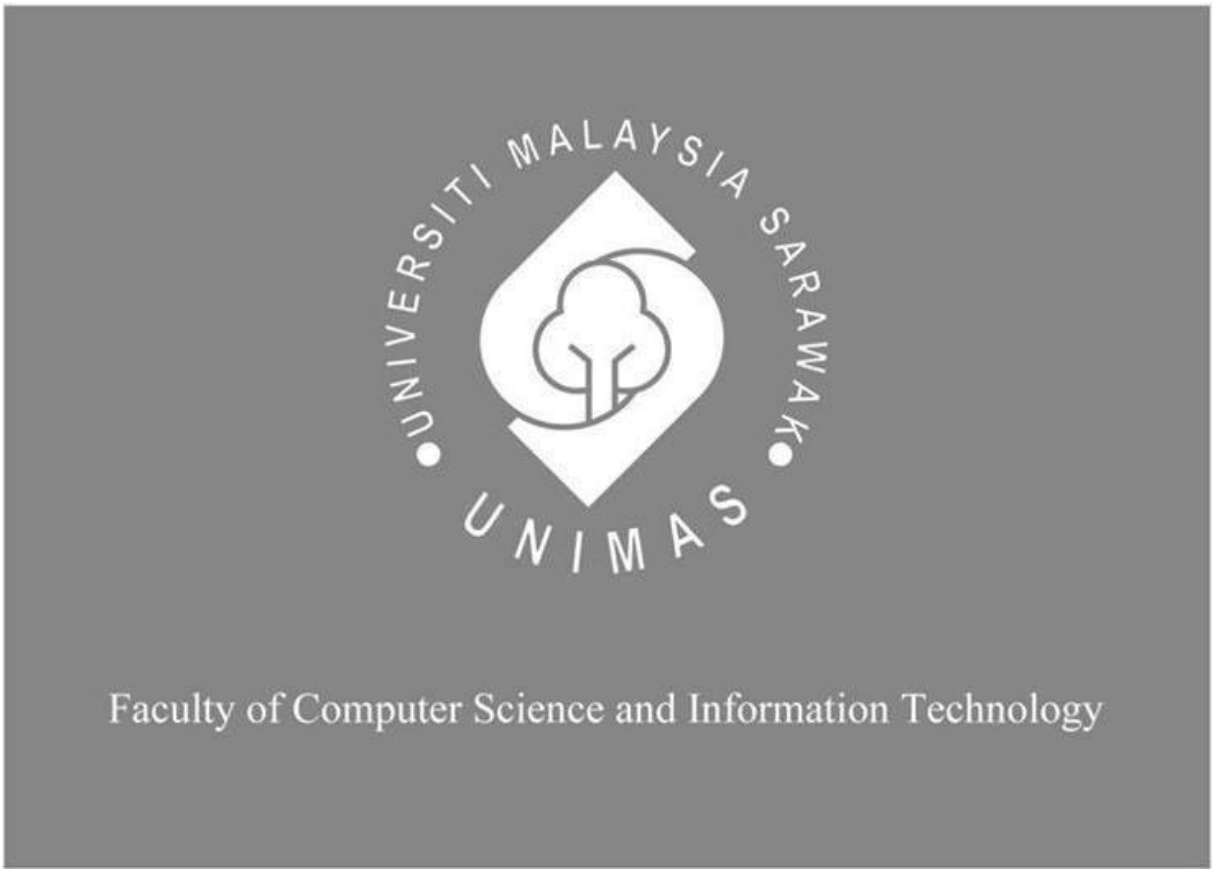

Cold Storage Monitoring System Using Internet of Thing (IoT)

Siti Nursyahirah Binti Sarija

Bachelor of Computer Science with Honours
(Network Computing)
2020

COLD STORAGE MONITORING SYSTEM USING INTERNET OF THING (IoT)

SITI NURSYAHIRAH BINTI SARIJA

This project is submitted in partial fulfilment of the

requirement for the degree of

Bachelor of Computer Science and Information Technology

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SISTEM PEMANTAUAN PENYIMPANAN DINGIN MENGGUNAKAN IOT

SITI NURSYAHIRAH BINTI SARIJA

Projek ini merupakan salah satu keperluan untuk

Ijazah Sarjana Muda Sains Komputer dan Teknologi Maklumat

Fakulti Sains Komputer dan Teknologi Maklumat

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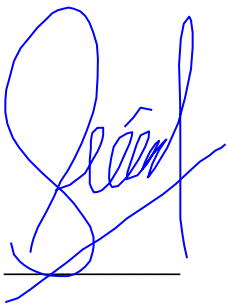
I hereby declare that the project with the title 'Cold Storage Monitoring System Using Internet of Thing (IoT)' submitted by me to the faculty of Computer Science and Information Technology, University Malaysia Sarawak (UNIMAS) is my genuine work under the guidance of Dr Mohamad Imran Bin Hj Bandan.



Siti Nursyahirah Binti Sarija

Faculty of Computer Science and Information Technology

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ABSTRACT

Food is an essential part of human life. Food is being consumed to allow humans to generate energy and stay healthy. The low intake on a specific type of food can lead to a risk of getting cancer. For example, a low intake of vegetable and fruit can cause human to be exposed to particular lung cancer (Block et al., 1992). Due to this issue, human started to realise the importance of consuming healthy food. Older generations have already understood the link between nutrition and health that gain through food. Their interest in 'healthy living' food consuming has to increase affluence and education among the world population (Kern, 2006). As the years go by, the food consumption trend is changing. Human is focusing more on fresh food consumption, especially for fruits and vegetables. Percentage of human consuming fresh food is increasing from 16.4% in the year 2001 to 17.4% in 2014 (McLynn, 2015). The cold storage is created in supermarkets and mini-market in order to ensure people live in urbanise area able to consume fresh and good quality of products such as vegetables and fruits.

ABSTRAK

Makanan adalah bahagian penting dalam kehidupan manusia. Makanan dimakan untuk membolehkan manusia menghasilkan tenaga dan kekal sihat. Pengambilan jenis makanan tertentu pada kadar yang rendah boleh membawa kepada risiko mendapat kanser. Sebagai contoh, pengambilan sayur dan buah yang kurang boleh menyebabkan manusia terdedah kepada kanser paru-paru tertentu (Block et al., 1992). Oleh kerana masalah ini, manusia mula menyedari betapa pentingnya memakan makanan sihat. Generasi lebih tua sudah memahami hubungan antara pemakanan dan kesihatan tubuh badan. Minat mereka dalam memakan makanan yang sihat telah meningkatkan kesedaran di kalangan penduduk dunia (Kern, 2006). Tahun silih berganti, trend pemakanan manusia semakin berubah. Manusia lebih menumpukan kepada pengambilan makanan segar terutama untuk buah-buahan dan sayur-sayuran. Peratusan makanan segar yang dimakan oleh manusia meningkat daripada 16.4 peratus pada tahun 2001 kepada 17.4 peratus pada tahun 2014 (McLynn, 2015). Penyimpanan sejuk dibuat di pasar raya dan pasar mini untuk memastikan orang yang tinggal di kawasan bandar turut dapat menikmati makanan yang segar dan berkualiti seperti sayur-sayuran dan buah-buahan.

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CHAPTER 1: INTRODUCTION

1.1 INTRODUCTION

Food is an essential part of human life. Food is being consumed to allow humans to generate energy and stay healthy. The low intake on a specific type of food can lead to a risk of getting cancer. For example, a low intake of vegetable and fruit can cause human to be exposed to particular lung cancer (Block et al., 1992). Due to this issue, human started to realise the importance of consuming healthy food. Older generations have already understood the link between nutrition and health that gain through food. Their interest in 'healthy living' food consuming has to increase affluence and education among the world population (Kern, 2006). As the years go by, the food consumption trend is changing. Human is focusing more on fresh food consumption, especially for fruits and vegetables. Percentage of human consuming fresh food is increasing from 16.4% in the year 2001 to 17.4% in 2014 (McLynn, 2015).

However, fresh food consumption in urbanise area can be quiet challenging. People who live in the city or any urbanise places usually get their fresh supply of vegetables and fruits from supermarkets or minimarkets. This is because of the land limitation that prevents farmers from farming in those urbanise area. Supermarkets and minimarkets get their fresh food supply from farmers that live outside of the city. In order to maintain the freshness of the products, supermarkets or minimarkets need to keep their product stocks in cold room storage. Temperature and humidity are a vital element of cold storage which always needed to be maintained and monitored (Most Common Challenges for Cold Storage, n.d.).

The temperature and humidity of cold storage are varying according to the type of product storage and the size of it. According to mynewdesk.com (2013), there are three types of cold storage that had been used. The first one is the modular cold room which is used for commercial purposes. Supermarket and minimarket usually use this type of cold storage because it allows the feature of the customised refrigerating setting. The second one is the industrial cold storage which suitable for storing a massive number of products. This cold storage is really big that it allows vehicles to be used to transport products in it. This storage is made for industries use which industries always involving the amount of product or stock. Lastly is the combi refrigeration, which is cold storage that has a combination of two different temperatures. One part of this cold storage is the chiller with the range of 2℃ - 12℃ while the other part is the freezer which used a temperature of -22℃ (Alvin, 2016).

The temperature and humidity of this cold storage room must be maintained according to the type of products stored. The ideal temperature for a dry foods product is between 10℃ to 15℃. For refrigerated products, it is better to be stored at temperature 4℃ and below. Next, dairy products such as yoghurt, cheese and butter are advised to be kept at a temperature of 2℃ to 4℃. Fresh seafood needs to be kept at -1℃ to 2℃ in order to maintain its freshness. Lastly, frozen food like chickens, shrimps and potatoes need to be kept at -18℃ to maintain it's colour and vitamin content (Storage Temperatures and Procedures, n.d.).

The low temperature of cold storage is important to preserve the quality of the products since it slows down the growth of bacteria. While high humidity of cold storage is essential in slow down the ripening process, this is due to the less amount of moisture loss from fresh products (CB, 2019). The cold storage's temperature and humidity also need to be monitored

frequently by the respected worker. The conventional cold storage monitoring system is quite hard to use. This is because the workers need to go to the cold storage in person, to be able to check the current temperature and humidity. Based on this particular problem, the Cold Storage Monitoring System Using Internet of Things (IoT) is proposed to overcome this problem.

1.2 PROBLEM STATEMENT

Cold storage is commonly known as a cold room that used to preserve and store a particular type of product at a specific temperature. They are usually used by supermarkets or mini-markets to store their vegetables and frozen food to maintain quality and product safety standards. The most concern issues regarding cold storage are the maintaining of temperature and humidity continually (Most Common Challenges for Cold Storage, n.d.).

Besides that, the temperature and humidity of cold storage need to be monitored at least two times a day. Some standards also stated that it needed to be monitored every two hours (How often should you record the temperature of a commercial fridge?, 2016). The traditional monitoring system can cause overloaded work to the user as the monitoring job can only be done when the user goes to the cold storage to check the current temperature and humidity (Most Common Challenges for Cold Storage, n.d.). Lastly, unexpected incidents that might occur in cold storage such as the malfunction of the cooling machines without prior notice.

1.3 SCOPE

Cold Storage Monitoring System Using Internet of Things (IoT) allows the user to monitor the current humidity and temperature of cold storage remotely. The user can monitor it through a mobile application, which able to display the current temperature and humidity of

the cold storage. The mobile application also enables the user to view the pattern of temperature and humidity weekly and generate a report by sending it directly to the email. Besides, the mobile application will notify the user through an alert message, and the buzzer will beep when there is a drastic increase or decrease in humidity and temperature. The buzzer will automatically switch off after the temperature or humidity return to the ideal value. Lastly, this cold storage is only in the size of a prototype, and it specifically focuses on storing vegetables.

1.4 AIMS AND OBJECTIVES

1. To design a monitoring system that enables the supermarket/minimarket to monitor their cold room environment.
2. To develop a prototype of the Cold Storage Monitoring System using Internet of Things (IoT).
3. To test and evaluate the functionality of the prototype.

1.5 BRIEF METHODOLOGY

Powel-Morse (2016) had stated that Dr Winston W. Royce introduces waterfall Methodology in the year 1970. The author also stated that his methodology is a software development process which stressed on accomplishing a logical step-up throughout the software development life cycle (SDLC) process. This logical progression is just like a waterfall which each phase is not overlapping as the next phase can only begin once the previous step is finished (Sharma, 2016). According to Sharma (2016) also, Waterfall Methodology is the earliest to be introduced and easy to understand and use.

This method has been chosen for the development of the Cold Storage Monitoring System using Internet of Things (IoT). There are two main reasons this methodology is chosen. The first reason is that this methodology suits well with the Final Year Project's Schedule that has been assigned by the faculty. The second reason is that it is suitable for Milestone-Focused Development which also focuses on the deadlines (Powel-Morse, 2016). This is very applicable to Final Year Project since there are deadlines given that need to be followed.

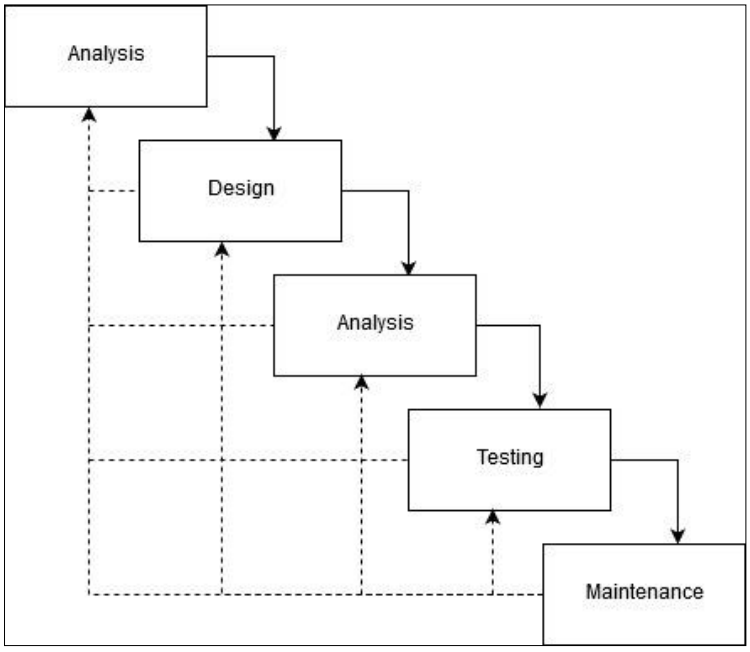

Figure 1.1: The Waterfall Model (Bassil, 2012).

The author, Bassil (2012) had indicated five phases comprises in this methodology. The phases are analysis phase, design phase, implementation phase, testing phase and maintenance phase, as shown in the diagram above. Each of the phases will be explained as below:

i. Analysis phase

This phase is the first phase of the Waterfall methodology. In this phase, project requirement analysis will be figured out based on the information gathered from the users and

the study done. The information-gathering process will be made by interviewing the targeted user. The requirements gathering will be analysed and finalise. Then, problem statement, objectives and scope of this project will be studied and defined.

ii. Design phase

The design phase is the second phase of this methodology. During this phase, the overall flow of the system will be design based on the requirement analysis in the previous phase. The designs that will be included are the architecture of the system, the block diagram of the system, the flow chart and the data flow diagram of the system.

iii. Implementation phase

The third phase is the implementation phase. In this phase, the system will be developing based on the design created in the previous phase. All the hardware will be assembling, and the code of the system will be written in this phase. The mobile application will also be developing in this phase.

iv. Testing phase

The next phase is the testing phase. This phase will allow the project to be testing and run at different scenarios in order to make sure that it is fully functioning. The testing that will be performing for this project is component testing. This testing allows each component and feature of the system to run and tested according to the design.

v. Maintenance phase

The last phase in this methodology is the maintenance part. This phase can be done once