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INVESTIGATION OF FOOD SAFETY METHODS USING IOT TECHNOLOGY

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Abstract
When food spoils in the refrigerator, harmful microorganisms grow. Our essential objective is to abandon that food. Food that has been spilled shouldn't be eaten because it could be very harmful to people. By preserving the necessary standard ambient conditions for food quality, it serves the purpose of consumer health protection. The economy of a country and the health of its citizens both depend on food safety. The critical requirements of reducing food waste, increasing transportation efficiency, and tracking food contamination can all be met by the integrated loT-based onto monaste, nereasin employing smart logistics. The majority of customers only care about the ingredients and how healthy they are. MQ4 Sensor food spoilage detection is the primary focus of our project. Sensors are one of the project's components. A process or change that makes a product unsuitable for consumption is one definition of food spoilage. The LED light indicator changes to indicate that the food has spoiled when it has gone bad. In addition to the light indicator, a buzzer sound and a message about the food's status are sent to the user. Sequence of events that lead to food spoilage Microorganisms must enter the food from one or more sources. The food environment encourages the growth of microbes. Food must be stored for a sufficient amount of time to allow for the necessary number of microbes to enter the food and cause changes or spoilage. The boundaries like moistness, microorganisms, and temperature are central point on which the pace of disintegration of food relies upon. In the event that the temperature of the stockpiling is between 40F to 140F, it is a peril zone since, microorganisms develop quickly, multiplying its number in 20 min. Similarly, the humidity in the room where the food is stored should be between 50 and 55 percent. As a result, a Food Monitoring device is used in this loT project to measure and display real-time values of temperature, humidity, and methane gas, which are important indicators of food quality. A notification will be sent to the user via an app in the event that the temperature reaches the critical value.

Keywords: LED, MQ4 sensor, Buzzer, IOT

I. Introduction

Food deterioration can be recognized in numerous ways. Our venture for the most part centers food deterioration discovery utilizing Sensor. Sensors are one of the project's components [2]. A process or change that makes a product unsuitable for consumption is one definition of food spoilage [3]. On decay of the food the light marker changes to demonstrate that food is ruined. The status of the food is communicated to the user in addition to the light indicator.[4],[5],[6] Food spoilage occurs in a series of events: Microorganisms must enter the food from one or more sources; the food environment encourages microbe growth; and food must be stored for enough time. To permit adequate important to cause decay or changes in food. Having a device that could identify the spoiled food by detecting the color change occurred in food will be useful [1], [7]. Not only in households but also in the

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industries having a system which can detect the spoilage in food will be much useful for the business people to grade them up.

II. Related work

S. NO	AUTHOR NAME	PROBLEM STATEMENT	TECHNIQUES USED	ACCURACY/RESULTS	DRAW BACKS
1	T K Gannavaram, V, R Bejgam, S B Keshipeddi, S Sunkari, V K Aluvala [6]	Food determination/nutritional security	IoT for interfacing objects/sensors.	**93.6**	
2	T K Gannavaram, V, R Bejgam [7]	Recognizability framework in dealing with transitory food detects the smell in spoiled meat	Electric Nose	**87.3**	It is difficult
3	P A Ravi Chander, G Lovina, Shiva Kumari [3]	Detect the spoilage in the raw milk	Arduino board	94.5	Very poor detection

III. Existing system

The food will remain in the refrigerator for days, and even if it is spoiled or not, we don't think about it because we keep it there.

Microorganisms grow there and spread throughout the refrigerators as a result. When we noticed a smell coming from the fridge, we learned about that.

Using various sensors, a prototype Arduino was developed to identify spoiled food.

The necessary sensors are housed in an esp8266 node MCU and an Arduino for this prototype.

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DRAWBACKS OF EXISTING SYSTEM

- Existing system requires 2 components to be installed for the detection to work properly.
- Expensive

IV. Proposed system

This device keeps an eye on the food that is stored in the refrigerator. It uses a sensor (MQ4) to detect the methane gas that is released when food spoils and sounds a buzzer to notify the person.
The alcohol content and light parameters of the surrounding environment, which have an impact on food's nutritional value, are detected by the proposed system for analyzing the ambient conditions. The proposed arrangement is intended to utilize an IoT stage utilized for logging and checking of sensor information. With the force of Web of Things, the natural elements influencing the food stockpiling can be observed from anyplace, whenever and from any gadget.
In order to interpret the parameters that have an effect on foodstuffs, this device makes use of storage units that have been outfitted with a variety of electronic sensors.

V. System model

SYSTEM ARCHITECTURE

The below figure 1 depicts shows the block diagram of food spoilage detection system. 5 volt power supply is given to Wi-Fi ESP 32. The outputs of ESP 32 are given to buzzer, green and red LED lights and MQ4 sensor.

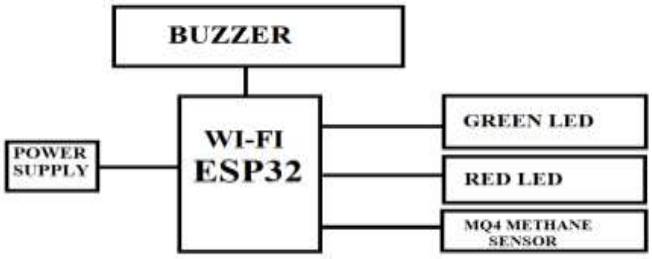

Figure 1. SYSTEM ARCHITECTURE

5.1 Flow of the Project

The figure 2. MQ4 sensor senses the methane gas from the food. After sensing it sends the inputs to the microcontroller and checks the methane level. If it crosses the cutoff value, an alert is sent through the buzzer, LED and app.

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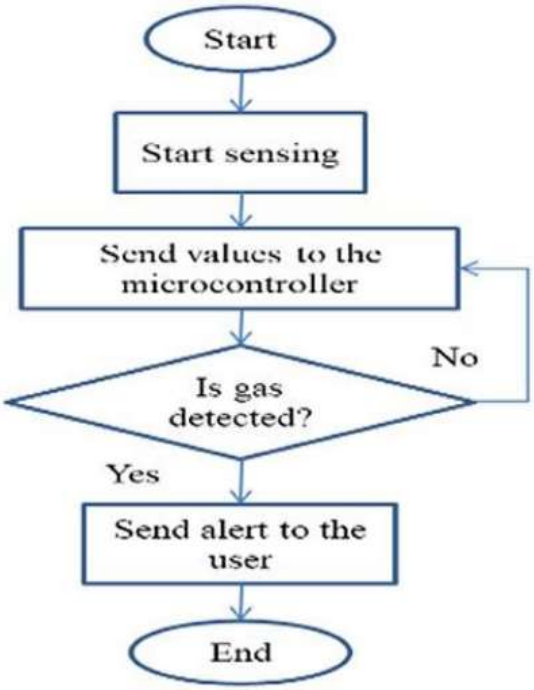

Figure 2. FLOW OF THE PROJECT

5.2 Use Case Diagram

A use case diagram that is shown in figure 3 is a type of behavioral diagram that is the result of a Use-case analysis and is written in the Unified Modeling Language (UML). Its will probably show a graphical outline of a framework's usefulness with regards to entertainers, their objectives (displayed as use cases), and any conditions between use cases.

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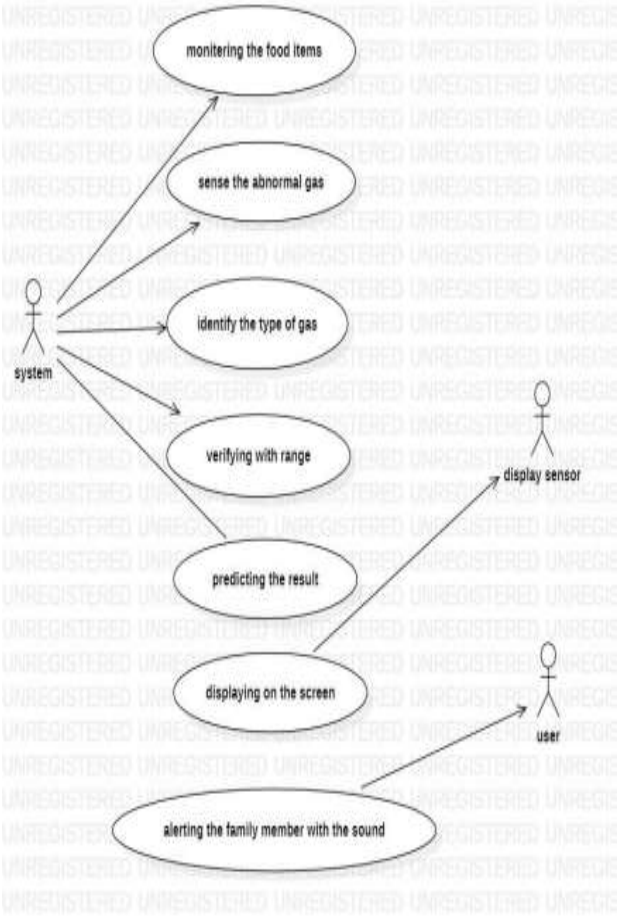

Figure 3. USE CASE DIAGRAM

5.3 Deployment Diagram

The system's deployment view is depicted in a deployment diagram which is figure 4. It is connected to the diagram of the components. Because the deployment diagrams are used to place the components. Nodes make up a deployment diagram. Nodes are merely physical hardware's used to deploy the application.

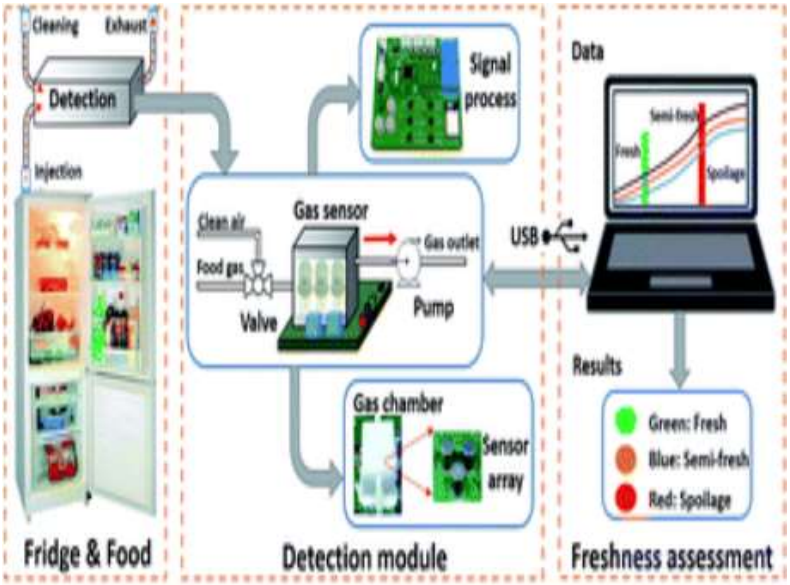

Figure 4. DEPLOYMENT DIAGRAM

5.4 Component Diagram

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The component diagram is shown in figure 5. A section frame, generally called an UML part graph, depicts the affiliation and wiring of the real parts in a structure. Part outlines are frequently drawn to demonstrate execution subtleties and double-check that arranged development covers each component of the framework's essential capabilities.

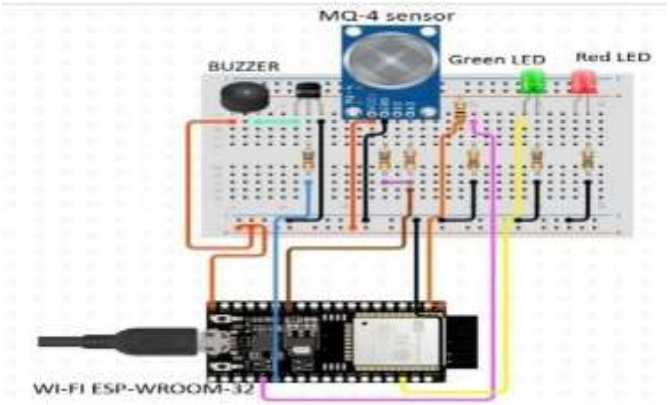

Figure 5. COMPONENT DIAGRAM

VI. Result and analysis

6.1 NO INPUT (INITIAL CONDITIONS)

The figures 6 and 7 shows the initial conditon of the project along with the observations in the serial monitor.

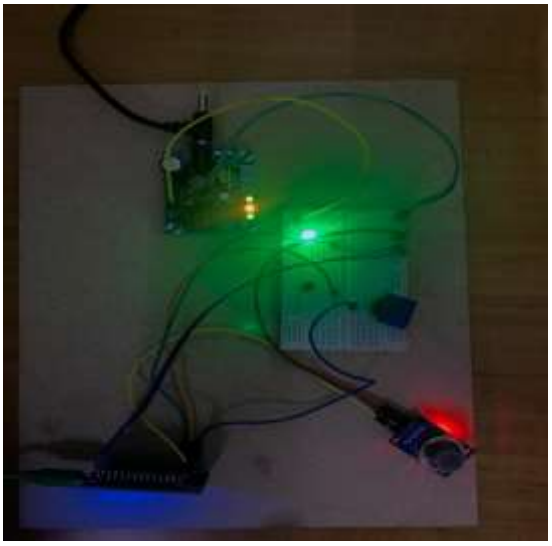

Figure 6. Initial condition (No input- GREEN LED)

Figure 7. Observations recorded with no input

6.2 CONSUMABLE FOOD AS INPUT (NORMAL CONDITION)

The figures 8-10 shows the normal condition when consumable food is being experimented resulting in a green light and also observations in serial monitor can be observed.

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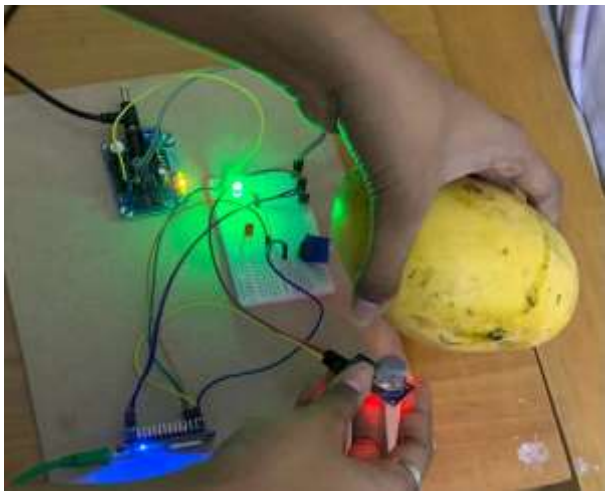

Figure 8. CONSUMABLE FOOD AS INPUT (NORMAL CONDITION- GREEN LED)

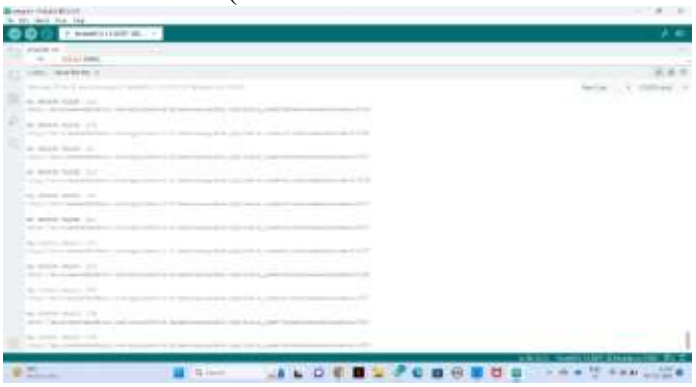

Figure 9. Observations recorded with CONSUMABLE FOOD AS INPUT

Figure 10. Observations recorded in FOOD SPOILAGE APP with CONSUMABLE FOOD AS INPUT

6.3 SPOILED FOOD AS INPUT (WARNING)

The figures 11,12,13 and 14 depicts the warning condition when spoiled food is being tested resulting in red LED light glow and send alert through the buzzer as well as through the app.

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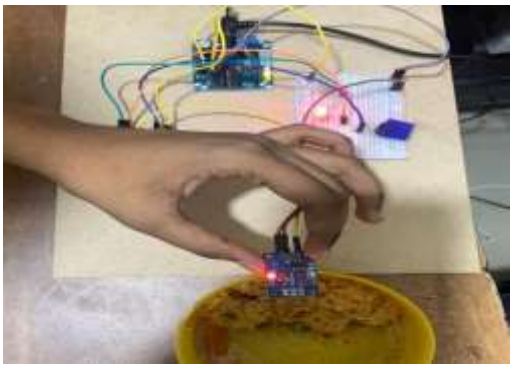

Figure 11. Spoiled Food as input

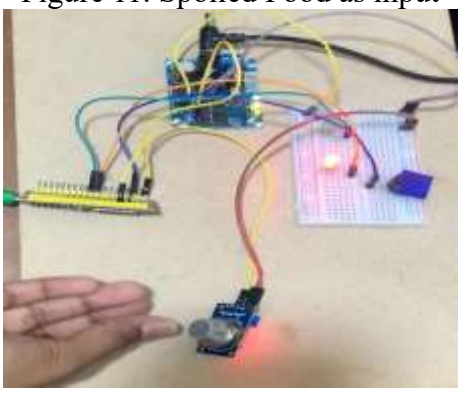

Figure 12. Spoiled Food as input (RED LED + BUZZER ALARM)

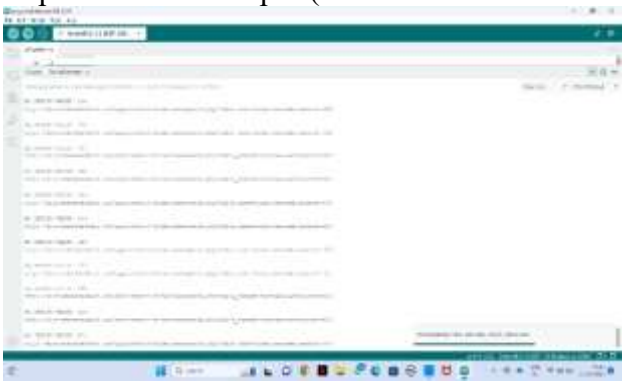

Figure 13. Observations recorded with Spoiled Food as input (RED LED + BUZZER ALARM)

Figure 14. Observations recorded in FOOD SPOILAGE APP with Spoiled Food as input

Conclusion and future scope

This study presents an original strategy for Observing and investigation of food deterioration utilizing a sensor bases framework. Food can be preserved for a longer period of time with the device that this study proposes. Moreover, food things can be kept from getting ruined by expanding their life expectancy. It keeps track of the quality of the food and keeps letting the user know about it through voice commands or a display. It also gives the user warnings about how long it will take for the food to spoil. The proposed device is 95 percent accurate. Image processing and machine learning algorithms for early spoilage detection can enhance the proposed smart device. This can be used in refrigeration frameworks for distinguishing food things, waste and checking for avoidance of food deterioration. Other food types could be tested with the device as well.

References

1. Kaushal, R.K., Harini, T., Lency, D.P., Sandhya, T. and Soniya, P., 2019. Iot Based Smart Food Monitoring System. International Journal of Current Engineering and Scientific Research, 6(6), pp.73-76.
2. Popa, A., Hnatiuc, M., Paun, M., Geman, O., Hemanth, D.J., Dorcea, D., Son, L.H. and Ghita, S., 2019. An intelligent IoT-based food quality monitoring approach using low-cost sensors. *Symmetry*, *11*(3), p.374.
3. Chander, B.R. and Kumari, G., 2020. Food quality monitoring system by using arduino. *J Eng Sci*, *11*, pp.625-30.
4. Yu, B., Zhan, P., Lei, M., Zhou, F. and Wang, P., 2020. Food quality monitoring system based on smart contracts and evaluation models. *IEEE Access*, *8*, pp.12479-12490.
5. Hebbar, N., 2020, February. Freshness of food detection using IoT and machine learning. In *2020 International Conference on Emerging Trends in Information Technology and Engineering (ic-ETITE)* (pp. 1-3). IEEE.
6. Bejgam, R., Keshipeddi, S.B., Sunkari, S. and Aluvala, V.K., 2021, July. Conversion of Sound Energy into Electrical Energy in Highly Populated Areas. In 2021 6th International Conference on Communication and Electronics Systems (ICCES) (pp. 32-36). IEEE.
7. Bejgam, R., 2021, March. Brief study and review on the next revolutionary autonomous vehicle technology. In *2021 International Conference on Advance Computing and Innovative Technologies in Engineering (ICACITE)* (pp. 34-37). IEEE.