FINAL REPORT

SHOPSMART: Your Digital Grocery Store Experience

INTRODUCTION

1.1 Project Overview

Smart Cart is an innovative solution designed to enhance and digitize the traditional grocery shopping process. It integrates technology with daily shopping to provide a smoother, faster, and more convenient experience for customers.The system enables users to scan items as they shop using QR codes or barcode scanners, which updates their virtual cart in real time. It helps users track total costs, view item details, and avoid long checkout queues by using online payment integration.Smart Cart is developed as a web-based application using modern frontend technologies like HTML, CSS, and JavaScript, supported by a secure backend with database connectivity. It also includes an admin dashboard to manage products, inventory, and customer activity.This system reduces human effort, minimizes billing errors, and enhances store management efficiency. The cart is user-friendly and suitable for supermarkets, departmental stores, and hypermarkets.By digitizing in-store shopping, Smart Cart offers transparency, ease of use, and a smart retail experience. It supports sustainable development by reducing paper receipts and encouraging digitalization.

1.2 Purpose

The purpose of the Smart Cart project is to modernize and streamline the traditional grocery shopping experience by integrating digital technology into retail operations. This system aims to reduce the time customers spend waiting in long billing queues by allowing them to scan items as they shop, maintaining a real-time digital cart. It helps users track their purchases, view product details, and pay directly through the application, making the entire process faster and more convenient. For store owners, it simplifies inventory management, minimizes human errors, and enhances billing accuracy. The purpose also extends to promoting contactless shopping, which is especially useful in maintaining hygiene and safety in post-pandemic retail environments. By using a centralized database and admin dashboard, store managers can easily update product information, monitor transactions, and analyze customer behavior. The system encourages the use of digital receipts, supporting eco-friendly practices by reducing paper waste. It also helps customers stay within budget by continuously displaying the total bill. Smart Cart is designed to create a smarter, smoother, and more efficient shopping experience for both customers and retailers, using accessible web technologies. Ultimately, it bridges the gap between traditional retail and modern digital convenience.

2. IDEATION PHASE

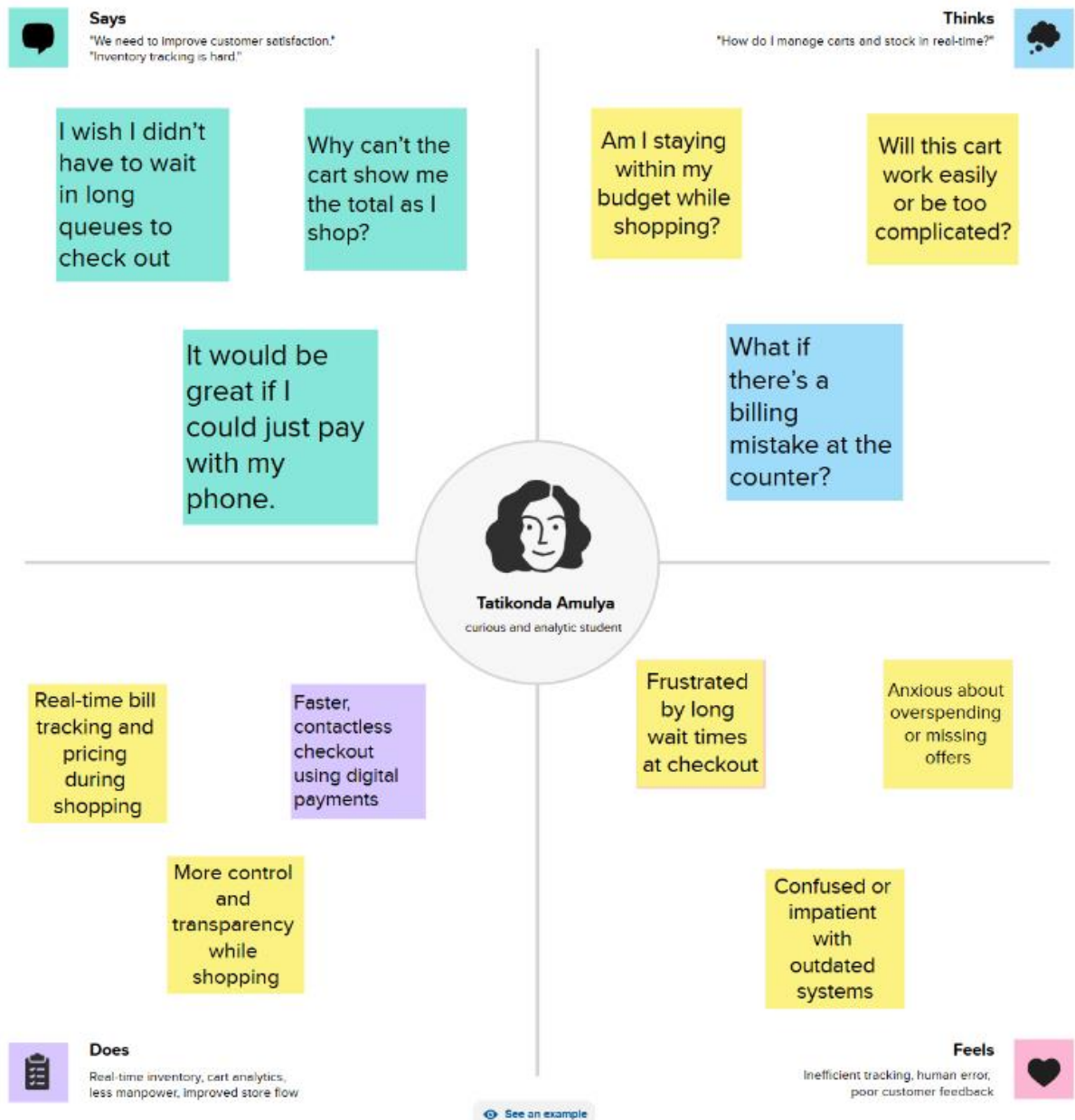## 2.1 Problem Statement

In today's fast-paced world, customers are often frustrated by long billing queues, lack of price transparency, and poor in-store shopping experiences. Traditional grocery stores still rely heavily on manual billing systems, which are time-consuming, prone to errors, and inefficient during peak hours. Shoppers face difficulty tracking their total expenditure while shopping and often encounter issues such as unavailable product information, mispriced items, and limited payment flexibility. Retailers, on the other hand, struggle with managing inventory in real time and providing a smooth checkout process. The absence of digital integration also makes it hard to analyze customer behavior, optimize stock levels, and reduce operational delays. The need for contactless and hygienic shopping methods has become more pressing post-pandemic, yet many stores remain unequipped. Additionally, the use of paper receipts contributes to environmental waste. There is a clear demand for a smarter, more transparent, and efficient shopping model that benefits both customers and retailers. ShopSmart aims to solve these issues by introducing a digital platform where users can scan, shop, and pay seamlessly. This system ensures faster checkouts, real-time price updates, and an overall enhanced grocery shopping experience powered by smart technology.

Problem Statement (PS)	I am	I'm trying to	But	Because	Which makes me feel
PS-1	a student working on a tech solution to improve grocery shopping.	create a smart cart system that automates billing and simplifies in-store shopping.	traditional shopping is time-consuming, with long queues, manual billing, and no real-time cost tracking.	today's consumers value convenience, speed, and digital payment methods in their shopping experience.	empowered to create a solution that solves real-world problems and improves everyday life.

2.2 Empathy Map Canvas

As a student working on the Smart Cart, the empathy map helped me understand real user problems deeply.I realized shoppers are often frustrated with long queues and slow billing. Many customers worry about spending too much without realizing it.They think digital solutions might be complex, but want something easy and helpful. They feel anxious about errors and waiting, especially during busy hours.Our team designed the Smart Cart to show live billing and offer QR payment to solve these pain points.We also considered store owners who need real-time inventory and cart tracking..

Says
"We need to improve customer satisfaction."
"Inventory tracking is hard."

Thinks
"How do I manage carts and stock in real-time?"

I wish I didn't have to wait in long queues to check out

Why can't the cart show me the total as I shop?

Am I staying within my budget while shopping?

Will this cart work easily or be too complicated?

It would be great if I could just pay with my phone.

What if there's a billing mistake at the counter?

Tatikonda Amulya
curious and analytic student

Real-time bill tracking and pricing during shopping

Faster, contactless checkout using digital payments

Frustrated by long wait times at checkout

Anxious about overspending or missing offers

More control and transparency while shopping

Confused or impatient with outdated systems

Does
Real-time inventory, cart analytics, less manpower, improved store flow

Feels
Inefficient tracking, human error, poor customer feedback

See an example

2.3 Brainstorming

The brainstorming phase focused on identifying the key challenges faced by both shoppers and store owners in traditional grocery shopping. Our team explored ideas to reduce queue times, enhance shopping convenience, and improve billing accuracy. We discussed integrating QR code scanning, real-time cart updates, and online payment methods. Suggestions for an admin dashboard to manage inventory and monitor customer behavior were also considered. We prioritized features that ensure a user-friendly interface and reduce manual tasks. Environmental concerns led us to include digital receipts. This session helped shape a clear vision for a smart, digital grocery shopping experience.

Brainstorm & idea prioritization

We conducted open discussions and whiteboarding sessions, focusing on:

- Core features of a smart cart
- Customer pain points in traditional shopping
- Integration possibilities (IoT, QR code, app, etc.)
- UX/UI flows
- Backend scalability and logic

🕐 **Focus Areas:** Frontend and Backend development
⌛ **Duration:** 1 week
👤 **Team Size:** 3 members

● **Objective:**

To generate innovative ideas that enhance the shopping experience using a smart cart, combining both tech and usability.

A **Team Collaboration overview**

Our team consisted of 3 dedicated members who collaborated closely over a 1-week development sprint. Each member focused on a specific technical area to streamline development.

B **Set the goal**

The primary goal of the **Smart Cart** project is to **enhance the in-store shopping experience** by developing a smart, technology-enabled cart.

C **Facilitation tools used**

Facilitation tools are methods or digital platforms that help a team:
- Organize ideas (brainstorming)
- Make decisions (prioritization)
- Collaborate effectively (task management)
- Solve problems (retrospectives or discussions)

1 **Problem statement**

Traditional shopping in supermarkets often leads to **long queues at checkout counters, manual billing delays,** and **inefficient store management.**
There is a clear need for a solution that can **automate billing, streamline the shopping process,** and **improve store operations** using smart technology.

PROBLEM

Traditional shopping in supermarkets often leads to **long queues at checkout counters, manual billing delays,** and **inefficient store management.**
There is a clear need for a solution that can **automate billing, streamline the shopping process,** and **improve store operations** using smart technology.

Key rules of brainstorming
To run an smooth and productive session

- Stay in topic.
- Encourage wild ideas.
- Defer judgment.
- Listen to others.
- Go for volume.
- If possible, be visual.

3. REQUIREMENT ANALYSIS

3.1 Technical architecture

Frontend: Built using HTML, CSS, JavaScript, and React for a responsive user experience.

Backend: Flask or Django handles product data, orders, user sessions, and security.

Data Pipeline: Python scripts for ingestion, validation, and formatting of data.

Visualization Layer: Charts integrated into admin dashboards using tools like Tableau or Chart.js.

Integration: RESTful APIs or GraphQL connect frontend to backend services.

Deployment: Hosted on cloud (AWS, Heroku) with scalable architecture and CI/CD pipelines.

Security: HTTPS, token-based authentication, and access-level control to protect user data.

3.2 Technology stack for Shopsmart

S.No	Component	Description	Technology Used
1	**Data Source**	Source of product and inventory data	MySQL / Google Sheets / Firebase
2	**Data Ingestion**	Fetching item/category data into the backend	Python / APIs / Webhooks
3	**Data Storage**	Stores product details, user data, and orders	PostgreSQL / Firebase / N
4	**Data Preprocessing**	Cleansing product names, categorization, and availability tagging	Python (Pandas) / Node.js
5	**Data Visualization**	Graphical display of orders, sales trends, and inventory	Chart.js / Google Charts / Tableau
6	**Backend Framework**	Business logic for cart, payments, delivery, etc.	Flask / Django / Node.js
7	**Frontend Interface**	Customer-facing UI: homepage, cart, checkout, profile	HTML, CSS, JavaScript, React.js
8	**Authentication**	User login, sign-up, and role-based access control	Firebase Auth / OAuth / JWT
9	**Payment Integration**	Secure transaction processing	Razorpay / Stripe / PayPal
10	**Hosting/Deployment**	Hosting the platform and dashboards	Heroku / Vercel / AWS

3.3 Solution requirement(Functional & Non-functional)

Functional Requirements

Following are the functional requirements of the ShopSmart digital grocery solution:

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration & Authentication	Allow customers to sign up, log in, and manage accounts securely.
FR-2	Product Browsing & Search	Enable users to browse categories or search for grocery items by keyword.
FR-3	Shopping Cart	Allow customers to add, remove, and update items in their cart.
FR-4	Order Placement & Checkout	Enable users to place orders and process payments securely.
FR-5	Order Tracking	Allow customers to view order status and track delivery.
FR-6	Admin Dashboard	Provide admin interface to manage inventory, prices, and users.
FR-7	Customer Support	Enable support team to manage queries and complaints.

Non-functional Requirements

Following are the non-functional requirements of the ShopSmart digital grocery solution:

FR No.	Non-Functional Requirement	Description
NFR-1	Usability	The interface should be user-friendly, responsive, and easy to navigate.
NFR-2	Security	User data and payment information must be

		securely stored and transmitted.
NFR-3	Reliability	The system should operate consistently without downtime or data loss.
NFR-4	Performance	Pages and dashboards should load within 2 seconds for optimal UX.
NFR-5	Availability	The platform should maintain 99.9% uptime and be accessible 24/7.
NFR-6	Scalability	The system should handle increasing number of users and orders smoothly.
NFR-7	Maintainability	The codebase should support easy updates and bug fixing.

4. PROJECT DESIGN

4.1 Data Flow Diagram & User stories

The Data Flow Diagram (DFD) for ShopSmart illustrates the flow of data across user interfaces, backend services, and external systems. It describes how a customer interacts with the platform to register, search for products, add them to the cart, and complete the order using integrated payment gateways.

Backend services handle catalog management, order processing, and real-time inventory updates. Data is then stored in cloud-based databases and used for generating reports and recommendations. Admins and customer support teams interact with the system via their respective dashboards to manage content and respond to queries
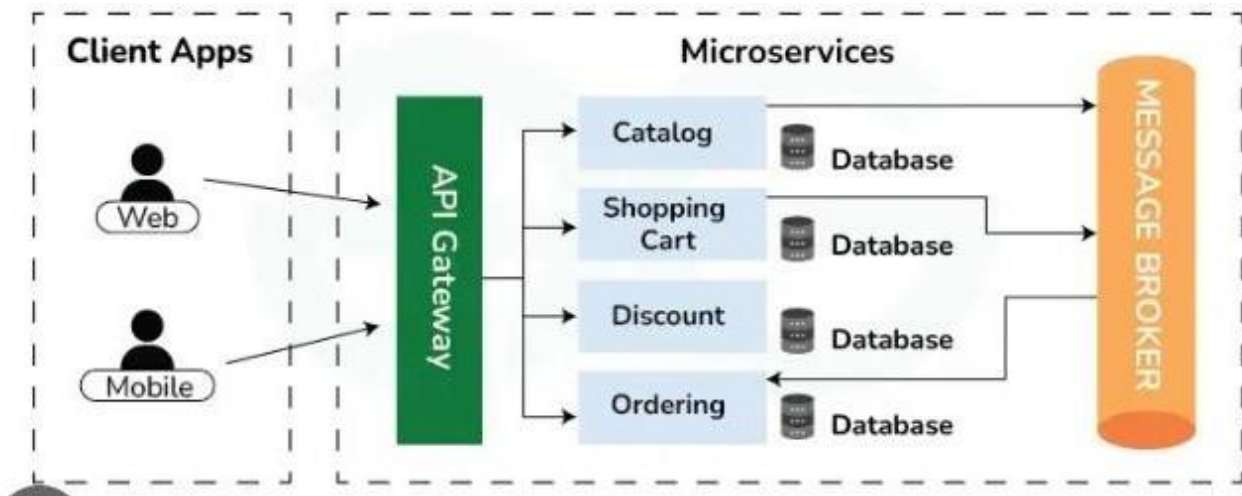
4.2 Problem – Solution

The Smart Cart Online Grocery Website addresses several key problems faced by traditional grocery shoppers. Customers often deal with long queues and limited store hours, which lead to inconvenience and time loss. Manual billing processes are slow and prone to errors, making the shopping experience inefficient. Additionally, traditional stores rarely offer personalized suggestions, and shoppers frequently forget to purchase essential items without proper reminders.

Smart Cart solves these issues by providing a seamless online grocery shopping experience available 24/7. The platform features automated billing that eliminates human error and speeds up the checkout process. It uses AI to offer personalized product recommendations based on users' shopping history. Furthermore, smart reminders and wish lists help users keep track of essentials, ensuring they never miss important items. With secure payment options and user-friendly design, Smart Cart enhances convenience, efficiency, and satisfaction in grocery shopping.

Smart Cart – Problem/Solution Canvas

Section	Details
1. Customer Segment(s) (CS)	Working professionals, parents, students, elderly people, and tech-savvy users seeking convenient grocery solutions.
2. Jobs-to-be-Done / Problems (J&P)	- Avoid physical store visits - Save time - Accurate billing - Personalized recommendations - Grocery reminders
3. Triggers (TR)	- Busy lifestyle - Health concerns - Smart Cart promotions - Poor offline service
4. Emotions: Before / After (EM)	Before: Stressed, frustrated, overwhelmed After: Confident, relaxed, satisfied
5. Available Solutions (AS)	- Supermarkets - Online competitors (BigBasket, Amazon Fresh) - Phone orders

	Cons: Less personalized, manual, or time-consuming
6. Customer Constraints (CC)	- Low digital literacy - Internet issues - Budget concerns - Trust in online orders/payments
7. Behaviour (BE)	- Browse online - Compare prices - Use reviews - Set up wishlists or repeat orders
8. Channels of Behaviour (CH)	Online: Website, App, Social Media, Emails Offline: Word of mouth, flyers/posters
9. Problem Root Cause (RC)	- Time scarcity - Outdated offline retail process - Poor stock visibility and inconsistent pricing
10. Your Solution (SL)	Smart Cart is an online grocery platform offering real-time stock, personalized recommendations, reminders, and fast checkout with secure payments.

4.3 Proposed solution

The **ShopSmart (Smart Cart)** project addresses the common issues faced by customers during grocery shopping, such as long queues, limited store hours, and inconsistent product availability. These problems particularly affect busy professionals, the elderly, and individuals with mobility challenges. To overcome these obstacles, Smart Cart offers a digital platform that allows users to browse, select, and purchase groceries with ease. It features real-time inventory updates, smart reminders for frequent purchases, AI-powered product recommendations, and secure payment options to enhance the overall shopping experience. Unlike generic e-commerce platforms, Smart Cart is uniquely optimized for daily household grocery needs, making it more relevant and user-friendly. It improves convenience, promotes digital inclusion, and ensures timely and accurate service, which in turn enhances customer satisfaction and reduces daily stress. The platform follows a freemium business model, offering free basic services with optional premium features such as express delivery, bulk discounts, and exclusive deals. Revenue can also be generated through partnerships, advertisements, and data insights for suppliers. Built on a scalable architecture, Smart Cart can be extended to various cities and regions, with support for regional language interfaces, mobile platforms, and local delivery integrations—making it a highly adaptable and future-ready solution for digital grocery shopping.

Architecture includes modules for data sourcing, transformation, Tableau visualization, and web deployment.

4.4 Solution architecture

The solution architecture for ShopSmart, an online smart- cart grocery platform, starts with multi- channel user interfaces built as a responsive React web app and a Flutter mobile app. All client requests first pass through a CloudFront CDN and an API Gateway that handles routing, rate limiting, and authentication via JWT/OAuth 2.0.

Behind the gateway, a set of stateless microservices—deployed in Docker containers on Kubernetes—manage core domains:
• Catalog Service (product, pricing, inventory)
• Cart & Checkout Service (shopping cart persistence, promotions, coupons)
• Order Service (order orchestration and status tracking)
• Payment Service (PCI- compliant integration with Stripe/Razorpay)
• User Service (profiles, addresses, preferences)
• Recommendation Service (AI/ML model for personalized suggestions)
• Notification Service (email/SMS/push via Twilio & Firebase)

Data is stored in a polyglot persistence layer: a PostgreSQL cluster for transactional data, Redis for session/cache, and Elasticsearch for product search. Inventory updates from partner stores feed into Kafka topics that fan- out to Catalog and Recommendation services in real time.

Orders are dispatched via an Integration Layer that exposes REST/GraphQL endpoints to third-party delivery partners (Dunzo/Swiggy, etc.). Event sourcing through Kafka ensures eventual consistency and auditability across services. Real- time dashboards (Grafana + Prometheus) monitor KPIs such as cart- to- checkout conversion, stockouts, and latency.

All services are packaged into CI/CD pipelines (GitHub Actions → ArgoCD) with automated testing and blue- green deployments to minimize downtime. The platform is container-agnostic, allowing horizontal scaling across regions to support peak demand.
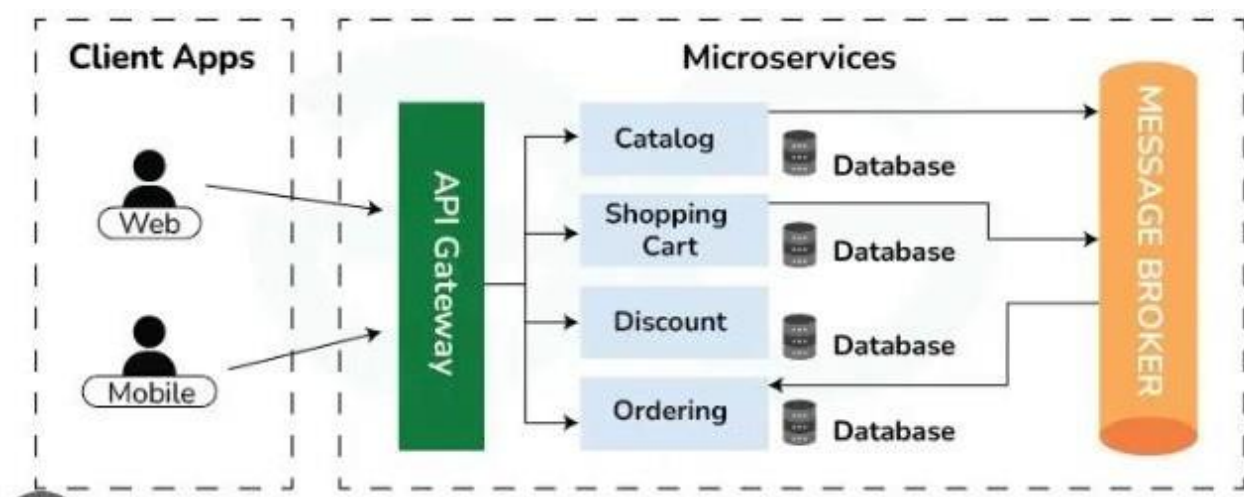
5. PROJECT PLANNING & SCHEDULING

5.1 Project Planning

The project planning was executed using an Agile-based sprint strategy to ensure structure, flexibility, and continuous improvement. The entire development process was broken into two focused sprints. The first sprint was dedicated to collecting raw data from global source and preprocessing it using Python and Excel to ensure accuracy and consistency. This phase also involved handling missing values, standardizing country names, and shaping the dataset for visualization. The second sprint concentrated on building the Tableau dashboards, testing interactivity, designing visual stories, and integrating them with the Flask-based web application. Each sprint included defined goals, story points, and task estimation using Fibonacci series logic, allowing the team to track progress and maintain a steady development velocity. This approach ensured that tasks were not only completed on time but also refined iteratively for maximum impact and usability.

The project follows a 3-sprint agile approach: Data Collection, Dashboard Development, and Web Deployment.

Project Tracker, Velocity & Burndown Chart: (4 Marks)

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	20	6 Days	19 may 2025	25 may 2025	20	25 may 2025
Sprint-2	20	6 Days	27 may 2025	04 june 2025	18	04 june 2025
Sprint-3	20	6 Days	05 june 2025	11 june 2025	15	11 june 2025
Sprint-4	20	6 Days	12 june 2025	17 june 2025	15	17 june 2025

6. FUNCTIONAL AND PERFORMANCE TESTING

6.1 Performance Testing

ShopSmart is a smart cart system designed to digitize and simplify the grocery shopping experience.
It allows customers to scan items, view real-time billing, and pay instantly using QR
codes. This eliminates long queues and manual checkouts in stores.
The system includes a user-friendly frontend, a secure backend, and a connected database.
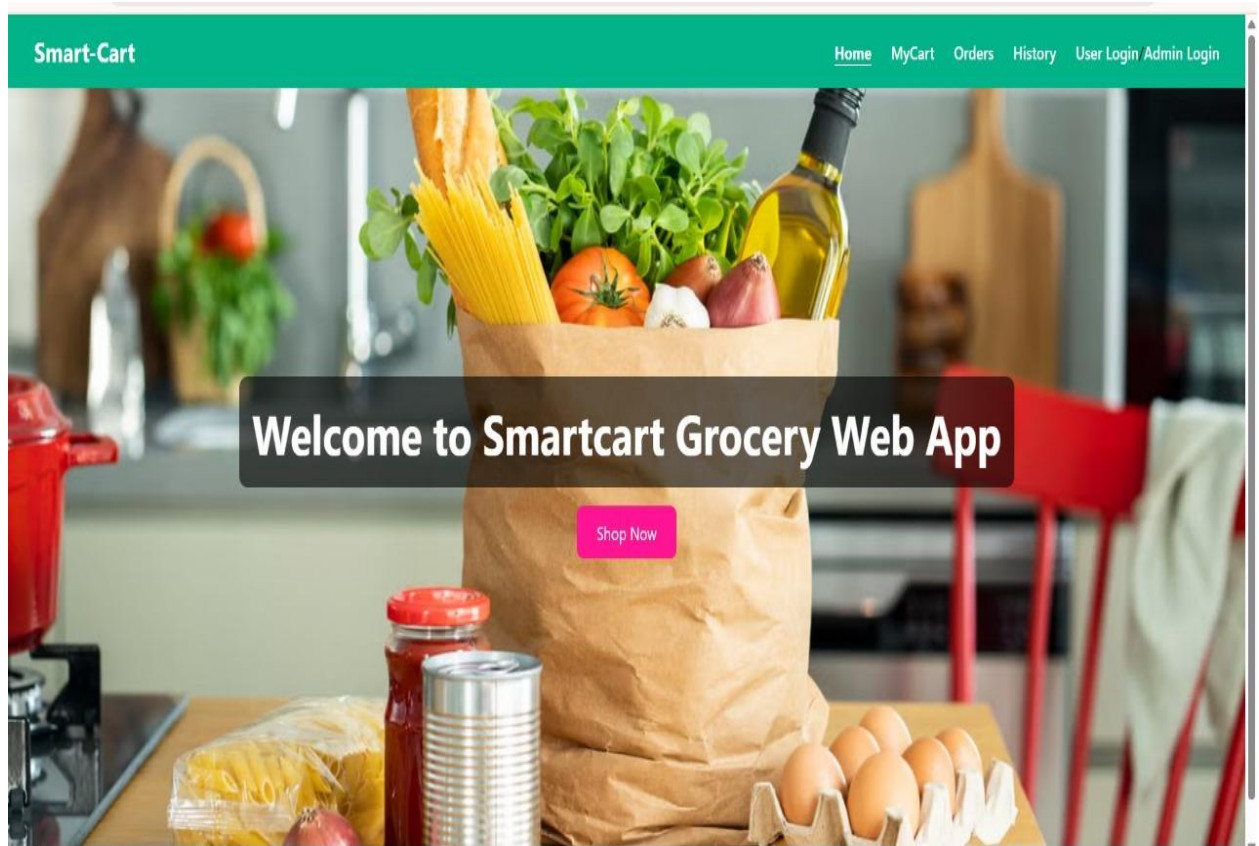Customers benefit from faster shopping, while store admins gain better inventory control.
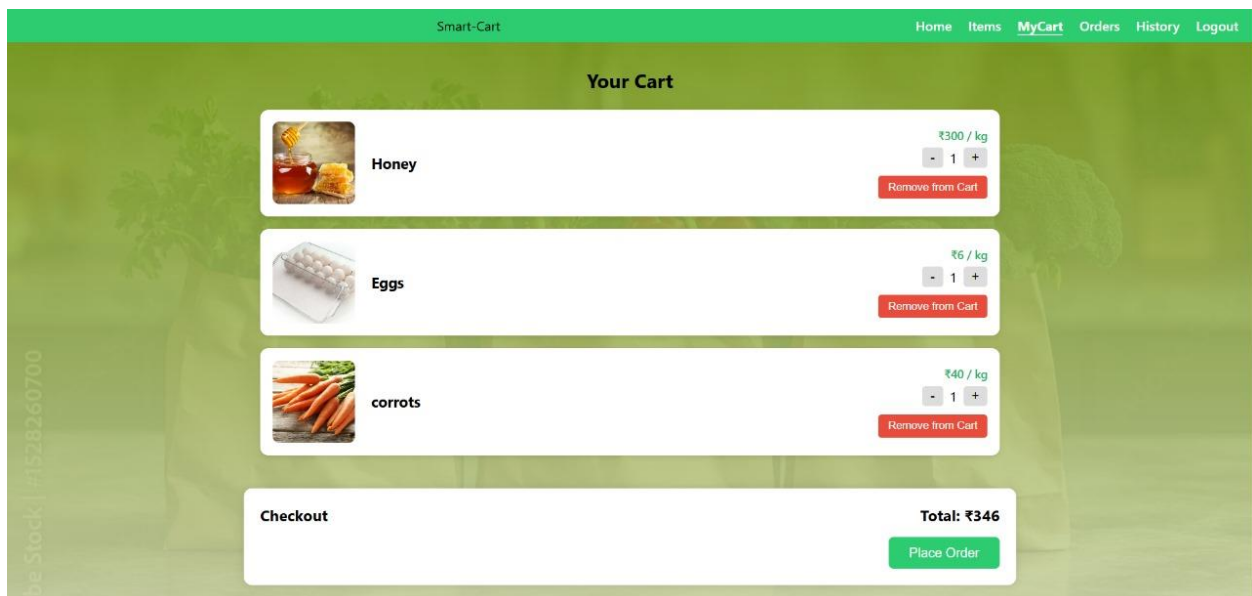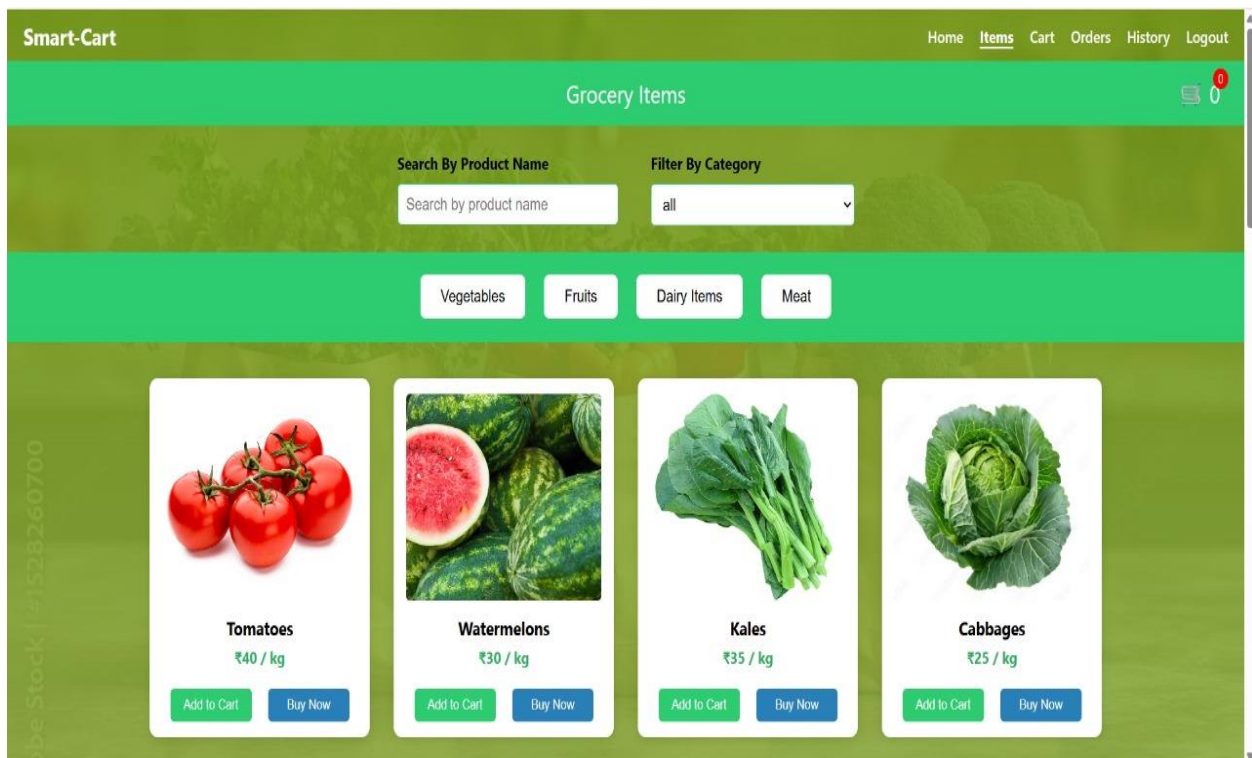Developed by a 3-member team in one week, the project focuses on practicality and user ease.
ShopSmart blends technology and convenience to modernize retail shopping.

RESULTS

6.2 Output Screenshots

Grocery Items

Search By Product Name

Search by product name

Filter By Category

all

| Vegetables | Fruits | Dairy Items | Meat |

Tomatoes
₹40 / kg
Add to Cart Buy Now

Watermelons
₹30 / kg
Add to Cart Buy Now

Kales
₹35 / kg
Add to Cart Buy Now

Cabbages
₹25 / kg
Add to Cart Buy Now

Your Cart

Honey

₹300 / kg
- 1 +
Remove from Cart

Eggs

₹6 / kg
- 1 +
Remove from Cart

corrots

₹40 / kg
- 1 +
Remove from Cart

Checkout

Total: ₹346

Place Order

Users

Sl/No	User ID	User Name	Email	Operation
1	6860e997e8b33875ad5d5e88	Amulya	228x1a42i6@khitguntur.ac.in	View

7. ADVANTAGES & DISADVANTAGES

Advantages

1. **Time-Saving and Convenient:**
Users can scan items while shopping and make instant digital payments, reducing time spent in long billing queues.

2. **Real-Time Tracking and Transparency:**
Customers can view item prices, total bill, and availability instantly, promoting informed and budget-friendly shopping.

Disadvantages

1. **Requires Digital Literacy and Devices:**
Not all customers, especially older adults or those unfamiliar with smartphones, may find the system easy to use.

2. **Initial Setup Cost and Maintenance:**
Implementing scanners, database systems, and admin panels requires upfront investment and ongoing technical maintenance.

8.CONCLUSION

In conclusion, ShopSmart offers an innovative and practical solution to modernize the grocery shopping experience. By integrating smart technology with traditional retail, it reduces billing time, enhances convenience, and provides real-time information to customers. The system is user-friendly, efficient, and environmentally conscious through features like digital receipts. It benefits both customers and store owners by improving operational efficiency and customer satisfaction. With AI-based recommendations, secure payments, and inventory tracking, it transforms shopping into a smarter and stress-free process. The platform also addresses the needs of elderly and differently-abled individuals through digital access. Its scalable and customizable architecture ensures adaptability across regions. ShopSmart not only promotes digital inclusion but also supports sustainable retail practices. Overall, it is a forward-thinking step toward the future of smart retail.

9.FUTURE SCOPE

The future scope of ShopSmart is vast, with the potential to evolve into a fully integrated smart retail ecosystem. Features like AI-powered voice assistance, image recognition for product scanning, and predictive shopping suggestions based on user behavior can further enhance user experience. Integration with smart IoT-based shopping carts and in-store navigation systems can make the platform even more interactive. Expansion into mobile apps with offline capabilities will ensure wider accessibility. Collaborations with local vendors and farmers can support hyperlocal delivery and promote fresh produce. Additionally, implementing data analytics and customer behavior insights can help stores optimize inventory and improve sales strategies. The platform can also be extended to other retail sectors beyond groceries, such as pharmacies or electronics. With continuous innovation, ShopSmart has the potential to lead the transformation of traditional shopping into a fully digital, personalized, and intelligent experience.

APPENDIX

GitHub & Project Demo Link:

https://github.com/Amulya-456/ShopSmart-Your-Digital-Grocery-Store-Experience