**Project Proposal**

**Food Price Forecasting & Market Stability Analysis**

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**Abstract**: The purpose of the study targets the times of natural disasters, the COVID pandemic, and issues faced by people related to availability of the food items. Here we are planning to compare the food price indices, consumer and producer indices before and during the pandemic also the customer buying patterns and panic buying. We will be comparing multiple cloud-based services for data storing, analysis, and machine learning.

**Keywords:** Food Price Forecasting, Market Stability, Time-Series Forecasting, Economic Indicators, Supply Chain Disruptions, Statistical Modelling, Historical Data Analysis, Commodity Price Volatility, Policy Impact Assessment, Data-Driven Decision Making, Global supply networks, Cloud Computing, Consumer Behaviour purchasing patterns, Prediction

**Introduction**:

Extreme weather conditions delay the food supply chain. It can change food prices. Because of this, customers, producers, and suppliers find it difficult to maintain market stability. This project will help with well-informed and long-term decisions.

Due to limited availability of labor, interruptions in the supply chain, rising customer demand, and customer panic buying. Utilizing machine learning for demand forecasting and price prediction would be helpful. This will help improve budgeting and will help people find the best offers and notify them about the availability of the food items. Inventory control and demand forecasting will help to avoid supply shortages and stockpiling due to panic buying.

We already know local hurricanes in the US create panic and it will cause changes in the food cost and availability of the food items.

Data-driven systems will help improve market transparency, stabilize the prices, and guarantee more table distribution of supplies during these moments. This study will create a robust and effective grocery supply chain by utilizing cloud-based solutions and advanced analytics.

**Literature Review:**

The COVID-19 pandemic significantly disrupted global food supply chains, leading to notable fluctuations in food prices and shifts in consumer purchasing behaviors. Studies have documented that lockdown measures and movement restrictions resulted in supply chain interruptions, causing price fluctuations and altered consumption patterns [1]. The consumers stocked essential goods, increasing demand and causing temporary shortages, while the producers struggled with transportation and labor constraints. The study, therefore, looks at how speculations about COVID-19 spreading through food have affected consumers' eating and purchasing habits. This study through the probit model analyzed how consumers' eating and purchasing habits have been influenced [5]. Apart from this there are many other reasons that can cause food price fluctuations and panic buying trends like weather crisis and inflation. The inflammatory pressures caused strain on food supply chains and impacted consumer purchasing behaviors.

Food security is a critical aspect of human survival. As the world continues to expand and become more interconnected, there is a growing global demand for safe-to-eat, quality food that can be delivered to the consumer in a safe and efficient manner. A system that can achieve this will need to consider the logistical challenges of providing food to all countries around the globe in the current and future state while maintaining resiliency against distribution disruptions due to geopolitical impacts, such as wars, policy changes, pandemics, etc. [4].

With this challenge, cloud computing offers vital tools for processing large datasets and facilitating real-time economic forecasting. This research utilizes data analytics techniques to analyze food price trends before, during, and after the pandemic. This study will compare cloud service providers like AWS, Azure, and Google Cloud Platform (GCP) and observe their performance.

By implementing the same data analysis workflow across various cloud platforms, we will identify which service is the most efficient and cost-effective solution for historic and real-time economic monitoring. This comparison will provide valuable insights to government officials, businesses, and researchers on the best cloud-based methods for handling food price analysis and market forecasting during the crisis.

**Gain and Contributions from the Project:**

1. Improved Market Insight: The research offers useful data on market dynamics through the examination of food price indices, consumer price indices, and producer purchases before and during the pandemic. This can result in improved market understanding and the ability to foresee changes in the market, leading to improved decision-making.

2. More market stability: This research will create an evidence-driven system for improving market information and tracking food prices. This can assist distributors in managing commodity delivery during periods of peaks, e.g., pandemics or natural disasters, mellowing the impact of extreme price fluctuations and scarcity.

3. Support to Government Authority: The tools and dashboards constructed by this project can potentially be used to aid government authorities in maintaining market stability, minimizing shortages, and implementing equitable distribution of necessary goods. This is mainly relevant to planning in the long term and management of crises.

**Simplification and Practical implications of the project:**

This research addresses the volatility of food prices, which impacts individuals, businesses, and governments. Data-driven forecasting is essential for making better judgments because traditional approaches frequently overlook abrupt changes in the market. Businesses can control inventories, customers can benefit from price stability, and policymakers may anticipate inflation by developing a real-time food price forecasting system. This method uses economic data and time-series research to guarantee transparency and dependability, unlike AI algorithms. This initiative improves the accuracy, accessibility, and feasibility of food price forecasts with practical implications in economic planning, policymaking, and crisis management.

**Anticipated methods to be employed in the research project:**

Our analysis of food price fluctuation, consumer spending, and producer pricing trends before, during, and after the COVID-19 pandemic will leverage cloud services for data processing and visualization. Different cloud service providers like AWS, Azure, and GCP will be used based on their respective strengths in big data analytics, machine learning, and data visualization tools.

AWS: AWS Lambda, Amazon S3, and Amazon QuickSight will be utilized for scalable storage, on-demand data processing, and interactive visualizations.

Azure: Azure Data Factory, Azure Machine Learning, and Power BI will integrate datasets, execute predictive models, and create insights.

GCP: BigQuery, Cloud Dataflow, and Looker Studio will be used for large-scale data analysis, real-time processing, and visualization.

By comparing these platforms, we can identify the most effective cloud environment for economic analysis that provides data to governments, businesses, and consumers so they may make more educated choices in the event of a future crisis.

1. Food Price Index

* The average price of a basket of food items over time.
* The overall trend of food inflation or deflation.

1. Consumer Price Index

* Measures how much consumers pay for food at retail stores.
* Directly reflects affordability and cost-of-living changes.

1. Producer Price Index

* The price producers receive for their goods before they reach consumers.
* Helps identify production cost drivers such as raw material prices, labor costs, and supply chain expenses.

**Project plan, schedule, and team tasks:**

**Project Schedule:**

|  |  |  |  |
| --- | --- | --- | --- |
| **Week** | **Date** | **Work Planned** | **Work Delivered** |
| 1 | 01/22/2025 - 01/26/2025 | Group formation and Topic discussion. | Submitted the team member names. Submitted the topics we as a team are interested in. |
| 2 | 01/27/2025 - 02/02/2025 | Choose one of the topics from the submitted options. | Combined data-driven analysis with cloud computing by creating a CI/CD pipeline comparing cloud service providers. Submitted Homework 1: project background and project foundation. |
| 3 | 02/03/2025 - 02/09/2025 | Select a field to conduct the research in. Find the data set. | Explore the fields and research what KPI will be used for data analysis. Decided to go further in Agriculture technology with economic analytics. |
| 4 | 02/10/2025 - 02/16/2025 | Find out the datasets to work with. Start the initial information gathering for the research project proposal. | Consolidated all the information into one document. The goal achieved for the data set on which the research is to be conducted. |
| 5 | 02/17/2025 - 02/23/2025 | Start putting all the information into the document to complete the project proposal document. Decide the main 3 KPI for the visualization to be displayed on the dashboard. | The project proposal has been completed, and the three KPIs for dashboard visualization have been finalized. |
| 6 | 02/24/2025 - 03/02/2025 | Clean the data set and prepare train and test data set. Start implementing the algorithm to build the prediction model. | TBD |
| 7 | 03/03/2025 - 03/09/2025 | Deploy the initial machine learning model on the cloud. Continue adding the research done so far in the final research paper draft. | TBD |
| 8 | 03/10/2025 - 03/16/2025 | Continue training the model and adjust hyperparameters | TBD |
| 9 | 03/17/2025 - 03/23/2025 | Validate the trained model using cloud-based test datasets. | TBD |
| 10 | 03/24/2025 - 03/30/2025 | Start building the dashboard to be represented. Implement model improvements and optimize performance. | TBD |
| 11 | 03/31/2025 - 04/06/2025 | Prepare data visualizations and dashboards for results. | TBD |
| 12 | 04/07/2025 - 04/13/2025 | Conduct regression testing and continue adding and revising data in the final paper draft. | TBD |
| 13 | 04/14/2025 - 04/20/202 | Conduct performance testing and review if all the documentation is done properly | TBD |
| 14 | 04/21/2025 - 04/27/2025 | Finalize the documentation for the paper, and project simulation, and submit the paper | TBD |
| 15 | 04/27/2025 - 05/04/2025 | Submission in case if not submitted last week | TBD |

**Team Tasks & Project Plan:**

Data collection: Compilation of historical data on food prices of during and after pandemic. (Prachi, Vivek, Janhavi)

Data Pre-processing: The gathered data will be cleaned and standardized. Handling feature engineering, selection, and missing values and outliers. (Janhavi, Vivek)

Cloud Platform Setup: Configuration of AWS, Azure, or GCP Infrastructure. Required setup for processing, storing and analyzing data. (Rajeshwari, Tanvi)

Data Analysis Implementation and Visualization: To handle the food price and purchase data, we will create data analysis workflows. To show trends and patterns, we will make visualizations using graphs such as bar charts, line charts, scatter plots, pie charts, histograms, heat maps, box plots, and tree maps. (Vivek, Janhavi, Tanvi)

Machine Learning Pipeline: (Prachi, Janhavi, Rajeshwari)

1. Problem Framing: First, we will specify the prediction goal (e.g., classification of customer behavior, forecasting of food prices). We'll identify the kind of machine learning issue (clustering, classification, or regression).
2. Model Selection: Depending on the nature of the issue, we will select the best algorithm.

Linear regression, Random Forest, Gradient Boost

Logistic Regression, KNN, SVM

K means Clustering, Hierarchical Clustering

1. Data Splitting: The dataset will be separated into test, validation, and training sets.
2. Model Training: Using training data, we will train the chosen model.
3. Model Evaluation: Using the validation set, we will evaluate the model's performance.

Cloud-based solution Development: We will create a working prototype of a cloud-based system for tracking and predicting food prices in real-time. The most effective cloud platform will be used to deploy the prototype. (Tanvi, Rajeshwari)

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