

# Retail Barcode System: A Web-Based Product Identification and Pricing System

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**Abstract:** *The retail industry requires fast, accurate, and scalable systems for product identification, pricing, and inventory management, especially in high-volume environments like supermarkets and department stores where traditional manual billing is time-consuming and prone to errors. With rapid digital transformation, barcode-based automation integrated with web technologies has emerged as a reliable solution. This paper presents the design and implementation of a web-based Retail Barcode System that automates product identification, pricing, billing, and inventory updates by retrieving real-time product information from a centralized database. The system ensures accurate pricing, efficient stock control, reduced checkout time, minimized pricing discrepancies, improved inventory visibility, and enhanced overall operational efficiency.*

**Keywords:** Retail Barcode System, Web-Based Application, Product Identification, Pricing System, Inventory Management, Barcode-based Automation

## I. INTRODUCTION

Retail businesses depend on accurate product identification and correct pricing to ensure smooth operations and customer satisfaction. Traditional manual billing systems used in small and medium shops are prone to human errors, price inconsistencies, and inefficiencies, especially during busy hours. These systems also lack proper sales tracking and analysis tools, making business decisions difficult. Barcode technology provides a reliable solution by enabling fast and accurate product identification through machine-readable codes. It retrieves real-time pricing information from a database, reducing manual input and ensuring transparency. The proposed Retail Barcode System integrates barcode generation, scanning, billing, and sales reporting into a web-based platform. This system improves billing speed, pricing accuracy, inventory management, and supports better decision-making.

## II. LITERATURE REVIEW

### Barcode-Based Retail Systems

Barcode-based retail systems use unique machine-readable codes to quickly retrieve product details, improving billing speed and accuracy while reducing human errors. However, most systems focus only on basic billing and lack advanced features like sales analysis and reporting, limiting business insights and decision-making support.

### Manual Billing and Its Limitations

Manual billing systems rely on human price entry, making them prone to errors, slow checkout, and customer dissatisfaction. They also lack data consistency, security, and proper sales record management. These limitations emphasize the need for automated and secure billing systems.

### Sales Analysis in Retail

Sales analysis helps retailers understand product performance, customer behavior, and sales trends, supporting better inventory and pricing decisions. Visual tools like bar and line charts make data easier to interpret, especially for non-



technical users. However, many basic retail systems lack integrated sales visualization features, limiting meaningful business insights and effective decision-making.

### **Need for an Integrated Retail Solution**

Existing barcode systems improve billing but lack proper analytics, while manual systems are slow and error-prone. Sales analysis tools are often separate and complex for small retailers. Therefore, an integrated web-based Retail Barcode System is needed to combine accurate billing, data storage, and visual sales reporting in one platform.

### **III. METHODOLOGY**

The Retail Barcode System follows a structured methodology integrating product data management, barcode generation and scanning, data storage, and sales visualization. It is designed to reduce manual intervention, minimize errors, and ensure efficient, accurate, and reliable retail operations.

#### **Product Data Entry**

The first step in the methodology is product data entry. The user enters essential product details such as product name and price through a web-based interface. The system performs basic validation to ensure that the entered information is complete and accurate. Once validated, the product details are stored in the database. Accurate product data entry is critical, as it serves as the foundation for barcode generation and product identification during billing.

#### **Barcode Generation**

After successful data entry, the system generates a unique barcode for each product. Barcode generation is performed using standard barcode generation techniques that convert product-related information into a machine readable format. Each barcode is uniquely associated with a specific product in the database. The generated barcode can be printed or attached to the product, allowing quick and accurate identification during the scanning process.

#### **Barcode Scanning**

During the billing process, the barcode attached to the product is scanned using the barcode scanner module. The scanned barcode acts as a key that links the physical product to its corresponding database record. Once scanned, the system automatically retrieves the stored product details, including the product name and actual price. This automated process eliminates manual price entry, reduces human errors, and speeds up the checkout process.

#### **Data Storage**

Every time a barcode is scanned, the system records the transaction details in the database. The stored information typically includes product name, product price, and transaction timestamp. Maintaining a structured record of all transactions enables the system to support sales tracking and historical data analysis. Secure and systematic data storage ensures data integrity and reliability for future reference.

#### **Sales Analysis**

In the final stage, the stored transaction data is processed to perform sales analysis. The system uses the recorded data to generate visual representations such as bar charts, line charts, and doughnut charts. These visual tools help retailers analyze product-wise sales performance, identify trends, and understand overall business growth. Sales analysis supports informed decision-making related to inventory management and business planning.



#### **IV. IMPLEMENTATION AND RESULTS**

##### **A. System Implementation**

The proposed LeafDoc system is implemented as a web-based prototype following a client-server architecture. The frontend is responsible for user interaction, while the backend manages image processing and AI-based analysis through secure API integration.

The user interface allows users to upload plant or leaf images and view structured analysis results. Upon image submission, the backend securely communicates with a generative vision-language AI model to perform plant identification and disease diagnosis. Separate processing workflows are maintained for identification, diagnosis, and chatbot interaction to ensure modularity and scalability.

Sensitive configuration parameters, including API credentials, are managed using environment variables to maintain system security. The prototype implementation demonstrates the feasibility of integrating generative AI into a practical plant health monitoring application.

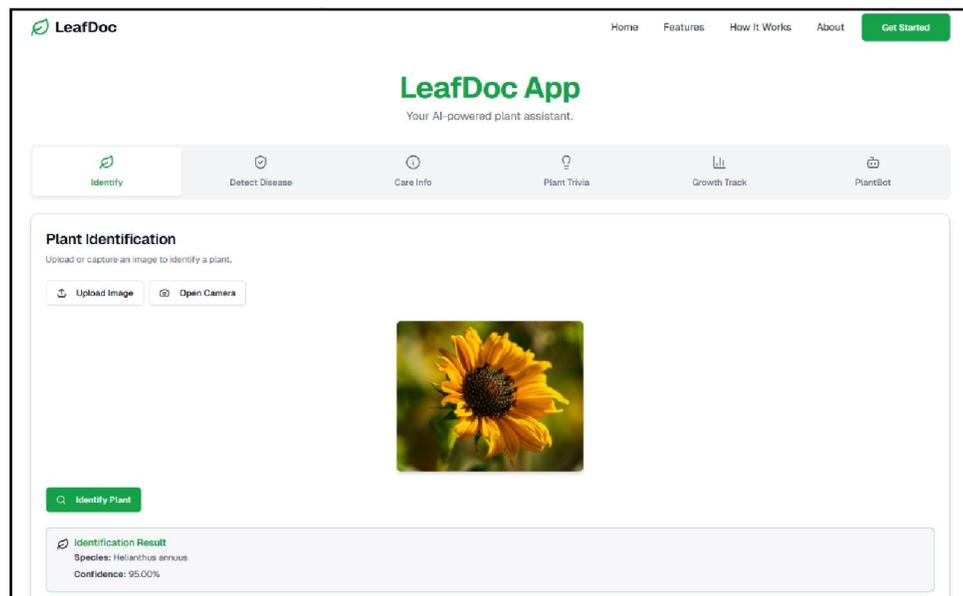
##### **B. Functional Results**

The system was evaluated using multiple plant and leaf images to verify functional performance.

###### **1. Plant Identification**

When a plant image was uploaded, the system successfully identified the plant species and generated structured output including the species name and confidence level.

As shown in Fig. 1, the system correctly identified a sunflower image as *Helianthus annuus* with a confidence score of 95%. This demonstrates the capability of the AI model to interpret visual features and provide reliable plant identification results.



**Fig. 1. Plant Identification Result**

###### **2. Disease Detection and Recommendation**

Following plant identification, the system performed disease analysis on symptomatic leaf images.

As illustrated in Fig. 2, the system detected Rose Rust disease with a confidence score of 85% based on visible symptoms such as yellowing and brown spots. In addition to identifying the disease, the system generated practical treatment suggestions, including removal of infected leaves and use of appropriate fungicides.



This integrated output highlights the system's ability to combine identification, diagnosis, and advisory support within a single workflow.

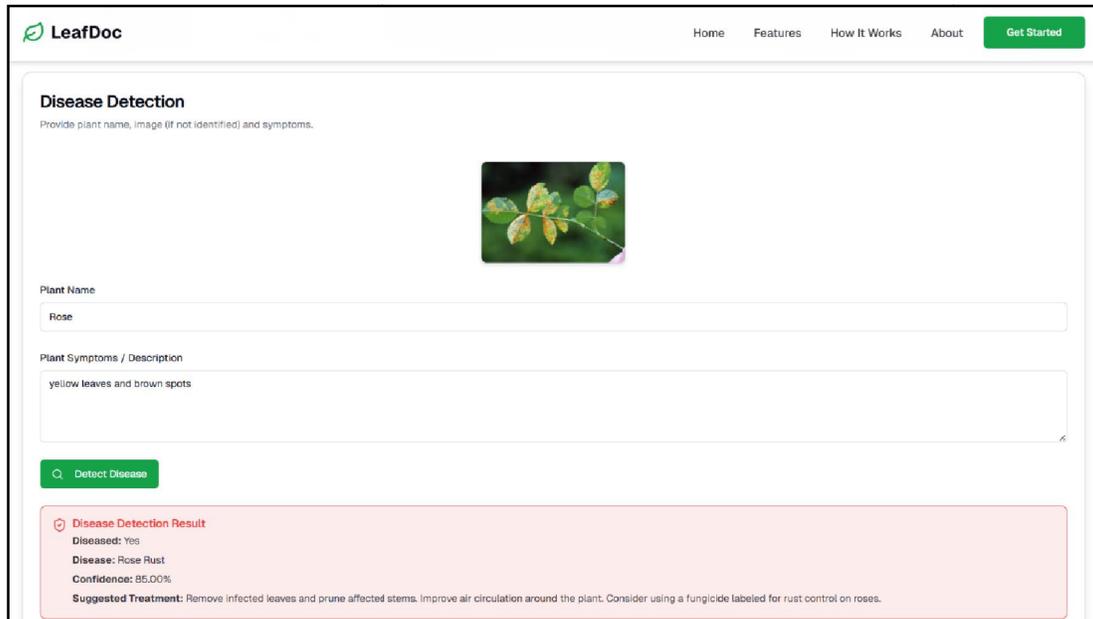


Fig. 2. Disease Detection and Recommendation Output

### C. Result Analysis

The experimental results indicate that the proposed system successfully performs sequential plant identification and disease diagnosis using a single generative AI framework. The evaluation focuses on functional correctness and usability rather than traditional dataset-based accuracy metrics, as the system relies on API-based generative inference. The results demonstrate:

- Accurate plant species identification
- Effective detection of visible plant diseases
- Generation of meaningful treatment recommendations
- Seamless integration between analysis and user interface

The system proved particularly useful for non-expert users by eliminating the requirement for prior plant knowledge before disease diagnosis.

### D. Discussion

The implementation confirms that integrating plant identification and disease detection within a unified generative AI framework enhances system usability and practicality. The API-based approach allows the system to analyze a wide variety of plants without requiring model retraining or large labeled datasets.

However, system performance may depend on factors such as image clarity, lighting conditions, and symptom visibility. Despite these limitations, the results demonstrate strong potential for real-world application in agriculture and home gardening.

The modular architecture also enables future enhancements, including multilingual support, environmental data integration, and large-scale deployment.



## V. CONCLUSION

The Retail Barcode System provides an efficient and automated solution for product identification and pricing by replacing manual billing with barcode-based automation, ensuring accurate price retrieval and reduced human errors. With unique barcodes linked to a centralized database, the system guarantees pricing consistency, transparency, and faster transactions, enhancing customer trust and operational efficiency. Additionally, it includes graphical sales reporting through charts to help retailers analyze performance and trends for better decision-making. Overall, the system overcomes the limitations of traditional billing methods and offers a scalable foundation for modern retail management.

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