SMART SHOPPING CART FOR AUTO BILL CALCULATION USING NFC

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VISSALINI A/P SAMINADAN

This report is submitted in partial fulfilment of the requirements for the Bachelor of Computer Science (Computer Network) With Honors

FACULTY OF INFORMATION AND COMMUNCATION TECHNOLOGY
UNIVERSITI TEKNIKAL MALAYSIA MELAKA
2017

DECLARATION

I hereby declare that this project report entitled

SMART SHOPPING CART FOR AUTO BILL CALCULATION USING NFC

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DEDICATION

This thesis is dedicated with a special feeling of gratitude to my loving parents, Saminadan and Saraswathi for their words of encouragement and support from financial wise during the completion of my thesis. Not forgetting my siblings for their support and ideas throughout this project.

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ABSTRACT

A futuristic shopping complex is not only a place to shop but it demands an innovative and high technology that aids the convenience, efficiency and effective style in daily life. On the other hand, shopping activities can be a time consuming especially during special offers, discount provided on various products and large crowd on weekends, which a lot of people need to face a long queue to make the payment. However, the existing way of calculating the total amount of items produced several problems for instance expensive devices, non-accurate amount of calculation and non-user-friendly interface system. Therefore, the idea for Smart Shopping Cart is introduced to reduce the time spending on queue and smoothen the billing process, which the bill can be calculated expeditiously with exact price of product according to its current market rate. Studies have shown that there are three methods used on smart shopping cart, which are server based cart, cloud based cart and Bluetooth based cart. Server based and cloud cart is using shopping cart with RFID but the cost is expensive because it needs alternative hardware to build with it. In contrast, the Bluetooth based cart uses cart with RFID but it causes a mesh during data transmission as it transmits data in a long distance. Thus, there are few objectives for this project development, which are a)to study the NFC based shopping cart at the shopping mall, b)to design automatic bill calculation interface for smart shopping cart and c)to implement the new bill calculation interface based on NFC for smart shopping cart system. As a result, the effect of this study will provide a future shopping platform to be a possible solution.

ABSTRAK

Sebuah kompleks membeli-belah futuristik adalah bukan sahaja tempat untuk membeli-belah tetapi ia menuntut teknologi inovatif dan tinggi yang membantu kemudahan, kecekapan dan gaya berkesan dalam kehidupan seharian. Sebaliknya, aktiviti membeli-belah boleh menjadi memakan masa terutamanya semasa tawaran istimewa, diskaun disediakan pada pelbagai produk dan orang ramai besar pada hujung minggu, yang banyak orang perlu menghadapi barisan yang panjang untuk membuat pembayaran. Walau bagaimanapun, cara yang sedia ada dalam mengira jumlah barangan yang dihasilkan beberapa masalah untuk peranti contoh mahal, jumlah bukan tepat pengiraan dan sistem antara muka bukan mudah difahami. Oleh itu, idea untuk Smart Shopping Cart diperkenalkan untuk mengurangkan perbelanjaan masa pada baris gilir dan melicinkan proses bil, yang rang undang-undang boleh dikira dengan segera dengan harga sebenar produk mengikut kadar pasaran semasa. Kajian telah menunjukkan bahawa terdapat tiga kaedah yang digunakan ke atas troli membeli-belah pintar, yang mudah berasaskan pelayan, troli berasaskan Cloud dan torli berdasarkan Bluetooth. Pelayan berasaskan Cloud dan mudah untuk menggunakan shopping cart dengan RFID tetapi kos adalah mahal kerana ia memerlukan perkakasan alternatif untuk membina dengannya. Sebaliknya, kereta itu berdasarkan Bluetooth menggunakan troli dengan RFID tetapi ia menyebabkan mesh semasa penghantaran data kerana ia menghantar data dalam jarak yang panjang. Oleh itu, terdapat beberapa objektif untuk pembangunan projek ini, yang a) untuk mengkaji troli membeli-belah NFC berdasarkan di pusat membeli-belah, b) untuk mereka bentuk automatik antara muka banyak rang undang-undang untuk troli membeli-belah pintar dan c) untuk melaksanakan antara muka banyak rang undang-undang baru berdasarkan NFC untuk sistem shopping cart pintar.

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LIST OF ABBREVIATIONS

Abbreviations	Full Form
NFC	Near Field Communications
RFID	Radio Frequency Identification
RAD	Rapid Application Development
DFD	Data Flow Diagram
XML	Extensible Markup Language

LIST OF ATTACHMENTS

CHAPTER 1

INTRODUCTION

1.1 Introduction

Radio-Frequency Identification (RFID) is the use of radio waves to read and capture information stored on a tag attached to an object. A tag can be read from up to several feet away and does not need to be within direct line-of-sight of the reader to be tracked. Two type of tag in RFID, which are active and passive.

An active tag is a RFID tag that can communicate from long range. It have the capability of initiating communications with highest data bandwidth.

A passive tag is a RFID tag that does not contain a battery; the power is supplied by the reader. When radio waves from the reader are encountered by a passive RFID tag, the coiled antenna within the tag forms a magnetic field. The tag draws power from it, energizing the circuits in the tag. The tag then sends the information encoded in the tag's memory.

Near Field Communications. NFC is a set of standards for portable devices. It allows them to establish peer-to-peer radio communications, passing data from one device to another by touching them or putting them very close together.

Now a day's purchasing and shopping at big malls is becoming daily activity in metro cities. We can see big rush at these malls on holidays and weekends. This crowd becomes huge when there are special offers and discount. People purchase different items and put them in trolley.

After total purchase one need to go to billing counter for payments. At billing counter the cashier prepare the bill using bar code reader which is very time consuming process and results in long queue at billing counter. Besides, the customer also may encounter problem when the staff careless about the expired promotion labels on the products.

The idea for smart shopping cart is introduced to smoothen then billing process. By implement and execute this technology, the bill can be calculated expeditiously with exact price of product according to its current market rate.

The automatic billing system will calculate the total bill by reading the RFID tags attached to the products put in the cart and will send total value to the display. RFID is the special type wireless card which has inbuilt the embedded chip along with loop antenna. The inbuilt embedded chip represents the 12 digit card number. This magnetic signal is transmitted by the loop antenna connected along with this circuit which is used to read the RFID card number.

Method to implement this idea is by use tag with NFC based which is used for short range, this is to avoid detect product from different trolley.

Therefore, a new smart shopping cart for bill calculation using NFC is proposed.

1.2 Problem Statement

Studies have shown that there is three method which already exist for smart shopping cart which is server based cart, cloud based cart and Bluetooth based cart.

Server based and cloud cart is using shopping cart with RFID but its cost expensive because it need few more hardware to implement in it.

On the other hand, Bluetooth based cart also using cart with RFID but it can cause a mesh during data transmission as it can transmit data in long distance.

All of this smart cart create latency or delay in the data transmission in network environment. On the other hand, a long queue of the customer at the counter not only create human congestion but also data traffic congestion.

Table 1.1: Summary of Problem Statement

PS	Problem Statement
PS1	Cost expensive because it need few hardware to implement.
PS2	Can cause mesh during data transmission as it can transfer data in long distance.
PS3	Create latency or delay in data transmission in network environment.

1.3 Project Question

Table 1.2: Summary of Project Question

PS	PQ	Project Question
PS1	PQ1	Which hardware can calculate automatically in less cost?
PS2	PQ2	How to avoid mesh in signal during data transmission?
PS3	PQ3	What is the time taken to transmit data using NFC device?

1.4 Project Objective

The objectives of these proposed solutions as listed:

Table 1.3: Summary of Project Objective

PS	PQ	PO	Project Objective
PS1	PQ1	PS2	To study the NFC based shopping cart at the shopping mall.
PS2	PQ2	PO2	To design automatic bill calculation interface for smart shopping cart.
PS3	PQ3	PQ3	To implement the new bill calculation interface based on NFC for smart shopping cart system.

1.5 Project Scope

The scope of the project covered another way for auto bill calculation on shopping cart. Radio Frequency Identification RFID) is the use of radio waves to read and capture information stored on a tag attached to an object. A tag can be read from up to several feet away and does not need to be within direct line-of-sight of the reader to be tracked. The proposed project is implemented by install Near Filed Communication (NFC) device which consist of reader and tag to a laptop in a Wireless Communication Lab and install Read-a-Card software in that particular laptop to encode the reader and its tag. Moreover, in the laptop an interface will be created to arrange the calculation systematically which can show the total amount of purchase.

1.6 Project Contribution

Table 1.4: Summary of Project Contribution

PS	PQ	PO	PC	Project Contribution
PS1	PQ1	PO1	PC1	Propose suitable method for auto bill calculation on shopping cart.
PS2	PQ2	PO2	PC2	Propose Near Field Communication based shopping cart.
PS3	PQ3	PO3	PC3	Testing and analyze the new invention in RFID using NFC.

1.7 Thesis organization

Chapter 1: Introduction

This chapter discuss about the background of the project. It defines the problem statement, project question, project scope, project contribution, thesis organization and conclusion.

Chapter 2: Literature Review

This chapter discuss about the preview works that are related to the project, critical review and justification, and proposed solution for further project.

Chapter 3: Project Methodology

This chapter discuss about the methodology used in the project, which explained the selected methodology for each stage and the project milestone.

Chapter 4: Analysis and Design

This chapter discuss about the problem analysis that explained the situation for the project. Requirement analysis such as data requirement, functional requirement, non-functional requirement and other requirement also will be explained.

Chapter 5: Implementation

This chapter discuss about the software development environment setup, software configuration management and implementation status.

Chapter 6: Testing

This chapter discuss about the test plan, test strategy, test design, test results and analysis.

Chapter 7: Project Conclusion

This chapter discuss about the project summarization, project contribution, project limitation and the future works

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

E-Commerce offers a new dimension of shopping environment. The current shopping system consists of shopping cart, barcode scanner, cashier and cashing system. However, the current system of shopping cart payment using barcode gives problem such as long queue or miscalculation of products.

Therefore, a new shopping system is highly in demand. There are various shopping system available such as server based, cloud based and Bluetooth based shopping cart.

This chapter explain the currently existing smart shopping cart to calculate bill automatically by few methods. Previously, recent ideas have shown on some improvement made in terms of hardware and implementation progress in each shopping cart.

2.2 Background of study

Shopping cart using auto bill calculation already exist in this globalized world. Even though there are few inventors invented shopping cart according to the advancing technology yet there are some faults still occur in the inventions.(Rajeshkumar, Mohanraj, & Varatharaj, 2016) One of the cart is server based and cloud based cart; this cart really brought huge differences in technology wise, such as it ease the customer's shopping system and this cart also can store data in the database systematically. Unfortunately, this cart couldn't be implemented widely due to its high cost budget from hardware side(Dilip, Ganpat, Sunil, & Bhimrao, 2016). Its need router and

some other hardware to build this cart which might cost expensive.

Besides, there is also Bluetooth based cart which can ease the customer's shopping flow and its developing cost cheaper than the server and cloud based cart(Chandrasekar & Sangeetha, 2015). Although this invention look advanced, it still create some error such as cause mesh during data transmission as it can connect in range of 10 meters, this might confused the reading at the display screen of each customer.

2.2.1 Server Based and Cloud Based Cart

Current charging system which is server based and cloud based are usable and dependable system, yet there is a few weaknesses too by execute the framework world generally. One of the drawbacks is both of it cost costly as it require some equipment to introduce. Besides, it might make latency and delay in information transmission.

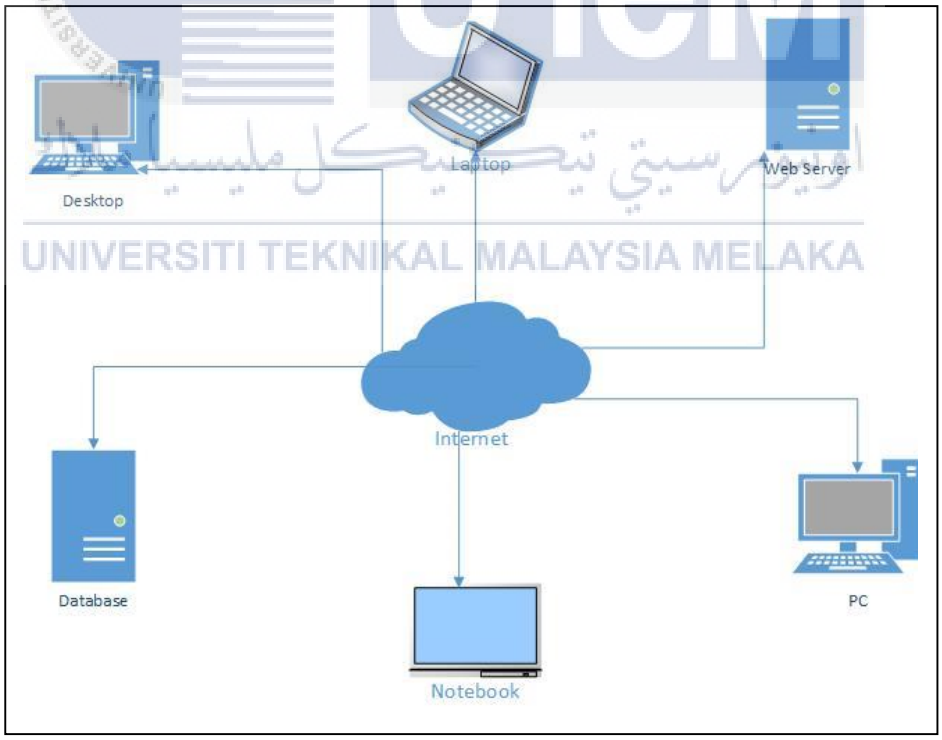


Figure 2.2.1 Server Based and Cloud Based Cart

2.2.2 Bluetooth Based Cart

Bluetooth transmission based cart additionally urged to be utilized by shopping complex since it is as indicated by current innovation improvement, however it can bring about a huge work amid information transmission as its can exchange information from long distance. This may influence client's charging screen substance and item's estimation.

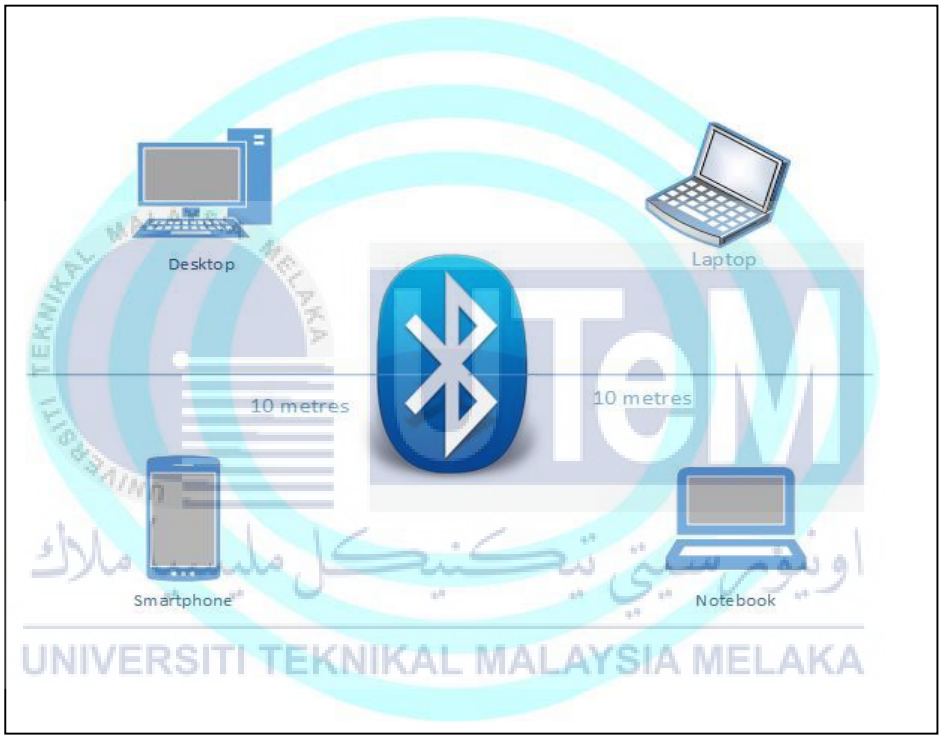


Figure 2.2.2 Bluetooth Based Cart

2.3 Critical Review of Current Problem

There are many shopping cart based RFID already invented , yet there is still some failure occur when it comes to implementation level due to some reasons. Galande Jayshree, Rutuja Gholap, Preeti Yadav in the year 2014 proposed RFID Based Automatic Billing Trolley(Jayshree, Gholap, & Yadav, 2014). This paper proposed a framework that is set in all the trolleys. It will comprise of a RFID per user. Every one of the items in the shopping center is outfitted with RFID labels. At the point when a man puts any items in the trolley, its code is distinguished and the cost of those items will be put away in memory. As we put the items, the expenses is added to aggregate bill. Accordingly the charging will be done in the trolley itself. Thing name and its cost will be shown on LCD. Additionally the items name and its cost can be reported utilizing headset. At the charging counter the aggregate bill information is exchanged to PC by remote RF modules. A few past reviews have additionally examined the improvement of promoting applications, including the review entitled "Plan of EMarketing at PT. Rajawali Nusindo" and "Outline of Web-based Marketing Information Systems. This framework other than as a special media can likewise prepare requesting merchandise, requesting exchange handling, and show the status of the merchandise, and additionally giving reports the buy of an item level. In any case, there are still deficiencies in the framework, particularly regarding advertising, which is a type of advancement that is completed is constrained to show just things accessible. There is no particular way to deal with pull in potential purchasers to buy the item provided. Restricted portability and absence of client personalization.

2.4 Proposed Solution, NFC Based shopping cart

NFC Based shopping cart is an idea to be develop for automatic bill calculation shopping cart. There are some reasons I choose this method; firstly it is low cost device and affordable price range. Furthermore, it transmit data in a short range which affected the neighbor trolley. Additionally NFC is an advance technology which will be used by people in coming years.

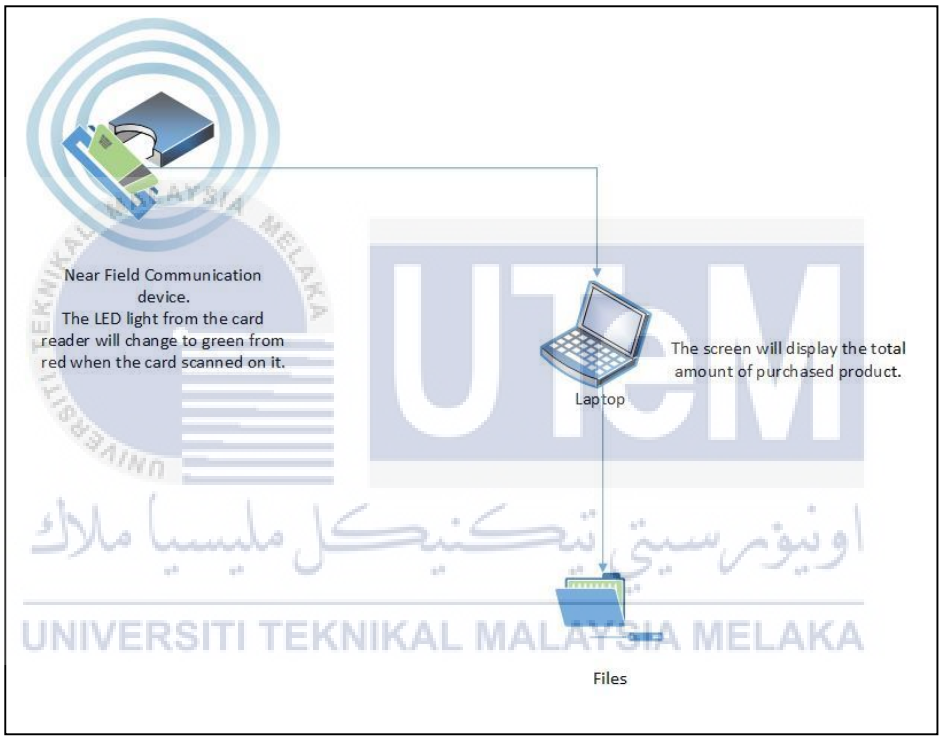


Figure 2.4 NFC Based shopping cart

2.5 Conclusion

This chapter explained about the literature review about previous project and related to this project. The NFC approach has been used as a reference to this project. The flow of the system of the proposed project is based on idea and the functions provide by the device.

CHAPTER 3

METHODOLOGY

3.1 Introduction

The third chapter is concerned with the methodology use for this study. The methodological approach taken in this study is Rapid Application Development (RAD). The RAD method is one of the more practical way to conduct and develop a project. RAD approach has a number of phases: Requirements Planning Stage, User Design Phase, Rapid Construction Stage and Transition Stage. This chapter covered the milestone of the project and Gantt chart according to the time period correspond to the project development.

3.2 Methodology

RAD model is a type of incremental model, as its components or functions develop as if it is a mini project. A prototype is constructed to show the customer on how the product will be in future. RAD is a people-centered and incremental development approach. Active user involvement, as well as collaboration and co-operation between all stakeholders are imperative. Testing is integrated throughout the development life cycle so that the system is tested and reviewed by both developers and users incrementally.

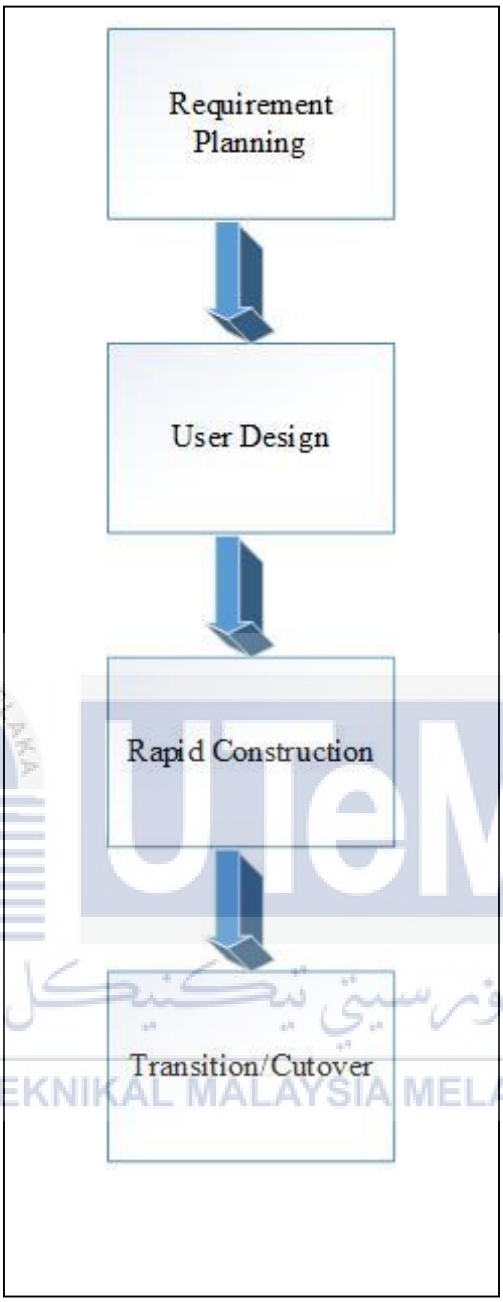


Figure 3.2 Phases in RAD

3.2.1 Requirement Planning

This phase is to identify the user need and the developers and users make an agreement to each other to the business needs, project scope and all the system requirements. Objectives of the project are identified and gather all the requirement based on the problem statement.

3.2.2 User Design

This phase is done by present the visual representation of design and workflow by the developers to the users. The user design is completed which consists of the process of interaction with the users. By this process, the users will responded to the actual working prototype and the developers begin to build the models and prototype.

3.2.3 Rapid Construction

This phase consists of the process of interaction between the user and interface, it detail is explained in chapter 5. The developers built a look alike system (prototype) for the users to have a look and give feedback on its. This phase will help the developers to modify and enhance the user needs.

3.2.4 Transition/Cutover

This will be the final phase where the data conversion, full-scale testing of the system, system changeover and user acceptance test will be done. This phase will be explained detail in chapter 6 where the presentation and testing of project took place.

Table 3.3 Project Milestone

Week	Activity	Note/Action
1 13-17 Feb Meeting 1	Proposal PSM: Discussion	Deliverable-Proposal Action- Student
	Proposal Assessment & Verification	Action- Supervisor, Evaluator
2 20-24 Feb	Proposal Correction / Improvement	Action- Student
	List of Supervisor/ title	Action- PSM/PD Committee
3 27 Feb - 3 Mac Meeting 2	Proposal Presentation & Submission via PSM Online System Chapter 1 (System Development Begins)	Deliverable-Proposal Presentation (PP) Action- Student
4 6-10 Mac	Chapter 1 Chapter 2	Deliverable-Chapter 1 Action- Student, Supervisor
5 13-17 Mac	Chapter 2	Action Student
6 20-24 Mac Meeting 3	Chapter 2 Chapter 3	Deliverable – Chapter 2 Progress Presentation 1 Action- Student , Supervisor
	Student Status	Action- Supervisor, PSM/PD Committee
7 27-31 Mac	Chapter 3 Chapter 4	Action- Student
8 3-7 April	MID SEMESTER BREAK	

9 10-14 April	Chapter 4 Project Demo	Deliverable: Chapter 3 Action- Student, Supervisor
10 17-21 April Meeting 4	Chapter 4 Project Demo	Deliverable- Progress Presentation 2
	Student Status	Action- Supervisor, PSM/PD Committee
11 24-28 April Demonstration	Project Demo	Action-Student
	Determination of Student Status (Continue/Withdraw)	Submit student status to Committee Action- Supervisor, PSM/PD Committee
12 1-5 May	Project Demo PSM 1 Report	Action- Student, Supervisor
13 8-12 May Meeting 5	Project Demo PSM 1 Report PSM 1 Showcase Poster Submission	Action- Student, Supervisor
14 15-19 May Meeting 5	Project Demo Submission of the PSM 1 Report onto the PSM e-Repository online system	Action- Student, Supervisor
15 22-26 May PSM 1 Showcase	PSM 1 SHOWCASE Wed, 24 May 2017: 8:00 a.m- 5:00 p.m	Action- Student, Supervisor, Evaluator PSM/PD Committee

16 29 May – 2 Jun	REVISION WEEK Correction on the draft report based on the comments by the Supervisor and Evaluator during the final presentation session. Submit PSM 1 Logbooks to PSM Online System	 Deliverable- Complete PSM 1 Logbooks Action- Student, Supervisor
17& 18 5- 18 Jun	FINAL EXAMINATON WEEKS	

Table 3.4 Gantt Chart

WEEKS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
TASK																
1. Submitting proposal																
2. Correction / Enhancement of proposal and Chapter 1																
3. Chapter 1 (System Development)																
4. Chapter 1 and Chapter 2																
5. Chapter 2																
6. Chapter 2 and Chapter 3 (Chapter2 and Progress Presentation 1)																
7. Chapter 3 and Chapter 4																
8. Chapter 4																
9. Chapter 4 (Progress Presentation 2)																
10. Demonstration of PSM Report																
11. Project Demonstration and PSM Report																
12. Final Presentation																
13. Documentation																

3.5 Conclusion

In a nutshell, this chapter on how the project is conducted within the time period given while the all the user requirement should include in the development and how the work flow from beginning to the ending. The methodology used is RAD because this methodology ease to follow by a system developer. Its phases will guide the developer from beginning of process to the ending of the process. All the phases implemented simultaneous with the developing environment.

CHAPTER 4

SYSTEM ANALYSIS AND DESIGN

4.1 Introduction

This chapter explain the analysis and overall design of the project that is developed. The analysis is done to create a solution for the problem facing by customer at shopping complex. System architecture, user interface design and database of this system is explained clearly in this chapter. Each modules in this chapter explicit the design and development of the project.

4.2 Problem Analysis

The existing shopping system is not systematic when it comes to bill payment procedure. Customers need to face a long queue to pay their bill even it is for a single item. Moreover, prices shown in the label might be differ from system due to market price changes. Finally, customer might take many product which lead to exceed their budget limit.

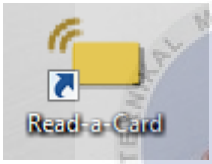
4.3 Requirement Analysis

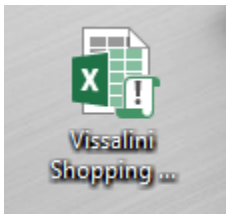
Requirement analysis is elaborated all the required tools to develop this project. . Module 4.3.1.1 explained the software requirement for this project and module 4.3.1.2 on the hardware requirement for this project.

4.3.1 Software and Hardware Requirement

Software and hardware used to develop the system have been explained detail with its specification and image for a clear understandings.

Table 4.3.1.1 Software Requirement

Read-a-card
 
 	
	• USB 2.0 Full Speed Interface
	• CCID Compliance
	• Smart Card Reader:
	  ○ Read/write speed up to 424 kbps
	  ○ Built-in antenna for contactless tag access, with card reading distance of up to 50 mm (depending on tag type)
	  ○ Supports ISO 14443 Type A and B cards, MIFARE, FeliCa, and all 4 types of NFC (ISO/IEC 18092) tags
	  ○ Built-in anti-collision feature (only 1 tag is accessed at any time)
	• Application Programming Interface:
	  ○ Supports PC/SC
	  ○ Supports CT-API (through wrapper on top of PC/SC)
	• Peripherals:
	  ○ User-controllable bi-color LED
	  ○ User-controllable buzzer
	• Supports Android™ OS 3.1 and above

Microsoft Excel 2013 and 2016  	Microsoft Excel is a software used to do the full system which consist of user interface and full coding.

Microsoft Visio 	Microsoft Visio is a software used to do the drawings and flow chart of the system.
Windows 7 	Windows 7 is a computer operating system released by Microsoft used for software installation setup and develop the system.
Windows 8 	Windows 8 is a computer operating system released by Microsoft used for the system presentation.

Table 4.3.1.2 Hardware Requirement

Laptop 	Processor: Intel Core i7-6500U Processor 2.5GHz (4M Cache, up to 3.10GHz) Memory: 4GB DDR3. Storage: 1TB HDD 5400rpm SATA. Display: 15.6-inch 16:9 HD 1366x768 LED Backlit Display. Graphics: NVidia GeForce 940m 2GB GDDR3 VRAM. Optical drive: 8x Super Multi DL DVDRW. Connectivity: 802.11n WiFi + Bluetooth.
Ultrabook 	Manufacturer: ACER M Aspire: P3-171odel name CPU type: Intel Core i3-3229Y CPU speed: 1400 Mhz OS: Microsoft Windows 8.1 Display Size: 11.6" 1366 X 768 Touch Technology: Multi-touch RAM: 2048 MB SSD: 64 GB Battery capacity: 42 (Wh)
NFC Reader 	(13~23Day Delivery++) USB ACR122U A9 NFC
NFC Tag 	RFID Smart Card Reader Writer for All 4 Types of NFC (ISO/IEC18092) Tags

4.4 High Level Design

High Level Design is designed to explicit the system architecture and database design. This method can ease the understanding of the user before the real system to be developed.

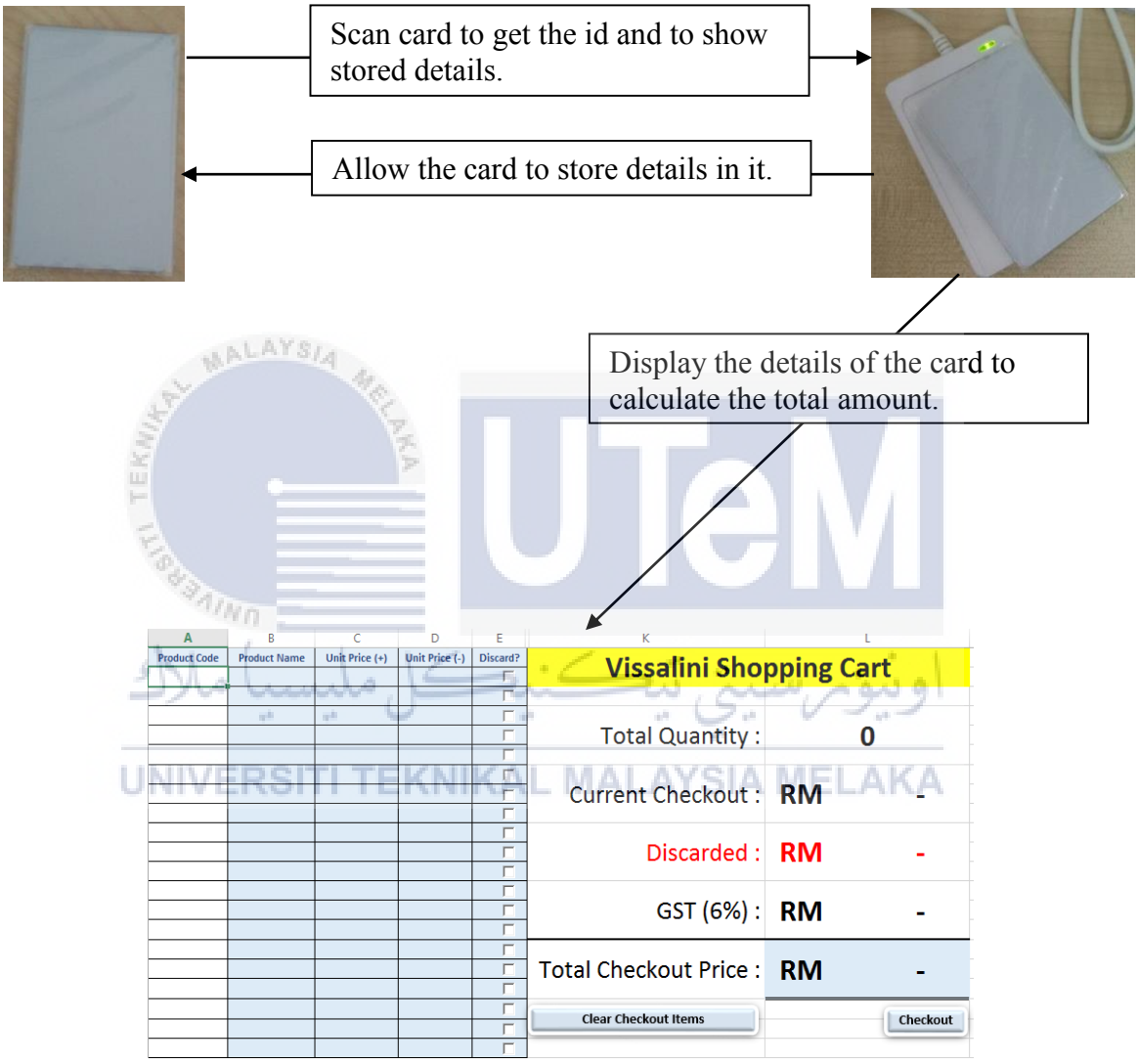


Figure 4.4 High Level Design

4.4.1 System Architecture

System architecture show the physical design of the system, it emphasize on how the hardware arranged.

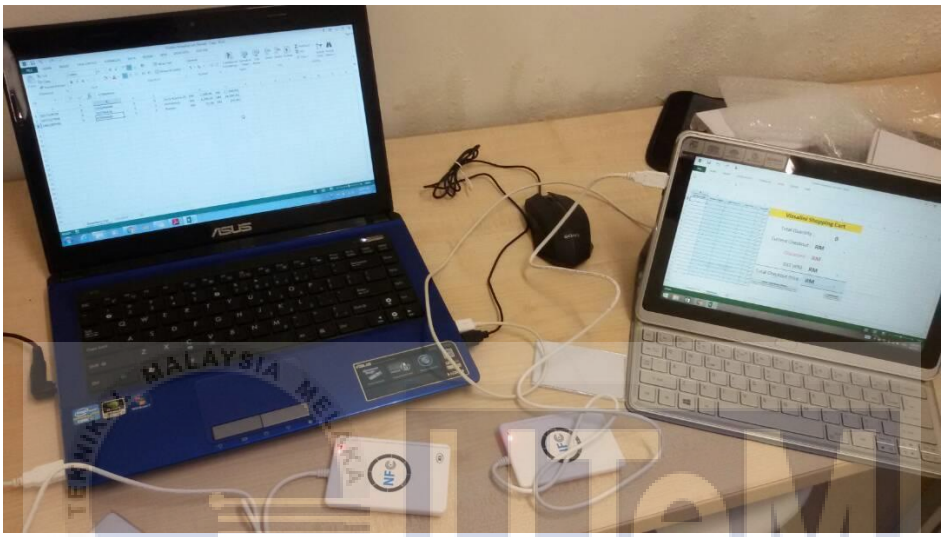


Figure 4.4.1 System Architecture

4.4.2 User Interface Design

User interface design is designed to interact with user. Here, user can interact with the system easily. Icons provided in this design is helpful for the user to use this system.

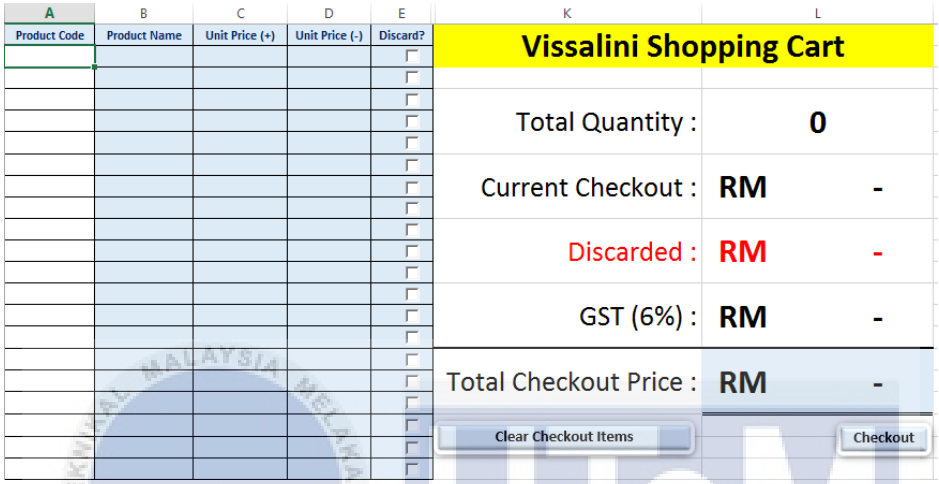


Figure 4.4.2 User Interface Design

4.4.3 Database Design

Database design is to show the database file. Here, the detail of product is keyed-in to be extracted in the user interface design. All the data stored in this file based of product details.

4.4.3.1 Database File

This file created in excel to store the data of products matching with its unique ID. Data is extracted according to the ID in the tag to display in the user interface to calculate the total amount.

Product Code (+)	Transaction (+)	Product Code (-)	Transaction (-)	Condition	Product Name	Price (Add)		Price (Reduce)	
1859746716	0	2625362286	0	0	Ginger Bread	RM	1.50	RM	(1.50)
1857199500	0	2359145070	0	0	Pen	RM	2.50	RM	(2.50)
1857254236	0	1551086446	0	0	Sony Xperia Z4	RM	2,300.00	RM	(2,300.00)
1857327404	0	747746414	0	0	Notebook	RM	4,200.00	RM	(4,200.00)
1861389596	0	479064686	0	0	Reader	RM	55.00	RM	(55.00)

Figure 4.4.3.1 Database File

4.4.3.2 Data Flow Diagram

This diagram provide the information regarding representation of **entities** and their **relationships** to each other, typically used in computing in regard to the organization of data within databases or information systems.

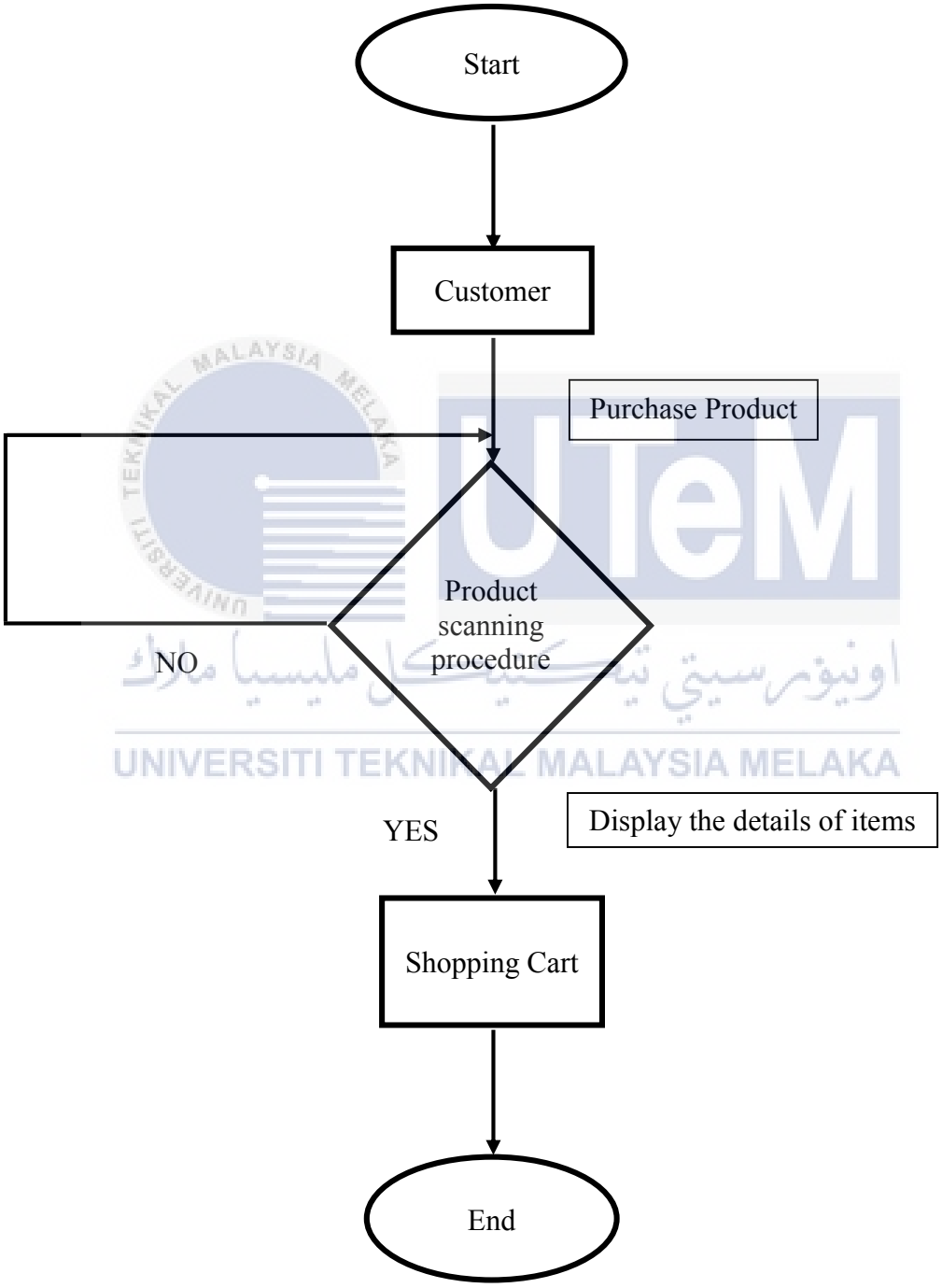


Figure 4.4.3.2 Data Flow Diagram

4.5 Conclusion

In a nutshell, this chapter have explained about the design, system flow and how the system operated once implemented. All the diagrams included to give an overview to the client. By follow the step in this chapter, workflow of the project can be developed smoothly.

CHAPTER 5

IMPLEMENTATION

5.1 Introduction

Implementation is a phase where the end user of your system is foremost to your mind. During this phase, you create the documentation and tools for end user for run the system securely. The real system is implemented to be view by the user. Programmers are occupied with encoding, designers is developed graphic material and the actual organization take place.

5.2 Software Implementation

This process explained how the software need to be set to be run by the user once installation done.

5.2.1 Retrieve information of card.

At the status tab of the dialog box, the ID of each scanned card is obtained and to set its items at database.

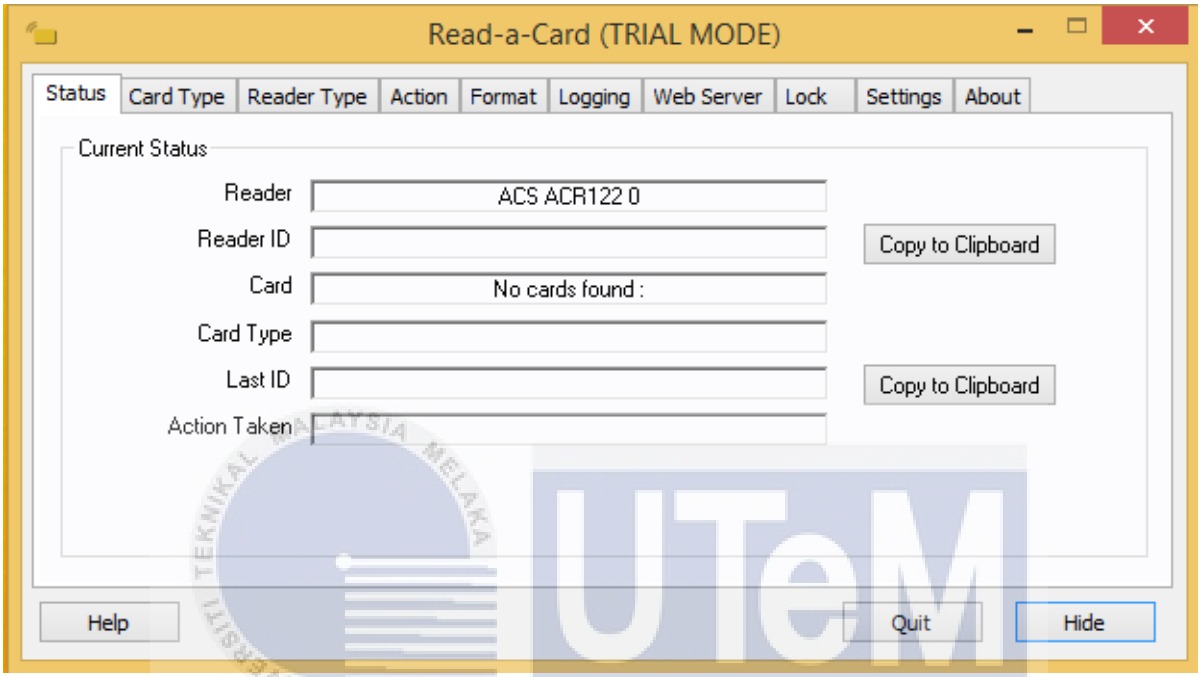


Figure 5.2.1 Details of card

5.2.2 Identify type of card

This section enable selection type of card we using for detection on the scanner.

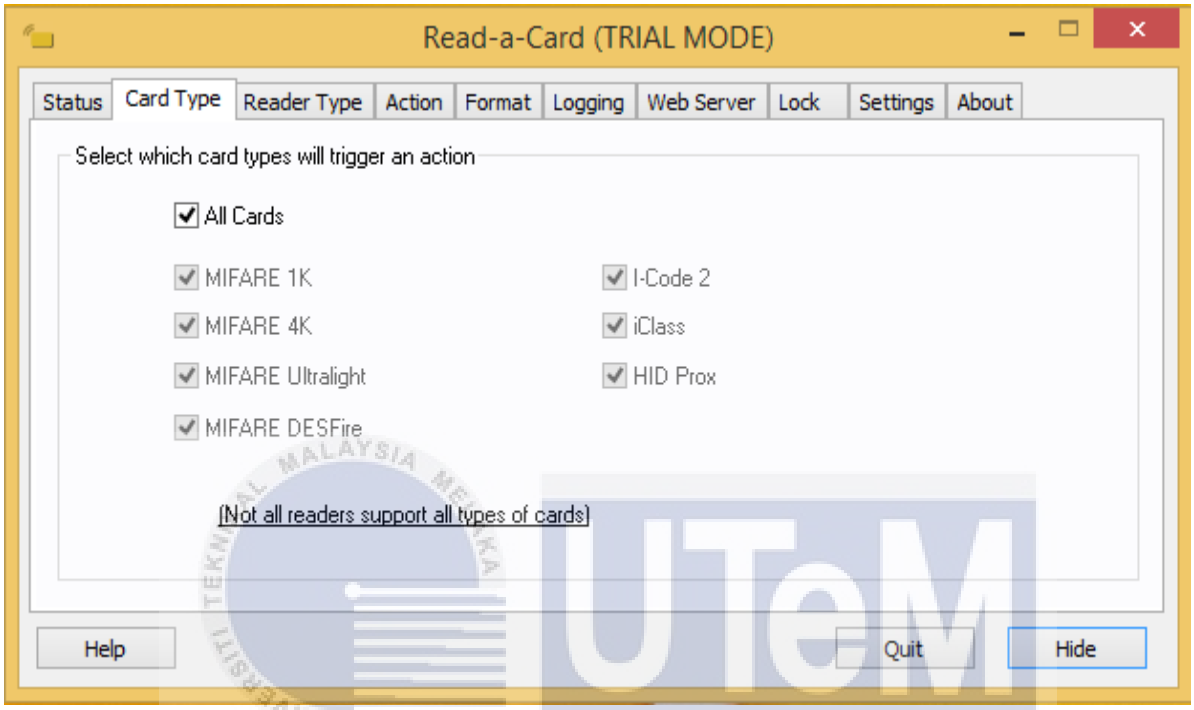


Figure 5.2.2 Type of card used

5.2.3 Reader type

This function enable selection of the card we used which is supported by all PC or only by selected PC.

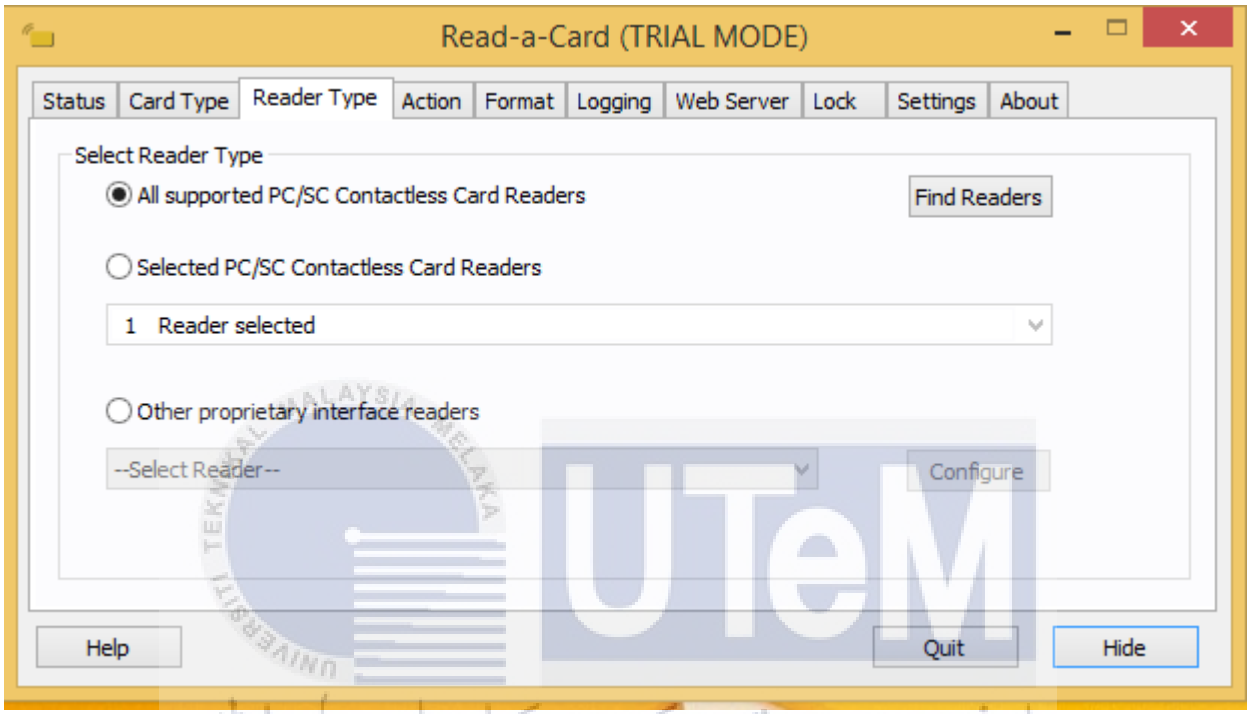


Figure 5.2.3 Select Reader Type

5.2.4 Action

This function to enable us clarify how the user, used the card whether by Place ID in keyboard buffer or by other method.

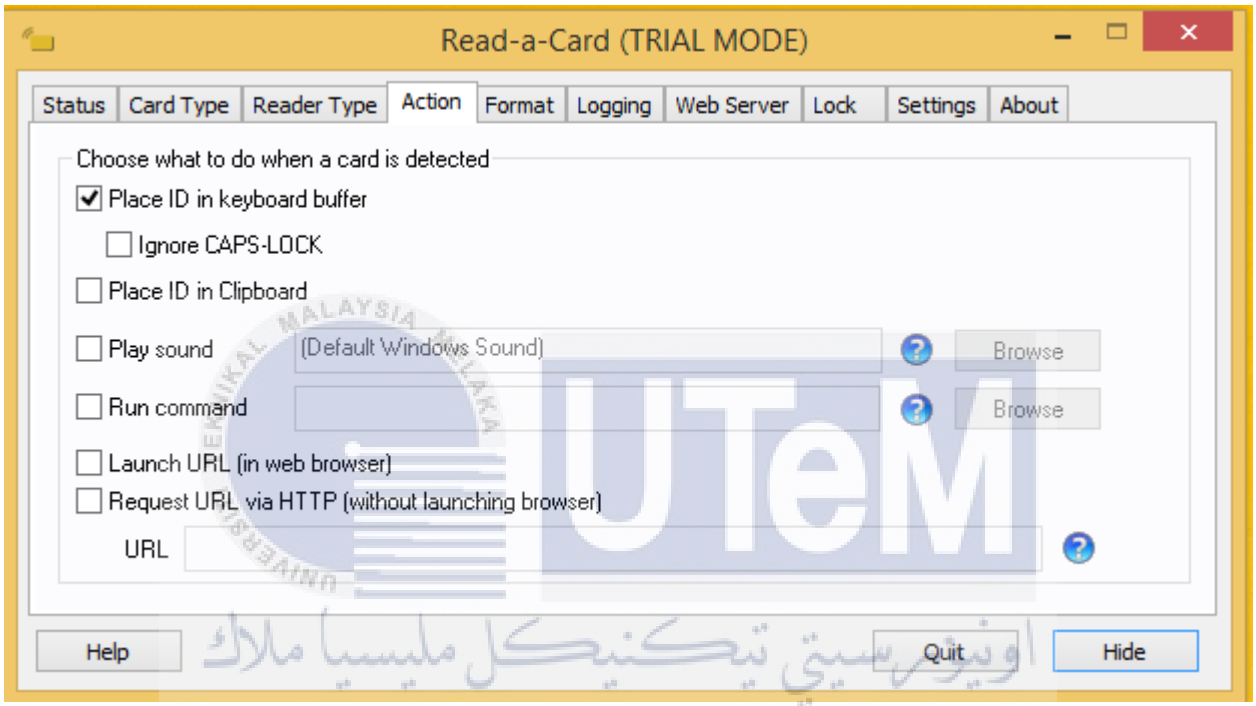


Figure 5.2.4 Choose action when card detected

5.2.5 Format

This function produced option on how to set the UID. Each card processed two UID Number one by set the format to “Decimal-Reversed (32bit)” and “Decimal-Standard (32bit)”. At this part, the ID is encoded and the ID retrieved by Decimal-Reversed (32bit)” for add the item’s price and encode the ID retrieve by Decimal-Standard (32bit) to minus the price as the products is removed.

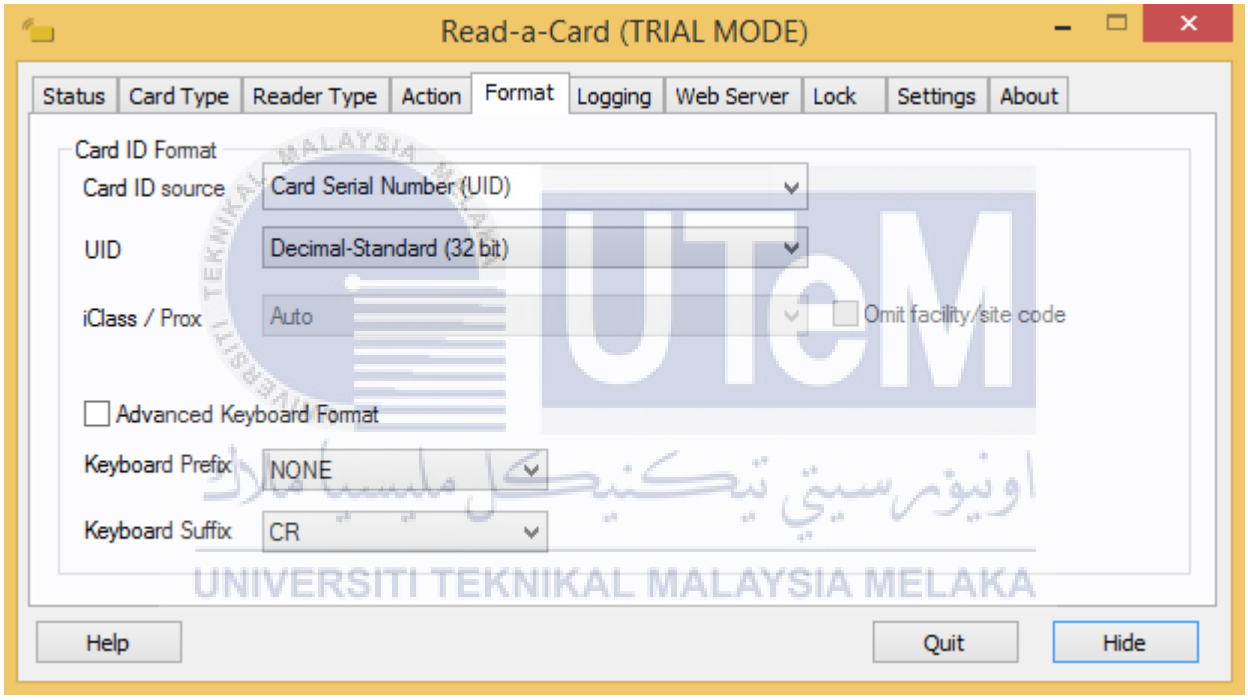


Figure 5.2.5 Choose format of UID of card

5.2.6 Logging

This function is main part in our system which the type of output is declared. For this system .xml type is choose as the output by Microsoft Excel.

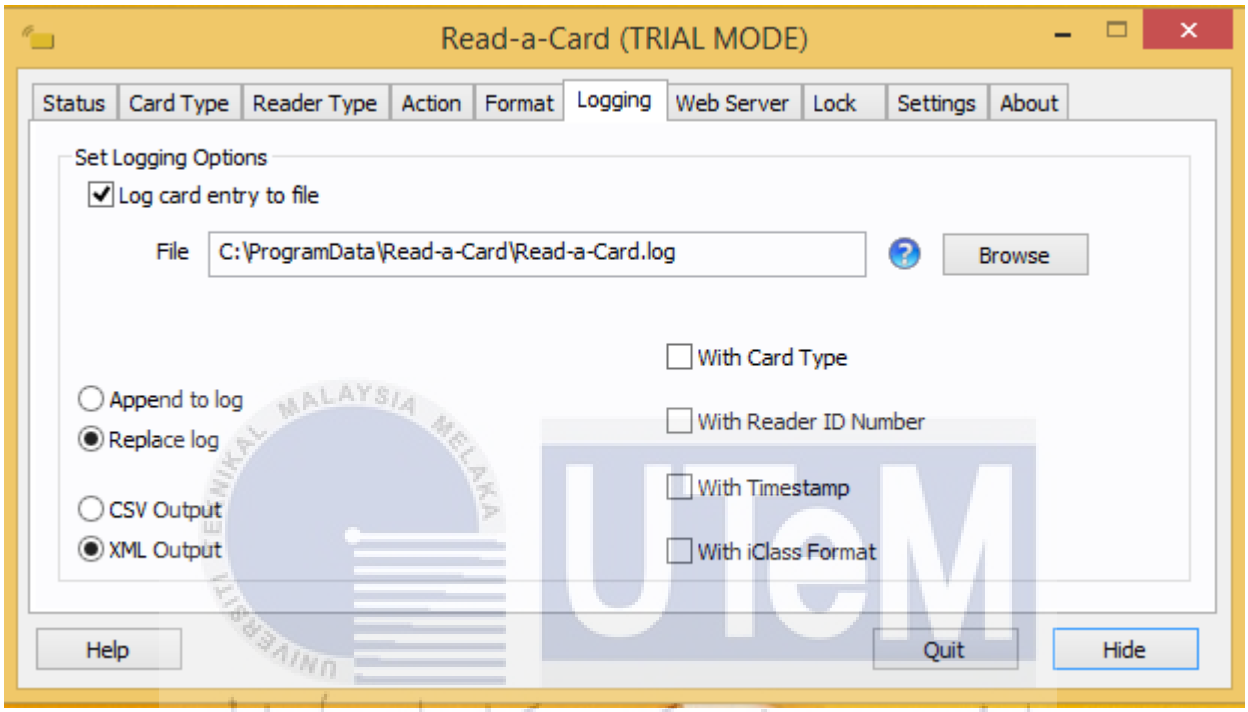


Figure 5.2.6 Options for log card entry file

5.2.7 Web Server

Here the number need to be set, by default it already in port 21059.

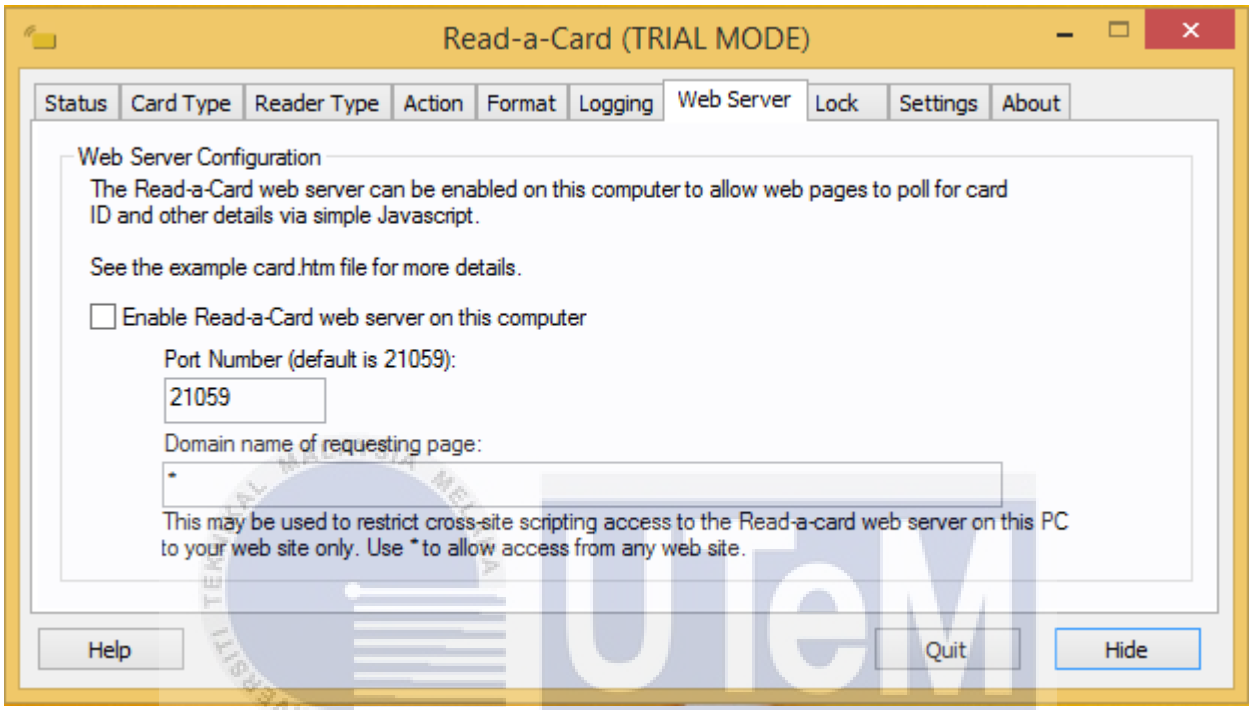


Figure 5.2.7 Set port number

5.2.8 Lock

This function provide security to the system. Password can be applied for the system to be more secure.

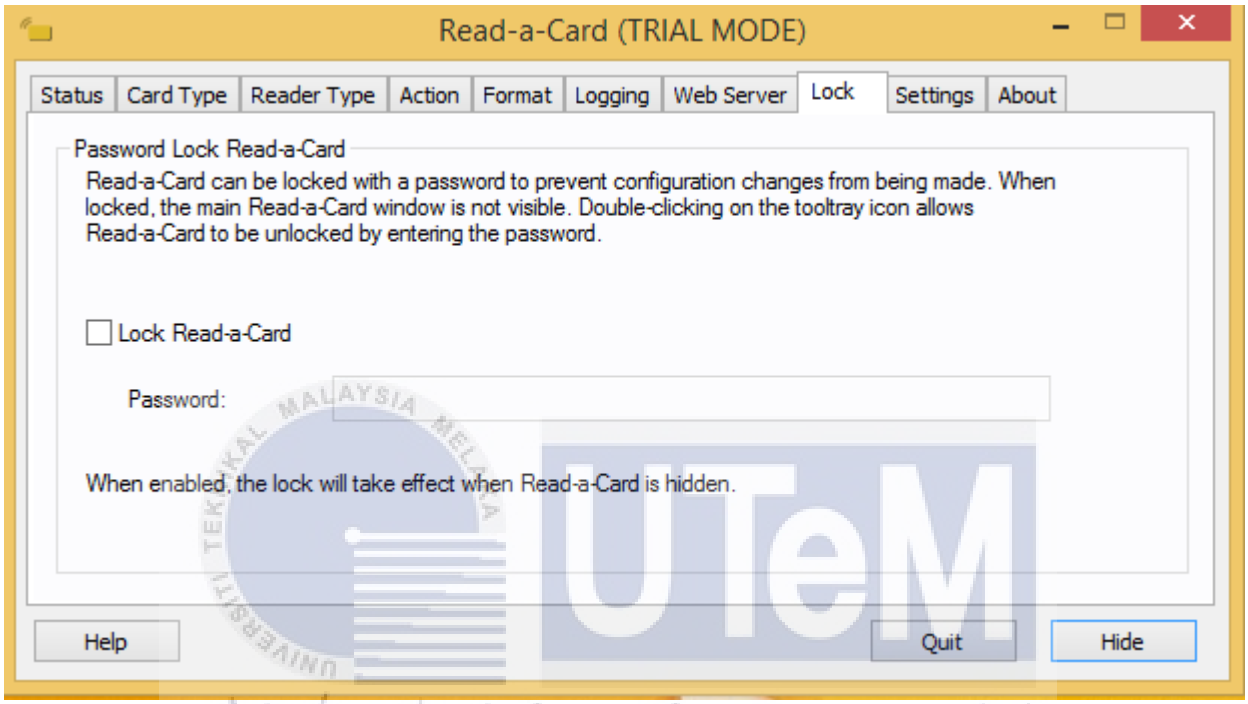


Figure 5.2.8 Set password for secure

5.2.9 Settings

This function can enable us to set the duration of card to be scanned. And the option chosen was "Ignore duplicate card presentation (on the same reader) within 10 seconds" to avoid the reader read the card multiple times within 10 seconds.

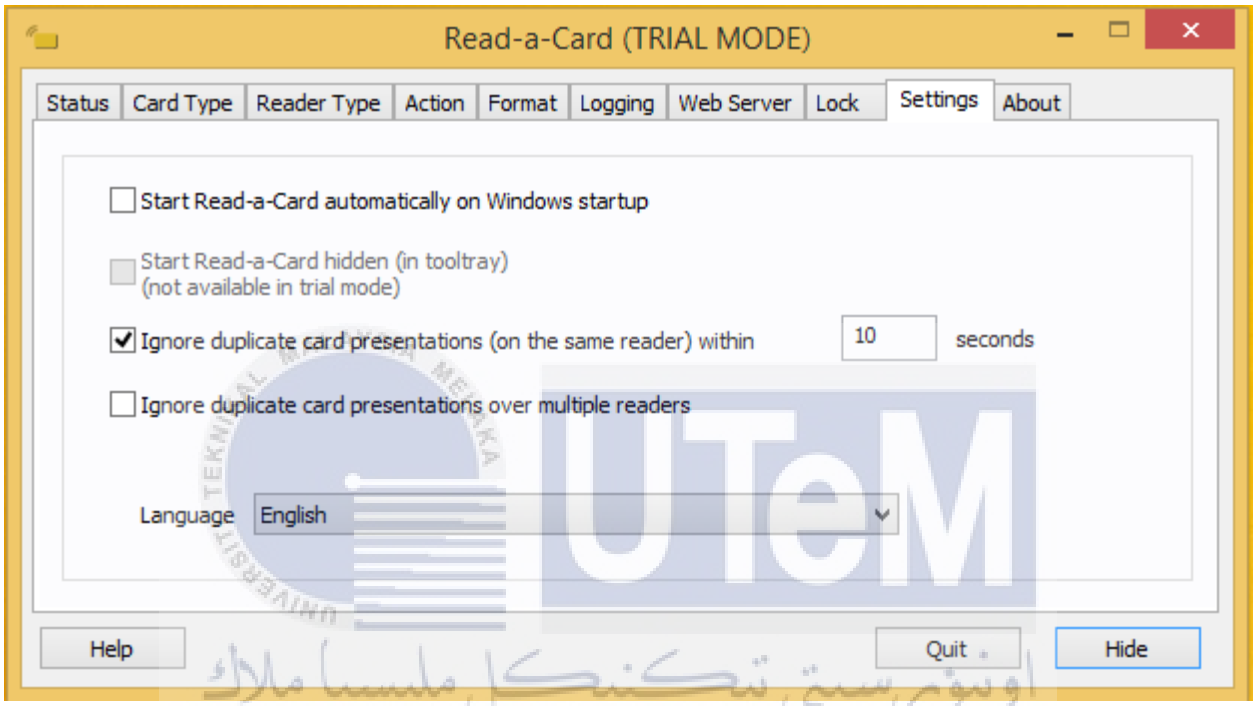
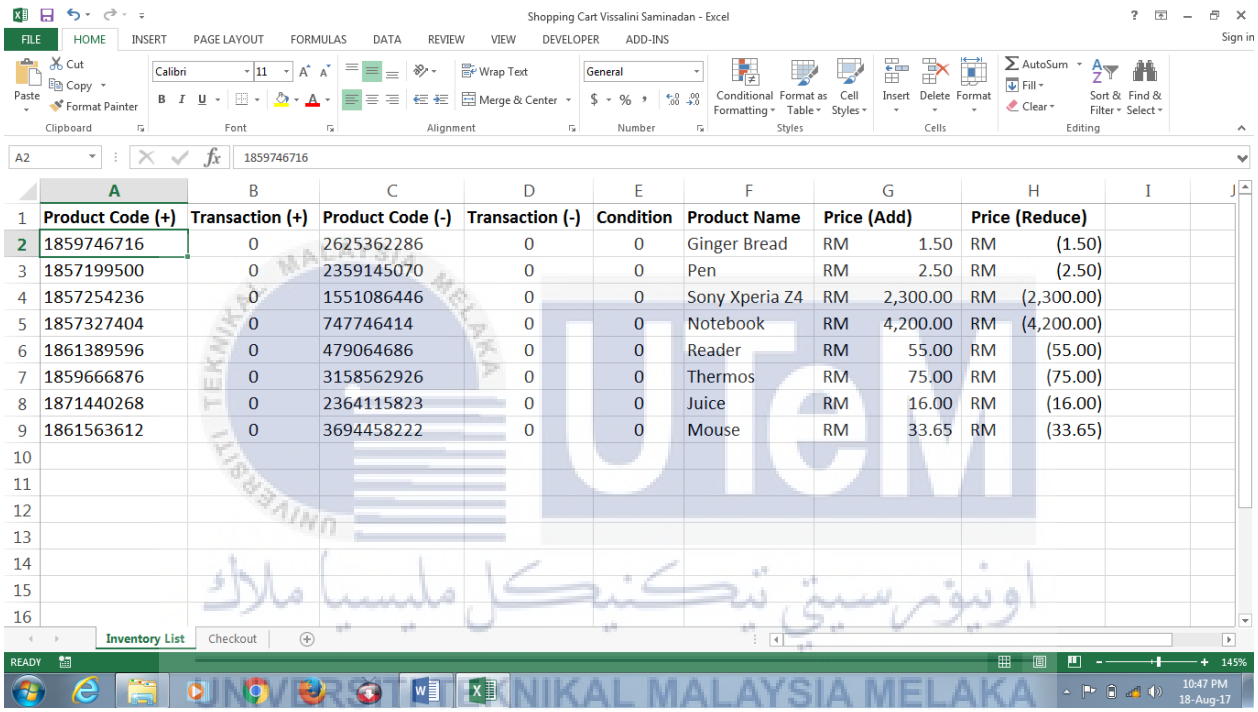


Figure 5.2.9 Setting time for read card

5.3 Interface of System in Microsoft Excel

5.3.1 Interface of Database

Columns are created to declare each function to be performed when the card is scanned. The item's name and price declared at this file with its own ID to retrieve by the system during calculation process.



	A	B	C	D	E	F	G	H	I	J
1	Product Code (+)	Transaction (+)	Product Code (-)	Transaction (-)	Condition	Product Name	Price (Add)	Price (Reduce)		
2	1859746716	0	2625362286	0	0	Ginger Bread	RM 1.50	RM (1.50)		
3	1857199500	0	2359145070	0	0	Pen	RM 2.50	RM (2.50)		
4	1857254236	0	1551086446	0	0	Sony Xperia Z4	RM 2,300.00	RM (2,300.00)		
5	1857327404	0	747746414	0	0	Notebook	RM 4,200.00	RM (4,200.00)		
6	1861389596	0	479064686	0	0	Reader	RM 55.00	RM (55.00)		
7	1859666876	0	3158562926	0	0	Thermos	RM 75.00	RM (75.00)		
8	1871440268	0	2364115823	0	0	Juice	RM 16.00	RM (16.00)		
9	1861563612	0	3694458222	0	0	Mouse	RM 33.65	RM (33.65)		
10										
11										
12										
13										
14										
15										
16										

Figure 5.3.1 Database file

5.3.2 Coding to link the pages

Codes are used to link the database sheet and calculation process sheet in the system.

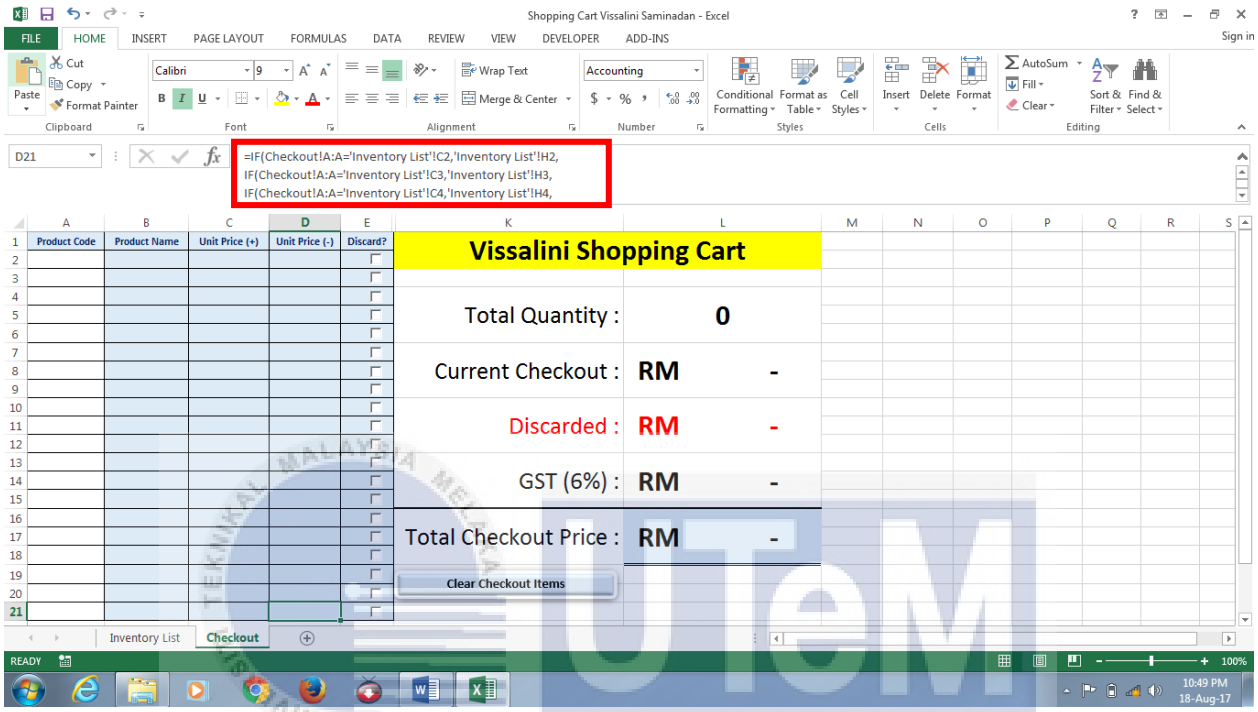


Figure 5.3.2 Codes link between two sheets

5.3.3 Codes to calculate items

Codes are used to calculate items by the system when user add products by retrieve Decimal-Reversed (32bit) and to minus price from the system if user remove the product by retrieve Decimal-Standard (32bit).

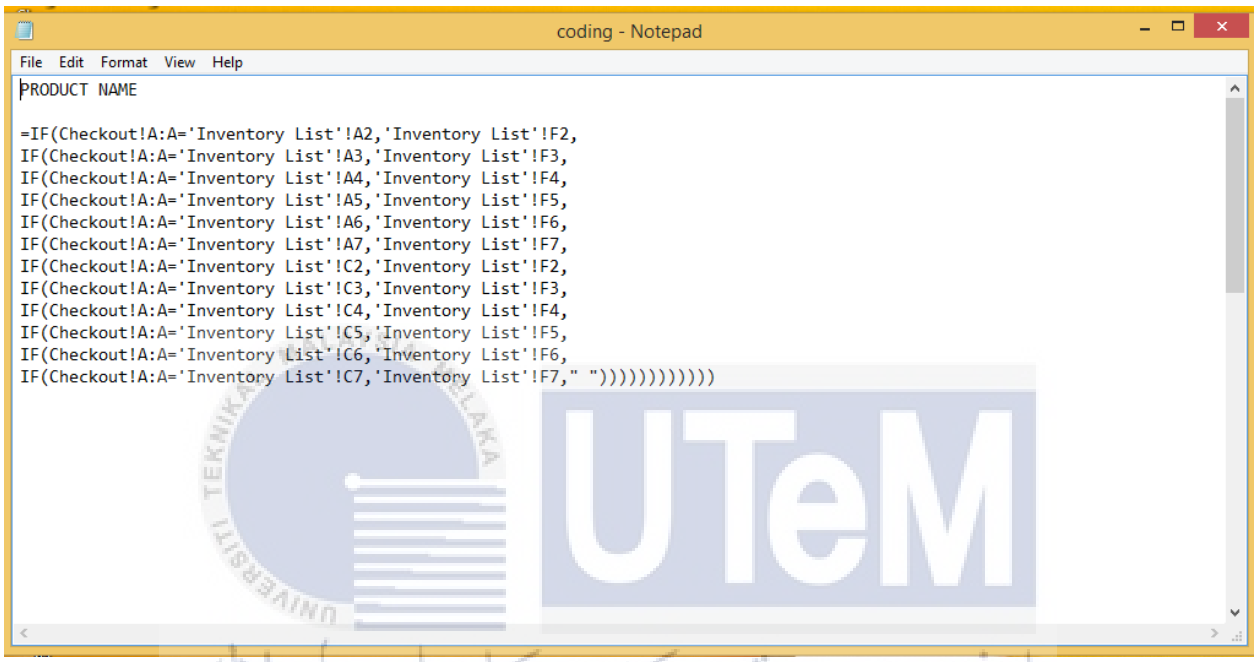


Figure 5.3.3 Codes used to calculate price

5.4 Implementation Status

The progress of development is done based on the Gantt Chart attached. The entire required component which include the planning, literature review, analysis, design and implementation has been done on time.

5.5 Conclusion

This phase describer the implementation way of the overall smart shopping card and in marks the end of completion of the system development and further to be continued is Testing Phase. The software used and each function on it clearly stated and the codes used in Microsoft Excel to generate the system is shown.

CHAPTER 6

TESTING

6.1 Introduction

This chapter involved in which the smart shopping cart is tested by the user and evaluated. Functions and compatibility of the system is ensured. This phase allows to measure strength and weakness of a specific system. User Acceptance Test also is part of this phase to revise the acceptancy of the user and all the requirements are functioning well. This chapter covers the detail of the testing that is ought to be carried out to tested the smart shopping cart.

6.2 Test Plan

There are two types of plan to test the system which is the Alpha Testing and Beta Testing. Alpha Testing requires Operating System Compatibility Testing and Software Compatibility Testing while Beta Testing involve User Acceptance Test.

- Operating System Compatibility Testing is done to test the version of the Microsoft office 2016 with Operating System of Windows 8.
- Software Compatibility Testing is done to test the most compatible software that can interact with the device used is contactless Near Field Communication (NFC) device and .xml file format is Read-a-Card which enable us to do some setting to make sure the flow of price is correct.
- User Acceptance Test is done to evaluate the most preferred functions of smart shopping cart by customer based on acceptance criteria such as interface, interactivity, navigation and user friendly.

6.2.1 Test User

The smart shopping cart is tested by the real user, ordinary customer.

6.2.1.1 Users of Smart Shopping Cart

Users of shopping complex consist from variety knowledge level in IT field. Some are expert, some moderate and some never touch the LCD Screen. The system is straight forward to user where they just scan the product and untick the checkbox if they want to remove the item. It should not be a burden for them to utilize it.

6.2.1.2 Test Environment

Test environment can categorized according to Alpha and Beta testing in smart shopping cart system.

- Operating System Compatibility Testing

  This test carried out by use the Microsoft Excel 2016 with laptop's Operating System, Windows 8. Once installed, some functions in Microsoft Excel is enable to check its functionality such as 'macros' and it works.

- Software Compatibility Testing

  This test carried out by install Go-to-Tags software which recommended by the NFC device user guide, unfortunately this software is not compatible for Window 8 and additional fees need to be paid for encoding wise. After tried use Read-a-Card software, it was easy to install and connect the device to .xml file. Even the settings in the software give options to choose .xml based file.

- User Acceptance Test

  This test involve by providing a manual which consist some question regarding the function the functions and the client need to utilize the system fully according by the provided use manual.

6.3 Test Strategy

Testing is done in this phase and chosen strategy were Alpha and Beta testing strategy. Alpha Test used during Operating System Compatibility Testing and Software Compatibility Testing. Beta Testing used during User Acceptance Test, this test perform by the real user whom going to use the system once implemented. These both strategies used in the testing phase.

6.4 Test Implementation

Test implementation included test description with test case for each module and test data covers real life data.

6.4.1 Test Description

Table 6.1 Test Description

Test Name	Test Case
Operating System Compatibility Testing	- Do Windows 8 compatible for installation of Microsoft Office 2016? - Can it enable the function of "macros" In Microsoft Excel 2016?
Software Compatibility Testing	- Do the software can be linked to excel output file? - Do the software enable Microsoft Excel perform certain task?
User Acceptance Test	- Have they try use smart shopping cart? - How they feel if this system implemented in real life?

6.4.2 Test Data

Table 6.2 Test Data

Test Name	Method	Explanation
Operating System Compatibility Testing	Test	Test the performance of Microsoft Office 2016 in Window 8.
Software Compatibility Testing	Test	Test the output in Microsoft Excel once linked with the software.
User Acceptance Test	Execute the system	Check the system according to the explanation in user manual.

6.5 Test Result and Analysis

This part will explain what the output for each testing made.

6.5.1 Operating System Compatibility Testing

Once installation done, the software can be accessed without error.

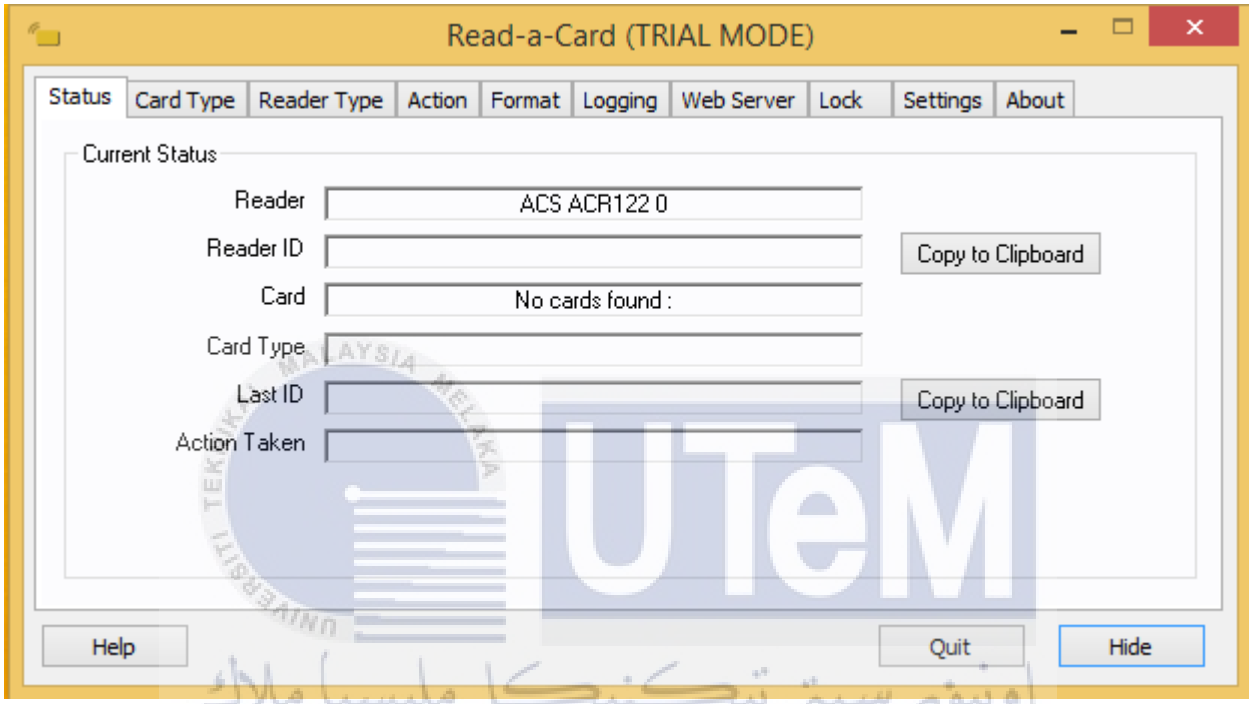


Figure 6.5.1 Access the system

6.5.2 Software Compatibility Testing

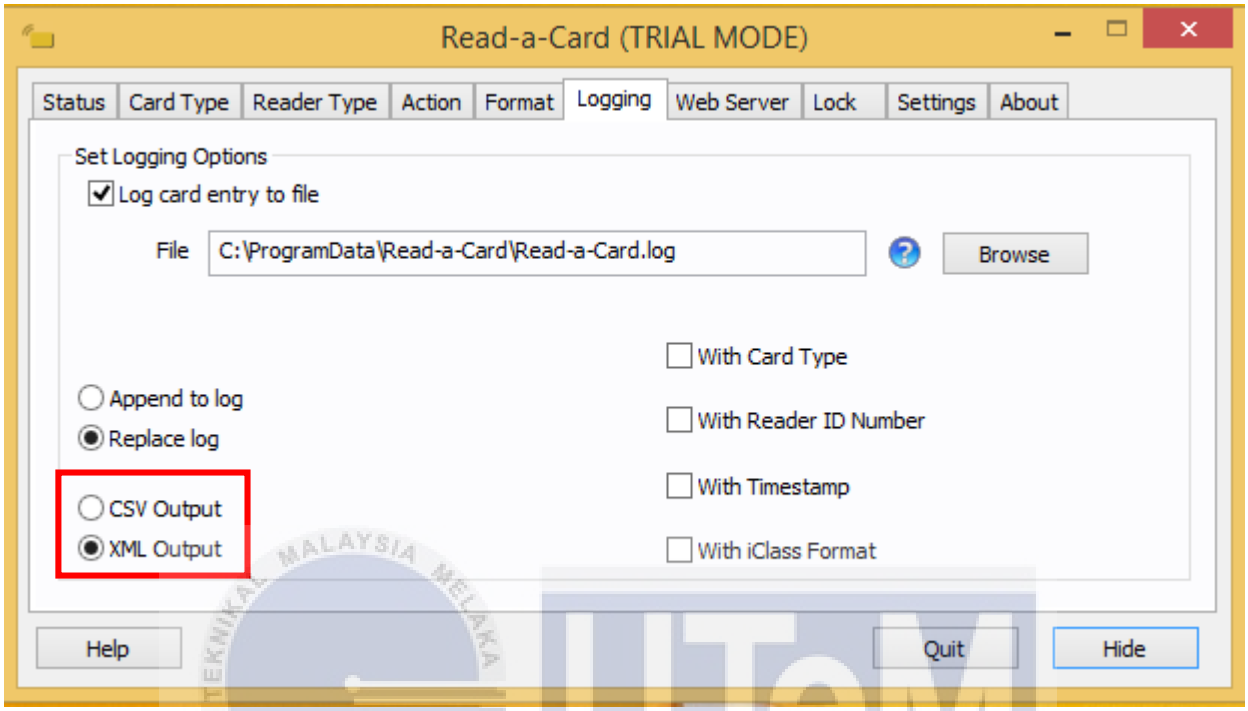


Figure 6.5.2 Produce XML output

6.5.3 User Acceptance Test

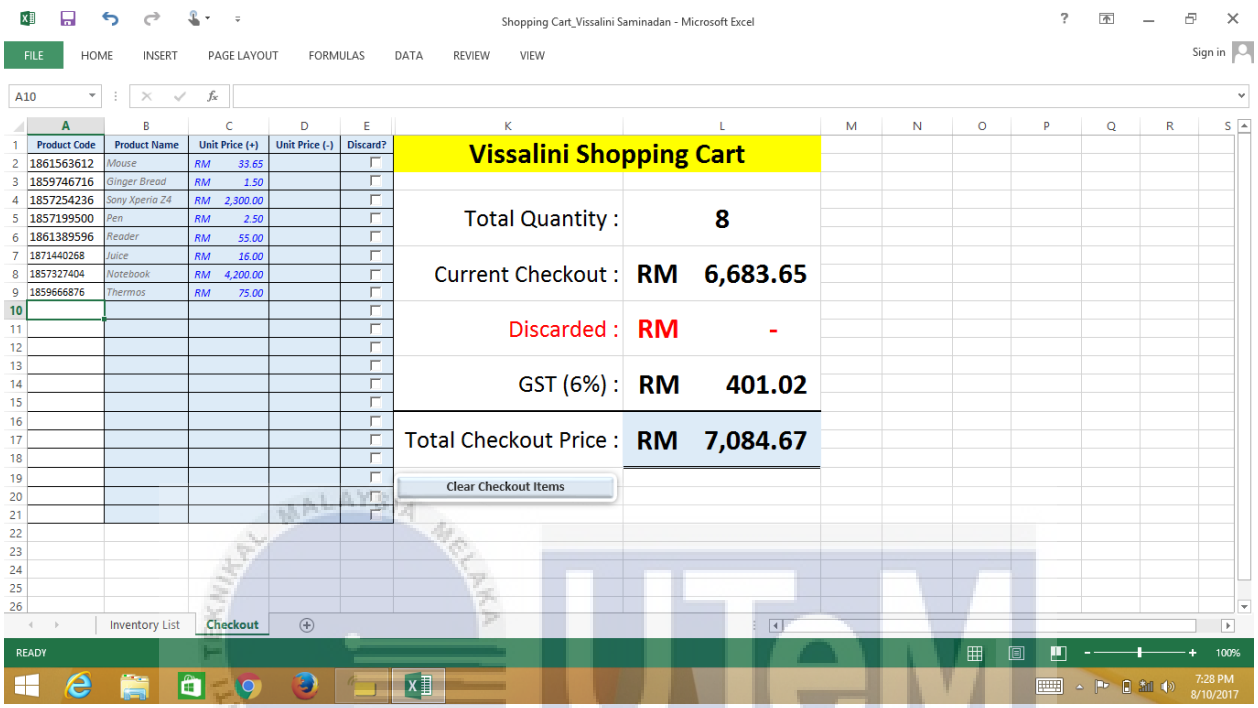


Figure 6.5.3 User scan product

Figure 6.5.3.1 User remove product manually

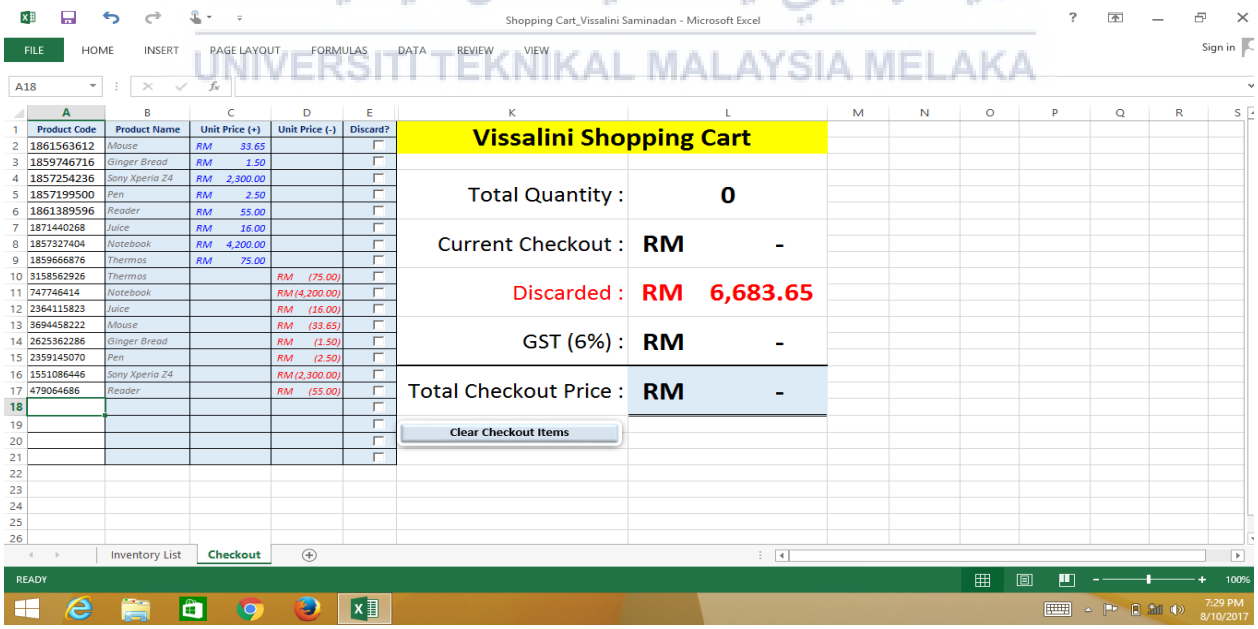


Figure 6.5.3.2 User remove product automatically

6.6 Conclusion

This chapter covers the testing that is further divided into two parts which are Alpha testing and Beta testing. There were two tests under Alpha testing and two tests under Beta testing. The next chapter discusses the overall conclusion of the thesis.

CHAPTER 7

CONCLUSION

7.1 Observation on weaknesses and strengths

By analyze the result of testing the system's strength and weakness of project has been identified and tabulated.

Table 7.1 Strength and weakness

Strength	• Customers can calculate the total amount of purchase while shopping. • Long queue at cashier can be avoided. • Check price easily if label on the product missed. • Procedure to execute the system is easy.
Weakness	• High cost for installation and maintenance. • System might get corrupted if device malfunctioned.

7.2 Propositions on improvement

This project is developed to improve the method of shopping by using smart shopping cart. Manual shop cart where there is only a trolley to fill up the items and long queue at the cashier for payment is a well-known method since few decades.

As the nation growing swiftly, people need more time for other beneficial stuffs. So, by introducing smart shopping cart, they can have the shopping process easily and bill payment can be done within a second along with avoid long queue in cashier. Unfortunately, the system developed is just to calculate total amount and remove price from the system if the customer take back the product, it could not search the accurate position of the thing which can make their finding products method easier. The do not need to go up and down in a complex just to find each product. Therefore, maybe in future, it is suggested that "Search Items" function to be developed and introduced to the user.

Moreover, currently developed system's interface not attractive. The interface and database are in the same file might confuse during retrieve data from database.

So the next level of update might be create an attractive and eye-catchy interface with adding-in some extra functions mentioned earlier, "Search Items" will be practical and usable by the customer.

7.3 Project Contribution

The project more useful for the user as the system is advanced and could make their job easier. Moreover, coming generation can reduce their time in shopping complex and invest more to achieve their life goal.

Developing a new and useful system for the Final Year Project embrace a thought in me as I am a well-trained UTeM's future graduate.

A good project is believed will give a great impact to the supervisor, faculty and university. Therefore, this project is expected to contribute positive changes in coming year.

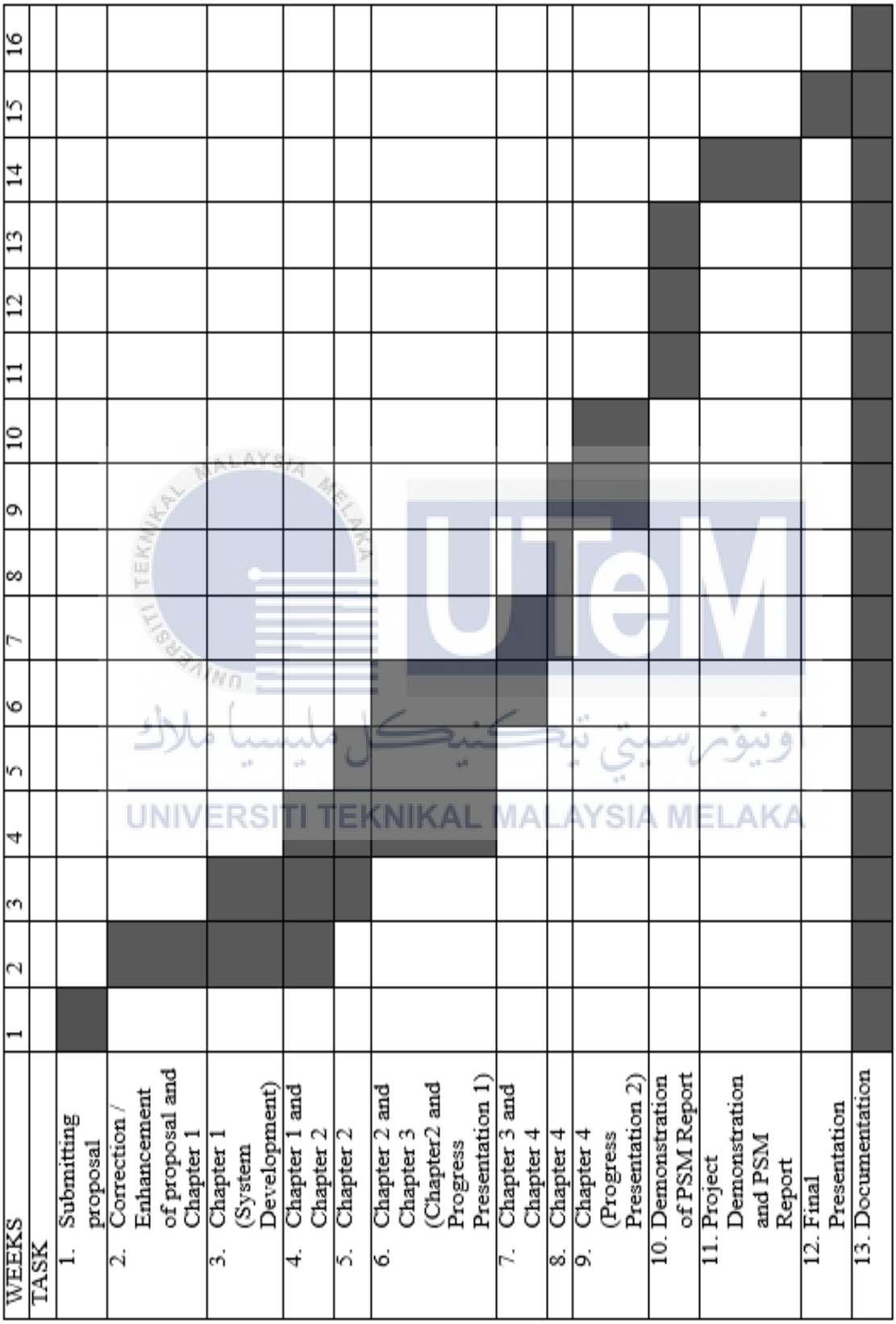
7.4 Conclusion

In a nutshell, the project have meet all the objectives stated in proposal and in introduction of the Final Year Project I's report. This project has enhanced the requirement of smart shopping cart should be implemented to improve.

References

1. Chandrasekar, P., & Sangeetha, T. (2015). Smart shopping cart with automatic billing system through RFID and ZigBee. *2014 International Conference on Information Communication and Embedded Systems, ICICES 2014*, 73–76. https://doi.org/10.1109/ICICES.2014.7033996
2. Dilip, G. P., Ganpat, S. M., Sunil, H. S., & Bhimrao, B. S. (2016). Intelligent Trolley for Automatic Billing in Mall Using Internet Server, *4*(1), 22–25.
3. Jayshree, G., Gholap, R., & Yadav, P. (2014). RFID Based Automatic Billing Trolley, *4*(3), 136–139.
4. Rajathi, G. (n.d.). Automated Smart Trolley with Smart Billing Using Arduino. Retrieved from www.ijraset.com
5. Rajeshkumar, R., Mohanraj, R., & Varatharaj, M. (2016). Automatic Barcode Based Bill Calculation by Using Smart Trolley, *6*(3), 2539–2542. https://doi.org/10.4010/2016.599

APPENDIX A: GANTT CHART



APPENDIX B: STORY BOARD

Database (Inventory List)

Product Code (+)	Transaction (+)	Product Code (-)	Transaction (-)	Condition	Product Name	Price Add (+)	Price Reduce (-)

System (Check Out)

Product Code	Product Name	Unit Price (+)	Unit Price (-)	Discard
				☐
				☐
				☐
				☐

Calculation

Vissalini Shopping Cart	
Total Quantity:	**0**
Current Checkout:	**RM -**
Discarded:	**RM -**
GST (6%):	**RM -**
Total Checkout Price:	**RM -**
Clear Checkout Items	

APPENDIX C: LOG BOOK

اونيۏرسيتي تيکنيکل مليسيا ملاك

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

FAKULTI TEKNOLOGI MAKLUMAT DAN KOMUNIKASI

LOG BOOK

BITU 3973

PROJEK SARJANA MUDA I

PROJECT TITLE

SMART SHOPPING CART FOR AUTO BILL CALCULATION USING NFC

SUPERVISOR'S NAME: DR. ZAHEERA ZAINAL ABIDIN

STUDENT'S NAME: VISSALINI A/P SAMINADAN

MATRIC NUMBER: B031510071

COURSE: 3 BITC

WEEK: 2

DATE	ACTIVITY	SUPERVISOR'S INITAL
22/2/17	- Discuss topic for Project with supervisor. - Research on internet regarding RFID and NFC.	DR. ZAHEERA ZAINAL ABIDIN *Pensyarah Kanan* Fakulti Teknologi Maklumat Dan Komunikasi (FTMK) Universiti Teknikal Malaysia Melaka (UTeM) Hang Tuah Jaya 76100 Durian Tunggal, Melaka, Malaysia

Supervisor's Comment

The task has been delivered as scheduled.

WEEK: 3

DATE	ACTIVITY	SUPERVISOR'S INITAL
27/2/17	- Submit proposal. - Supervisor advice on the error detected in the proposal.	
28/2/17	- Repair the correction and submitted to supervisor. - Supervisor approve the edited proposal.	DR. ZAHEERA ZAINAL ABIDIN *Pensyarah Kanan* Fakulti Teknologi Maklumat Dan Komunikasi (FTMK) Universiti Teknikal Malaysia Melaka (UTeM) Hang Tuah Jaya 76100 Durian Tunggal, Melaka, Malaysia
3/3/17	- Proposal submitted by the high committee of Final Year Project.	

Supervisor's Comment

The proposal has been prepared by Vissalini and she uploaded into the e-Repository.

WEEK: 4

DATE	ACTIVITY	SUPERVISOR'S INITAL
8/3/17	- Started with Chapter 1 Introduction to RFID and NFC Investigate how RFID and NFC works - Scope - Objective - Continue Chapter 1 thesis.	DR. ZAHEERA ZAINAL ABIDIN *Pensyarah Kanan* Fakulti Teknologi Maklumat Dan Komunikasi (FTMK) Universiti Teknikal Malaysia Melaka (UTeM) Hang Tuah Jaya 76100 Durian Tunggal, Melaka, Malaysia

Supervisor's Comment

The progress work on scheduled

WEEK: 5

DATE	ACTIVITY	SUPERVISOR'S INITAL
16/3/17	- Thesis writing for Chapter 2 and Chapter 3 (Learn how to use Mendeley) - Supervisor guide on how to write thesis in professional way. - Story board of system created.	DR. ZAHEERA ZAINAL ABIDIN *Pensyarah Kanan* Fakulti Teknologi Maklumat Dan Komunikasi (FTMK) Universiti Teknikal Malaysia Melaka (UTeM) Hang Tuah Jaya 76100 Durian Tunggal, Melaka, Malaysia

Supervisor's Comment

Good progress

WEEK: 6

DATE	ACTIVITY	SUPERVISOR'S INITAL
22/3/17	- Submit thesis of Chapter 2 and Chapter 3. - Supervisor checked and explain on the error. • Thesis writing of Literature Review • Thesis writing of Methodology	DR. ZAHEERA ZAINAL ABIDIN *Pensyarah Kanan* Fakulti Teknologi Maklumat Dan Komunikasi (FTMK) Universiti Teknikal Malaysia Melaka (UTeM) Hang Tuah Jaya 76100 Durian Tunggal, Melaka, Malaysia

Supervisor's Comment

Good progress.

WEEK: 8

DATE	ACTIVITY	SUPERVISOR'S INITAL
12/4/17	- Submit edited report of chapter 2 and 3. - Started with Chapter 4:- Analysis and Design - Development of system has started.	DR. ZAHEERA ZAINAL ABIDIN *Pensyarah Kanan* Fakulti Teknologi Maklumat Dan Komunikasi (FTMK) Universiti Teknikal Malaysia Melaka (UTeM) Hang Tuah Jaya 76100 Durian Tunggal, Melaka, Malaysia

Supervisor's Comment

Student shows good progress and determination to complete the chapter 2, 3 & 4.

WEEK: 9

DATE	ACTIVITY	SUPERVISOR'S INITAL
26/4/17	- Improvement of system from Chapter 1 to Chapter 4. - Thing to be improved:- • Use Mendeley • Elaborate more on Literature Review • Provide reference for each image from google. • State reference clearly for each chapter	DR. ZAHEERA ZAINAL ABIDIN *Pensyarah Kanan* Fakulti Teknologi Maklumat Dan Komunikasi (FTMK) Universiti Teknikal Malaysia Melaka (UTeM) Hang Tuah Jaya 76100 Durian Tunggal, Melaka, Malaysia
28/4/17	- Done correction of supervision by supervisor.	

Supervisor's Comment

Good progress.

WEEK: 10

DATE	ACTIVITY	SUPERVISOR'S INITAL
11/5/17	- Supervisor's comment on system. • Improve the function in the system. • Report need to be follow the correct format. • Create video for the system developed. • Provide Powerpoint during presentation.	DR. ZAHEERA ZAINAL ABIDIN *Pensyarah Kanan* Fakulti Teknologi Maklumat Dan Komunikasi (FTMK) Universiti Teknikal Malaysia Melaka (UTeM) Hang Tuah Jaya 76100 Durian Tunggal, Melaka, Malaysia

Supervisor's Comment

Good progress

WEEK: 11

DATE	ACTIVITY	SUPERVISOR'S INITAL
23/5/17	Final Presentation of Final Year Project I. Supervisor and evaluator evaluate the whole system and report.	DR. ZAHEERA ZAINAL ABIDIN *Pensyarah Kanan* Fakulti Teknologi Maklumat Dan Komunikasi (FTMK) Universiti Teknikal Malaysia Melaka (UTeM) Hang Tuah Jaya 76100 Durian Tunggal, Melaka, Malaysia

Supervisor's Comment

Good present.

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UNIVERSITI TEKNIKAL MALAYSIA MELAKA

FAKULTI TEKNOLOGI MAKLUMAT DAN KOMUNIKASI

LOG BOOK

BITU 3973

PROJEK SARJANA MUDA II

PROJECT TITLE

SMART SHOPPING CART FOR AUTO BILL CALCULATION USING NFC

SUPERVISOR'S NAME: DR. ZAHEERA ZAINAL ABIDIN

STUDENT'S NAME: VISSALINI A/P SAMINADAN

MATRIC NUMBER: B031510071

COURSE: 3 BITC

WEEK: 3

DATE	ACTIVITY	SUPERVISOR'S INITAL
18/7/17	- Meet supervisor to ask guide on report for PSM II. She explained well on how the report should be.	DR. ZAHEERA ZAINAL ABIDIN *Pensyarah Kanan* Fakulti Teknologi Maklumat Dan Komunikasi (FTMK) Universiti Teknikal Malaysia Melaka (UTeM) Hang Tuah Jaya 76100 Durian Tunggal, Melaka, Malaysia

Supervisor's Comment

The task has been delivered.

WEEK: 6

DATE	ACTIVITY	SUPERVISOR'S INITAL
3/8/17	- Thesis writing of Chapter 5 submitted. - Supervisor asked to repair the thesis and guideline for Chapter 6 and Chapter 7 given. - Demonstrate full system to supervisor.	DR. ZAHEERA ZAINAL ABIDIN *Pensyarah Kanan* Fakulti Teknologi Maklumat Dan Komunikasi (FTMK) Universiti Teknikal Malaysia Melaka (UTeM) Hang Tuah Jaya 76100 Durian Tunggal, Melaka, Malaysia

Supervisor's Comment

Student showed commitment and progressing well.

WEEK: 7

DATE	ACTIVITY	SUPERVISOR'S INITAL
17/8/17	- Meet supervisor and she asked for prepare a user manual and short summary of project report as it will be useful for juniors.	DR. ZAHEERA ZAINAL ABIDIN *Pensyarah Kanan* Fakulti Teknologi Maklumat Dan Komunikasi (FTMK) Universiti Teknikal Malaysia Melaka (UTeM) Hang Tuah Jaya 76100 Durian Tunggal, Melaka, Malaysia

Supervisor's Comment

Vissa shows a good progress and prepared the PSM report

WEEK: 8

DATE	ACTIVITY	SUPERVISOR'S INITAL
21/8/17	-Final presentation. Supervisor and evaluator evaluate the whole system and report.	DR. ZAHEERA ZAINAL ABIDIN *Pensyarah Kanan* Fakulti Teknologi Maklumat Dan Komunikasi (FTMK) Universiti Teknikal Malaysia Melaka (UTeM) Hang Tuah Jaya 76100 Durian Tunggal, Melaka, Malaysia

Supervisor's Comment

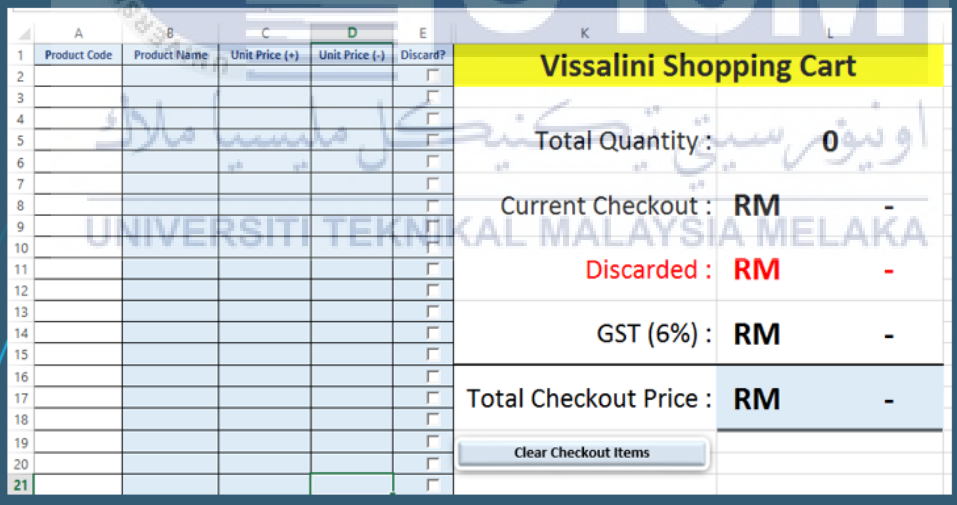
Vissa has performed and showed her project during presentation and submit the report.

APPENDIX D: USER MANUAL FOR USER ACCPENTANCE TEST

Objective

- To study the NFC based shopping cart at the shopping mall.
- To design automatic bill calculation interface for smart shopping cart.
- To implement the new bill calculation interface based on NFC for smart shopping cart system.

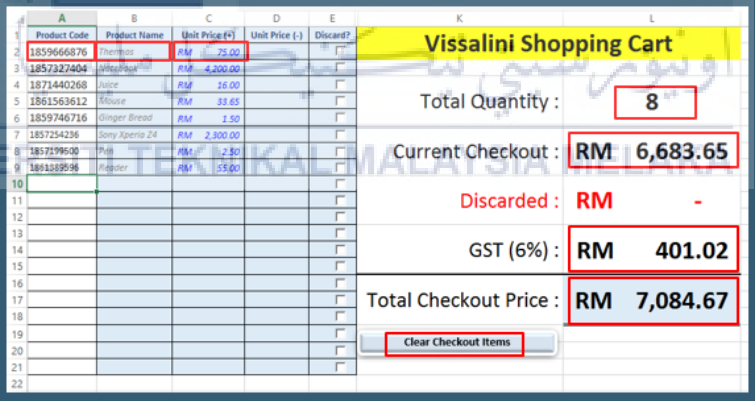
Overview of Design



How to Add Items?

- 1. Go to the "Checkout" screen.
- 2. Place cursor at the 1st box.
- 3. Scan tags attached to the items.
- 4. Click "Clear Checkout Items" once done purchase.

Add items



How to remove items manually?

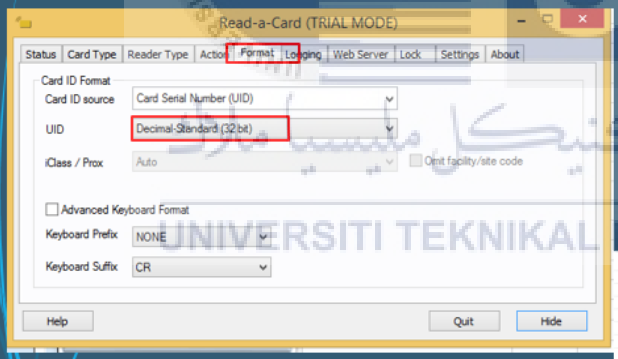
- 1. Go to the "Checkout" screen.
- 2. Place cursor at the 1st box.
- 3. Scan tags attached to the items.
- 4. "Tick" checkbox below the Discarded column according to the items.
- 5. Click "Clear Checkout Items" once done purchase.

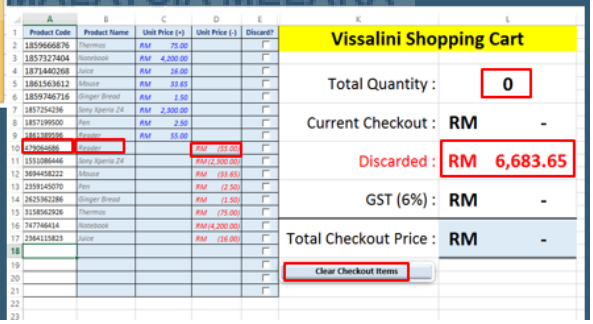
Remove Items (Manually)

How to remove items automatically?

- 1. Go to the "Checkout" screen.
- 2. Place cursor at the 1st box.
- 3. Scan tags attached to the items.
- 4. Go to Read-a-Card dialog box.
- 5. Go to Format tab and change UID to "Decimal-Standard(32)bit" format.
- 6. Go to the "Checkout" screen.
- 7. Scan again the tag from the unwanted items. System will automatically discard it.
- 8. Click "Clear Checkout Items" once done purchase.

Remove Items (Automatically)





APPENDIX E: USER ACCEPTANCE TESTING