UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DEVELOPMENT OF SMART SHOPPING CART USING RFID AND GPS

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Mechanical Engineering Technology (Automotive) with Honours.

by

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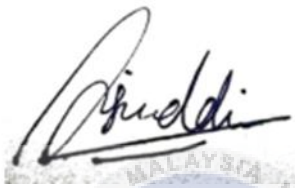

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I hereby, declared this report entitled DEVELOPMENT OF SMART SHOPPING CART USING RFID AND GPS is the results of my own research except as cited in references.

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APPROVAL

This report is submitted to the Faculty of Mechanical and Manufacturing Engineering Technology of Universiti Teknikal Malaysia Melaka (UTeM) as a partial fulfilment of the requirements for the degree of Bachelor of Mechanical Engineering Technology (Automotive) with Honours. The member of the supervisory is as follow:

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ABSTRAK

Pusat membeli-belah adalah sebuah tempat di mana setiap individu mendapatkan barang keperluan mereka. Pada era industri 4.0, kaedah pembelian yang cekap perlu dikembangkan dan diperlukan dan kaedah pembayaran yang lebih pendek perlu dititikberatkan. Di samping itu, kenaikan kos sara hidup juga dapat mempengaruhi proses pembelian pelanggan di mana pelanggan perlu menetapkan anggaran untuk setiap pembelian yang ingin mereka lakukan. Tujuan projek ini adalah untuk menghasilkan Smart Shopping Cart yang dilengkapi dengan RFID dan GPS bersama dengan kombinasi aplikasi mudah alih di mana pengguna dapat melihat harga bagi setiap barang yang diletakkan di dalam troli. Projek ini memerlukan pelanggan untuk mengimbas setiap item yang dilampirkan dengan tag RFID sebelum dimasukkan ke dalam troli pintar. Projek ini perlu disambungkan dengan telefon pintar pelanggan melalui Wi-Fi, kemudian setiap data yang diperoleh dari item yang diimbas akan dipaparkan di telefon pintar melalui aplikasi mudah alih. Selanjutnya, projek ini dapat mengurangkan masa yang diperlukan pelanggan untuk beratur dengan menggunakan tag RFID yang diletakkan pada setiap item. Seterusnya, melalui projek ini pemilik pusat membeli-belah dapat menentukan lokasi setiap troli seterusnya dapat mengurangkan risiko kehilangan troli.

ABSTRACT

A shopping mall is a place where everybody can find their necessities. In the era of industrial 4.0, an efficient buying method need to be developed and needed and shorter payment methods was needed to emphasize. Also, the rising cost of living can also affect the customer buying process whereby customers need to set a budget for every purchase they want to perform. The purpose of this project is to develop a smart shopping cart with RFID and GPS with a combination of mobile application where user can view item price that placed in the cart. This project required a customer to scan each item that attaches to the RFID tag before place into the smart cart. The smart cart first needs to connect with customer smartphone via Wi-Fi, then each data obtained from items scanned will be displayed at smartphone through the mobile application. Furthermore, this project can reduce time taken for a customer to queue by using an RFID tag that placed on each item. Subsequently, through this project mall owners can determine the location of each shopping cart thus will reduce the risk of losing the cart.

DEDICATION

This pile of pages consisting valuable knowledges is dedicated to my beloved parents, Osman Bin Omar and Rosnah Binti Ismail who have risked and sacrificed their everything just for me to reach this stage. Without the support given, the journey towards the end of this chapter would be tons of burden for me. I would like to extend my thanks to supervisor that always guide and my fellow friend who always support and help me.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

LIST OF SYMBOLS

A	-	Current
V	-	Voltage

LIST OF ABBREVIATIONS

PCA	Principal Component Analysis
RFID	Radio Frequency Identification
GPS	Global Positioning System
ID	Identification
LCD	Liquid Crystal Display
GUI	Graphical User Interface
GSM	Global system for mobile communication
Mbps	Megabits per second
Kbps	Kilobits per second
Mhz	Megahertz
URL	Uniform Resource Locator
USB	Universal Serial Bus
QR	Quick Response
UART	Universal Asynchronous Receiver Transmitter

LIST OF PUBLICATIONS

CHAPTER 1

INTRODUCTION

1.1 Background

Shopping is a necessary activity to be done for families a to restock their daily needs. Nowadays there are many shopping mall or supermarket has been built and they all compete to meet customer satisfaction. Conventional shopping process have several problems that will complicate customer situation. The process begins with customer choose their needs item or products then if there are no price tag at the product, they need to search for price check devices just to know the price. Other than that, common issues that customer confront during shopping is time taken to pay their bills. Customer needs to queue up that sometimes consume longer time if the other customer buys more items. This project made up to counter all the above problem that faced by customer.

One of the facilities that must have in all supermarket or shopping mall is shopping cart, it is a tool that will help customer to carry all the needed items. However, there are a lot of things can be improved within shopping system and these conventional shopping cart itself. Other than that, there are also some features that can be improved in shopping mall which is payment bill. In most shopping mall the most inconvenience situation customer need to faced is time taken to queues just to pay. Nevertheless, thanks to these eras of embedded and automation system there are a lot of improvement that can be made.

Embedded system as described by (Steve Heath,2003) is a microprocessor-based system that is built to control a function or range of functions and is not designed to be programmed by the end user in the same way that is a PC. Embedded system has evolved and been used in daily application such as smartwatch, washing machine, microwave ovens, automobiles, and factory

robot. To increase customer shopping experience an embedded system can be implemented through the shopping cart and help customer to achieve their satisfaction.

Industries nowadays are eager to develop and implement Internet of Things as their main component of operations. The IoT is a system that interrelated computing devices that able to communicate or transfer data over the network without the need of human interaction. System that implements with IoT technology can be monitored real-time and easy to access by user. IoT consist of embedded system such as processors that act as the main and devices such as sensors that collect and send data acquired through IoT gateway to database. In this project, the data or items that scan by the cart transferred through shopping mall system by real-time.

In this project the hardware that will use is ESP8266 NodeMCU along with radio-frequency identification (RFID) tag and reader, and global positioning (GPS) module in order to design an embedded system of smart shopping cart. There is also implementation of android application system to be integrated with the smart shopping cart system to help customer monitor items they want to buy. This project will be improved customer satisfaction while shopping by reducing time taken when queue to pay the bill. This project proposedly to improve and overcome the problem that faced by customer during shopping and help the shopping mall gained good reputation from the customer.

1.2 Problem Statement

Shopping experiences need to be improved so that customer will always have a enjoyment while do the activity. To increase the efficiency of shopping experience for the customer, shopping malls need to improve their shopping system by inventing new technology such as improving the time taken to make payment. According to research by (Kursunluoglu, 2011) state that 43.2% of customer loyalty toward the retailers are based on their satisfaction by experience during shopping at that place.

Conventional method system that used at the current shopping mall are lack of customer friendly such that the customers with limited budget need to aware of items they took so that will not exceed their limit. If the situation occurs, they need to find the price scanner to double check the price according to their budget. This will increase the time taken at the shopping mall. Other situation of time consuming for the customer is when they want to make payment, the conventional way always takes time longer as the cashier need to scan each item that the customer took before the payment can be made. Based on research study from (Pei *et al.*, 2020) shows that, relationship shopping environment affect the customer satisfaction and experience that can lead to competitive advantage for the shopping mall to provide the necessity that will lead to customer support.

Besides that, there are certain unethical action from customer that causing the losses to the shopping mall which is the loss of shopping carts day by day. The shopping mall needs to compensate the losses by getting new shopping cart.

1.3 Objectives

1. To develop smart shopping cart equipped with RFID and GPS.
2. To develop android application for monitoring position of the smart shopping cart.
3. To monitor the performance of smart shopping cart.

1.4 Scope

The limitations of this smart shopping cart project are only to read items with a registered RFID tag only. This project focus on improving the current shopping system method. The android system installed for user interfaced only display items listed according to its quantity bought. The database cloud only accessible at the shopping mall. The smart shopping cart project limitations:

1. The smart shopping cart only work in a system that integrated with the cart systems.
2. The shopping cart uses ESP8266 to connect the microcontroller and the android application system.
3. The shopping cart use NodeMCU as the microcontroller.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Literature reviews by means is a thorough summary of previous reports or research based on a topics or title that want to be develop. It contains several arguments and improvement that want to be fix based on deficiency of previous project topics. Literature reviews bring about from related to a specific area of research for example from scholarly articles, books, and reliable sources. It should contain summarization and clarify the previous research. It should help the researcher towards their field of research (Denney and Tewksbury, 2013). Shopping mall nowadays is a mandatory place for community to restocks their daily needs. In such important place, shopping malls facilities and environment need to be improved so that it will ease the customer to freely buy their needs and make things easy for them. As for the improvement that can be made at the shopping mall is by reducing the queuing delays during the payment bills (Berdaliyev and James, 2016).

2.2 Improve customer shopping experience.

According to (Shanmugavadivel and Gomathy, 2019a), to reduce the time taken for customer to queue and pay their bills at the counter is by developing a system that does not require for customer to tag their bought items at the counter as the system has display the customer through Liquid Crystal Display (LCD) at the cart. This project proposed that combination of two Arduino Uno act as microcontroller to control all the hardware and using XBee module as the wireless connection medium between these two Arduino. The purpose of first XBee module is to relay the information detected by Radio-frequency Identification (RFID) which is items that customer scan to the second XBee module that containing database to make comparisons and send the data back to display. Each item that detected by the RFID will trigger the installed buzzer and LCD will display the items name and total cost. There are also delete button in case the customer changes their mind not to buy certain items.

However, in the Smart Shopping cart, the main goal to reduce the time taken for customer to pay bills still the same as certain improvement will be made from the previous project. The Smart Shopping Cart will be improved such as there will be addition of RFID tag at the Smart Shopping Cart so that when customer reach the counter to check out they do not have to display the items bought instead just scan the RFID tag that comes with the Smart Shopping Cart and it will display the items and total amount of payment that need to be paid by the customer. This improvement been made to ensure the integrity and build trust between customer and the shopping mall (Nikolova, Möllering and Reihlen, 2015).