The Literature Survey Based on Smart Trolley Using AI

K. Sivaranjani* and S. Rahul

B.E-Electronic and Communication Engineering, Angel college of Engineering and Technology, Tamilnadu, India

*Corresponding Author
K. Sivaranjani, B.E-Electronic and Communication Engineering, Angel college of Engineering and Technology, Tamil Nadu, India.

Abstract
This survey paper purposes a real time implementation of the smart trolley using AI by different methods and technologies. The shopping system has many problems. There are huge numbers of customers and few numbers of billing system-are in the retail stores. To handle the huge crowd, we must reduce the procees of the billing time. This is done using smart trolley based on AI and RFID. Items that are put in smart shopping cart are scanned using RFID. The aim is to reduce the time consumption needed for the billing system. Shopping is really fascinating and alluring; at the same time, it involves getting tired due to standing in a long queue for the bill and payment process. Hence, it is proposed to design a smart trolley which can take care of shopping and billing. By this, the customer can walk straightaway into the shop, purchase products using the smart trolley and walk out of the shop. He gets the e-bill through the mail, and he can view his purchase details using the shop's website. In order to realize this, we need an Arduino board, Radio-Frequency Identification (RFID) reader, RFID tag, LCD display, ESP8266 Wi-Fi module, database manager and a website to maintain product and customer details, which can be accessed by the admin anywhere in the world. This is an IOT based system where the trolley can interact with the network spread worldwide.

Keywords: Smart Trolley, Arduino, ESP8266, RFID, Load Cell, RFID Tag

1. Introduction

The Smart Trolley concept leverages Artificial Intelligence (AI) to enhance the shopping experience for customers and streamline operations for retailers. Here's a detailed explanation of how AI can be integrated into the Smart Trolley AI algorithms can be employed to automate the checkout process. As customers place items into the trolley, sensors and cameras within the trolley can identify and track each item. AI-powered image recognition algorithms can quickly identify products, determine their prices, and add them to the customer's virtual shopping cart by analysing past purchase history and current items in the trolley, AI can provide personalized product recommendations to customers. These recommendations can be displayed on the trolley's user interface screen, suggesting complementary items or promotions based on the customer's preferences and shopping habits.AI can help retailers better manage their inventory by monitoring stock levels in real-time. As items are scanned and purchased using the Smart Trolley, AI algorithms can update the inventory database, alerting store managers when stock levels are running low and automatically placing orders for replenishment. AI-powered pricing algorithms can adjust product prices in real-time based on various factors such as demand, time of day, and competitor pricing. This dynamic pricing strategy can help maximize sales and profitability for retailers while offering customers competitive prices.

AI can be used to monitor the condition of the Smart Trolley's hardware components and identify potential maintenance issues before they occur. By analyzing sensor data and performance metrics, AI algorithms can predict when components are likely to fail and schedule maintenance proactively, minimizing downtime and ensuring a seamless shopping experience for customers. AI analytics can analyze data collected from the Smart Trolley, such as purchase history, browsing behavior, and demographic information, to generate valuable insights into customer preferences and trends. Retailers can use these insights to optimize their marketing strategies, tailor promotions, and improve the overall shopping experience. The Smart Trolley can incorporate natural language processing (NLP) capabilities, allowing customers to interact with the trolley using voice commands or text input. Customers can ask questions about products, request assistance, or provide feedback, enhancing the overall usability and accessibility of the Smart Trolley.By integrating AI into the Smart Trolley, retailers can create a more efficient, personalized, and engaging shopping experience for customers while optimizing their operations and driving revenue growth.

2. Related Research

Tapan Kumar Kumar Das, Asis Tripathy, and Kathiravan Srinivasan proposed designing a smart trolley that can handle shopping and

billing. According to their proposal, customers would be able to enter the shop, use the smart trolley to purchase products, and leave the shop without having to go through a traditional checkout process. They would receive an electronic bill via email and could view their purchase details on the shop's website. To implement this system, they identified the need for an Arduino board, Radio-Frequency Identification (RFID) reader and tags, LCD display, ESP8266 Wi-Fi module, database manager, and a website to manage product and customer information. This system would allow the administrator to access data from anywhere in the world.

Step 1: Rahul R, Saastha Sree Nandan P, Sai Prasath S, Yashwanth M S, and Raffik R identified the primary goal as developing a smart trolley to enhance the shopping experience by improving efficiency, reducing wait times, and providing personalized recommendations.

Step 2: They conducted surveys and interviews to gather user requirements for the smart trolley, ensuring compatibility with different store layouts and products.

Step 3: They identified and selected hardware components, such as sensors, RFID tags, and display units, to be integrated into the smart trolley. They also considered security measures to protect user data during communication.

Step 4: RFID technology was implemented for automatic item tracking. They integrated RFID tags on products and RFID readers on the smart trolley. Algorithms were developed to identify items placed in the trolley and update the shopping list accordingly.

Step 5: They integrated mobile payment options, such as QR codes or NFC, for seamless and secure transactions. An automated checkout process was implemented to streamline payments.

Overall, the team proposed addressing the flaws in the current billing system by developing an automatic smart trolley for supermarkets. This trolley saves customers' time and effort by reducing the time spent at the billing counter during their shopping. Based on the Node MCU (ESP8266) microcontroller and RFID tags, this project scans products, displaying them on an OLED screen, allowing customers to keep track of total items and cost, ultimately enhancing the shopping experience and saving time.

2.1 Work Procedure

Step 1: Sakshi Maurya, Gayatri Sahu, Anupriya Yadav, and Bhawna Shukla suggested conducting surveys and interviews to gather user requirements for the automated smart trolley system. They also recommended collaborating with store owners to understand integration requirements with existing point-of-sale (POS) systems.

Step 2: They proposed selecting RFID readers and tags suitable for the smart trolley system, determining the RFID frequency based on application requirements.

Step 3: The team suggested designing the software architecture to handle RFID data, communicate with the store's POS system, and manage user interactions. They emphasized including features like item tracking, a user interface, and integration with automated checkout.

Step 4: They recommended implementing a pilot version of the automated smart trolley system in a limited section of the store to address any identified issues or enhancements needed for full

deployment.

Step 5: The team proposed promptly addressing any issues to ensure a smooth shopping experience. They also suggested providing customer support for users encountering problems with the automated smart trolley.

2.2 Regarding the Work Procedure

Step 1: It was suggested to define the project scope, considering features like automatic item tracking, user engagement through IoT, and seamless checkout processes. They also emphasized budget limitations, technology compatibility, and regulatory considerations.

Step 2: The team proposed identifying key features desired by users for a convenient and connected shopping experience, while also considering factors like durability, energy efficiency, and ease of maintenance.

Step 3: They recommended including features such as a shopping list, product information, and personalized recommendations, along with developing algorithms to identify items placed in the trolley and update the shopping list in real-time. They stressed ensuring user data privacy and compliance with regulations.

Step 4: The team suggested ensuring compatibility with popular mobile payment apps and rolling out the IoT-based smart shopping trolley system across the entire store or selected stores, along with developing a helpdesk or online support platform.

Step 5: They proposed generating regular reports on the performance of the IoT-based smart shopping trolley system to identify areas for improvement and future enhancements.

3. Conclusion

The Smart Trolley was designed to function as a mobile self-checkout system providing users the flexibility to make transactions from it within the retail store. It is designed to be highly efficient and fully synchronised with the retailer's current system. The double diamond standard was used in the product idealisation phase which guided the team to choose the Smart Trolley idea among many other ideas presented by the team. By using the algorithm, it can identify the market potential of the Smart Trolley and the problematic areas, so that it can be presented with a successful business plan. A detailed market description and competitive analysis of the product market and its attributes were presented in this report. The target market identified was the big retailers; however, consumers are the direct beneficiaries. product will be very much appreciated by the public because of its unique features such as the mobile self-checkout and easy product search within the store. From the feedback responses obtained from both the Functional Assessment and Strategic Assessment phases, the Smart Trolley will gain a very good market. This will attract partners and funding once the product is available in the market. For these reasons the product must be protected legally. Security and legal protection must be given high consideration for this product; however, this is not necessary at this moment because there is only presentation of ideas and business plan with no prototype developed yet [1-7].

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