

IOT AND BIG DATA-BASED FOOD SAFETY TRACEABILITY SYSTEM FOR PUBLIC HEALTH MONITORING

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ABSTRACT: IoT and Big Data analytics are being used in this project to make a food safety tracking system that protects public health. Because the food supply chain is so complicated, it is hard to make sure that quality, safety, and openness are maintained during production, processing, transport, and distribution. IoT-enabled sensors and smart devices are used in the proposed system to keep an eye on the production of food, the temperature of storage, transportation, and environmental factors in real time. Big data technologies make it easy to store, analyze, and make choices based on huge amounts of different types of data. With a digital traceability system, farmers, manufacturers, distributors, regulators, and customers can all keep track of the lifecycle of a food product and quickly find safety risks. The method lowers the risk of contamination and makes the supply chain more open. It also makes it easier to manage food safety and do recalls. Both IoT and big data work together to keep people healthy and boost trust in today's food supply systems.

Keywords: *Food Safety, Traceability System, Internet of Things (IoT), Big Data, Supply Chain Management, Public Health.*

1. INTRODUCTION

Food safety is a worldwide problem because food supply systems are so complicated and people want safe, high-quality food more and more. Modern customers want to know how food is transported, processed, and where it comes from. Standard food monitoring systems, on the other hand, might not be able to see or watch things in real time, which makes it harder to find sources of contamination and quality problems. To keep an eye on, track, and control food safety all along the supply chain, we need high-tech tools.

Internet of Things (IoT) technology lets data be collected and food safety monitored in real time. IoT sensors, RFID tags, and other advanced tracking

technology can keep an eye on temperature, humidity, and storage conditions while food is being made, moved, and stored. A lot of information is collected by these devices so that people in the supply chain can keep an eye on food safety and quality. Continuous contact between devices through the Internet of Things makes it easier to see how food is handled.

Big data technology must be used to collect and analyze data from IoT devices. Data analytics can find trends, outliers, and threats to food safety before they happen. IoT technology and Big Data analytics can help make decisions based on data, which can lead to better risk



management and food quality control. This makes it easier for people to follow the rules and helps the officials act quickly when food is contaminated.

IoT and Big Data are used in a food safety tracking system to follow food from the farm to the table. This method keeps track of the whole food supply chain, from growing the food to transporting it, storing it, and giving it to people. With better tracking, stakeholders can quickly find sources of pollution and fix the problem to protect public health. This unified method helps keep food safe, builds trust among customers, and makes the supply chain work better.

2. LITERATURE SURVEY

Liu et al. (2025): To make the food supply chain more clear, a method is being proposed that uses IoT and big data to track food safety. Internet of Things sensors keep an eye on the temperature, humidity, and storage conditions of food while it is being delivered and stored. Big data analytics gathers and studies a lot of data so that it can be used for tracking and making decisions in real time. The results show better management of food safety, faster identification of the cause of contamination, and better tracking.

Gonzalez & Ramirez (2024): This research presents an IoT-enabled food traceability system that uses big data analytics to keep an eye on the quality of food in the supply chain. During production, processing, and marketing, sensors keep an eye on the conditions of the product in real time. Big data systems look at collected data to find problems and make sure products are safe. By quickly tracking food products, the suggested technology improves consumer

health and the openness of the supply chain.

Karthikeyan & Subramanian (2023): The project suggests using IoT and big data to create an intelligent food safety tracking system that will protect both raw and processed foods. IoT environmental and logistical data is stored and analyzed by big data tools. With this technology, everyone can keep track of food from the time it is made to the time it is eaten. The results show that the method makes it easier to track food and keep it safe.

Hernandez et al. (2022): Internet of Things (IoT) and big data analytics make it easier to track food, which improves quality and safety. IoT devices are used by the framework to gather data about production, transport, and storage. Processing large amounts of data is used to find risks in the food supply chain. The way lets people know more about food safety issues faster and more clearly.

Almeida & Pereira (2021): Based on big data analytics and the Internet of Things, this study shows a food safety monitoring and tracking system. Real-time data is collected by sensors all along the food production and transportation network. Using a lot of data, analytical models find problems with quality and risks of contamination. The suggested framework makes it easier to handle the supply chain, track food, and protect public health.

3. PROPOSED SYSTEM ARCHITECTURE

The components that comprise the proposed system are as follows.

Database Design

The system employs three distinct types of databases: databases for real-time



monitoring, databases for online crawling, and databases for the past. In order to facilitate analysis and visualization, the database retains outdated data. Information regarding rice is collected from the internet by a web search database. This information pertains to rice-related merchandise, including goods and rice-based foods. This information is collected using a web crawler that is created with Scrapy. Scrapy is an open-source web crawling system that enhances the reliability and scalability of crawlers by autonomously determining who has access to what and identifying comparable content.

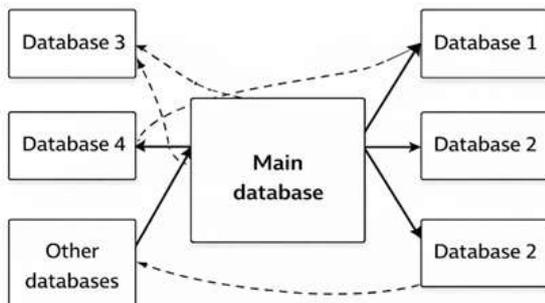


Figure1: Main Database Architecture

Data Preprocessing

An intuitive food search engine was developed subsequent to the accumulation of a substantial amount of food-related data. The data is stored in Elasticsearch, and the Django framework for Python is employed to construct it. This approach provides a space that is free of advertisements, a plethora of pertinent content, a minimal number of duplicate articles, and effortless categorizing. By enabling the concurrent operation of multiple computers, Elasticsearch enhances the system's performance. The three primary components of the system are the Model, View, and Template layers. They facilitate the management of

consumer inquiries, the storage of data, and the presentation of results.

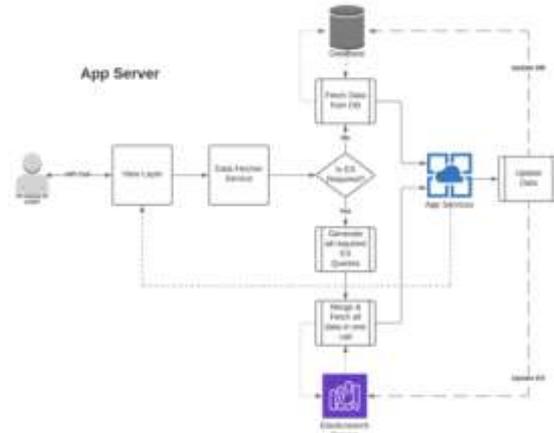


Figure2: App Server Data Processing Architecture

Data Analysis Process

Machine learning (ML) is employed to analyze and categorize rice data. A subset of artificial intelligence (AI), machine learning (ML) enables computers to learn from data autonomously and improve over time. Artificial intelligence (AI) enables computers to perform tasks more efficiently by replicating human behavior and identifying patterns in vast datasets. A system was developed to effectively organize various types of data into the appropriate categories after an adequate amount of information regarding rice had been collected.

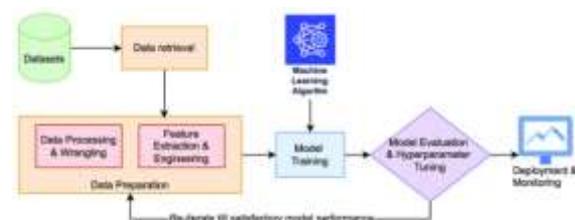


Figure3: Machine Learning Model Development Workflow

Food Traceability Process

The food monitoring system maintains data throughout the entire food supply chain by employing RFID and barcode technology. Information is obtained by a

cloud platform through the processes of growing, organizing, selling, and transferring objects. Customers can access the complete history of the product, from the vendor to the sales location, by scanning the barcode or RFID tag on the rice. This ensures that food knowledge is precise, dependable, and unambiguous.

The architecture of the system for Internet of Things (IoT) and Big Data comprises five stages: support, network, data, system, and user. Information is collected by IoT devices during production and transportation, and it is subsequently processed and stored in databases.

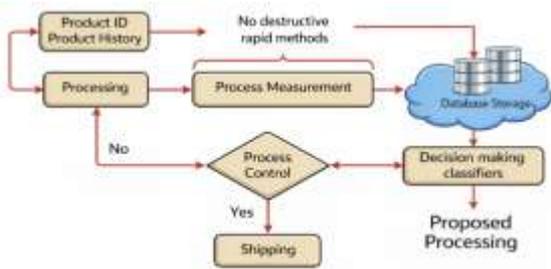


Figure4. Food Traceability Architecture

4.RESULTS



Fig4.1 User login



Fig4.2 Register your details here

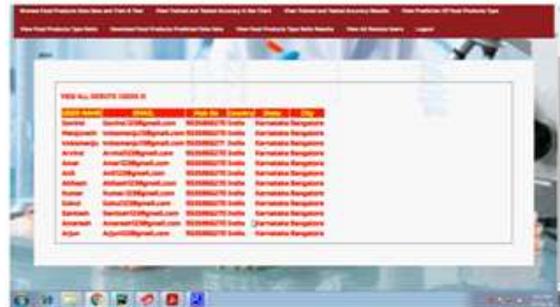


Fig4.3 View all Remote users



Fig4.4 View Food Products Type Trained and Tested Results

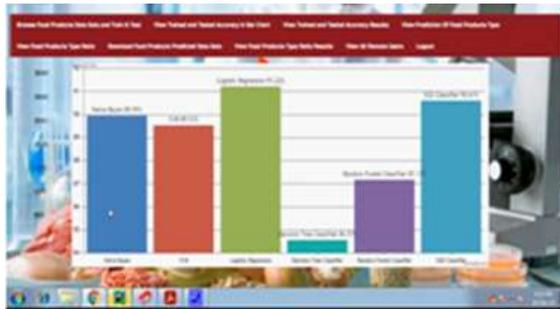


Fig4.5 Bar graph



Fig4.6 Line Chart



Fig4.7 Pie Chart

5. CONCLUSION

In conclusion, using Big Data and the Internet of Things (IoT) to create a food safety tracking system is a good way to protect public health and make sure food is safe. Smart sensors, RFID tags, cloud computing, and data analytics are all part of the system. It lets people see and watch food products in real time along the whole supply chain, from production and processing to distribution and consumption. Big data analysis makes it easier to find possible dangers, faster to find sources of contamination, and helps the food business and regulatory agencies make quick decisions. As a result, this traceability structure improves the whole system for managing food safety, makes people more accountable, and builds customer trust in modern digital agriculture and food supply chains.

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