

Project Proposal

Diabetes Care

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Abstract

Diabetes is a chronic illness that causes health problems. Its effect can reflect on teeth and gums, eyes, kidneys, heart arteries. Diabetes is also the third leading cause of death after cancer and cardiovascular disease. Malfunction of the body causes leading cause of diabetes by not producing enough insulin to use inside the body. Increasing of glucose in blood cell will lead to diabetes which effects to the whole body. Sugar or substances as glucose with enters body cell by the control of insulin. The result of inability controls insulin that causes the increasing of glucose in blood flow. As a result, blood sugar levels rise. An increasing amount of blood sugar will sequentially destroy blood vessel in the end. The longer diabetes is not in control, the heavier symptoms to affect to the body. The cause of death by diabetes is coming from complication instead of diabetes itself.

In this project, we plan to develop web application “Diabetes Care.” The system developed for caring and controlling the spread or expansion of diabetes and prevents complication caused by diabetes. The system will be available to diabetic patients by following ways:

- Develop the features for a Patient to record the status of the blood sugar from results of urine tests or inspection results from the doctor by blood. For user can checking the status of change.

With these features, it can help patients or relatives of patients to access and control clinical information that positive to diabetes care. Moreover, any person who has authority to monitoring patient, such as a nurse, can manage and response to information provided by the application as see fit.

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Chapter One | Introduction and Background

Nowadays, many people have the problems on their health. Main reason regardless of genetic disease or quality of life is that people do not take proper care themselves well enough. In this work, we will focus on the problem of diabetes. The diabetes is one of group of NCDs (Non-Communicable diseases). However, in the year 2010 survey found that the cause of death of the world's population, 73% of all diseases caused by NCDs and more importantly, more than 80% are the population of developing countries. NCDs is the disease that inability to spread, infect, or transfer to others, neither by germs, air, or any intermediary. NCDs typically cause by failing of internal body system that caused by malfunctioning of organs, cell, flows, or any internal subsystem inside the body. A survey from Diabetes Association of Thailand shows that huge amount of Thai population are diagnoses to have diabetes. In Thailand average annual numbers of deaths from diabetes are counting to 7000 people per year. From survey results, the patient must get to take care to prevent from complications caused by diabetes which is a cause of death. Some people might use some website or application to help them to plan to control diabetes. However, some website or application patient cannot update a status of glycemic and view to the difference between today with another day for make easy to observe.

This application develops for users who want to manage their health, preventing complication disease. It can be an alternative method for nutrition discipline, and control and monitor glycemic level to everyone who uses this web application as their assets.

We plan to develop the web application that can support the user to manage personal information, planning to control diabetes, record glycemic level and overviewing using the graph for easier analyzing their current status. Besides that, the system has provided diabetes survey. When the user has logged into system user will be forced to finishes the review. The system also focused on helping the user to control their health status and prevent complication disease from happening.

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Chapter Two | Literature Review and Business Review

2.1 Literature Review

2.1.1 Diabetes

Diabetes is a condition where the amount of glucose in your blood is too high because the body cannot use it properly. [9]

When someone has diabetes, their body can't maintain healthy levels of glucose in the blood. Glucose is a form of sugar which is the main source of energy for our bodies. Unhealthy levels of glucose in the blood can lead to long term and short term health complications. [9]

Diabetes develops when glucose can't enter the body's cells to use as fuel. It happens when either:

- There is no insulin to unlock the cells. In this type 1 diabetes, the body's immune system destroys the cells that release insulin, eventually eliminating insulin production from the body. Without insulin, cells cannot absorb sugar (glucose), which they need to produce energy.[20]
- There is not enough insulin or the insulin is there but not working properly. In this type 2 diabetes, the body isn't able to use insulin the right way. This is called insulin resistance. As type 2 diabetes gets worse, the pancreas may make less and less insulin. This is called insulin deficiency.[20]

Nutrition behavior of patient is cause to impact blood sugar. Because in food have the glycemic index that has an impact on glucose.

The glycemic index is a relative ranking of carbohydrate in foods according to how they affect blood glucose levels.

Exercise is an important part of any diabetes treatment plan. For the best health benefits, experts recommend at least 150 minutes a week of moderately intense physical activities such as: Fast walking, Lap swimming, Bicycling [18]

Exercise has so many benefits, but the biggest one is that it makes it easier to control your blood glucose (blood sugar) level. People with type 2 diabetes have too much glucose in their blood, either because their body doesn't produce enough insulin to process it, or because their body doesn't use insulin properly (insulin resistant). In either case, exercise can reduce the glucose in your blood. Muscles can use glucose without insulin when you're exercising. When you exercise, your muscles get the glucose they need, and in turn, your blood glucose level goes down. [5]

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Diabetes is one of the most common NCDs globally. It is the fourth or fifth leading cause of death in most high-income countries and developing countries.

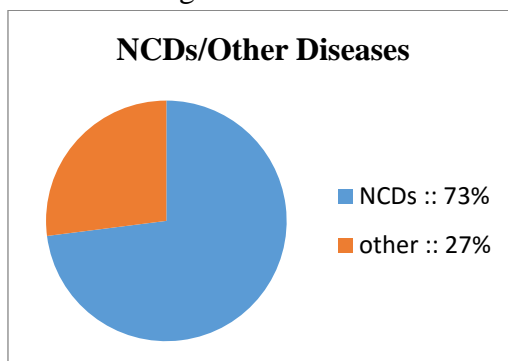


Figure 01: The death rate from the disease NCDS of the world population. [7]

Disease/year	2550	2551	2552	2553	2554	2555	2556	2557
Cancer	53,434	55,403	56,058	58,076	61,082	63,272	67,692	70,075
heart disease	18,452	18,820	18,375	18,399	20,130	21,142	24,597	24,995
lung disease	14,179	14,542	14,542	16,369	16,884	15,226	21,676	26,103
Diabetes	7,686	7,725	7,019	6,855	7,625	7,749	9,703	11,389
High blood pressure	2,291	2,463	2,295	2,478	3,664	3,684	5,186	7,115

Table 01: The death rate from the disease NCDS in Thailand. [17]

2.1.2 Body mass index

Body Mass Index (BMI) is a person's weight in kilograms divided by the square of height in meters. A high BMI can be an indicator of high body fatness. BMI can be used to screen for weight categories that may lead to health problems. [19]

The body mass index is calculated based on the following formula:

Bodyweight in kilograms divided by height in meters squared

Or

$$\text{BMI} = \text{weight (Kg)} / (\text{height (m)} * \text{height (m)})$$

Body mass index was found to associate with the risk of being diagnosed with type 2 diabetes. Type 2 diabetes risk may be incrementally higher in those with a higher body mass index

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2.2 Business Review

2.2.1 Overview

There are problems that diabetes patient faced when they want to get method to control and follow the status of blood sugar. And they don't know how to care health from the complication of diabetes. So "Diabetes Care" can help to control and follow the blood sugar level and get the recommend about the symptom, warning in each level of blood sugar from this application.

Diabetes Care is a Web application that can support all devices (desktops, tablets, and phones). "Diabetes Care" supports all devices are mean the web application can run on program web browser from desktops, tablets, and phones

2.2.2 Target

The primary target of this application developed for the diabetic who wants to care health from the complication of diabetes, including people who are looking for a good system to control and follow the status of blood sugar.

2.2.3 Benefit

- User can get recommend of blood sugar.
- User can plan nutrition.
- User can get analyze per day about health
- User can plan exercise.
- User can view body mass.

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2.3 Business Tools/Software Review

2.3.1 Glucose Buddy



Figure 02: Glucose Buddy

This comprehensive diabetes app lets you record, annotate, and graph your blood glucose level, medication doses, food eaten, and exercise. Browse and post to the Glucose Buddy forums from your phone or view your data on the Glucose Buddy website. Notifications remind you when it's time to check your blood glucose.[3]

Pro

- The user can record and view the glucose value in graph
- The user can view body mass.
- The user can plan nutrition.
- The user can record medicine.

Con

- The application can't support the Nutritionists to management nutrition.
- The application can't support the user to analyze the behavior in each day.

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2.3.2 MyNetDiary



Figure 03: MyNetDiary

The MyNetDiary is the application that can plan and track carbs, fats, proteins and all nutrients along with exercise. Monitor your body measurements, blood glucose and cholesterol, blood pressure, medications and diabetes-specific conditions. Chart everything health-related with custom trackers. Use special reports to understand how your personal health is affected by diet, exercise and medications.[2]

Pro

- The user can record and view the glucose value in graph
- The user can record medicine.
- The user can view body mass.
- The user can plan nutrition.

Con

- The application can't support the Nutritionists to management nutrition.
- The application can't support the user to analyze the behavior in each day.

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2.3.3 Track3 Diabetes Tracker



Figure 04: Track3 Diabetes Tracker

This app is very straightforward and easy to use with many options and functions. You can log your daily glucose readings, insulin injections, meals and even exercise. Also, it has a “memory” function that remembers that you entered, for example, “humalog 6 units before breakfast” and you can select that instead of having to enter it again.[1]

Pro

- The application supports the user can separate the diabetes type.
- The application can support the user to manage the nutrition.
- The application supports the user can view the blood sugar in graph

Con

- The application can't support the Nutritionists to manage nutrition.
- The application can't support the user to analyze the behavior in each day.
- The application cannot give suggestion about blood sugar in each level.

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2.3.4 dLife Diabetes Companion



Figure 05: dLife Diabetes Companion

The dLife Diabetes Companion is the diabetes mobile application. The dLife Diabetes Companion offers you access to the most essential tools you'll need to manage your diabetes. And healthy diabetes-friendly recipes, and track and manage your blood glucose levels anytime, anywhere.[15]

Pro

- The user can record and view the glucose value in graph
- The user can plan nutrition.

Con

- The application can't support the Nutritionists to management nutrition.
- The application can't support the user to analyze the behavior in each day.
- The user can't view body mass.
- The user can't record medicine.

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2.3.5 WaveSense Diabetes Manager



Figure 06: WaveSense Diabetes Manager

The WaveSense Diabetes Manager can help to track blood glucose. Enter your information in seconds, review the data with convenient charts and graphs, and gain a new perspective on diabetes management.[16]

Pro

- The user can record and view the glucose value in graph
- The user can plan nutrition.
- The user can view body mass.

Con

- The application can't support the Nutritionists to management nutrition.
- The application can't support the user to analyze the behavior in each day.
- The user can't record medicine.

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2.3 Technology Review

2.3.1 C# Programming

Technology Description

C# is a multi-paradigm programming language encompassing strong typing, imperative, declarative, functional, generic, object-oriented (class-based), and component-oriented programming disciplines. It was developed by Microsoft within its .NET initiative and later approved [8].

Alternative Technology

- VB.Net (Visual Basic .Net)
- C++
- JAVA

The selection technology

- It is written in simple language.
- C# supports language interoperability.
- C# can access code written in any .NET compliant language and can also inherit the classes written in these languages.

2.3.2 .NET MVC 5

Technology Description

.NET MVC 5 implements the Model-View-Controller (MVC) pattern, which helps Web developers build Web sites that are easy to maintain, because MVC decreases the dependency between application layers. ASP.NET MVC also improves the testability of ASP.NET Web applications by supporting test-driven development (TDD).

.NET MVC 5 has updates ASP.NET Identity, bootstrap, authentication filters and support attribute routing.

Alternative Technology

None

The selection technology

- .NET MVC 5 allows us to build the application using the Model-View-Controller architecture.
- .Net MVC 5 could be run on non-Microsoft Platforms and Multi Language Support in Webpage, .NET is fully objecting Oriented Programming.
- .NET MVC 5 includes features that enable fast, test-driven development for creating the application that use the last standards.

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2.3.3 HTML5

Technology Description

Hypertext Markup Language 5 is a revision of the HTML, HTML is the standard programming language for an appearance of web pages and describing the contents. HTML 5 is supports for multimedia on mobile devices. HTML 5 add new syntactic features were introduced to support this, such as video, audio and canvas tags. [8]

Alternative Technology

- HTML4

The selection technology

- HTML5 is standardized for creating the member interface of website.
- HTML5 can be displayed from any web browser.
- HTML5 can support media element, such as audio and video.
- HTML5 offers an offline application cache facility which will load the page the user has visited even if the user is temporarily offline.
- HTML5 can optimal for creation mobile application and website.

2.4 Development tools review

2.4.1 Microsoft Visual studio

Tool Description

Microsoft Visual Studio is an integrated development environment (IDE) from Microsoft. It is used to develop computer programs for Microsoft Windows, as well as web sites, web applications and web services. Visual Studio uses Microsoft software development platforms such as Windows API, Windows Forms, Windows Presentation Foundation, Windows Store and Microsoft Silverlight. It can produce both native code and managed code [10].

Alternative Technology

None

The selection tools

- Visual Studio provides the features to create the web application and mobile application with ASP.NET MVC technology.
- Visual Studio provides tools to develop web application and mobile application.
- Visual Studio is have error checker and auto-correct.

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Chapter Three | Quality Standard

3.1 ISO29110 for Very Small Entity (VSE)

ISO29110 is a guide applies to a Very Small Entity (VSE), enterprise, organization, department or project up to 25 people, dedicated to software development. The Guide provides Project Management and Software Implementation processes which integrate practices based on the selection of ISO/IEC 12207- Systems and Software Engineering — Software Life Cycle Processes and ISO/IEC 15289 Software Engineering – Software Life Cycle Process – guidelines for the content of software life cycle process information products (documentation) standard elements.

3.1.1 Project Management process

The purpose of the Project Management process is to establish and carry out in a systematic way the tasks of the software implementation project, which allows complying with the project's objectives in the expected quality, time and cost.

Activities

- Project Planning Process.
- Project Plan Execution Process.
- Project Assessment and Control Process.
- Project Closure Process.

3.1.2 Software Implementation process

The purpose of the Software Implementation process is the systematic performance of the analysis, design, construction, integration and test activities for new or modified software products according to the specified requirements.

Activities

- Software Implementation Initiation Process.
- Software Requirements Analysis Process.
- Software Architectural Design Process.
- Software Construction Process.
- Software Integration and Test Process.
- Software Delivery Process.

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Chapter Four | Project Plan

4.1 Motivation

Diabetes is a disease that needs to monitor as intermediary diabetes causes complications. Currently, several applications can help patient access to health care of them. Whether meal plan or exercise plan, But many application has been developed make it difficult to understand to use and difficult to follow the each value whether glycemic value or calories for view the difference value in each day. The most application supports only individuals obese.

So we are developing the application better that has more benefits for diabetics who need to prevent the complications.

Diabetes Care is the application that has been developing to support the patient diabetes. By the "Diabetes Care" has been developed in part of the feature that can monitor nutrition behavior to analyze glycemic index in each day. Besides the application can monitor the blood sugar in every time that the patient gets the check from doctor and record in "Diabetes Care" by view the difference in form graph. The application developed for the patient that can use the most benefit and easy to use for people with diabetes.

4.2 Aim and Objective

4.2.1 Aim

To develop the “Diabetes Care Web application” to support diabetic. When diabetic need to know status information about preliminary data of the patient. The user or patient can follow info its treatment for preventing disease or provide care glycemic to level in standard that the doctor can admit.

4.2.2 Objective

To develop the web application following features for “Diabetics Care.”

- To develop the web application that has a function to support patient can planning the nutrition in each day for control the glycemic index and body mass.
- To develop the web application that has a function to support patient can planning the exercise in each day for monitor the body mass.
- To develop the web application that has a function to support patient can monitor the status of blood sugar value and get a suggestion from a system.
- To develop the web application that has a function to support patient can control the behavior of patient living.

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4.3 Deliverable and limits

4.3.1 System Architecture

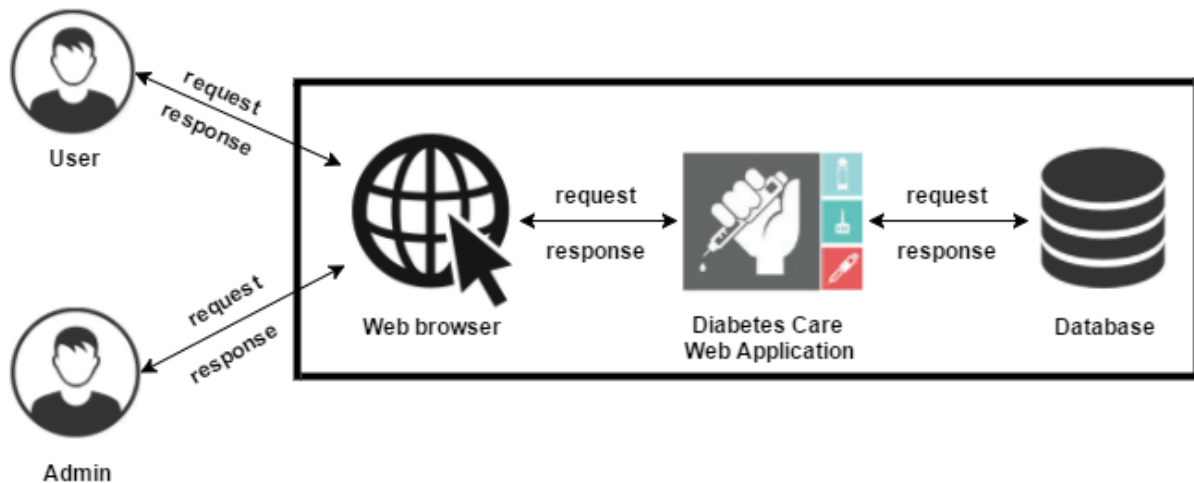


Figure 07: The Architecture of the system

The Architecture of “Diabetes”

The “Diabetes Care Web Application” can run on the different platform (mobile web browser, PC web browser). The first part, database server stores the data of Diabetes application about the information of Patient, nutritionists and data of foods and activity. Second, The user who can send the request via a web browser to “Diabetes Care web application”. The application will request information from the database and return to the user.

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4.3.2 Document

- Proposal
- Project plan
- Software requirement specification
- Software design document
- Testing document
- Traceability record
- Software quality assurance document
- Certification client and server system
- Video clips from the demo program

4.3.3 Limits

- The internet connection is required for using this system
- The system can test on google chrome web browser version 53.0.
- The system supports only Thai languages.
- Exercise guidelines for people with diabetes. Reference from::
www.thairunning.com and www.doctor.or.th

4.4 Future Work

- Diabetes Care can develop to mobile application.
- Diabetes Care web application can help public user to planning healthy.
- Diabetes Care web application can develop to be technology internet of thing.

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4.5 Software Process

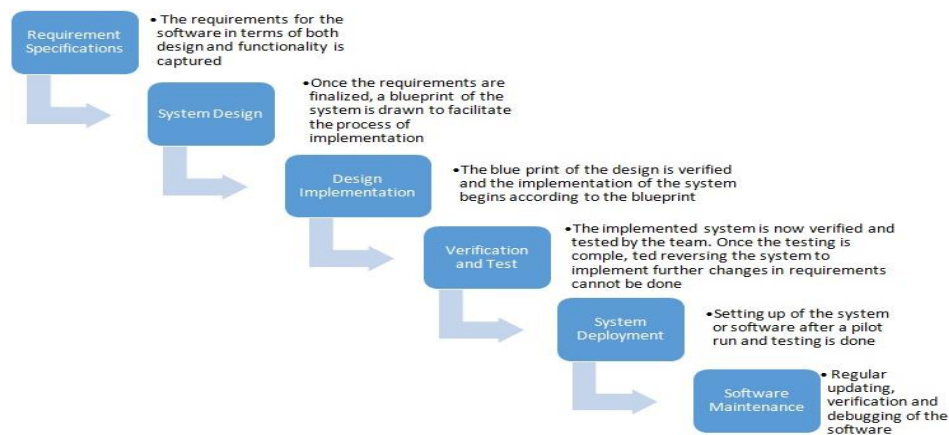


Figure 08: Waterfall Model

The waterfall model is a sequential design process, used in software development processes, in which progress is seen as flowing steadily downwards (like a waterfall) through the phases of conception, initiation, analysis, design, construction, testing, production/implementation and maintenance. [14]

The waterfall development model originates in the manufacturing and construction industries: highly structured physical environments in which after-the-fact changes are prohibitively costly, if not impossible. Because no formal software development methodologies existed at the time, this hardware-oriented model was simply adapted for software development. [13]

Requirement Analysis: All possible requirements of the system to be developed are captured in this phase and documented in a requirement specification doc.

System Design: The requirement specifications from first phase are studied in this phase and system design is prepared. System Design helps in specifying hardware and system requirements and also helps in defining overall system architecture.

Implementation: With inputs from system design, the system is first developed in small programs called units, which are integrated in the next phase. Each unit is developed and tested for its functionality which is referred to as Unit Testing.

Testing: All the units developed in the implementation phase are integrated into a system after testing of each unit. Post integration the entire system is tested for any faults and failures.

Deployment: Once the functional and non-functional testing is done, the product is deployed in the customer environment or released into the market.

Maintenance: There are some issues which come up in the client environment. To fix those issues patches are released. Also to enhance the product some better versions are released. Maintenance is done to deliver these changes in the customer environment.

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4.6 Schedule and milestones

4.6.1 Features

There are three types of Patients:

1. Patient
2. Admin
3. Nutritionists
4. Nurse
5. Doctor

Feature#1: Authentication system.

Description: This feature supports the user to login to system and to log out of the system. The system shall provide UI to enter username and password for user need to login. And system shall provide logout button for user need to sign out.

User: Patient, Nutritionists, Admin, Nurse, Doctor

Detail:

- 1-1 The patient can login to the system using username and password.
- 1-2 The patient logout when stop uses the system by clicking logout button.
- 1-3 The nutritionists can log in to manage the nutrition by using username and password.
- 1-4 Nutritionists can log out when finish the process by clicking logout button.
- 1-5 Admin can login to manage nutritionists and nurse account by using username and password.
- 1-6 Admin can log out when finish the process by clicking logout button.
- 1-7 The nurse can login to manage patient account and activity by using username and password.
- 1-8 The nurse can logout when to finish the process by clicking logout button.

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Feature#2: Account management.

Description: This feature supports to manage the account. The nurse can enter patient to the system, and the patient can view personal information. Which is information that about (name, age, gender, weight, height, diabetes type and date that start treatment). And support admin can manage nutritionists and nurse. When the admin has requested from nutritionists and nurse, need to register to the system. The system shall provide an interface to admin for add nutritionists (username, password, and name), edit username, password, and name of nutritionists and admin can delete nutritionists from the system

User: Patient, Admin, Nurse

Detail:

- 2-1 The nurse can enter patient (username, password, name, age, gender, weight, height, diabetes type and date that start treatment) to the database server.
- 2-2 The patient can view name, age, gender, weight, height, diabetes type, and date that start treatment of his on profile page.
- 2-3 The patient can update name, age, gender, weight, height, diabetes type, and date that start treatment on his profile page.
- 2-4 The patient can change the password by input current password and new password.
- 2-5 Admin can add nutritionists to the system by input username, password, and nutritionist's name.
- 2-6 Admin can edit username, password, and name of nutritionists.
- 2-7 Admin can delete nutritionists from the system.
- 2-8 Admin can add the nurse to the system by input username, password, and nurse's name.
- 2-9 Admin can edit username, password, and name of nurse.
- 2-10 Admin can delete nurse from the system.

Feature#3: Nutrition management.

Description: This feature supports to manage nutrition. Help the nutritionists to manage food name, the glycemic index of food, and food calorie. When the nutritionists need to add food to database or update in the database or delete from the database. The system shall provide UI to nutritionists for add/update/delete food list on the database.

User: Nutritionists

Detail:

- 3-1 The nutritionists can add food by input food name, the glycemic index of food, and food calorie to the database.
- 3-2 The nutritionists can edit/update food name, the glycemic index of food, and food calorie on the database.

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3-3 The nutritionists can delete the food from the database.

Feature#4: Activity management

Description: This feature supports to manage activity. Help the nurse to management exercise for the patient. When nurse needs to add exercise by input patient symptom and exercise advice to the database or update/edit in the database or delete from the database. The system requests input patient symptom and exercises advice to create new exercise. The system shall provide UI to updating patient symptom and exercises advice. The system provides delete button to remove exercise from a database.

User: Doctor, Nurse

Detail:

4-1 The nurse and doctor can add exercise suggestion by input patient symptom and exercise advice to a database

4-2 The nurse and doctor can update patient symptom and exercise advice.

4-3 The nurse and doctor can delete exercise from a database by clicking delete button.

Feature#5: Activity plan and recommend system.

Description: This feature supports the plan to exercise on each day of the patient. The patient will get the suggestion about precautions exercise from the system. The patient can select symptoms that show on the body. And the system will provide the advice about appropriate exercise.

User: Patient

Details:

5-2 The patient can select the symptoms that show on the body from database.

5-3 The patient can view the suggestion about precautions exercise using the information from <https://www.doctor.or.th/article/detail/11496>.

Feature#6: Nutrition plan system.

Description: This feature supports to plan about nutrition in each day. The patient can select foods name from database and record in the plan. The system brings food chosen to calculate calorie and glycemic index. After system calculated the system will display data to the patient.

User: Patient

Details:

6-1 The patient can select the foods name from the database.

6-2 The patient can record food name in a plan.

6-2 The patient can view the average of glycemic index and calorie of food in the selected plan.

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Feature#7: Health monitors system.

Description: This feature supports to monitor the blood sugar. The patient can record blood sugar value, and the view is a statistic line graph. And the system provides the recommended about a level of blood sugar to the patient. This feature helps the patient can monitor blood sugar to the level that doctor admit. And this feature supports to track BMI value. The system shall bring weight data and height data from patient profile to calculated BMI and return value to a patient.

User: Patient

Detail:

- 7-1 The patient can record blood sugar value.
- 7-2 The patient can view body mass value that calculated by using $BMI = \text{weight (Kg)} / (\text{height (m)} * \text{height (m)})$.
- 7-3 The patient can view statistic line graph of blood sugar and body mass.
- 7-4 The patient can view interpretation about blood sugar level from system.

Feature#8: Behavior monitors system.

Description: This feature supports to monitor the behavior of patient on each day. When the patient login the system will redirect to behavior page. The system shall request the patient to select food and medicine that eats in that day. The system brings the data from the patient to analyze about the glycemic index of the food. And the system shall display analyze result like the traffic light to patient

User: Patient

Detail:

- 8-1 The patient can select food name from the database.
- 8-2 The patient can check the list of medicine.
- 8-3 The patient can view the daily graph of glycemic level.

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Relationship between Features and User

Feature No.	Patient	Admin	Nutritionists	Nurse	Doctor
Feature 1	/	/	/	/	/
Feature 2	/	/		/	
Feature 3			/		
Feature 4			/	/	/
Feature 5	/				
Feature 6	/				
Feature 7	/				
Feature 8	/				

Table 02: Relationship between Features and User

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4.6.2 Milestone

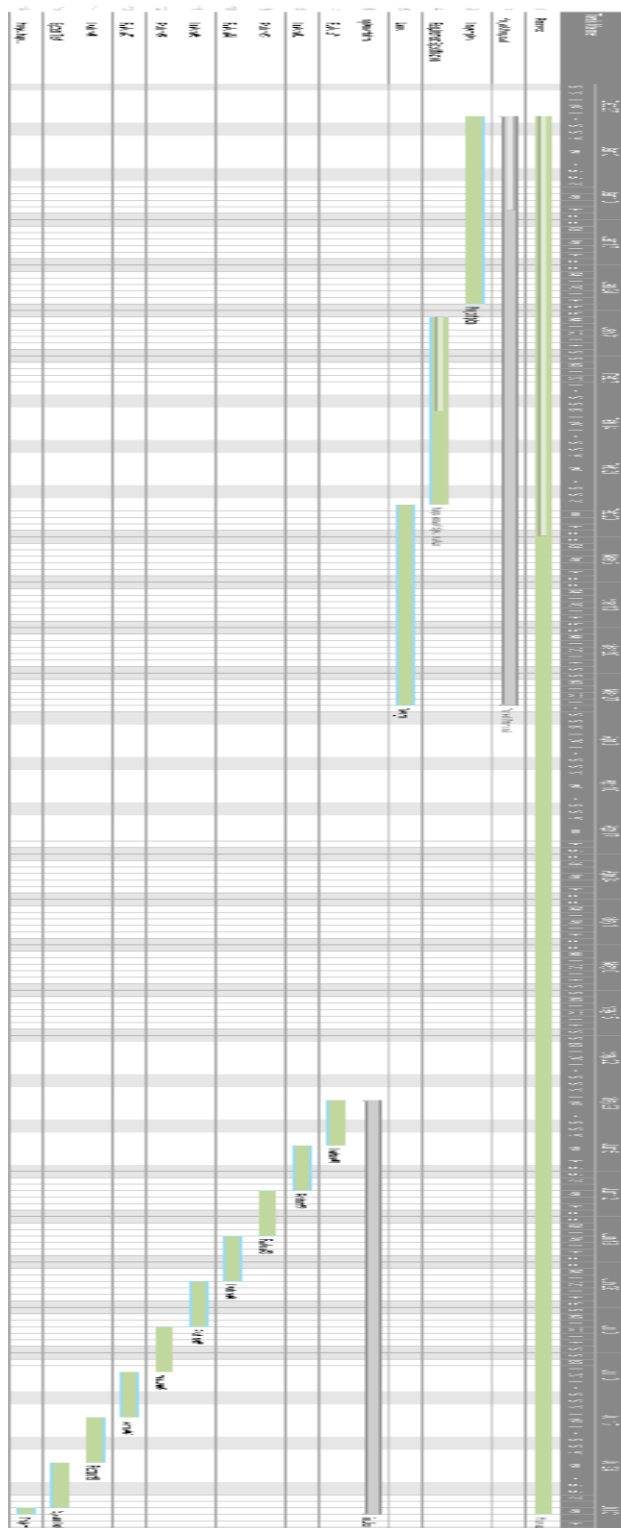


Figure 09: Milestone

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