making decisions can be improved with integration with Internet of Things (IoT) technology. To encourage the use of freshness detection systems in many areas of the food business, cost-effectiveness and scalability are crucial factors. To address issues with the gathering and processing of sensitive data, it is also necessary to put in place privacy protection and data security safeguards. In conclusion, the study of food freshness detection methods offers a solution to raise food quality, lessen waste, protect consumers, and encourage sustainability in the food business. Stakeholders can use these strategies and revolutionize how food freshness is monitored, controlled, and optimized by resolving the difficulties and concentrating on next developments. A more effective, open, and customer-focused food system will be possible with the integration of cutting-edge technologies and fresh ideas.

IV.   PROPOSED SYSTEM

1.8 PROPOSED SYSTEM

Block Diagram :
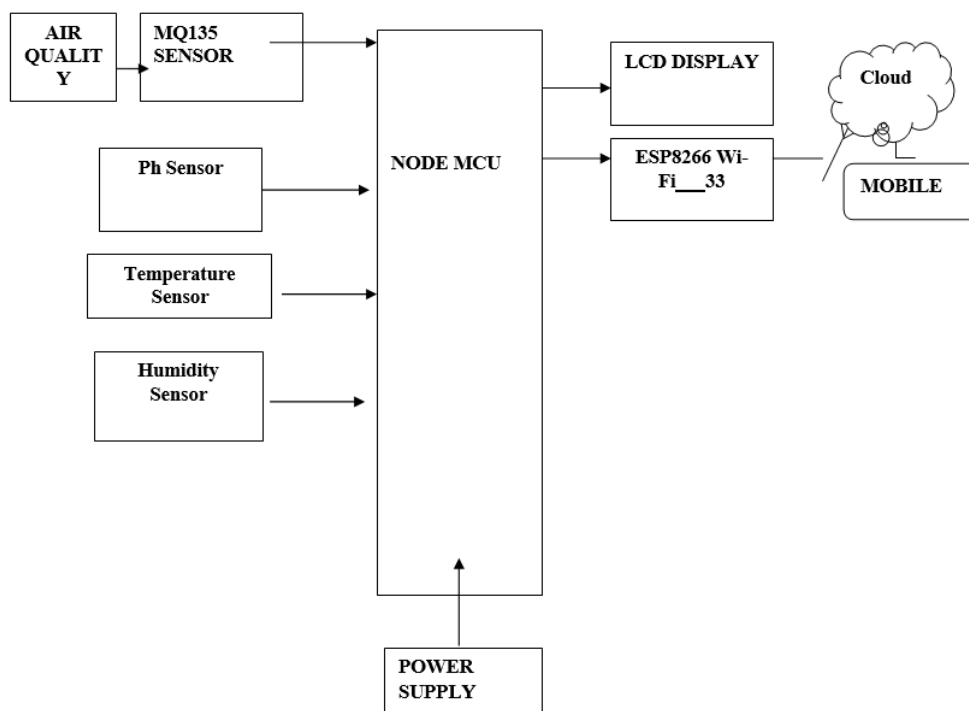
PH sensor:
A pH sensor helps to measure the acidity or alkalinity of the water with a value between 0-14. When the pH value dips below seven, the water starts to become more acidic. Any number above seven equates to more alkaline. Each type of pH sensor works differently to measure the quality of the water.

MQ135 gas sensor :
A device that is used to detect or measure or monitor the gases like ammonia, benzene, sulfur, carbon dioxide, smoke, and other harmful gases are called as an air quality gas sensor. The MQ135 air quality sensor, which belongs to the series of MQ gas sensors, is widely used to detect harmful gases, and smoke in the fresh air. This article gives a brief description of how to measure and detect gases by using an MQ135 air quality sensor.

Humidity sensor :
The humidity sensor is a device that senses, measures, and reports the relative humidity (RH) of air or determines the amount of water vapor present in gas mixture (air) or pure gas. Humidity sensing is related to a water adsorption and desorption process.

Temperature sensor:
A temperature sensor is a device that detects and measures hotness and coolness and converts it into an electrical signal.

ESP8266 wifi:
The ESP8266 WiFi Module is a self contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your WiFi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor.

LCD display :LCD (Liquid Crystal Display) is a type of flat panel display which uses liquid crystals in its primary form of operation. LEDs have a large and varying set of use cases for consumers and businesses, as they can be commonly found in smartphones, televisions, computer monitors and instrument panels.

ThingSpeak:
Thing speak is a managed open-source platform used for prototyping that enables systems and devices to upload data to the Internet and perform data analysis on the uploaded data. It uses HTTPS and MQTT protocols to store and retrieve data from devices and systems. Data can be sent to ThingSpeak from a device or a system, a real-time visualization of the data created, and alerts sent using web services like Twitter and Twilio. (ThingSpeak, 2019) In ThingSpeak platform, devices can be easily configured to send data to the website, the uploaded data can then be aggregated, analyzed using MATLAB and visualized in real time. The data analysis can be done automatically based on schedules [2]. The systems can be connected to the Internet without setting up a server or developing a software.

Methodology :
In this system by using Temperature sensor we can measure the hotness of food and by using moisture sensor we can measure moisture contentment of food. A pH sensor helps to measure the acidity or alkalinity of the water with a value between 0-14. When the pH value dips below seven, the water starts to become more acidic. Any number above seven equates to more alkaline. Each type of pH sensor works differently to measure the quality of the water. and by using MQ135 gas sensor we can measure the the gases like ammonia, benzene, sulfur, carbon dioxide, smoke, and other harmful gases in the food. This values are we can see on lcd display and we can monitor in phone by using think speak app. By using the all sensor's threshold values, we can measure the food quality.

V.   CONCLUSION

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