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Innovating The Traditional Dairy Business Using Cutting-Edge Technologies and Machine Learning

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ABSTRACT: The development of the Indian dairy industry is crucial for the economy of the nation. By utilizing big data analytics and precision farming, we are building a real-time, data-integrated, data-driven, continuous decisionmaking engine called My Dairy. Scientists from many fields, dairy farmers, and business experts are all involved in this transdisciplinary research and extension effort. The creation of a system capable of gathering, integrating, managing, and analyzing on- and off-farm data in real time for useful and pertinent activities is essential. By connecting the milkman with the consumers and the vendors through the application, the traditional system of milk delivery and other dairy goods will be advanced and innovated. India's rural areas experience a shortage of milk and dairy products, which inspired the idea to build an interface between them. Additionally, the milkman would have connections to the suppliers of milk. The production method used to create dairy cattle in the present period is the main topic of this study. This study discovered that the production forces in dairy farms are based on basic technologies and a focus on subsistence necessities. It is anticipated that dairy farming will no longer be seen as a side business but rather as a viable and alluring career for the next generation. Young breeders, who unquestionably possess superior skills to those of the incumbent breeders, are thus encouraged to emerge as a result of this scenario. Farmers' growing sense of entrepreneurialism is anticipated to have an impact on rising income and employment. The role that production mode has in boosting output per labor unit is also crucial. The expected increase in labor productivity is due to innovation and technology. The My Dairy application displays a price list for products (such as milk, curd, butter, and paneer), a summary of the purchase order, payment history, customer comments, offers, and indentation order. Despite the fact that milk has been divided into various types of milks, many dairy products, including cream, butter, cheese, and ghee, are still considered to be addictive.

KEYWORDS: Machine Learning, Trans disciplinary research, MERN stack, SMS service

I. INTRODUCTION

The prompt delivery of milk and dairy products is vital for households in the flurry of everyday life since certain necessities stand out as indispensables. Daily schedules and routines are hinged on the dependability of these delivery. The purpose of this study is to build an innovative application that will cater to the regular delivery of milk and milk products while ensuring that it seamlessly satisfies the always changing demands of individuals and families. This study recognizes the importance of this daily need and seeks to meet it. However, within the small-scale industry that serves this vital function, a cumbersome manual process currently prevails. Operators are burdened with the task of collecting orders from a multitude of retailers and then painstakingly compiling these orders into a composite format for placement at the manufacturer's site. This manual labour extends to the meticulous upkeep of records pertaining to orders and sales within a database. The decision-making process, hinging on the status of this database, is predominantly conducted through manual analysis. The current approach, riddled with manual interventions, has proven to be inefficient, time consuming, and susceptible to errors. These inherent challenges have led to difficulties in ensuring the timely delivery of milk and milk products to households. Furthermore, it hampers the ability to optimize operations and adapt swiftly to changing demands and market dynamics. In response to these pressing issues, this study underscores the imperative need for the development of an integrated system. This system must be able to effectively gather, handle, and analyse realtime data from both on- and off-farm sources. This should make it possible to take useful and pertinent steps that improve the consistency and promptness of milk and milk product delivery to households. To make sure that every morning begins with the guarantee of prompt milk delivery, this research essentially aims to close the gap between conventional manual operations and modern, data-driven, and technologically-empowered alternatives.



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Machine learning (ML) is a relatively recent technique that has demonstrated its ability to combine multiple data types, including both structured and unstructured data1 (Géron, 2019), in this case pertaining to the existence of food safety concerns to create predictions regarding food safety. Computers are programmed to "learn" from input data provided to them via machine learning (ML). According to Alpaydin (2010), Murphy (2012), Shalev-Shwartz & Ben-David (2014), learning is the process of transforming the input of experience (such as historical data) into the output of knowledge (such as categorization and prediction). Several research have employed ML models to monitor and predict food safety, proving that this technology is a viable tool for tackling the challenge of food safety monitoring and prediction.

A. Materials and Procedures

1) Findings: These dairy products are frequently bought and consumed on a regular basis. The purpose of the study is to comprehend Indian consumers' purchase patterns for dairy goods. It looks into the demographics, brand preferences, purchasing patterns, brand loyalty, and the weight that consumers give to the quality of milk and dairy products as factors that affect consumer purchasing decisions products.

The study concentrates on the habitual buying behavior of Indian consumers regarding dairy products, considering the variations in quantity, quality, and pricing across different buying habits.

The emergence of mobile applications has had a profound impact on a number of industries, including the food industry. Due to the disruption caused by mobile apps, there are now delivery services, platforms for restaurant reservations, and apps for supermarket shopping. These developments have created new commercial opportunities as well as increased consumer convenience. The ease of ordering via a mobile device, real-time tracking, and customized recommendations have transformed consumer interactions with the food industry. This section looks at the bigger picture of mobile applications in the food industry, giving us an understanding of the dynamics of this technological change.

Investigating new trends and technological advancements in the dairy industry as we look ahead to the future of dairy trade. The potential impact of artificial intelligence, the Internet of Things (IoT), and other cutting-edge innovations on dairy commerce applications is explored in this section. It also takes into account the potential for sustainability and traceability features in dairy-focused apps, in line with shifting customer expectations for goods with ethical sourcing and little environmental impact.

The dataset comprising milking records from high-yield Polish Holstein Friesian dairy cattle, which produce over 40 liters of milk per day included 2208 recordings of milking, and the researchers wanted to know how different variables impacted the makeup of milk produced by these high-yield dairy cow. A typical assumption in statistical analysis, the study discovered that the residuals—differences between actual and anticipated values—in the data followed a normal distribution. The fact that the mean of these residuals was nearly zero shows that the statistical models used were effective in fitting the data. The fact that the variance was so low (0.016) implies that the models did a good job of describing the variation in the data. The coefficient of determination (R-squared), a gauge of how well the statistical models fit the data, was calculated to be 0.946. An R-squared of 0.946 indicates that the models, notably Multiple Linear Regression and Curve Estimation, were very successful in describing the variability in the milk composition data. An R-squared of 1 would indicate a perfect fit.

Non-probability sampling techniques were used in the study of consumer purchasing patterns for milk and other dairy products in India, which indicates that the respondents weren't chosen at random but rather on the basis of predetermined standards. The Shapiro-Wilk test, the Cronbach Alpha test, the Kruskal Wallis test, the Mann-Whitney U test, and the Cronbach Alpha test were used for data analysis. The Cronbach Alpha test was used to evaluate internal consistency, the Kruskal Wallis test to compare groups, the Shapiro-Wilk test to check for normality, and the

Mann-Whitney U test to compare two independent groups. Distributing questionnaires to dairy product customers in India was part of the data collection process. With a value of 0.858, the outcome indicates a high degree of correlation between the survey replies. This suggests that the data was dependable and consistent.

The investigation makes use of non-probability sampling procedures, which means that the respondents weren't chosen at random but rather on the basis of particular standards. The Shapiro-Wilk test, the Cronbach Alpha test, the Mann-Whitney U test, and the Kruskal Wallis test were some of the statistical methods used to analyze the data. These tests were used to compare groups, measure internal consistency, test for normality, and compare two independent groups,



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respectively. Distributing questionnaires to dairy product customers in India was part of the data collection process. Using a measure of internal consistency called the Cronbach's Alpha test, the study evaluated the validity of the data that had been gathered.. The result, with a value of 0.858, suggests a high level of correlation among the survey responses. This indicates that the data collected was consistent and reliable.

Clustering, variance analysis, hypothesis creation, and hypothesis validation are all part of a thorough investigation of import substitution. Ward clustering is a key technique for reducing dispersion. Rules and measurements are crucial for interpretation. While Wilkes lambda statistics and canonical roots are used in variance analysis to evaluate the grouping significance, linear discriminant analysis is used to allocate objects.

Discusses major discoveries, a model for mobile agricultural applications, and the possibilities of mobile technology in agriculture. High mobile phone penetration, the widespread usage of Nokia phones, dependable networks, and the significance of system integration are some of these results. The research highlights the importance of user experience and provides insightful information for the creation of mobile agriculture models. With an emphasis on dairy production, this study offers perceptions into the potential of mobile technology in agriculture. Here is a list of the main conclusions and observations. These results show that the target demographic is prepared to use mobile agriculture applications.

2) *Methodology:* The framework integrates technologies from the MERN stack, K-means clustering, regression models, etc. For detecting the depth of a water body and gathering data on the speed of water flow, we will employ sensors like ultrasonic sensors and water level sensors, respectively.

a) Recognizing Consumer Behavior: Consumer behavior refers to the methods used by people, groups, or organizations to make decisions about the selection, use, and disposal of goods and services. It explores consumer emotions, attitudes, and preferences in order to influence their purchasing choices. This knowledge helps marketers satisfy client wants, provide value, and eventually bring in money.

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Manufacturer plan	t	Distributor name	Product name	Quantity
Distributor 1	Distributor 2	Distributor 3	Distribu	tor N
Login Place order Modify order analysis	Retailer name	ProductName	Quantity	Date
Prediction				
Retailer 1	Retailer 2	Retailer 3	Retails	
			Plac Modify o	e order order analysis
Customer 1	Customer 2	Customer 3	Custor	mer N

Fig. 1. System architecture

b) Predicting the Consumers Behaviour: Consumer behavior prediction involves:

- Segmentation is the process of dividing up a consumer base into more manageable groupings according to their purchase habits. This segmentation aids in recognizing various market segments and addressing individual customer needs.
- In order to predict future customer behavior, predictive analytics makes use of statistical techniques and historical data analysis. Using mathematical models created from historical data, predictive analytics uses trends to make forecasts or recommend the best course of action. Regression, neural networks, and decision trees are typical strategies.

B. Introduction of ML algorithms

Numerous varieties of NN are among the ML algorithms that are most frequently employed to evaluate unstructured data. Recurrent neural networks (RNN) are used to evaluate text data, whereas convolutional neural networks (CNN) are used to analyze image data. Zhou et al. (2019) have recently examined the ML techniques used to analyze unstructured



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data linked to food safety. For more details, the reader is directed to this review. A BN model, which includes the Bayes classifier, is a visual model with nodes (representing variables) and directed arcs (linking the variables) that have conditional distributions connecting them (Nielsen & Jensen, 2009). Each node categorization and its parent nodes are given a conditional distribution.

Using ML to combat food fraud primarily on the identification of added materials to food (Laga & Sarno, 2020; Lim et al., 2016; Mithun et al., 2018), classification of different quality levels of one food product (Dong et al., 2012; Voetal., 2020; Zhang et al., 2014), and prediction of general food fraud (Bouzembrak & Marvin, 2016; Marvin et al., 2016). Some research use the BN technique to forecast the occurrence of food fraud and to identify elements that contribute to food fraud activities (Bouzembrak & Marvin, 2019; Laga & Sarno, 2020; Marvin et al., 2016).

Data are essential to the examination of ML models. There are two main types of data used in the chosen articles: structured data and unstructured data. Highly ordered data are referred to as structured data, and they typically take the form of letters and numbers that are maintained in databases or tables. Data

that are not structured in a preset manner are referred to as unstructured data. It comes with a variety of native formats, typically a range of them, such as image files or text files.

In order to accurately reflect the scientific trend of ML applications for the monitoring and prediction of food safety, only peer-reviewed primary research articles that have been published and were published in journals with an ISI impact factor were included in our review. We assessed these research' advantages and disadvantages in this review. We discovered, for instance, that across all ML applications, BN was widely utilized for modeling due to its simple model structure and ease of incorporating expert information. We also offered suggestions for future research, such as (a) comparing several MLs can help in improving prediction outcomes. Given the breadth and regular updating of ML models (based on the fundamental ML models), it is likely that these search strings relating to ML models did not cover all potential ML models. In the current review, the most widely applied ML models for food safety were retrieved and reviewed. The debate could serve as both an introduction to the subject and as a starting point for further research on further uses of ML models in this situation.

One of the non-hierarchical clustering techniques is the K-means method. Standardized data are needed since the variables under research have a distinct scale and size value. The information is transformed into standard values using Z scores Z N (0, 1). Equation (1) contains the formula needed for this (Kalayc, 2008).

$Z = (X - \mu) \sigma$

II. FUTUREWORK AND CONCLUSION

Our aim is to construct an interactive, user-friendly app for testing during the next two months while still in the development stage of our application. User information will be kept on the server. The system for dairy food products that has been developed intends to decrease manual order processing, forecast developments, and improve price. It makes the supply chain's data management and communication more effective. Storage and sharing of product, payment, and cart information, simple searching, and alerts for sales, offers, and payments are all planned features. In this study, machine learning (ML) models for tracking and forecasting food safety are identified and evaluated. A thorough literature search turned up 114 pertinent research, 75% of which were recent (5 years) publications. The recovered research' excellent predictive accuracy suggests that ML models present a feasible approach for tracking and forecasting sales. Because of its simple model structure and ease of incorporating expert knowledge, BN is the most often utilized method for analyzing structured data among the various ML models used in the 114 research. Due to its ease of handling both image and text data, NN is the primary method for analyzing unstructured data. The recommendations for data sources and input variables made in this study point to a number of directions for further research using ML models for the observation and forecasting of sales

- .• Currently in the development stage with a two-month target for testing deployment.
- Create an application that is interactive, user-friendly, and optimized.



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• User registration results in data storage on the server, which protects data.

• The suggested system for dairy food products attempts to minimize manual order processing and helps distributors and retailers foresee trends and optimize pricing.

• Emphasis on easy access to information and feedback, enhancing communication across the supply chain.

• Combining and managing various data sources effectively for better decision-making.

• The features that are planned include saving important data, emailing data, making it simple to find information using a search bar, and sending timely alerts for sales, offers, and payments.

• Deliver a solid and user-centered application that streamlines supply chain procedures in the dairy industry as the overall objective.

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"Acknowledgment(s)" is spelled without an "e" after the "g" in American English.

As you can see, the formatting ensures that the text ends in two equal-sized columns rather than only displaying one column on the last page.

This template was adapted from those provided by the IEEE on their own website.

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