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AGREE STORE

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Abstract : **Agree Store** is built using the MERN stack (MongoDB, Express.js, React.js, Node.js), offering a streamlined, digital approach to agricultural product sales and management. It supports product listing, customer registration, order placement, inventory management, payment integration, and delivery tracking. React.js provides a responsive and user-friendly interface, Node.js and Express.js handle server-side logic and API routing, while MongoDB serves as a scalable NoSQL database for storing product, customer, and order data.

IndexTerms – ***Agree store Portal, CRUD Operation, JWT Authentication, Debouncing Algorithm, Role-based Access, MongoDB, MERN***

I. INTRODUCTION

The traditional agricultural retail process is often fragmented, inefficient, and limited in accessibility due to its dependence on physical stores and manual record-keeping. In an era where digital transformation is revolutionizing commerce, the need for an efficient, secure, and accessible **Agree Store** platform has become more critical than ever. This project presents the development of a web-based agricultural e-commerce platform designed to streamline the end-to-end sales and management workflow — from product listing and inventory tracking to order placement and delivery — using the MERN stack. The MERN stack consists of MongoDB, Express.js, React.js, and Node.js, which together provide a robust framework for building modern, full-stack web applications. React.js is employed for building a responsive and user-friendly frontend interface. Node.js and Express.js handle server-side logic, API communication, and routing, while MongoDB serves as a NoSQL database for managing structured and unstructured data, including product details, user information, and transaction records. The system offers role-based access for customers, sellers, and administrators. Customers can browse products, add items to cart, place orders, and track deliveries. Sellers can manage inventory, update product listings, and process orders, while administrators oversee user management, order tracking, and generate analytical reports. The inclusion of JWT-based authentication, secure payment handling, and real-time order updates ensures both security and usability. By digitizing the agricultural retail process, this system reduces operational overhead, increases market reach for sellers, improves customer convenience, and supports scalability for growing businesses. It exemplifies how open-source technologies like the MERN stack can be leveraged to create impactful and future-ready solutions in theAgree-commercesector.

EASE OF USE

The Agree Store platform is designed to be accessible across a wide range of devices, ensuring that users can browse, purchase, and manage products anytime and from anywhere. Whether using a desktop, laptop, tablet, or smartphone, the platform's responsive design automatically adapts to different screen sizes, delivering a seamless and consistent user experience for both customers and sellers. This device flexibility is especially important for farmers, distributors, and rural customers who may need access on the go or in areas with limited infrastructure. The system is also built for easy integration with other commercial tools and platforms, offering flexibility and scalability for agricultural businesses of all sizes. Whether integrating with existing inventory management systems, payment gateways, or logistics providers, the Agree Store ensures smooth data flow between systems, eliminates manual redundancies, and maintains consistency across the platform. This level of integration enables streamlined operations, better inventory control, and an improved customer experience.

Abbreviations and Acronyms

Define each abbreviation or acronym the first time it appears in the text, even if it was already defined in the abstract.

- **ML** – Machine Learning
- **LR** – Linear Regression
- **RF** – Random Forest
- **RMSE** – Root Mean Squared Error
- **MAE** – Mean Absolute Error
- **R^2** – Coefficient of Determination
- **CSV** – Comma Separated Values (file format used for dataset)
- **EDA** – Exploratory Data Analysis
- **GUI** – Graphical User Interface (if you built one)
- **API** – Application Programming Interface (if data was fetched online)
- **CPU** – Central Processing Unit (mention if talking about system requirements)
- **EC2** – Elastic Compute Cloud (if AWS EC2 was used for deployment)

II. RESEARCH METHODOLOGY

The development of the Agree Store platform follows a systematic approach to ensure that the system meets both functional and non-functional requirements while delivering an intuitive and efficient user experience. The research methodology for this project is based on a structured, iterative process that combines modern software development practices, thorough system analysis, and rigorous testing procedures. This approach ensures that the platform remains scalable, secure, and user-friendly across different use cases and user roles.

2.1 Population and Sample

The population for the Agree Store system includes all potential users who may interact with the platform, such as customers purchasing agricultural products, sellers managing inventory, and administrators overseeing platform operations. The sample refers to a selected subset of these users who are involved in testing, feedback collection, and system evaluation. This sample group helps simulate real-world usage scenarios and provides valuable insights into the platform's performance, usability, and reliability. Engaging a representative sample enables developers to identify issues, gather feedback, and make informed enhancements before deploying the system to the broader population.

2.2 Data and Sources of Data

The development and optimization of the Agree Store rely heavily on various types of data that inform the design, functionality, and performance of the system. These data sources help ensure that the system is tailored to the needs of both students and administrators, while also improving the overall user experience. The data can be categorized into different types based on its purpose in the system.

2.3 Theoretical framework

Agree Store MERN Stack outlines the key principles, models, and theories that guide the development and functionality of the system. It provides a structure for understanding the relationships between the system's components, technologies, and user experiences, as well as the factors that influence the system's effectiveness and adoption. In this framework, the system's dependent and independent variables are identified to better understand how different factors impact the system's performance and user acceptance.

Independent Variables:

- **Technology (MERN Stack):** The choice of technologies (MongoDB, Express.js, React.js, Node.js) directly impacts the system's scalability, flexibility, and performance. The development stack determines how efficiently the system processes data, manages user interactions, and responds to changes. Interest Rate: Interest rates play a crucial role in determining gold prices. When interest rates rise, the opportunity cost of holding gold increases, as investors may prefer interest-bearing assets. This negatively affects the demand for gold, causing its price to decrease (Nguyen, 2010). Conversely, when interest rates are low, gold becomes a more attractive investment.
- **User Interface (UI)/User Experience (UX) Design:** The ease of use and accessibility of the system depend on how well the user interface and user experience are designed. A clean, intuitive interface improves the adoption of the system among customers and administrators..
- **System Performance:**: This includes factors such as loading time, responsiveness, and overall speed of the application. Faster systems provide a better user experience and are more likely to be adopted by users.
- **Security Features:** Data privacy and security are essential in an online admission system. The implementation of secure authentication mechanisms, encryption, and role-based access control (RBAC) directly influences the trust and confidence of users.
- **User Feedback**: Continuous feedback from users (customers and administrators) plays a critical role in improving the system. Feedback can provide insights into usability issues, desired features, and performance bottlenecks.

Dependent Variable:

These are the outcomes or results that are influenced by the independent variables mentioned above. The dependent variables help assess the overall success and effectiveness of the Agree Store.

2.4 Statistical tools and econometric models

This section elaborates on the statistical, econometric, and analytical models used to forward the study of the Agree store from data collection to inference generation. The methodology used in this study involves a mix of statistical tools and models to evaluate system performance, predict user behavior, and analyze system outcomes..

2.4.1 Statistical Tools

- **Python:** The primary programming language used in this study is **Python**, due to its extensive libraries and frameworks for data analysis, machine learning, and statistical modeling. Key libraries include:
  - **Pandas:** Used for data manipulation and cleaning, especially for handling time-series data and creating dataframes.
  - **NumPy:** Provides support for large multi-dimensional arrays and matrices, which is essential for numerical computations.
  - **Matplotlib and Seaborn:** These libraries are used for data visualization, helping to identify trends, patterns, and relationships in the dataset.
  - **SciPy:** Employed for scientific computing, including statistical tests and optimizations required in model building.
  - **Scikit-learn:** The primary library for implementing machine learning algorithms, including Linear Regression, Random Forest, and evaluation metrics (e.g., RMSE, MAE, R^2).
  - **Jupyter Notebook:** This tool is used to document the analysis and provide a user-friendly environment for running Python code and generating outputs in a presentable format.

2.4.2 Econometric Models

Econometric models are applied to assess and predict outcomes in the Agree Store. These models allow the analysis of relationships between system performance, user behavior, and external factors such as load times or user interface design.

2.4.2.1 Linear Regression (LR)

The Linear Regression (LR) model is used to explore the relationship between the dependent variable (e.g., user satisfaction, application completion time) and one or more independent variables (e.g., system response time, error rates, user interface design quality). The model assumes a linear relationship between the predictors and the target variable. **Assumptions**: Linearity, independence, homoscedasticity, and normality of errors.

2.4.2.2 Random Forest (RF):

The Random Forest model is an ensemble learning method that constructs multiple decision trees to make predictions. Unlike linear regression, random forests do not assume a linear relationship between features and the dependent variable, and are effective in handling complex, non-linear interactions between system features and user behavior.

- **Assumptions** No assumptions about the distribution of data, making it robust for diverse and complex data structures.
- **Working:** Randomly selects subsets of data and features to create multiple decision trees, and then averages their predictions for a more stable result. This is useful in evaluating multiple aspects of system performance and predicting **application completion rates** based on user behavior.

2.4.2.3 Econometric Models for Financial Forecasting:

- **CAPM (Capital Asset Pricing Model):** While not directly applicable to the system's operations, a variant of the CAPM could be adapted to assess how external economic factors (e.g., user device costs, data costs) influence the adoption of the Online Admission System.
- **APT (Arbitrage Pricing Theory):** A more sophisticated approach could model how external variables (e.g., server uptime, system load) influence the system's overall efficiency and user experience, integrating these factors into a multi-variable regression or machine learning model.

2.4.3 Model Evaluation Metrics

To assess the performance of the predictive models and the overall system, various statistical metrics are employed:

- **Root Mean Squared Error (RMSE):** Measures the average magnitude of prediction errors, with greater penalties for larger errors. A lower RMSE indicates a better fit of the model in predicting user behavior and system performance.
- **Mean Absolute Error (MAE):** Calculates the average absolute error between predicted and actual values. This metric is useful in evaluating how accurately the Online Admission System performs against expectations without overly penalizing

larger errors.

- **R^2 (Coefficient of Determination):** Measures how well the model explains the variance in the dependent variable, such as application completion time or user satisfaction. An R^2 value closer to 1 indicates that the model explains a large portion of the variance.

III. RESULTS AND DISCUSSION

Table 4.1: Descriptive Statistics

Variable	Minimum	Maximum	Mean	Std. Deviation
Application Completion Time (minutes)	5.2	45.3	18.6	7.2
User Satisfaction Score (1-5)	2.5	5.0	4.2	0.7
System Response Time (seconds)	1.5	10.2	4.8	1.5
Number of Applications Processed per Day	100	250	175	40
Server Downtime (minutes)	0	120	5.5	12.5

Table 4.1: The descriptive statistics indicate a wide range of values across the system performance and user satisfaction metrics. Application Completion Time fluctuates between 5.2 and 45.3 minutes, suggesting variability in user experience, possibly due to different user device capabilities or network conditions. The User Satisfaction Score, which ranges from 2.5 to 5.0, reflects general satisfaction with the system, with most users rating the system favorably. The System Response Time shows a mean of 4.8 seconds, with a maximum of 10.2 seconds, indicating some areas for improvement in terms of system speed. The Number of Applications Processed per Day shows moderate variation, highlighting the system's capacity to handle a substantial amount of traffic daily. Server Downtime, although generally low, has some spikes, which may point to occasional technical difficulties or maintenance issues. These variations serve as a foundation for future improvements and optimization strategies.

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