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DEVELOPMENT OF SMART DAIRY FARMING

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Abstract: Smart dairy farming (SDF) is the key concept that can satisfy the increasing demand for quality dairy products. SDF can reduce environmental issues, decrease the use of resources, and raise animal health by using advanced sensing and data analysing technologies. Since 2015, milk is the most demanding product and it has become a product with heavy price fluctuation. In order to compete in the worldwide market, the European dairy market needs to improve its production by using the Internet of Things.

Keywords: Quick response code (QR Code), Smart dairy farming (SDF).

I. INTRODUCTION

Dairy farmers need a variety of data sources that contain dynamic and static cow data about feeding, calving, nutrition, insemination, and the process of milk production because they are in the era of precision farming, which is thought to be more important for information provision and for capturing competitive markets. The manufacturing of milk began to be impacted by the Internet of things. This action must be made in order to provide the vast global population's need for dairy. The ability to meet the demand for milk without the aid of cutting-edge technology is virtually entirely gone in the next decades; after that, there will be no other way to meet that demand.

The decision of when to milk the cow is always thought to be a difficult task. Milk may be delicate and perishable due to a lack of technology. IoT can assist farmers in this area by providing them with wearable sensor devices that keep them informed of each cow's status. The sensor-based device can accurately and effectively identify a cow's disease before it affects the cow's ability to produce milk. The farmer can attach the sensor to the cow's neck, tail, or leg to collect data in real-time for a variety of analyses, including behavior, activity, health, feed consumption, milk output, and reproductive control.

These wearable sensors can detect cow ailments and diseases, including mastitis and other conditions that could lower milk production [3]. Misconduct is the primary issue affecting the milk industry and industries associated with food. The farmers won't be familiar with the techniques used to examine the milk that is Milk is a nutrient-rich, pale milky liquid produced by mammals.

It is a vital source of sustenance and delivers the necessary nutrients to sustain physiological growth. Growing The potential for a product to generate profit is closely correlated with its commercial viability. Manufacturers have the propensity to use this and take advantage of consumers, especially when the latter are uninformed. India, a country with a high percentage of vegetarians, relies more on milk than meat to meet its dietary needs. Milk adulteration is a serious crime, and the dairy industry is a sizable one.

The goal of the ongoing endeavor is to create and deploy a smart dairy forming. One can forecast the adulteration of milk in several ways, such as by adding too much water or sugar, etc., using the intensity of the reflected light. In order to increase milk production while spending the least amount of money possible, the final product may be utilized to remove factors that are lowering it and improve factors that are boosting it.

Investigating electrical impedance spectroscopy as an alternative to conventional ways of identifying milk is the main goal of the study, "Electrical Characterization of milk samples by Electrical Impedance Spectroscopy (EIS)". The behaviour of the electrical impedance module's real and fictitious components (reactance), as well as the values admittance, phase, and diffusion coefficient (D), were also looked at and will be discussed.

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Comparisons of the measured spectra with theoretical models of equivalent circuits were done in order to understand how the samples behaved electrically. Understanding this electrical phenomenon will aid future analytical techniques. The results show that milk generally behaves resistively, with an estimated resistance value of 500 Ohms and a small storage load.

In the study on "Hygienic state of raw milk contaminated with additional water in El-Beheira governorate". The following research was done to find out how often zoonotic Y. Enterocolitica is in raw milk and to assess the risks associated with milk adulteration by adding a focus on the type of water that could be utilized in the adulteration procedure and its quality.

Raw cow milk samples were randomly collected from several homes in the Egyptian governorate of ElBeheira and processed chemically. 53 samples of water and 132 samples of raw milk were chosen at random from the same source. According to the findings, 8.3% of Y. enterocolitica from milk samples could be isolated. 52.8% of milk was fabricated by water addition.

This essay, "A Research on Milk Adulteration and Methods of Detection of Several Chemical Adulterants Qualitatively," provides a brief explanation of the various methods of adulterant detection. Many vital nutrients like protein, vitamins, carbs, fats, and minerals are all present in milk. Milk is the only food that has these vital elements.

Milk is sometimes said to as a complete food for this reason, among others [3]. Breastfeeding milk contains a variety of antibodies, including IgA, which helps protect children from the disease [1]. Several milk-producing animals, including cows, buffaloes, and goats, among others, may easily receive it. India produces 90% of the global volume of buffalo milk, accounting for 17% of the world's total milk production.

Milk is produced and exported via a proper supply chain, which establishes a network between various businesses and aids in the dissemination of the sample. Milk and its by-products are consumed by more than six billion people worldwide. The many components of milk Lactose, water, fat, protein, milk sugar, and salt and minerals are all present in the particles. The milk contains minute amounts of different phospholipids, vitamins, and enzymes.Optical Sensing System for Identifying Water Adulteration in Milk is a project. When using contaminated water to dilute milk, additional health concerns are introduced and its nutritional value is decreased. The prevalence of illnesses including cholera, jaundice, and typhoid is high. Urea, caustic soda, formalin, and other substances are examples of adulterants.

While short-term effects of taking them include infections like gastroenteritis long-term effects can be even more severe including hypertension and heart issues. With everything mentioned above, it is now imperative to deal with this problem immediately. In the past, contact-based techniques have been employed to identify milk adulteration. To identify adulteration, these techniques subject the milk to chemical reactions.

"Milk Adulteration and Detection System" project. Mixing inferior milk with superior milk results in tainted milk. For instance, goat milk is frequently contaminated with cow milk 97 for better profit. Although the health risks associated with this approach are not fully understood (some people may have cow's milk allergies), it is nevertheless a major ethical and business concern in the food industry. 98 Cheap cow milk is frequently added to the milk of ewes, goats, buffalos, and sheep56 97 99-110. 111– 114 An optical biosensor (BIACORE 3000) tool 97 115 is used for the detection of cow milk in the milk of sheep and goats. The primary benefit of this technology is the ability to automate the process and achieve detection within minutes (>0.1%). This approach is quick, easy, inexpensive, and sensitive enough to detect 5% reconstituted milk in fresh milk [5].

The autosomal genes TMPRSS3, TMC1, USHIC, CDH23, and TMIE have mutations that have been linked to hereditary hearing loss. We looked at 374 families with the condition to look for probable mutations in order to evaluate the role of these genes in Autosomal Recessive, Non-Syndromic Hearing Loss (ARNSHL) in India. Four TMPRSS3 mutations, eight in TMC1, ten in USHIC, eight in CDH23, and three in TMIE were discovered. 33 possibly pathogenic variations were found in these genes, 23 of which were novel and the rest had already been described. Of the families analysed, mutations in these five genes account for nearly one-tenth of ARNSHL [6].

This paper presents research on electrical impedance spectroscopy (EIS) as an alternative to characterize milk, seeking to build an analysis approach. The behavior of the real and imaginary parts (reactance) of the electrical impedance module, as well as the derived values admittance, phase, and diffusion coefficient (D), were also examined and will be addressed. To comprehend how the samples behaved electrically, comparisons of the measured spectra with theoretical representations of equivalent circuits were made.

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Future analysis techniques and applications will benefit from an understanding of this electrical phenomenon. The findings showed that milk is a solution with mostly resistive behavior, with a resistance of around 500 Ohms, a capacitance of about 0.5 Microfarad (F), and an admittance of the order of MiliSiemens (mS), while also exhibiting modest storage charge due to low viscosity. A mixed RC model with a series resistor, a parallel resistor, and a capacitor was the corresponding circuit that suited the data the best [7].

This study suggested a method for detecting water adulteration in milk using machine learning techniques in conjunction with digital image analysis. With 94% overall accuracy and 97% precision, the SVM-based class prediction model outperformed the other machine learning methods in the classification of contaminated milk samples based on the amount of added water. With R 2 (P) and RMSEP of 0.83 and 5.94, respectively, the XGB-based regression model was able to outperform PCR, PLSR, SVMR, and ANNR in its attempt to quantitatively determine the amount of added water. The suggested method can be utilized as an alternate strategy for quickly identifying milk adulterated with water [8].

The preservation of milk samples for microbiological tests by the Brazilian Network of Milk Quality Control Labs involves the use of preservatives to maintain the microbiota from the time of sample collection to the moment of analysis. The active chemicals and preservative content, as well as interactions between the preservatives, incubation duration, and packaging temperature, can all affect the number of bacteria. This study set out to determine whether various sodium azide and chloramphenicol concentrations could prolong the analytical shelf life of milk samples. Two farms were selected, one with a low bacterial level and one with a high bacterial count. Milk was poured into sterile vials and examined following the addition of standard sodium azide and chloramphenicol concentrations, doubled concentrations, tripled concentrations, and as a control, without preservatives. The samples were incubated for 14 days at 3 °C, 6 °C, and 9 °C, with flow cytometry used each day to count the number of bacteria present. The samples' analytical vitality was extended without affecting the outcomes thanks to the conservation benefits of the tripled preservative concentrations [9].

The possible relationships between two alternative implementations of the Poisson-Nernst- Planck (PNP) anomalous models used to evaluate the electrical response of electrolytic cells. One of them is constructed within the framework of fractional calculus and takes into account integrodifferential boundary conditions, which are also formulated using fractional derivatives; the other is an expansion of the conventional PNP model put forth by Barsoukov and Macdonald, which is also related to equivalent circuits with constant phase elements (CPEs). Both extensions are capable of explaining the experimental evidence shown here and may be connected to an anomalous diffusion with sub-diffusive features through the electrical conductivity. In addition, we use the Bayesian inversion method to extract the relevant parameter from the analytical impedance formulas. We employ the delayed-rejection adaptive Metropolis method (DRAM) in the context of Markov-chain Monte Carlo (MCMC) techniques to obtain the posterior distributions of the parameter and the accompanying confidence intervals in order to solve the relevant inverse issue [10].

This study is set up to be a "adulterant based" study rather than a "techniques based" one, with qualitative detection methods being used for the majority of common adulterants and quantitative detection methods being restricted to a small number of key adulterants of milk. In addition to conventional methods, new advancements in these detection approaches have also been noted. Currently milk is being contaminated in more sophisticated ways that demands for cutting edge research for the identification of adulterants.

There is no need to introduce milk's nutritional benefits for human health. Yet, it is concerning since many individuals are contaminating it with substances that are dangerous to human health, such as water, detergents, caustic soda, starch, formalin, urea, ammonium sulphate, and sodium carbonate. They produced synthetic milk with no nutritional value because of their monetary avarice. To qualitatively and statistically evaluate these adulterations, numerous analytical methods have been devised. Concentrate on the quantification of urea which is one of the various adulterants and present an extensive literature analysis of the existing approaches for accomplishing the same. This perspective, provide a novel method for measuring the amount of urea in milk [12].

In this project, 46 randomly selected samples of cow milk were obtained from various locations in the Sharkia Governorate, Egypt, and transported to the laboratory for bacteriological analysis (Isolation and identification of Yersinia spp. and molecular detection of the virulence gene (virF) in Yersinia enterocolitica). These analyses were done to determine the incidence of mastitis. According to the CMT findings, 33 (71.7%) of the investigated cow milk samples tested positive, compared to 13 (28.3%) that tested negative. Although the WST results showed that 34 (73.9%) of the tested samples were positive and 12 (26.1%) were negative. A study of the MSCC/ml. showed that positive CMT samples had larger quantities of MSCC exceeding 6.8 ×106 /ml, while negative CMT samples had less than 3.55105 MSCC/ml.

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This investigation is into the occurrence of Yersinia enterocolitica and Yersinia pseudotuberculosis in raw milk from livestock farms in Tehran. During the course of six months, Tehran's animal farms provided 360 samples of raw milk. Y. According to FDA criteria, Y. enterocolitica and pseudotuberculosis were isolated and identified. The samples were then cultivated in the selective medium known as CIN agar at 25°C following treatment with low temperature (10°C for 10 days) and alkaline treatment (using KOH). Following incubation, bull eye-like colonies were selected, described using phenotypic assays, and subsequently verified by the API-20E strip test (Bio-merieux, France) and identification of the ail and inv genes by PCR. Y had testing for bio-typing and serotyping. Enterocolitica isolates [14].

In Assiut, Egypt, 50 samples of raw cow's milk were randomly selected from dairy stores and street vendors for a total of 100 samples. Samples were analyzed for detection of adulteration and heat treatment. An automatic milk analyzer was used to calculate For the detection of adulteration by addition of water and partial skimming, consider density, additional water%, freezing point, fat%, and S.N.F%. Moreover, general and targeted tests were performed on milk samples to look for inhibitory chemicals, some commercial additions, and heat treatment. The findings showed that various percentages of milk samples were adulterated. More adulteration was found in the milk samples sold by street vendors than in those of dairy stores. It is possible to draw the conclusion that milk sold in Assiut City is manufactured and handled under insufficient control procedures, allowing greedy producers and sellers to adulterate milk to maximize their profit [15].

This study looks into Khartoum State's adulteration of marketable fresh milk with water and starch. The research also demonstrates the prevalence of adulteration among customers in addition to potential financial losses during processing. The collection of 300 samples took place in Omdurman, Bahri, and Khartoum. To determine the quality of each sample, it underwent a chemical inspection and analysis. On the other hand, the EKO milk gadget was used to determine whether starch had been added to the milk. The samples' densities were evaluated using a lactometer. Also, the total solids in the samples were detected using an oven operating at 105.0 °C or lower. For that analysis, the Lish-Meddall equation was applied. The study came to the conclusion that the addition of water (35.3%) rather than starch is what caused the adulteration in Khartoum State. According to the research, milk marketing should be governed by laws and regulations that specify the quality of milk that is marketed. Distribution, nominations of the producer and the distributors, good labs, and Trained technicians in order to regulate the quality than to save customer health and economy [16].

This study was conducted with the recently-emerging worry of mixing natural milk with synthetic milk in mind. Vegetable oils are emulsified with the right amount of detergent and urea to create synthetic milk. Electrical admittance spectroscopy was used to assess samples of natural and manufactured milk. Statistics reveal a statistically significant difference in the conductance at 100 kHz and 8 °C (G). Experimental findings for a lab-fabricated prototype are provided [17].

II. SUMMARY AND OBSERVATION

Some farmers attempt to use improper techniques, such as adulterating milk by adding excessive amounts of water, sugar, detergent, etc., in order to profit financially. When representatives of the dairy industry trying to take advantage of the public by giving incorrect information about the quantity of milk purchased and inaccurate quality readings.

This is where the issue arises, and it needs to be resolved since, in our opinion, the relationship between producers and dairy farms is crucial to the success of the dairy industry. Hence, to address all these concerns or at least decrease them we need to build a better procedure to bring transparency between them. As a result, we are attempting to find a solution by utilizing contemporary technology including sensors, IoT approaches, etc. so that we can maintain trust between them.

III. CONCLUSION

Dairy farming is a lucrative industry in today's globe that can be promoted to enhance a nation's economic standing. Incorrect information can be rectified from the existing implementation, including faulty quality readings and miscalculated milk purchases. They provide significant cost savings over commercially available dairy automation systems.

The system that is being offered is an overall architecture for better implementing the most recent methods for enhancing feeding and milking procedures. IoT-based farming can be more effective if the system has a comprehensive architecture, better technology adaption, and versatile design. Although the initial investment may be substantial, eventual technical advancements may allow for a balance between the amounts invested and income gained.

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