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Well-organized Milk Distribution Monitoring System based on Internet of Things (IoT)

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Abstract: *India became the largest milk producer in 1997 (16% of global production) and milk became the single most valuable agricultural commodity in India. India's practice of boiling milk prior to consumption has played a crucial role in ensuring that there have been no major health epidemics attributable to milk. The project, milk distribution monitoring system targets the cold chain maintenance and milk spoilage avoidance. The system is based on Internet of Things and data mining. Traditionally milk is supplied in cans with minimum monitoring which may result in milk getting spoiled before its use specially during transportation at any point of time which causes vendors to know about milk spoilage only after the milk has been spoiled completely. To overcome these problems first data mining technique is employed to discover the routing plans so as to generate case-based routing plans for the drivers.*

Then the existing sensor based system will measure the pH value of milk and determine its quality. The system will direct to nearest milk booth with the highest proximity by using routing technique where data center serves as a cloud server to calculate the costs of a finding the nearest milk booth request, and these costs will be frequently updated by considering the location of van and the total number of milk booth in each areas whose data is accessible any time in the network. In this paper novel IoT architecture able to path and sketch milk production and distribution through the supply chain and in food processing environments, it is very effective information identification and traceability.

Key Words: Data mining, optimization, K-means Clustering Case based routing, Variable Neighbourhood Search.

1. INTRODUCTION

Milk being perishable commodity needs to have an effective and efficient marketing system. An efficient and effective marketing system minimizes the cost of marketing services and ensures the largest share of consumers price to the producers. The quality produce should be provided to the consumers at reasonable price. But the presence of the intermediaries in the channel of milk marketing and distribution not only works against the managerial skill of milk producers but also decreases the marketing efficiency. For the development of the dairy industry, it is necessary to know the marketing margin, and price spread of milk which may help to explore the possibilities of reducing marketing costs and margins for the welfare of the producers and consumers. Milk being an extremely nutritional drink of our daily life should be consumed within time. Milk spoilage is an indefinite term and difficult to measure with accuracy. Using Internet of Things we can locate in real time the nearest location to dispose the milk before it gets spoiled. The driver of the milk delivery vehicle gets the notifications about the most optimal routes to deliver milk before spoilage.

The pH and temperature sensors embedded in the milk cartons continuously measure the pH and temperature of the milk and if the pH and temperature values passes the predefined threshold value, the VNS algorithm comes into the picture. The Variable Neighborhood Search algorithm takes input from the K-means clustering techniques output and finds the optimal path for delivery of milk before spoilage. If the pH or temperature of the milk goes above the threshold the VNS algorithm starts working in order to find the most suitable path to deliver milk.

2. PROPOSED SYSTEM

Routing algorithm will be used to offer a solution of finding an available milk booth if the PH value deviates. This is implemented by a system prototype with wireless access in an open-source physical computing platform based on Ardiuno and using a smart phone that provides the communication and user interface for both the control system and the vehicles to verify the feasibility of the system. It will also give an alert SMS to vehicle driver so that collection of milk can be faster without more spoilage. This way it will maintain good quality and cost effective distribution of milk.

3. LITERATURE-REVIEW

To compare the marketing aspects of cooperative and private dairy plants, one milk plant each from the co-operative and private sectors were selected purposively in the Coimbatore district of Tamil Nadu. The installed capacity of each of these plants was 2 lakh litres per day. The average daily milk procurement of the co-operative dairy plant was 1,25,000 litres. On an average, the plant processed 90,000-1,00,000 litres per day of market milk, namely toned milk, standardised milk and full cream milk. The surplus milk was converted into various dairy products, namely, 'Butter', 'Ghee', 'Flavoured milk', and 'Milk peda'. The milk and milk products of the co-operative dairy were sold through booths, parlours, wholesalers, retailers and clearing and forwarding agents. On the other hand, the average milk procurement of the private dairy plant was 1,50,000 litres per day. It processed around 95,000 – 1,05,000 litres of market milk per day in three types of milk, namely toned milk, standardized milk and full-cream milk. The excess milk was converted into several products like butter, ghee, flavoured milk and paneer and the dairy products were sold through wholesalers, retailers and commission agents for the private dairy. Milk consumption is one of the most basic need for the human, so as to transport milk in order to fulfill the basic human need is quite a challenging task. To avoid spoilage and preserve good quality milk various technological procedures were used. In traditional times, milk cartons used be delivered from milk vehicles to the customers but it had no supervision and often milk used to be wasted as vendors came to know about the spoilage much later. New methods have been researched with the purpose of developing more accurate and efficient means of detecting milk spoilage which includes ph and temperature monitoring.

1. Power supply
2. PH Meter
3. Milk Density sensor
4. Temperature sensor
5. Bluetooth
6. Cooling system

4. SYSTEM-ARCHITECTURE

The IoT enabled milk distribution chain in action definitions of IoT can be found in different researches, such as United States, European, Japan, and China. Although definitions from different organizations are somehow different, the requirements for IoT are essentially the same, such as being able to integrate heterogeneous devices, ubiquitous data exchange, localization and tracking capabilities, and even being able to make the simple decision by themselves. The IoT makes possible a new cooperative between food producers, transportation and hospitality/retail companies who can work together as never before to ensure efficient delivery and product safety. With IoT-based business solutions, companies across the supply chain gain the real-time visibility and enable the automated, intelligent actions needed to ensure milk is of the highest quality, delivered on time and prepared in optimal settings. IRJET sample template format ,Define abbreviations and acronyms the first time they are used in the text, even after they have been defined in the abstract. Abbreviations such as IEEE, SI, MKS, CGS, sc, dc, and rms do not have to be defined. Do not use abbreviations in the title or heads unless they are unavoidable.

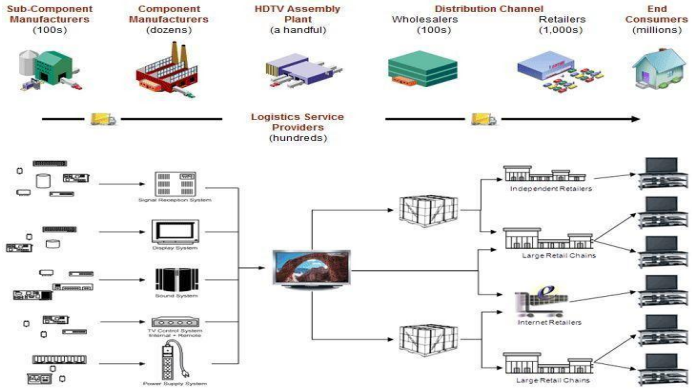


Fig -1: System Architecture

A whole picture of distribution chains in the era of Internet-of-Things For instance, food companies that use IoT-connected testing equipment can confirm food quality as it leaves the factory or warehouse. Fleet managers can then leverage the IoT to make sure 315 temperature sensitive, perishable goods don't go bad in transit through sensor enabled refrigeration systems. Any temperature fluctuations can trigger alerts that automatically adjust the truck's refrigeration during transportation. If the system is not able to auto-correct, an alert can be sent to the food supplier, who can replace bad goods before they arrive at the customer's dock. And by using an IoT- based fleet management solution to enable continual visibility into connected trucks, trucking managers can optimize routing and ensure on-time delivery of the new goods via an alternate vehicle. In the end, the customer receives quality goods on time and is never aware there was an issue. Plus, the sensor-enabled refrigeration system can send alerts to the manufacturer, pinpointing the exact part that broke down and facilitating faster replacement and fixes on server side database stores all the booth location points(latitude, longitude) and area names and also the user details like username and password. Firstly, admin has to login into the system by entering the correct username and password. Then if admin wants to a new booth into the database he can add it through the function called 'Add Booth'. If admin wants to delete a booth he can do it using 'Delete Booth'. Next, K-means clustering is performed on the selected booth points through the function 'Perform Clustering.

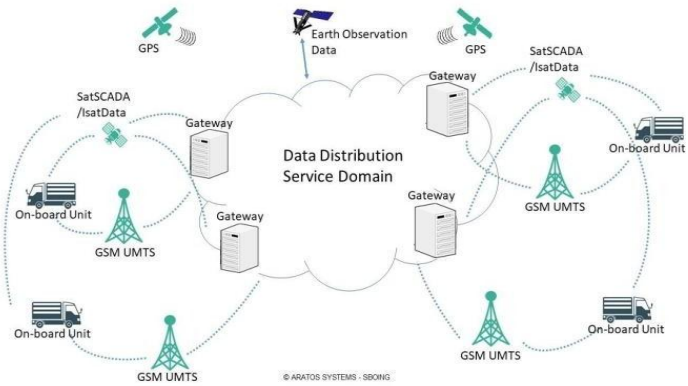


Fig -2: Implementation Flow

On client side, the result of the K-means clustering is loaded onto the android app for navigation purpose. The route is updated every 20s according to the real- time traffic data. If there is any change in the pH- level the system generates an alert and navigates the route to the next nearest milk booth location using VNS algorithm.

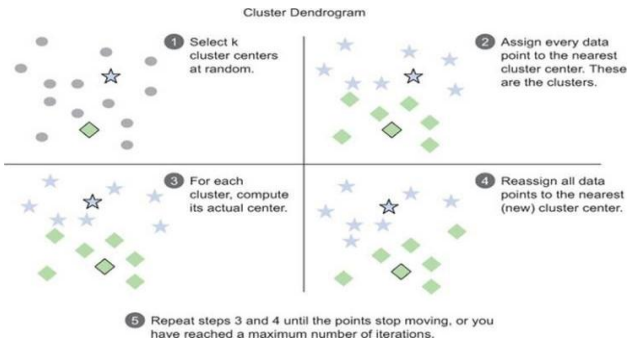
5. ALGORITHMS

We have adopted a modified version of K- means clustering algorithm for clustering of location point nodes and Variable Neighborhood Search(VNS) for finding the best optimal final route.

1.K-means Clustering and following Case-Based

Algorithm 1:Case-Based Routing Function K-means()

1. Predefine K=n cluster heads.
2. Calculate Euclidean distance between cluster head and location points.
3. Assign points to cluster group accordingly. 4.Update the cluster group of the points in the database.



Function Case-Based()

1. {Clusters} C= K-means({PastCases} P).

2. Select all points from each Cluster one by one.

3. Calculate sequence of clusters by comparing with minimum distance with each point.

4. Find the final route obtained.

5. Update this route in the OptimalPath table database accordingly.

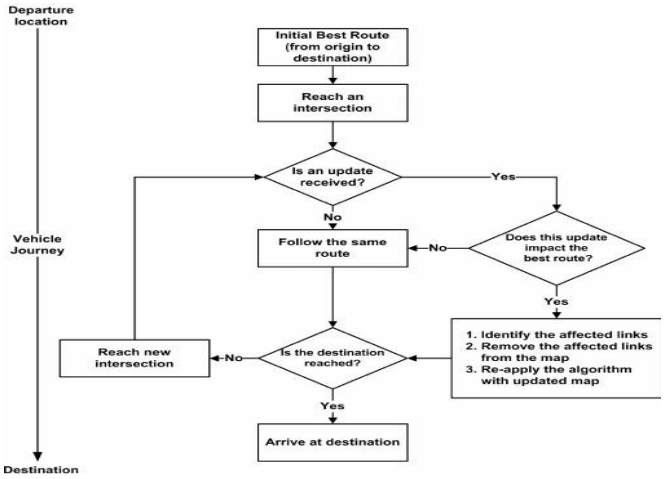


Fig 3: Case-Based routing Flowchart

2.Variable Neighbourhood Search(VNS) Algorithm

Algorithm 2: VNS Function VNS()

1. Solution Sbest = Case-based_Routing().

2. If Random generated ph value>6.7 ,generate alert.

3. Re-route of Sbestfrom the breakdown point.

4. Comparing node distance to find the optimal path Sopt.

5. If Sopt>Sbest ,Set Sopt=Sbest else same route Sbest
.

6. If new node found ,new route taken else same route continued.

7. Stop, final optimal path found to be followed.

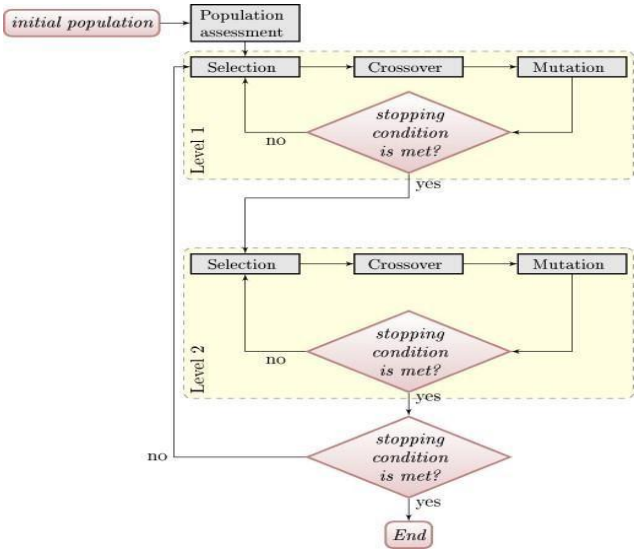


Fig 4: VNS algorithm flowchart

6. RESULT

1. Server Side-Add route to the clusters

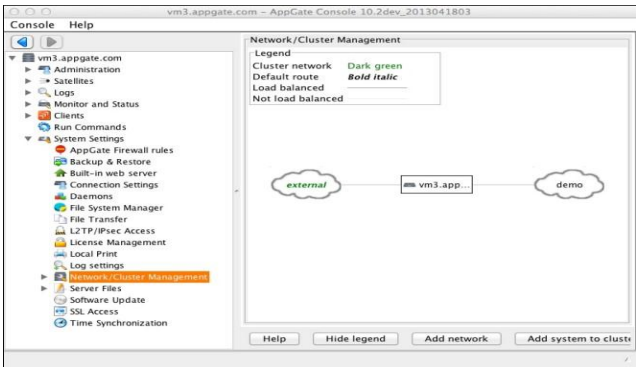


Fig 5: Server Side-Add route to the clusters

2. Android app: Load Routes

Fig 6: Android app: Load Routes

3. Android App: On change in Ph-value ,re-route to nearest booth

Fig 7: Android App: On change in Ph-value ,re-route to nearest booth

7. CONCLUSION

This system has the capability to diminish milk spoilage extensively and if used worldwide then would produce in tons of data that will help to improve not only milk transportation but also customer satisfaction. The ultimate goal of the project is to benefit the milk production industry and the end consumer of the dairy products.

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