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An IoT based Investigation to Reduce the Contamination of Food: An Monitoring based Investigation

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***Abstract*:- The evolution of multipurpose sensors over the last decades has been investigated with the aim of developing innovative devices with applications in several fields of technology, including in the food industry. These integrated systems are capable of providing reliable information about the quality of the packed products during their storage period. This technology, when combined with IoT, can provide a lot more information than conventional food inspection technologies. The original system described in this work relies on a simple but effective method of integrated food monitoring, right at the client's home, suitable for user-prepared vacuum-packed foods. The proposed solution analyses temperature, moisture, light as these parameters affect nutritional values of food items such as fruits and vegetables and makes the analysis results accessible to the user via a mobile application. The aim of the present investigation to develop a smart IoT-based food-monitoring system in our supply chain management using MCU and various sensors that continuously monitor the various factors, which may affect the food quality.**

Keywords: IoT, Food, Monitoring, Technology, Application

INTRODUCTION

The temperature mapping is especially essential for the facilities working with sensitive products such as food. Mapping is performed to verify the efficiency of storage conditions in refrigerated/cool warehouses. Temperature mapping can be influenced by external factors such as weather, but also internal ones, such as airflow limitations. If the monitoring devices are zoned, the operating data can be compared to provide a picture of the overall functioning of the system [1]. Depending on the business in question, this could involve activities such as monitoring the manufacturing of a product, shipping the product by air, sea, or land; ensuring that it meets quality standards, and delivering the product to customers. Supply chain management is important because it can help achieve several business objectives. For instance, controlling manufacturing processes can improve product quality, reducingthe risk of recalls and lawsuits while helping to build a strong consumer brand. At the same time, controls over shipping procedures can improve customer service by avoiding costly shortages or periods of inventory oversupply. Overall, supply chain management provides several opportunities for companies to improve their profit margins, and is especially important for companies with large and international operations [3]. Briefly, the Internet of Things is the concept of connecting any device (so long as it has an on/off switch) to the Internet and other connected devices. The IoT is a giant network of connected things and people – all of which collect and share data about the way they are used and about the environment around them. Devices and objects with built in sensors are connected to an Internet of Things platform, which integrates data from the different devices and applies analytics to share the most valuable information with applications built to address specific needs. These powerful IoT platforms can pinpoint exactly what information is useful and what can safely be ignored. This information can be used to detect patterns, make recommendations, and detect possible problems before they occur. The information picked up by connected devices enables me to make smart decisions about which components to stock up on, based on realtime information, which helps me save time and money [2][5].

IoT is defined by the European Commission Information Society (Saint-Exupery, 2009) as "things with identities and virtual personalities operating in smart spaces using intelligent interfaces to connect and communicate within social, environmental, and user contexts" or "things with identities and virtual personalities operating in smart spaces using intelligent interfaces to connect and communicate within social, environmental, and user contexts." "Interconnected items that play an active role in what could be referred to as the Future Internet."

IoT architecture is made up of numerous layers: I device layer, ii) network layer 48, iii) service support layer, iv) application layer, v) management and security All devices implemented in the environment and communication gateways are included in the Device 49 layer, which includes sensors (e.g. temperature, light, motion, and location), devices that transmit 51 and receive information over the communication network directly or via gateways (e.g. 52 receptors and transmitters), energy supply devices (e.g. batteries, solar panels), and devices that 53 can manipulate data. All 54 significant communication technologies, including wired and wireless, are included at the device layer.

The agri-food chain is facing significant new challenges nowadays. Among others, monitoring addition, controlling temperature along supply chains emerge as a key aspect to deal with food waste. As well as increasing both food safety and

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the quality offered to consumers. Whereas, the early stages of processing and distribution compliance with the temperatures established for food safety were reached, however, in the last three stages (considering here transport, retail, and households) temperature control and maintenance have become particularly complex. In the retail sector, in particular, the scarcity of data available on the fulfillment of cold chain control is highlighted. In addition, many studies are confirming that the temperature of display cabinets in refrigeration units is not always the appropriate one, according to safety standards [2][3][4].

This system provides solutions in domains such as price management in perishable products, the frequency of temperature measurement in retail establishments, and economic problems caused by food waste. Another aim is to create a system with enough flexibility to extend the scope of supervising other relevant parameters in the working environment (door opening-closing, consumer presence time in front of the exhibitor, lighting, and energy consumption). The current work shows a complete functional solution for temperature monitoring in the food cold chain. Thus, the full accessibility to all the details about the designed device opens the possibility to communities of scientists and technicians to correct and improve aspects, extend functionalities, replace components, or compare operation modes [12][13].

METHODOLOGY FOLLOWED

In modern business management, individual businesses cannot compete as independent entities but rather as active members of the wider supply chain involving a network of multiple businesses and relationships. As such, supply chains are operating under an ever-changing environment and are vulnerable to a myriad of risks at all levels. This environment is an ever-changing landscape because of many factors. Many supply chains extend over wide geographical areas and are vulnerable to many global risks. Customers are more and more demanding in terms of product customization, price and level of service. Products complexity is also increasing due to the high clock speed in many industries following the rapid changes in technology and the continuous introduction of new products to the market. Furthermore, the external environment is highly dynamic due to economic (energy cost, prices and availability of raw materials, currency exchange rates), social (unrest, demanding customers) and natural factors (extreme weather conditions, earthquakes, tsunamis). In order to survive in such a complex environment, companies need to be extremely agile and build a high level of resilience and risk mitigation capabilities and structural flexibility that allow rapid response to these challenges. Experts summarized the principles that can guide supply chain managers into what he calls the '4Rs': Responsiveness, Reliability, Resilience and Relationships. Information technology (IT) has been, and continue to be, an essential enabler for effective supply chain management (SCM). IT has made a major impact on the nature and structure of supply chains due to its ability of internal integration of various processes and more importantly external integration with suppliers and customers. This has been achieved through improving communication, acquiring and transmitting data, thus enabling effective decision-making and enhancing supply chain performance.

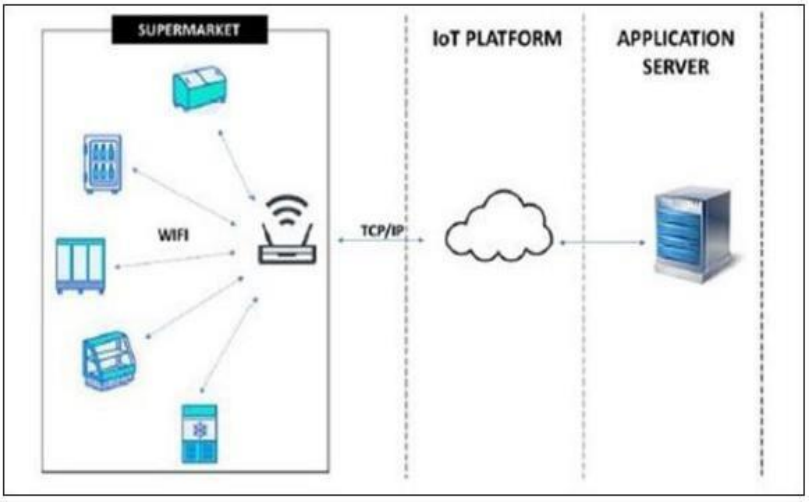

Fig. 1 Project Model

Internet of Things (IoT), one of the latest IT developments, is a new IT revolution providing a paradigm shift in several areas including SCM. IoT takes supply chain communications to another level: the possibility of human to things communication and autonomous coordination among 'things' while being stored in a facility or being transported between different supply chain entities. These new capabilities offer tremendous opportunities to deal more effectively with SCM challenges. IoT provides new levels of supply chain visibility, agility and adaptability to cope with various SCM challenges.

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REQUIREMENT OF INVESTIGATION

- **Hardware Requirement**

Fig. 2 Hardware Requirements

It shows the depiction of the hardware equipment's used in proper functioning of the product. These equipment's are finalized after having proper testing and trails for relevant output with near about accuracy.

- **Software Requirement and Modern Engineering Tools**

Fig. 3 Software tools

It shows the depiction of the complete cycle of software's used in the project's fulfillment. Use of each software has been mentioned under there respective logo's. All software's are selected on various parameters by which these can contribute for our system.

RESULTS AND DISCUSSION

The successful design and implementation of this project will result into a system that can fetch and store huge amounts of product data from the sensors installed and simultaneously process the data to provide insights that can help in increasing food shelf life and help us in improving various other parameters.

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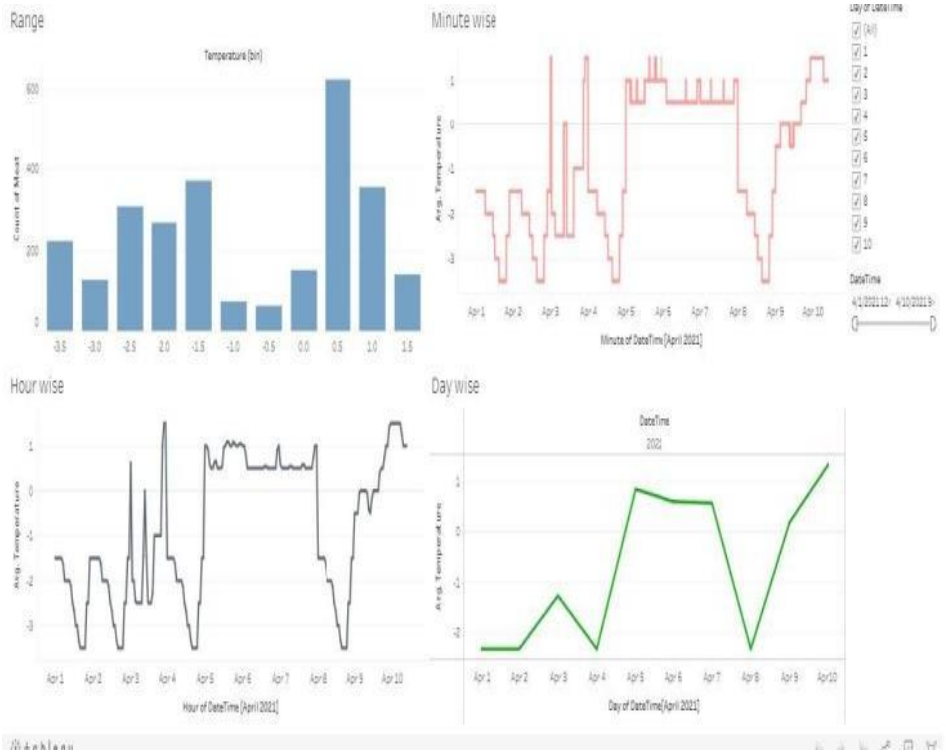

Fig. 4 Tableau Dashboard of Fridge 2

It show the analytics performed from sensor which is placed in Meat Fridge Section. As displayed data visualization is broken down into 4 parts. These 4 parts shows how the sensor is working on a day, hour and minute basis. Filter has been created on the right hand side of the dashboard to visualize the data of the particular sensor to analyze on time factor with respect to it's temperature.

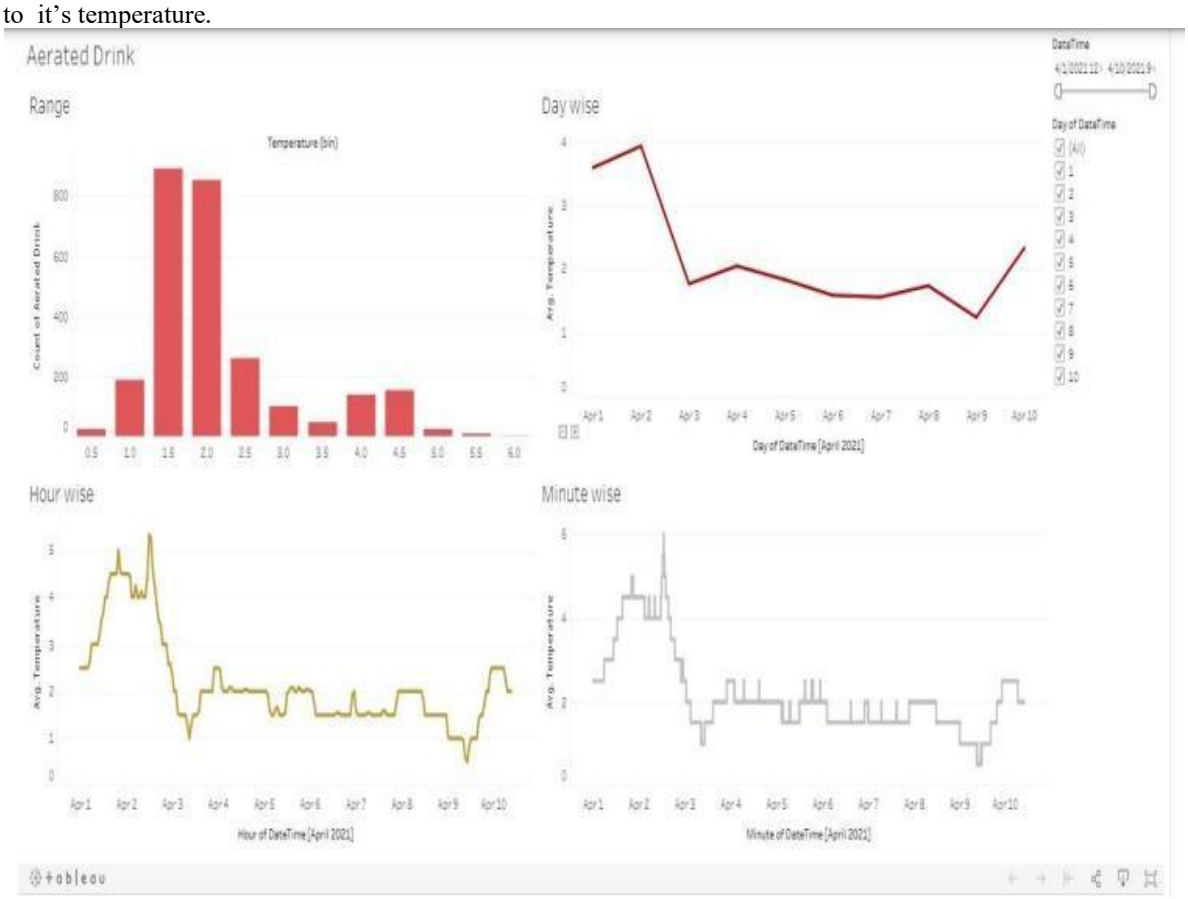

Fig. 5 Tableau Dashboard of Fridge 3

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It shows the analytics performed on Aerated Drink. As displayed data visualization is broken down into 4 parts. These 4 parts show how the sensor is working on a day, hour and minute basis. Filter has been created on the right hand side of the dashboard to visualize the data of the particular sensor to analyze on time factor w.r.t it's temperature.

CONCLUSION AND FUTURE SCOPE CONCLUSION

The integrated IoT - based online monitoring approach using smart logistics can address the critical needs of reducing foodwaste, increasing transportation efficiency, and tracking food contamination. In this project work, implementation IoT in Supply Chain Management with Food Logistics has been done. Therefore, interfacing of various sensors with NodeMCU to monitor and control the environmental conditions was successful. Data is sent to the ThingSpeak server. The user can get updates related to food product through ThingSpeak and Tableau. A login page is implemented for secure access to the database. The system is helpful to monitor the various parameters and it will also inform the consumer by uploading the data on the cloud computing server (ThingSpeak) using IoT.

- Created awareness about IoT in future and its use with products.

- Created awareness about SCM of food logistics to different food distribution sectors.

- The project was able to address some real time issues related to food logistics using IOT With the implementation of the system, we could observe reduction in food wastage and proper management of food.

- With all this, the most crucial part has been done, that was of Monitoring Temperature trends over various movements and perform Descriptive analytics to understand some crucial trends.

- Moreover, the effect of external temperature was Observed on the system. Which turned out to be a crucial factor in consideration of the temperature and airflow inside?

- As mentioned above, the data captured and cleaned was then processed and visualized using tools to make a closed loop system

FUTURE WORK

- Easily configure devices to send data to ThingSpeak using popular IoT protocols
- Use of Data to draw conclusions/results on what conditions can we make items last longer and reduce wastage.
- Updating and Upgrading of systems on requirements and on technological advancements.
- Resilience: One of the biggest challenge will be while working on multiple networks if one network goes down, the process should continue uninterrupted.
- Quality of data: The records, which do not meet the quality guidelines will react The overall integrity of the data. Making sure the data meets quality guideline while Analyzing.

REFERENCE

[1] Agrawal, S., and M. Lal Das "Internet of Things — A paradigm shift of future Internet applications", Nirma University International Conference on Engineering, 2011.
[2] APICS, "Supply Chain Operations Reference Model, Revision 11.0", 2015. [4] Z. Bi, L. D. Xu and C. Wang, "Internet of Things for Enterprise Systems of Modern Manufacturing,"IEEE Transactions on Industrial Informatics, Vol. 10, No. 2, May 2014, 1537- 1546
[3] IoT Middleware: A Survey on Issues and Enabling Technologies [6] Patterson, J., "Strategic sourcing: A systematic approach to supplier evaluation, selection, and development", CAPS Research, September 2000, 4(1): 1-6.
[4] Stundza, T., "Boeing careful when picking the 'best.' Purchasing", November 2000, 129(9):106.
[5] Diaz-Ruiz, R.; Costa-Font, M.; L´opez-i-Gelats, F.; Gil, J.M., "Food waste prevention along the food supply chain:A multi-actor approach to identify effective solutions", Resour. Conserv. Recycl, 2019, 149, 249–260.
[6] Gustavsson, J.; Cederberg, C.; Sonesson, U. Global Food Losses and Food Waste; Food and Agriculture Organization of the United Nations (FAO): Rome, Italy, 2011. 50
[7] Derens-Bertheau, E.; Osswald, V.; Laguerre, O.; Alvarez, G., "Cold chain of chilled food in France", Int. J. Refrig., 2015, 52, 161–167.
[8] Kim, W.R.; Aung, M.M.; Chang, Y.S.; Makatsoris, C., "Freshness Gauge based cold storage management: A method for adjusting temperature and humidity levels for food quality", Food Control, 2015, 47, 510–519.
[9] Badia-Melis, Ricardo, Ruiz-Garcia, Luis Hierro, Javier Villalba, Jose., "Refrigerated Fruit Storage Monitoring Combining Two Different Wireless Sensing Technologies: RFID and WSN", Sensors (Basel, Switzerland), Vol. 15, March 2015, 4781-4795.
[10] Gabriela Bogdanovsk´a1, Be´ata Stehl´ıkov´a1, J´an Ka˘cur1, "Analysis of Temperatures in the Cold Storage of Finished Products", Advances in Science and Technology Research Journal, Vol.13, Issue 3, September 2019.
[11] Google Images-https://www.google.co.in/imghp?(This link is the common link for google images where we can get all relevant images as per search.