SMART STORE: EMPOWERING FARMERS AND DEPARTMENTAL STORE OWNERS THROUGH AI-DRIVEN RETAIL MANAGEMENT

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Abstract

The "Smart Store" project aims to revolutionize retail management by integrating AI & ML-driven solutions for departmental stores and farmers. Through predictive analytics, dynamic pricing, and streamlined inventory tracking, the app enhances sales, reduces wastage, and boosts revenue. Key components include user-friendly interfaces for stakeholders, ML models for product expiration prediction, and a robust database for seamless data sharing. The report covers market assessment, regulatory considerations, business models, and concept development. By addressing these aspects, Smart Store optimizes operations, promotes farmer sales, and improves overall customer satisfaction in the retail and agriculture sectors.

1. Problem Statement

The problem statement revolves around optimizing inventory management and promoting sales by leveraging machine learning to predict product expiration, recommending dynamic pricing, facilitating farmer sales, and enhancing product quality for departmental stores.

2. Market/Customer/Business need Assessment

The "Smart Store" project addresses the pressing needs of both the retail market and its customer by leveraging advanced technology and data-driven strategies. Let's delve deeper into each aspect of the Market/Customer/Business Need Assessment:

2.1 Market:

There is a growing demand within the retail industry for efficient management solutions. This demand stems from the increasing complexity of modern retail operations, including inventory management, sales optimization, and customer engagement. Traditional methods often fall short in meeting these challenges, leading businesses to seek innovative technologies like AI and machine learning.

2.2 Customer Need:

- Simplified Inventory Tracking: Many store owners struggle with manual inventory tracking systems that are prone to errors and inefficiencies. Smart Store offers a digital platform that automates inventory management, providing real-time insights into stock levels, product expiration dates, and replenishment needs.
- Increased Sales: By utilizing predictive analytics, Smart Store identifies products nearing expiration and strategically promotes them to customers with discounts or special offers. This not only reduces waste but also stimulates sales by offering attractive deals on products that would otherwise be discarded.
- Quality Assurance: For consumers, quality is paramount. Smart Store ensures quality assurance by recommending products from trusted farmers and suppliers, fostering a sense of trust and reliability in the store's offerings.

2.3 Business Need:

- Revenue Growth: By optimizing inventory turnover and promoting sales of expiring products, Smart Store contributes directly to revenue growth. The app's dynamic pricing strategies and targeted promotions help increase customer traffic and drive sales.
- Cost Reduction: Efficient inventory management leads to reduced wastage and lower operational costs associated with overstocking or understocking. Smart Store also minimizes manual labor in inventory tracking and sales promotion, further reducing costs.
- Improved Customer Satisfaction: Ultimately, Smart Store's focus on data-driven decision-making, quality products, and personalized promotions enhances overall customer satisfaction. Satisfied customers are more likely to return, leading to increased loyalty and positive word-of-mouth referrals.

3. Target Specifications and Characterization

3.1 Customers:

- Departmental Store Owners: These are the primary users of the Smart Store app. They include owners or managers of grocery stores, supermarkets, and other retail outlets. Their main goal is to streamline operations, reduce costs, increase sales, and enhance customer satisfaction.
- Farmers: Farmers are essential stakeholders in the Smart Store ecosystem. They use the app to showcase and sell their produce directly to stores, bypassing intermediaries and ensuring fair pricing for their products. The app provides them with a platform to reach a wider market and improve their sales.
- End Consumers: The final users of the products sold through Smart Store. They value quality, affordability, and convenience. For them, the app offers access to fresh, locally sourced products, promotional discounts, and a seamless shopping experience.

3.2 Characteristics:

- User friendly Interface: Both departmental store owners and farmers are expected to be comfortable with using technology. They should be able to navigate the app's interfaces, upload product information, monitor sales analytics, and respond to customer inquiries efficiently.
- Value Convenience: Convenience is a key factor driving adoption. Store owners appreciate the convenience of automated inventory management, predictive analytics, and targeted promotions. Farmers value the convenience of reaching a wider market without the need for traditional distribution channels.
- Seek Cost-Effective Solutions: Both store owners and farmers are cost-conscious. They seek solutions that offer tangible benefits such as cost reduction, increased sales, and improved profitability. Smart Store's value proposition lies in its ability to deliver these benefits through data-driven insights and streamlined processes.

4 . External Search:

- Retail industry reports on inventory management and sales optimization.
- McKinsey & Company's report on retail digitization trends
  https://www.mckinsey.com/industries/retail/our-insights/the-tech-transformation-imperative-in-retail
- AI and ML applications in retail.
  https://www.techtarget.com/searchenterpriseai/feature/10-common-uses-for-machine-learning-applications-in-business
  https://www.datasciencecentral.com/common-applications-of-machine-learning-for-small-scale/
- Agriculture technology trends.
  https://www.infopulse.com/blog/technology-trends-agriculture-farming
  https://www.ruralmutual.com/resource/farm-technology/3-emerging-trends-in-agriculture-technology/

5. Benchmarking Alternate Products

- Compare with existing inventory management software.
  https://www.sortly.com/solutions/inventory-management-software/
  https://www.zoho.com/in/inventory/?network=g&device=c&keyword=inventory%20management%20software&campaignid=15061881800&creative=585829472520&matchtype=e&adposition=&placement=&adgroup=134162755852&targetid=kwd-34829222&gad_source=1&gclid=CjwKCAjwzN-vBhAkEiwAYiO7oAUcFF-bqn07i4ggjaEWWVfX-zhLbRFcuJvF2q-SLwuLNhoL3VdORhoCbMsQAvD_BwE
- Analyze competitor solutions in retail AI and farmer-to-store platforms.
  https://startups.epam.com/blog/artificial-intelligence-in-retail
  https://www.weforum.org/agenda/2023/01/here-s-how-artificial-intelligence-benefit-retail-sector-davos2023/

6. Applicable Patents:

- Patent 1: Purchase Intent Determination And Real Time In-store Shopper Assistance
  A method and a purchase intent determination and assistance management system (PIDAMS) for determining purchase intent of an anonymous shopper and providing assistance in a retail store are provided. The PIDAMS identifies an anonymous shopper, receives images of the anonymous shopper, and determines shopper attributes of the anonymous shopper within a region of interest using sensors. The PIDAMS generates an event based on a configurable dwell time threshold, determines the purchase intent of the anonymous shopper by iteratively ranking the anonymous shopper based on section attributes, transmits alert notifications, renders information on target items and offers on the target items to a store assistant who accepted an alert notification to provide assistance to the anonymous shopper, and receives and stores feedback on a communication between the anonymous shopper and the store assistant for iteratively ranking the anonymous shopper in conjunction with conversion data extracted from the feedback.

- Patent 2: Empowering Dynamic Pricing with AI: A Symphony of Real-Time Data and Algorithms
  At the heart of dynamic pricing lies the seamless integration of AI algorithms, perpetually deciphering a myriad of real-time data points. From market demand and competitor pricing to consumer behavior, seasonality, and external influences shaping buyer sentiment, businesses now make precise pricing decisions. This delicate balance between revenue maximization and meeting consumer demand defines the essence of dynamic pricing in the digital age.

7. Applicable Regulations

- Data Protection Laws (e.g., GDPR):
  GDPR (General Data Protection Regulation): Smart Store will ensure compliance with GDPR requirements regarding the collection, storage, processing, and sharing of personal data. This includes obtaining user consent, implementing data encryption and security measures, providing data access and transparency, and adhering to data retention and deletion policies.
- Business Regulations:
  Retail Operations: Smart Store will adhere to regulations governing retail operations, including product labeling, pricing transparency, consumer rights, refunds, and warranties. This ensures that the app provides accurate product information, fair pricing, and excellent customer service in compliance with local retail laws.
- Farmer-Producer Interactions: Smart Store will facilitate fair and transparent interactions between farmers and store owners, respecting contractual agreements, pricing negotiations, quality standards, and payment terms. The app will also promote ethical sourcing practices, sustainability, and compliance with agricultural regulations regarding product safety, labeling, and traceability.

8. Applicable Constraints

- Data Collection from shopkeepers and vendors
- Continuous data collection and maintenance
- Lack of technical knowledge for the store owners, customer and farmers
- Taking care of rarely bought products
- Convincing the shopkeepers to implement the system in their shops.
- To address budget constraints, Smart Store may consider prioritizing essential features and functionalities, outsourcing certain development tasks to cost-effective providers or freelancers, leveraging open-source software components, and negotiating favorable terms with technology vendors and service providers. It may face limitations in terms of expertise, particularly in areas such as AI and machine learning development, database management, cybersecurity, and user experience design. This could impact the speed and quality of software development and deployment.
- By proactively addressing these constraints, can optimize its development process, minimize risks, and ensure successful implementation and scalability of the app while staying within budget and resource limitations.

9. Business Model:

9.1 Basic Model for Store Owners:

- **Inventory Management Tools**: Access to basic inventory management features such as product cataloging, stock tracking, and low-stock alerts.
- Sales Tracking: Ability to monitor sales transactions, track revenue, and generate basic sales reports.
- Product Expiration Alerts: Receive notifications for products nearing expiration to avoid wastage and optimize inventory turnover.
- Limited Promotional Features: Basic promotional tools for creating discounts, seasonal offers, and simple marketing campaigns.
- Supplier Integration: Basic integration with suppliers for placing orders, receiving invoices, and managing supplier relationships.
- Customer Support: Standard customer support via email or chat for technical assistance and troubleshooting.
- Training Resources: Access to basic training materials, tutorials, and guides for using the Smart Store platform effectively.
- The pricing for this Basic Plan can be structured as a low monthly fee or an affordable annual subscription to cater to the budget constraints of small departmental stores. Additionally, Smart Store can offer discounts or promotions for new subscribers or those opting for longer-term commitments.
- By offering a streamlined and cost-effective plan with essential features, Smart Store enables small departmental stores to benefit from digital retail management tools, improve operational efficiency, and stay competitive in the market without breaking their budget.

9.2 Commission-Based Model for Farmer Sales:

- Farmers who list and sell their products through Smart Store will operate on a commission-based model. Smart Store will charge a percentage commission on each successful sale made through the platform.
- The commission rate may vary depending on factors such as product category, sales volume, and promotional activities. Smart Store will provide farmers with transparent pricing and payment mechanisms, ensuring fair compensation for their sales efforts.
- This model incentivizes farmers to actively participate in the platform, optimize their product listings, and collaborate with store owners to enhance sales and profitability.

9.3 Partnership with Suppliers for Revenue Sharing:

- Smart Store will establish partnerships with suppliers, including farmers, distributors, and manufacturers, to create a mutually beneficial revenue-sharing model.
- Suppliers who provide products to SmartStore's network of departmental stores will receive a share of the revenue generated from their sales. The revenue-sharing percentage will be negotiated based on the terms of the partnership and the value provided by the supplier.
- This partnership model encourages suppliers to offer competitive pricing, high-quality products, and reliable supply chain support, contributing to the overall success of Smart Store and its ecosystem of stakeholders.

9.4 Customer Buying Model:

- Smart Store will offer a seamless and convenient purchasing experience for end consumers. Customers can browse through a wide range of products listed by departmental stores on the platform.
- Additionally, Smart Store may offer occasional promotions, discounts, loyalty rewards, and referral programs to incentivize repeat purchases and customer retention.

This holistic business model for Smart Store, covering revenue generation from store owners, farmers, suppliers, and end consumers. This comprehensive approach ensures a balanced ecosystem where all stakeholders benefit from the platform's services and capabilities.

10. Concept Generation:

- The idea emerged from market research highlighting inefficiencies in traditional retail practices and the potential of ML and digital platforms to transform the sector.
- Understanding the problems faced by the departmental stores and farmers.

11. Concept Development:

Features for Departmental Stores:

- Inventory management, sales tracking, and promotions.
- Affordable subscription plans for small stores.
- Improved efficiency and competitiveness.

Commission-Based Model for Farmers:

- Farmers sell products on the platform.
- Smart Store takes a commission on sales.
- Incentives for farmers to optimize sales.

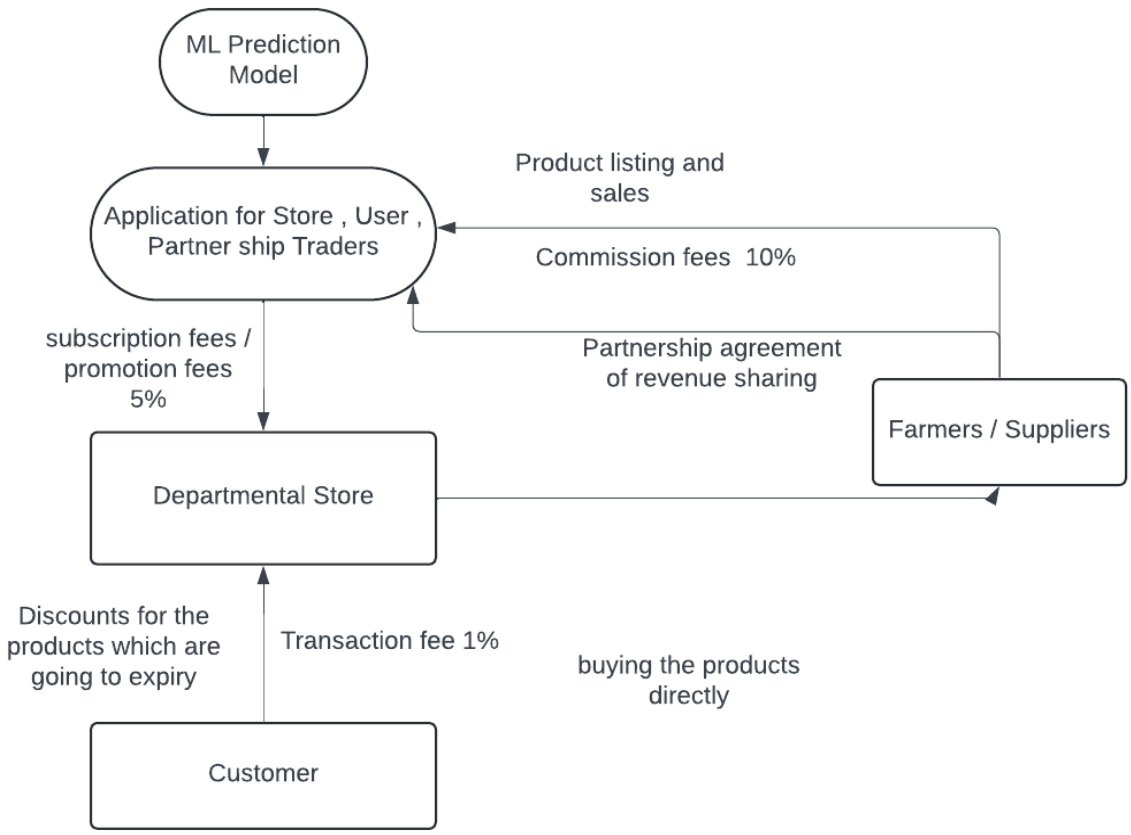
Supplier Partnerships:

- Revenue-sharing with suppliers.
- Encourages competitive pricing and quality products.

Customer Experience:

- Seamless purchasing, promotions, and rewards.
- Focus on customer satisfaction and retention.

12.Product Prototype with Schematic Diagram



13.Product Details:

- **Sales Tracking:**
  The platform (Smart Store) tracks sales data for products listed by suppliers. This includes information such as product ID, quantity sold, sales price, and transaction details.
  Data sources for sales tracking include the platform's database, transaction logs, and sales reports generated by the platform's analytics tools.
- **Revenue Calculation:**
  Based on the sales data tracked, the platform calculates the total revenue generated from the sales of each supplier's products over a specific period (e.g., monthly, quarterly).
  Revenue calculation includes multiplying the quantity sold by the sales price for each product, summing up the total sales revenue for each supplier.
- **Revenue Sharing Agreement:**
  The platform has a revenue sharing agreement with suppliers, outlining the percentage of revenue that will be shared with each supplier from the sales of their products.
  The revenue sharing agreement also specifies the frequency of revenue sharing payouts (e.g., monthly, quarterly).

Data Sources:

- **Platform Database:** Contains all sales data, supplier information, and revenue sharing agreement details.
- **Transaction Logs:** Record every transaction processed through the platform, including product sales and payment information.
- **Sales Reports:** Generated by the platform's analytics tools to provide insights into sales performance, revenue generated, and revenue sharing calculations.

14. Code Implementation:

Data set: (target_groceries_data.csv)

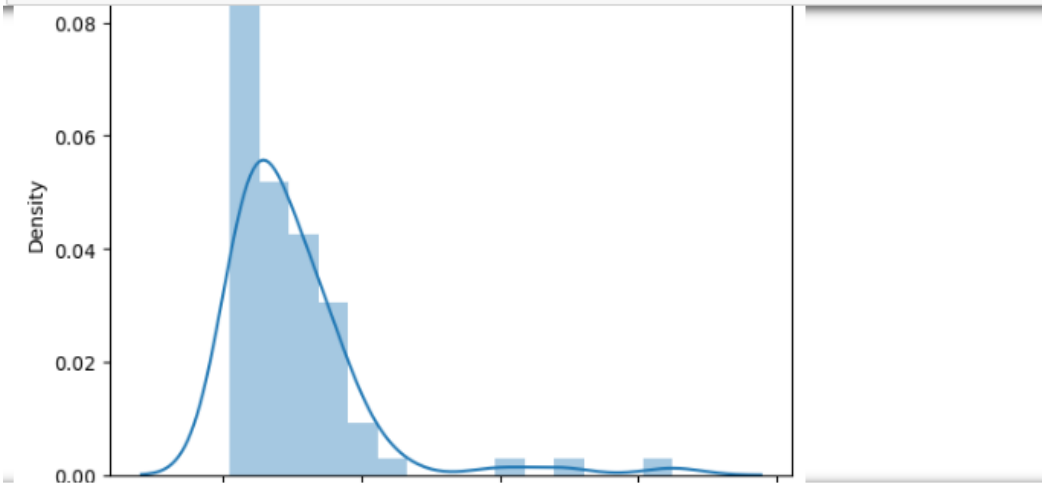
Github link : https://github.com/suganyajulianna/Fenn-Lab---Task-0---Prediction-of-Expiry-of-the-products

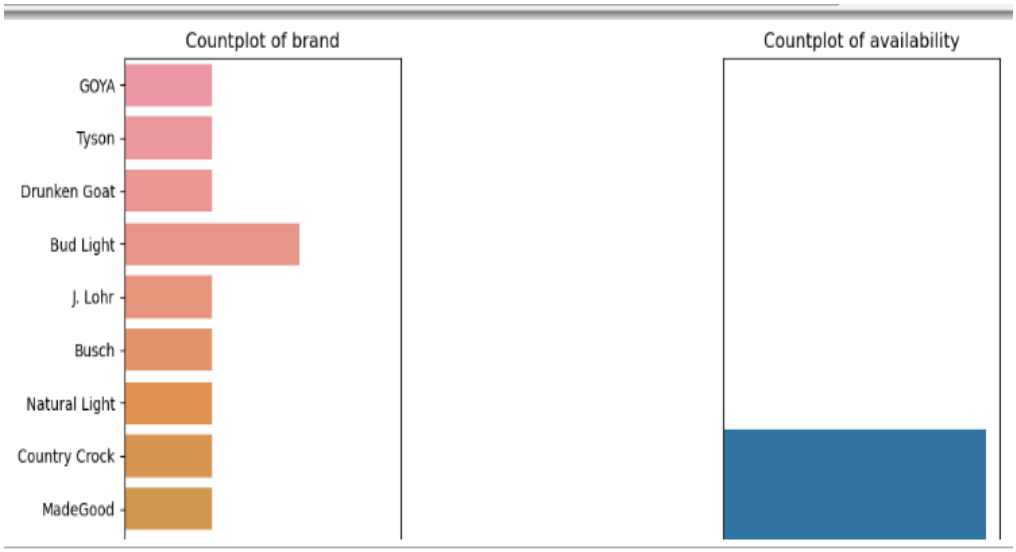
	title	url	brand	main_image	sku	description	raw_description	gtin13	currency
0	Goya Chorizos - 3.5oz	https://www.target.com/p/goya-chorizos-3-5oz/-...	GOYA	https://target.scene7.com/is/image/Target/GUES...	47112125	Goya Chorizo, 3.5 Ounce | GOYA Chorizo is a de...	<div class="h-margin-v-default" data-test="ite...	4.133103e+10	USD
1	Tyson Grilled & Ready Oven Roasted Diced Chick...	https://www.target.com/p/tyson-grilled-38-read...	Tyson	https://target.scene7.com/is/image/Target/GUES...	14778739	Made with chicken raised with no antibiotics e...	<div class="h-margin-v-default" data-test="ite...	2.370002e+10	USD
2	The Drunken Goat Semi Soft Goat Cheese Bathed ...	https://www.target.com/p/the-drunken-goat-semi...	Drunken Goat	https://target.scene7.com/is/image/Target/GUES...	14929058	Literally meaning "goat with wine" this semi...	<div class="h-margin-v-default" data-test="ite...	8.210000e+11	USD

- Performed EDA
  Check the data type , 5 point summary , Data Visualizations ,Outliers ,Check the null values , Encoding

visualize the distribution of all the numerical columns and cat variables

```
for i in a:
    sns.distplot(df[i])
    plt.show()
```





- Feature Engineering
- Model Building
- Comparing the models with the metrices

```
## Linear Regression:
Mean Absolute Error: 0.1875
Root Mean Squared Error: 0.4330127018922193
R-squared: 0.12727272727272732
Accuracy: 0.8125


## Logistic Regression:
Logistic Regression Accuracy: 0.9375
Logistic Regression MSE: 0.0625
Logistic Regression R2 Score: 0.7090909090909091

## Support vector Machine:
Support Vector Machine (SVM) Accuracy: 0.9375
Support Vector Machine (SVM) MSE: 0.0625
Support Vector Machine (SVM) R2 Score: 0.7090909090909091

## Random Forest Classifier:
Random Forest Classifier Accuracy: 1.0
Random Forest Classifier MSE: 0.0
Random Forest Classifier R2 Score: 1.0
```

Interpretation :

The Random Forest Classifier model achieved a perfect accuracy of 1.0, MSE of 0.0 indicating no errors, and R2 score of 1.0 indicating perfect fit. These results suggest that the model performed exceptionally well on your test data and made accurate predictions for whether products are going to expire soon or not. However, it's important to ensure that the model is not overfitting to the training data and that these results generalize well to new, unseen data.

14. Conclusion

In conclusion, the revenue-sharing model with suppliers within the Smart Store platform fosters a collaborative and mutually beneficial relationship. The structured process of tracking sales, calculating revenue, and transparent reporting ensures fairness and accountability in revenue sharing.

This model incentivizes suppliers, including farmers, distributors, and manufacturers, to offer competitive pricing, high-quality products, and efficient supply chain services. By aligning incentives and sharing a portion of the revenue generated from their products, Smart Store encourages suppliers to actively participate, optimize their offerings, and contribute to the platform's success.