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INTELLIGENT FOOD MONITORING AND ALERT SYSTEM USING BLUETOOTH LOW ENERGY AND IOT SENSORS

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ABSTRACT: This research shows how to make an Intelligent Food Monitoring and Alert System that uses Internet of Things (IoT) and Bluetooth Low Energy (BLE) devices to constantly check the safety and quality of food. The system monitors storage conditions for spoiling using temperature, humidity, and gas sensors. Using Bluetooth Low Energy (BLE), IoT devices communicate data to a mobile or cloud platform for analysis and display. The proposed system reduces waste and health concerns by detecting spoiled food early. Alarms and warnings are provided immediately when environmental conditions exceed safety limits. Because BLE technology uses less energy, the system can be used for a long time in supply lines, restaurants, and households. It also logs data for trend tracking and predictive analysis. The affordable, expandable architecture makes it straightforward to link to digital storage systems. The study enhances food safety, operations efficiency, and the environment using intelligence analytics and IoT connectivity. Given these features, the suggested method is a reliable, automated, and smart way to handle and monitor food.

Keywords: *Intelligent Food Monitoring, Bluetooth Low Energy (BLE), IoT Sensors, Food Safety Management, Real-Time Alert System.*

1.INTRODUCTION

The 1995 GATT report states that controlling international food trade is necessary to protect public health. The agreement outline compensated for this. Recent years have seen greater attention to food safety issues such food poisoning, mad cow disease, bird flu, foot-and-mouth disease, and swine crush. These events have delayed economic progress and threatened worldwide public health. This shows the growing importance of food safety rules and inspections

Many people benefit from meat, milk, fish, and fruit, but most must make their own choices. Traditional product evaluation and tracking approaches fail to solve these concerns. A simple and effective system for monitoring, managing, evaluating, and documenting all pertinent data is needed to assure food safety.

Modern food production involves processing, transportation, and stocking. Before serving, the dish must go through these steps. Food management concerns like transportation hassles can cause food deterioration and poor food security. A good food safety system should send the seller information about dispatched orders, consumer food safety and quality reviews, producer market research reports, and other pertinent data.

A food quality monitoring and recording system integrating IoT and Bluetooth low energy to control and monitor food safety is one creative solution. The Internet of Things and Bluetooth Low Energy (BLE)

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can detect items without human touch. These tools enable global information sharing and monitoring. They use cutting-edge database and network technology to autonomously detect targets and collect radio frequency wave data.

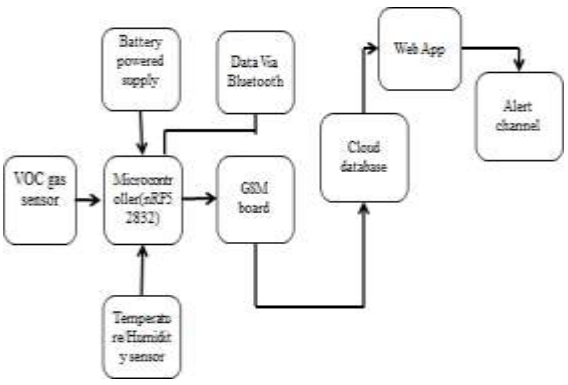
Internet of Things technology outperforms bar code technology in many situations. It can encrypt data, read it forever, find tasks autonomously, and read enormous amounts of data from far away. After deployment, product tracking management will change significantly.

This study describes an IoT-based food safety monitoring method. Additionally, we compare Bluetooth Low Energy (BLE) to the Internet of Things.

It provides all the information needed for transportation, packaging, repackaging, and production from new varieties' growth to sale. Every step of the food chain has real-time data. Reading and writing data anywhere and anytime enhances food quality by making ingredients easier to find.

The business concept, system design, and strategy implementation of an IoT food delivery chain are examined in this article. Business process analysis underpins it.

2.BLOCK DIAGRAM



1. EXSISTING WORK

- Kong Xiansheng and Sun Jing developed a Near Field Communication (NFC)-based system to assess food quality.Their system uses an exterior probe and a pH monitor, with increased space between the pH meter's resonance circuit and electrodes.
- The sensor electrodes are wrapped in hydrogel, forming an electrolytic solution that absorbs water.The resonant circuit consists of an electrical monitor and a magnetic coil for signal detection.
- AbeerAlsahejari and Vassilis Kodogiannis (July 2016) developed a fuzzy-wavelet neural network model to detect substandard meat.Their system uses temperature and humidity sensors to measure moisture content and temperature of food products.
- Teer Akiratkerdcharoen, Phurnvirachongthanasphisut, and Tharaseesaared (August 2015) were the first to use an electronic nose (e-nose) in smart homes to monitor bacterial contamination in canned food.
- This method applies Principal Component Analysis (PCA) to evaluate preserved food items and detect ammonia levels.Sharmitha Bhadra and Douglas J. Thomson (July 2015) studied a pH-sensitive polymer electrode CO_2 sensor.
- The sensor measures atmospheric CO_2 levels based on voltage variations and is integrated into a chipless near-field RFID tag.

4. PROPOSED METHOD

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The microcontroller and the server can talk to each other through Bluetooth Low Energy in this setting. Bluetooth Low Energy (BLE) uses much less power than Bluetooth, which can use up to 30mA in this case.The system is small when compared to other systems on the market.

nRF52832MICROCONTROLLER:

The nRF52832 has a powerful Cortex-M4F CPU that lets it run even the most difficult apps with complex math needs on a single device. With DSP instructions, a Floating Point Unit (FPU), single-cycle multiply and collect, and hardware division, the integrated circuit (IC) can do a lot of work with not much power. There are many modes that the 2.4GHz radio can handle, including Bluetooth low energy, ANT, and 2.4GHz custom.

You can get to memory on the radio while packets are being sent and received with Easy DMA. Other perks include high-definition RSSI and features that are very easy to use. Nordic makes Bluetooth signaling layers that use little power. To work, the nRF52832 only needs a source energy of 1.7V to 3.6V, which means it uses less power. When not needed for a job, each clock and peripheral can be turned off fully on its own. This saves energy.

Fig1: Nrf52832microcontroller

SENSORS:

VOCSENSOR:

A strong UV light source is used to take out the electrons from the VOC molecule. In the next step, the molecule is checked to see if there are any VOC molecules at the sensor. The ionization potential (IP) of each type of VOC molecule tells you how much energy is needed to free an electron. The unit used to measure this is electron volts, or eV. PID devices have a certain amount of energy, which can also be written as electronvolts (eV). With this much energy, the sensors can ionize and pick up on any substance whose IP value is less than the eV rate.

DHT 11SENSOR:

A capacitive humidity sensor and a thermometer are used by the DHT11 to measure the temperature and humidity of the air.

Pulses from the clock set the numbers when they need to be set. Because of this, the optocoupler circuit sends data from the sensor to the computer. For when the voltage changes, the optocoupler circuit keeps the electrical connection safe.

BLE TECHNOLOGY

The frequency range for Bluetooth Smart and Classic Bluetooth is different, but the frequency range for both is 2.400-2.4835 GHz ISM. Bluetooth Classic has 79 1-MHz channels, but Bluetooth Smart only has 40 2-MHz channels. To send data within a channel, Gaussian frequency shift modulation is used. This method works like Classic Bluetooth's Basic Rate method. The most power that can be sent at a rate of 1 Mbit/s is 10 mW

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Fig1: BLEtechnology

THING SPEAK API:

Because of this, the open-source Internet of Things (IoT) software and API Thing Speak use HTTP to keep and get data from devices that are connected to the Internet or a local area network.You can use ThingSpeak to write programs that record sensor data, keep track of where things are, and connect things to a social network so they can share what they're doing right now. When set up this way, the XAMPP server can send and receive data. The thing speak online app shows the meal information in a picture.

5. LITERATURE SURVEY

- At least 23 kids died on July 16, 2013, when pesticides got into their lunch at a primary school in the Saran district of the Indian state of Bihar, in the village of DharmashatiGandhiman.
- After they ate it, more people got sick. Because the school didn't have enough space, lunch was served in the headmistress's house.
- Changes in temperature and humidity make fruits and veggies go bad in India's main markets.
- India makes a lot of milk and milk products, so it's important to keep an eye on how much it exports.
- When the temperature and humidity change, plants in markets die. In mountainous places, people grow fruits and vegetables.
- It is very important that these things get to their goal safely.Because of this, it needs to be watched while it's being moved.

6. RESULTS AND DISCUSSION

Many places have used Bluetooth low energy and the Internet of Things to make food tracking systems safer, more effective, and more efficient. It has been used to find explosives, protect the public's health, keep the environment safe, check the quality of food, study smells, and even go into space. This is because the real smell system is very complicated. The manufactured olfactory system is also not linear. The best things about a sensor depend on how precise, sensitive, and particular it is. Usually, the steps we've talked about are used on more than one sensor to get the same features. The abilities might not work well with all sensors, though. Different feature methods can be used for each sensor to get different features that can then be used for pattern recognition to improve performance.

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6. CONCLUSION

The Intelligent Food Monitoring and Alert System, which uses Bluetooth Low Energy (BLE) and Internet of Things (IoT) devices, is a smart and effective way to keep food safe and of good quality. The technology makes it possible to keep track of storage conditions in real time by constantly checking things like temperature, humidity, and signs that food is going bad. Because BLE technology makes it easy for sensors and monitoring tools to talk to each other in a cheap and low-power way, long-term implementation is a good idea. IoT integration makes it possible to store data in the cloud for analysis, get alerts right away, and view data from afar. Less food is wasted, there is less chance of contamination, and the supply line is more clear. The system works best for homes, restaurants, supermarkets, and cold storage centers. Automated alerts help users take quick correction action before the quality of the food starts to decline. Data analytics can also help with predictive maintenance and better control of inventory. The technology uses little power, can be expanded, and can be used in different types of food storage facilities.

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