Monitoring Quality and Safety of Organic Products through Effective Temperature Management

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Abstract: Organic products are becoming increasingly popular due to their perceived health and environmental benefits. However, ensuring the quality and safety of organic products is crucial to maintain consumer trust and meet regulatory requirements. One critical aspect of ensuring product quality and safety is effective temperature management throughout the supply chain.Temperature plays a crucial role in maintaining the integrity of organic products. Organic products are often perishable and susceptible to spoilage, making temperature control essential to prevent bacterial growth, enzymatic reactions, and degradation of nutritional value. Moreover, fluctuations in temperature can potentially compromise the organic integrity of the products, leading to loss of organic certification.To effectively monitor the quality and safety of organic products, a comprehensive temperature management system is vital. This system should include temperature monitoring devices, such as data loggers or sensors, which can track temperature variations during transportation, storage, and distribution. These devices should accurately record temperature readings at frequent intervals and provide real-time alerts in case of temperature deviations.Food safety and hygiene is a major concern in order to prevent the food wastage. The Quality of the food needs to be monitored and it must be prevented from rotting and decaying by the atmospheric factors like temperature, humidity and dark. Therefore, it is useful to deploy quality monitoring devices at food stores. These quality monitoring devices keep a watch on the environmental factor that cause or pace up decay of the food. Later, the environmental factors can be controlled like by refrigeration, vacuum storage etc. In this paper, a similar food quality monitoring device will be designed that will keep watch of environmental factors like temperature, humidity, alcohol content and exposure to light. The device is built on Arduino UNO which is a popular prototyping board. The Arduino board is interfaced with various sensors like DHT-11 to monitor temperature and humidity, MQ135 to detect Ammonia content,MQ136 to detect Hydrogen Sulphide.The Relay is used to Fan On/off status in the room.The sensed values from the different sensor are viewed on an web application.Based on the sensor's data the appropriate data is captured and manipulated based on the limit given in the software.This is an IoT device and sends the measured sensor data to an IoT platform. This interfaced with the Arduino.

Keywords:- Arduino,MQ-135 sensor,MQ-136 sensor, DHT-11 Temperature Humdity Sensor, Relay, Fan,GPS,IOT Device.

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I. INTRODUCTION

Monitoring the quality and safety of organic products is crucial to ensure that consumers receive high-quality, safe, and authentic organic products. One important aspect of monitoring is effective temperature management, as temperature plays a critical role in the quality and safety of organic products.Temperature management is essential for organic products as it helps to control the growth of microorganisms, maintain product integrity, and prevent spoilage. Organic products, such as fruits, vegetables, dairy products, and meats, are highly perishable and sensitive to temperature fluctuations. Improper temperature management can lead to accelerated spoilage, bacterial growth, and reduced product shelf life.To effectively monitor the quality and safety of organic products, it is important to implement temperature controls at every stage of the supply chain - from production and storage to transportation and retail. This involves using temperature monitoring devices, such as data loggers or temperature sensors, to continuously monitor and record the temperature conditions.In production, organic farms and processing facilities must ensure that the temperature conditions are optimal during harvesting, washing, sorting, and packaging. For example, certain organic fruits and vegetables require specific temperature ranges to preserve their quality and prevent post-harvest losses.During storage, organic products need to be stored at proper temperatures to maintain their freshness and nutritional content. Cold storage facilities and refrigerated trucks play a critical role in preserving the quality and safety of organic products, especially for perishable items like dairy and meat.Transportation also poses temperature challenges, as organic products may be subject to temperature fluctuations during transit. Shipping containers or delivery trucks should have temperature-controlled systems to maintain the required temperature conditions.Retailers and consumers should also handle organic products properly to ensure their safety. Retailers need to maintain proper temperature conditions in refrigerated sections and follow best practices for handling and storing organic products.Effective temperature management can be achieved by implementing standard operating procedures (SOPs) and Good Manufacturing Practices (GMP) that outline temperature control measures. Regular monitoring, calibration, and maintenance of temperature monitoring equipment are also crucial to ensure accurate measurements and reliable data.Monitoring the quality and safety of organic products through effective temperature management is vital to ensure that consumers receive high-quality, safe, and authentic organic products. Proper temperature control at every stage of the supply chain is essential to prevent spoilage, maintain product integrity, and maximize product shelf life. By implementing temperature monitoring devices and following best practices, organic producers, retailers, and consumers can ensure that organic products are of the highest quality and meet the expectations of organic standards.The food we consume can affect in any form of contamination that may occur due to storage or chemical changes within the food. There are several viruses and bacteria that causes food contamination and leads to numerous food borne diseases, for example Norovirus a very contagious virus caused by contaminated food or water. About 351,000 people die of food poisoning globally every year. In some countries, majority of people struggles on daily basis for food, due to preservation of foods and use of chemicals to artificially increase the time span of food causes people illness. It is necessary to develop a system that can help people to identify the freshness of food or quality of food items. Our proposed system may give the good quality (freshness) management in food. It is based on electrical, and sensors.sensors play a vital role to detect the bacterial contamination in food sample. Based on the combination of the sensor outputs quality of the food should be detected.

II. LITERATURE SURVEY

Literature survey is gathering the information of previous work done related to your project. It contains the research study year, researchers name, technologies used and drawback of the system.

Installed Measurement Devices monitoring systems:

These frameworks are the better forms of the manual Framework. Estimation gadgets for environmental circumstances are introduced inside the food store. But there is no programmed handoff of data. One needs to go to the store to find data about the ongoing environmental circumstances and food conditions. Postponements in estimation perusing, the disappointment of gadgets, and the upkeep of gadgets are a portion of the weaknesses of the framework which would have an adverse effect on food quality.[1]

Artificial Intelligence technology in Food quality monitoring system

To foster a clever framework, man-made consciousness(Simulated intelligence) covers various strategies. Among a few AI procedures, the fluffy rationale is a method that is utilized to handle the fluffy data and rule-based surmising to develop choice help, all things considered, applications.The Fluffy set hypothesis is applied to assess the expiry of food wares
[2].

Deep Learning Technology in Food quality monitoring system Profound learning assists the machine with acting like the human mind by extricating highlights naturally by brain organization and afterward preparing them to decide. In the framework has been suggested that takes food variety as a central point of deterioration.[3]

Machine Learning technology in Food quality monitoring system

Machine learning (ML) is a process that uses sample data to train the model in order to make decisions.The proposed system in [8] uses ML systems such as GPRand SVR to calculate the age of fruit and decide the edibility of the fruit. In the food spoilage is determined using PCA and KNN algorithms of machine learning. The information from MQ gas sensors is fed to PCA to reduce the data. It also uses KNN for classification of food. [4]

Problem Definition

The project "Monitoring Quality and Safety of Organic Products through Effective Temperature Management" is motivated by the pressing need to address challenges in preserving the integrity of organic products across their supply chain. The primary problem revolves around the susceptibility of organic items to quality degradation and safety risks due to temperature fluctuations during production, storage, transportation, and retail. Maintaining compliance with stringent organic standards poses a challenge for producers and retailers, requiring a comprehensive temperature management system to ensure that these products meet authenticity and quality criteria. Moreover, the global concern of food contamination amplifies the urgency for innovative solutions. The project introduces an electrical sensor- based system, built on Arduino UNO and interfaced with various sensors, to detect bacterial contamination and assess the overall quality of organic food items. Integrating Internet of Things (IoT) technology adds complexity, demanding seamless coordination between monitoring devices, data transmission, and real-time analysis. The project aims to overcome these challenges by developing a robust system that not only captures and interprets sensor data but also incorporates proactive measures based on predefined limits, etc.

III. BLOCK DIGRAM

In our design, Arduino board acts as the heart of our system.The food quality monitoring device designed in this project is based on Arduino.Our project is solely based upon Arduino.

1. Arduino
2. MQ-2 sensor
3. Flame sensor
4. DHT-11 Temperature Humidity Sensor
5. MQ-135 Sensor
6. MQ-136 Sensor
7. GPS
8. Fan
9. Relay

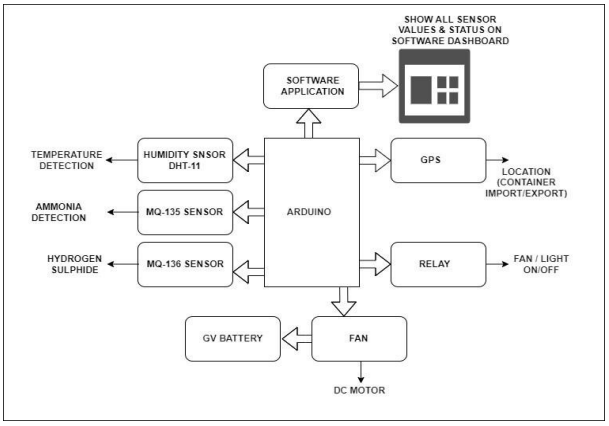

Fig: Block Diagram

VI. SYSTEM DESIGN

As shown in Fig. It consists of, Arduino microcontroller, DTH11, sensor,MQ 135Sensor,MQ-136 Sensor ,Relay,Fan,GPS. Hardware implementation deals in drawing the schematic on the plane paper according to the application, testing the schematic design over the breadboard to find if the design meets the objective, carrying out the layout of the schematic tested on breadboard, finally preparing the board and testing the designed hardware. The Arduino board is interfaced with various sensors like DHT-11 to monitor temperature and humidity, MQ135 to detect Ammonia content,MQ136 to detect Hydrogen Sulphide.The Relay is used to Fan On/off status in the room.The sensed values from the different sensor are viewed on an web application.Based on the sensor's data the appropriate data is captured and manipulated based on the limit given in the software.This is an IoT device and sends the measured sensor data to an IoT platform. This interfaced with the Arduino. The sensor data is also displayed on a interfaced with the Arduino UNO. The IoT platform used for logging and monitoring of sensor data is embedded spot.The food is monitored through the sensors and converted into analog values to be displayed on the IoT platform to be monitored wherever required.The MQ gas series plays important role in this aim.

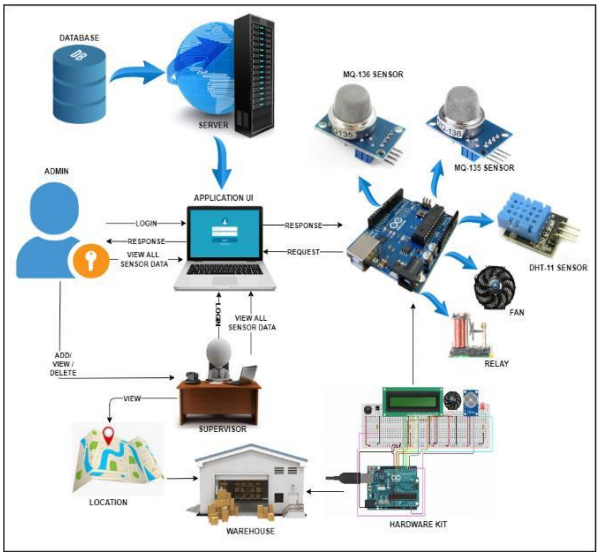

Fig: System Architecture

V. PROPOSE WORKING

This project proposes a system to analyze the ambient conditions under which the food item is being stored and transported. The proposed solution senses the temperature, humidity, alcohol content and light parameters of surrounding environment as these parameters affect nutritional values of food items. This system makes use of storage units implanted with various electronic sensors which can read those parameters affecting food materials. These quality monitoring devices keep a watch on the environmental factor that cause or pace up decay of the food. Later, the environmental factors can be controlled like by refrigeration, vacuum storage etc. The proposed solution is designed to use an IoT platform used for logging and monitoring of sensor data. With the power of Internet of Things, the environmental factors affecting the food storage can be monitored from anywhere, anytime and from any device.

Area of Project: IOT

VI. PROPOSE SYSTEM

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VII. FUTURE SCOPE

The future scope of monitoring quality and safety of organic products through effective temperature management lies in the integration of advanced Stand. Abbrev., in press.technologies, data analytics, and compliance with regulations. These advancements will not only enhance product safety but also strengthen consumer confidence in organic products.

VIII. CONCLUSION

In conclusion, effective temperature management is crucial in monitoring the quality and safety of organic products. Organic products are highly sensitive to temperature fluctuations and improper storage conditions can lead to spoilage, loss of nutritional value, and the growth of harmful bacteria.By implementing effective temperature monitoring systems, such as temperature sensors, data loggers, and real- time monitoring software, organic product producers can ensure that optimal storage conditions are maintained throughout the supply chain. This allows for early detection and prevention of temperature deviations, minimizing the risk of product deterioration and ensuring that organic products meet the desired quality and safety standards.Monitoring the quality and safety of organic products through effective temperature management is essential for ensuring consumer satisfaction and meeting regulatory requirements. It helps in maintaining product integrity, preventing spoilage, and upholding the core principles of organic farming. With the advancements in temperature monitoring technology, organic product producers now have the tools to effectively monitor and manage temperature throughout the supply chain, ensuring the delivery of high-quality and safe organic products to consumers.

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