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DR. D. Y. PATIL INSTITUTE OF TECHNOLOGY

Department Of Artificial Intelligence and Data Science

Project Review -2 ON

Smart Cart with Automatic Billing,Product Information and Recommendation System

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ABOUT THE PROJECT

Traditional retail purchasing presents considerable obstacles, such as:

•**Lengthy checkout procedures :** Lengthy queues at checkout counters result in frustration among customers, leading to reduced satisfaction and potential loss of sales.

•**Laborious product scanning:** Manual scanning in retail stores leads to slow checkout processes, long lines, and errors in pricing and item identification, causing customer frustration and missed sales opportunities.

ABOUT THE PROJECT

In the ever-evolving landscape of retail, technological advancements continue to reshape the way we shop. One such innovation, the Smart Shopping Cart with **RFID-Based Automatic Billing and Product Recommendation System**, promises to revolutionize the shopping experience. By seamlessly combining convenience, personalization, and efficiency. This cutting-edge solution aims to address long-standing challenges and create a more engaging and tailored journey for customers. In this context, let's explore how this technology is poised to transform the way we interact with retail environments and user in a new era of shopping.

MAJOR OBJECTIVES

- **Streamlining Checkout Processes:** By implementing automated checkout systems, the aim is to reduce waiting times and eliminate checkout bottlenecks, leading to improved customer satisfaction and increased sales.

- **Efficient Inventory Management:** The system will employ real-time data analysis and automated reordering mechanisms to ensure optimal stock levels, minimizing instances of product unavailability and wastage.

- **Personalized Shopping Experience:** By harnessing customer data and AI algorithms, the system will offer personalized product recommendations, enhancing customer engagement and loyalty.

MAJOR OBJECTIVES

- **Cost-Effective Operations:** Through automation, the Automated Supermarket System aims to reduce labor costs and increase operational efficiency, enabling retailers to maintain competitive prices without compromising on service quality.

- **Recommendation of products:** In this integrated system,to reduce the queue and to enhance the customer experience we are using the recommendation system to give the visual understanding of the product that will be recommended to the user using catalogs.

- **Cost Threshold Limiting feature:** In this system,we will try to give the alert of specific amount shopping purchase done at certain instances of shopping time intervals.

PROJECT GOALS

- **Enhanced Shopping Experience**: Improve the overall shopping experience for customers by reducing checkout time, providing detailed cloth information, and offering personalized clothing recommendations.

- **Increased Sales**: Increase sales for retailers by offering targeted recommendations, optimizing inventory levels, and minimizing cart abandonment.

- **Efficient Inventory Management**: Enable retailers to maintain optimal stock levels, reducing overstock and understock situations.

- **Data-Driven Insights**: Provide retailers with valuable data and insights into customer preferences, enabling them to make informed decisions regarding inventory and marketing strategies.

PROJECT GOALS

- **User Adoption:** Achieve high user adoption rates for the mobile application by ensuring its usability, reliability, and usefulness.

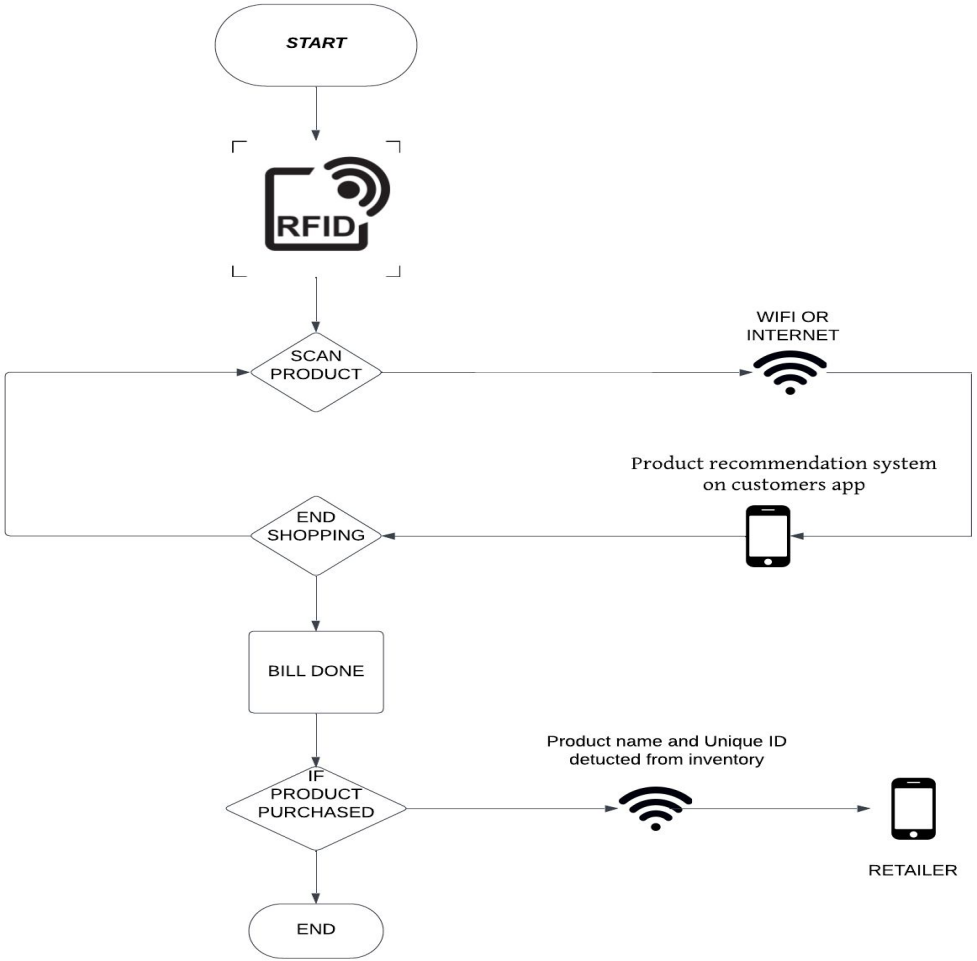
- **Security and Privacy:** Ensure the security and privacy of customer data and transactions, building trust with users.

- **Scalability:** Develop a scalable system that can be easily expanded to accommodate a growing number of stores and customers.

- **Eco-Friendly Initiatives:** By reducing paper usage (receipts) and optimizing inventory management, smart cart systems can contribute to more sustainable and environmentally friendly retail practices.

Workflow Diagram

The adjoining flowchart represents the overall working flow and mechanism of the proposed system.



LITERATURE REVIEW

Sr. No.	PAPER NAME	AUTHOR NAME	ADVANTAGES	DISADVANTAGES	FUTURE SCOPE
1.	IoT-Based Smart Shopping Cart Using Radio Frequency Identification. ***Date of publishing : April 8, 2020***	MOBEEN SHAHROZ , MUHAMMAD FAHEEM MUSHTAQ , MAQSOOD AHMAD , SALEEM ULLAH , ARIF MEHMOOD , AND GYU SANG CHO	Provides eco-friendly services in cost-effective manners.	Implementing the IoT-based Smart Shopping Cart may involve substantial initial Costs for setting up the RFID infrastructure	Integration with Smart Payment Solutions Implementation in Other Retail Sectors
2.	IoT based Smart Shopping Trolley with Mobile Cart Application ***Date of publishing: 19-20 March 2021***	S Kowshika; S.S Madhu mitha; G Madhu Varshini	Smart shopping cart secures mobility of consumers and accelerates their purchasing experience ,the Model has easy access, is economical and showcases an intelligent and easy shopping experience to reduce time, energy of the consumers	Any technical glitches or failures could impact the shopping experience,	While RFID tags have become more affordable over the years, they still add to the overall product cost.

Sr. No.	PAPER NAME	AUTHOR NAME	ADVANTAGES	DISADVANTAGES	FUTURE SCOPE
3.	Intelligent Wardrobe Clothing Recommendation System Based on ZigBee Network and CLO Value Measurement ***26-27 December 2022***	Ms. Rupali Sawant, Kripa Krishnan, Shweta Bhokre, Priyanka Bhosale	Personalized Wardrobe Management, Efficient Clothing Selection, Minimized Decision Fatigue	Technical Complexity may occur, Setting up the intelligent wardrobe system may involve initial expenses for installation.	Smart Fabric Technology can be used, User-Focused Customization can be implemented
4.	Smart Shopping Cart with Automatic Billing System through RFID and ZigBee ***Date of publishing: 16-22 May 2021***	Mr.P. Chandrasekar, Ms.T. Sangeetha	Application creates an automated central bill system for supermarkets.Customers can pay their bill through credit/debit cards	In a ZigBee mesh network, interference or signal disruptions may occur, affecting reliability	**Interoperability:** Can focus on creating standardized protocols to ensure interoperability between different RFID and ZigBee systems.

Gap Analysis

- Following are the gaps that we came across while analysing the research papers.
  - Technically,the systems were not using **recommendation systems** in carts so as to efficiently give a better user experience based on the choice.
  - When a user shops any product he/she may purchase the product which may **exceed the limit** of money that he /she intend to spent on that purchase at that time.Hence it causes unnecessary deadlock at shopping sight.
  - If a user forgot to bring their mobile phone then it may lead to a problem that unnecessary queue will be created .
  - None of the implemented systems have mentioned about theft and security of products, which makes our system to stand-out from others.

Key Features of our System

1. **Recommendation System:** One of the main feature in our Smart Cart is the Cloth Recommendation System, which will suggest/recommend various types of clothes based on the preferences of the users.
2. **Hybrid Billing System:** Some of the drawbacks of other systems are they don't specify what to do if the user forgot his mobile or don't have a option for online/ card payment. Our system aims to have a Manual counter, just incase you don't have your mobile or option for online payments/ cards, don't worry we got you. Hence reducing Mobile dependencies.
3. **Budget Limitation Feature:** Added feature in our Smart System is that at the start of the shopping a user can mention his/her preferred budget, so that you won't exceed your budget at the counter Our system has a amazing feature that will alert you when you cross your mentioned budget.
4. **Increased Security:** No implemented system has mentioned about theft and security of products, which makes our system to stand-out from others. Our system will simply link the inventory management system to Exit gates, which will make shoplifting near to impossible.

TOOLS TO BE USED

Tools required for Building and designing of Smart Cart:

1. RFID Tags
2. RFID Readers
3. Antennas
4. Microcontroller or Single-Board Computer
5. Sensors (Optional)
6. Communication model

TECHNOLOGY TO BE USED

Technology used in Smart cart:

1. **<u>Communication Protocols:</u>** For connecting our smart cart with mobile application we will be using wireless communication protocols such as Wifi or NFC(Near Field Communication)
    a. **Wifi** : Wi-Fi is a wireless networking technology that will enables to connect RFID reader to internet or a local network without the need for physical cables.
    b. **NFC** : Near Field Communication (NFC) is a set of short-range wireless technologies, typically requiring a distance of 4 cm or less to initiate a connection.

TECHNOLOGY TO BE USED

Algorithms: Various algorithms will be used in our project for, RFID data parsing, real-time data sync, Item recommendation, Mobile applications and User experience.

1. **RFID data parsing:**

   Algorithm: Simple Data Extraction Algorithm

   Description: This algorithm reads RFID tag data and extracts relevant information such as item IDs, descriptions, prices, and sizes.

2. **Real-Time Data Sync:**

   Algorithm: Publish-Subscribe Pattern

   Description: Implement a publish-subscribe pattern to ensure real-time data synchronization between the mobile app and the shopping cart.

TECHNOLOGY TO BE USED

Item Recommendations:

Algorithm:Collaborative/Content based Filtering

Description: Collaborative filtering recommends items based on the behavior and preferences of similar users. It can provide personalized clothing recommendations to users based on their past selections and those of similar shoppers.

User Experience (UX):

Algorithm: Smooth Animation and Responsive UI

Description: Ensure a smooth and responsive user experience by implementing algorithms that optimize animations and interface responsiveness.

ADVANTAGES

1. **Efficient Checkout Process**
2. **Automated Billing**
3. **Automated tracking and monitoring.**
4. **Data Analysis**
5. **Reduced Queues and Congestion:**
6. **Improved Staff Allocation**
7. **Eco-Friendly Initiatives:**

DISADVANTAGES

1. **Mobile dependency increases**
2. **Wifi or Internet dependency increases**
3. **Any Glitch in Database management system will led to total failure**
4. **Mobile Application might be difficult for some people to handle**
5. **Recommendation system may not always give accurate recommendations**

FUTURE PLANS

- **Offer recommendations:** We can recommend to a particular customer that any shopping sale,discount offer is currently available to the shopping store for the products that has been purchased by them earlier.

- **In out based system:** We can use in-out weight based cart so as to delete or insert any product into the cart.

- **Customer Analytics:** Utilize the gathered data to perform in-depth customer analytics, enabling the store to understand shopping behaviours, preferences, and trends, leading to more targeted marketing campaigns and inventory management.

FUTURE PLANS

- **Virtual Fitting Rooms:** Integrate augmented reality (AR) technology to offer virtual fitting rooms, enabling customers to visualize how clothing items will look and fit before making a purchase decision.

- **Seamless Online Experience:** Extend the Smart Shopping Cart experience beyond the physical store to online platforms, enabling customers to create virtual carts and receive personalized recommendations while shopping online.

- **Voice and Gesture Control:** Introduce voice and gesture recognition capabilities, allowing customers to interact with the cart and make selections without physically touching it.

APPLICATIONS

Retail Stores: Smart shopping carts are already making an impact in retail stores by improving the overall shopping experience and operational efficiency

Medical Stores: Smart carts can also find applications in medical stores or pharmacies in area such as Medication management, patient information

Hardware tools and shopping: In hardware stores or for shopping tools and equipment, smart carts can provide several benefits such as checklist management, tool tracking, product information.

PROJECT STAGES

Stage 1: Project Planning and Research

- Define project objectives, goals, scope, and stakeholders.
- Market Research
- Technology Selection
- Budget and Resource Planning
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Stage 2: RFID System Integration:

- RFID Hardware Setup
- RFID Software Development
- Cloth Information Database

PROJECT STAGES

Stage 3: Automatic Billing System:

- Billing Logic Development: Design and implement the automatic billing system that calculates item prices, discounts, and the final total in real-time.
- Secure Payment Integration: Integrate secure payment gateways to facilitate payments through the mobile app.

Stage 4: Mobile Application Development:

- App Wireframing and Design: Create wireframes and design the user interface (UI) of the mobile application.
- Mobile App Development: Develop the mobile app for both Android and iOS platforms, including features for scanning RFID tags, displaying cloth information, and processing payments.
- User Authentication and Security*: Implement robust user authentication and data security measures.

Stage 5: Cloth Recommendations System:

- Data Collection and Analysis: Gather data on customer preferences and historical shopping behavior for machine learning.
- Machine Learning Model Development: Train machine learning models to provide personalized clothing recommendations.
- Integration with the Mobile App: Integrate the recommendation system into the mobile app to display personalized suggestions to users.

Stage 6: Testing and Quality Assurance:

- .Unit Testing: Conduct unit testing for each component (RFID, billing, mobile app, recommendation system) to ensure they function correctly.
- Integration Testing: Test the integrated system to verify that all components work seamlessly together.
- User Acceptance Testing: Involve end-users to evaluate the system's usability, functionality, and performance.

Stage 7: Deployment:

- Deployment to Stores: Roll out the Smart Cart system to one or more pilot stores for real-world testing.

- Training: Train store staff and customers on how to use the system effectively.

Stage 8: Documentation:

- Project Proposal
- Project Plan
- Requirements Specification
- Software/Hardware Specifications
- Testing and Quality Assurance
- Project Report
- Presentation Materials
- Source Code Repository
- Acknowledgments

DISTRIBUTION OF WORK

Designing and Building of Smart Cart:

- Saurabh Kale and Pranav Mule

Mobile Application and Recommendation System:

- Gautami Kadam and Jay Sawant