



Role of IoT in Food Safety

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Abstract: *Organic products are grown up a system of agriculture without the use of chemicals, fertilizers and pesticides with an natural environment and social responsible. This method of farming that works at grass root level preserving the reproductive and regenerative capacity of the soil. It produces nutritious food rich in vitality which has resistance to diseases in food processing sector. Organic food sector covers fruit, vegetables, spices, meat, poultry, milk, fisheries, plantation, grains, etc, all are consumption from agro-processing industry. Now-a-days it is necessary to avoid the preservatives, additives that are sprayed on the food. Hence to find the harmful preservative is a challenge which can be overcome by using the IOT devices. Therefore in recent years there is a need to improve the awareness of the general public health about organic foods. The health conscious public is that most life style diseases are avoidable. The fear of getting sick is compelling people to start taking precautions and avoid unhealthy food. This article is spreading word about having a healthy lifestyle and guiding people to change their preference to organic diets.*

Keywords: Organic food, Preservatives, IoT devices

I. INTRODUCTION

Preservation of food products containing chemical food preservatives is usually based on the combined or synergistic activity of several additives, intrinsic product parameters (e.g. composition, acidity, water activity) and extrinsic factors (e.g. processing temperature, storage atmosphere and temperature). The concept of combinations of preservatives and treatments to preserve foods is frequently called the hurdle or barrier concept. Combinations of additives and preservatives systems provide unlimited preservation alternatives for applications in food products to meet consumer demands for healthy and safe foods.

In India it is necessary to make more regulations to set forth what would add up to Organic Food. The need to re-educate farmers is important, especially returning to the old ways of farming in India. The northern part of India has still not fully discovered the Organic Food Industry. Although, Organic food industry is growing and so many new brands are entering the industry. As expected in the coming few years the consumer percentage will increase and will learn more about Organic food. Organic food industry growth will lead to better environmental practices. Environment consciousness is needed to grow with the Organic Food market, guiding people more about Organic food and its benefits to the environment.

II. ROLE OF IoT IN FOOD SAFETY

These predictions are based on the growing availability of wireless temperature sensors as well as geo location devices and pathogen detection scanners. Industrial IoT technology gives food manufacturers and the food service industry real-time data to identify problems, reduce waste and prevent expensive, brand-damaging outbreaks and recalls.

Maintaining a safe temperature range for perishable food from farm to fork remains a technical and logistical challenge, and it's not the only one food producers and handlers contend with. Other areas for potential improvement in food



safety are recordkeeping, the scope of monitoring, real-time visibility into systems, human error and cost management. Accurate data, available to managers as the readings are taken, can help with all of these tasks. IoT applications like RFID sensors connected to GPS networks have already begun to improve tracking of food as it moves through the supply chain, boosting efficiency, reducing shrinkage, and better predicting shelf life[10].



Figure 1: Mobile Applications

III. ORGANIC FOOD PURCHASES IN EMERGING MARKET

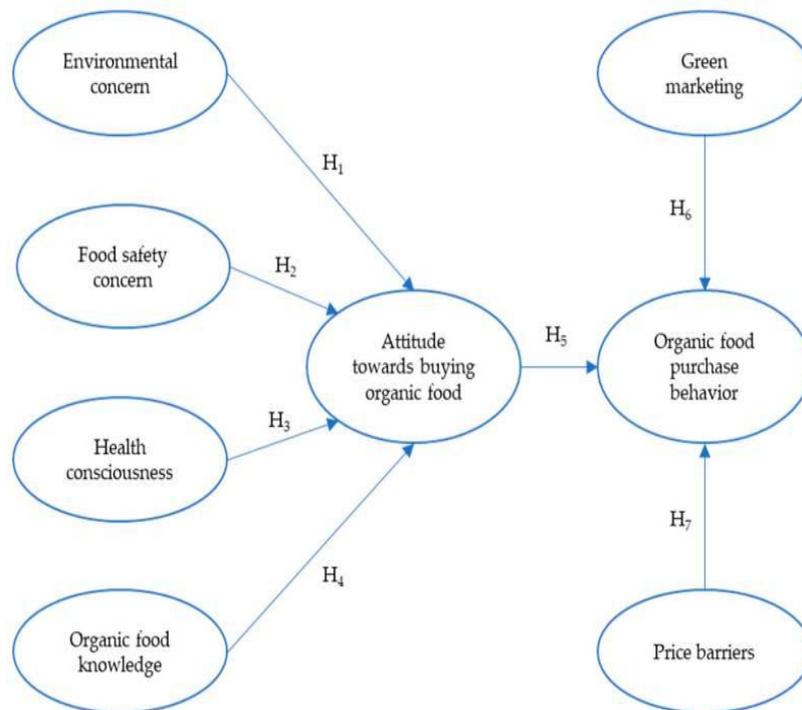


Figure 2: Organic food purchase awareness

The consumption of food has a significant impact on the environment, individuals and public health. This study aims to investigate the integrative effects of consumers’ personal and situational factors on their attitude and purchase behavior of organic meat. The consumption of this product has been widely regarded as contributing towards sustainable food practices. The study was conducted in an emerging market economy, i.e., in India. Data were collected using a



customized and validated survey instrument from a sample of 609 organic meat consumers at four food outlets in our country. The findings suggested that consumers’ concerns regarding the environment, health, food safety and their knowledge of organic food, all significantly impacted their attitude towards the purchase behavior of organic meat. Interestingly, their positive attitude did not necessarily translate into their actual purchase of organic meat. Additionally, food stores’ green marketing practices significantly enhanced consumers’ actual purchase behavior. Conversely, premium prices of organic meat were certainly a deterrent for the actual purchase of organic meat. The findings of this study have several important implications for organic food producers, retailers, policy makers and socio-environmental organizations that seek to develop intervention strategies aimed at increasing organic meat consumption in India.

According to Dunlap and Jones, environmental concern denotes “the degree to which people are aware of problems regarding the environment and support efforts to solve them or indicate the willingness to contribute personally to their solution”(Figure 2). In general, consumers who are concerned about the environment tend to develop positive environmental attitudes, express willingness to pay more for eco-friendly products and exhibit pro-environmental behavior.

IV. PRESERVATIVES IN FOODS

Chemical food preservatives are applied to foods as direct additives during processing, or develop by themselves during processes such as fermentation. Certain preservatives have been used either accidentally or intentionally for centuries, and include sodium chloride (common salt), sugar, acids, alcohols and components of smoke. In addition to preservation, these compounds contribute to the quality and identity of the products, and are applied through processing procedures such as salting, curing, fermentation and smoking.

V. TYPES OF PRESERVATIVES

5.1 Natural Food Preservatives

- To preserve the natural characteristics of the food
• To preserve the appearance of the food
• To increase of shelf value of food storage

5.2 Chemical Food Preservatives

- Benzonates
• Nitrites
• Sulphites
• Sorbates

5.3 Artificial Preservatives

- Antimicrobial agents
• Antioxidants
• Chelating agent

Table with 4 columns: Chemical Affected, Organism(s), Action, Use in Foods. Rows include Sulfites, Sodium Nitrite, Propionic Acid, Sorbic Acid, and Benzoic Acid.

Table 1: Common preservatives and their primary activity



All food products except for the one growing food preservatives in them. Every manufacturer adds food preservative to the food during processing. The purpose is generally to avoid spoilage during the certain time. The above table 1 shows actions in foods.

VI. PRESERVATION PLANNING

As shown in Figure 4, preservation planning is an important bridge between the data producers and consumers. During the planning stage several questions (some of which are listed below) must be addressed. In the past these questions have been the responsibility of biomedical data custodians and curators working in libraries, archives and repositories, who are usually engaged during the latter part of data lifecycle management (during data preservation and access services). It is notable that importance should be placed on data preservation during the planning of initial activities (e.g.collection, processing, storage), along with the ensuing activities (data analysis, sharing and reuse)[14]. In opinion, developing a community of data stewards for biomedical research programs within institutions is an important step towards long-term preservation of biomedical data[15][16].

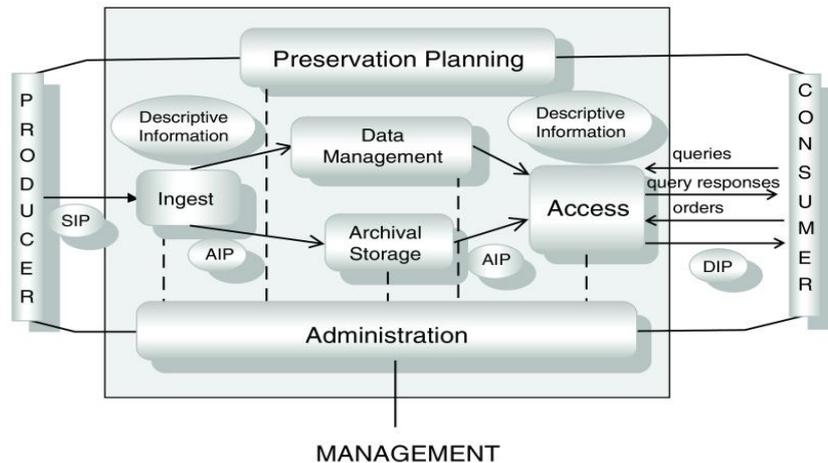


Figure 4.

VII. STUDY OF IOT IN FOOD SAFETY

Researchers and engineers around the globe are proposing different methods and architectures and based on that suggesting a variety of equipment to monitor and fetch the information regarding crop status during different stages, considering numerous crop and field types. Focusing on the market demand, many leading manufactures are providing a range of sensors, unmanned aerial vehicles (UAVs), robots, communication devices, and other heavy machinery to deliver the sensed data. In addition, various commissions, food organizations, and government bodies are developing polices and guidelines to observe and regulate the use of these technologies in order to maintain food and environment safety .There are reasonable efforts that highlight the role of the IoT in the agriculture industry, but most of the published work focuses only on applications . Most of the existing articles either provide no insight or show limited focus on the various IoT-based architectures, prototypes, advanced methods, the use of IoT for food quality, and other future issues. Considering the latest facts and figures. This manuscript examines the trends in IoT-based agriculture research and reveals numerous key issues that must be addressed in order to transform the agriculture industry by utilizing the recent IoT developments. The major contribution of this article is to provide real insight regarding:

- Expectations of the world from the food industry
- Very recent developments in IoT, both scholarly and in industry are highlighted and how these developments are helping to provide solutions to the food industry.
- Role of IoT to cope these limitations and other issues like resources shortage and their precise use, food spoilage, climate changes, environmental pollution, and urbanization.



- Strategies and policies that need to be considered when implementing IoT-based technologies
- Critical issues that are left to solve and possible solutions that are further required, while suggestions are provided considering these challenges[1...9].

Table 2: IoT review in food safety

S NO	Author	Food Preservatives	IoT Devices	Used Techniques	Future Work
1.	N. Moonrungeesee, S. Pencharee, and J. Jakmunee [1]	Food colours	Image Sensors (Camera)	Chlorophyll status, Fruit ripeness, Leaf	Take pictures of any object, focuses lens
2	H. A. A Camacho[2]		Microphone	Machine maintenance, bug detection, to make audio queries.	Detects usual/ unusual sound and convert to electrical signals
3	R. Stiglitz, E. Mikhailova, C. Post, M. Schlautman[7]	Antioxidants	Barometer	Measures the elevation height in hilly agriculture.	Measures air pressure as an altimeter. Mostly used in correcting
4	Y. Yang, X.[6] Wan, J. Cui	Sulphites	Inertial Sensor	Precise distance of plant, leave or any other object is measured from camera.	Uses accelerometer and gyro to determine the object altitude in relation to the inertial system
5.	Z. Kou and C. Wu[9]	fungies	Cleanse and filter	IoT Analytics	detects affecting data,

Table 3: Chemical Food Preservatives

Food Preservatives	Acceptable Daily intake (mg/Kg body weight)	Used in Organic food Commonly used levels (%) Decreased
Lactic acid	No limit	No limit
Citric acid	No limit	No limit
Acetic acid	No limit	No limit
Sodium Diacetate	15	0.3-0.5
Sodium benzoate	5	0.03-0.2
Sodium propionate	10	0.1-0.3
Potassium sorbate	25	0.05-0.2
Methyl paraben	10	0.05-0.1
Sodium nitrite	0.2	0.01-0.02
Sulphur dioxide	0.7	0.005-0.2

VIII. LIMITATIONS

Role of IoT to cope these limitations and other issues like resources shortage and their precise use, food spoilage, climate changes, environmental pollution, and urbanization.

Strategies and policies that need to be considered when implementing IoT-based technologies.

Although, Organic food industry is growing and so many new brands are entering the industry. As expected in the coming few years the consumer percentage will increase and will learn more about Organic food[11]. Organic food industry growth will lead to better environmental practices.

**IX. CONCLUSION**

The change in the Organic food industry was first noticed in the products such as sugar, maida and other mill products that were developed organically with the label of 'Organic' on them. The first step in the direction of the Organic food Industry was the Jaivik Bharat certification. According to this certification, any brand which claims that they produce their foods or products organically had to be certified, this was a major initiative by the government to organize Organic food market. The current scenario states that the current certified and organized organic market is around Rs2,500 crore and is increasing at a CAGR of 20 percent. In order to make it constant, the industry needs to be examined carefully and controlled by using laws. The main aim is to gain consumer's trust in products and to maintain the superior quality of these products[12].

Half of the Indian manufactured products are Organic by default due to small and dry land for farming. Foods that easily qualify to be part of Organic Category are backyard poultry, Indian sheep and goat, jackfruit, forest produced and tamarind. In India there is a need to make more regulations to set forth what would add up to Organic Food. The need to re-educate farmers is important, especially returning to the old ways of farming in India[13]. The northern part of India has still not fully discovered the Organic Food Industry. Environment consciousness is needed to grow with the Organic Food market, guiding people more about Organic food and its benefits to the environment.

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