A Novel Swift and Intelligent Approach for Revamping Shopping Experience

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ABSTRACT
Today, Walmart, supermarkets, shopping malls, and grocery shops all experience heavy traffic on a daily basis, which is exacerbated on weekends. People now purchase a large number of products and load them onto a cart. After making a purchase, one should proceed up to the counter to make a payment. As a result, there are frequently long lineups throughout the billing procedure. Swift Intelli Cart offers a solution for the aforementioned problem. The paper's major goal is to develop a technology-based, affordable, and user-friendly solution to help with personal shopping. All of the mall's items has to have RFID tags on it in order to do this. In this article, RFID scanners and digital display screens will be added to carts. When an item is placed in the cart, the RFID code is immediately read, and the item name and price are shown on the LCD. This results in the cost being added to the total bill. The wireless cart control might be useful for elderly people and anyone with physical limitations. Additionally, a theft prevention system is put in place to protect goods from unintentional theft. To reduce time and make the system quicker and more effective, additional features that benefit the consumer will be implemented. The finest possible purchasing experience will be provided for the customers overall thanks to this method.

Keywords
RFID, Barcode Scanner, Arduino, Shopping Cart.

1. INTRODUCTION
Smart shopping carts are revolutionizing the way we shop. These high-tech devices are equipped with a range of features that make them more efficient and user-friendly than traditional shopping carts. From touchscreens to RFID scanners, these shopping carts are changing the way we interact with products and stores. Despite the exponential growth of e-commerce in recent years, retail sales still make up around 85% of all sales. The need to wait in a queue to complete the billing procedure is one of the challenges clients encounter.

By allowing consumers to process items on their own and charge them to their carts, the recommended method does away with the need for lengthy queues. The customers must then add the products to their basket after a quick scan, at which point the final price will be displayed. The customer may then see their bill and make an electronic payment. As a consequence, fewer individuals lose time standing in long lines and do not have to perform the arduous chore of bar code scanning.

Swift Intelli cart enhances the customer experience while also providing a number of benefits for retailers. They let retailers to get useful data on consumer behavior, preferences, and purchasing trends. Then, with this information, inventory management may be improved, and marketing efforts can be strengthened.

2. LITERATURE REVIEW
Smart shopping trolleys are an emerging technology designed to enhance the shopping experience by providing various features to shoppers such as time- saving, recommendations, and seamless checkout. The following is a brief literature review of studies related to smart shopping trolleys. The authors of [1] were successful in creating a low- priced, clever, and completely working model that would facilitate and enhance customers' shopping experiences. Due to its reliable tracking capabilities and security features, they chose RFID. The system introduced features including budget management, product addition/removal, recommendations, and addition and subtraction of the cost of the product based on its inclusion in the basket.

The authors of [2] developed a smart shopping cart by mounting RFID readers to a cart and using ZigBee wireless technology to link them to a central server. It made the automatic bill generation by scanning the goods, which was subsequently forwarded to a central department for billing. User experience was negatively impacted by this system's restriction to only receiving payments in person at the counter.In order to transmit bills to a central server, the authors of created a concept model using RFID and ZigBee tags that were affixed to the objects.

Again, the issue is the lack of alternative payment methods to the traditional counter payments for the bill. In order to collect the bill as soon as the customer is recognized, the worker must have the consumer wait in a queue. In [4][5] authors conjured up a high-tech shopping cart with an RFID reader on each cart and RFID tags on every item. Following the scanning of the merchandise, the information is shown on the LCD screen to give the buyer all the details they want regarding the item. Although it was intended to help customers escape long lines, there was also a chance of robberies and collisions [6]. A smart shopping cart was developed by the authors in [7] with RFID tags on each item and each cart had readers. Consumers are given access to all relevant product information on the LCD screen following the scanning of the item. But the billing did

not match the scanned products at all. Despite having the intention of letting customers skip lines, it also raised the risk of thefts and accidents.

The authors of [8] view a supermarket as a setting with a large range of product options. These goods may include food, drinks, or any kind of home item. The primary objectives of supermarkets are to make all products readily available and to save customers' time, but occasionally customers become impatient while standing in line at the cash register, and occasionally they become perplexed when comparing the total cost of all the items with their available funds before paying. The program will be used to assign the trolley to the consumers. Otherwise, it may be used as a standard trolley. Additionally, this may aid in boosting client traffic in supermarkets and hypermarkets.

The scenario in malls, where trolleys are needed to move a variety of things around as you buy, is taken into consideration by the authors in [9]. The consumer must push the trolley while gathering stuff from rack to rack. While the consumer is shopping, the smart trolley follows them and keeps a safe distance between them. When an item is retained in the cart, the bill is automatically calculated. Since there won't be a need for a separate billing counter, the final billing will be simpler.[10].

3. PROBLEM IDENTIFICATION

3.1 Barcode scanner and Time Consumption

The traditional barcode technology is currently in use at supermarkets and shopping centers in India. The drawback of such a system is that only one product may be scanned at a time. The billing procedure takes a long time because of this. Consider a line where the first customer has 20 items in his cart but the second customer just has to purchase one item. The second customer will have to wait far longer than necessary to be served at the counter because of the customers in front of him.

These costs the individual and others waiting behind him a lot of time. Consequently, we have discovered a much superior solution via our project, which aids in efficient time management when scanning and preparing the bill during checkout.

3.2 Budget Management

Due to the fact that they cannot predict the price of the items they have added to their shopping basket, it is highly usual for consumers to overspend at huge shopping centers. By showing the product price and overall cost of the commodities on the LCD, Swift Intelli Cart greatly aids in minimizing or lowering the aforementioned issue. If the listed price is more than the customer's budget, they may simply eliminate the items.

3.3 Wireless Movement

People tend to overload their shopping cart. This increases the difficulty in the movement of the cart. This becomes a hassle to people as they cannot push heavy weights across the store. Swift Intelli Cart provides assisted movement for the shopping cart.

4. METHODOLOGY

The method we suggest is based on the idea of automated invoicing while shopping, which is made possible by RFID with help from other IOT-based technologies. Instead of a bar code, every item in supermarkets and shopping centers comes with a distinct RFID tag. Each shopping cart has a customized configuration that includes an RFID reader and an LCD screen to provide all relevant product information.

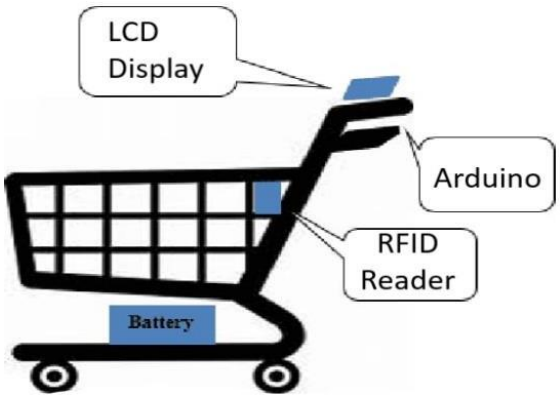

Fig. 1 Trolley Cart Design

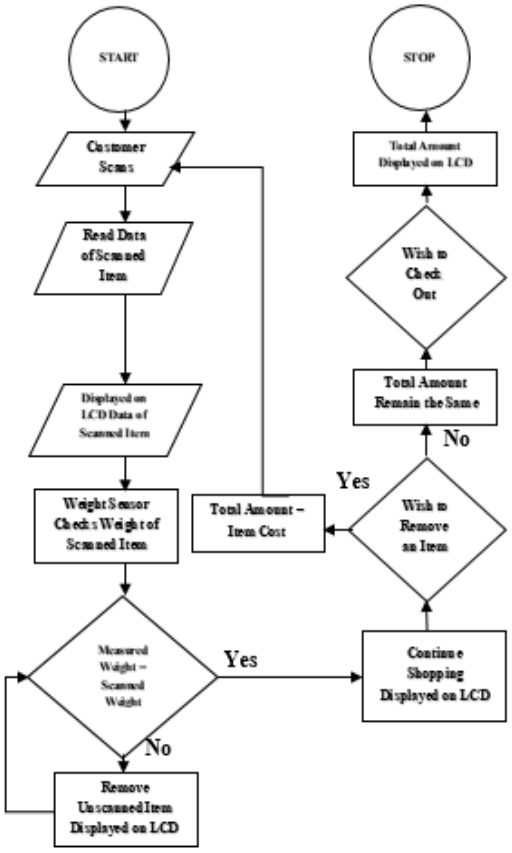

Fig. 2 Flow Diagram of the Proposed Architecture

4.1 Arduino

The open-source Arduino is referred to as Analogue Reference (AREF). On occasion, an electronic prototype platform consisting of adaptable, user-friendly software and hardware components is used to determine a third- party reference voltage (ranging from 0 -5 Volts) as the highest possible value for the analog input pins. Readers should include anybody with an interest in making interactive things or surroundings, including artists, designers, hobbyists, and others. The development process of the Arduino Uno board is seen in Fig. 4.

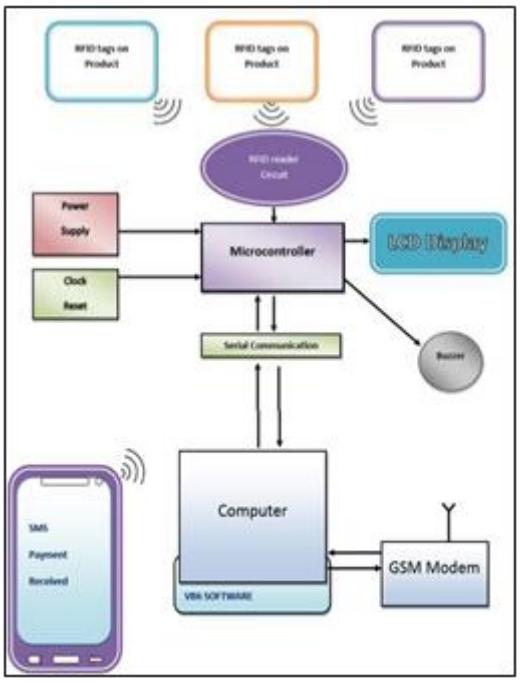

Fig. 3 Block Diagram

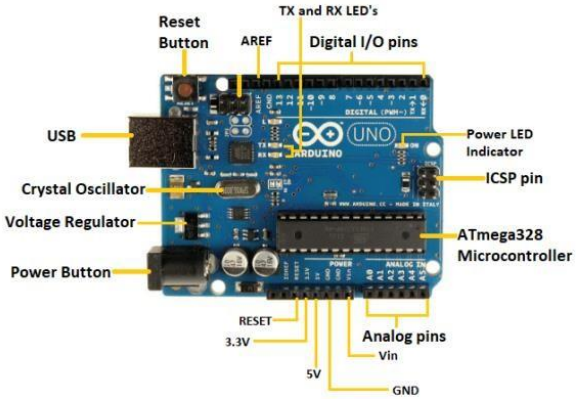

Fig. 4 Arduino Configuration

4.2 Readers And Tags For RFID

The radio frequency identification (RFID) card reader diagram is shown in Figure below. An RFID scanner that can detect neighboring tags is included inside the shopping cart. A special number has been allocated to the tag. RFID labels, a type of tracking technology, identify items using smart barcodes.

4.3 LCD or Liquid Crystal Display

The LCD screen used is the common 16*2-character LCD. The greatest display choice is this sort of LCD, which is widely used with Arduino microcontrollers. As opposed to seven segments, LCDs have no limitations on the display of animations, special characters, or even unique characters. LCDs are also affordable, simple to programme and offer these advantages. In this project, a trolley-mounted LCD is available to show the product specifics as they are added or deleted, as well as the updated bill data. The orders to the LCD are delivered through written code in order to show the necessary material. Two of the LCD's registers are the Commanding and Information registers. The command register contains the commands that were transmitted to the LCD. In Fig.6, the LCD interface may be seen.

Fig. 5 RFID Card Reader

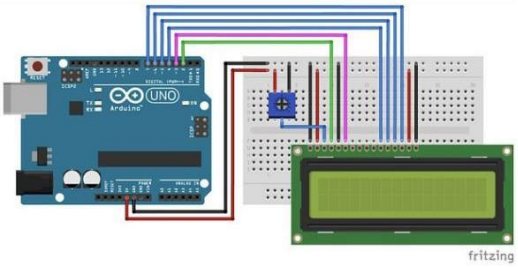

Fig. 6 LCD and Arduino Interfacing

4.4 Push Button

An easy-to-use switch that manages a machine or other operation is a push button. Most often, buttons are composed of a metal or acrylic. The push button's shape can either be flat or can be adjusted to fit the fingers or hands for comfort. The specific design determines everything. Normally, it may be either open or closed. The last banknote is produced when the button is pushed. The push-button diagram may be seen in Fig. 7.

Fig. 7 Push Button

4.5 Bridge Driver L298N Dual H

Two DC motors may be simultaneously controlled for speed and direction using the dual H-Bridge motor driver L298N. The module can power DC motors with voltages ranging from 5 to 35V and peak currents up to 2A.

4.6 Node MCU ESP8266

Internet of Things (IoT) applications are the focus of the open-source Node MCU firmware and development board. Its hardware is constructed with ESP-12 sections, whereas its software is created on an ESP8266 Wi-Fi SoC.

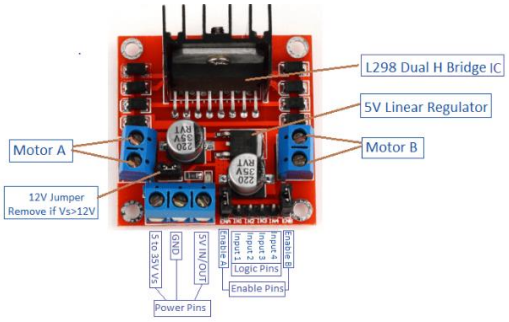

Fig. 8 L298N Dual H Bridge Driver

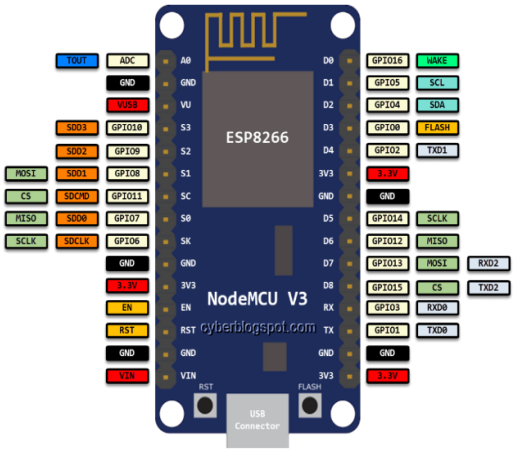

Fig. 9 Node MCU ESP8266

4.7 RFID Card Reader

Electromagnetic fields are implemented by radio- frequency identification (RFID) to recognize and locate tags that are affixed to objects. A transmitter, a tiny radio transponder, and a radio receiver make up an RFID system. When a nearby RFID reader device sends a pulse of electromagnetic interference to the tag, the tag reacts by sending digital data—often an inventory number needed to identify the item—back to the reader. Use this number to keep record of all inventory items.

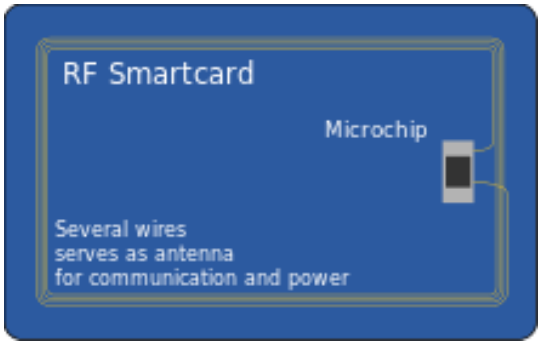

Fig. 10 RFID Card

5. RESULTS

This product may be exhibited live because it is portable. The table below is a comparison of the existing features and the features provided by Swift Intelli Cart.

Table. 1 Comparison of the features of proposed

Features	Existing Architecture	Proposed Architecture (Swift Intelli Cart)
Cart	✓	✓
RFID Tag and Reader	✓	✓
Weight Sensor	✗	✓
Ultrasonic Obstacle Detection	✗	✓
Automatic Movement	✗	✓
Anti-theft Mechanism	✓	✓
LCD Display	✓	✓

A pie cart representing the features of Swift Intelli Cart is shown below:

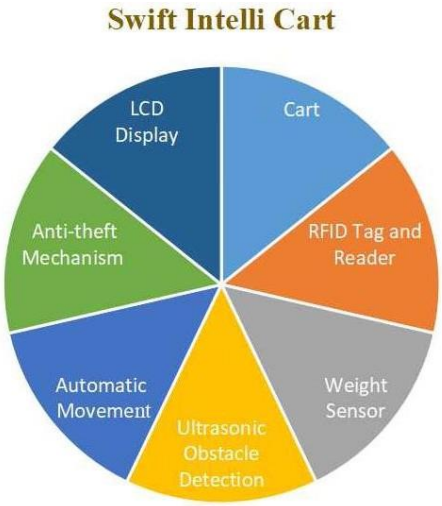

Fig. 11 Features of Swift Intelli Cart

A pie cart representing the features of existing architecture is shown below:

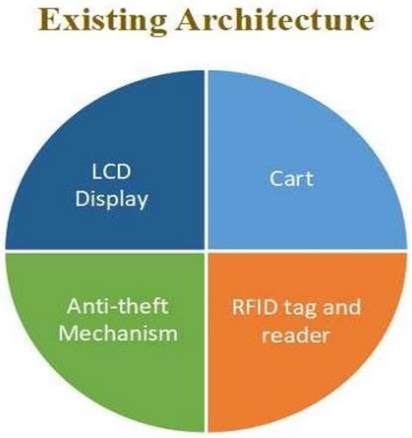

Fig. 12 Features of Existing Architecture

The below graph shows the comparison between the distance covered and the time taken to cover that distance of the automatic movement of the cart using Blynk application.

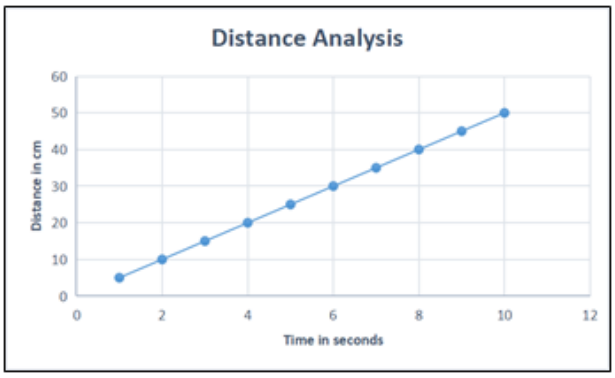

Fig. 13 Distance Analysis

All the functions described are demonstrated below:

1. A Welcome message appears on the LCD as soon as the device is turned on.

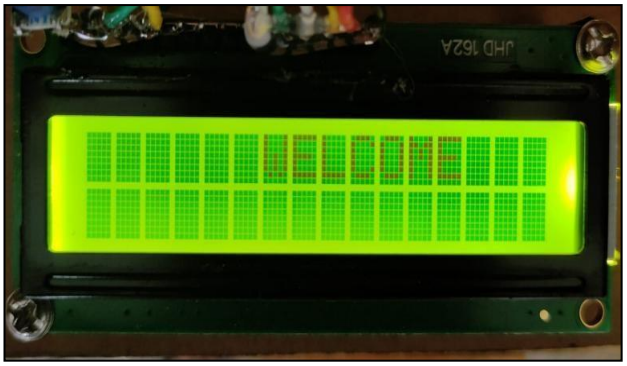

Fig. 14 Welcome Screen Display

2. As soon as the device is turned on, it is ready to scan goods. The scanning procedure is shown in the following graphic.

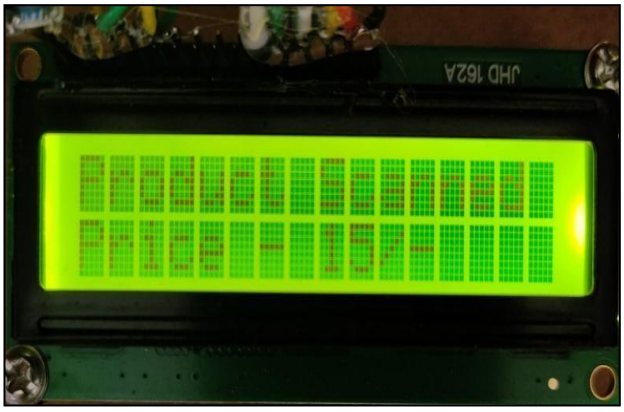

Fig. 15 Product Scanning

3. The consumer can also choose to remove a product from the basket if they change their minds for whatever reason or if it was accidentally scanned more than once. The product must be scanned one more in order to permit deletion.
4. Both the LCD and the Blynk app reflect the entire amount due.

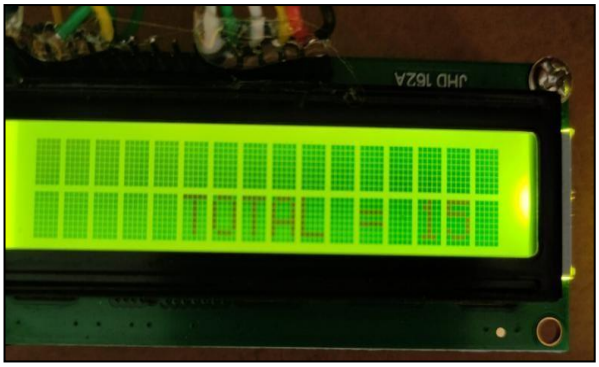

Fig. 16 Total Bill Displayed on LCD

Fig. 17 Total Bill Displayed on Blynk Application

Listed below are some images of the Swift Intelli Cart prototype.

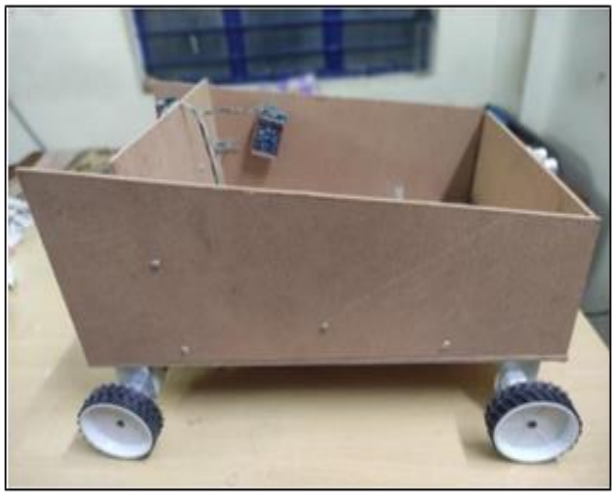

Fig.18 Cart Prototype

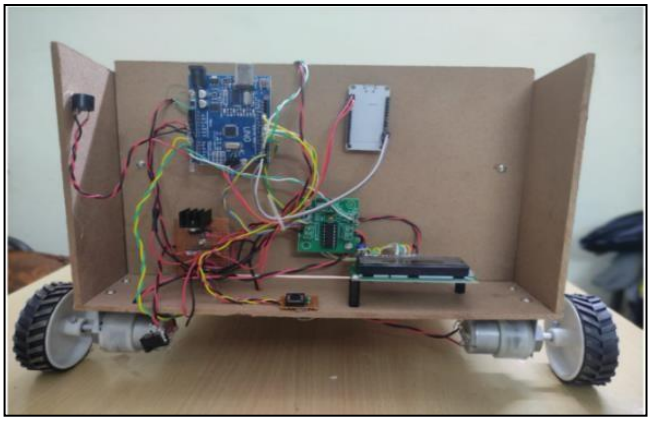

Fig. 19 Components Interfacing

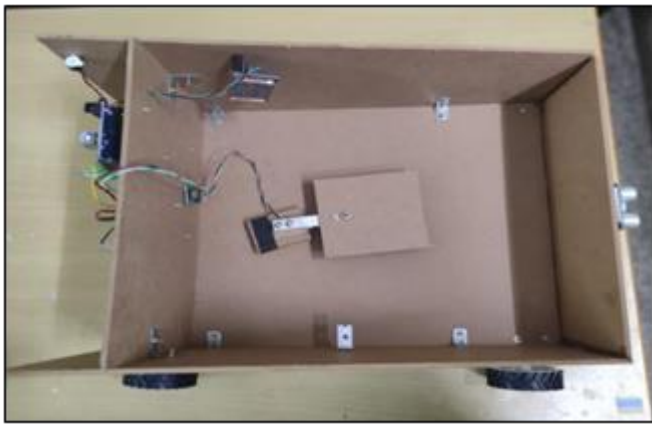

Fig. 20 Top View of the Cart

6. CONCLUSION

The Swift Intelli Cart represents a significant technological advancement in the retail industry. These carts offer a range of benefits to both customers and retailers, including an enhanced shopping experience, real-time product information, and valuable data insights. Swift Intelli Cart can provide clients personalized recommendations and offers, direct them through the store, and improve the shopping experience by utilizing technology like sensors, cameras, and machine learning algorithms. Swift Intelli Cart gives merchants the chance to gather useful information about consumer behavior, preferences, and purchase trends.

This information can then be utilized to enhance marketing campaigns, enhance inventory control, and promote business expansion. The adoption of Swift Intelli Cart and other cutting-edge technology is paving the way for a more smooth and customized shopping experience, making the future of the retail industry overall appear promising.

7. REFERENCES

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