Advanced Research and Development Journal
ISSN: Applied | Volume 1 Issue 1 | October-December 2025 | Inaugural Edition | ARD-006
www.ardjournal.com | DOI:

IOT-ENABLED REAL-TIME FOOD MONITORING USING BLUETOOTH LOW ENERGY SENSORS

*1B. SAI SINDHU, IOT Developer, NEWZEN INFOTECH, HYDERABAD.
*2B.SAI RAM, IOT Engineer, NEWZEN INFOTECH, HYDERABAD.

ABSTRACT: The Internet of Things (IoT) and Bluetooth Low Energy (BLE) have proven effective in tracking food in a variety of industries, including environmental management, food processing, agriculture, healthcare, and cosmetics. Numerous sensors keep an eye on things like ambient temperature, storage temperature, gas concentrations, and humidity. Byproducts of gas decomposition are detectable by gas analyzers. Depending on which is farthest from the server, the application uses Bluetooth Low Energy (BLE) or the Internet of Things (IoT) to gather data from samples. When paired with a public wireless GSM/GPRS network, this device can send and receive data over long distances. Combining GSM/GPRS with public wireless networks and the internet can result in significant cost savings. Improved tracking signal detection often results in improved device performance. Quality control can be improved with a food tracking device that makes use of Bluetooth Low Energy (BLE) and the Internet of Things. Throughout the industrial manufacturing process, this enhances the product's overall quality, consistency, and uniformity. This study looks at the most cutting-edge and relevant applications that are now changing the world.

Keywords: Bluetooth Low Energy (BLE); Internet of Things (IoT); Food safety; Quality tracing.

1. INTRODUCTION

A 1995 GATT agreement states that public health protection is the primary justification for restricting international trade in agricultural products. According to the agreement, this information had to be disclosed. A growing number of people have been ill after consuming particular foods in recent years. Examples include pig foot-and-mouth disease, avian influenza, pig-killing viral infections, foodborne illness, and bovine spongiform encephalopathy. These incidents have endangered public health and had a detrimental effect on the world economy. Strict regulations and ongoing oversight are required for food safety.

Despite the fact that milk, fruit, fish, and field animals are healthy, most individuals still make their own decisions. There are currently enough personnel responding to inquiries regarding product review and tracking. Every aspect of food safety must be closely observed, assessed, and promptly documented.

Food preparation involves three distinct steps: filling, packing, and ending. Until all of these procedures are completed, the food cannot be consumed. For instance, if food spoils due to poor tracking, food security may not be sufficient. Important data, such as sales figures, consumer reviews regarding the product's quality and safety, and the findings of manufacturers' market research, should be visible to vendors in a food safety system.

Advanced Research and Development Journal
ISSN: Applied | Volume 1 Issue 1 | October-December 2025 | Inaugural Edition | ARD-006
www.ardjournal.com | DOI:

Using Bluetooth Low Energy and the Internet of Things to monitor food quality is an innovative solution to this issue. This approach can be used to rank, regulate, and evaluate food safety. The Internet of Things and Bluetooth Low Energy make it simpler to locate objects that aren't in the physical world. These devices facilitate data transmission and reception and enable TV viewing worldwide. They accomplish this by using a variety of computer and network technologies to independently locate targets and gather data that can be transmitted via radio waves.

It is obvious that Internet of Things technology outperforms traditional tagging methods. It can read and process vast volumes of data across long distances, protect digital material, and make choices without human assistance. Product tracking has a significant impact on management.

This paper examines the relationship between the Internet of Things (IoT) and Bluetooth Low Energy (BLE) and offers a method for using IoT to ensure food safety.

You should begin producing them as soon as the new varieties are available. You'll save time and work by doing this instead of selling, packing, and shipping the old items. Information on the food supply chain is readily available at each stage of the shipping process. Accessing and retrieving data at any time and from any location makes it simpler to obtain unbiased information on food quality.

This study examines the various applications of the Internet of Things in the food transportation sector. Prioritizing business planning, strategy implementation, and system development is crucial. Business process research was the initial source of the concept.

2. LITERATURE SURVEY

On July 16, 2013, at least 23 children are believed to have vanished from a primary school in Dharmashati, Gandaman, Bihar, India. Their entire lunch was poisoned, so they had to discard it.

Due to its widespread use, the number of ailments has increased dramatically. Food was brought in from the headmistress's home because the school was so little.

The heat and weather fluctuations in India's most well-known markets cause food to spoil quickly.

Since milk and dairy products are produced in large quantities in India, they must undergo stringent inspection before being exported. Weather variations might be detrimental to market plants. Many vegetables and fruits thrive in mountainous regions.

It is crucial that these products reach their destination. As a result, ongoing supervision is required throughout the relocation process.

3. EXSISTING WORK

Sun Jing and Kong Xiansheng devised a method of communication close by. They also manufactured an external device and the pH meter. The wires and resonance circuit of the pH meter are now positioned correctly. The hydrogel layer creates electrical solutions when the sensor lines come into contact with water. The resonant circuit has electrical sensing components as well as electromagnetic inductors. Kodogiannis and Alsahejar developed a fuzzy-wavelet neural network model in July 2016 that can identify inferior meat. Prior to serving the main dish, it measures the humidity and temperature. Phurnvirachongthanaphisat,

Advanced Research and Development Journal
ISSN: Applied | Volume 1 Issue 1 | October-December 2025 | Inaugural Edition | ARD-006
www.ardjournal.com | DOI:

Tharaseesaared, and Teer Akiratkerdcharoen demonstrated how e-nose technology can be utilized in smart homes to detect bacteria that has spread and food that has gone bad.

- This approach uses principal component analysis (PCA) to identify ammonia and determine the storage quality.
- Sanhitha Bhadra and Douglas J. Thomson demonstrated a novel kind of CO2 sensor with two pH-sensitive polymer electrodes in July 2015. The monitor provides information that varies according to the amount of CO2 in the air.
- This sensor is already present in chipless near-field RFID tags.

4. PROPOSED METHOD

In this instance, Bluetooth Low Energy facilitates communication between the CPU and the computer. Compared to Bluetooth that uses Low Energy (BLE), which can consume up to 30mA, Bluetooth that does not requires a lot more power. Compared to other models now available on the market, this computer is significantly smaller.

nRF52832 MICROCONTROLLER:

The nRF52832 can run complex programs that require a lot of complex math on a single device thanks to its secure Cortex-M4F CPU. The integrated circuit's (IC) hardware division, floating point unit (FPU), DSP instructions, and single-cycle multiplication and accumulation allow it to perform intricate mathematical operations with minimal power consumption. There are various modes of operation for the 2.4GHz radio, including Bluetooth Low Energy. Another option is the 2.4GHz model. The other option you can utilize is ANT.

Basic data-gram access (DMA) functions on the radio provide memory access during packet transmission and reception. It features a high-density RSSI and a user-friendly toolkit. Bluetooth Low Energy standards were created by Nordic. Because the nRF 52532 runs at a low voltage range of 1.7V to 3.6V, it consumes less power. The clock and any associated gadgets should be turned off when not in use. It appears that this has no effect whatsoever on the energy.

Fig1: Nrf52832 microcontroller

SENSORS:

VOC SENSOR:

Electrons from VOC molecules are extracted using a powerful UV light source. The monitor then detects any organic chemical molecules that are moving. The ionization potential (IP) of an organic material can be used to determine the energy required for an electron to exit the compound. This quantity can be displayed in electron volts (eV). In PID systems, energy is measured in electronvolts (eV). By producing ions with this much energy, the sensors might be able to identify compounds whose ionization potential is less than their electronvolt rate.

Advanced Research and Development Journal
ISSN: Applied | Volume 1 Issue 1 | October-December 2025 | Inaugural Edition | ARD-006
www.ardjournal.com | DOI:

DHT11 SENSOR:

The DHT11 features a highly sensitive humidity monitor and thermostat that provide precise temperature and humidity measurements.

Sometimes they are required to set numerical values. Without passing via a computer, the devices can transmit data to the computer thanks to the optocoupler circuit. The optocoupler circuit protects the electrical link by managing voltage variations.

BLE TECHNOLOGY

Both Bluetooth Smart and Bluetooth Classic operate in the 2.400 to 2.4835 GHz frequency range, despite having different operating systems. This gadget has 40 Smart channels operating at 2 MHz and 79 Smart channels operating at 1 MHz. Gaussian frequency shift modulation is used to transmit data over a medium. This Bluetooth Basic Rate version differs from the others. One megabit can be sent every second with ten milliwatts of power.

Fig2: BLE technology

THING SPEAK API:

This is made feasible by the Hypertext Transfer Protocol (HTTP). LAN and Internet of Things devices can store and retrieve data. The Thing Speak API provides access to open-source Internet of Things choices capable of doing this.

Develop applications that gather sensor data, track objects' locations, and establish connections with social networks so users may post updates using ThingSpeak. Data can be delivered both ways as long as the XAMPP server is configured properly. By using the free software Thing Speak, you can precisely figure out how many calories the dish contains.

5. BLOCK DIAGRAM

Advanced Research and Development Journal
ISSN: Applied | Volume 1 Issue 1 | October-December 2025 | Inaugural Edition | ARD-006
www.ardjournal.com | DOI:

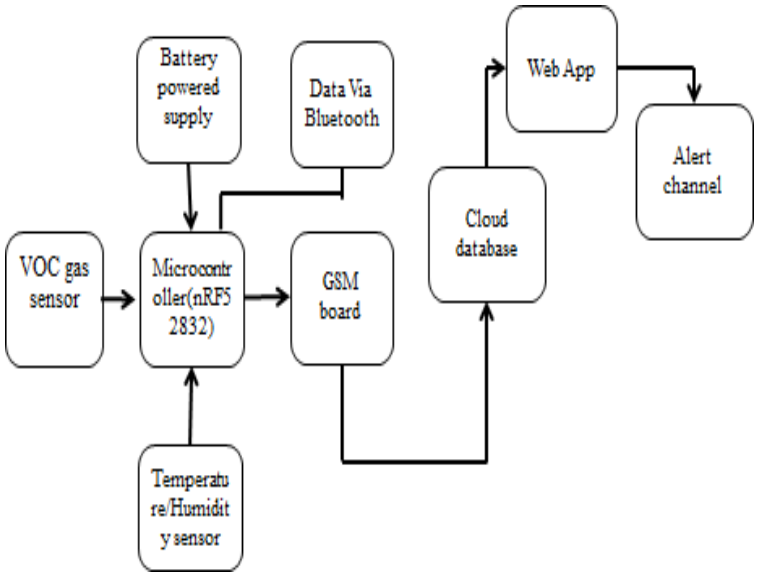
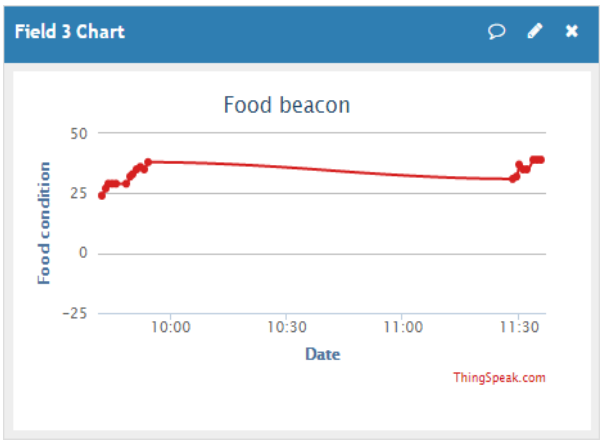


Fig 3: Block Diagram

6. RESULTS AND DISCUSSION

To make things safer, more effective, and more efficient, many businesses have implemented food monitoring systems that employ Bluetooth Low Energy and the Internet of Things. It can be used to safeguard the planet, detect explosives, explore space, and preserve food. The scent system's complexity is the primary cause of this. Synthetic perfumes require a lot more effort.

The three most crucial aspects of a sensor are selection, sensitivity, and accuracy. These techniques are frequently employed to generate the same qualities by engaging many senses. Additionally, some instruments may not be functioning as well as they ought to. Separating distinct features makes it easier to recognize patterns. Information can be obtained from each sensor in a variety of ways.



Advanced Research and Development Journal
ISSN: Applied | Volume 1 Issue 1 | October-December 2025 | Inaugural Edition | ARD-006
www.ardjournal.com | DOI:

7. CONCLUSION

Many individuals are interested in adaptable food warning systems based on the Internet of Things and BLE. Making these technologies usable in more real-life scenarios is, of course, the next logical step.

As a result, experts and practitioners ought to collaborate and exchange knowledge. In the future, after these issues and the associated processes are resolved, BLE and Internet of Things-based food tracking systems will need to address numerous unmet market demands.

REFERENCES

1. LiuChuanju. Research on the digitized production model under the network environment[J], Journal of Networks, 2011,12-3 :160-163;
2. YuShanshan, based on NET-business supply chain management system design and realization micro computer,2011,12-3 :168-170;
3. LiMinzhe, Sun Junmao, Cao Xinming, the status quo, debate and suggestions of the safety of agricultural products in China. China Agricultural Science and Technology, 2012, 5 (3) :68-71
4. Sanford, V., Pervasive Computing Goes the Last Hundred Feet wit internet of things Systems, IEEE CS and IEEE Cosmic, April- June, 2013.
5. Lederman, R.; Edmond, J.P.; Lang, W.: Shelf life prediction by intelligent internet of things. In Hasid, H.D.;Kreowski, H.J.; Scholz-Reiter, B. (Eds.): Dynamics in Logistics - First International Conference, LDIC 2011Bremen, Germany, August 2012Proceedings. Springer, Berlin, 231-- 238, May 2008
6. Jedermann, R. und Lang, W.: Technische Grenzen des Einsatzes von UHF Identifikations

systemen internet of things) imLebensmittelbereich. Technical Report SFB637-B6-07-3, University of Bremen, November 2011

7. Jedermann, R.; Lang, W.: Semi-passive internet of things and beyond: steps towards automated quality tracingin the food chain. In: International Journal of Radio Frequency Identification Technology and Applications(IJRFITA), Vol. 1(2012)3, pp. 247 – 259
8. B G Anil Kumar,K C Bhagyalakshmi, K.Lavanya,K H Gowranga, A Bluetooth low energy based beacon system for smart short range surveillance.
9. Shaarmistha Bhadra,Douglas J.Thomson, Greg E.Bridges ,Near-Field coupled RFID tag for carbon dioxide concentration sensing.
10. Phunvira Chongthanaphisut, TharaSeesaard, T eerakiat Kerdcharoen, Monitoring of microbial canned food spoilage & contamination based on e-nose for smart home.