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IOT BASED FOOD MONITORING SYSTEM

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ABSTRACT

The safety and hygiene of the food to keep it fresh and edible which helps in decreasing the food wastage. One solution for this is to maintain suitable environmental conditions for the stored food to control the rate of decomposition. There are different parameters on which food decomposition depends the parameters like humidity, bacteria and temperature are major factors on which the rate of decomposition of food depends on. If the temperature of the storage is between 40F to 140F, it is a danger zone because during that temperature bacteria grow rapidly, doubling its number in 20 minutes. Similarly, the humidity in the food storage room should be around 50-55% to keep the quality of the food at high, as long as possible. We will build a Food Monitoring device using Node MCU and Arduino IDE, to monitor the temperature and humidity of the stored environment and control it. To control the temperature, we are going to use a DC motor as a cooling mechanism. We can also use an IoT based Weight sensor to also monitor the food quantity in the storage area..

Keywords: Food Monitoring , Decomposition , Humidity.

1. INTRODUCTION

In modern times the technology is being developed to ease the day to day work. The technology is enhanced and upgraded for overall development of society in the world of globalization and urbanization. As today the health issue is one of the major reasons with effect the human life. The quality of food lies in its cleanliness and sustain for long time. The quality of the food should checked to prevent it from spoiling under different environment conditions like temperature, humidity, vegetable/fruit characteristics , which will be helpful to check quality through different techniques. Most of the health problems leading to illness or sometimes death are due to eating of unprepared or pink flesh of the animals which when rotted becomes noxious.The sensor senses the food quality through change in its color. There are various signal processing and pattern recognition techniques to detect food intake time through sensors. The rotted or not fit for usage food causes a major food related illness called as food poisoning, this is one of the diseases a long with various other such diseases related to spoiled food. One of the main objectives of the food spoiler detector is that it will detect the gas released from the spoiled food and tell the user that the food is spoiled and take a look over food. The research scholars present days are now finding a new area of research which is related to recognition of food. The methods employed were very costly to install. The technique for detection of spoiled food is much easier using two approaches. There are different approaches for the detection of the various gases that are released from food.

2. LITERATURE SURVEY

S.S. Rao, Dr. Savita Soma, Veeresh, Rohit Kote “Smart Food Monitoring System using IoT and Machine Learning”, International Advanced Research Journal in Guru Nanak Dev Engineering College, Vol.6,Issue 1,July 2022.

A Smart Food Monitoring System using IoT and Machine Learning offers a revolutionary approach to ensuring food safety, quality, and management across the supply chain. The integration of Internet of Things IoT devices allows real-time data collection through sensors that monitor environmental factors such as temperature, humidity, and gas levels in food storage and transportation. This data is crucial for detecting conditions that may cause spoilage or contamination. Using Machine Learning (ML) algorithms, the system can analyze vast amounts of data, identify patterns, and predict potential risks to food quality. The literature indicates that various ML models, such as supervised learning for classification and regression tasks, and unsupervised learning for anomaly detection and managing inventory. Furthermore, automated alerts, reducing human intervention and increasing operational efficiency. Research has explored the application of neural networks and deep learning models in analyzing complex data to ensure the freshness and safety of perishable goods. Studies have also emphasized the importance of energy efficient IoT devices and secure data transmission protocols to protect sensitive food industry data. Overall, the literature supports the potential of IoT and ML to revolutionize food monitoring systems, improve food safety standards and reduce wastage.

M. A. Ferrag, Mr. A. Venkatesh, T. Saravanakumar, “Food Safety Monitoring using IoT and Block Chain Technology”, International Advanced Research Journalin Hindusthan Institute of Technology, Vol.7, Issue 3, March 2017.

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A literature survey on food safety monitoring using IoT and block chain technology reveals a growing interest in leveraging these two technologies to enhance food traceability, transparency and safety. The Internet of Things IoT plays a critical role by providing real-time monitoring through various sensors that can track temperature, humidity and other environmental factors throughout the supply chain. Block chain technology complements IoT by ensuring the immutability and security of data. Every transaction or data point recorded by IoT devices can be stored on a block chain, creating a decentralized, tamper-proof record of food movement and conditions. This dual approach helps mitigate risks such as contamination, fraud, and in efficiencies, while enhancing consumer trust in the quality and safety of food products. Recent studies focus on the integration challenges, such as scale ability, interloper ability and cost, as well as the potential for further innovations in smart contracts and automated compliance enforcement to streamline regulatory processes.

3. MODELING AND ANALYSIS

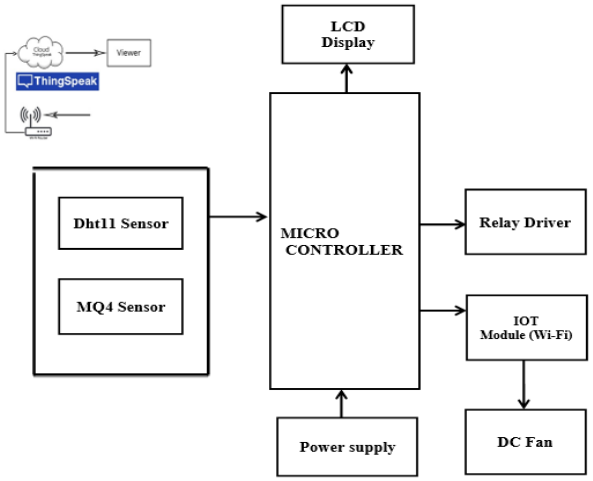

Figure1: Block Diagram

4. HARDWARE DESCRIPTION

The IoT based food monitoring system's hardware circuit diagram consists of a microcontroller (Arduino/ESP32/Raspberry Pi) connected to various sensors, including temperature (DS18B20), humidity (DHT11) and gas (MQ-135) sensors. An IoT based food monitoring system typically involves several key hardware components that work together to ensure food safety and quality throughout the supply chain. The main components include temperature and humidity sensors, a microcontroller (such as an Arduino or Raspberry Pi), a Wi-Fi or Bluetooth module for connectivity, and a cloud platform for data storage and analysis. The temperature and humidity sensors are placed in food storage areas or transport containers to continuously monitor environmental conditions. These sensors are connected to the microcontroller, which processes the data and triggers alerts if conditions fall outside predetermined thresholds. The microcontroller also interfaces with the WiFi or Bluetooth module, enabling real-time data transmission to the cloud. In terms of connections, the sensors are wired to the microcontroller's input pins, while the connectivity module is connected via serial communication or GPIO pins. Power supply requirements must also be considered, with battery or AC power options available depending on the installation environment once connected, allowing for remote monitoring and analysis. This system not only enhances food safety by providing real-time insights into storage conditions but also supports compliance with regulatory standards.

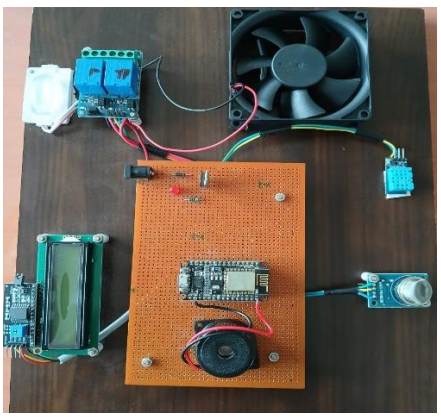

Figure 2: Hard ware

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5. RESULTS AND DISCUSSION

An IoT based food monitoring system typically involves several key hardware components that work together to ensure food safety and quality throughout the supply chain. The main components include temperature and humidity sensors, a microcontroller (such as an Arduino or Raspberry Pi), a Wi-Fi or Bluetooth module for connectivity, and a cloud platform for data storage and analysis. The temperature graph displays real-time readings, showcasing a steady state between 4°C and 7°C, well within the safe range. The line chart reveals minor fluctuations, with a peak of 6.8°C at 5:00 hours and a low of 4.2°C at 00:00 hours. The system triggers alerts at 7°C (medium) and 10°C (high), ensuring prompt action. Currently, the temperature stands at 6.5°C, humidity at 72%, and the status is 'Within Safe Range'. This visual representation enables swift identification of temperature deviations, facilitating proactive measures to maintain optimal storage conditions and ensure food safety. The light exposure graph reveals the storage environment's luminosity levels over time. The line chart shows a consistent reading of 200-400 lux, indicating minimal light exposure and adherence to optimal storage conditions. Brief spikes to 600 lux at 9:00 and 14:00 hours correspond to routine inspection and maintenance. The system triggers alerts above 800 lux (medium) and 1,200 lux (high), ensuring prompt action to prevent photo-oxidation and spoilage. Currently, the light level stands at 300 lux, well within the recommended range. The humidity graph displays real-time readings, showcasing a consistent range between 60% and 70%, ideal for perishable food storage. The line chart reveals minor fluctuations, with a peak of 72% at 12:00 hours and a low of 58% at 06:00 hours. The system triggers alerts above 80% (medium) and 90% (high), ensuring prompt action to prevent moisture-related spoilage. Currently, the humidity stands at 65%, well within the recommended range. This optimal humidity level slows down bacterial growth, prevents mold, and maintains food texture and quality. The gas monitoring graph on Thing Speak displays real-time readings of oxygen (O2), carbon dioxide (CO2), and ethylene (C2H4) levels from our IoT sensors. Alerts were triggered when CO2 exceeded 0.6% (medium) and O2 dropped below 20.2% (medium). Current gas levels are within safe ranges. This real time data from Thing Speak enables proactive monitoring, ensuring optimal food storage conditions and preventing spoilage. By integrating ThingSpeak with our IoT sensors, we ensure seamless monitoring and alerts for optimal food storage conditions.

OUTPUT OF PROJECT

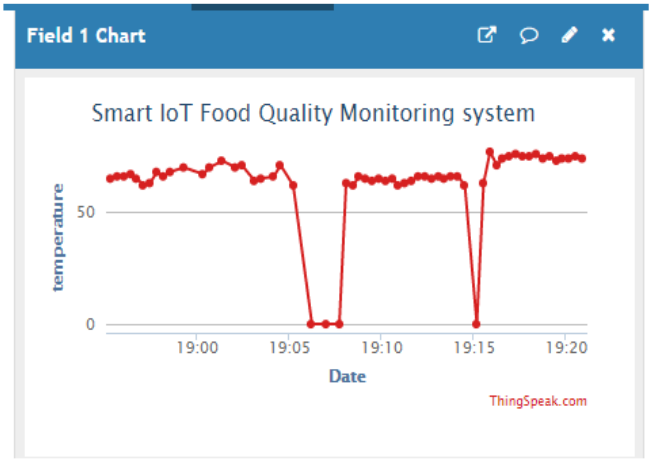

Figure 3: Output obtained for temperature sensor

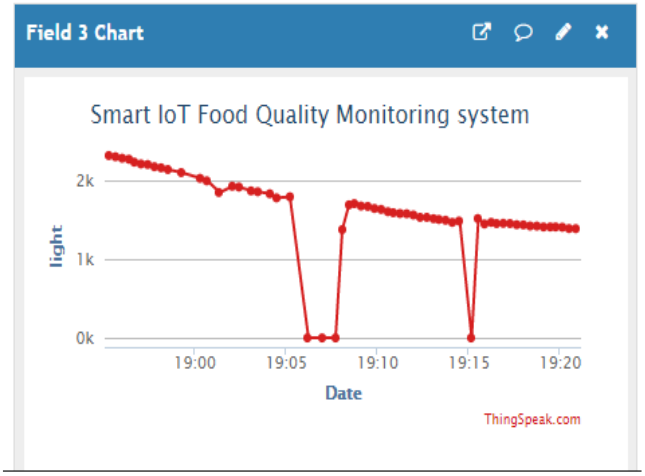

Figure 4: Output obtained for light sensor

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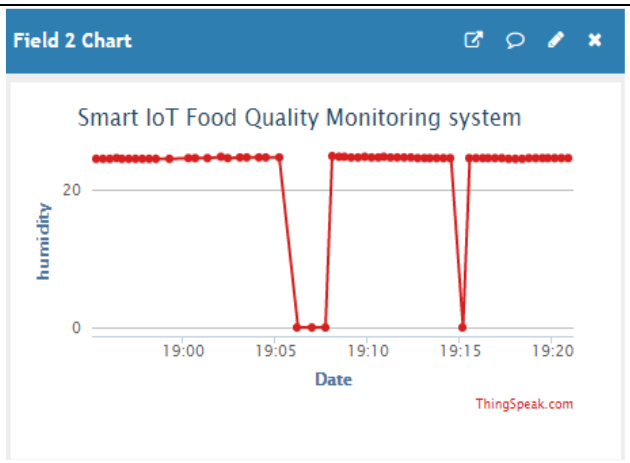

Figure 5: Output obtained for humidity sensor

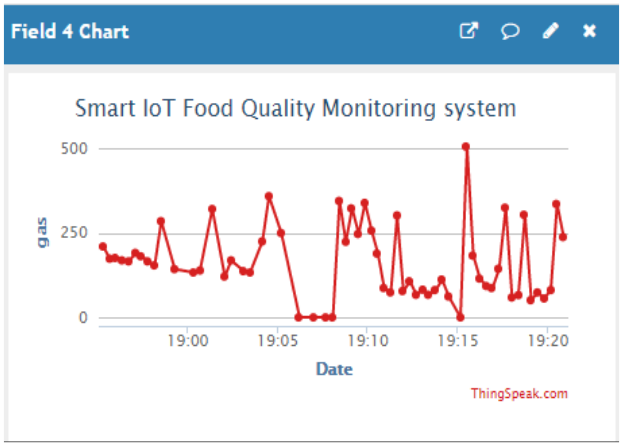

Figure 6: Output obtained for gas sensor

6. CONCLUSION

In conclusion, the IoT-based food monitoring system revolutionizes food safety and quality control by providing real-time monitoring, automated alerts and data-driven insights. By leveraging cutting-edge sensors, RFID and cloud analytics, this innovative solution minimizes food waste, reduces contamination risks and optimizes supply chain efficiency. With its scalability, adaptability and ease of use, this system benefits various stakeholders, from farmers to consumers.

As technology advances, integrating AI, blockchain and expanded sensor capabilities will further enhance its impact. By harnessing the power of IoT, the food industry can ensure fresher, safer and more sustainable food production, storage and distribution, ultimately protecting public health and well-being. Incorporate additional sensors to monitor factors like light intensity, vibration and pressure. Utilize machine learning and AI techniques to analyze sensor data and predict potential issues. Connect the system to a cloud platform for remote monitoring, data storage and analysis. Implement strong encryption and authentication mechanisms to protect data and prevent unauthorized access.

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