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IOT-DRIVEN FOOD MONITORING SYSTEM WITH BLUETOOTH LOW ENERGY

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ABSTRACT: It has been demonstrated that the Internet of Things (IoT) and Bluetooth Low Energy (BLE) are helpful for tracking food in a variety of industries, including food production, agriculture, healthcare, cosmetics, and environmental management. Several sensors, including those that measure temperature, humidity, gas, and storage temperature, are part of this system. Byproducts of gas breakdown can be found using gas analyzers. Depending on how far away the server is, the app uses Bluetooth Low Energy (BLE) or the Internet of Things (IoT) to get information from test samples. This device can send and receive data over long distances when it is linked to a public wireless GSM/GPRS network. Combining GSM/GPRS, the internet, and public wireless networks will save a lot less money. The majority of the time, increased tracking signal recognition improves the device's performance. A food tracking gadget that tracks food via Bluetooth Low Energy (BLE) and the Internet of Things (IoT) can aid in quality control. This enhances the product's quality, uniformity, and consistency throughout the entire industrial production process. This essay examines the most significant and recent apps that have revolutionized society.
Keywords: Bluetooth Low Energy (BLE); Internet of Things (IoT); Food safety; Quality tracing.

1. INTRODUCTION

The primary rationale for restricting the trade of agricultural products worldwide is public health, as stipulated in a 1995 GATT agreement. Public disclosure of this information was mandated by the agreement. Food poisoning has become increasingly prevalent in recent years. Food poisoning, mad cow disease, infectious diseases that kill pigs, bird flu, and hog foot-and-mouth disease are among the examples. The global economy has been adversely affected by these events, which also compromise the health of individuals. Food safety necessitates stringent regulations and ongoing supervision.

Despite the advantages associated with agricultural products such as milk, fruit, fish, and cattle, the majority of individuals continue to make their own decisions. Presently, there is an adequate number of individuals responding to inquiries regarding product evaluation and tracking. Careful and immediate monitoring, evaluation, and documentation of all food safety aspects are essential.

Currently, food is manufactured through three distinct processes: filling, packaging, and processing. The food should be consumed only after the procedures have been finalized. For example, food security may not be sufficient when food spoilage is the consequence of inadequate tracking. Suppliers should be provided with a comprehensive array of critical information, such as sales data, customer feedback on product quality and safety, and the findings of producer market research, as part of a food safety system.

The development of a system that monitors food quality through the use of Bluetooth low energy and the Internet of Things is a creative solution to this problem. The system enables the evaluation, regulation, and ranking of food safety. By utilizing Bluetooth Low Energy and the Internet of Things, it is possible to locate objects that are no longer physically present. These devices facilitate the application of global data transfer

and observation. In order to achieve this objective, they independently identify targets, compile data that is appropriate for radio frequency signals, and integrate intricate database and network technologies.

Conventional barcode systems are evidently outperformed by Internet of Things technology. It has the capacity to decide what needs to be done without human intervention, protect digital data, read vast amounts of data over great distances, and read continuously. Product tracking significantly impacts management.

This research investigates the relationship between the Internet of Things (IoT) and Bluetooth Low Energy (BLE) and proposes a method for utilizing the IoT to ensure food safety.

By initiating production immediately, you can reduce the time and effort necessary for product sales, packaging, and shipping when new varieties become available. Any time during the delivery process, information regarding the food supply chain is easily accessible. When data can be entered and retrieved at any time and from any location, it becomes simpler to collect objective data that can be used to assess the quality of a meal.

In this paper, the numerous applications of the internet of things in the food supply chain are examined. System architecture, strategic execution, and business planning are prioritized. The concept originated in the field of business process analysis.

2. LITERATURE SURVEY

On July 16, 2013, it is estimated that at least 23 children disappeared from a primary school in Dharmashati, Gandaman, Bihar, India. They were compelled to discard their entire lunch due to the toxins.

The incidence of illness has been significantly increased as a result of its widespread use. The school's diminutive size necessitated that lunch be transported from the headmistress's residence.

Regular fluctuations in temperature and humidity in India's most renowned markets result in the rapid spoilage of food.

India generates an abundance of dairy products and milk; consequently, exports necessitate meticulous examination. Market plants are susceptible to weather fluctuations that may result in their demise. Fruits and vegetables are abundantly produced in the mountains.

It is imperative that these items reach their destination in a safe manner. This suggests that it is necessary to maintain continuous supervision during the transfer.

3. EXSISTING WORK

Kong Xiansheng and Sun Jing, who also developed an external device and the pH meter, were responsible for the development of near field communication. The resonant circuit and wires of the pH meter are now properly oriented. Electrical solutions are produced by the hydrogel layer when the electrodes of the sensor come into contact with water. The resonant circuit is composed of electromagnetic inductors and electrical sensor components. In July 2016, Kodogiannis and Alsahejar (2016) created a fuzzy-wavelet neural network model that was specifically designed to detect spoiled meat. The temperature and humidity sensors verify the levels prior to serving the main course. Teer Akiratkerdcharoen, Tharaseesaared, and Phurnvirachongthanaphisat demonstrated the potential of e-nose to determine the quantity of food that has been contaminated with bacteria or has gone bad in smart homes.

By employing the principal component analysis (PCA) principle, this methodology detects ammonia and determines the current condition of the stored goods.

In July 2015, Sanhitha Bhadra and Douglas J. Thomson introduced a novel CO2 sensor that employs two pH-sensitive polymer electrodes. The monitor's output values are contingent upon the atmospheric CO2 concentrations.

This sensor is already present in non-chip near-field RFID tags.

4. PROPOSED METHOD

Bluetooth Low Energy lets the computer and microprocessor interact more readily in this configuration. Whereas Bluetooth Low Energy (BLE) uses less than 15mA, Standard Bluetooth can consume up to 30mA of power.This one is

rather small when compared to other personal computers available nowadays.

nRF52832 MICROCONTROLLER:

Thanks to the secure Cortex-M4F CPU of the nRF52832, one device can run even the most complicated apps with sophisticated math needs. Hardware division, DSP instructions, single-cycle multiply and collect, floating point unit (FPU), enable the integrated circuit (IC) to execute complex mathematical operations while consuming the lowest amount of power. Among the several modes of operation the 2.4GHz radio can run in is Bluetooth low energy. Two further modes are ANT and 2.4GHz custom.

Using the basic data-gram access (DMA) features of the radio allows you to access memory even with packets being sent and received. Two further advantages are a high-density RSSI and a user-friendly toolkit. Nordic developed the Bluetooth low energy criteria. The nRF 52532 uses less power because of its low operating voltage range, 1.7V to 3.6V. Turn off the clock or a peripheral when not in use. Energy apparently does not change as a result.

Fig1: Nrf52832 microcontroller

SENSORS:

VOC SENSOR:

VOC molecule electrons are extracted using a strong ultraviolet light source. After that, the monitor is checked for any molecules of volatile organic compounds. Ionization potential (IP) of a volatile organic compound helps one to estimate its electron release energy. One can present this value using electron volts (eV). Energy in PID devices is measured in electronvolts (eV). Generating ions with this energy allows the sensors to detect molecules whose IP value is less than their eV rate.

DHT11 SENSOR:

DHT11 boasts a very sensitive humidity sensor as well as a thermostat for exact temperature and humidity readings.

Numerical values have to be set occasionally. The optocoupler circuit lets the sensors transmit data straight to the computer. Through control of voltage fluctuations, the optocoupler circuit guarantees a safe electrical connection.

BLE TECHNOLOGY

Though they run in different ways, Bluetooth Smart and Bluetooth Classic are compatible with frequencies between 2.400 and 2.4835 GHz. This gadget boasts 79 1 MHz Smart channels overall and 40 2 MHz Smart channels. Gaussian frequency shift modulation drives data over a channel. This is an other Bluetooth Basic Rate protocol with a twist. One megabit per second can be transmitted from ten milliwatts of power.

Fig1: BLE technology

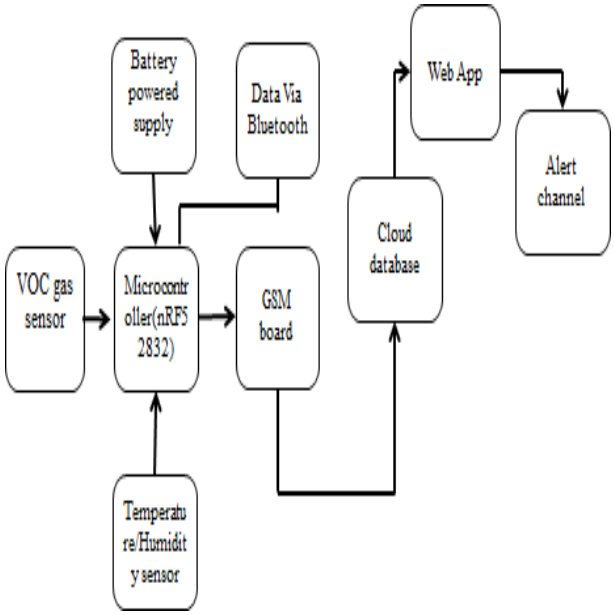
THING SPEAK API:

Thanks to the Hypertext Transfer Protocol (Http), LAN and Internet of Things devices can save and retrieve data. Furthermore there are open-source Internet of Things solutions leveraging the Thing Speak API to achieve this.

Create apps that track object location, gather sensor data, and link it to a social network so ThingSpeak may be used to update its status. Correct configuration of the XAMPP server allows data reception and transmission both ways.

Find the exact calorie count in that meal using the Thing Speak web app.

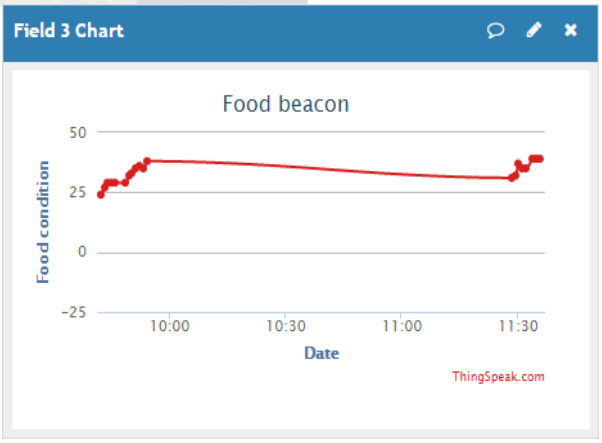
5. BLOCK DIAGRAM



6. RESULTS AND DISCUSSION

Many companies have set up food tracking systems using Bluetooth low energy and the Internet of Things to raise safety, efficiency, and effectiveness. Among its several applications are those in food safety, space exploration, bomb detection, and environmental protection. This is mostly resulting from the complexity of the olfactory system. Making synthetic smells calls for more effort.

Selectivity, sensitivity, and accuracy are three most crucial traits of a sensor. Many times, these techniques are applied to teach several sensors to produce the same properties. Moreover, some devices might not be using all their possible capacity. Separating out unique characteristics helps one to recognize patterns. One can accomplish this by means of several approaches for feature extraction from every sensor.



7. CONCLUSION

Flexible food tracking systems grounded on BLE and the Internet of Things have attracted a lot of attention. The next reasonable action is to expand the relevance of these instruments to more actual situations.

Professionals and practitioners thus should cooperate and exchange information. Once these issues and the related logistics are resolved, food monitoring systems based on BLE and the Internet of Things should be able to handle many more challenges and satisfy a sizable portion of the unmet future demand in the sector.

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