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Smart Tiffin Box - A Brief Review

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Abstract: The Smart Tiffin Box revolutionizes traditional food storage with advanced technology, targeting individuals with busy lifestyles. It integrates sensors and communication modules to monitor temperature, freshness, and nutritional content. A user-friendly mobile app allows customization, real-time updates, and nutritional tracking. The design includes smart sensors and microcontrollers for optimal storage conditions, preventing spoilage. Extensive testing validates its reliability for dynamic lifestyles. The project signifies a technological leap in smart food storage, addressing challenges and offering an intelligent solution. In conclusion, the Smart Tiffin Box enhances daily life by intelligently managing dietary preferences.

Keywords: Smart Tiffin Box, Temperature, Freshness, and Nutritional Content

I. INTRODUCTION

Global food losses have recently been documented to be in the order of 25 percent to 50 percent of production volumes, caloric content and/or market values depending on the commodity. A great number of organizations all over the world such as UN Food and Agriculture Organization (FAO) are studying this enormous problem of postharvest food losses. Much of the developing world in general lacks access to affordable refrigeration systems for precooling, refrigerated transport, cold storage, or freezing during postharvest handling and distribution of perishable foods. [1]. This UK study, commissioned by the Food Standards Agency and conducted in 89 primary schools, aims to enhance the nutritional content of children's packed lunches. The 12-month SMART lunch box program intervention involved 1,291 eight to nine-year-olds, assessing food weights, specific items, and nutrient levels. Results showed the intervention group had higher weights of fruit, vegetables, dairy, and starchy foods, with lower weights of savoury snacks. There was a positive impact on vitamin A and folate levels, an 11% increase in vegetables/salad provision, and a 13% decrease in crisps. While improvements were noted, the overall nutrient profile showed only small gains. Acknowledging the feasibility of such interventions, the study calls for additional strategies to align packed lunches with government standards for school meals, addressing the persistent issue of poor-quality packed lunches in the UK [2]. Human life masses are the evils of poverty and hunger. The world produces enough food to feed every one of us, yet almost one billion people live in hunger. Between one third and half of all food produced globally is wasted or lost along supply chains every year. That's enough to feed twice the number of hungry people in the world. Producing food that will be lost or wasted means wasting human labor, money, land, energy, and water. To put things in perspective, in order to produce food that is never consumed, a surface area larger than Canada and India combined is used, three times the water volume of Lake Geneva is squandered, and roughly 20% of total deforestation is caused. Stunningly, if food losses and waste were a country, it would be the third largest greenhouse gas emitter in the world, as well as a significant contributor to climate change[3].

According to statistics from the Food and Agriculture Organization of the United Nations, up to 1.6 billion tons of food are wasted globally each year, with the edible portion reaching 1.3 billion tons.In July 2022, five United Nations agencies jointly released the "2022 World Food Security and Nutrition Status" report, which stated that the global number of hungry people reached 828 million, exceeding one-tenth of the global total. About 258 million people in 58 countries and regions were affected by the severe food crisis, up from 193 million people in 53 countries and regions in 2021 [4]. Food is any substance which when consumed provides nutritional support for the body. It may be of plant or animal origin, containing the known five essential nutrients namely, carbohydrates, fats, proteins, vitamins and minerals. Usually after consumption, food undergoes different metabolic processes that eventually lead to the production of energy, maintenance of life, and/or stimulation of growth (Aguilera 1999). The history of early man shows that, people obtained food substances through hunting, gathering, and agriculture. The assurance and protection of food quality has always been important to man. This is evident from the fact that, one of the earliest laws known to man was that of Food. Right from the Garden of Eden, there was a law guiding the consumption of food. In our time too, governments over many centuries have endeavoured to provide for the safety and wholesomeness of man's food by legal provisions, (Alsberg 1970; Jango-Cohen 2005) [5]. The electronic nose system was based on wireless data transmission using ZigBee, a series

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of gas sensors, and a LabVIEW Graphic User Interface, and it was tested with green and yellow mango samples. The integration of sensors in food packaging provides the consumer with smart packaging solutions. These advances have led to improved food quality, safety, longer shelf-life and usability. While most packaging innovations have been the result of global trends and consumer preferences, a few innovations have stemmed from rather unexpected sources, such as the emergence of nano-sensors and the technology of material sensing in nm size range. Undoubtedly, future smart packaging developments will focus on food safety (detecting microbial growth, oxidation, and improved tamper visibility), food quality (sensing volatile flavors and aromas), shelf-life tracking, authentication, convenience, and sustainability of food products [6]. The term Fuzzy logic was discovered by Prof. Lofti A.Zahed in 1964.the Fuzzy logic deals with the Fuzzy logic is a technique which refers the all technologies that are grade of sharp boundary. This technique is based on four concept i.e. fuzzy sets, linguistic variable, possibility distribution and fuzzy if-else rules. The fuzzy logic deals approximations instead of exact or fix reasoning. It provides a platform for the engineers to introduce the human reasoning with the control algorithm. The fuzzy logic technique is not only based on the data computing process but also implements the artificial intelligence, human reasoning as well as control algorithm. In this paper, we will deal with the various fuzzy rules, Member functions in MATLAB® Simulation using fuzzy logic toolbox. The fuzzy logic toolbox provides the interfaces with member function for designing or simulation fuzzy logic system. It defines the precious definitions and boundary (does not exist) .In the Tiffin food problem we cannot determine the exact human reasoning, so using the fuzzy logic we can determine the status of this problem.

II. MATERIALS USED

- IOT Board
- Microphone
- Strain Gauge
- Stainless Steel
- Silicone Seals and Gaskets
- Heating Coil
- Temperature Control
- Battery

III. METHODS

In the present paper, the behavior of food in vacuum packs is investigated using our original electronic system, described herein. We use the Wireless Sensor Networks (WSNs) approach for implementing the communication between the acquisition board and the computer. The power consumption is a constraint in WSNs. The system proposed by us is divided into two modules of low cost and low power consumption. The first module consists of a data acquisition board while the second one implements the user interface, data storage, analysis and remote transmission of the results. The acquired data provide information about the status of the food, the degree of degradation and the storage conditions. The block diagram of the two modules of our system is depicted in Figure 1.

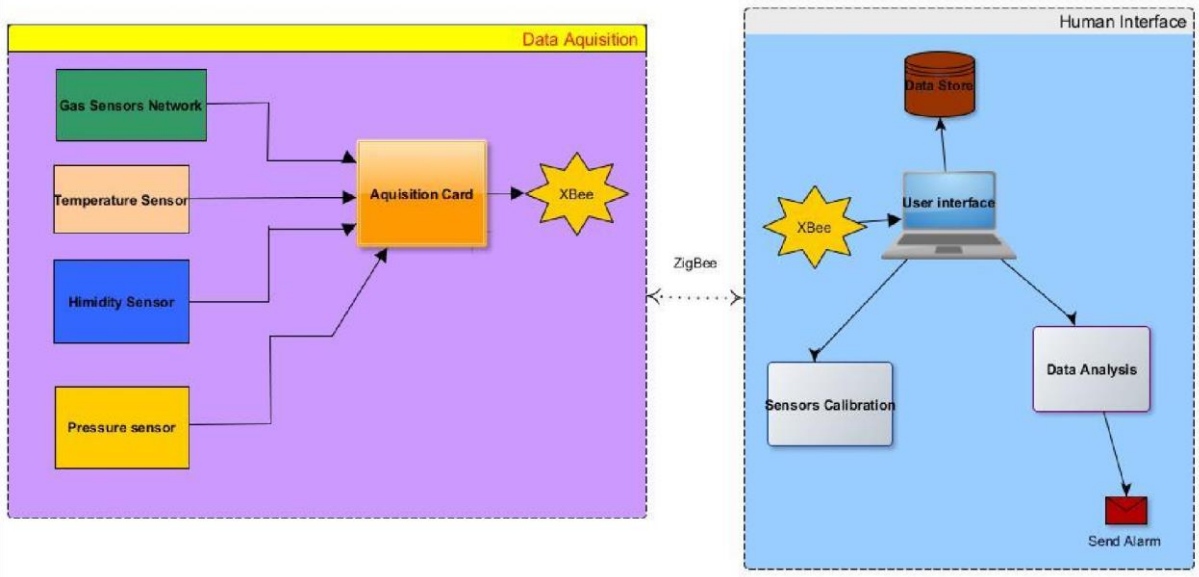

Fig 1 [6]

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The data acquisition module includes analog and digital sensors for temperature, humidity, gas concentration and pressure. The sensors communicate with the Arduino board through the serial interfaces I2C and SPI. The Arduino board is connected to an XBee wireless communication modem which implements the ZigBee protocol for transmitting the data from the sensors to the computer. The second module implements the recording and processing of acquired data and provides a human-machine interface developed in the LabVIEW programming environment running on a PC. The interface can be viewed by multiple users using a web-server. The computer is connected to the second XBee modem in order to communicate with the data acquisition module.

The measurements collected from the sensors are stored in an Excel spreadsheet in order to be analyzed in MATLAB. If the measurements lie outside the normal range of prescribed values, an alarm message is programmed in the LabVIEW interface.

This section evaluates the performance of the proposed system for analyzing the selected parameters in a vacuum container. The results obtained with an onion placed in the container are compared against the reference measurement performed with an empty container

IV. FUTURE SCOPE

The smart food storage is cost effective, economical & user friendly. Going further, most of the units can be embedded within the controller such as android application, with change in technology thereby improving the detection system. The factors identified may further be empirically tested and validated on the F&V supply chain of different states. A similar empirical study may further be carried out for the supply chain of various related sector like food processing unit, beverages industry, cold chain industry. In future we can use different sensors such as moisture sensor, chemical sensor which can be helpful to preserve the food. In future the information can be received through various means like email. The future smart IoT smart food storage can use the gas sensor to check the freshness of food item and also use the CCTV camera for visualization of all activities inside the warehouse and display it to the user in real time.

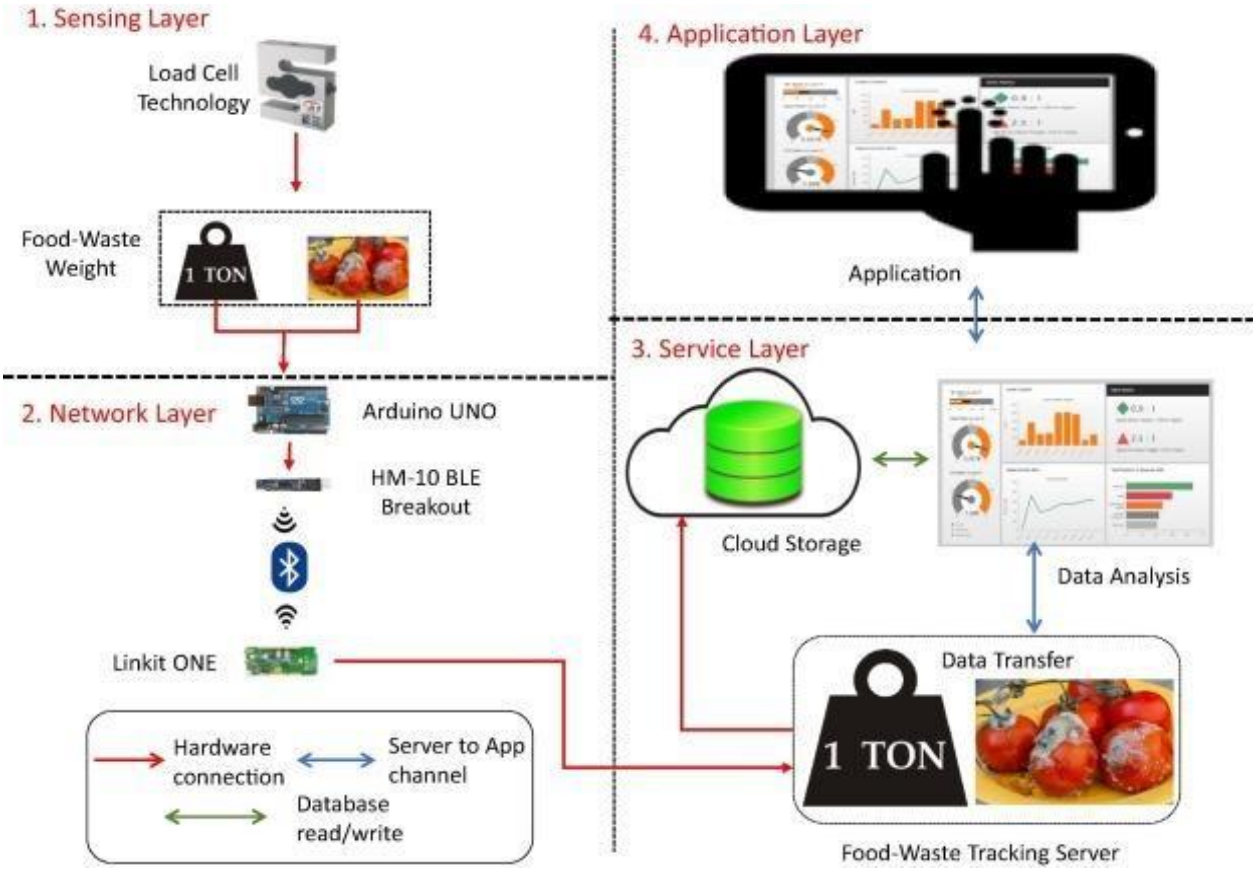

Fig 2[3]

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V. CONCLUSION

This project is designed for managing items stored in the warehouse. The business system is tuned to food habits and convenience of rural and urban folks of the previous generation. The safety and nutritional quality of frozen products is to be emphasized only when high quality raw materials will be used, good manufacturing practices to be employed in the preservation process, and the products kept in accordance with specified temperatures.

Various sensors are embedded to form the smart food storage system. The temperature sensor is used to sense the raise in temperature .Beyond a particular range of temperature the message is sent through the server to the mobile and the mobile user can switch on/off the fan present in the warehouse .Humidity sensor is used to see the percentage of humidity present in the warehouse. Some food requires the light to so we make use of LDR sensor. If LDR is 1 then light is detected and SMS to be sent. On detection of smoke, the smoke sensor helps in detecting smoke inside the warehouse and sends messages. On using android app manager receives information about temperature , humidity , LDR and smoke inside the warehouse.

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