Faculty of Electrical and Electronic Engineering Technology

DEVELOPMENT OF IoT-BASED SMART SHOPPING CART USING BARCODE SCANNER

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Bachelor of Electrical Engineering Technology (Industrial Automation & Robotics) with Honours

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DEVELOPMENT OF IoT-BASED SMART SHOPPING CART USING BARCODE SCANNER

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**A project report submitted
in partial fulfillment of the requirements for the degree of Bachelor of Electrical
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I hereby declare that I have checked this project report and in my opinion, this project report is adequate in terms of scope and quality for the award of the degree of Bachelor of Electrical Engineering Technology (Industrial Automation and Robotics) with Honours. The member of the supervisory is as follow:

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DEDICATION

I would want to use this opportunity to express my gratitude to everyone of my close friends and family members for their support throughout this journey. My supportive and loving parents, Thanabalan and Nagaletchumy, whose words of love and encouragement, as well as their urge that I be tenacious, continue to ring in my ears deserve an additional measure of gratitude. I would like to express my gratitude to Mrs. Nurul Kausar Binti Ab Majid, my supervisor, for all of her assistance and support throughout the entirety of this project. I would like to dedicate this work and send special thanks to her. If I did not have the aid that was offered, getting to the end of this chapter would be fraught with a great deal of hardship and would be much more challenging for me.

ABSTRACT

A shopping mall is a place that sells a wide range of products. On holidays and weekends, malls get a lot of foot traffic. When there are special offers and discounts, the rush is much greater. With the use of a shopping cart, numerous things are purchased in shopping malls or market. However, when it comes time to pay the final bill payment, the customer must proceed to the cashier to make payment and the shopping mall does not have sufficient counters that are able to handle all of the customers. Additionally, scanning each and every product of every consumer becomes a massive process, resulting in long lines. This led to big crowds at shopping malls. There are also times when customers become confused when comparing the total price of all the products to the budget that they have in their wallet before billing. To solve these problems, it is proposed to implement a smart shopping cart, which would involve developing existing shopping carts such that it will contain a barcode scanner and allow customers to scan product barcodes. As a result, the product id, name, price, and quantity will be automatically displayed on the LCD and an application. Here, customers can also keep the track on the total cost of products according to their budget. Then, the final bill will be automated to the application. In this manner, customer can directly pay the money at the billing counter and depart with the commodities he or she has bought, which saves the customer's time and eliminates the need for them to wait in a lengthy line in order to pay for their purchases. This concept which is 'Smart Shopping Cart' is proposed to keep track the budget from the total cost of added products, improve the speed, reducing the long waiting queue and also to save time.

ABSTRAK

Pusat beli-belah ialah tempat yang menjual pelbagai jenis produk. Pada hari cuti dan hujung minggu, pusat membeli-belah mendapat banyak lalu lintas pejalan kaki. Apabila terdapat tawaran istimewa dan diskaun, tergesa-gesa adalah lebih besar. Dengan menggunakan troli beli-belah, banyak barangan dibeli di pusat membeli-belah atau pasar. Walau bagaimanapun, apabila tiba masa untuk membayar pembayaran bil terakhir, pelanggan mesti pergi ke juruwang untuk membuat pembayaran dan pusat beli-belah tidak mempunyai kaunter yang mencukupi yang mampu mengendalikan semua pelanggan. Selain itu, mengimbas setiap produk setiap pengguna menjadi satu proses besar-besaran, mengakibatkan barisan panjang. Ini membawa kepada orang ramai yang ramai di pusat membeli-belah. Terdapat juga masa apabila pelanggan menjadi keliru apabila membandingkan jumlah harga semua produk dengan bajet yang mereka ada dalam dompet mereka sebelum mengebil. Untuk menyelesaikan masalah ini, adalah dicadangkan untuk melaksanakan troli beli-belah pintar, yang akan melibatkan pembangunan troli beli-belah sedia ada supaya ia akan mengandungi pengimbas kod bar dan membolehkan pelanggan mengimbas kod bar produk. Akibatnya, id produk, nama, harga dan kuantiti akan dipaparkan secara automatik pada LCD dan apl. Di sini, pelanggan juga boleh menjejaki jumlah kos produk mengikut bajet mereka. Kemudian, bil akhir akan diautomatikkan kepada apl. Dengan cara ini, pelanggan boleh membayar terus wang di kaunter pengebilan dan berlepas dengan komoditi yang telah dibelinya, yang menjimatkan masa pelanggan dan menghilangkan keperluan untuk mereka beratur panjang untuk membayar pembelian mereka. Konsep 'Smart Shopping Cart' ini dicadangkan untuk menjejaki belanjawan daripada jumlah kos produk tambahan, meningkatkan kelajuan, mengurangkan giliran menunggu yang panjang dan juga menjimatkan masa.

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LIST OF ABBREVIATIONS

RFID   -   Radio-frequency identification

IoT   -   Internet of Things

QR   -   Quick Response

LCD   -   Liquid Crystal Display

Kbps   -   Kilobits per second

Mhz   -   Megahertz

LIST OF APPENDICES

CHAPTER 1

INTRODUCTION

1.1   Background

These days, going to the mall or market to shop has developed into a common activity in the lives of most individuals. As we all can see, in comparison to the shopping mall systems of some other nations, there is still much room for improvement in terms of providing customers with a high-quality shopping experience. Every supermarkets and malls have shopping trolley and baskets for customers to store their purchases.

Mankind has always invented things based on their needs. As time went on, people became increasingly demanding of their surroundings. In the olden days, there were a few stores, but as time went on, several businessmen started spending their money in the market, and they began the business of selling and purchasing the products. As a result, the mall concept evolved, and barcode technology surfaced in the 1970s.

All of these advancements are required to make the existing system faster and more efficient. With the help of barcode technology, industrial work has also been decreased. When products are transported from one location to another, barcode technology aids in inventory control. Following the successful application of barcodes, the company began applying them to the products as well. This was done for the simple reason that it became much simpler and more efficient to maintain product information within the database following the application of barcodes.

Continuous development was required in the common billing system in order to improve the quality of the customers' shopping experience. To overcome this issue, I proposed the new idea of developing smart shopping cart using IoT which will be implementing barcode scanning and also an application to keep the track of total cost of added products, reduce the rush, save time and also human endeavors. In this system, the shopping carts will be developed which will feature barcode scanner. This will allow customers to scan the product's barcode, which will then the product's id, name, price and quantity are automatically displayed on the LCD which is additionally connected with the cart and the application. The total purchased items price will be displayed on LCD display. In the event that a customer needs to remove the item, they need to rescan the item which is able to delete it from the whole charge. When the customer is done with the shopping the final bill will be automated to the application and customer just have to pay the total amount and leave the counter. It does away with the customary practise of scanning things at the billing counter, which in turn speeds up the entire shopping process.

In addition to this, the customer will be aware of the total amount that needs to be paid, and as a consequence, he or she will be able to organise their shopping trips so that they only purchase the necessities, which will result in increased savings. As a result of the fact that the entire billing process is now automated, the likelihood of human error has been greatly reduced. In addition to that, the system possesses a function that allows the consumer to erase any scanned products that they have already purchased, which further improves the overall quality of the shopping experience. It will also save the customers' time, keep the record of added products with respect to their spending plan and reduce the amount of labour needed in the shopping mall. Therefore, it has the prospective to make the shopping more easier and efficient for customers.

1.2   Problem Statement

The disadvantages of using the existing method of shopping are due to the lengthy time and unpleasant shopping experience that both the customer and the mall's labour must endure to get from having the products in the basket to be paying at the counter. The current system of billing process is taking long time due to the long queue after purchasing items. Most of the customers will always tend to walk out of the long queue. There are also customers who come in with a set budget will need to keep track of the products they purchased, and if they lose track of the entire amount, they will need to find a barcode scanner and scan each item, which will be a troublesome process of shopping experience for them. Not only that, after choosing the products and proceeding to the counter for the payment, the cashier will need to scan each and every product for the final billing which also consume a long time.

Therefore, to develop the existing system, shopping cart that feature barcode scanner with LCD display is designed and also developed an application. Each products barcode can be scanned using a barcode scanner that will be affixed to the shopping cart. Then, the product's name, price and quantity will be displayed on LCD display as well as in the application. Then, at last the final bill with total amount that need to be paid will be automated in the application which is easier and efficient where then the customer will just have to do the payment at the billing counter without scanning again the products.

As a result, the project's developed system is aimed at:

1. Both customer and workers can reduce the average time spent at the billing counter.

2. Shortening the lengthy line of customers waiting to make their payments at the billing counter.

3. Providing efficient and satisfying shopping experience for the customers.

4. Making the payment at the billing counter without scanning again each product.

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5. Reducing the employee work in the shopping mall.

6. Keep track of added products in the shopping cart according to the customers' shopping budget plan.

1.3   Project Objective

The primary objective of this project is to suggest a method that is both organised and efficient. This will allow for an increase in speed, which will please the customers, and a reduction in time, which will shorten the lines of people waiting. Specifically, the objectives are as follows:

a)   To design a smart shopping cart that consist of barcode scanner technology.

b)   To develop an application to generate final bill of total item purchase price.

c)   To analysis an effective performance of Smart Shopping Cart's designed system.

1.4   Scope of Project

In order to eliminate any potential for confusion regarding the outcome of this project as a result of certain limitations and restrictions, the scope of the project has been established as follows:

a) The shopping cart will only work in a system that has designed with the cart's system.

b) The final bill will be automated to an application.

c) The shopping cart use is based on the NodeMCU itself which is the microcontroller.

d) Use of NodeMCU so as to simplify communication as it has inbuilt Wi-Fi module.

The limitation of this smart shopping cart design is centered on moving forward the current system of shopping method. The developed application will generate and display the customer's final total bill which is included with the product's name, price and quantity. Then, customers will only have to make payment for the final bill at the counter, or they will have the option to make payment via online in the application.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Research must first be conducted in order to change and produce something new that specifies a higher level of product quality and assurance. The concept for Smart Shopping Cart arose from a smattering of thoughts, which included the elements covered in this chapter.

2.2 Provide an easy and satisfying shopping experience for customers

According to (Akshay Patil, 2017), the embedded system of automated smart shopping cart using QR code is designed where all of the items in the shopping mall will feature QR codes. The system is functional whenever a customer places any goods in the shopping cart, at which point the product's code is recognised. The prices for those products are recorded, and the total price is displayed on the LCD display. An application has been developed for smart phones that gives customers the ability to scan the things they want to buy, generate a bill that includes all of the products they choose, and then pay for their purchases all in one go. The customer's final bill is generated as soon as all of the items have been scanned and the client has confirmed the purchase order. At this point, the consumer is sent to the payment choices available to them. The entire process of generating the bill is carried out automatically.

Another approach according to (Rhythm Mehta, Dhruva Ashok, Anshul Ahluwalia, Prof. Siva Rama Krishnan, 2017) is the system of a smart shopping cart using a QR code system for bill calculation and RFID system are designed. The user can scan the items that they want to purchase but the drawback is that, customers have to wait for extremely long periods of time in order to complete the checkout procedure, and this is true regardless of the quantity of

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things they are purchasing from the store. As shows in Figure 2.1, the system uses Quick Response (QR) codes to identify each individual product.

Figure 2.1 Product QR Scanning

Another approach, IoT based Human Guided Smart Shopping Cart System for Shopping Center by (Shivika et al, 2020) designed a system where RFID tags and load cells are utilised throughout the decision-making process in this system. However, the drawback is that the system is not efficient in terms of cost, and RFID tags are placed on all items.

According to (Zarana Panchal, 2018), RFID technolofy is used. Whenever a customer places an item in their shopping cart, that item is scanned automatically. On the LCD display, the information on these products as well as the total amount due is displayed. ZIGBEE is a form of short-range wireless communication, and it is used to transmit bills to a cental server. The traditional counter payments are the only method of payment available, which is another disadvantage of this method. There are no other payment methods available. The fact that the employee is supposed to collect the bill once the consumer has been identified causes the customer to wait in lines for longer than necessary.

However, in Smart Shopping Cart, instead of QR code and RFID tag, barcode system will be used. It is to build and adapt the existing system in the shopping malls so that it functions in a manner that is more beneficial to the customers. The main contrast between

barcodes and QR codes lies on their respective dimensional specifications. The cost of QR code scanners is significantly higher than that of barcode scanners. Moreover, barcodes are significantly more compact and lighter than RFID tags, making them significantly simpler to utilise. Barcodes are far more cost-effective than RFID tags due to the fact that they are directly printed onto plastic or paper materials. As a result, the only expense incurred is the cost of the ink, which is a negligible portion of the total price. According to (Chan, 2017), Barcodes could make the process of inventory management more efficient cutting down on the time it takes to enter data, making it easier to track items, and allowing for real-time inventory control. Depending on the type of barcode and printing solution used, the error rate for printing and scanning barcodes can be as low as 1 error per 36 trillion characters. Figure 2.2 and 2.3 shows the types of barcodes label that are printed. Here, barcodes have shown to be a very useful tool for controlling costs, lowering error rates, and improving visibility throughout the supply chain. Thus, implementing barcode system in 'Smart Shopping Cart' is more reliable than QR code and RFID system.

Figure 2.2 Company Barcode Lable

Figure 2.3 Shipping Barcode Label