Smart Basket-AI Grocery Companion

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## *Abstract*— Effective grocery shopping management is a common problem; many people frequently forget necessary items, overspend, or pass up deals. While existing grocery list apps like "Out of Milk" and "AnyList" provide the bare minimum of features like list creation, sharing, and category sorting, they are lacking in intelligent navigation, real-time interaction, and personalized recommendations. We suggest Smart Grocery Buddy, a cutting-edge smartphone app that fills these gaps by improving the grocery shopping experience with AI-powered features and real-time assistance.

## Three significant innovations are incorporated into Smart Grocery Buddy: AI-Powered Recommendations that make product recommendations based on past purchases and preferences through collaborative or content-based filtering; Dynamic Price Alerts that use predictive models to predict price reductions and Store Layout Integration that uses graph-based pathfinding algorithms for aisle-by-aisle navigation.

***Keywords— AI-powered grocery list management, store navigation, dynamic price alerts, collaborative filtering, content-based filtering, predictive price modeling, real-time notifications, time-series forecasting.***

1. INTRODUCTION

SmartBasket is a retail system utilizing artificial intelligence, thought to improve the shopping experience via intelligence automation.SmartBasket utilizes HP Filtering for personalized recommendations, A\*Pathfinding for in-building navigation, Time Series Forecasting for dynamic price alerts, along with Simple Moving Average (SMA) for timely replenishment suggestions. SmartBasket learns from user patterns and product data, to provide accurate and contextually relevant information. As SmartBasket provide intelligent automation to combine convenience and personalized experiences.it increases value overall for both customers and the stocking store. SmartBasket also provides a steppingstone to a smarter, data-driven retail space. Further, SmartBasket decreases decision fatigue by considering need and limiting purchase choices. SmartBasket demonstrates how artificial intelligence can change habitual consumer experiences.

1. RELATED WORKS

Hybrid Recommendation Systems:  Li and Wang (2023) proposed a dynamic hybrid recommender system that adjusts user interactions to improve product suitability in e-commerce.

A\*Pathfinding for Retail: Wu and Chen (2023) developed an A\*based algorithm, with indoor RFID tracking to make recommendations for optimized paths through supermarkets.

Time Series Forecasting: Kumar and Bansal (2022) found Facebook Prophet to be superior to ARIMA for forecasting for retail pricing trends for irregular products and improved forecasting accuracy.

Simple Moving Average (SMA): Sharma et al. (2022) used SMA to automate restock alerts in smart pantry systems to improve continuity of supply for regularly consumed products.

1. PROPOSED SYSTEM

The SmartBasket initiative advanced upon previously discussed retail innovations by incorporating four related algorithms to augment the changing of the shopping experience: Hybrid Filtering, A Pathfinding\*, Time Series Forecasting, and Simple Moving Average (SMA). Hybrid filtering brings together collaborative and content-based techniques to create more accurate and individualized recommendations for products. A Pathfinding\* algorithm is able to optimize product retrieval in stores by mapping the shortest path to products while the user is shopping which can increase in-store efficiency. Time Series Forecasting (ARIMA/Prophet) used a method of forewarning the consumer about future price fluctuations so that the user can make better purchasing decisions. SMA with the caveat of historical or frequently purchased product purchases, will predict if and when users may require replenishment on the products consistently purchased, saving a user from running out of an essential. These algorithms work together and do so in an intelligible way to enrich, expedient, intelligent, and easeful shopping for users allowing the consumer to maximize their time, money, and effort. The overall implementation of each of these technologies is a significant step closer to an environment that is personalized, efficient and based-in evidence, retail system.

IV. SYSTEM ARCHITECTURE

The architecture proposed in this paper is focused on offering an intelligent, user-centric shopping assistant—SmartBasket—to optimize household grocery planning through automatic consumption tracking and tailored buying recommendations. This system architecture integrates purchase history, user-defined constraints, behavior patterns, and category-specific item properties to deliver a seamless and adaptive shopping experience. All modules are synergistic in nature to offer shopping efficiency with minimized waste and overspending.

At the core of the system is the application of structured inputs such as item names, categories, units purchased, estimated rates of consumption, and leftovers. Such points of data are captured from manual entries or electronic records of transactions. A user profile layer monitors in perpetuity each individual's shopping and consumption history, the basis for predictive and decision-making models.

The core data pipeline begins in the Item Data Entry Module, wherein users import or enter product information. These get processed by the Consumption Estimation Module, wherein remaining stock and monthly consumption is estimated. It uses pre-established heuristics and user ratings to dynamically increase its accuracy in estimates over a period.

Feature engineering techniques are subsequently applied to extract meaningful features such as average usage per month, seasonal flags, and item criticality ratings. These engineered features are provided as inputs to the Recommendation Engine.

The heart of SmartBasket is its Smart Suggestion Module, which applies logic-based algorithms and rule-based inference to predict optimal quantities for each item. The system will never suggest an overstocked item; if an item is low in stock, the system suggests restocking based on past usage trends and budget.

In parallel, a Budget Optimization Layer guarantees that the total value of the suggested basket falls within the user-set limit for the monthly budget. This component considers trade-offs and provides substitute recommendations for more economical options when necessary.

The final result is rendered through a responsive and interactive Web Interface built with HTML, TailwindCSS, and JavaScript. It allows the user to display, modify, or approve the automatically generated shopping list, all in full transparency and control. Data persistence is achieved through local storage mechanisms.

In addition, a Feedback and Learning Loop recognizes user modifications and post-purchase data to progressively refine the estimation and recommendation algorithms over time and hence provide increasingly accurate and tailored results.

A diagram of a computer system

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Fig. 2. System Architecture

A diagram of a product management system

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 Fig. 3. DFD of the Proposed System

A diagram of a flowchart

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Fig. 4. Flowchart diagram

V. METHODOLOGY

Household shopping inefficiencies usually lead to wastage of products, over-spending, and inefficient consumption cycles. As product variety and user needs vary from month to month, this problem gets worse. The solution is a predictive system that makes dynamic consumption estimates, monitors usage, and recommends future purchases under budget constraints.

5.1 Problem Formulation

Let Qtot be the sum of the quantity of items to be bought within a month. This is a function of past consumption habits, estimated stock left, and budget constraints.

Qtot = ∑(Qp − Qr)

where:

– Qp is forecasted monthly use of a product

– Qr is stock left

The system seeks to minimize:

Ctotal = ∑(Qt × Punit)

subject to:

Ctotal ≤ Budget

Where Punit is the per-product unit price. SmartBasket uses this model for every item, adapts according to priority, and ensures the shopping list stays within user-specified constraints. The ultimate result is an optimized cart tailored to the household's behavior of usage.

VI. RESULT AND CONCLUSION

**Conclusion**

In conclusion, the SmartBasket project uses cutting-edge AI techniques to advance the retail shopping experience toward a more intelligent, efficient, and customized shopping experience. SmartBasket balances user convenience and intelligent shopper consumption by utilizing Hybrid Filtering for tailored suggestions, A\* Pathfinding for store navigation, Time Series Forecasts for price alerts, and Simple Moving Average (SMA) to generate recommendations based on shopping patterns. Together, the algorithms will help users by anticipating their needs, cutting down on shopping time, and encouraging them to spend more wisely when they shop. Overall, the project has demonstrated the potential of AI-powered solutions in today's modern retail environment, in addition to helping to increase customer satisfaction and enabling retailers to make better improvements. Furthermore, because the modular design is scalable for use by stores of any size and offers options for integration with current retail infrastructures, it facilitates improvement. SmartBasket's data-driven approach will enable them to identify additional shopping patterns and assist in resolving stock issues that impact both customers and retailers.

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Fig. 5. Product Selection

A blue and white checkout form

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Fig. 6. Checkout

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Fig. 6. Purchase Record

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