

SmartPantry AI: Transforming Home Kitchens Through Intelligent Automation

Abstract

The rapid advancement of artificial intelligence in smart home ecosystems has opened new opportunities for optimizing domestic resource management, particularly in the domain of kitchen inventory control and meal planning. However, modern households continue to face persistent challenges such as food waste, inefficient grocery management, manual data entry, and lack of personalized meal recommendations. These issues contribute not only to economic loss but also to environmental concerns due to unnecessary food disposal.

This work presents a Smart Kitchen Inventory Management System, a web-based application developed using the Django framework and integrated with Google's Gemini AI to address these challenges through automation and intelligent decision support. The system focuses on real-time inventory tracking, AI-driven recipe generation, and automated grocery bill digitization. A Model–View–Template (MVT) architecture with an SQLite backend ensures structured data management and scalability. The proposed methodology integrates computer vision techniques for bill scanning, natural language processing for recipe generation via the Gemini API, and rule-based logic for expiry date monitoring and notification. Additional modules support nutritional tracking and dynamic shopping list creation.

The system was designed to minimize manual intervention while maximizing usability across devices through a responsive interface. By leveraging artificial intelligence and automation, the proposed solution enhances decision-making in meal planning, reduces food waste, and streamlines household grocery management. The findings demonstrate that integrating AI-driven recommendation systems with real-time inventory monitoring can significantly improve operational efficiency in home kitchens. The framework also provides a scalable foundation for future enhancements, including predictive consumption modeling and integration with IoT-enabled appliances.

Keywords: Smart Kitchen, Inventory Management System, Artificial Intelligence, Gemini API, Django Framework, Computer Vision, Recipe Generation, Food Waste Reduction, Smart Home Automation.