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Integrating Checkout and Shopping: The Cart-Smart: Business Plan

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***Abstract:** This business plan proposes a solution to the issue of long lines at billing counters in shopping malls, particularly during holidays and weekends when there are large discounts and offers. The proposed solution involves equipping all products in the mall with RFID tags and all shopping carts with RFID readers and digital displays. When a product is placed in the cart, its code will be automatically detected, and the product's name and price will be displayed on the LCD screen. The price will be added to the final bill. If a customer removes a product from the cart, the price will be deducted from the total amount, and this information will be sent to the central billing unit through the Smart Cart module. This system will enable customers to complete their billing process within the shopping cart itself, reducing wait times and improving the overall shopping experience.*

I. INTRODUCTION

Shopping is a ubiquitous activity that has been a part of human society for centuries. In recent times, advancements in technology have significantly impacted the shopping experience. One such advancement is the self-checkout system, which has become increasingly popular in stores across the world. However, while this technology offers convenience to shoppers, it also presents some challenges for stores, particularly when it comes to floor space and checkout queues.

In many stores, especially smaller ones, space is at a premium. Limited floor space can make it difficult for shoppers to move around freely, especially during peak shopping times. This issue can lead to overcrowding, which can be a major turn-off for shoppers. The situation is even more challenging in larger stores, where the volume of customers can be overwhelming. Long queues at checkout counters can be frustrating for shoppers, leading to dissatisfaction and, in some cases, even abandonment of their purchases.

This is where the "Cart-Smart" comes in. The Cart-Smart is an innovative solution that integrates the checkout system into the shopping cart itself. It offers shoppers a unique and convenient experience by allowing them to avoid traditional checkout lines, saving time and reducing stress. With Cart-Smart, shoppers can scan items using a handheld device, add them to their virtual cart, and complete the checkout process without ever having to leave their cart.

This solution has the potential to revolutionize the shopping experience, particularly in large stores. By reducing the time shoppers spend waiting in lines, Cart-Smart can improve customer satisfaction, leading to increased retention and revenue for stores. Furthermore, by freeing up floor space, Cart-Smart can enhance the overall shopping experience by making it more comfortable and hassle-free.

II. REVIEW OF LITERATURE

One study by García-Sánchez, Caba-Pérez, and López-Guzmán (2012) found that the implementation of smart trolley carts in retail stores can result in several benefits, including enhanced customer experience, increased sales, and reduced labour costs.

The study also highlighted the potential challenges in implementing smart trolley carts, such as the high cost of technology, the need for strong IT infrastructure, and concerns around customer privacy and data security. However, the authors concluded that the benefits of smart trolley carts outweigh the challenges, making them a feasible and viable option for retailers.

Overall, the literature suggests that smart trolley carts have the potential to revolutionize the retail industry by improving the shopping experience for customers while also reducing labour costs for retailers. However, further research is needed to fully explore their potential and address any remaining concerns around technology and security.

Radio Frequency Identification (RFID) technology can be used in smart trolleys to automatically scan items as they are placed in the trolley. In a 2006 article titled "An Introduction to RFID Technology," the author provides a comprehensive overview of RFID technology, including its basic components and various applications. The article discusses different types of RFID tags and their advantages and disadvantages.

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It also provides insights into the current state of the RFID market and its potential for future growth.

For the smart trolley business plan, the use of RFID technology can significantly enhance the shopping experience for customers. The technology can enable automatic scanning of items, reducing the need for manual scanning at checkout. This can result in faster checkout times and improved customer satisfaction. The smart trolley can also provide real-time inventory management, enabling retailers to better track and manage their inventory. Overall, the use of RFID technology in smart trolleys has the potential to revolutionize the shopping experience and streamline retail operations.

The article titled "Arduino Nano Boards: Specs for Every IoT and BLE Sense" by Tom's Hardware (2019) provides an overview of the Arduino Nano boards, which are small, affordable, and versatile development boards designed for IoT and BLE applications. The article describes the key features and technical specifications of the boards, including the type of microcontroller used, the available connectivity options, and the board's power consumption.

The Arduino Nano boards are particularly useful for developing smart devices, such as sensors and actuators, for IoT applications. The boards offer a wide range of connectivity options, including Bluetooth Low Energy (BLE), Wi-Fi, and Ethernet, making them ideal for connecting to the internet and interacting with other devices. The boards are also compatible with a range of sensors and actuators, making them highly customizable and adaptable to various applications.

In summary, the Arduino Nano boards are a useful tool for developers seeking to create smart devices for IoT and BLE applications. Their versatility, affordability, and wide range of connectivity options make them a popular choice for hobbyists and professionals alike.

The paper by Anderl et al. (2020) discusses the use of graph-based online attribution modelling to map the customer journey in an online context. While this research is not directly related to the development of a smart trolley for retail environments, it provides valuable insights into understanding and mapping the customer journey. The use of RFID technology in the smart trolley can provide a wealth of data that can be used to analyse customer behaviour and understand their preferences, which can ultimately improve the customer experience. By mapping the customer journey, retailers can identify potential areas for improvement in the shopping experience and develop strategies to enhance customer satisfaction and loyalty. Therefore, the lessons learned from this research can be applied to the development

The article by Zaidi and Aziz (2015) examines the impact of store atmospherics and store layout on consumer buying patterns in a retail environment. This research highlights the importance of the physical environment and how it can influence customer behaviour. With the development of a smart trolley that uses RFID technology, retailers can further enhance the physical environment by providing a more personalized shopping experience. The technology can be used to analyse customer behaviour, preferences, and buying patterns, which can be used to customize the store layout and atmosphere to better suit customer needs. For example, if the data shows that customers tend to spend more time in certain areas of the store, retailers can use this information to design a more effective store layout that enhances customer flow and accessibility. Overall, this research provides valuable insights into how retailers can use technology to enhance the physical environment and improve customer satisfaction.

The paper titled "Design and Implementation of Smart Shopping Trolley System with RFID Technology" by Zhang et al. (2014) presents a smart shopping trolley system that uses Radio Frequency Identification (RFID) technology to improve the shopping experience for customers. The system allows for automatic scanning of items added to the trolley and provides customers with real-time information on item prices and total cost. The authors argue that this technology can help to reduce waiting times in checkout queues and streamline the shopping process. Furthermore, they discuss the potential for the system to be used in conjunction with other technologies such as mobile payment systems and loyalty programs. Overall, the paper provides useful insights into the potential benefits of RFID technology in the context of retail environments and could be useful in informing the development of a smart trolley system for our business

III. PROTOTYPE AND CONCEPT

This project is used to scan the items as soon as item is added into the trolley. So, we designed the trolley in such a way that the upper part of the trolley will be a scanner like they will be no separate scanner space, the whole trolley acts like the scanner.

For a prototype we are using RFID Module and Arduino board to build a demo of smart shopping trolley including payment option. In this model, the items are stored and tagged to RFID, which each product will be having unique barcode.

The main system for this prototype is Arduino board where the programming code is stored. We have few RFID cards which stores the item barcode of milk, butter, and buttermilk. The Arduino board runs the entire process from reading RFID card to store and calculate the price. Here we are using RZFID module for a scanner and 3 RFID cards. The system has a buzzer that turns “ON” when the card is scanned.

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There are two LEDs lights which are red and green, the green LED represent the item is scanned and added to the cart meanwhile red LED represent the item is removed from the cart, we have LED display which displays item is added, item is removed, total price etc. The items can be removed by long press the reset button. The pair of lithium battery are used to run this entire circuit.
We used java programming to store in the Arduino board
"Else if((strncmp(input="00345713AF34100") ==0) &&(a==0))"
In this code we need to replace the RFID card number while scanning, so when the number has matched them, it collects all the details of that item and show in the led display like item name, price and discount.
After running the code and uploaded we can start testing the circuit we designed. First when the circuit is "ON" it display welcome message like "Welcome to Super Market", then the LED shows "Please ADD the item", then when we used one of the RFID cards for example "Milk" which we tagged to one of the RFID cards. When we scan that card, the LED will display "Milk is added "and the amount will be shown too. Like this we can keep on going adding the items into cart and the price will added to total amount automatically. In case we need to remove the item press the rest button and scan the RFID card of that item willing to remove from the cart, then LED will display "Item is removed" and price gets updated. At the end of shopping, you can view the total price and pay it through your convince way.

IV. MARKETING PLAN

Smart carts are technologically advanced shopping carts that use sensors and artificial intelligence to improve the customer's shopping experience. They typically include features such as touchscreen interfaces, barcode scanning capabilities, and automated payment options. Smart carts have a broad customer segment, but will most likely appeal to tech-savvy shoppers who like to use new technology to improve their shopping experience. Additionally, smart carts are particularly appealing to busy parents and individuals who can take advantage of the convenient and time-saving features that smart carts can offer.
Smart carts are also beneficial for retailers looking to improve their customers' shopping experience, increase customer loyalty, and collect data on customer behavior and preferences. This may include supermarkets, department stores and other large retailers.

A. Market Analysis

Smart cart products are a new trend in the retail industry to provide customers with an enhanced shopping experience. In India, the smart cart product market is growing rapidly due to the increasing demand for convenient and personalized shopping experience. The smart cart product market includes both online and offline retailers, supermarkets, and hypermarkets.

B. Market Segmentation

A smart cart is a digital platform that enables shoppers to conveniently purchase groceries online. Effectively selling smart cart products in India requires a segmentation strategy. This includes segmenting the market into different groups based on demographic, geographic, and behavioural factors. For example, a smart cart platform could target busy urban professionals who value convenience and time-saving features. Or you could sell to families with small children who have difficulty physically getting to the grocery store. By tailoring product messages and features to specific segments, Smart Cart can enhance its appeal and better meet the needs of its target Indian customers.

C. Target Market

The target market for smart cart products can be identified as Indian urban and semi-urban areas with high disposable income and preference for convenient shopping experience. The target audience is tech-savvy consumers who are willing to adopt new technologies in their daily activities. Smart cart products also appeal to time-constrained consumers who want to save time shopping.

D. Marketing Strategies

1) *Online Marketing:* Use social media and e-commerce platforms to promote smart his cart products to potential customers.
2) *Actions in Store:* Set up demo booths in retail stores to showcase smart card product features and offer discounts and free trials.
3) *Influencer Marketing:* Partner with influencers who have a significant online presence and follow them to promote your smart cart product.
4) *Loyalty Program:* Offer a loyalty program to encourage customers to use your smart cart products regularly.
5) *Partnerships with Retailers:* Partner with retailers to promote smart cart products in stores and offer special discounts to customers

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V. FINANCIAL PLAN

The business has two main sources of revenue:

1) *Product Sales:* Sales of Cart-Smart Systems
2) *Services:* Maintenance and Servicing of units sold

Table 1 Unit Costs Estimate	
	Amount (Rs.)
Basic Trolley	2800
Hand Break	400
Display	1100
Scanner	1500
Object Sensor	1050
Installation	1000
Total	7850

Table 2 Pricing	
	Amount (Rs.)
Price/Unit	11000
Service	1000
Selling and Distribution	1500
Costs Growth/Year	5%

We had been to several merchants in SP Road, Bengaluru. In the wake of having a meaningful conversation about our item, they had given us a citation for each fragment. We took the normal of each portion and made the COST TABLE. For evaluating procedures, we had associated with a couple of our companions who stay in western nations where this item is normally utilized. We took their assistance and investigated the worldwide market and associated with a couple of individuals in that area and examined the costing, valuing, and different components. After the conversation and doing a ton of estimations, we got the cost per unit to be 11,000 and we determined the help and dissemination cost.

The following table and graphs show the estimated balance sheet of the organization which includes various aspects of the business.

Table 3 – Balance Sheet

Particulars	Dec 31 2024	Dec 31 2025	Dec 31 2026	Dec 31 2027	Dec 31 2028
Sales units (Estimate)	50	100	300	1,000	1,500
Product sales	5,50,000	11,00,000	33,00,000	1,10,00,000	1,65,00,000
Service	50,000	1,00,000	3,00,000	10,00,000	45,00,000
Total Revenue	6,00,000	12,00,000	36,00,000	1,20,00,000	2,10,00,000
Costs					
Manufacturing costs	3,92,500	7,85,000	23,55,000	78,50,000	1,17,75,000
Salaries for 12 employees	6,00,000	6,00,000	6,50,000	6,50,000	7,00,000
Rent	5,00,000	5,25,000	5,51,250	5,78,813	6,07,753
Marketing/ Selling & Distribution	75,000	1,50,000	4,50,000	15,00,000	22,50,000
R&D	2,50,000	2,75,000	2,80,000	3,00,000	3,15,000
Total costs	18,17,500	23,00,000	42,86,250	1,08,78,813	1,36,22,753
Profit / Loss	-12,17,500	-11,00,000	-6,86,250	11,21,187	73,77,247

Number of Stores	5	10	3	10	15
units	10	10	100	100	100
	50	100	300	1000	1500

VI. BUSINESS MODEL CANVAS

<table>
<tr><th>Key Partners</th><th>Key Activities</th><th>Value Proposition</th><th>Customer Relationships</th><th>Customer segments</th></tr>
<tr><td rowspan="3">Manufacturer-
Actual Manufacture of prodcut would be outsourced

Dealer Network-
The Distribution Channel</td><td>Designing
Marketing
Customer Support
Maintenance</td><td rowspan="3">Convenience to stores customers

lower staffing requirements

Lowered business operating costs

creating a novel shopping experience</td><td>Call centers

on call service staff

large stores would have an engineer/rep on hand

trained reps at stores</td><td rowspan="3">Hypermarket stores

supermarket stores

other large stores with low staffing needs

tech savy populace</td></tr>
<tr><td>Key Resources</td><td>Channels</td></tr>
<tr><td>Engineers involved in product design and improvement</td><td>Pure B2B operations

Primarily by approaching large stores and product demos and trial phases</td></tr>
<tr><td colspan="3">Cost structure</td><td colspan="2">Revenue streams</td></tr>
<tr><td colspan="3">Primary Costs: Manufacture and R&D
Premises Rent
Staff: R&D team, Custimer support, business development, software development</td><td colspan="2">Product sales

Maintenance and service contracts</td></tr>
</table>

VII. IDEA ASSESSMENT SCORECARD

Element	Question	Low 1-3	Medium 4-6	High 7-9	Reason for the score
Product	Is this really a product or process innovation?			7	A large improvement over what exists
	Can the intellectual property be legally protected			7	The product and design can be patented
Market	Are customers receptive? Does this solve a problem?	3			The current alternatives are very attractive
Industry	Is the industry attractive?			7	Attractive

People	Does the venture's mission fit the personal aspirations of the entrepreneur(s), their willingness to take the to risks and give up control?	3			There are discrepancies between the venture's mission and the entrepreneur's personal aspiration and their willingness to take risks and give up control
	Is the entrepreneurial team sufficiently connected, up, down and across the value chain?	2			The entrepreneurial team has no personal or professional ties with customers, suppliers and competitors
Money	Are the gross or operating margin satisfactory given the typical industry or cost structure?		4		Ventures gross or operating margin are typical for the industry
	Are operating and cash cycles optimized?	3			Inventory is ineffective. Venture must prepay suppliers. Little control on accounts payable. Possible bad debts
	Does the venture's revenue model entail customer repeat sales or recurring revenue		4		Some limited revenue generated through repeat sales and/or subscription
Total Scores	40				

A score of 45-44 indicates a likely to be funded project. The venture can provide a point solution to a narrowly defined problem. Opportunity here means possible grants, alliances, and license agreements to build a more complete end-customer solution.

VIII. FEASIBILITY

A. Technical Feasibility

Bangalore has a strong technical infrastructure, with a thriving startup ecosystem and a large pool of talented engineers and developers. The country also has a growing electronics manufacturing industry, with several government initiatives aimed at promoting local manufacturing. Overall, the technical feasibility of developing a smart trolley in Bangalore is high.

B. Market Feasibility

Bangalore has a large and rapidly growing retail market, with a diverse range of customers and a growing demand for innovative products. However, the market for smart trolleys is still relatively new and untested in Bangalore, and it may take time to build awareness and demand for the product. Additionally, the price sensitivity of Bangalore consumers may be a challenge for a premium product like a smart trolley.

C. Financial Feasibility

Developing a smart trolley would require significant investment, including research and development, manufacturing, marketing, and distribution. While Bangalore offers several government incentives and subsidies for startups and manufacturing, accessing funding can still be a challenge. However, if the product is successful, there is potential for high returns on investment, given the size and growth potential of the Bangalore retail market.

D. Legal Feasibility

Bangalore has a well-established legal and regulatory framework for intellectual property protection, safety regulations, and environmental standards. However, navigating the regulatory landscape can be complex and time-consuming, particularly for a new product category like a smart trolley.

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E. Operational Feasibility

Bangalore has a complex and diverse retail landscape, with different formats and channels, and varying levels of technological sophistication. A smart trolley would need to be designed and marketed to address the specific needs of different types of retailers and consumers, and it may take time to establish a reliable and efficient distribution network.

IX. CHALLENGES

A. Price Sensitivity

As mentioned earlier, Bangalore consumers are highly price-sensitive and may not be willing to pay a premium price for a smart trolley. This may require the development of a cost-effective product that still offers significant value to consumers.

B. Competition

The Bangalore retail market is highly competitive, with both domestic and international players competing for market share. This means that a smart trolley would need to differentiate itself from existing offerings and provide a unique value proposition to retailers and consumers.

C. Regulatory Compliance

Bangalore has a complex regulatory landscape, and navigating the various legal and regulatory requirements can be challenging. This may include compliance with intellectual property laws, safety regulations, and environmental standards, among others.

D. Infrastructure

The infrastructure for retail and distribution in Bangalore is still developing, and there may be challenges in establishing a reliable and efficient distribution network for a smart trolley.

E. Consumer Education

A smart trolley is a new product category in Bangalore, and there may be a need for consumer education to build awareness and demand for the product.

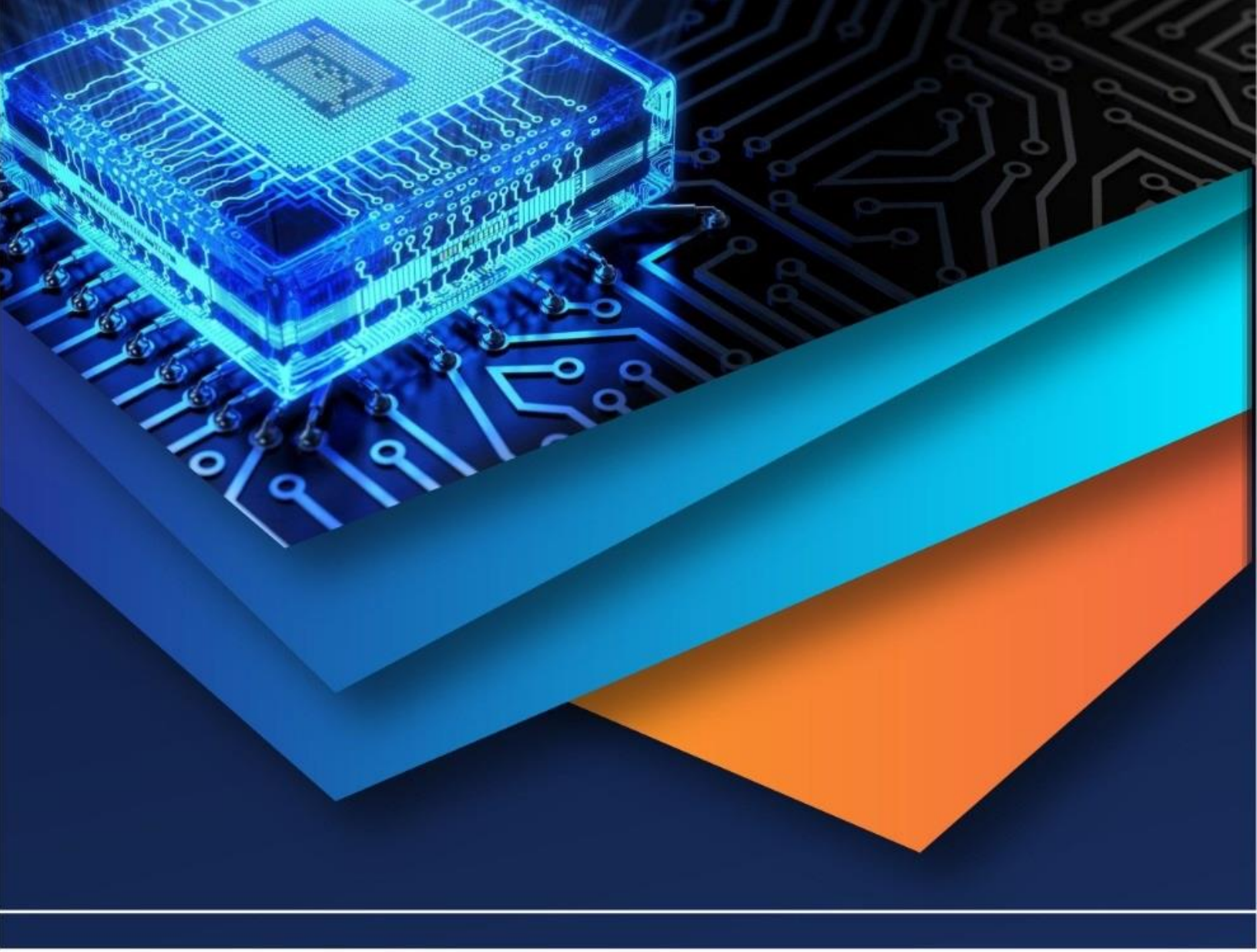
F. Technical Challenges

Developing a smart trolley involves a range of technical challenges, such as developing robust and reliable hardware and software, integrating different sensors and systems, and ensuring compatibility with existing retail infrastructure.

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