REFRIGERATOR TEMPERATURE MONITORING USING RFID

NOR HANIM BIN ABD AZIZ

ELECTRICAL & ELECTRONICS ENGINEERING
UNIVERSITI TEKNOLOGI PETRONAS

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FINAL PROJECT REPORT

Submitted to the Electrical & Electronics Engineering Programme
in Partial Fulfillment of the Requirements
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Universiti Teknologi Petronas
Bandar Seri Iskandar
31750 Tronoh
Perak Darul Ridzuan

CERTIFICATION OF APPROVAL

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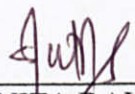
Approved by,



(MS. HANITA DAUD)
(Project Supervisor)

UNIVERSITI TEKNOLOGI PETRONAS

TRONOH, PERAK
June 2009

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.

NOR HAKIM B ABD AZIZ

ABSTRACT

Food poisoning is a common, usually mild, but sometimes deadly illness. Typical symptoms include nausea, vomiting, abdominal cramping, and diarrhea that occur suddenly (within 48 hours) after consuming a contaminated food or drink. The known causes of food poisoning can be divided into two categories: infectious agents and toxic agents which is can make our food to be rotten. One of the way to prevent this is by make a good decision during buying food from supermarket but sometime we don't even know whether the food is good or not. Supermarket also must make sure all of their products are in good condition. As an outcome for this problem, the author comes with a solution called 'Refrigerator temperature monitoring using RFID'. Transponder with temperature sensor will be placed in every refrigerator in the supermarket and the transponder will keep taking the refrigerator temperature as a data send to the reader. System from a host or computer will detect if the data of refrigerator temperature exceed the limit (max 4.5 degree Celsius) and system will alert the user of the system. As an interface for the RFID application, Microsoft visual basic 2008 is used and Microsoft Office Access is used for the database. ActiveWave Demonstration Kit which is the RFID hardware chosen for this project. Besides, the system also provides a system for reviewing and editing the details of refrigerator. This will make a record documentation work easier. Upon completion of the project, supermarket that using this product can monitor easily the refrigerator in their supermarket and customer will be more satisfied. This will make all the products in the refrigerator always in good condition and always save for customer.

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CHAPTER 1
INTRODUCTION

1.1 RFID System

Radio-frequency identification (RFID) is an automatic identification method, relying on storing and remotely retrieving data using devices called RFID tags or transponders. Radio Frequency Identification Systems (RFID) are widely used and allow advanced solutions for a variety of applications in the area of authentication, ticketing, access control, supply management, etc. An RFID solution used radio frequency (RF) signal to broadcast the data captured and maintain RFID chip. An RFID system is composed of three components which is a programmable transponder or tag, a reader (with an antenna) and a host. Much of the criteria for RFID systems are depending on the type of the tag. In essence, RFID system is just a reader and a tag communicating in the air at a certain frequency, like any other radio communicating. The readers, antenna, tags and frequency make up the basics of RFID system. [1]

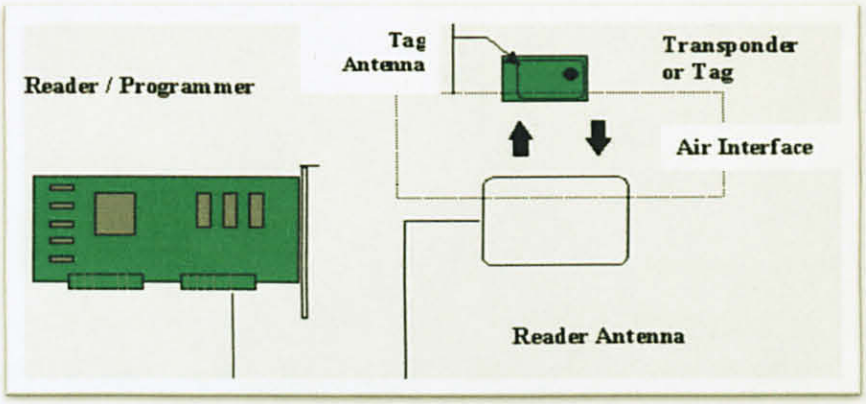

Figure 1: RFID System Components

The basic components of a transponder may be represented as shown in figure 1. This is example of the RFID system component. This system is fabricated as low power integrated circuits suitable for interfacing to external coils for data transfer and power generation.

1.2 Uses of RFID System

Tag can be active, passive, or semi-passive. An RFID tag is an object that can be applied to or incorporated into a product, animal, or person for the purpose of identification using radio waves. For example Johnson & Johnson which produce health-care products is using RFID technology for a wide range of applications. They used RFID to comply with retailer mandates that certain products be shipped with RFID tags attached at the case and pallet level. RFID tags are used to track promotional product displays at RFID-enabled retail locations, and is employing the technology to manage surgical implants. The firm wanted to find a way of making its supply chain more efficiently.

Some tags can be read from several distances away and beyond the line of sight of the reader. Most RFID tags contain at least two parts. One is an integrated circuit for storing and processing information, modulating and demodulating a (RF) signal and can also be used for other specialized functions. [2]

1.3 Problem Statement

Nowadays people go to supermarket to get their raw material for cook and to look for other product like milk and many more. Some of this product needs to be kept in proper place with suitable temperature to maintain it condition. So it will be placed in refrigerators. Mostly in supermarket, there is more than one of refrigerator. This makes it hard to maintain the entire refrigerator. If one of this refrigerator having problem, it will effect the entire product in it. Customer will start to complain and this is bad to the supermarket reputation. Hopefully this project will be the best solution to overcome this problem.

1.4 Significant of this Project

The project basically provides a solution of advancement in monitoring refrigerator temperature in the supermarket. This system is based on integration and application of theories in engineering discipline especially in communications and micro-controller based fields. The theories learnt in this project should be the base of learning experience and platform for better understanding on engineering principles. Besides, the programming skill will be an extra skills and knowledge in future. Upon completion of the project, supermarket that using this product can monitor easily the refrigerator in their supermarket and customer will be more satisfied.

1.5 Objective and Scope of Study

The objectives of Refrigerator temperature monitoring with RFID are:

- To quickly detect if any of the refrigerator temperature is having problem.(temperature rise)
- To ensure all the food in the supermarket are in good condition for customer.
- To make a data storage system of refrigerator details.

In progress to make this project successful many research needed. Basic understanding of RFID system is very important in this project. Some programming and simulation after the prototype complete must be done in allocated time frame. For the programming part, Microsoft Visual Basic will use in developing the database for this project.

To successfully implement the whole system, milestone that have to achieve are;

- To fully understand the functions of the hardware (RFID reader and tag).
- To develop a software as an interface between the hardware and the database in a computer.

CHAPTER 2
LITERATURE REVIEW

2.0 Critical Review (or Literature Survey)

To understand and appreciate the capabilities of RFID systems it is necessary to consider their constituent parts. It is also necessary to consider the data flow requirements that influence the choice of systems and the practicalities of communicating across the air interface. By considering the system components and their function within the data flow chain it is possible to grasp most of the important issues that influence the effective application of RFID. However, it is useful to begin by briefly considering the manner in which wireless communication is achieved, as the techniques involved have an important bearing upon the design of the system components.

2.1 The Tag (Transponder)

If the reader transmits the data out into space, what is out there transmitting back? The answer of course is tag. RFID tag is made up of two basic parts which is the chip or integrated circuit and antenna. The chip is a tiny computer that stores a series of numbers unique to the chip. The chip also has logic to tell itself what to do when it is in front of a reader. The antenna enables the chip to receive power and communicate, enabling the RFID tag to exchange data with the reader.

Some tags are active tags because a battery powers their communication. Most of the tags produced today are passive tags. This means that the only time they communicate is when they are in closed presence of a reader. Being in the presence of a reader means they are sitting in an electromagnetic field. When a passive tags enters an electric or magnetic field, the tags draws enough energy from that field to power itself and broadcast its information.

2.1.1 Active Tag

- Has its own battery power to contact the reader. Power from the battery is used to run the microchip's circuitry and to broadcast a signal to a reader. An active tag's onboard power source enables the tag to broadcast a signal out at a great range by either constantly broadcasting a signal when the reader talks first. Some of the more powerful active tags can communicate up to 1km. for this project; this type of tag has been chosen since the tag can broadcast a signal in a great range.
- Active tags are much larger and therefore can carry a lot more memory capability. Rather than simply having a unique serial number on the tag like passive tag.
- Despite their cost, active tags have proven a significant return on investment for many applications.
- For this project, this type of tag has been selected since the tag can broadcast a signal in a great range.

Figure 2: Active Tag

2.1.2 Passive Tag

- It does not require a battery. Rather, a passive tag derives its power from the electromagnetic field created by the signal from RFID reader to reader to respond to the reader with its information.

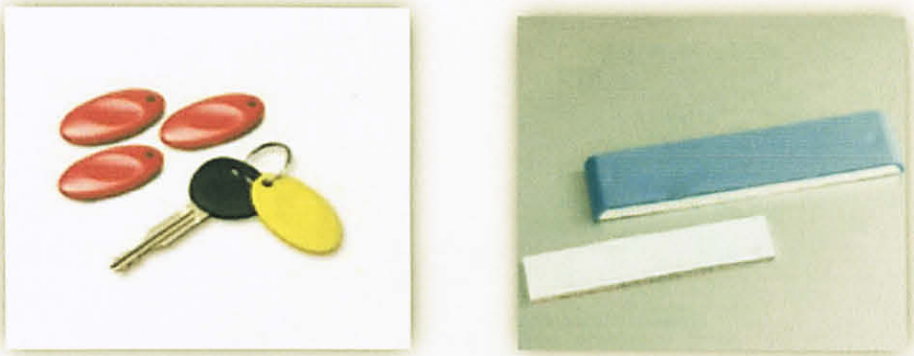

Figure 3: Passive Tag

2.1.3 Semi-Passive Tag

- It used a battery to run the chip's circuitry but communicate by drawing power from the reader's radio waves (like a passive tag). Because these tags have a battery, they are larger and more expensive than passive tags, but have greater communication ranges.

Figure 4: Semi-passive Tag

Table 1 show the comparison of various tag type. It compares the various tags by price range, how they work, pros and cons.

Table 1: Key attributes for various tag types [3]

Type	Price Range	How They Work	Pros	Cons
Active Tags	High	Battery-run tags that constantly emit radio frequency signals;	Good tracking for far objects (read range 100+ feet); have an on board power source; requires less power from reader.	More expensive than passive tags; Requires maintenance.
Passive Tags	Low	Activate by electromagnetic waves or RFID reader. These waves turn the tag on so it can reflect the information stored in the tag. Powered by energy from the reader	Cost effective. Requires no maintenance. Smaller, Lighter, Almost unlimited life	Read range currently 10 – 25 feet; Reader difficulty working through metal/ liquid. High power from reader.
Read Only Tags	Low	Information written on the tag during manufacturing is permanent – also can be field programmable	Good for one time recording. Tag similar to 2D label with the advantage that line of sight not require	Information written to tag can never be change
Read Write Tags	High	Users can add new or write over existing information when tag is near a reader.	Give user flexibility to add information at any time.	Costly Usage is very small.

2.2 RFID Operating Frequencies

Table 2 : RFID operating frequencies and associated characteristics. [4]

Band	Low frequency	High frequency	Ultra high frequency	microwave
Frequency	30-300KHz	3-30MHz	300MHz-3GHz	2-30GHz
Typical RFID frequencies	125-134KHz	13.56MHz	433MHz or 865-956MHz 2.45Ghz	2.45GHz
Approximate read range	Less than 0.5 metre	Up to 1.5 metre	433Mhz=up to 100 metres 865-956Mhz=0.5 to 5 metres	Up to 10 metres
Typical data transfer rate	Less than 1 kbit/s	Approximately 25 kbit/s	433-956=30 kbit/s 2.45=100kbit/s	Up to 100 kbit/s
Characteristic	Short range low data transfer rate,penetrates water but not metal	Higher range,reasonable data rate(similar to GSM phone,penetrates water but not metal.	Long range,high data transfer rates, Concurrent read of<100 items,cannot penetrate water or metal	Long range,high data transfer rates, cannot penetrate water or metal
Typical use	Animal ID Car immobilizer	Smart labels,contact-less travel cards,access and security	Specialist animal tracking logistic	Moving vehicle toll

Table 2 shows RFID operating frequencies and all associated characteristics of it. For this project, the author chose ultra high frequency (UHF) band which suits the best to this project.

2.3 Comparing The Primary Auto-ID Technologies

Table 3: Comparison between auto-ID technologies [4]

	Bar codes	Contact memory	Passive RFID	Active RFID
Modification of data	Unmodified	Modifiable	Modifiable	Modifiable
Security of data	Minimal security	Highly security	Ranges from minimal to highly security	Highly security
Amount of data	Linear bar codes: hold 8-30 characters; other 2-D bar codes: hold up to 7200 numbers	Up to 8MB	Up to 84KB	Up to 8MB
Costs	Low	High	Medium	Very high
Standards	Stable and agreed	Proprietary; no standard	Evolving to an agreed standard	Proprietary and evolving open standards
Life span	Short unless laser-etched into metal	Long	Indefinite	3-5 years
Potential interference	Optical barriers such as dirt or objects placed between tag and reader	Contact blockage	Environments or fields that affect transmission of radio frequency	Limited barriers since the broadcast signal from the tag is strong
Reading distance	Line of sight-LOS (3-5 feet)	Contact required	No contact or LOS required; distance up to 50 feet	No contact or LOS; distance up to 100 metres and beyond

Table 3 shows the comparison between auto-ID technologies. It compares the characteristics of bar codes, contact memory, passive RFID and active RFID. Characteristics of active RFID are the most suitable for this project.

CHAPTER 3
METHODOLOGY

3.1 Overall Flow of the Project (Flow Chart of Project)

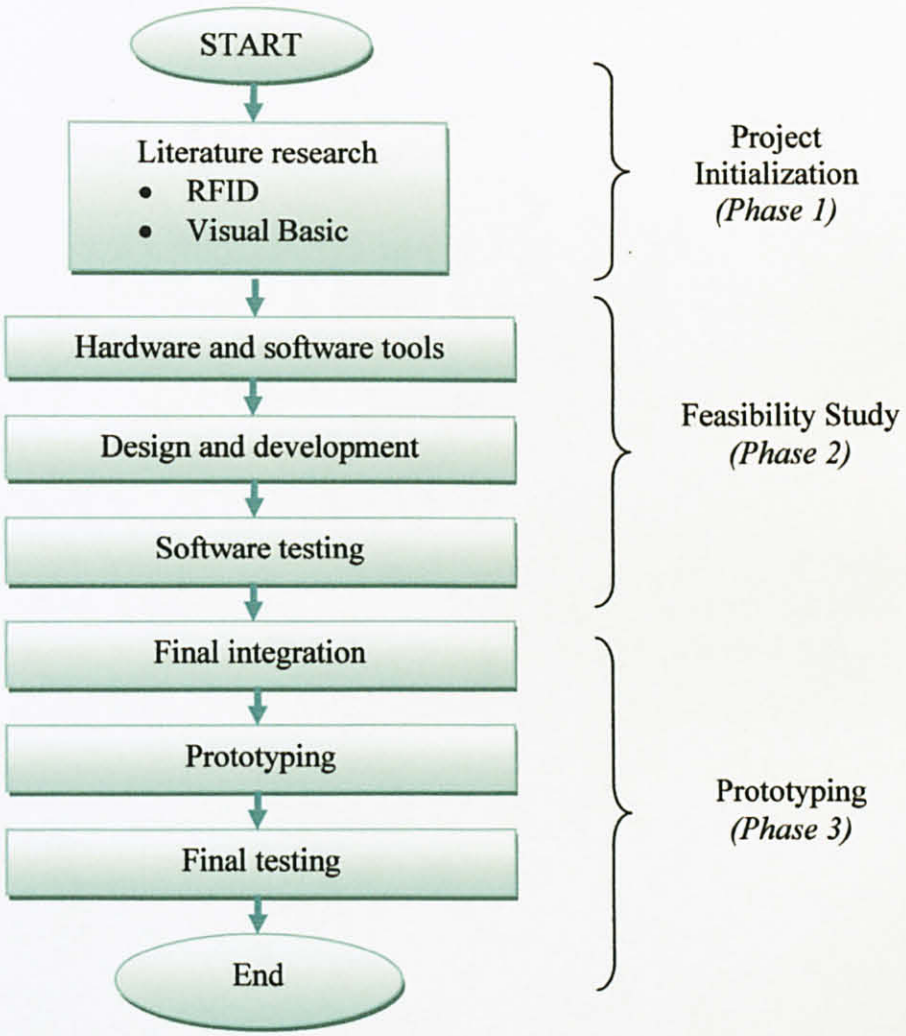

Figure 5: Overall Flow of the Project

Figure 5 show the overall project flow of this project. Project flow is divided into three phases which is initialization phase, feasibility study phase and prototyping phase.

There are some procedures to be followed in order to carry out and implement the project. This is to ensure that the project can be accomplished within the given timeframe.

3.1.1 Project Initialization (Phase 1)

Elements of projects involved in this stage include the research of RFID system technology. Understanding in Microsoft visual basic is included in this stage. In this stage also all the problem, difficulty and challenge that will be faced will be identified.

3.1.2 Feasibility Study (Phase 2)

This stage focused on preparing the prototype of the RFID system. All the preparation such as tools and part in constructing and designing the prototype will be done within the time planned. The design of the layout of the project and the flow of the project will be constructing. The programming and software part also will be start in this phase.

3.1.3 Prototyping (Phase 3)

Prototyping is a phase where the task of design and build based on the available and costless parts and components. Final integration will be focusing more on the interfacing between devices, hardware and system of the project. In the final testing stage, the combination of all the main features is tested together with the software application. Fine tuning will be done to ensure the smoothness of the project.

3.2 Graphical User Interface (GUI) Flowchart

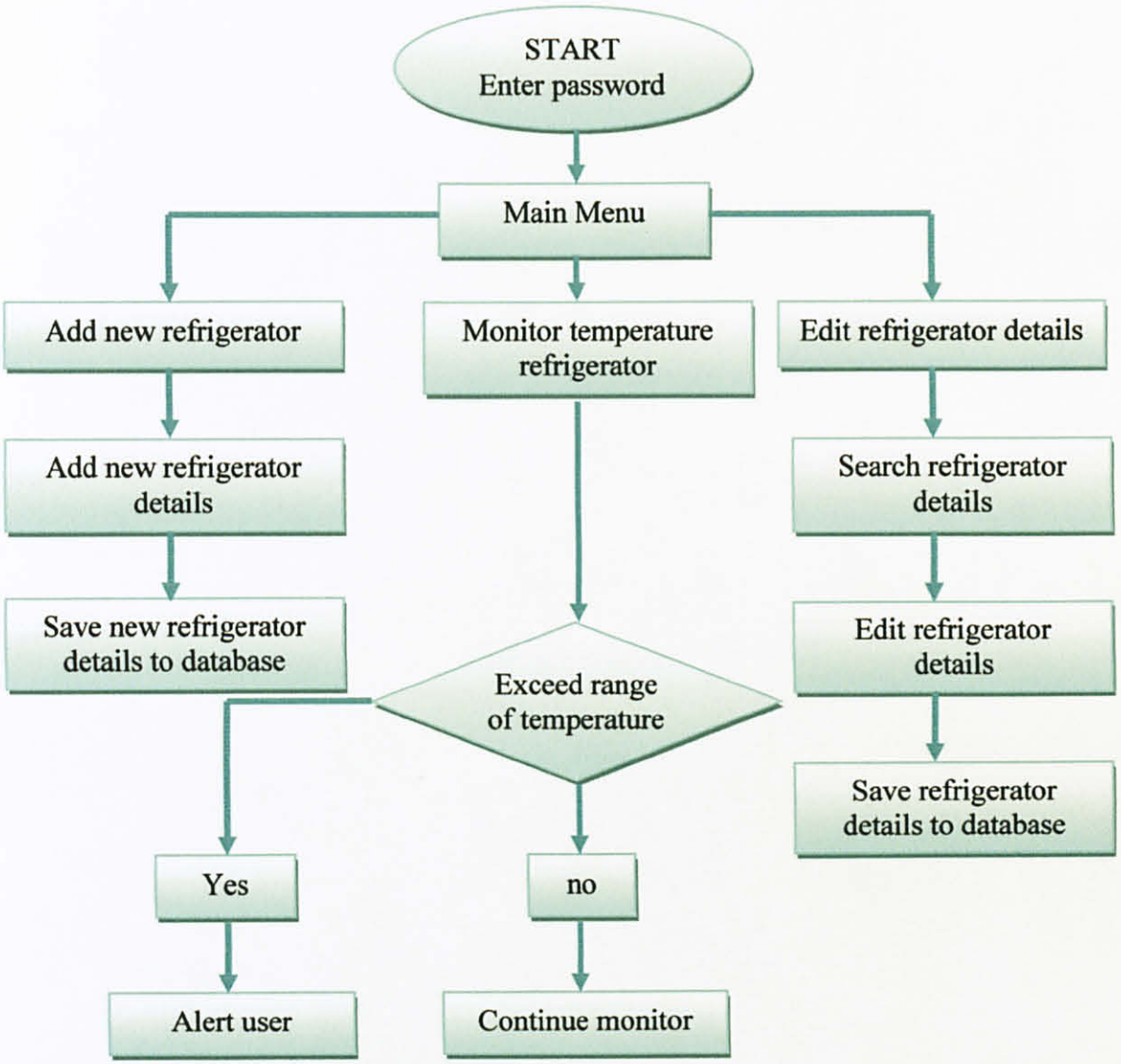

Figure 6: Graphical User Interface Flowchart

After entering the right password, user can go through the main menu form. From the main menu, user can choose three major tasks which are add new refrigerator details, edit current refrigerator details or monitoring refrigerator temperature. If user chooses to add new refrigerator details, the new form of new refrigerator details will appear and user can fill up required information of new refrigerator details. Then user can choose whether to

save or discard the record by clicking the 'save' button and 'cancel' button or reset button to reset the details filled up. When user chooses the 'save' button, it will save the record into the database which is in Microsoft Office Access file format. When user chooses 'cancel' button, the program will prompt the confirmation message to user before showing Main Menu again. If user chooses to edit refrigerator details, search form will appear and user can search the required refrigerator detail. If the details required found, user can edit the detail and save the details in the database. If user choose to monitor refrigerator temperature, monitor refrigerator form will appear and user can start monitor the refrigerator. If any refrigerator's temperature monitored exceeds the specified range, beep sound and pop up window giving a warning will appear. If not, user can continue monitoring.

3.3 HARDWARE IDENTIFICATION

Figure 7: ActiveWave Demonstration Kit

For this project, the ActiveWave demonstration kit is used. This demonstration kit consists of tags, power supply, readers, field generator, connector cable, standard motion detector, and programming station software application.

3.3.1 System requirements

An IBM-compatible personal computer with the following features:

a. Microsoft windows 98, 2000, or XP.
b. Pentium class processor or higher.
c. Minimum 120 MB of available hard disk space.
d. Minimum 64MB RAM (128MB for XP)
e. CD-ROM drive
f. XGA or higher monitor (minimum 1024x768 pixels resolution)
g. An available RS-232(DB9) port or Ethernet (RJ45) port.

3.3.2 Hardware Components

3.3.2.1 Tags

Tags are attached to specific persons, specific items, or groups of items. Several different ActiveWave tag models are available; each one transmitting at 916 MHz, 868 MHz, or 927 MHz. Tags may be electronically enabled or disabled, so they can be "seen" or "unseen" by ActiveWave Readers. All ActiveWave tags have anti-collision circuitry that assures each tag's information is received when more than one tag is transmitting. Some tag models have on-board re-writable memory that can be used to store information relating to the person or item that the tag is assigned to. The amount of tag memory varies depending on the specific application requirements. An on-board temperature sensor can also be included.

Through the ActiveWave Programming Station, each of the RFID tags can be configured for use as a hands-free access tag,

inventory tag, or asset tag for tracking purposes. A specific asset tag can be assigned to a specific access tag through the ActiveWave Tracker Program, so movement of the asset can be restricted to a specific person. With such assignment, if the asset moves past a Reader without the assigned person present, an alarm will occur so appropriate action can be taken. Each tag remains in sleep mode until it moves within range of an ActiveWave Reader or Field Generator When the tag detects this field, it will wake up immediately and transmit its data. Using the ActiveWave Programming Station, you can configure the tags to awaken periodically at a specified interval, transmit its data, and then go to sleep again. These tags also have a unique anti-collision capability, which ensures that the Reader will always receive the data accurately, even when other tags are present. This allows multiple tags to be read in sequence using only a single reader.

3.3.2.2 Readers

Readers interface the Host applications to the rest of the ActiveWave system (tags and Field Generators). Readers are used to read the tags and transmit the received data to the Host computer. Readers are also used to enable, disable, wake up, and program tags. Readers transmit data at 433 MHz and receive data at 916 MHz, 868 MHz, or 927 MHz. Readers communicate to the Host computer via an RS-232 cable or via an Ethernet network connection. The Reader is essentially the Host computer's RF link to the rest of the ActiveWave system. The Host computer communicates to the Reader via an RS232 cable or Ethernet cable. The Reader communicates to the tags via RF links. Using any software application written with ActiveWave's API software definitions, the user can control the functions of the Reader. The Reader can be used to program or read

tags. To ensure that no data is lost, the ActiveWave communications protocol is designed such that every command gets a return acknowledgment.[5]

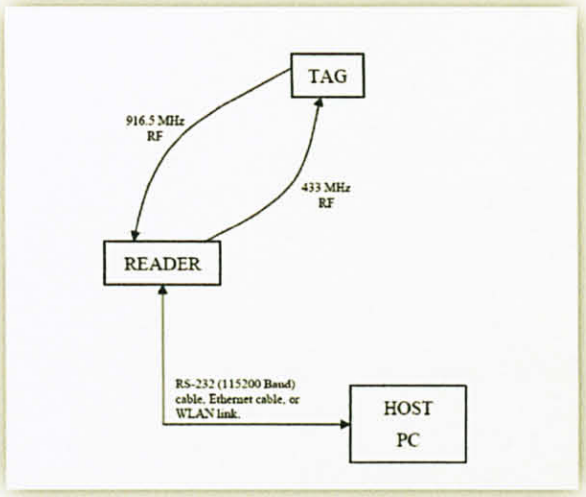

Figure 8: Basic ActiveWave System without a Field Generator

The basic ActiveWave System consists of only three components – the Host (PC running any ActiveWave application), the Reader, and at least one tag. Configuration of the Reader and tag are done via either an RS-232 connection or Ethernet connection. All monitoring and tracking of the tag are done via the same connection from the Host to the Reader. [5]

3.3.2 *Overview of Programming Station*

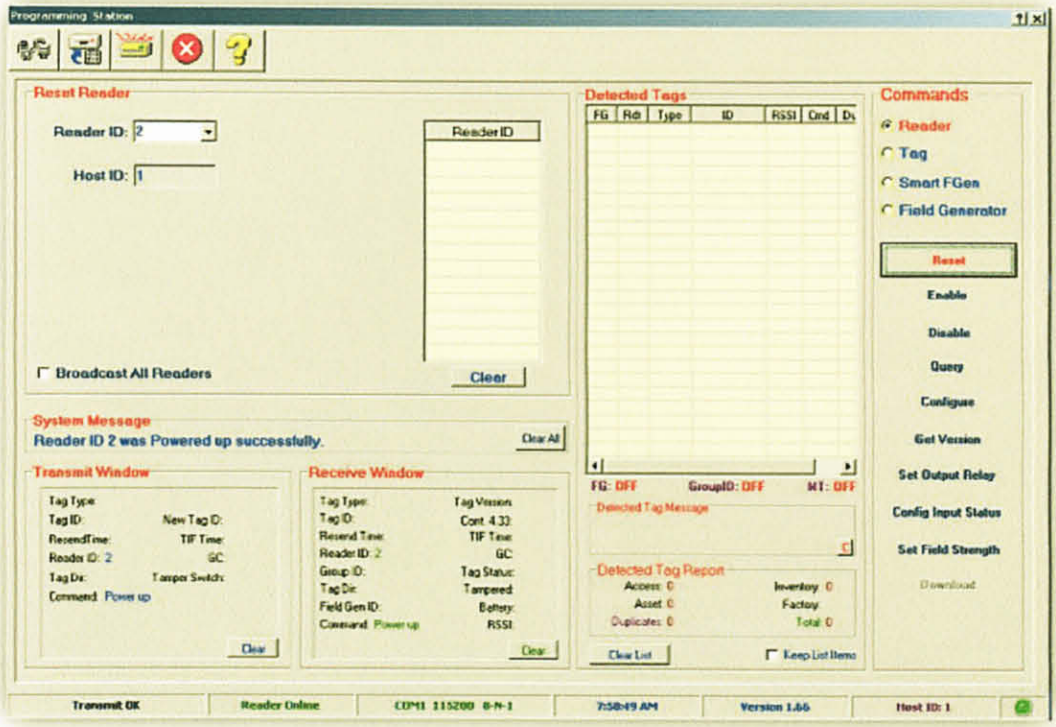

Figure 9: Programming Station

The Programming Station is a Windows-based application as shown in figure 9 used to configure and read tags, Readers, and Field Generators. This application is used to setup or modify a new ActiveWave system. The ActiveWave Programming Station allows user to easily configure all devices of an ActiveWave system. The numerous options that can be configured are organized in a very simple manner, with the commands on the right side and the configurable information in the top left area. The rest of the window gives you up-to-date information on what user are doing and what information the Reader is receiving and sending.[5]

3.4 SOFTWARE IDENTIFICATION

3.4.1 Overview of Microsoft Visual Basic

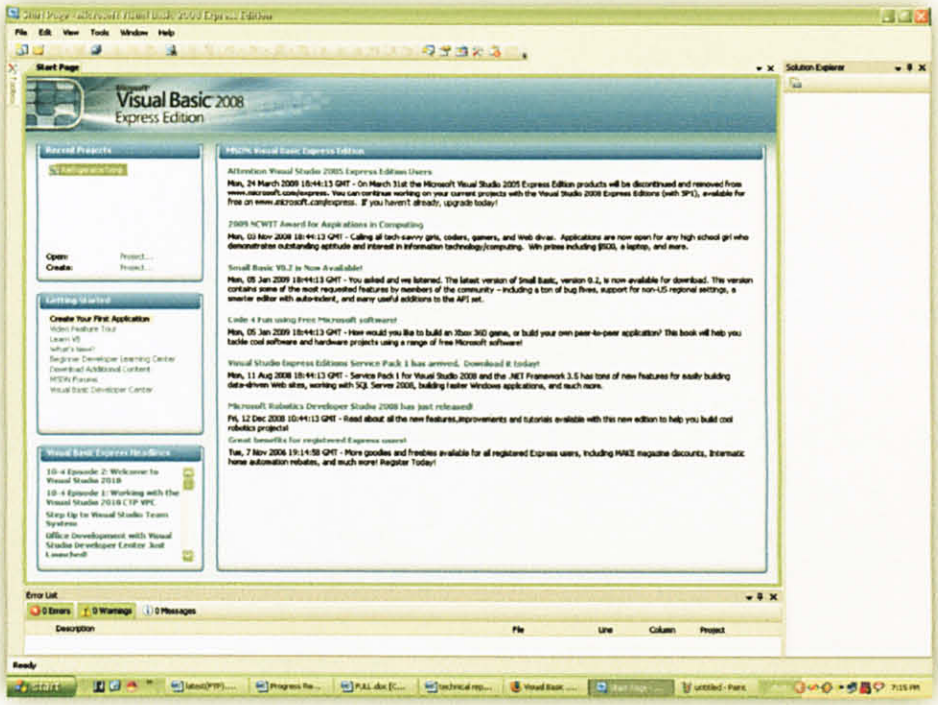

Figure 10: Microsoft Visual Basic Editor

The Microsoft Visual Basic (VB) is an easy programming language and widely used to develop Graphic User Interface (GUI) in this project. Additionally, it suits for developing applications. VB Editor Environment is shown in figure above. The components of VB Editor comprises of Title Bar, Menu Bar, Tool Bar, Form Design and Project Container Windows, Tool Box, Properties Window, Project Window, Code Editor Window, Form Layout Window, and Immediate Window. [6]

3.4.2 *Overview of Microsoft Office Access.*

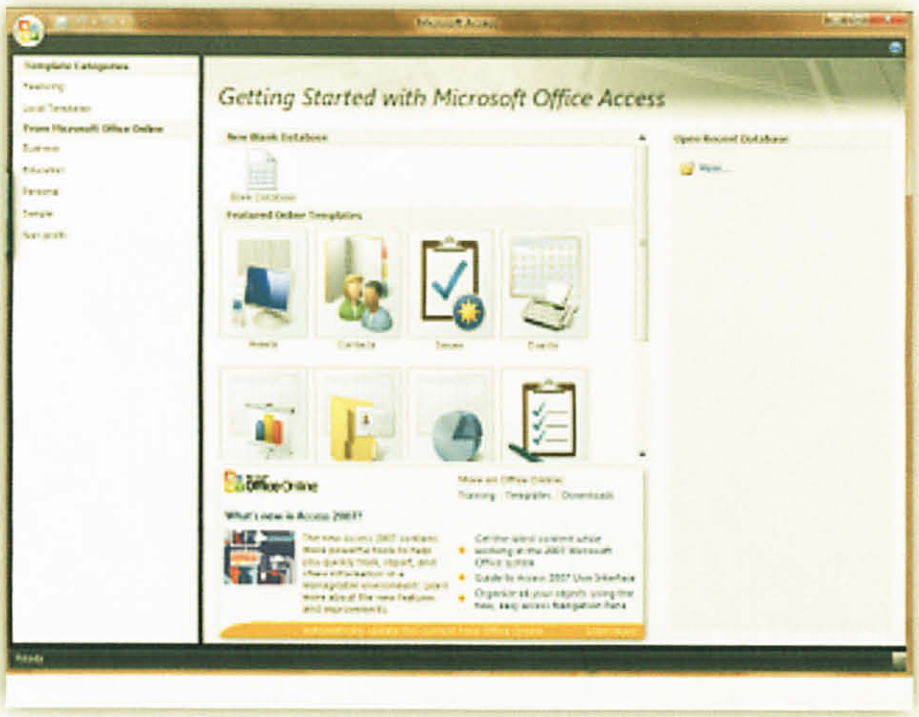

Figure 11: Microsoft Office Access Editor

Microsoft Office Access, previously known as Microsoft Access, is a relational database management system from Microsoft that combines the relational Microsoft Jet Database Engine with a graphical user interface and software development tools. Access stores data in its own format based on the Access Jet Database Engine. Software developers and data architects can use it to develop application software and non-programmer "power users" can use it to build simple applications. It supports some object-oriented techniques but falls short of being a fully object-oriented development tool. This software used in this project as a database for the interface. [7]

CHAPTER 4
RESULTS AND DISCUSSIONS

4.0 Results

4.1 Graphical User Interface (GUI) using Visual Basic

4.1.1 Database in Microsoft Office Access

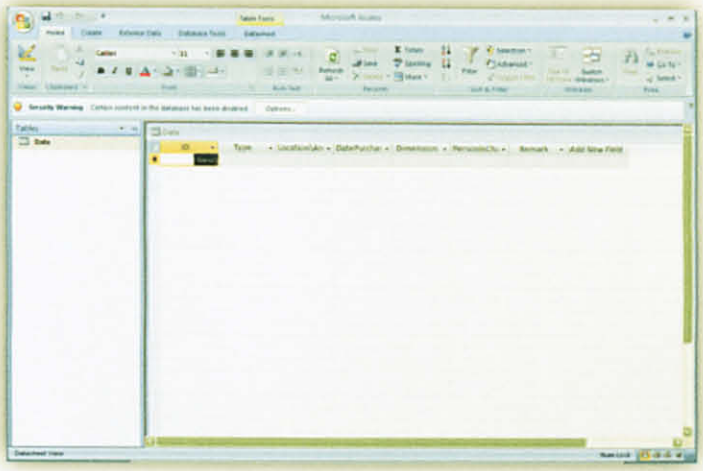

Figure 12: Database in Microsoft Office Access

Figure 12 show the database for the interface in Microsoft Office Access for this project. Microsoft Office Access is more easy to use compare to Microsoft SQL Server Management Studio Express (SQL) even Microsoft SQL Server Management Studio Express (SQL) is able to manage large amount of data unlike Microsoft Office Access. For this database, table with 8 column have been done which is column for ID, type, location/area, date purchase dimension person in charge, remark and the last column is add new field for adding any new field of data. All the details filled in the interface form will be save here.

4.1.2 *User Login Interface*

Figure 13: User Login Interface

Figure above shows the login form for the people in charge (PIC) in monitoring temperature of refrigerator in the supermarket. Password will be required to enter the main page. After login the system, the PIC will be able to monitor all the refrigerators temperature. Besides, all the detail and information can be seen and be edited here. This interface is provides by Visual Basic with Graphical User Interface (GUI) design using the form layout. After entered the right password, main menu form will be displayed. If the password is wrong, warning will pop up on the screen. User can try again with entering the right password after click the ok button. In main menu form, there are four button that can be select which is 'add new refrigerator' button, 'edit refrigerator' button, 'monitor refrigerator' button and the last button is 'exit' button.

4.1.3 *Add New Refrigerator Interface*

Figure 14: Add New Refrigerator Interface

After the user of the system manages to get pass through login system, they could be able to get access to all the information of the refrigerators and be able to monitor the refrigerators temperature. For adding new refrigerator detail, user can click 'add new refrigerator' button. Create new record form will be displayed. The details required will include the refrigerator type/model, location of the refrigerator, date of the refrigerator purchased, dimension of the refrigerator and person in charge of the refrigerator. The last section is remarks section. This section is for additional details of the refrigerator such as information of the refrigerator having any problem before. For refrigerator id, it is auto fill. After finished adding the detail of the refrigerator, user must click the 'save' button. If 'reset' button is clicked, all the information filled will be lost. This button function is to make work easier when many of the details filled before is wrong. All the details will be saved in the data file in Microsoft office Access.

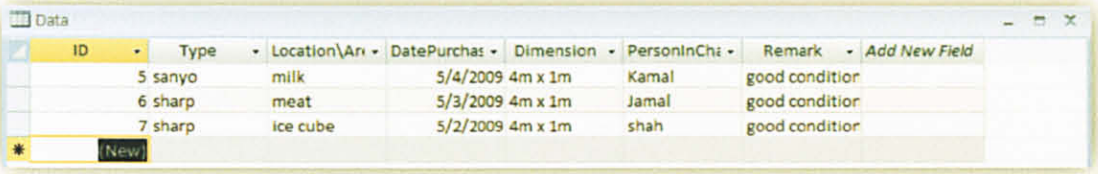

Figure 15: Database in Microsoft Office Access

4.1.4 Edit refrigerator Details interface

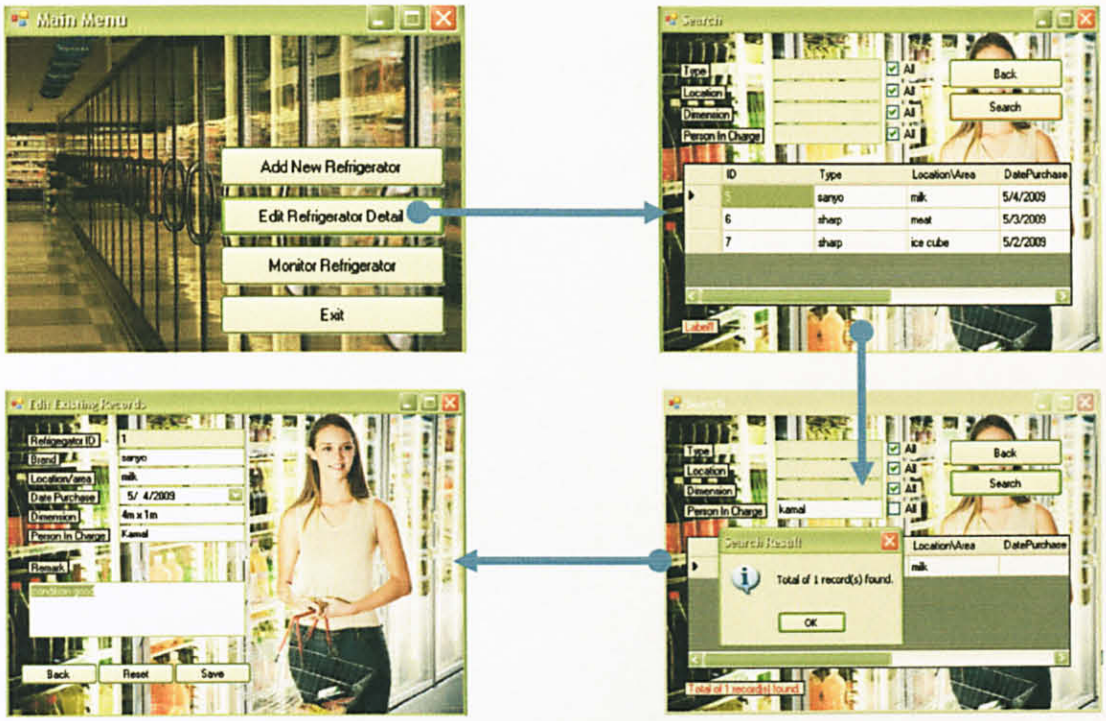

Figure 16: Edit refrigerator Details Interface

This system also provides a form to edit current refrigerator details. User can click the 'edit refrigerator details' to do so. This form will show all refrigerator details in the system. For start searching, user can choose either he wants to search by type, location, dimension or person in charge. User just has to untick the category that he wants to search and type the specific word in the text box provided. As an example, I want to search details by person in charge. Kamal is the person who is responsible to a refrigerator. I untick in the box beside the person in charge category and type Kamal in the text box as showed in the figure 16. Search result will pop up to the interface. Click 'ok' button to review the detail.

4.1.5 Monitor Refrigerator Interface

Figure 17: Monitor Refrigerator Interface

Basically, monitoring the refrigerators temperature is the main objective of this project. The second last button which is 'monitor refrigerator' button is the main function of this system. Clicking to this button will enable the user to monitor temperature of all refrigerators that having the temperature sensor tag. Data from tag which is temperature of the refrigerator will display in this form. There is a range of temperature that is suitable for the refrigerator. This interface will detect if any of the temperature of refrigerator exceed the limit. The maximum limit of the temperature is 4.5°C. Warning pop up window will display on the screen and a long beep tone sound through the computer's speaker to alert user. The last button is 'Exit' button. This button will bring out the user from this system

Figure 18: Warning Pop Up Window

4.2 Discussions

4.2.1 Problems faced during completion the project.

During completion of this project, many problems have been faced. Some of the problem cannot be avoided such as hardware problem. The price of RFID hardware is too expensive makes the author and other students who are also using the same hardware need to share the hardware. Budget of RM 500 provided by UTP is not enough for the hardware for every student who is using the same hardware. They need to take turn in using the hardware. They need to properly manage their time to accomplish this project within the given timeframe. The other problem regarding to the hardware is the submission of the hardware to UTP is late than planned submission date. This will affect the smoothness of the project.

The programming part is hardest part for this project. Using Microsoft Visual Basic for the first time need the author to work hard in completing the programming part. Research and study on Microsoft Visual Basic have been done and the author also refers to internet and lecturer regarding to the programming part.

4.2.2 Lesson learned.

From this project, the author gets the new experience and knowledge in how to complete a project. Time management is the most important in completing the project within the timeframe given. Many skills related to the project gained during completion of the project such as programming skill, presentation skill, and etc. Knowledge of basic RFID application and how RFID works have been discover by the author. Hopefully, this entire lesson learned by the author can be applied in the future.

CHAPTER 5
CONCLUSION AND RECOMMENDATION

5.1 CONCLUSION

As a conclusion, upon completion of the project, supermarket that using this product can monitor easily the refrigerator in their supermarket and customer will be more satisfied. Sudden rise in temperature of refrigerator that exceeds the range of suitable temperature will alert user with the beep sound through the computer speaker and warning pop up window will be display on the screen. User of this system can easily review the details of refrigerator required and user also able to edit the details of the refrigerator.

5.2 RECOMMENDATION

This project is still in the early stage and can be expanded further. For expansion of this project, Global System for Mobile Communication (GSM) application can be apply to inform the person in charge so that the person do not have to stay at the computer to monitor the temperature of the refrigerator. Global System for Mobile Communication (GSM) modem is a wireless modem that works with GSM network. Wireless modem behaves like a dial-up modem but the main difference between them is that dial-up modem sends and receives data through a fixed telephone line while a wireless modem sends and receives data through radio waves. [8]

REFERENCES

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[7] (http://en.wikipedia.org/wiki/Microsoft_Access)

[8] Joachim Tisal, *The GSM Network GPRS Evolution: One Step Towards UMT,* Chichester, England: John Wiley & Sons, 2001.

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APPENDIX

VISUAL BASIC SOURCE CODE

Login form code:

```
Public Class login

    Private Sub Button1_Click(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles Button1.Click
        If txtPassword.Text = "a" Then
            MainMenu.Show()
            Me.Hide()
            'While UsersTableAdapter.Fill(FypDBDataSet.Users) = 0
' Loading Users DataSet. Is it empty?
            '    MsgBox("Please create an initial user, for administrative
purposes.")
            '    formUsers.ShowDialog()                    ' Open Users Form
            '    Me.Hide()
            'End While
        Else
            MsgBox("Sorry, you are not the authorize person to modify user
account. Please try again." & vbNewLine & "Please enter the password one
more time.", MsgBoxStyle.Exclamation)
            'Me.DialogResult = Windows.Forms.DialogResult.No
        End If
    End Sub

    Private Sub Button2_Click(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles Button2.Click
        Me.Close()
    End Sub

End Class
```

Main menu form code

```
Public Class MainMenu

    Private Sub Button1_Click(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles Button1.Click
        Dim frm As New AddNewData
        AddNewData.ID = ""
        Me.Hide()
        AddNewData.Show()
    End Sub

    Private Sub Button2_Click(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles Button2.Click
        Me.Hide()
        search.Show()
    End Sub

    Private Sub Button3_Click(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles Button3.Click
        Me.Hide()
        Monitor.Show()
    End Sub

    Private Sub Button4_Click(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles Button4.Click
        Application.Exit()
    End Sub

    Private Sub MainMenu_Load(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles MyBase.Load
        'TODO: This line of code loads data into the 'RefTempDataSet.Data'
table. You can move, or remove it, as needed.
        Me.DataTableAdapter.Fill(Me.RefTempDataSet.Data)

        My.Settings.Item("RefTempConnectionString") =
"Provider=Microsoft.Jet.OLEDB.4.0;Data Source=""D:\\RefTemp.mdb"""
    End Sub

    Private Sub DataBindingNavigatorSaveItem_Click(ByVal sender As
System.Object, ByVal e As System.EventArgs)
        Me.Validate()
        Me.DataBindingSource.EndEdit()
        Me.TableAdapterManager.UpdateAll(Me.RefTempDataSet)

    End Sub
End Class
```

Add new data form code

```
Imports VB = Microsoft.VisualBasic
Imports System.Globalization
Imports System.Threading

Public Class AddNewData
    Public ID As String

    Private Sub Button2_Click(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles Button2.Click
        Me.Validate()
        Me.DataBindingSource.EndEdit()
        Me.DataTableAdapter.Update(Me.RefTempDataSet.Data)
        Me.RefTempDataSet.Data.AcceptChanges()
        MessageBox.Show("Data being saved successfully.", "Refrigerator",
MessageBoxButtons.OK, MessageBoxIcon.Information)
        Me.Close()
    End Sub

    Private Sub AddNewData_FormClosing(ByVal sender As Object, ByVal e As
System.Windows.Forms.FormClosingEventArgs) Handles Me.FormClosing
        MainMenu.Show()
    End Sub


    Private Sub Button3_Click(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles Button3.Click
        Me.Close()
        MainMenu.Show()
    End Sub

    Private Sub AddNewData_Load(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles MyBase.Load
        'TODO: This line of code loads data into the 'RefTempDataSet.Data'
table. You can move, or remove it, as needed.

        Me.DataTableAdapter.Fill(Me.RefTempDataSet.Data)
        If ID = "" Then
            Me.Text = "Create New Record"
            DataBindingSource.AddNew()
            'btnApprove.Visible = False
            'txtApprove.Visible = False
        Else
            Me.Text = "Edit Existing Records"
            DataBindingSource.Position = Me.DataBindingSource.Find("ID",
ID)

        End If

    End Sub
```

```
    Private Sub Button1_Click(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles Button1.Click
        TextBox1.Text = ""
        TextBox3.Text = ""
        TextBox4.Text = ""
        TextBox6.Text = ""
        TextBox7.Text = ""

    End Sub

    Private Sub TextBox2_TextChanged(ByVal sender As System.Object, ByVal
e As System.EventArgs) Handles TextBox2.TextChanged

    End Sub
End Class
```

Edit refrigerator details form code

```
Imports System.Data.OleDb
Imports VB = Microsoft.VisualBasic
Imports System.Globalization

Public Class search

    Private Sub Button2_Click(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles Button2.Click

        Dim tempSQL As String = ""
        If type.Text <> "" And type.Enabled Then
            tempSQL = IIf(tempSQL = "", "", tempSQL & " AND ") & " [Type]
LIKE '%" & type.Text & "%'"
        End If
        If location.Text <> "" And location.Enabled Then
            tempSQL = IIf(tempSQL = "", "", tempSQL & " AND ") & "
[Location\Area] LIKE '%" & location.Text & "%'"
        End If
        If Dimension.Text <> "" And Dimension.Enabled Then
            tempSQL = IIf(tempSQL = "", "", tempSQL & " AND ") & "
[Dimension] LIKE '%" & Dimension.Text & "%'"
        End If
        If PIC.Text <> "" And PIC.Enabled Then
            tempSQL = IIf(tempSQL = "", "", tempSQL & " AND ") & "
[PersonInCharge] LIKE '%" & PIC.Text & "%'"
        End If

        Me.DataTableAdapter.Fill(Me.RefTempDataSet.Data)
        Me.DataBindingSource.Filter = tempSQL
        Me.DataBindingSource.Sort = "[ID] asc"

        If Me.DataGridView1.Rows.Count < 1 Then
            txtStatus.Text = "No record found."
            MessageBox.Show("No record found.", "No Record found",
MessageBoxButtons.OK, MessageBoxIcon.Information)
```

```
        Else
            txtStatus.Text = "Total of " & Me.DataGridView1.Rows.Count & "
record(s) found."
            MessageBox.Show("Total of " & Me.DataGridView1.Rows.Count & "
record(s) found.", "Search Result", MessageBoxButtons.OK,
MessageBoxIcon.Information)
        End If
    End Sub


    Private Sub Search_FormClosed(ByVal sender As Object, ByVal e As
System.Windows.Forms.FormClosedEventArgs) Handles Me.FormClosed
        MainMenu.Show()
    End Sub

    Private Sub search_Load(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles MyBase.Load
        'TODO: This line of code loads data into the 'RefTempDataSet.Data'
table. You can move, or remove it, as needed.
        Me.DataTableAdapter.Fill(Me.RefTempDataSet.Data)
        CheckBox1.Checked = True
        location.Enabled = False

        CheckBox2.Checked = True
        Dimension.Enabled = False

        CheckBox3.Checked = True
        PIC.Enabled = False

        CheckBox4.Checked = True
        type.Enabled = False

    End Sub

    Private Sub CheckBox4_CheckedChanged(ByVal sender As System.Object,
ByVal e As System.EventArgs) Handles CheckBox4.CheckedChanged
        If CheckBox4.Checked Then
            type.Enabled = False
            type.Text = ""
        Else
            type.Enabled = True
            type.Text = ""
        End If
    End Sub

    Private Sub CheckBox1_CheckedChanged(ByVal sender As System.Object,
ByVal e As System.EventArgs) Handles CheckBox1.CheckedChanged
        If CheckBox1.Checked Then
            location.Enabled = False
            location.Text = ""
        Else
            location.Enabled = True
            location.Text = ""
        End If
    End Sub
```

```
    Private Sub CheckBox2_CheckedChanged(ByVal sender As System.Object,
ByVal e As System.EventArgs) Handles CheckBox2.CheckedChanged
        If CheckBox2.Checked Then
            Dimension.Enabled = False
            Dimension.Text = ""
        Else
            Dimension.Enabled = True
            Dimension.Text = ""
        End If
    End Sub

    Private Sub CheckBox3_CheckedChanged(ByVal sender As System.Object,
ByVal e As System.EventArgs) Handles CheckBox3.CheckedChanged
        If CheckBox3.Checked Then
            PIC.Enabled = False
            PIC.Text = ""
        Else
            PIC.Enabled = True
            PIC.Text = ""
        End If
    End Sub

    Private Sub Button1_Click(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles Button1.Click
        Me.Hide()
        MainMenu.Show()
    End Sub


    Private Sub DataGridView1_CellContentDoubleClick(ByVal sender As
Object, ByVal e As System.Windows.Forms.DataGridViewCellEventArgs) Handles
DataGridView1.CellContentDoubleClick
        If DataGridView1 Is Nothing Then Exit Sub
        If DataGridView1.CurrentRow Is Nothing Then Exit Sub
        Dim frm As New AddNewData
        frm.ID =
DataGridView1.Rows(DataGridView1.CurrentRow.Index).Cells(IDDataGridViewTex
tBoxColumn.Index).Value
        frm.Show()
        Me.Cursor = Cursors.Default
        Me.Hide()
    End Sub
End Class
```