PORTABLE STORE ASSISTANT

By

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FINAL REPORT

Submitted to the Electrical & Electronics Engineering Programme
in Partial Fulfillment of the Requirements
for the Degree
Bachelor of Engineering (Hons)
(Electrical & Electronics Engineering)

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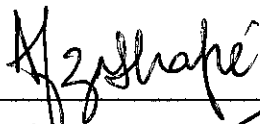# CERTIFICATION OF APPROVAL

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A project dissertation submitted to the
Electrical & Electronics Engineering Programme
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Approved:

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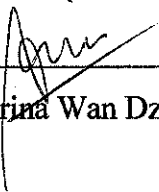Dr Afza Shafie
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TRONOH, PERAK

DECEMBER 2007

CERTIFICATION OF ORIGINALITY

This is to certify that I am responsible for the work submitted in this project, that the original work is my own except as specified in the references and acknowledgements, and that the original work contained herein have not been undertaken or done by unspecified sources or persons.

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Wan Sabrina Wan Dzulpakar

ABSTRACT

The portable store assistant (PSA) is a device to assist shopper with their shopping activities. It will also help to increase the efficiency in management of the store through the implement of service provided to customer. This device consists of a complete system that incorporates a barcode scanner, a display screen, database and wireless link to electronic point of sales. It provides self-scanning, running trolley totals, price checks and easy self-checkout. It will be able to scan the items that placed in the trolley, allowing the customers to pay without wasting time to queue at the checkout counters. This device will be attached to the shopping trolley and would be using a barcode scanner to scan the items and at the same time will display the price of the items at the screen. Wireless technology will be used to send the information from the device to the checkout counters. The customer no longer has to empty the trolley and place the individual products on the conveyor belt. The checkout prints the receipt as usual and the customer pays the amount shown. This will saves the checkout counter and the customer significant time and increase the efficiency of the shopping activities. A simulation of the system was successfully developed for this project.

ACKNOWLEDGEMENT

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LIST OF ABBREVIATIONS

Final Year Project @ Final Year Design Project	FYP
Portable Store Assistant	PSA
Electronic Point of Sales	e-POS
Personal Digital Assistant	PDA

CHAPTER 1

INTRODUCTION

1.1 Background of Study

This project involves development of a device that can assist shoppers with their shopping activities. Thus, it helps increase the efficiencies of the shop owner through improvement of services provided to the customers. The device provides self-scanning, running trolley totals, price checks and easy self-checkout.

This device will consist of three major components. The first component is the barcode scanner that will scan the items they wish to purchase. The second component is the display screen that will display the input from the barcode scanner. The price of the individual product appears on the display, along with the running total of the merchandise scanned. Lastly, the third component is the wireless communication where it will send the data to the checkout counter when the customer approaches the counter.

This project will consist of three major stages. The earlier stage will be on the research on the device and preparing the report. The second stage will be preparing the display screen and the programming code. The last stage will be developing the prototype and presentation.

1.2 Problem Statement

The conventional way of shopping is very time consuming to the customers. The time taken to queue and pay may sometimes take hours especially during the peak season. Customers also face difficulty to check the price of a good since some of the items do not have the price tags. This is particularly true for hypermarkets in Malaysia. In addition, some customers tend to lose track of their budget while carrying out their shopping activities.

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At the same time, the storeowner will have to provide a large number of checkout counters in order to reduce the queuing time. This implies that the owner will have to roster more staff at these counters, thus resulting in staffing problem in other aspects of the store operations. More often than not, customers tend to avoid doing their shopping activities if they need to wait a long queue.

One possible alternative to increase shopping time efficiency is the portable store assistant (PSA). With this device, the customer needs only to pay at the electronic point of sales (E - POS) thus reducing queuing time. In addition, it encourages environmentally friendly shopping activity since the shopper is given a choice to utilize shopping bags. Portable store assistant technology has transformed the industrial and manufacturing process, providing meaningful tracking and product quality information, and has transcended to retail stores to secure products from theft and ensure a more efficient inventory evaluation

1.3   Objective and scope of study

The primary objective of this project is to design a device to assist shopping activities. This device will incorporate an integrated system capable of quickly identifying products by their barcodes/tags and calculate the total purchase. The device can also reduce significant time at the checkout counter and increase the efficiency. This device will be suitable for all stores.

In order for flexibility and easy management of the shopping activities, PSA is a portable device that will be attached to the shopping trolley. A prototype of the device will be developed in this project. However, the prototype will only be the system and testing is limited to simulation and will make use of two computers.

CHAPTER 2
LITERATURE REVIEW

2.1 Current PSA

Portable store assistant is a system that can help customer to do their shopping activities. There are a few company that had been involve in design a system that can help in many ways the customers and the shop owners in this business.

The PSA enables the shop owner to communicate directly with customers as they shop and provide them with information specific to their location. Customers can also access online shopping lists created at home, offering them a unique sense of self-sufficiency. Using the cart-mounted solution, customers can view their purchase history or personal shopping lists highlighting items within their vicinity and the display is automatically updated as customers move from aisle to aisle. The solution allows customers to place special orders for photo, pharmacy, flowers and deli items in advance, and notifies them when their requests are ready. The IBM Personal Shopping Assistant enables customers to locate products in the store and scan items as they shop to keep a running tally in helping to make the shopping experience faster and more convenient. Through the use of loyalty cards, shop owners can tailor promotions to each consumer in real time. For example, when a user scans the card with the handheld scanner on the IBM Mobile Tablet for Retail, the system displays electronic coupons based on the customer's past purchases—helping to encourage additional purchases and repeat visits. Because customers can bag their items as they go, and access self-service pay stations, including IBM self checkout systems, they can bypass checkout lines and finish their shopping faster. Driving large baskets through self-service also offers the opportunity for retailers to reduce costs and streamline operations. [18]

2.2 Barcode

Barcodes have been widely used in many industrial products for automatic identification in data collection and inventory control purposes. It is well known that in many stores laser bar-code readers are used at check-out counters. Barcodes are simple visual representations of data which can be transferred to a computer via a barcode scanner. In modern society, barcodes are extensively used on most commodities. The barcode for a commodity is just like an identification number for a person. A barcode is a series of thick and thin parallel lines stamped on packages. Bar coding, is the most common ID technology that been used in the market. It is an automatic identification (Auto ID) technology that streamlines identification and data collection. The benefits of using Barcodes for automated data collection are very simple: speed and accuracy. Time after time, it has been proven that entering Barcode data is at least 100 times faster and more accurate than traditional manual keyboard entry, which translates into a dramatic increase in efficiency and productivity for any operation. [1]

Most barcode scanners are, however integrated with point-of-sale equipment and are thus not convenient for the customer to go to the cashier to check the price every time the items do not have the price tags. One way to overcome this problem is to plug the scanner to a computer such as a notebook or palm-top when on the move. This is cumbersome, as both the scanner and the computer have to be moved about. Moreover, the effective reach of the scanner is limited by the length of the cable linking it to the computer [3]

2.3 Display screen

The displays should be adjustable through a range that accommodates multiple users and work-stations, and provides adjustment to compensate for other miscellaneous variables such as glare. [10]

In many industrial, educational and simple menu applications, touch screens can be faster and more accurate than keyboards. There are a variety of technical approaches to touch screen terminals. The choice of technology will depend largely upon the

desired application. Touch screens are being used in the industrial and process control areas and as a training aid. [11]

The technology of touch screens is discussed with emphasis on the development of appropriate software and human factors. A touch screen was compared with an intelligent keypad in an experiment in which CEGB personnel controlled simulated plant. Users preferred the touch screen in normal conditions and particularly for emergency working. Touch screens are seen to possess many advantages over conventional man-machine interfaces. Their use is shown to be appropriate in applications such as alarm analysis, data and mimic selection and interactive graphics. [12]

2.4 Wireless Technology

Wireless communications is a fast-growing technology that enables people to access networks and services without cables. Deployment can be envisaged in various scenarios: different devices belonging to a single user, such as a mobile telephone, a portable computer, and a personal digital assistant (PDA), that need to interact in order to share documents; a user who receives email on a PDA; a shopping mall where customers display special offers on their PDAs; car drivers loading maps and other tourist information while driving on a motorway. All of these scenarios have become reality from a technological point of view, and successful experiments are being carried out around the world. The wireless approach shows many advantages but also has some disadvantages with respect to cabled networks. Mobility is clearly one of the major advantages of wireless with respect to cabled devices, which require plug-ing. Another advantage lies in the way new wireless users can dynamically join or leave the network, move among different environments, create ad hoc networks for a limited time, and then leave. Wireless networks are simple to deploy, and in some cases cost less than wired LANs. Nevertheless, the technological challenges involved in wireless networks are not trivial, leading to disadvantages with respect to cabled networks, such as lower reliability due to interference, higher power consumption, data security threats due to the inherent broadcast properties of the radio medium, worries about user safety due to continued exposition to radio frequency, and lower data rates.[17].

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Bluetooth is an industrial specification for wireless personal area networks (PANs). Bluetooth provides a way to connect and exchange information between devices such as mobile phones, laptops, PCs, printers, digital cameras, and video game consoles over a secure, globally unlicensed short-range radio frequency. Bluetooth exists in many products, such as phones, printers, modems and headsets. The technology is useful when transferring information between two or more devices that are near each other in low-bandwidth situations. Bluetooth is commonly used to transfer sound data with phones (i.e. with a Bluetooth headset) or byte data with hand-held computers (transferring files). [20]

Bluetooth simplifies the discovery and setup of services between devices. Bluetooth devices advertise all of the services they provide. This makes using services easier because there is no longer a need to setup network addresses or permissions as in many other networks. [20]

CHAPTER 3

METHODOLOGY

3.1 Procedure Identification

Figure 1 show the main flow chart of the method to undergo this project. It shows the basic procedure that will be done in the process of finishing this project.
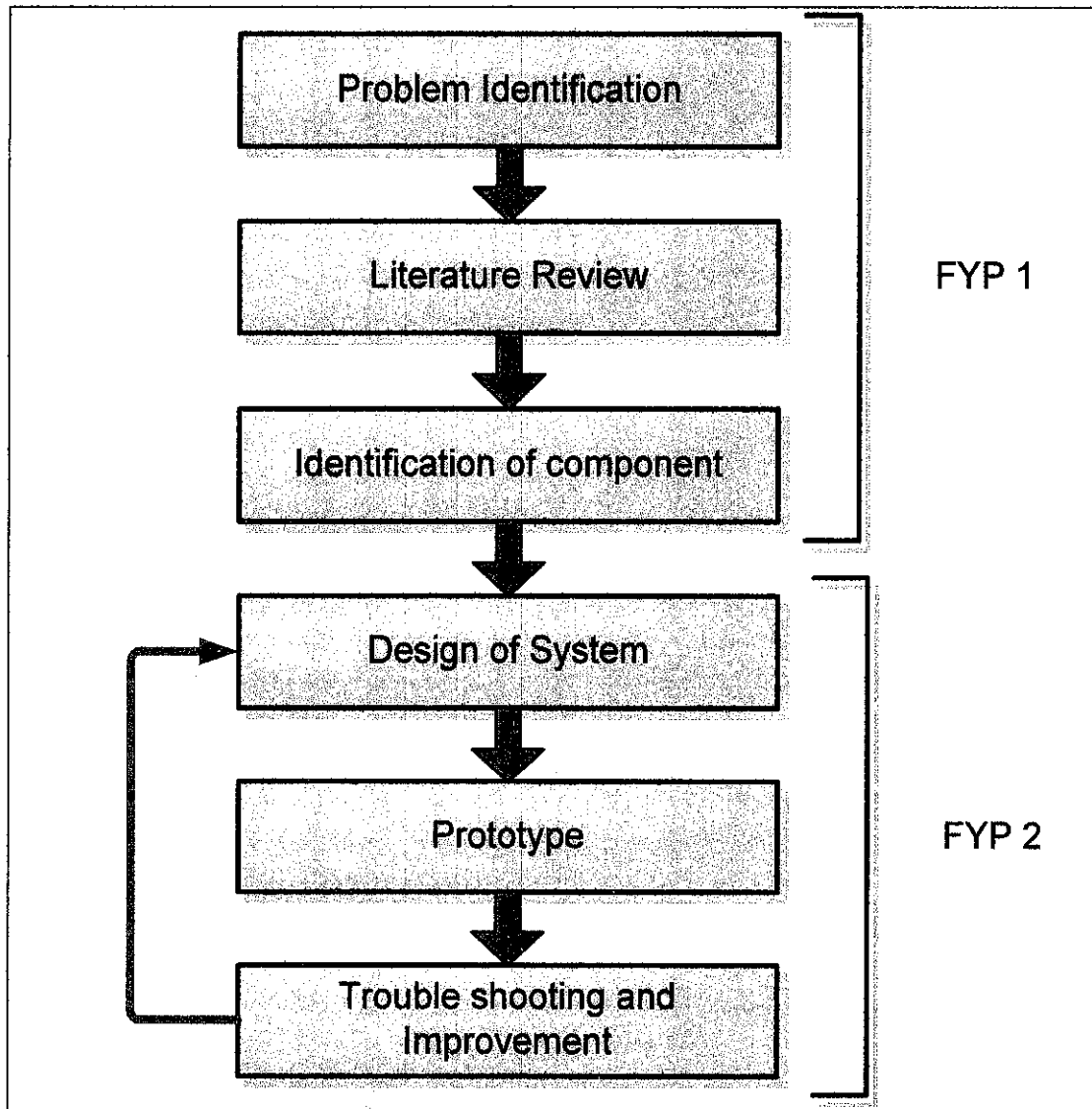
Figure 3.1: Methodology Flow Chart

The project starts with research and studies conducted based on journals, white papers books and articles obtain from both resource center and internet.

Simultaneously, the interface and the integration of all the part are done. Some try and error are done for the programming side as to create the best interface.

The barcodes scanned by the attached scanner will be send to the database to call the necessary function. At the same time, visual basic will interpret the barcodes and displayed them on the Liquid Crystal Display (LCD) panel. The LCD will be placed fixed on the trolley. The purpose of the display is to inform the user of items bought and the total value.

The systems features include:

- Identifying products by their barcode

- Displaying their price, as well as total value

- Displays the total number of items

- Wirelessly send signal to the cashier as the trolley approach the checkout counter

3.1.1 Barcode Scanner/Reader

Figure 3.2: Barcode scanner/reader

Barcode readers, or scanners, come in a variety of sizes, shapes, and prices. The most familiar bar code scanner is the checkout scanner used in many grocery stores. This scanner uses a helium neon laser. This barcode scanner is a portable scanner as it will be attached to this device.

A barcode is a self-contained message with information encoded in the width of bars and spaces in a printed pattern. Since barcodes are used with computers, binary code is used. Essentially, the black bars and white spaces represent ones and zeros - the language computer understand.

In their simplest form, barcodes are read by sweeping a small spot of light across the printed barcode symbol by a barcode scanner. The sweep starts at the white space before the first bar, continues past the last bar and ends in the white space which follows the last bar. Because a barcode cannot be read if the sweep wanders outside the symbol area, bar heights are chosen to make it easy to keep the sweep within the bar code area. The longer the information to be coded, the longer the barcode is. As the length increases, the height of bars must be increased to allow for more wandering during reading. [8]

3.1.2 Display mode controller: Enables user to interface with database

The display mode controller will be a physical switch that enables the user to see the total value of the items in the trolley, its list of items, etc. The functions themselves can be easily programmed on the visual basic software, to which the display mode controller will connect.

3.1.3 LCD or Touch screen Display

A typical touch screen input system is basically an input device like a mouse or track pad. A touch screen system is made up of a touch sensor, a controller card, and a software driver. The touch screen is an input device, so it needs to be combined with a display and a PC or other device to make a complete touch input system. Once the software driver for the touch screen is installed, the touch screen emulates mouse functions. Touching the screen is basically the same as clicking the mouse at the same point at the screen. Touch screen systems are being used in a variety of applications, including point-of-sale systems, public information displays, industrial control systems, and more. [19]

The item information is displayed to the user with the use of an LCD display. The LCD will be placed fixed on the trolley. The purpose of the display is to inform the users the total purchase and items that have been purchased. This LCD display is a touch screen display. It will be a user-friendly display.

3.1.4 Bluetooth

The key features of *Bluetooth* technology are robustness, low power, and low cost. *.Bluetooth* enabled electronic devices connect and communicate wirelessly through short-range. Bluetooth is an unlicensed wireless communication. *Bluetooth* technology is designed to have very low power consumption. Bluetooth can have a range of up to 1 meter or 3 feet that will enable only the trolley that approaching the checkout counter be detected. [6] This technology is the most suitable wireless technology for this project because of the short range of detection and low power consumption. Low power consumption is most needed as this will be a portable device.

3.2 Tool Required

Since the Microsoft Visual Basic Software is available at home and have more features, some practice on using the software will be done to familiarize with the functions. The Microsoft Visual Basic Software is used to prepare the layout/interface of the display. The visual basic software also provides the database system. The database for all the items will be documented into the system where it is first been generated using Microsoft Access. Each time the items been scan, the device will search the information from this database system. A barcode scanner/reader also needed in this project. This will be the device that will scan the barcode of the items and call the information from database to be showed at the display. The display will be using the LCD. The LCD will be a touch screen display. A Bluetooth transmitter also needed to transmit the data from PSA to the checkout counter. The customers will interact with the system through this display. After finish shopping, the customer will only need to approach the checkout counter and the Bluetooth transmitter will send the total to the checkout counter via Bluetooth. Figure 3.3 shows the basic design for this device incorporates all the equipment mention earlier.
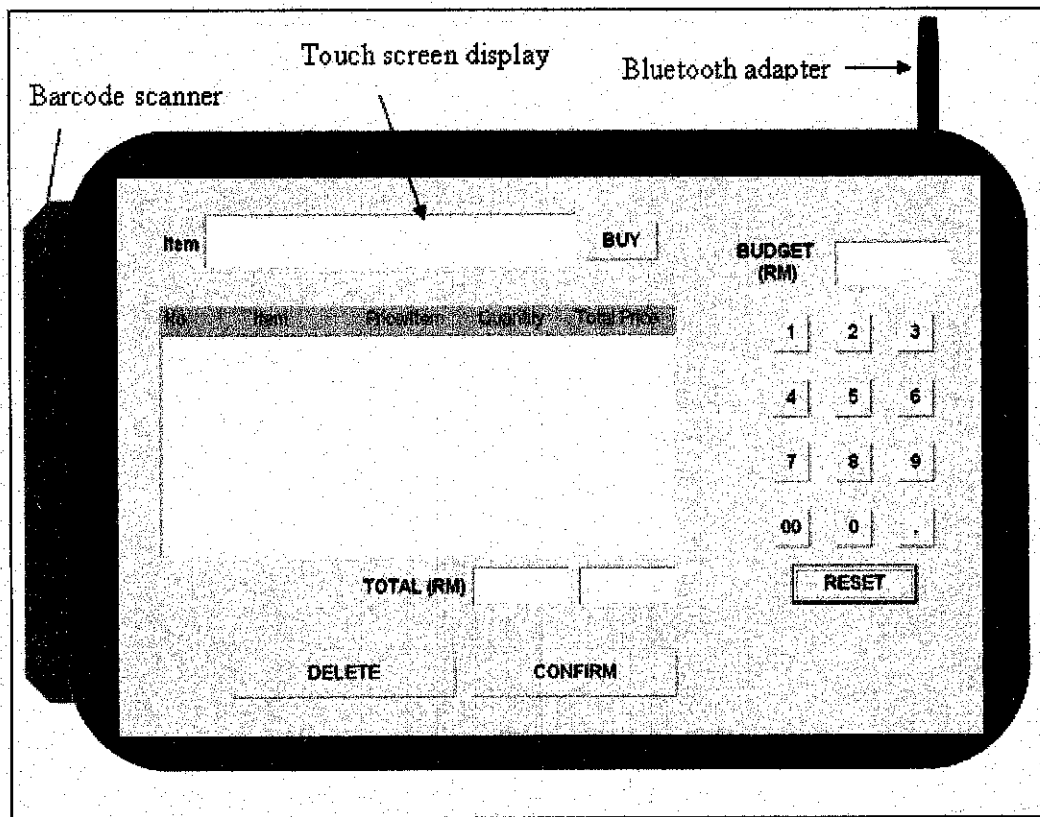
Figure 3.3: The basic prototype design of the PSA

3.3 Gantt Charts

Two Gantt charts for the development of the project in Semester 1 and Semester II are given in Appendix B respectively. Initially, the project started with research and brief analysis based on books, journals, technical papers, previous student's reports, thesis and articles obtained from both the Information Resource Centre and internet. Also, some interviews and consultation sessions were held with the lecturers and related personnel on the project overview. The full understanding of the system is essential to get the brief overview of the equipment and software needed. The familiarization of the Visual Basic 6 software will be done by using online tutorials, reference books and self-attempt. Next, the database is built in the Microsoft Access. After getting the basic system to work, the project will be finalized and further enhancement will be implemented.

CHAPTER 4

RESULTS & DISCUSSION

The main objective of this project is to have a system that can assist shoppers with their shopping activities. This project is also to help increase the efficiencies of the shop owner by doing improvement of services provided to the customers.
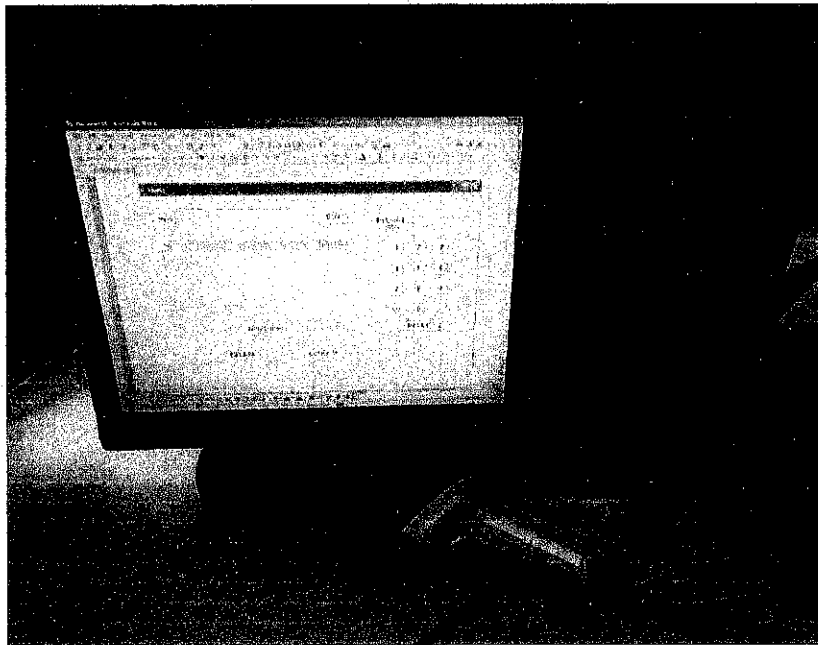
Figure 4.1: Basic equipment in the system

The planning is to install the system on trolley. The price of the individual product appears on the display, along with the running total of the merchandise scanned. Moreover, the owner needs not to put the price tags on the products, as it can be check using this device. When placing more than one unit of a single product into the trolley, the enter key on the shopping list adds them up. Should the customer decide to buy less, the delete key is used to remove items from the list. This makes it easy to keep track of costs, for instance, when shopping for a big party. A further advantage is that customers no longer have to place every item on the conveyor belt at the

checkout. Additionally, the customer has the benefit of seeing their total purchase while shopping. The benefits of portable store assistant;

Benefits to the shop owner include:

- No requirement for putting price tags on the products

- Increase the customer satisfaction and thus customer loyalty

- Saves the checkout counter significant time and increase the efficiency

- Better customer service as a result of shopping lists and self-scanning functions

Benefits to the customer include:

- Self-scan their products

- More rapid check-out process, since the products no longer have to be removed from the trolley and placed on the conveyor belt

- Running total on a screen onboard the cart

Figure 4.1 show the general communication between the PSA and the main system. The e-POS is basically the checkout counter. Whenever the PSA near the e-POS, Bluetooth connection will connect the PSA and the e-POS. PSA will send the information to the e-POS. the e-POS will update with the database system of the store to keep track of the item been bought and stock available in the store. This can be monitor by the store management.
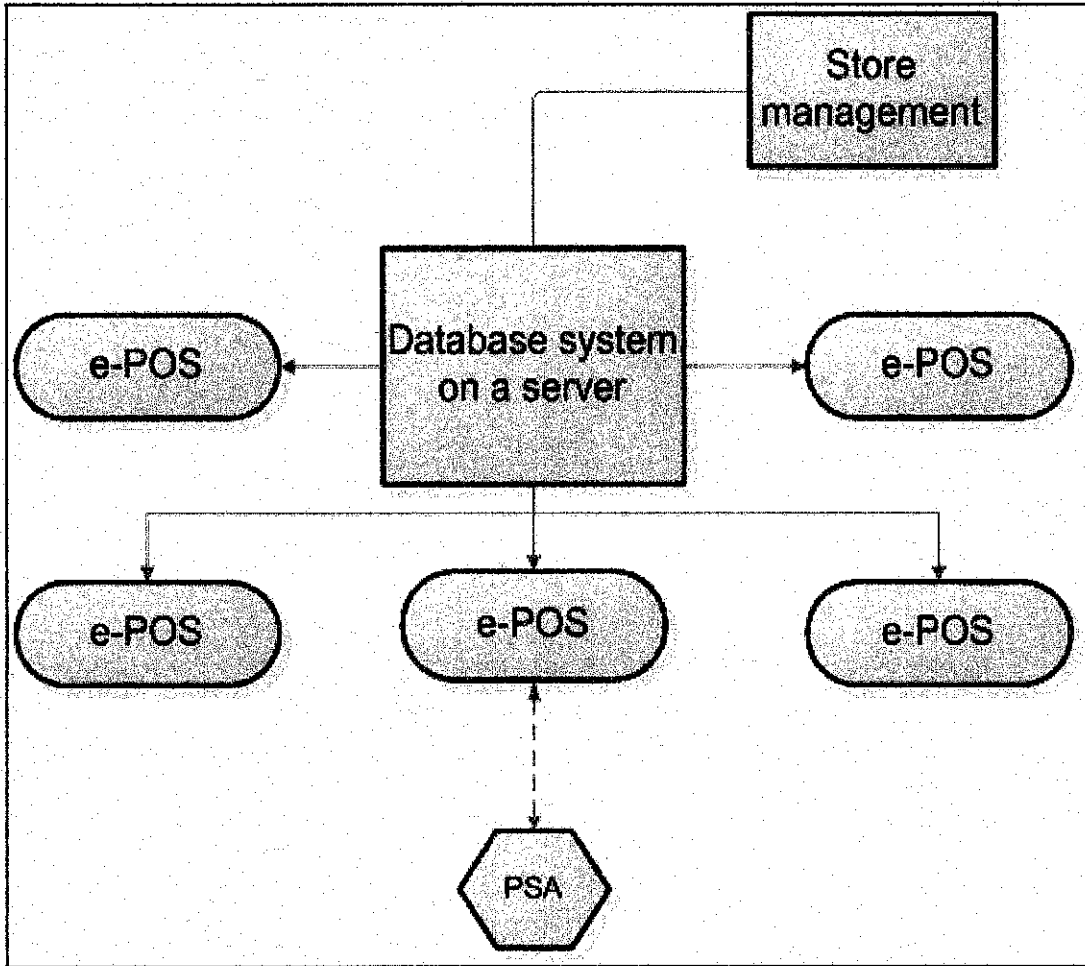
Figure 4.2: Overview of the system at the store
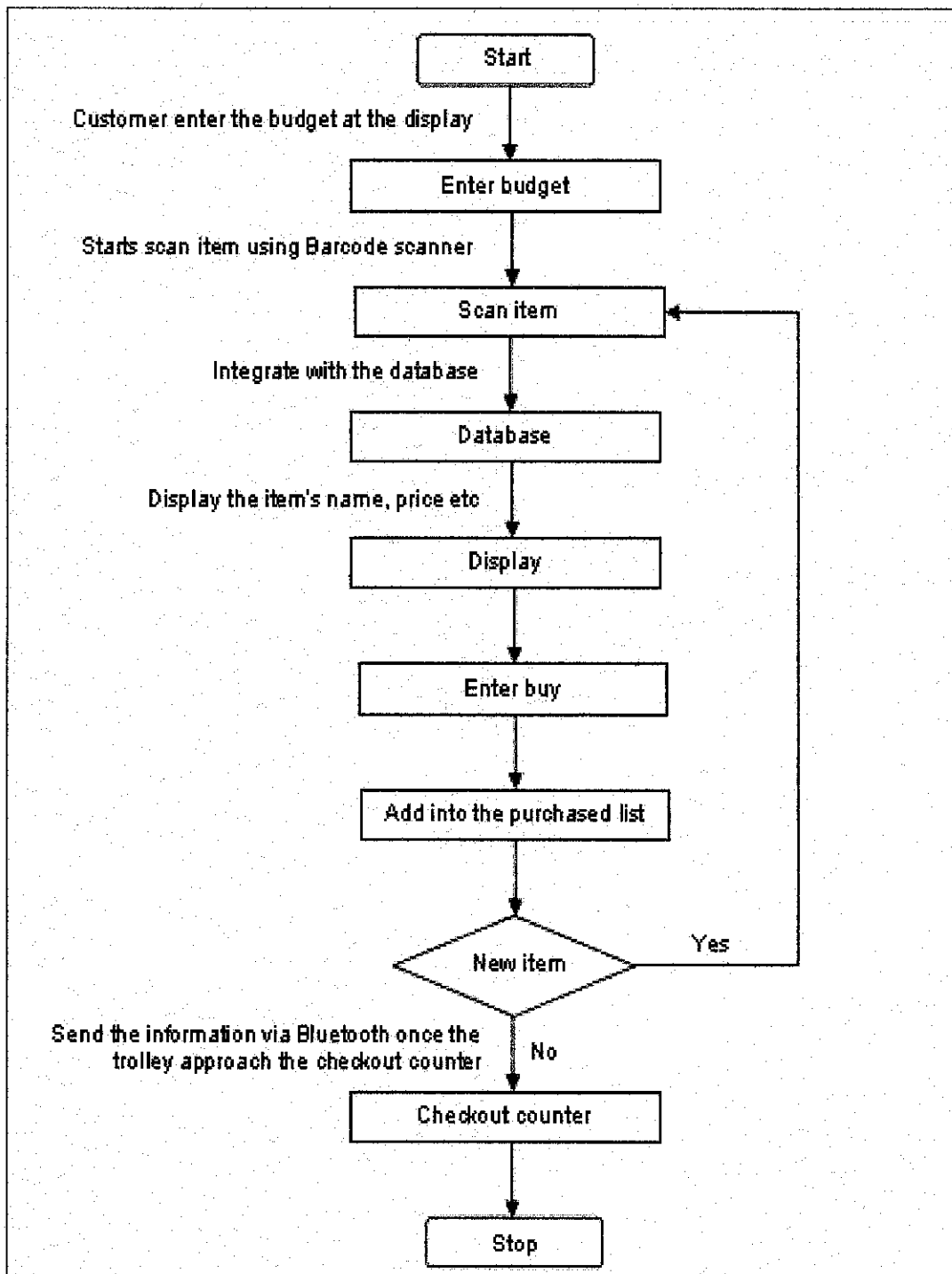
Figure 4.3: Framework of the PSA

Figure 4.3 show the frame work of the system that is the main elements in completing the system. The working principle of the bar code reader is related to the database. The data will be scanned into the reader. Then, it will be imported into the databases. The item information will be display to the user with the use of an LCD display. The main purpose of the display is to inform the user of items purchased and the total purchase. The customers also can key-in their budget trough the display.

Previously, the display only show the basic information that need to be display. The display can show at most 50 items. But only 5 items will be display at one time, the customers need to scroll down or up to see the rest of the items that have been bought.
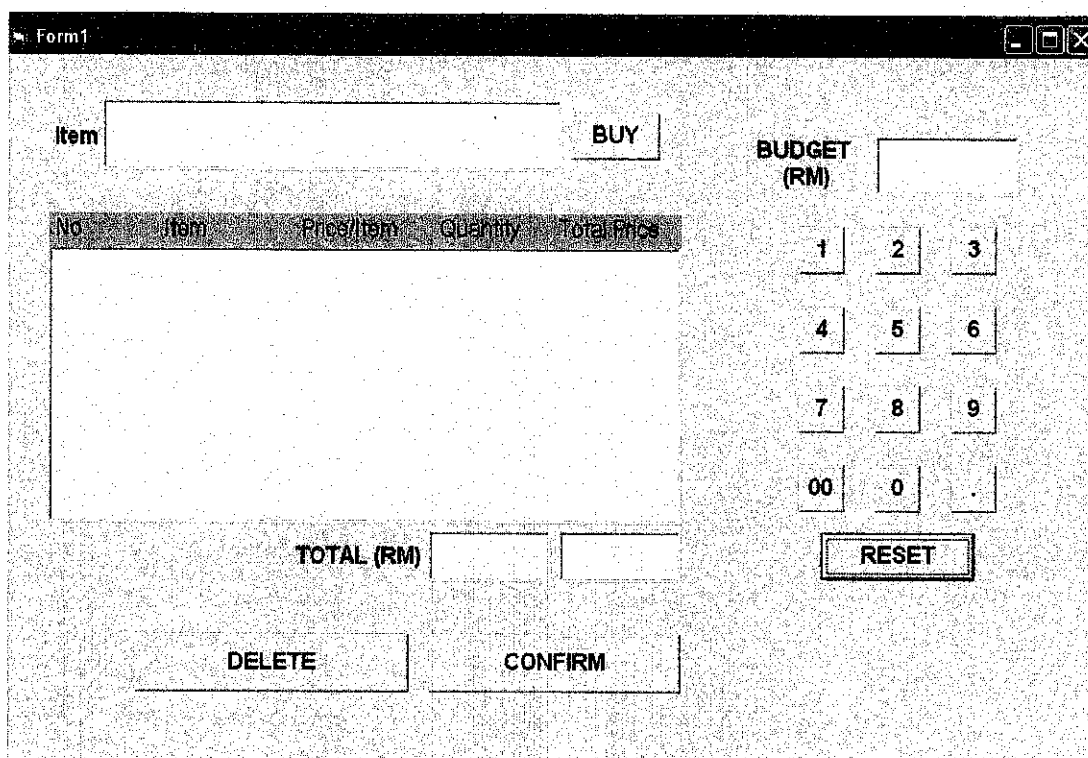
Figure 4.4: Basic display of the device

The interface has been improved since the pervious one doesn't have the function to key in the budget. All the other function is still the same as the previous one.

In Figure 4.4, at the upper left of the display, there is a box and a buy button. The box will display the items scanned together with the price of the items. If the customer wants to buy the items, the customers need to press the buy button. The items will then be entering into the box below. The box in the middle will automatically calculate the total purchase of the items taken. It will also show price per items, quantity if each item taken, and lastly will calculate the total purchase for every thing.

Figure 4.5 show where the customer can enter their budget. There will be a box for the customer to put their budget for that particular time. If the total purchases exceed the budget, an alarm will be put on as shown in figure 4.6.This to make sure that the customer will be alert of their budget. If the customer want to delete any of the item, the customer just need to click the particular item and then press the reset/delete

button.

A barcode scanner had been borrowed from the EE department. Some testing had been done and the database is prepared by using the coding from the barcode scanned. Basically, the table shown below is the database that has been prepared using Microsoft Access. Every time the users scan an item, the system will search the code at this database and will display the price of the item. The number of item shown is the total item that still available in the store. The code below is the code that been scan from a few items for this project.

Table 4.1: Example database from Microsoft Access

Database					
ID	Code	Item	Price/Item	Number of Item	Total price
1	9316434264910	Pasta	3.50	1	$3.50
2	9310055615021	Breakfast cereal	2.00	1	$2.00
3	9555050308541	Instant noodle	1.00	1	$1.00
4	9555125613082	Pen	2.90	1	$2.90
5	9556277300714	Jelly 3 in 1	2.70	1	$2.70

The display below shows that, when the person clicks on the number, the number will appear at the above box. So that, the total budget will crosscheck with the budget the person had key in.
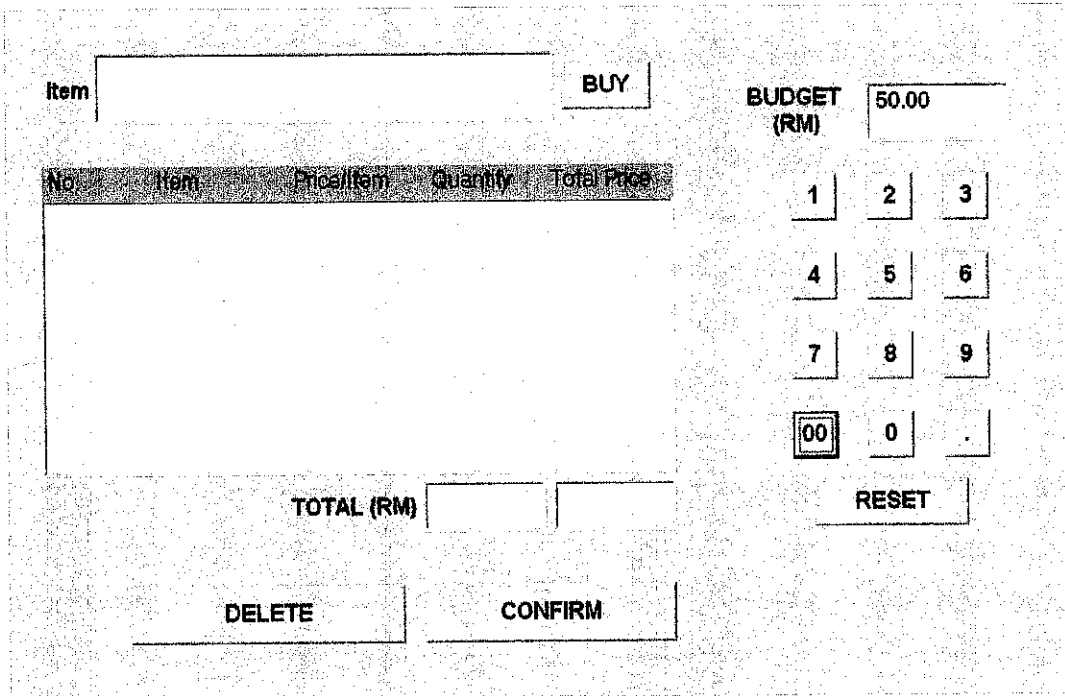
Figure 4.5: After a budget been entered
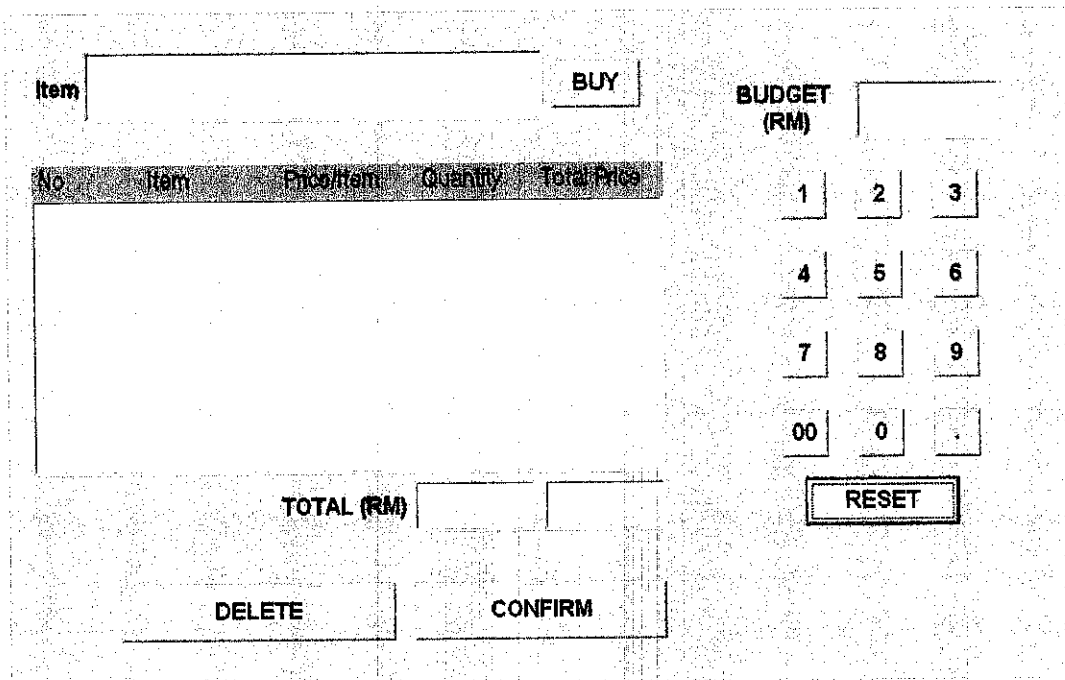
Figure 4.6: When the reset button is press

| Item | Granola Bar - NV | 12.99 | | BUY | | BUDGET (RM) | 60.00 |

No.	Item	Price/Item	Quantity	Total Price
2	Corn Flakes - Kllg	5.95	1	5.95
3	Simplot Hash Brown	5.99	1	5.99
4	Figo Golden Fish C	3.99	1	3.99
5	San Remo Vegeroni	3.90	1	3.90
6	Cloud 9 - J&J	4.50	1	4.50
7	Sunquick	8.50	1	5.99
8	Marina Chilli Tuna	3.95	1	3.95
9	Life Chilli Sauces	2.55	1	2.55
10	Gardenia	2.00	1	2.00
11	Sunsweet Pitted Prunes	3.50	2	7.0(

TOTAL   12   58.81

1 2 3
4 5 6
7 8 9
00 0 .
RESET

DELETE   CONFIRM

Figure 4.7: Item been inserted into the table

| Item | | | | BUY | | BUDGET (RM) | 50.00 |

No.	Item	Price/Item	Quantity	Total Price
2	Corn Flakes - Kllg	5.95	1	5.95
3	Simplot Hash Brown	5.99	1	5.99
4	Figo Golden Fish C			
5	San Remo Vegeroni			
6	Cloud 9 - J&J			
7	Sunquick			
8	Marina Chilli Tuna			
9	Life Chilli Sauces			
10	Gardenia			
11	Sunsweet Pitted Prunes	3.50	2	7.0(

Warning! ☒

⚠ Your item is more than your budget

OK

TOTAL   12   58.81

1 2 3
4 5 6
7 8 9
00 0 .
RESET

DELETE   CONFIRM

Figure 4.8: A warning box appear whenever the total price is more than the budget

CHAPTER 5

CONCLUSION & RECOMMENDATION

5.1 Conclusion

As a conclusion, the project is successfully developed. Although the programme is developed on the computer, the basic function of this system is successfully developed.

Using this system, the time needed by the customer in their shopping activities had been effectively reduced. The system will help the customer in saving the time until 40% of the total time taken by the customer to check the price of the item if the item does not have a price tags and the time taken to queue for paying.

This system is most practical implementation at hypermarket where most of the time lot of item will be purchase. This also best applicable for large quantities of purchasing and during the peak period of shopping for example during lunch time and after working hours.

5.2 Recommendation

The recommendation for upgrading the system is to develop/build the device by using hardware that is portable for example a touch screen, attached barcode scanner. By preparing the prototype, the student can try it to the shop for real implementation.

In addition, the system also can be implemented by replacing the barcode scanner with RFID. Although this technology is not that practical in supermarket as most of the item will be thrown away. The RFID is a new technology so the tagging for this is quite expensive. Furthermore, most of the item in supermarket is using the barcode tagging.

Other recommendations for improvement of the system are to incorporate a debit credit or the ATM card. By using the card, we can identify each user that makes use of the system/device. Furthermore, this facility will allow the customers to automatically pay for the goods at the checkout counter, without the need for the cashier to be there. Besides that, this facility may also be incorporated together with the MyKad.

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APPENDICES

APPENDIX A   CODING IN VISUAL BASIC

APPENDIX B   GANTT CHART

APPENDIX A
CODING IN VISUAL BASIC

```vb
Option Explicit    'general declaration
Dim text As Integer
'Dim dbTablecubaan As Database
'Private db As Database      'actual databse connection
'Private ws As Workspace     'used to connect to databse
'Private fl As File          'used to check for file existence
'Private td As Tabledef      'used to create tables

Private Sub cmdDelete_Click()
    'if an item is selected then delete it
    If List1.ListIndex <> -1 Then
        Call List1.RemoveItem(List1.ListIndex)
    End If
End Sub


Private Sub Command1_Click()
Text3.text = Text3.text & "1"   'when the button is press, the text box will show
the value
End Sub


Private Sub Command10_Click()
Text3.text = Text3.text & "00"
End Sub


Private Sub Command11_Click()
Text3.text = Text3.text & "0"
End Sub


Private Sub Command12_Click()
Text3.text = Text3.text & "."
End Sub


Private Sub Command14_Click()
Call List1.AddItem(Text4.text)   'Digunakan untuk memasukkan item pada txt4
kepada list1
Text4.text = ""
Dim I
 List1.Clear
   For I = 0 To Text4.ListCount - 1
     If Text4.Selected(I) Then
         List1.AddItem Text4.List(I)
     End If
   Next I
End Sub


Private Sub Command15_Click()
If Text1.text & Text1.text > Text3.text Then
        MsgBox "Your item is more than your budget", 48, "Warning!"
End If
End Sub
```

```vb
Private Sub Command18_Click()
Text3.text = " "       'when the button is press, the text box will delete all the value
End Sub

Private Sub Command2_Click()
Text3.text = Text3.text & "2"     'when the button is press, the text box will show
the value
End Sub

Private Sub Command3_Click()
Text3.text = Text3.text & "3"     'when the button is press, the text box will show
the value
End Sub

Private Sub Command4_Click()
Text3.text = Text3.text & "4"     'when the button is press, the text box will show
the value
End Sub

Private Sub Command5_Click()
Text3.text = Text3.text & "5"     'when the button is press, the text box will show
the value
End Sub

Private Sub Command6_Click()
Text3.text = Text3.text & "6"
End Sub

Private Sub Command7_Click()
Text3.text = Text3.text & "7"
End Sub

Private Sub Command8_Click()
Text3.text = Text3.text & "8"
End Sub

Private Sub Command9_Click()
Text3.text = Text3.text & "9"
End Sub

Private Sub List1_Click()
Dim cnnDb As New ADODB.Connection
Dim varInvNo As Long

Sub Main()
    'change into the project directory
Set db = App.Path & "\tablecubaan.mdb"

'open the database
cnnDb.Open "Provider = Microsoft.Jet.OLEDB.4.0;" _
& "Data source = tablecubaan.mdb"
```

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```vb
MsgBox ("Connection is now open")

'load the main form
frmtablecubaan.Show 1

'close the database
cnnDb.Close
MsgBox ("Connection is now closed")

Dim Number
While Number <= 50
   Number = Number + 1
Loop
{
Dim total As Integer
Dim check As Integer
Dim num1 As Integer
check = Me.bindingcontext().Count
For I = 0 To check - 1
  num1 = datagrid1.Item(Column, I)
  total = total + num1
Next I
datagrid1.Item(Column, check) = total
}
End Sub


Private Sub Text1_Change()
If Text1.text & Text1.text > Text3.text Then
        MsgBox "Your item is more than your budget", 48, "Warning!"
End If
End Sub


Private Sub Text3_KeyPress(KeyAscii As Integer)
Text3.text = " "
If KeyAscii < 48 Or KeyAscii > 57 Then KeyAscii = 0
'MsgBox "Enter The Value", vbCritical
End Sub


Private Sub Text4_Change()
Text4.SetFocus
'Set dbTablecubaan = OpenDatabase("C:\tablecubaan.mdb")
'Show
'Print dbTablecubaan.Name & "has been opened " & Error(Err)
End Sub
```

APPENDIX B
GANTT CHART

TABLE 1: Gantt chart for Final Year Project I

No.	Detail/ Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	Selection of Project Topic															
2	Preliminary Research Work															
3	Submission of Preliminary Report								B							
4	Literature review								R							
5	Submission of Progress Report								E							
6	Identification of components								A							
7	Familiarization of the software								K							
8	Test & build software															
9	Submission of Interim Report Final Draft															
10	Oral Presentation															

TABLE 2: Gantt chart for Final Year Project II

No.	Detail/ Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
1	Test & build software																	
2	Submission of Progress Report 1																	
3	Compile hardware & software												B					
4	Submission of Progress Report 2												R					
5	Poster Exhibition (pre-EDX)												E					
6	Submission of Dissertation (soft cover)												A					
7	Submission of Technical Report												K					
8	Oral Presentation																	5th Dec
9	Submission of Project Dissertation (Hard Bound)																	21st Dec