MILK ADULTERATION USING MACHINE LEARNING

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Abstract: In order to preserve the greatest quality, milk must pass through a milk supply chain that has an almost flawless cold chain. Transporters must make sure the milk that is collected from farms has been stored properly before the pickup event, that is, from the beginning of the production in the farm until the pickup event, in order to satisfy the continually growing demand from dairy processors for the provision of raw milk of the highest quality. We have suggested a model for the early identification of events in a milking cycle in order to solve this problem. We detect and recognize numerous events in a milking cycle as closely as possible to how they actually occur in the tank using online data from IoT sensors. This provides the transporter with a comprehensive, clear picture of the milk pH

Keywords: Cold Chain, Milking cycle, Sensors, IoT, pH .

I. INTRODUCTION

Milk is one of the staple foods that are consumed worldwide. However, one of the foods that is most susceptible to contamination is milk, which extremely easily tampered with. Usually, adulteration takes place either to enhance the shelf life or the volume of the milk life. It has emerged as one of the most pressing problems in most of the merging nations, as well as certain advanced nations, as well. Apart from the ethical issue, it also creates health hazards. Some of them are renal and skin disease, eye and heart problems and may also lead to cancer. So, for preventing these, determination of milk is very important.

Normal reasons for food adulteration include financial gain or improper sanitary processing, storing, transporting, and marketing circumstances. This eventually gets to the point where the customer is either taken advantage of or contracts an illness. These kinds of adulteration are rather typical in poorer nations. The consumer's knowledge of common adulterants and their consequences on health is just as crucial. In addition to being unethical and expensive, it also poses health risks. Some of these include eye, heart, and kidney disorders as well as skin, eye, and skin cancer. So, for preventing these, determination of milk is very important.

Our main objectives are as follows: -

- To ascertain the chemical make-up of milk sold in local markets, as well as to assess the milk's sanitary quality and conduct tests to look for different adulterants in the milk.
- To identify and assess the market's adulteration trend.
- To design a campaign to educate the public and the administration about this issue.

Milk is one of the staple foods that are consumed worldwide. milk is one of the foods that is most susceptible to contamination, which is extremely easy to tamper with. Milk adulteration is highly widespread and is a major societal issue in the modern world. Adulteration takes place either to enhance the shelf life or the volume of the milk life. It has emerged as one of the most pressing problems for the world. In addition to being unethical and expensive, it also poses health risks. Some of these include eye, heart, and kidney disorders as well as skin, eye, and skin cancer. So, for preventing these, dentification of milk adulteration is very important.

II. LITERATURE REVIEW

Moupali Chakraborty et al. [1] Limit of detection for common adulterants in milk: A study with different fat percent. Milk adulteration is one of the most dishonest food preparations which not only reduces the nutritional value but also causes various diseases to human. Detergents, ammonium sulphate (NH4)2SO4), sodium hydroxide (NaOH), sodium bicarbonate (NaHCO3), and common salt (NaCl) are some of the most common adulterants. The aim of the paper is to identify the minimum detectable limit for the above adulterants in milk. When submerged in various types of contaminated or unadulterated milk, an impedance sensor that is sensitive to the ionic content of the measuring medium produces variable impedance phase angle.

Natnaree Phukkaphan et al. [2] The Application of Gas Sensor Array based Electronic Nose for Milk Spoilage Detection: Milk spoilage caused by microorganisms is a major concern for healthy consumption. This study plans to apply the electronic nose framework (e-nose) involving a variety of various gas sensors as an initial tool for monitoring of food spoilage for maintaining are employed. The odor pattern was examined using principal component analysis in order to take into account the capabilities of an electronic nose for detecting freshness and milk spoiling (PCA). Thus, the investigation presented in this study can offer details on the use of electronic nose.

Moupali Chakraborty et al. [3] Milk Tester: Simultaneous Detection of Fat Content and Adulteration: This study describes an integrated milk testing device for the simultaneous detection of milk adulterants and fat content. The prototype has an integrated signal conditioning circuit for fat and adulteration detection as well as a tiny temperature control device. To comprehend the market obstacles, the suggested device is further contrasted with the currently existing milk testing tools.

Nachiket M et al. [4] Development of Electrical Impedance Sensor System for Milk Adulteration (A1 and A2): Milk is a nutrient-dense food for which there doesn't seem to be a suitable counterpart. Specific types of proteins known as A1 and A2 are present in cow's milk in varying amounts depending on the breed of the animal. Common adulterants including sodium hydroxide, hydrogen peroxide, and formaldehyde are frequently used to tamper with milk. In the study, a technique for detecting milk adulteration in milk of the A1 and A2 types utilizing electrical impedance testing was suggested.

Chirantan Das et al. [5] On-chip Detection and Quantification of Soap as an Adulterant in Milk Employing Electrical Impedance Spectroscopy: This study examines the feasibility of using electrical impedance spectroscopy to identify and quantify soap as an adulterant in cow milk (EIS). This method offers a straightforward, quick, accurate, and reasonably priced platform for milk quality monitoring. Variation of electrical parameters including the impedance, capacitance, conductance and current for and (w/w) of soap adulteration in milk are analyzed. With increased soap concentration in the milk, it has been discovered that capacitance, conductance, and current rise while impedance decreases.

Ilya A. Bakalets et al. [6] The article considers the application of the neural network model to check the quality of packaging of drinking milk in the technological production process. The neural network allows you to remove the routine load from the verification staff. Method of detection of possible defective areas and identification of signs of damage of packing areas is used. Experiments have shown that when using the proposed solution in production - the accuracy indicator can exceed 80conveyor belt in order to detect objects of a certain class is one of the most complex branches of computer vision. Methods of existing standard detection models were analyzed, with the development of which the performance of deep learning networks was significantly improved. An overview of systematic object detection methods covering single-stage and two-stage detectors is provided. Use of these methods of object detection for creation of efficient neural network technology is considered.

Rajashekhar B Somasagar et al. [7] The flavor un-stability in the milk changes the quality of the milk. In many cases the most common flavor defect of milk is feed flavor. It is hard to assess the milk flavor with human nose system. So it is necessary to develop the nostril system to determine the quality of milk based on the odor and flavor. It was done with the development of the embedded artificial electronic olfactory device called electronic nose and is processed and classified using microcontroller. With the help of this Embedded Electronic Noses (EEN) system, it can be easily determining the suitability of milk for consumption. The different flavors have different voltage values (such that different concentrations of gasses in the milk). This method provides a fast, simple, non-expensive and nondestructive method of milk quality assessment and classification. The gases like LPG, Butane, ammonia, ethanol propane was considered here.

III. RESEARCH METHODOLOGY

Initially different Milk samples are taken as source which includes fresh milk and adulterated milk. The fresh milk with has the pH range from 6.5-6.8, temperature from 30-35deg C, and also will have good odor. All the sensors in the sensor block are dipped in the fresh milk sample and result is obtained. For Adulterated milk samples different types of mixtures like sugar, salt, soap, H2O2 etc. are taken. For each adulterated sample different values will be obtained which will be used for our Dataset.

The Sensor block mainly includes 3 sensors, which are used to sense the changes in the standard parameter values. Sensors are: -

1. pH Sensor.
2. Temperature Sensor.
3. Air Quality Sensor.

As we collect the data from our Milk Samples and Sensors a manually generated Dataset is created in the format of CSV file. This Csv file is uploaded to the ThingSpeak server. ThingSpeak enables sensors to send data to the cloud where it is stored in either private or a public Channel.

This Csv file is then used by our raspberry Pi as an input Via the use of IoT as connection is established between the WIFI module of raspberry pi and our sensors. The Classification Algorithm is used in our Machine Learning Concept. The ANN (artificial neural network) Model is used to employ multi-layer connection. Firstly, Pre-processing is carried out where the data is prepared for primary processing or for further analysis. The term can be applied to any first or preparatory processing stage when there are several steps required to prepare data for the user.

The technique of turning raw data into numerical features that can be handled while keeping the information in the original data set is known as feature extraction. Compared to directly using machine learning on raw data, it produces superior outcomes. A procedure called classification divides a set of data into categories; it may be used to both structured and unstructured data.

Some of the advantages of this model are: -

- If in case milk is adulterated with sugar and water in exact proportion the lactometer test fails, in such case this project can be used.
- Ease of handling
- Low maintenance cost
- Output will be obtained in less response time.

Below figure represents the block diagram for the milk adulteration using ML.

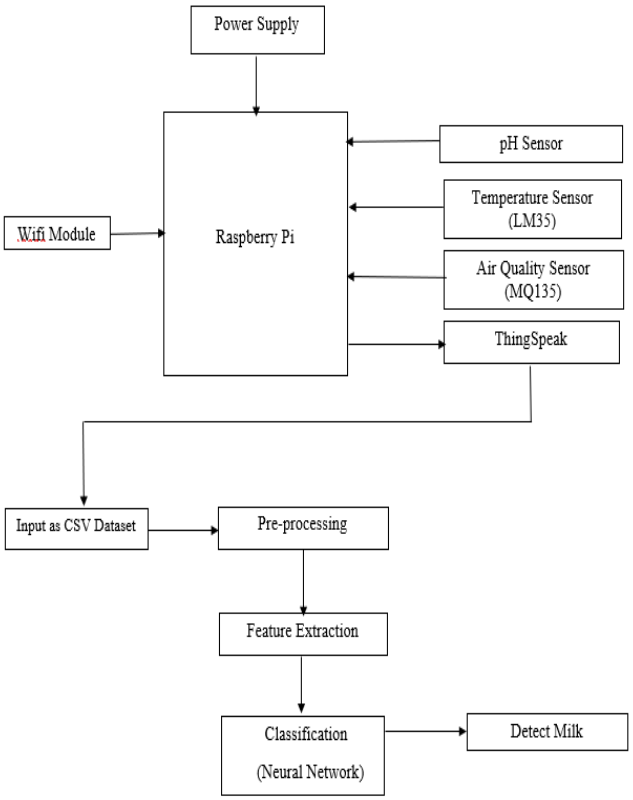

Fig. 1. block diagram for the milk adulteration using ML.

- Data Collection: Collecting a different and representative dataset of milk samples is essential for training an effective ML model. Samples should include both thinned andnon-adulterated milk from different sources and regions.

- Data Preprocessing: Before training an ML model, the collected data must be preprocessed to remove noise and insure thickness. This may involve data cleaning, normalization, and point engineering.

- Selection: The selection of features is critical in developing a good model. The selection process should consider the chemical parcels of milk, similar as its fat content, protein content, and lactose content. also, other parameters similar as temperature, pH, and conductivity can also be used as features.

- Model Selection Choosing an applicable ML algorithm is critical to the success of the design. Generally used algorithms for bracket problems include decision trees, arbitrary timbers, and support vector machines (SVMs).

- Model Training and Evaluation Once the dataset is set, the features are named, and the model is chosen, it's time to train and estimate the model. The dataset should be resolve into training and testing sets. The model is trained on the training set and estimated on the testing set to insure its delicacy.

- Model Deployment Once the model has been trained and estimated, it's time to emplace it. The deployment process should be well- proved, and the model should be tested in a real- world script to insure its effectiveness.

- Continual enhancement Continual enhancement is necessary to maintain the model's effectiveness over time. This may involve retraining the model with new data or streamlining the model's features to include fresh parameters.

IV. CONCLUSION AND FUTURE WORK

In this model, we design a Milk quality Detection System We Use Software plus Hardware for the Implementation and execution. We consider a general form of Application execution. It is being adulterated with water, milk powder, detergents, salt, urea which have harmful impact on human health. With the analysis of the scenario, we can conclude that public health is an important issue but adulteration in food is commonly practiced in the market. Consumers are unaware of this and government is doing very less to bring it into notice. But with proper awareness among the people understanding the criticality of the issue, adulteration can be prevented. Adulteration would be reduced in and of itself if consumers were aware of the practices of adulteration and how to avoid them.

As our project is a small-scale model in initial stage. Further, in future we can make an application where, the data which we got from our model on the cloud server can be reach upto vendors and consumer using their mobile numbers directly through the application.

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