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A Systematic Review of IoT Applications: Security & Privacy Issues

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ABSTRACT

Customers around the world are increasingly utilizing supermarkets to purchase goods. Supermarkets offer a large variety of products at competitive prices, making them a popular choice for shoppers. Supermarkets often have a wide variety of fresh produce, packaged groceries, bulk items, prepared foods, and sometimes a pharmacy and other services. Customers can conveniently purchase their desired products in one place and often find discounted prices, making the supermarket a cost-efficient option for grocery shopping. Shopping carts or baskets are often seen in supermarkets as a way for customers to carry their purchased items throughout the store. Shopping carts enable customers to quickly purchase more items than they could carry alone and the basket is used for smaller items. Depending on the store, customers can often rent the shopping cart or they can use their own reusable basket. The baskets are used to store items while customers shop, and the cart allows shoppers who have completed their purchases to quickly move their items to the checkout line. the purchasing process in supermarkets involves a few steps. Customers must first select the desired items from the shelves and bring them the check-out area. Then, the items must be scanned and weighed if applicable. The store's computer system will calculate the total cost of the items, and the customer will then pay for the items at the cash register. After this, the customer must wait in a line to receive their items and any change they may be due if they paid with cash. Lastly, they must pack their own items into bags before they can exit the store. This research explores the creation of a modernized smart shopping cart to streamline the supermarket checkout process. This smart cart is anticipated to better the customer experience in supermarkets.

Keywords: IoT, Smart Shopping, Smart Cart, Cryptography, RFID

INTRODUCTION

IoT is a system of interconnected devices and appliances that are able to communicate and interact through a network of wireless connections. IoT has made it possible for devices and appliances to share data, enabling devices to be controlled more efficiently and data collected more effectively. IoT enables devices to be monitored, managed, and adjusted remotely, creating smarter and more efficient ways of living [1]. It has become the foundation of many digital ecosystems, offering enhanced security, convenience, comfort, and energy efficiency. IoT enables common objects to contain computing power and the ability to communicate. By connecting objects from all over the world, IoT can help create a more connected and efficient environment. This is made possible by the introduction of sensors that can measure and monitor the environment and send data over long-distance connections. IoT is constantly evolving and will continue to bring new opportunities for users to stay connected and receive automated functions that are tailored to their needs [2].

Security and privacy concerns are a major issue with IoT, as it is vulnerable to malicious attacks. Companies and governments are using cryptography to ensure that the data sent over a network is secure, meaning that only authorized parties can access the data [3]. Cryptography also allows authentication of devices, making sure that only trusted and valid IoT devices can be connected and running within the same network. Furthermore, encryption can help promote data integrity by ensuring that data is treated with the same confidentiality between sender and recipient [4].

The research studies conduct various security protocols to examine their effectiveness in ensuring the security and privacy of data transmitted across various networks. The protocols used comprise of various techniques such as cryptographic algorithms, encryption techniques, digital signatures, trusted platforms, secure access control, packet inspection, and access control frameworks, to name a few [5]. These protocols enable devices to securely authenticate with each other and prevent any malicious code from entering the system. Furthermore, the studies look at the privacy implications of these protocols and determine how best to ensure the data stored on these devices remains secure and unaltered [6]. Finally, the studies ascertain how to audit these protocols for potential security threats. These security protocols help protect IoT devices from cyber-attacks and other malicious activities, improving security and privacy for users. Ultimately, these efforts help ensure that IoT systems are secure and trustworthy [7].

Among these needs is for an increasing amount of measures and protocols that would ensure the safety and privacy of data being transmitted across multiple networks. This data may range from financial information to sensitive healthcare data, to important industrial control systems and many of the world's smart cities [8]. Security protocols, such as the ones mentioned above, are crucial in providing solutions that would ensure the safety of information being sent and received within these increasingly complex networks. The research studies conducted today strive to provide the best security systems possible, so that individuals and companies can rest assured that their data is being kept secure, hiding behind various layers of encryption that enable only the intended recipients of the data to access it. In this way, these protocols enable vital security measures, not just within IoT environments but also across a variety of different networks [9].

This automation process has made it easier for customers to purchase large amounts of items without having to wait in large queues. As technology progresses, so does the automation market, with companies now developing automated checkout systems that could further reduce the need for queues and improve customer experience [10]. While automated checkout systems may provide convenience, they could also compromise the security of payment information which adds the basis for more research and development on how to implement secure and efficient automated checkout systems. This could include the use of modern technologies such as biometric authentication, radio-frequency identification (RFID) chips, and other methods that would ensure the safety of customers' payment information and ultimately make the purchasing experience easier and more secure [11]. From there, the customer is prompted to input payment information and the purchase is completed. This automation process has increased efficiency and decreased line waiting time, while also providing a more secure purchasing experience as customers are no longer handing tangible cards with credit or debit information on it to another individual. It also has allowed stores to handle large groups of customers quickly and customers can avoid the risk of losing their payment cards or having their information stolen [12].

Many grocery stores have become huge supermarkets, with an overwhelming selection of products that can be difficult to navigate. This can cause customers to become overwhelmed and frustrated with the amount of time it can take to find items in the store. This can result in physical exhaustion from having to walk around the store and mental frustration from feeling overwhelmed and confused when shopping. To combat this, grocery stores can try to optimize their store layouts, providing easy-to-read signs or displays to help customers find what they need quickly and efficiently. This can help customers find items they need quickly and reduce the amount of time and frustration associated with their shopping experience. This can potentially lead to shopper fatigue and perhaps even less satisfaction with their shopping experience [13]. To counteract this, supermarkets can designate specific aisle for specific groups of products, like produce, and put high-traffic items, like milk and eggs, closer to the store entrance; this would reduce the need for customers to walk around the store to find the items they need. Supermarkets can also have helpful staff in each aisle to assist customers with locating items they need. Adding technology like tablets to help people find items in the store and even automate checkout processes can also help reduce customer frustration and save time.

By making changes like adding self-checkouts and technology, as well as providing in-store staff or kiosks, retailers can make their stores easier to navigate and increase customer satisfaction. Additionally, the store can keep track of customer preferences and make the necessary improvements to the store shelves and aisles to ensure shoppers find what they want quickly and easily [14]. With the aid of IoT, all the items on the shelves will be equipped with sensors that can be activated by a computer system which can keep track of the stocks, match prices with competitors and can even provide customers with notifications through their smartphone apps. Some other features that a smart supermarket with IoT can offer are automated checkout systems, self-checkout machines, trackers to locate products around the store and even a map of the store. These features that are made available to customers are meant to reduce the amount of time they spend in the store, making their shopping experience faster, more organized, and more convenient. The IoT enabled shopping cart is integrated with a payment system, such as credit cards and PayPal. What's more, it also provides customers with real-time product information to help with product selection [15]. The cart also includes features such as automatic recommendation of items and product search. Moreover, the customer's purchase history can be used to provide exclusive discounts and promotional offers which helps to create a more personalized shopping experience. This checkout system allows shoppers to quickly and easily identify the items they purchased and their total cost by using a barcode scanner integrated with a mobile phone application [16]. Through this system, customers can pay with credit cards, debit cards, and PayPal, and will have instant access to a digital receipt upon completing the purchase. This simplifies and expedites the shopping experience with minimal effort. This ensures that the customer is aware of the total cost of their purchases and is charged accordingly. The customer can view their shopping history from within the application to assist them in budgeting for future purchases [17]. Additionally, customers may opt to join loyalty programs that provide discounts for repeat customers. This system can benefit both the customer and the retailer. Customers benefit from convenience, faster checkout times, and transparency. Retailers benefit from improved customer satisfaction and loyalty, as well as reduced checkout errors and less shrinkage. In addition, they are able to

track customer buying behaviors, enabling them to better tailor their products and services to customer preferences [18].

RELATED WORKS

The use of smart shopping systems that integrate IoT and AI is transforming the retail industry by giving stores the ability to be more automated, data-driven, and customer-focused. This facilitates more efficient and personalized shopping experiences and greater customer satisfaction and loyalty, while alleviating costs.

The Internet of Things (IoT) is allowing physical devices, such as vending machines and checkout counters, to be connected and managed digitally, giving them "smart" capabilities. Artificial Intelligence (AI) enables these smart devices to learn customer preferences, respond to changes in the environment, and anticipate customer needs. By analysing data and customer behaviour, AI-powered systems can deliver more efficient and personalized shopping experiences. This has allowed retailers to drive customer satisfaction and loyalty, while reducing their costs by automating complex processes. With these advances, the retail industry is on the cusp of a new era where automation, data-driven insights and real-time customer engagement will be essential [19].

AI is the ability of machines to mimic human behavior and is used in a variety of applications, such as speech and facial recognition, natural language processing, and computer vision. This technology enables robots to perform complex tasks, allowing humans to focus on higher-value work. AI also has a major impact on software development. AI-powered tools can automate mundane tasks, freeing up time for developers to focus on creative problem-solving and more advanced coding tasks [20]. They can also be used to suggest and even generate code from scratch, improving the development process and speeding up the time to market for products. AI is now being used in a range of everyday applications, from smart home devices to healthcare.

Radio Frequency Identification (RFID) and ZigBee communication technology can be used to create centralized and automated billing systems. RFID is used to track and identify objects using radio waves and can be embedded in products to provide automatic identification and tracking. ZigBee is a wireless communication technology that enables devices to communicate with each other using low-power radio signals. Together, these two technologies can be used to create a centralized billing system, allowing for automated billing to take place at shops or supermarkets. This system can lead to more accurate and efficient billing processes, allowing customers to purchase goods in a more timely and cost-effective manner. In previous studies, the researchers proposed an automated shopping cart that consists of three main components [21]. The first component is a robotic arm that is used to pick up and place items into the shopping cart. The second component is a camera system that visually identifies the items in the shopping cart and gives feedback to the robotic arm. The third component is an AI-powered software that helps the robotic arm to determine which items should be picked up, how many items should be taken, and how to arrange the items in the cart. All of these components work together to automate the shopping process and help customers quickly and efficiently collect their items. The smart shopping cart then autonomously guides shoppers through the store and collects the items as they are scanned. The cart also has sensors that measure the weight of the items to make sure nothing is left behind, and that the total amount matches the scanned items. This system offers shoppers a more intuitive and efficient shopping experience, reducing the amount of time spent in the store and thus allowing customers to enjoy the shopping experience more [22].

Futuristic Approach

This system can significantly reduce long queues and the likelihood of shoppers forgetting items. Additionally, it can improve customer service by creating a better store navigation experience and providing data about store visits and purchases in order to customize marketing campaigns [23]. The RFID tags attached to the products can reduce checkout time and make the whole shopping process more efficient. Furthermore, the sensors in the cart can reduce forgetting costly items. Customer privacy can also be maintained, as the data collected by the system is encrypted. Finally, the system can help retailers to identify marketing campaigns more efficiently and understand customers' shopping experience. This study provides an innovative solution to make shopping easier and enjoyable. The system can also help retailers to identify marketing campaigns more efficiently and understand customers' shopping experience [24].

Technologies like RFID tags and sensors, which help to create a central database that updates information about product location, price and quantity in the store. The store database is also integrated with point of sale system, so customers can immediately receive information they need while they are shopping around and they can keep their purchase records throughout the store systems [25].

In summary, the whole system provides an efficient way to make shopping easier and enjoyable by integrating customer experience, product information and purchase records into one central database. The RFID tags attached to

products and the sensors in the shopping cart will allow customers to shop longer and faster. The system also provides a privacy protection whereby customer data is encrypted. Overall, the system improves customer service, reduces waiting times, and helps retailers identify more effective marketing campaigns. The smart shopping cart is an automated shopping system that integrates the traditional shopping cart with a barcode reader placed at the top of the shopping basket. This system works by allowing customers to scan the barcodes of the items they are purchasing. The barcode reader reads the items' product codes and relays the data to a store database which stores the customers purchase data in a secure manner. This system also allows product data, such as price and quantity, to be accessed quickly and accurately. Additionally, customers can view their purchase history while they are still shopping and they can also receive real-time alerts on any promotions or discounts available. This system helps to reduce the time spent at checkout and improves the overall customer experience.

CONCLUSION

Having access to an automated system with accurate data and real-time updates on product availability and prices would provide customers with an efficient and hassle-free shopping experience. This could also help in eliminating long queues, as customers can now shop from the comfort of their own home. Furthermore, by employing such a system, customers could save time that would otherwise be wasted in waiting for the desired item in store. Finally, the intelligent shopper system could be used to engage customers and to understand their shopping habits. This would empower retailers to accurately know their customers' preferences and tailor their services to meet their exact needs. Additionally, retailers can use this system to promote their new products, initiate special offers and provide customers with exclusive discounts. In conclusion, the use of such an intelligent shopping system can provide customers with great convenience and retailers with enhanced marketing opportunities. By utilizing such a system, customers can benefit from improved customer service and retailers can benefit from increased customer loyalty and better understanding of customer demands.

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