MILK QUALITY MONITORING SYSTEM USING IoT AND ML

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Overview

Introduction

- Milk is the most important food source and raw material for human health.
- Determining the milk quality by manual methods can result in high margin of error or loss of time.
- Improving the quality of milk provides many nutrients.
- Low quality milk contains harmful bacterial like E-coli and listeria which is contamianted with chemicals, pesticides and foreign matter
- Leads to compromised immune system,malnutrition and gastrointestinal disorders.

Problem Statement

- Develop a predictive model for assessing milk quality based on various parameters to ensure the accuracy and safety of milk products consumed by consumers.
- The model should accurately predict milk quality attributes based on colour, turbidity, fat, pH, taste, temperature and odor etc.
- The predictive system will enable stakeholders in the dairy industry to preemptively identify potential issues, maintain high-quality standards, and ensure consumer satisfaction and health.

Objectives

- Test milk and products for safety, health, and compliance standards.
- Continuous improvement refines processes, enhances ML models for accurate milk predictions.
- Robust system detects early milk anomalies, minimizing substandard production issues.
- Transparent milk quality, traceability, and integrate consumer feedback actively.

Literature Survey

S.No	Title	Objective	Methods	Description	Performance	Author and Year
1.	IoT based detection of adultration in milk.	Milk, a nutrient-dense liquid. It is an essential food source for young mammals, providing a balance of carbohydrates, proteins, fats, vitamins, and minerals necessary for growth and development.	Arduino UNO controller and sensors to develop a system	Milk, a nutrient-dense liquid, is essential for young mammals and humans. However, milk adulteration can lead to increased quantity or improved appearance, thereby preventing health risks.	Identify milk quality by improve its appearance, texture, or taste.	Pachakula Nookaraju, 2023.
2.	Research on dairy products detection based on machine learning algorithm.	The machine model has the best estimation performance for milk fat and protein, providing a technical basis for predicting dairy product quality. The method is low-cost and non-destructive.	Support Vector Machine, and Random Forest.	The study developed an electronic nose model using seven metal oxide sensors to identify milk sources, estimate fat and protein content, and evaluate milk quality.	The model SVM with 91.5 percent accuracy rate.	Yang Zhang, 2022.
3.	Machine Learning Applied to Milk Sample Classification.	To detect adulterants and improve the inspection process for dairy products suitable for human consumption, particularly for children, contributing to the credibility of dairy product integrity.	Random forest	The study uses machine learning to classify milk samples, to detect adulterants and improve inspection for dairy products.	The model accurate at 96 percent.	Diego Ossa, 2022.

Literature Survey

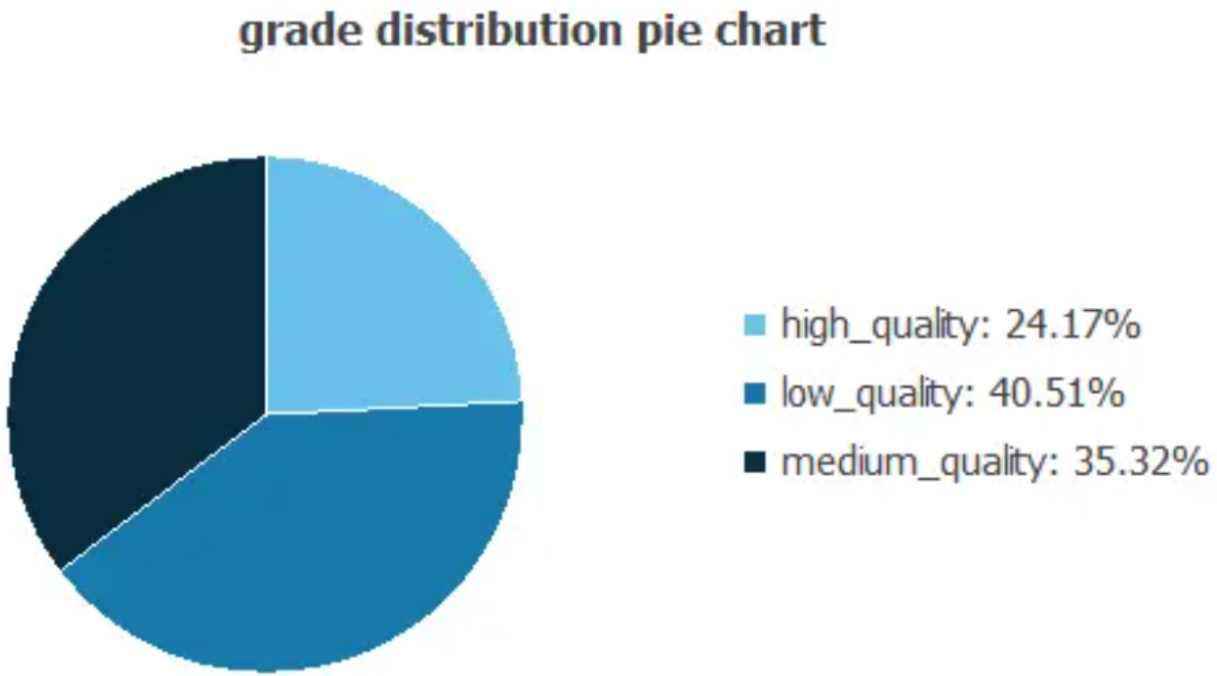
S.No	Title	Objective	Methods	Description	Performance	Author and Year
4.	Using Machine Learning Algorithms to Detect Milk Quality.	The Orange platform was used for application, and results were presented with visual graphics.	Neural Network and Adaptive Boosting algorithms were used for classification estimation	In this study, milk quality was determined using seven features from an open-source Kaggle dataset. Neural Network and Adaptive Boosting algorithms were used for classification estimation.	The Neural Network achieved 95.4 precent.	Ahmet C ̧ELIK, 2021.
5.	Predicting cow milk Quality traits from daily avalilable milk spectra using statistical machine learnig methods.	Use of modern statistical machine learning methods for trait prediction from mid-infrared spectroscopy may improve prediction accuracy for some traits.	partial least squares regression, boosting decision trees,	A study using milk samples from 622 cows with known protein composition and technological trait data accompanied by mid-infrared spectra analyzed the predictive ability of various algorithms.	The best prediction method for 6 of the 14 traits, while NN and RR were the best algorithms for 3 traits each	D. P. Berry, 2021.
6.	IoT for development of smart Dairy Farming.	The use of IoT and AI can help dairy farmers overcome traditional challenges and increase milk production.	Smart dairy farming (SDF) and proposes a state-of-the-art framework to help farmers increase milk yield using the latest technologies.	The increasing demand for milk and the growing population necessitates improved technological techniques for improving milk yield.	These methods can decrease negative factors and increase positive ones with minimal resources.	Maruf Pasha, 2020.

DataSet

- **1. Data Source:**
  The data source is the file "milknew.csv ". The number of columns is 8, and the number of rows is 1059.
- **2. Variables:** The variables are:
  pH: This feature defines pH of the milk, which is in the range of 3 to 9.5.
  Temperature: This feature defines the temperature of the milk, and its range is from 34'C to 90'C.
  Taste: This feature defines the taste of the milk and takes the possible values: 1 (good) or 0 (bad).
  Odor: This feature defines the odor of the milk and takes the possible values: 1 (good) or 0 (bad).
  Fat: This feature defines the fat of the milk and takes the possible values: 1 (good) or 0 (bad).

- Turbidity: This feature defines the turbidity of the milk and takes the possible values: 1 (good) or 0 (bad).
  Colour: This feature defines the color of the milk, which is in the range of 240 to 255.
  Grade: This is the target and takes the Values: low quality, medium quality, or high quality.
- All variables in the study are inputs, except "grade", which is the output that we want to extract from this machine learning study.
- Note: "grade" is categorical and can take the values low quality, medium quality, and high quality.
- **3. Instances:**
  The instances are divided into training, selection, and testing subsets. The milk dataset contains 429 instances of low quality, 374 instances of medium quality, and 256 instances of high quality.

- The figure is the pie chart for the variable milk quality class, and it shows its distribution.

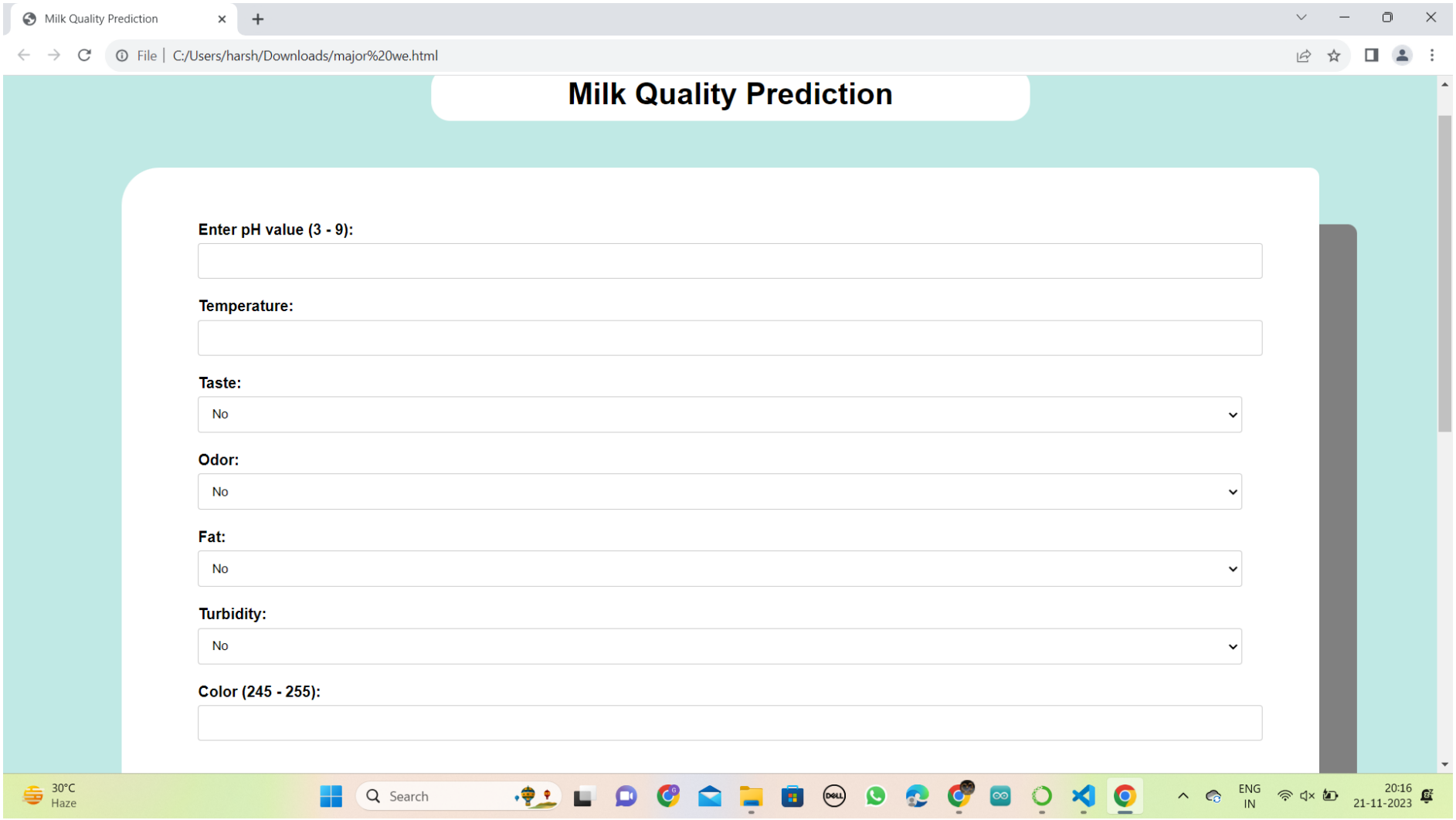


Tool and libraries

- Tools:
  Jupyter
- Libraries:
  1. NumPy
  2. Pandas
  3. Seaborn
  4. Matplotlib

Progress

- **Partial Implementation**:
  1. We have collected milk dataset.
  2. Trained the model.
  3. Developed the model.
  4. Upon implementing our model with Logistic Regression and Random Forest algorithm and evaluating their performance, we observed that the accuracy is 85 percent and 99 percent.
- **MileStones:**
  1. Identifying the Dataset.
  2. Training the model.


Milk Quality Prediction
File | C:/Users/harsh/Downloads/major%20we.html
Milk Quality Prediction
Enter pH value (3 - 9):
Temperature:
Taste:
No
Odor:
No
Fat:
No
Turbidity:
No
Color (245 - 255):
30°C
Haze
Search
ENG
IN
20:16
21-11-2023

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Thank you