



**SCHOOL OF COMPUTER SCIENCES**

**UNIVERSITI SAINS MALAYSIA**

**Group Innovation Project and Study for  
Sustainability Final Report**

**Food Bank**

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## **Declaration**

“We declare that all this submitted work is entirely our own except for those sources which we have referenced, and that it has not been previously submitted for assessment in any course.”

## **Acknowledgements**

We are most grateful for the help of our classmates who gave moral support and encouragement to complete this report. Their continuous support in a variety of ways throughout the creation of this report is appreciated.

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## **Abstract**

World hunger is a major issue faced by many countries everywhere these days. Despite the efforts put into ending the world's hunger, many countries still have problems regarding their citizens not having enough food for the day. Some people live on less than a dollar a day. On the opposite side of the spectrum, you have food waste which is a major issue causing the huge paradox to take place. On one hand we have hungry people whilst on the other hand we have food being wasted. This project is to aid in solving the Sustainable Development Goal (SDG) 2, also known as Zero Hunger, by proposing a system that can connect all of the community fridges in Penang, in a systematic fashion. The project has both scientific and ethical goals. From a scientific standpoint, it tries to provide an alternative treatment to manage the overwhelming amount of food waste as well as aid in reducing the cost of living for those in need, by providing access to food supplies in order to get nutritious food for free from the fridge to supplement/provide for their daily meals. From an ethical standpoint, the project will aid in raising serious awareness regarding food shortage, waste, and management. Our group, IoTbasics, will try to weave in both of these goals in a seamless manner in order to produce a system that is efficient, consistent, and capable of tackling SDG-2. With massive quantities of food wastage internationally, locally and so many needy; it was only a matter of time until individuals teamed together and developed a solution. Many communities throughout the world have come together and constructed communal fridges/shelves. We wanted to contribute to such amazing endeavors; we spotted a need that a bit of technology might assist fill by providing a mapping platform. The system is a simple mapping tool and event organizer, which assists users to identify nearby fridges. It includes a lot of clever alternatives to not only identify neighboring fridges but also see their content and arrange social events to donate food.

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# 1. Introduction

## 1.1 Background

Hunger has become a major problem that threatens hundreds of millions of people, as studies have indicated that there are more than 690 million people suffering from malnutrition. This is due to many problems, including the lack of food, or food insecurity. After the spread of the COVID-19 pandemic, hunger became a serious problem. And with the MCO regulations, it became difficult for volunteers, staff, and donors to move freely to reduce direct contact. We came up with an idea that placed many fridges in the most populated areas through Penang. As result, donors can directly put the donated food inside the fridge, and people can take what they need without any questions. The organization faced many problems because of the lack of a system that can facilitate the use of these fridges.

The system(website) proposed will provide donors and needy people easy access to the location of all fridges and reach the nearby one, also can have a glamour glance at the content of each fridge. This system will give individuals (donors) access to those fridges if they want to help and stack them up. Also, needy people can use the system to know where the nearby fridge is and what is inside it. In addition to that, the system will have a money donation muddle where users can donate to the organization or food event provider in order to run and contribute more to making Penang hanger-free and waste-free.

## 1.2 Problem statement

Regular surplus or unused food is available in many restaurants, malls, shops, and people in Penang. This is due to the lack of easy ways to make them donate the extra food to those who need it, most tend to throw in the garbage and not strain themselves in searching for an organization or searching for a poor person. Statistics have indicated that approximately 700 tons of daily food are thrown in Penang only. Imagine that there could be people who die or suffer from starvation every minute of the day in every single part of the world, and the food you throw away today could help to feed a family.

The current method of donating food to organizations whereas these organizations go through the process of distributing the food to people in need is time-consuming and needs a lot of labor. However, a lot of people would rather just throw food into garbage than take the effort to donate that food because either these organizations are far away from their location, or they don't have the time to do so. This system could solve this problem by providing a nearby fridge and excluding the middleman which is the organization from the donation process.

### 1.3 Project objectives

The objectives of this project are:

- To develop a website that has a good design and a comfortable interface to improve user experience.
- To develop a searching method that provides the user a map with the nearby community fridges.
- To share the fridge content with the users.
- To develop a platform where the donor can create events and set event details such as event date, time, address, and description.
- To help people who need food to attend food events and get food that they need.
- To provide an easy way for donors to reach the food event providers and donate to them.
- To encourage people to donate food which will lead to reduce of wasting food and helping poor people.

### 1.4 Proposed solution / project

The Chosen Sustainable Development Goal (SDG) that we are addressing is the second goal, which is Zero Hunger. According to the World Food Program, nearly 690 million people are hungry, or 8.9 percent of the world population due to man-made conflicts, climate change, and economic downturns.

On the other hand, many restaurants, malls, stores, and individuals in Penang have a daily surplus of unwanted food. As a food of thought, how do we usually dispose of the food in excess? Most of us tend to throw it into the garbage as we lack an easy way to donate the food to those who need it.

A UN report says that 1.6 billion tons of food are thrown into waste worldwide each year. The United Nations Environment Program's Wasted Food Index stated that 17 percent of food intended for consumption in stores, homes, and restaurants ends up in waste bins. An estimated daily amount of food wasted in Penang is 590 tons. Imagine that every minute of every day in every single part of the world, there might be people who die or suffer due to hunger, and the food you throw away today might help to feed a family.

Therefore, as part of the initiatives to achieve Zero Hunger and food waste revolution, we would like to highlight this problem and propose a new system that can connect and manage all the community fridges in Penang systematically. We wish to provide an alternative to treat excessive food by serving a convenient platform for people to donate it instead of turning it into waste.

## 1.5 Benefit or impact of the proposed solution

The main significance of the Project is to allow both the donor and the needy to contribute or receive food in a convenient manner. The technology allows donors and the needy to learn about nearby fridge locations. since the provider will take a photo for fridge content when donating the food, other users will be able to see some details about fridge content. The food may be placed straight in the fridge by the giver, and the food can be conveniently obtained by the needy. Furthermore, it would have numerous elements that will save time for contributors while also assisting in reducing the quantity of everyday garbage. Identifying community fridge locations, sharing fridge content, fridge stock status, and providing initiative support option to help food events providers to create more events.

There are many benefits provided by the project that aid in lowering the expense of life for the poor by providing food. The hungry can acquire free nutritious food from the refrigerator to supplement their daily meals. This can assist folks who are unable to purchase enough food to satisfy their hunger. It is not limited to that, a donation platform will be provided, where the user can donate any amount of money to the organization and food event provider to create more and more food events.

The prime impact that the project may change is reducing food waste and increasing community awareness of the need for food donation. Food waste is mostly caused by spoilage, over-purchasing, and overproduction. As a result, this mechanism enables donors to give food that they no longer require. The mall may also gather overproduced or soon-to-expire food and distribute it to those in need via the refrigerator.

## 1.6 Uniqueness of proposed solution

The proposed system has similarities with the existing systems such as the mapping tool where we will develop a method to search for the fridge locations in the map, however, this system will have the feature of searching for the nearest fridges. In addition to that, this system is going to have a social platform where donors can make and post events through the system. These events will be featured in the system to guarantee the maximum reach to the people in need so they can attend these events and have their stomachs filled.

This application also features a uniquely added idea for the specific organization or event provider which is a donation feature. Although this feature might not be in the MVP (minimal viable product) it is definitely a feature that must be absolutely implemented.

## 1.7 Contribution

List of tasks/works for each individual.

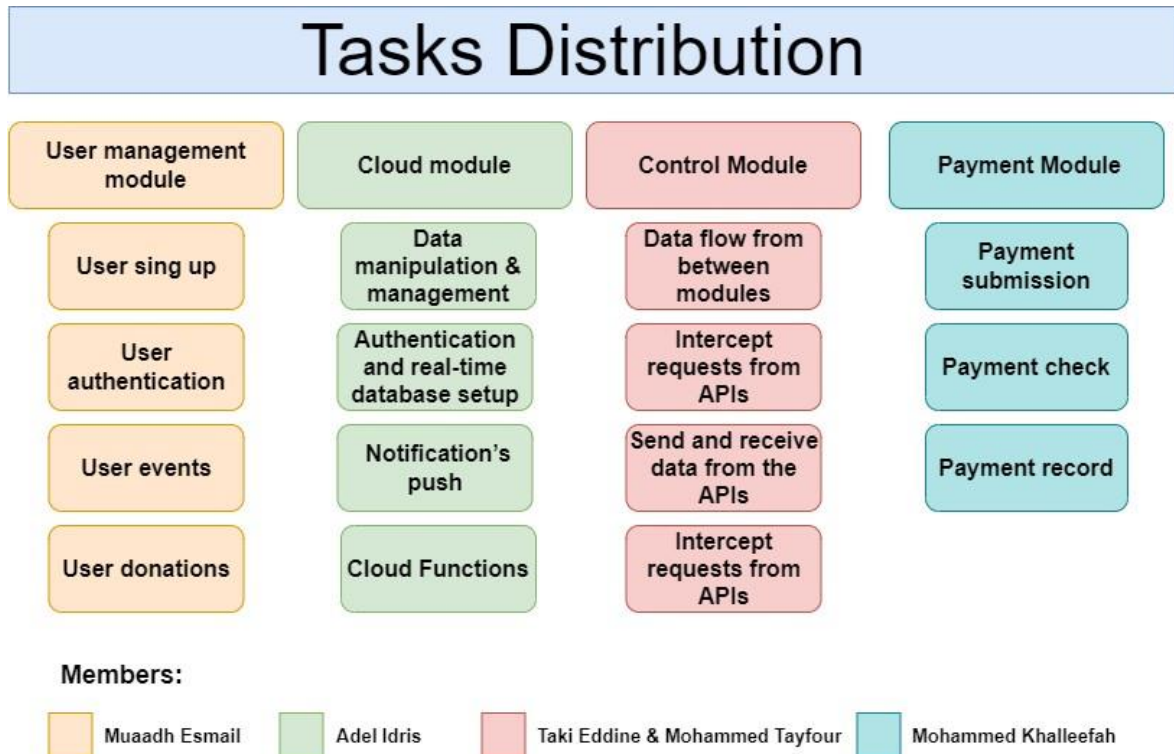


Figure 1: Task Distribution

The task distribution is highlighted as per the image where every project member is involved in their Module. Muaadh Esmail was involved in User management module, Adel Idris was involved in Cloud Module, Mohammed Khalleefah was involved in Payment Module, and Control Module was handled by Taki Eddine & Mohammed Tayfour.

In the case of the together tasks, we had a lot of discussions. We exchanged ideas(brainstorming) from different members of the group to create a new and distinctive idea that helps develop the system and improve the levels of the system as much as possible. Many ideas were put forward that led to the development of the system, and we made more than one decision by the group to reach the goal in the best way. In terms of system design, all team members participated in the design of the system in order to reach the best design that suits the user.

## 1.8 Organization of the report

The report consists of 7 chapters namely, Introduction, Background Study & Related Work , System Requirements and Analysis, System Design, Implementation, Testing and Evaluation, and Conclusion and Future Work. These 7 chapters are a documentation of how the project has been carried out in the 6 major steps of iterative and agile development namely, identifying the problem, planning, understanding the details, designing system components, building and testing system components, compiling all units as whole for testing and finally, deployment.

The first chapter of the report is an introduction to the project that provides a background of the project environment and introduces the problem that sparked the creation of the project. It underlines the objectives, motivation and innovativeness of the report and sets the tone for the rest of the report.

The second chapter of the report is a background study that covers on the existing solutions that the project proposed competes with. It includes comparisons between the project and existing solutions, concluding with how the project succeeds at doing better than the already available systems.

The third chapter of the report is the system analysis where the user requirements and use cases are analyzed. This chapter of the report is particularly important because it is where the system begins to take shape by assuring that it is created suitably for the target market and key stakeholders of the project. It includes the Use case and activity diagrams and hardware/software specifications of the project.

The fourth chapter of the report is the system design where the design choices and how the design is implemented are discussed. In this section, the system architecture, system's classes, system components and modules, database design, and input and output design are expanded upon.

The fifth chapter of the report is about the implementation of the project. It covers about the module implementation and explains how the project has been coded from ground up. This section also expands on how each module was implemented by each member.

The sixth chapter of the report is testing and evaluation of the project. This chapter discusses how the system was tested and evaluated. There are 4 types of testing discussed namely, unit testing, integration testing, system testing, and user acceptance testing. The system is then evaluated for its ability to meet the requirements defined in chapter 3

Finally, chapter 7 is the conclusion and future work. This chapter discusses on the limitations and shortcomings of the system that could be improved upon if the project were to be continued further. This section also concludes the report by summing up all of the report.

## 2. Background Study & Related Work

### 2.1 Existing System

The idea of developing an application with location services and cloud services to help donate food or money is not relatively new as some of these applications have already been existing for quite some time. However, none of these applications are focused on Malaysia and have a goal towards fighting hunger and reducing food waste.

The applications that are similar to our field include **FREEDGE** and **Food Rescue US**, where the first is a sharing mechanism aimed to eliminate food hunger and food waste, establishing a stronger community. And encourage equal access to nutritious food through the installation of community fridges that are used to exchange food and ideas at the local level [1]. The last connects food donors with hunger relief organizations, the **Food Rescue US** app [2] helps fight food insecurity. The app is intended for anyone interested in donating or receiving food. Users answer a few questions and then place an order for food delivery. The algorithm matches surplus food with nearby shelters and dispatches a driver to deliver it. Over 2,200 registered volunteers rescued and distributed 23.1 million meals to those in need.

### 2.2 Features Comparison of the existing System

Table 1: Feature comparison

Functionality	Freedge	Food Rescue US	Food Bank
Offline connectivity	×	×	×
Location services	✓	✓	✓
Store images	✓	×	✓
Cloud services	×	✓	✓
Free to use	✓	✓	✓
Request categories	×	✓	×
Real time push notifications	×	✓	×
Post social events	×	×	✓
Donate to support events	×	×	✓

## 3. System Requirements and Analysis

### 3.1 Status of project development

Food bank is a completely new web app, that is being specially developed from scratch under the course CAT 304 Group Innovation Project and Study for Sustainability.

### 3.2 Scope of the proposed solution

Food bank is designed to mainly focus on providing a platform for people that need food and would like to donate food as well as those who want to organize food driven events. The project scope focuses on providing fridges location, fridges content by providing photo of the fridge, and assisting users to get together by posting a food event. The system consists of user management module, cloud module, payment module and finally a control module.

### 3.3 System Capabilities & Limitations

This food bank system capabilities includes:

- Locate fridge.
- Get direction.
- Post food event.
- View fridge content.
- Support an event by donation.
- Attend an event.

On the other hand, like every application that is available on the market , our application, foodbank also comes with its own share of external and internal limitations. These challenges can be overcome if further effort of research and progress is the future. The challenges are as follows:

➤ *Network connectivity* - The application requires a constant network connection in order to receive and send information from the cloud.

### 3.4 Project Management

#### 3.4.1 Work Breakdown Structure

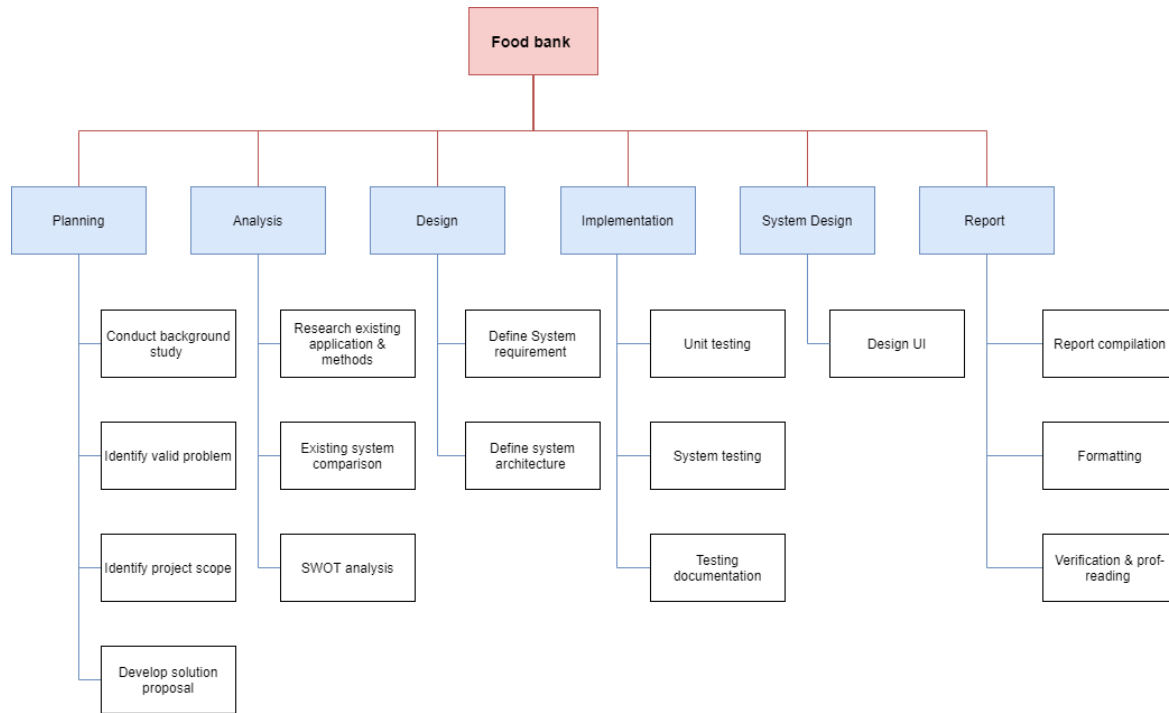


Figure 2: WBS diagram

### 3.4.2 Gantt Chart

First iteration.

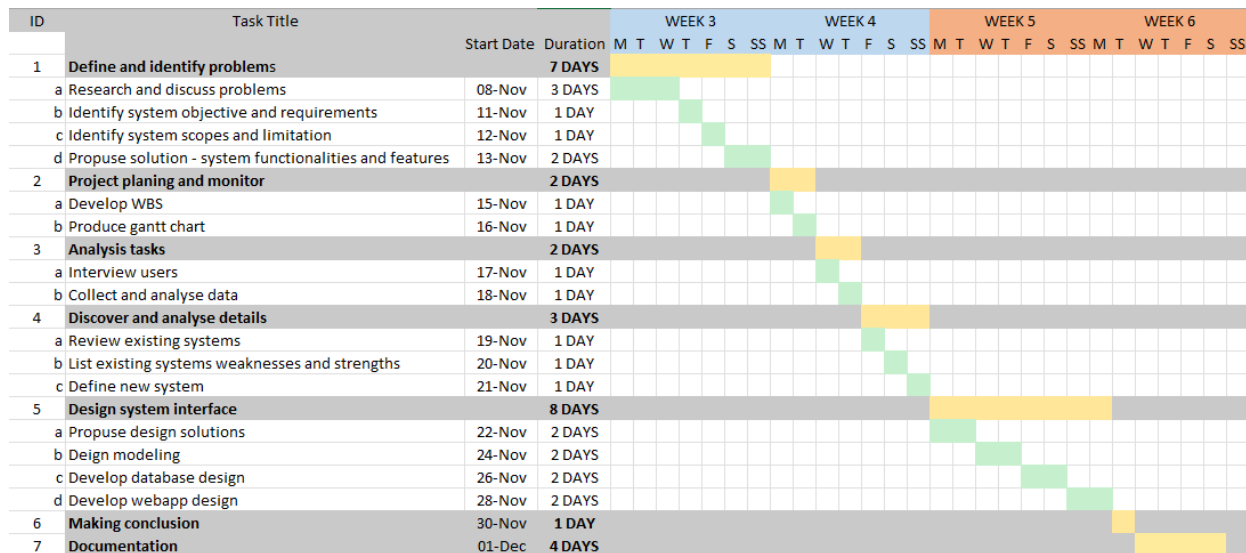


Figure 3: Gantt chart 1<sup>st</sup> iteration



## Second iteration.

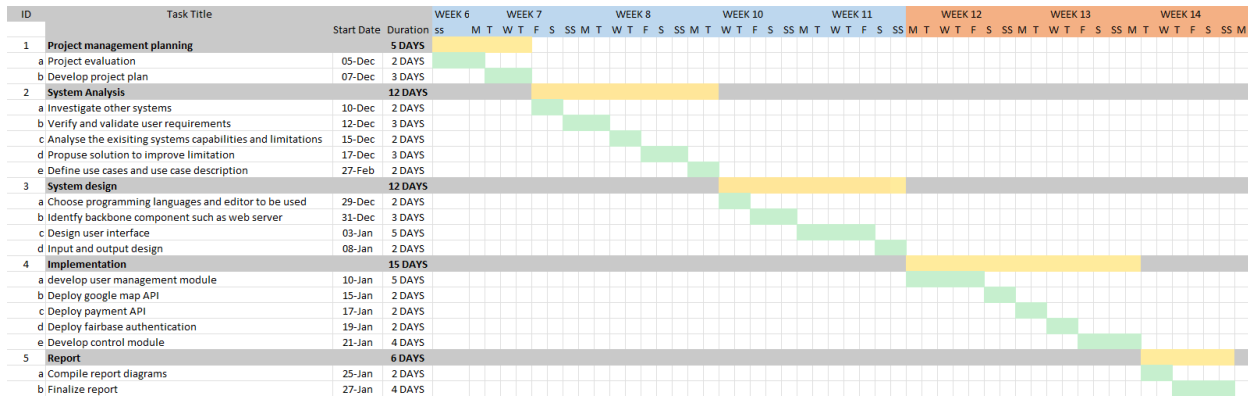


Figure 4: Gantt chart 2<sup>nd</sup> iteration

### 3.4.3 SWOT Analysis

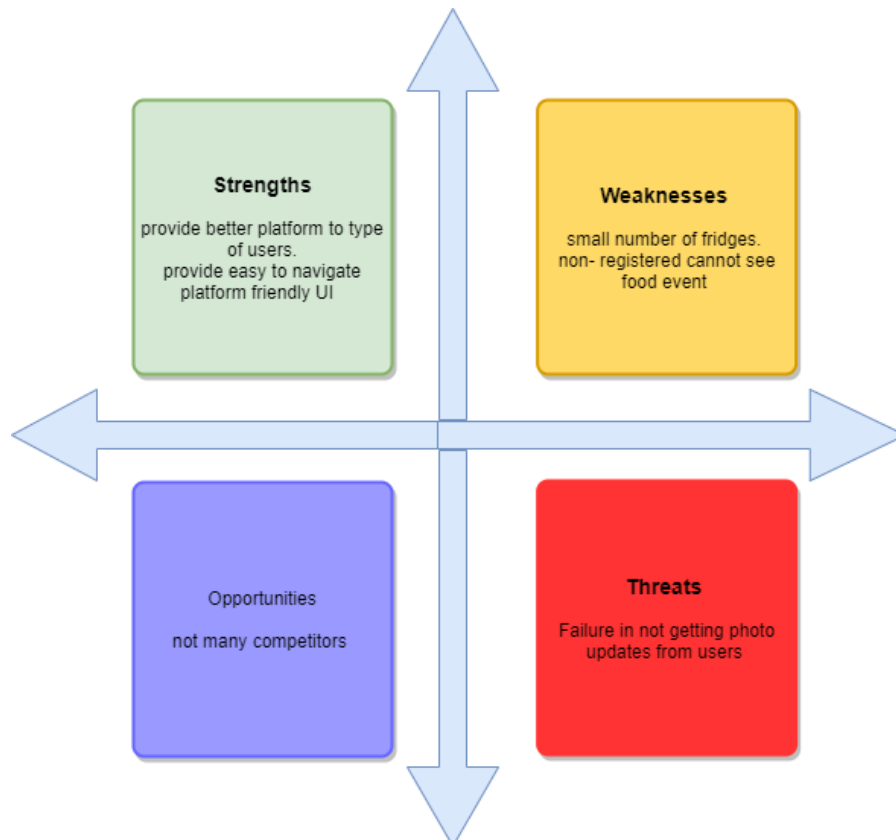


Figure 5: SWOT diagram

### 3.5 Development Methodology

We will be using the Agile Software Development Life Cycle (SDLC) for our project Food Bank.

Agile is a methodology (method) for managing software projects that focuses on building the product in several stages and in short periods of time, and each stage generates a product that is distinct from the previous one with additional characteristics. This (progressive) product is considered a real product that the customer can interact with. So based on that, we have chosen Agile SDLC because the iterative approach allows us to constantly improve our development in short time periods called iterations. Every iteration is like a mini-project of the main project, which includes all the tasks necessary to develop in incremental stages of functionality: planning, requirements analysis, design, coding, testing, and documentation. After the completion of every iteration, our team re-evaluates the priorities of the project to see what needs more development and improvement.

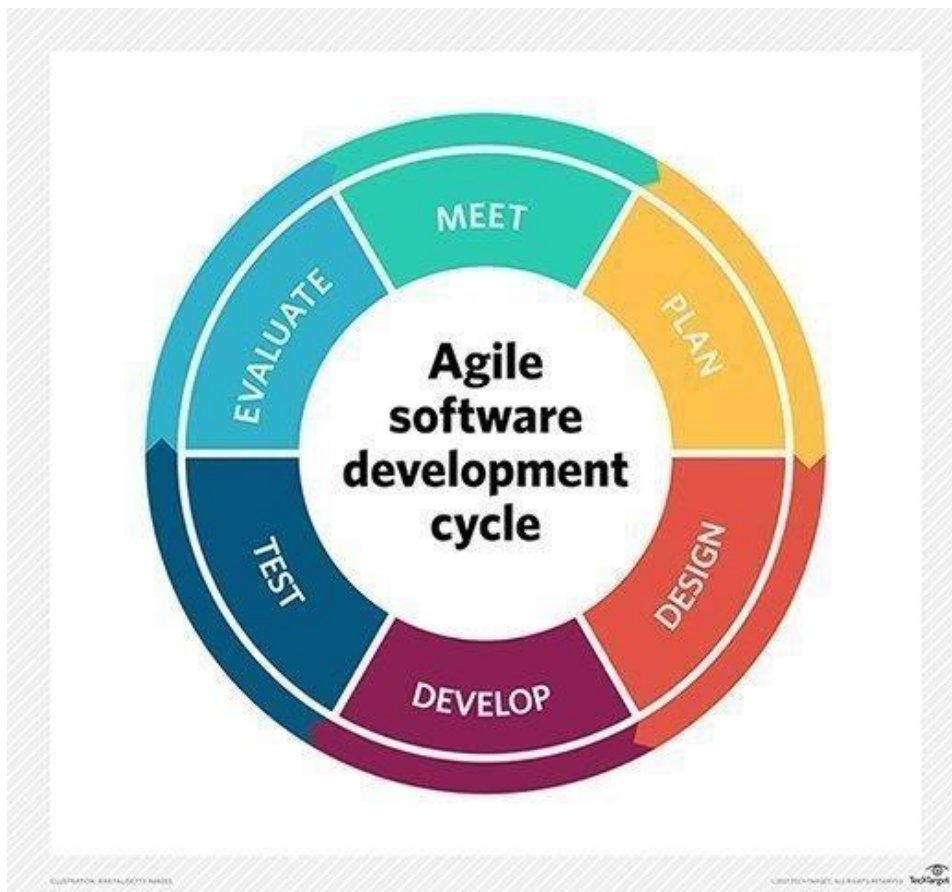


Figure 6: Agile development life cycle

### 3.6 Analysis of Proposed Solution/Project

Before we begin to progress any further with the system development, we first conducted small survey research in the computer science students to check whether our problem statement can be validated. Based on the survey questions, we see that people think Foodbank is a good idea and people would love to donate food.

#### Q1. Do you think that there is much food wasting in Penang?

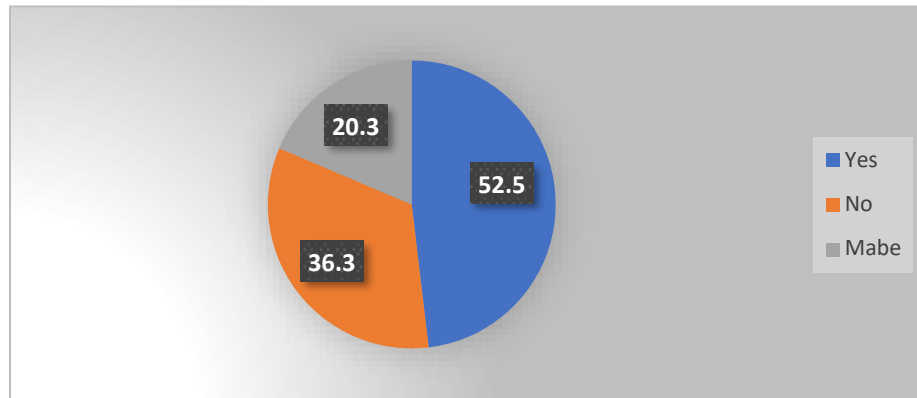


Figure 7: Analysis of Q1

#### Q2. Do you believe the Foodbank system can help poor people?

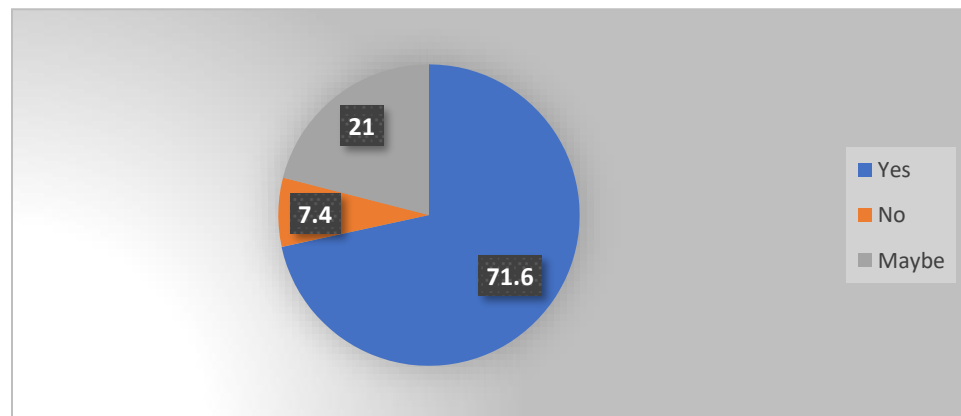


Figure 8: Analysis of Q2

#### Q3. If there was a donation fridge nearby you, would you donate food?

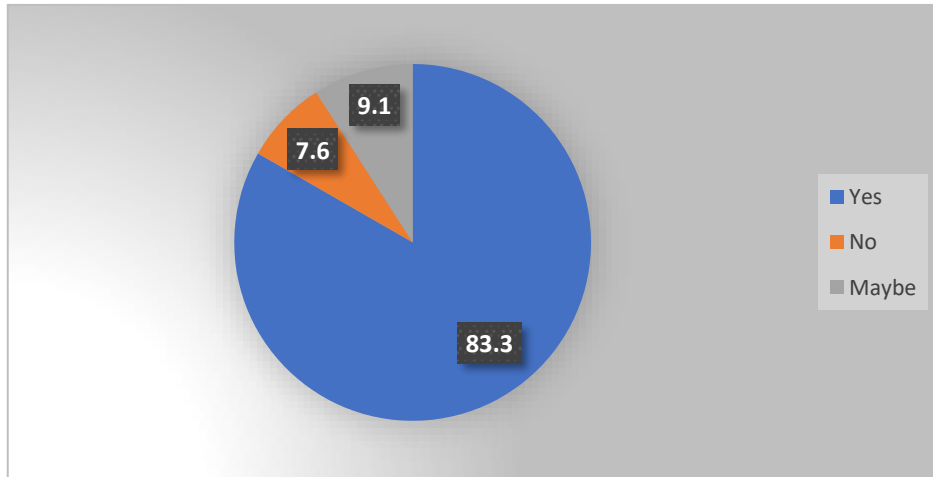


Figure 9: Analysis of Q3

About 57 people shared this survey, and as it turns out, students liked the idea, and some were excited about donating the food. As the first pie chart shows, many survey participants think there is a lot of food wasted. In addition, most participants believed that the idea of a Foodbank would help poor people find food, as indicated in the second pie chart. The good thing about this is that many of the participants in the services were enthusiastic about donating food if the fridge were available to donate nearby their homes. This is the incentive that prompted us to complete the system.

### 3.7 UML/ Design diagram

#### 3.7.1 Use Case Diagram

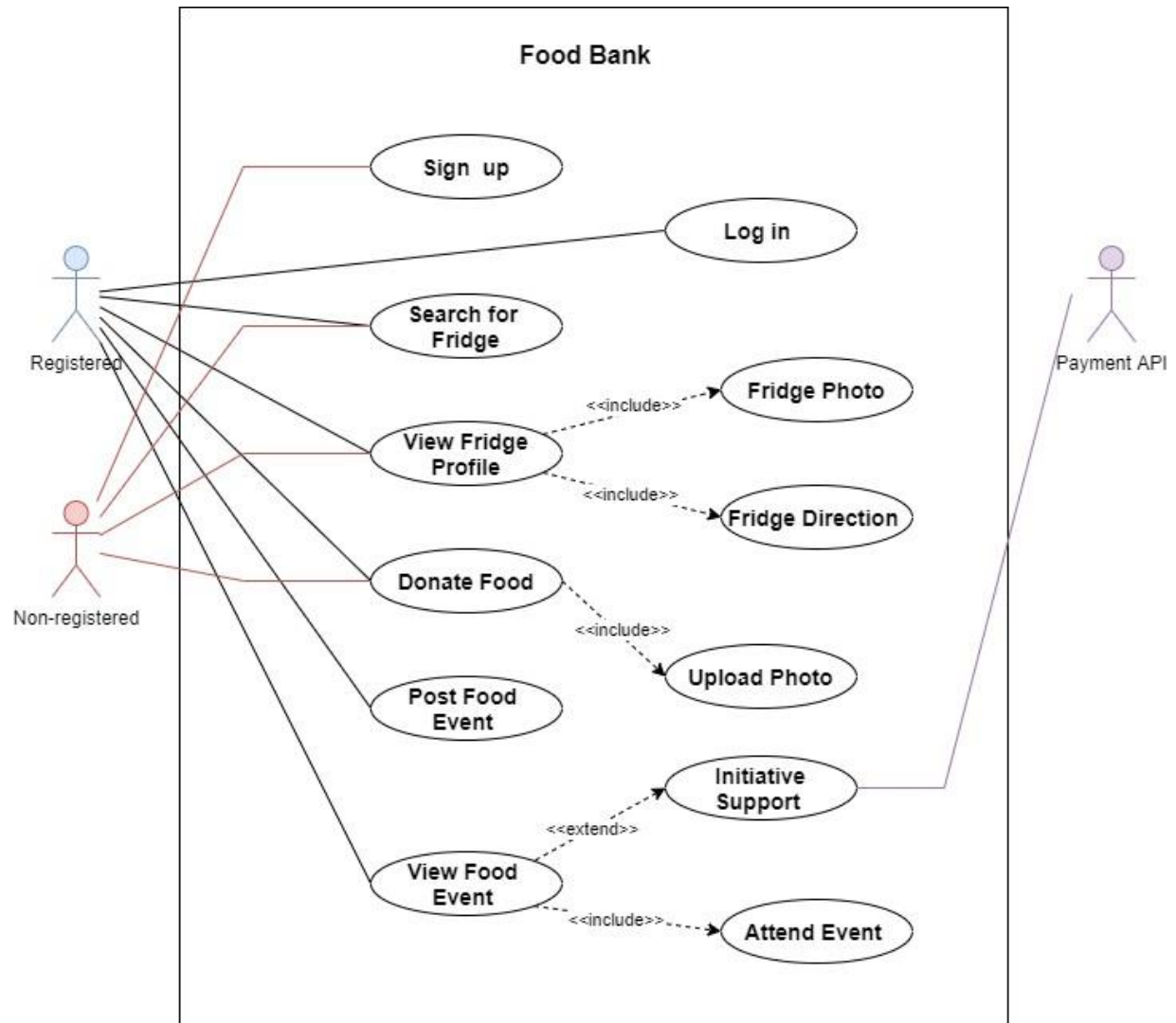


Figure 10: Use case diagram

#### 3.7.2 Use Case Description

##### ➤ Sign up

Table 2: Sign up

<b>Use case name:</b>	<b>Sign up.</b>	
<b>Scenario</b>	<b>User needs to sign up to be a registered user.</b>	
<b>Triggering event:</b>	<b>User needs to visit sign up page and enter his/her information to sign up.</b>	
<b>Brief description</b>	<b>The Sign up use case allows the User to create a login and become a Registered User to use the main function in the system.</b>	
<b>Actors:</b>	<b>User</b>	
<b>Relate use cases:</b>	<b>-</b>	
<b>Stakeholders:</b>	<b>User</b>	
<b>Preconditions:</b>	<b>User has an active email.</b>	
<b>Postconditions:</b>	<b>-</b>	
<b>Flow of activities:</b>	<b>Actors</b>	<b>System</b>
	<b>1. User needs to visit the sign up page.</b>  <b>2. user needs to enter his/her information.</b>   <b>5. User needs to enter his/her email and password.</b>	<b>3. check if the user is a registered user or not.</b> <ul style="list-style-type: none"> <li>• If yes, log-in</li> <li>• If no, user has registered successfully</li> </ul> <b>4. Go to Log-in page.</b>
<b>Exception conditions:</b>	<b>Failure to register the user.</b>	

➤ **Log-in:**

Table 3: Log in

<b>Use case name:</b>	<b>Log-in.</b>	
<b>Scenario</b>	<b>User needs to Log-in to visit the system as registered user.</b>	
<b>Triggering event:</b>	<b>User needs to visit Log-in page and enter his/her information to Log-in.</b>	
<b>Brief description</b>	<b>The Log-in use case allows the User to enter the system as registered user and to use the main function in the system.</b>	
<b>Actors:</b>	<b>User</b>	
<b>Relate use cases:</b>	<b>Sign up</b>	
<b>Stakeholders:</b>	<b>User</b>	
<b>Preconditions:</b>	<b>User already registered.</b>	
<b>Postconditions:</b>	<b>-</b>	
<b>Flow of activities:</b>	<b>Actors</b>	<b>System</b>
	<b>1. User needs to visit the log-in page.</b>  <b>2. user needs to enter his/her email and password.</b>       <b>5. User visit the Fridge page as registered user.</b>	<b>3. Check if the email and the password is valid.</b> <ul style="list-style-type: none"> <li>• If yes, log-in successfully</li> <li>• If no, user need to register,</li> </ul> <b>4. Go to Fridge page.</b>
<b>Exception conditions:</b>	<b>Failure to check the database.</b>	

➤ **Search for Fridges**

Table 4: Search for fridges

<b>Use case name:</b>	<b>Search for fridges.</b>	
<b>Scenario</b>	<b>User with or without account can search for the fridges to view fridge data.</b>	
<b>Triggering event:</b>	<b>User needs to visit the Fridge page search for the Fridges.</b>	
<b>Brief description</b>	<b>Search for fridges will allow the users(With or without account) to search for the fridges.</b>	
<b>Actors:</b>	<b>User</b>	
<b>Relate use cases:</b>	<b>-</b>	
<b>Stakeholders:</b>	<b>User</b>	
<b>Preconditions:</b>	<b>-</b>	
<b>Postconditions:</b>	<b>-</b>	
<b>Flow of activities:</b>	<b>Actors</b>	<b>System</b>
	<b>1. User need to visit the website .</b> <b>2. If user has account, log-in</b> <b>4. User needs to click search to see the fridges nearby.</b> <b>7. Show the nearby fridge to the user.</b>	<b>3. check for validation.</b>  <b>5. Ask user to allow the GPS.</b> <b>6. Take fridge data from database.</b>
<b>Exception conditions:</b>	<b>Failure to access user location.</b>	



➤ **View Fridge Profile**

Table 5: Fridges Profile

<b>Use case name:</b>	<b>View Fridge Profile.</b>	
<b>Scenario</b>	<b>User with or without account can view fridge Profile content and see where the fridge is located.</b>	
<b>Triggering event:</b>	<b>User needs to click view fridge profile to see fridge defiles.</b>	
<b>Brief description</b>	<b>View fridge profile will allow the users(With or without account) to see fridge content and fridge location.</b>	
<b>Actors:</b>	<b>User</b>	
<b>Relate use cases:</b>	<b>Fridge Photo, Fridge direction</b>	
<b>Stakeholders:</b>	<b>User</b>	
<b>Preconditions:</b>	<b>-</b>	
<b>Postconditions:</b>	<b>-</b>	
<b>Flow of activities:</b>	<b>Actors</b>	<b>System</b>
	<b>1. User need to visit the website .</b>  <b>2. If user has account, log-in</b>  <b>5. show the Fridge data to the user.</b>	<b>3. check for validation</b>  <b>4.Take Fridge data from database.</b>
<b>Exception conditions:</b>	<b>Failure to view the fridge data.</b>	

➤ **Donate Food**

Table 6: Donate food

<b>Use case name:</b>	<b>Donate Food.</b>	
<b>Scenario</b>	<b>User with or without account can go the fridge and donate Food, update photo.</b>	
<b>Triggering event:</b>	<b>User needs to go to fridge location to donate food.</b>	
<b>Brief description</b>	<b>After seeing the fridge details, user needs to go to the fridge location to donate food take photo, and upload it to the system.</b>	
<b>Actors:</b>	<b>User</b>	
<b>Relate use cases:</b>	<b>Upload Photo.</b>	
<b>Stakeholders:</b>	<b>User</b>	
<b>Preconditions:</b>	<b>Visit view fridge profile to see the fridge location.</b>	
<b>Postconditions:</b>	<b>-</b>	
<b>Flow of activities:</b>	<b>Actors</b>	<b>System</b>
	<b>1. User need to visit the website .</b> <b>2. If user has account, log-in</b> <b>4. view fridge profile.</b>  <b>6. Go the fridge location.</b> <b>7. Take photo &amp; upload photo.</b>	<b>3. Check for validation.</b>  <b>5. Display fridge profile.</b>   <b>8. Save photo to the database.</b>
<b>Exception conditions:</b>	<b>Failure to view the fridge data.</b>	

➤ **Post Food Event**

Table 7: Post food event

<b>Use case name:</b>	<b>Post Food Event.</b>	
<b>Scenario</b>	<b>Only registered user can visit Food event page and post the event.</b>	
<b>Triggering event:</b>	<b>User needs to visit Food Event page to post the event.</b>	
<b>Brief description</b>	<b>After user log-in, user needs to visit Food Event page and click post event, user needs to enter event title, event date, event time, event address and event description .then click post to save the event.</b>	
<b>Actors:</b>	<b>User</b>	
<b>Relate use cases:</b>	<b>Log-in</b>	
<b>Stakeholders:</b>	<b>User</b>	
<b>Preconditions:</b>	<b>Should be a registered user to post an event.</b>	
<b>Postconditions:</b>	<b>-</b>	
<b>Flow of activities:</b>	<b>Actors</b>	<b>System</b>
	<b>1. User need to visit the website .</b> <b>2. User needs to log-in</b> <b>4.Visit Events page.</b> <b>5.Select post event and enter event details.</b> <b>6. click post Event.</b> <b>8.Display Event details.</b>	<b>3. Check for validation.</b>  <b>7. save event details to the database.</b>
<b>Exception conditions:</b>	<b>Failure to save the event to the database.</b>	

➤ **View Food Event**

Table 8: View food event

<b>Use case name:</b>	<b>View Food Event.</b>	
<b>Scenario</b>	<b>Only registered user can visit Food event page and see events details, attend event, or/and support the event.</b>	
<b>Triggering event:</b>	<b>User needs to visit Food Event page to see, attend, support events.</b>	
<b>Brief description</b>	<b>After user log-in, user needs to visit Food Event page, user allow to see the available events and attend events as much as user wants. And/or support the event provider.</b>	
<b>Actors:</b>	<b>User</b>	
<b>Relate use cases:</b>	<b>Initiative Support, Attend Event.</b>	
<b>Stakeholders:</b>	<b>User</b>	
<b>Preconditions:</b>	<b>Should be a registered user to post an event.</b>	
<b>Postconditions:</b>	<b>-</b>	
<b>Flow of activities:</b>	<b>Actors</b>	<b>System</b>
	1. User need to visit the website . 2. User needs to log-in 4.Visit Events page. 5. if user select attend event. 7. Display that attend request saved. 8. If user select initiative support, user will donate event provider.	3. Check for validation. 6. save user attend request.
<b>Exception conditions:</b>	<b>Failure to display event data from database.</b>	

### 3.7.3 Activity Diagram

#### ➤ User log in

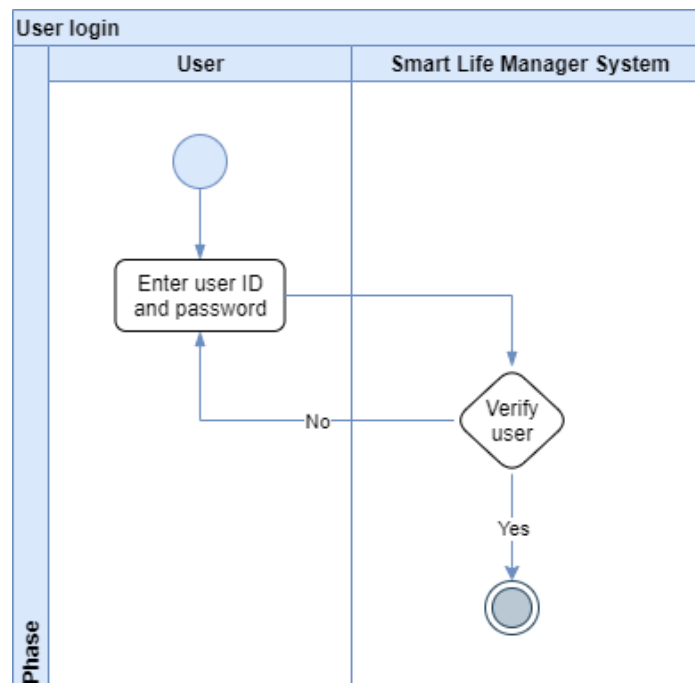


Figure 11: User log in

#### ➤ Search for fridge

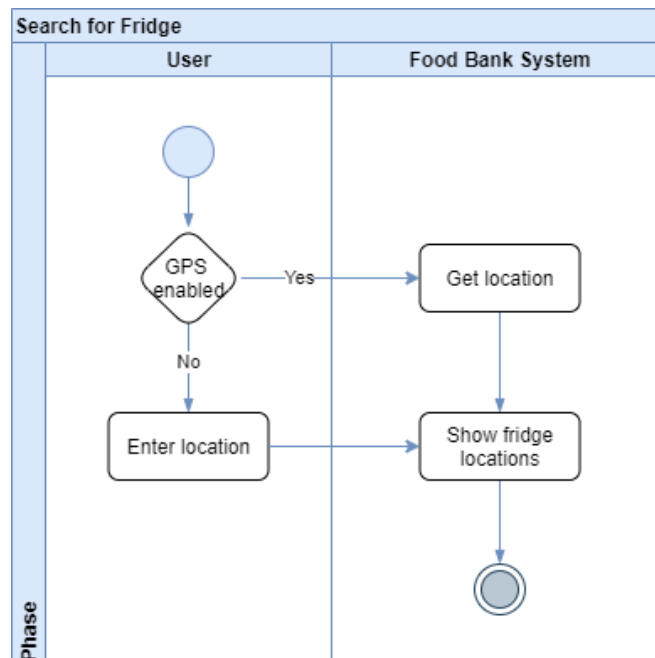


Figure 12: Search for fridge

➤ **View fridge profile**

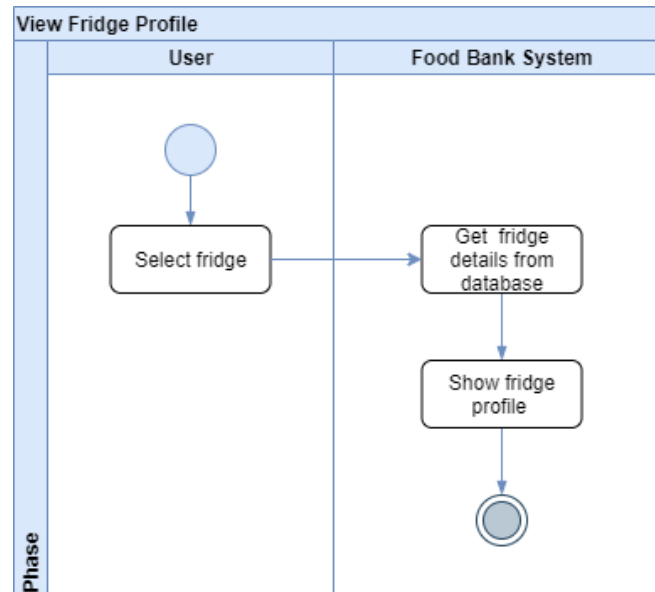


Figure 13: View fridge profile

➤ **Fridge photo**

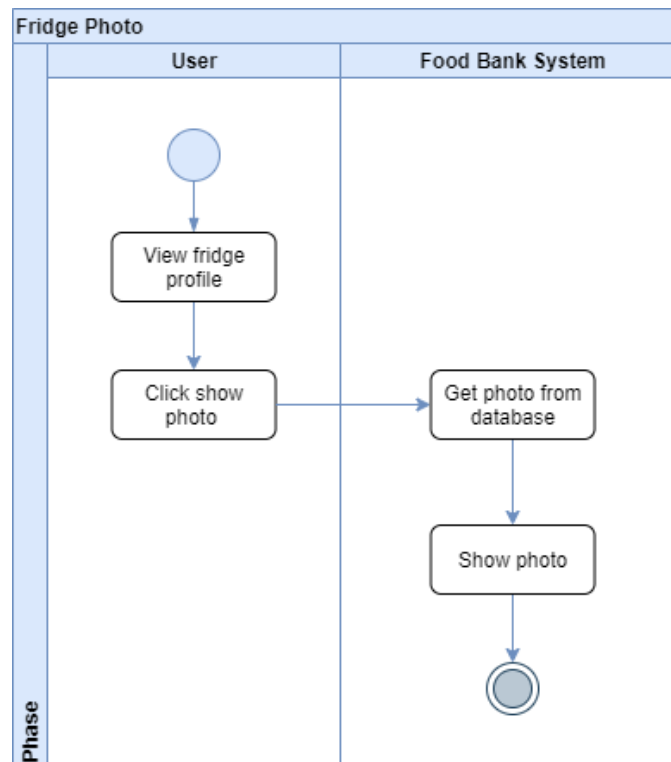


Figure 14: Fridge photo

## ➤ Fridge direction

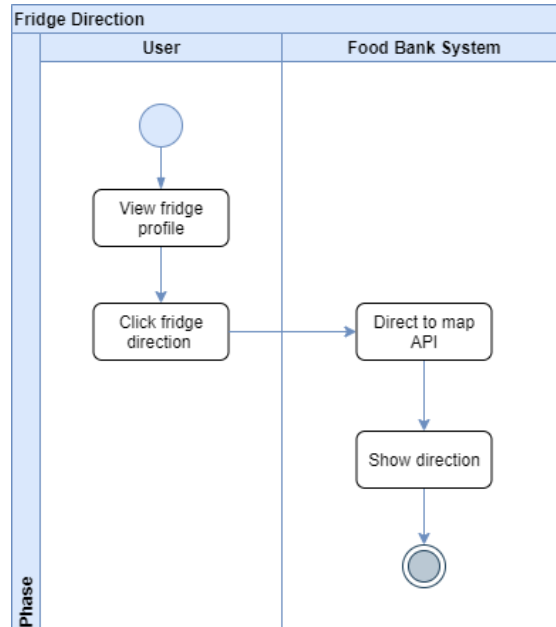


Figure 15: Fridge direction

## ➤ Donate food

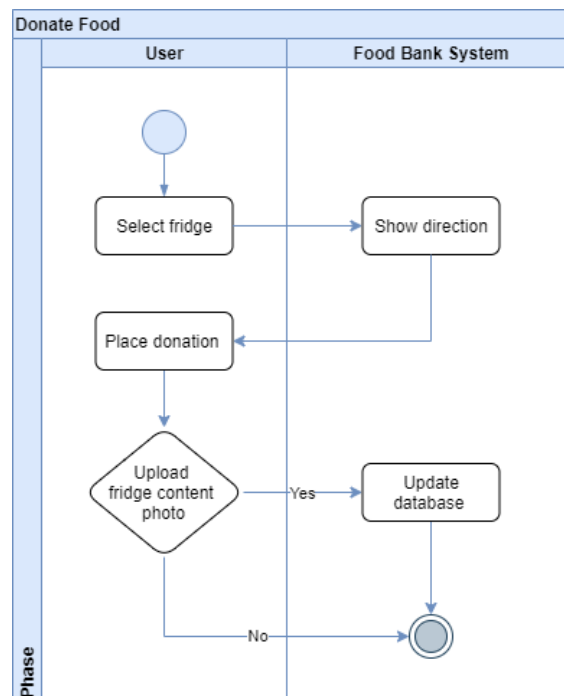


Figure 16: Donate food

➤ **Post food event**

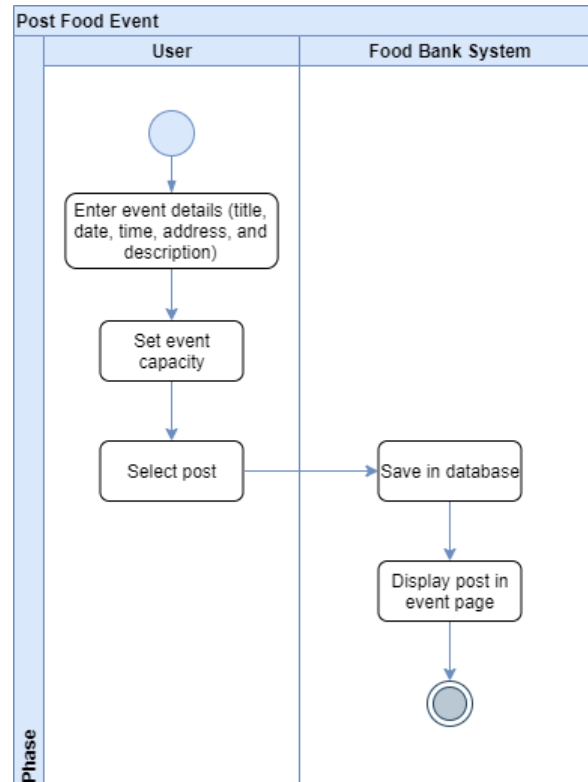


Figure 17: Post food event

➤ **View fridge photo**

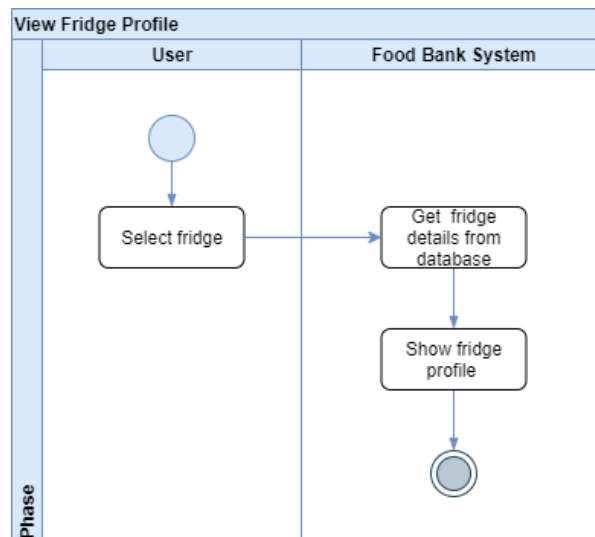


Figure 18: View fridge photo



➤ **Attend event**

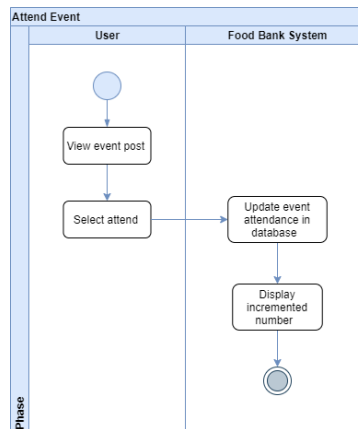


Figure 19: Attend event

➤ **Initiative support**

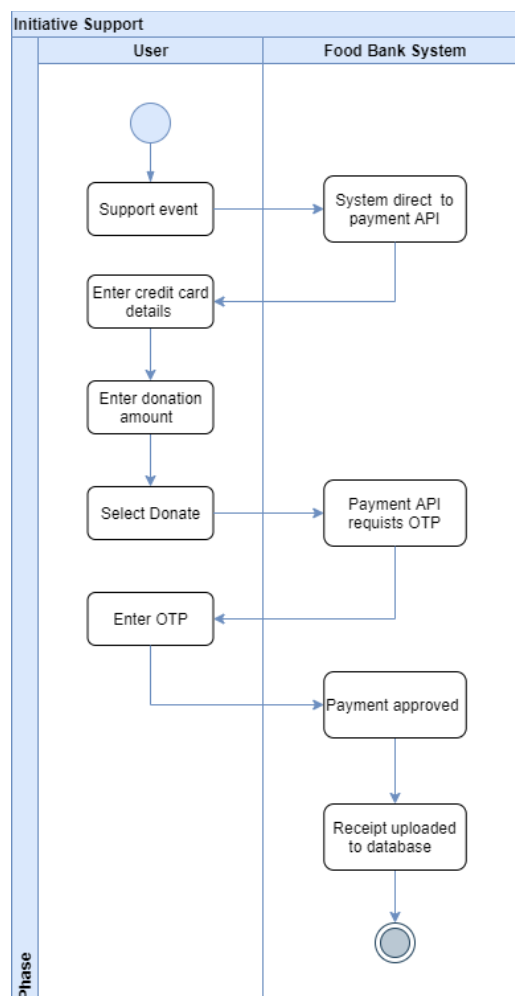


Figure 20: Initiative support

### 3.7.4 Sequence Diagram

#### ➤ **Sequence Diagram**

- **Non-registered:**

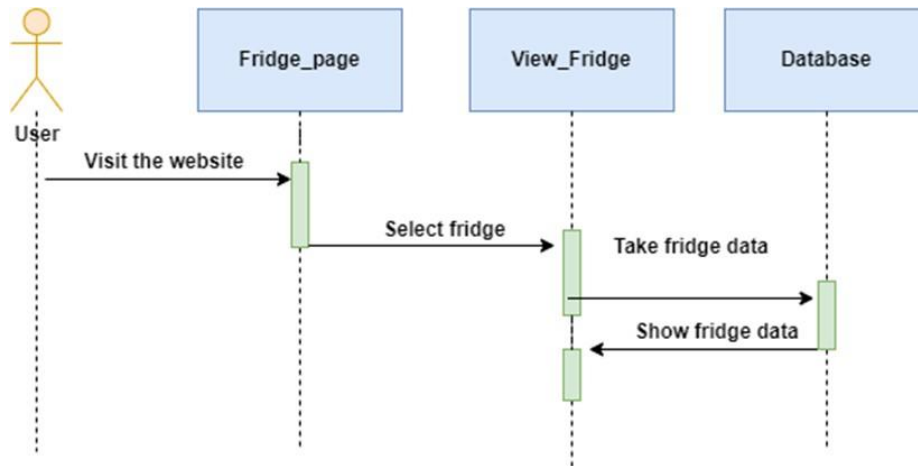


Figure 21: Non-registered

The sequence diagram above shows the use case of the view fridge for the user without an account. Users without an account can view fridge content and see where the fridge is located. User has to visit the website then select the fridge to see the fridge's data.

- **View Fridge Profile:**

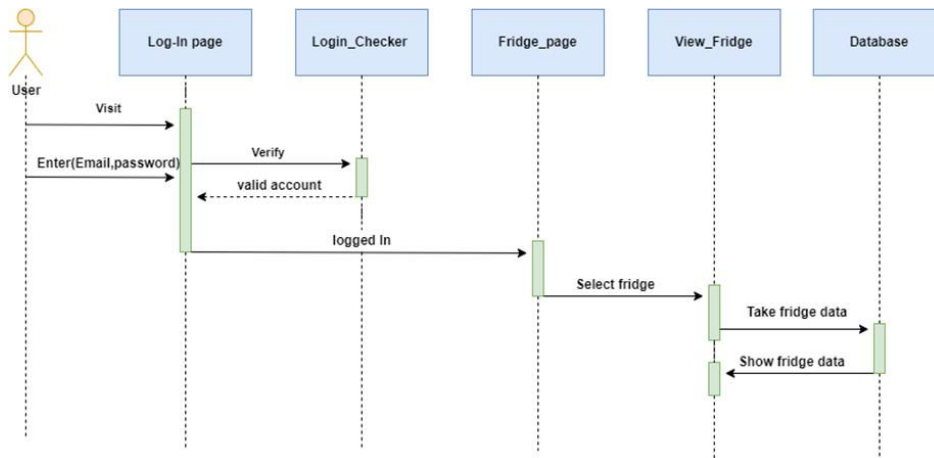


Figure 22: View fridge profile

The sequence diagram above shows the use case of the view fridge for the user with an account. Users with an account can view fridge content and see where the fridge is located. User has to visit the website then log in to the website, select the fridge to see the fridge's data.

- **Attend Event:**

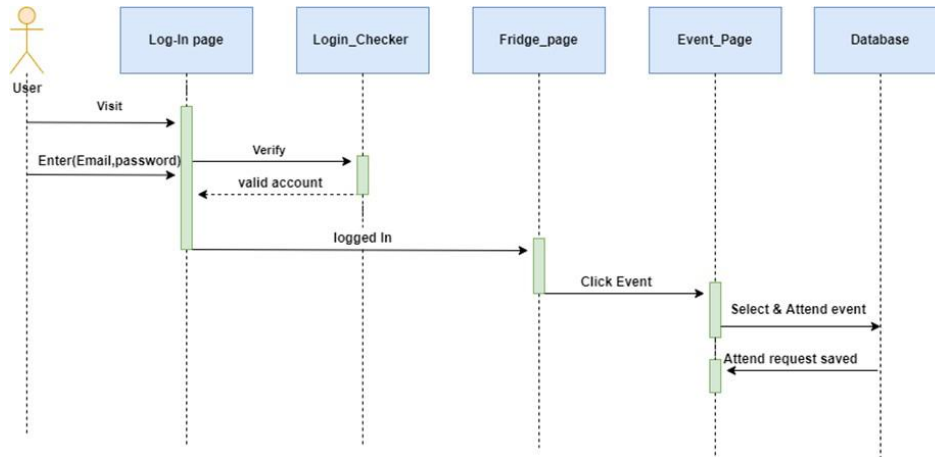


Figure 23: Attend event

The sequence diagram above shows the use case of attending the event. User has to log in to his/her account, then visit the event page to see the events, select an event and click attend. Attending request will be saved in the database and show the user that the attending request has been saved.

- **Post Event:**

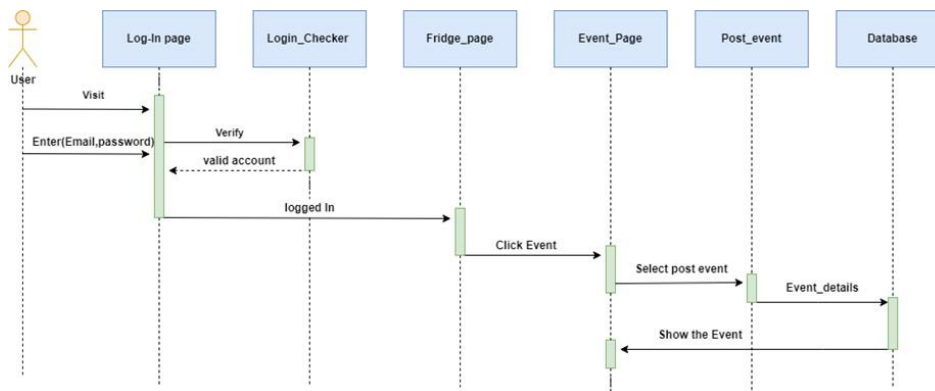


Figure 24: Post Event

The sequence diagram above shows the use case of post the event. User has to log in to his/her account, then visit the event page, click add an event, add event details and click post. Event details will be saved in the database then display on the event page.

- **Initiative Support:**

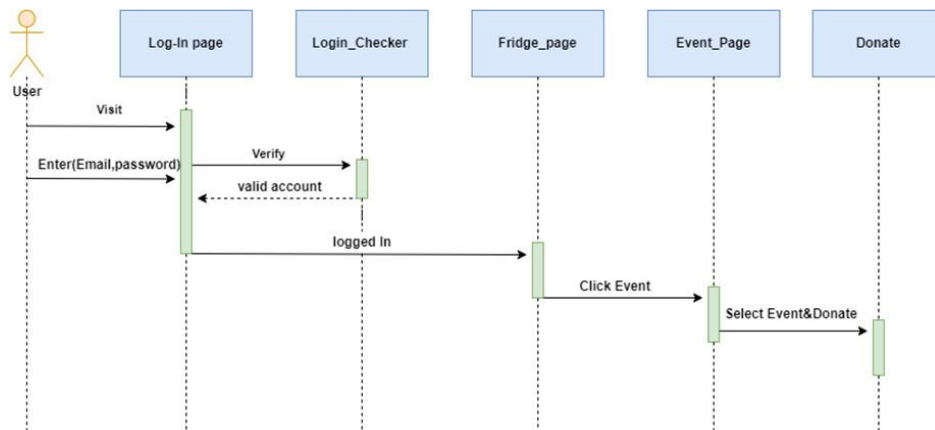


Figure 25: Initiative Support

The sequence diagram above shows the use case of donation for the event. User has to log in to his/her account, then visit the event page to see the events, select an event and click donate to visit the donation page.

### 3.8 Technology Deployed

#### 3.8.1 Hardware Specification

The Food Bank system is a web application. The following table shows the requirements to run:

Table 9: Hardware Specification

Processor Windows	Pentium 4
Process Mac	Intel
Min RAM	128 MB
Recommended RAM	
Min Disk Space	100 MB
Rec. Disk Space	
Windows	Windows XP SP2
OS X	OS X 10.5.6
Linux	Ubuntu 10.04
	Debian 6
	OpenSuse 11.3
	Fedora Linux 14

### 3.8.2 Software Specification - including OS system

To run the web application, a web browser is needed. The following specs show the requirements to run some web browsers.

Table 10: Software Specification - i

	<b>Internet Explorer 8</b>	<b>Internet Explorer 9</b>	<b>Firefox</b>
Processor Windows	233 Mhz	1-GHz	Pentium 4
Process Mac			Intel
Min RAM	64 MB (XP)		
Recommended RAM	512 MB	512 MB	512 MB
Min Disk Space	150 MB (XP), 70 (Vista)		
Rec. Disk Space	70 Mb	70 Mb	200 MB
Rec. Disk Space 64-bit	120 MB	120 MB	
Windows	Windows XP	Windows Vista	Windows XP SP2 (FF 13)
OS X			OS X 10.5
Linux			Any recent

Table 10: Hardware Specification - ii

	<b>Chrome</b>	<b>Opera</b>	<b>Safari</b>
Processor Windows	Pentium 4	Pentium II	500-MHz Pentium-class
Process Mac	Intel	Intel	
Min RAM	128 MB	128 MB	256 MB
Recommended RAM		256 MB	
Min Disk Space	100 MB	20 MB	unknown
Rec. Disk Space		100 MB	
Windows	Windows XP SP2	Windows 2000	Windows XP SP2
OS X	OS X 10.5.6	Mac OS X 10.5	OS X 10.5.8
Linux	Ubuntu 10.04	Any recent	Not available
	Debian 6		
	OpenSuse 11.3		
	Fedora Linux 14		

For the development and the deployment of the application, the following tools are vital to the deployment of the application:

Table 11: List of tools

Application	Usage
 <b>Firebase</b> <i>Firebase</i>	<p>It provides built-in features that ease the development of the application and is smooth in the execution</p> <ul style="list-style-type: none"> <li>• Authentication</li> <li>• Database</li> <li>• Storage</li> </ul>
 <b>Visual Studio Code</b>	<p>The most powerful text editor, it is widely used and known for its plugins and it is used by all developers pretty much.</p>
 <b>Adobe Illustrator</b>	<p>Adobe Illustrator the design beast. Admittedly, using a specialized application such as Figma or Adobe XD would have been far better, but adobe illustrator is what we opted for because most of us are familiar with the environment whereas not all of us are familiar with either of the other options.</p>
 <b>XAMPP</b>	<p>XAMPP, among others is a powerful PHP local server that provides a runtime environment for PHP on a local machine. Saving us the trouble to host the application on a server and pay for it.</p>

### 3.8.3 Programming Languages / Tools

Because it is a web application, we opted to use HTML, and CSS for our front-end. Mainly because there is exactly nothing else to use except for more complicated languages such as ReactJS which is not fit for the architecture of this application. A component-based language does not fit for non-component-based applications such as this one.

For our backend, among the many choices, namely NodeJS, Python, and PHP, we chose PHP as our backend language. It is a far simpler language than any of its mates and it is relatively straight forward and fits the context of our application. It supports a dedicated SDK for Firebase and it is overall a very powerful language to use.

## 4. System Design

### 4.1 System architecture

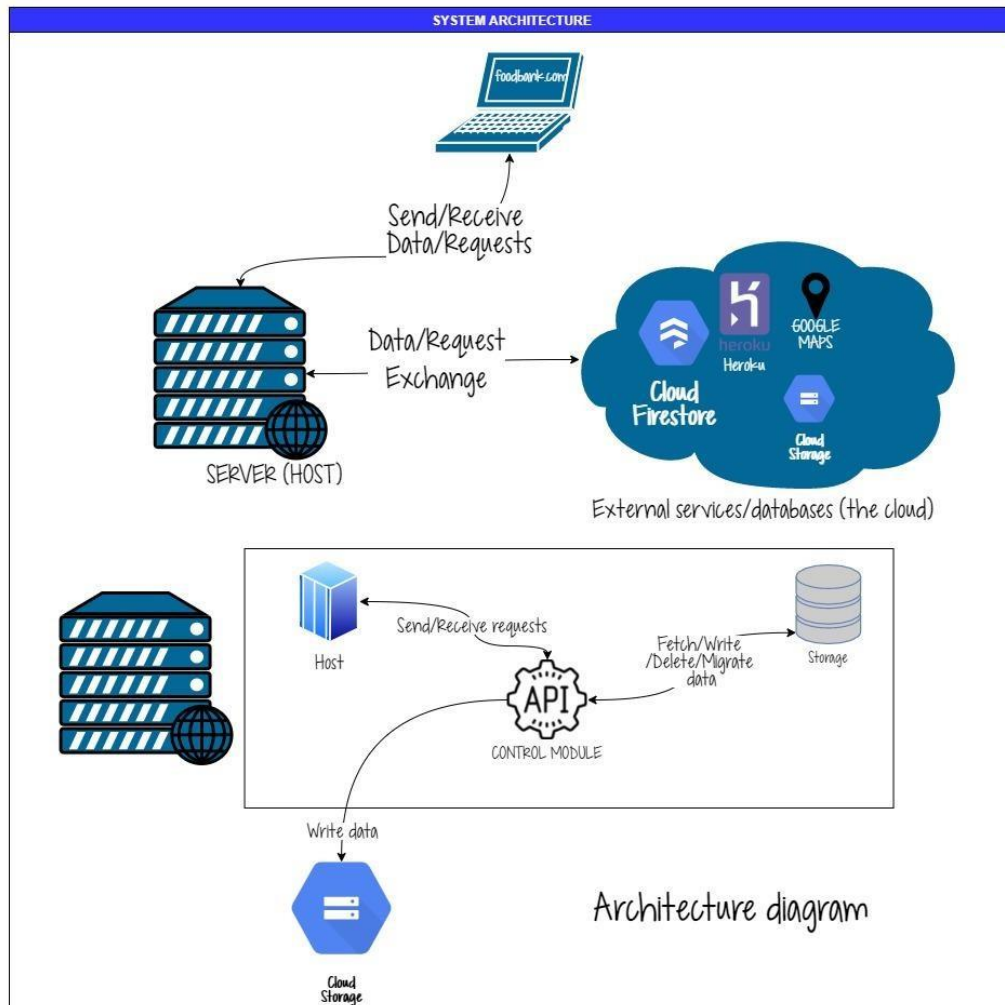


Figure 26: System architecture

The system consists of mainly 5 components. Firebase firestore, server to connect to over the internet, maps API, the users themselves, and the end devices of the users. Users access the app through the website. The firebase is used to authenticate the user, store the data in the real-time database, and to store the pictures taken by said users in the storage unit of firebase. The maps API is used to retrieve the map information to show the available fridges and available status about it.



## 4.2 System components / modules

As previously mentioned in 1.7 in the contribution section, the development of the Food Bank system is split into 3 main modules and a cooperative module

- User Management Module Components:
  - o Singin/Signup
  - o Events
  - o Donations
  - o Maps and fridges
- Cloud module components:
  - o Data manipulation
  - o Authentication
  - o Database and storage.
  - o Cloud functions
- Payment module:
  - o Payment submissions and checks
  - o Transactions
  - o Records

The bridge between these modules is the

- Control Module:
  - o APIs

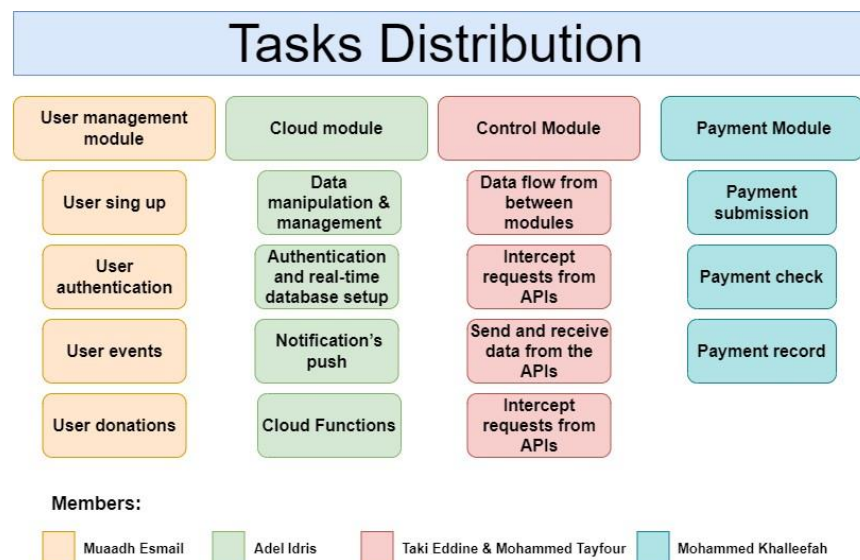


Figure 27: Task distribution

### 4.3 Database design

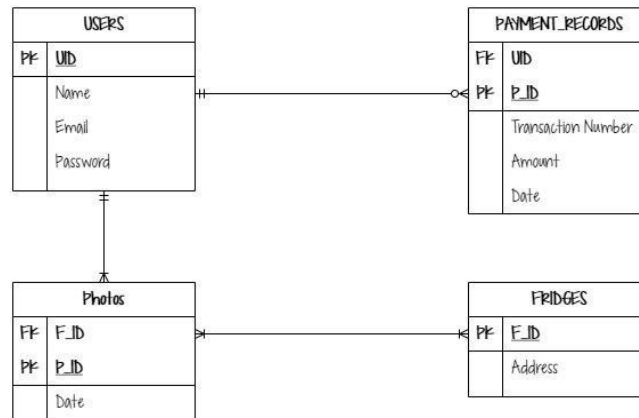


Figure 28: ERD diagram

### 4.4 Interface design

#### ➤ Log in page

[Home](#) [Events](#) [Log in](#)

[Don't have account Sign up here](#)  
LOG IN

Copyrights to Foodbank ©2022

Figure 29: Log in page

## ➤ Land page

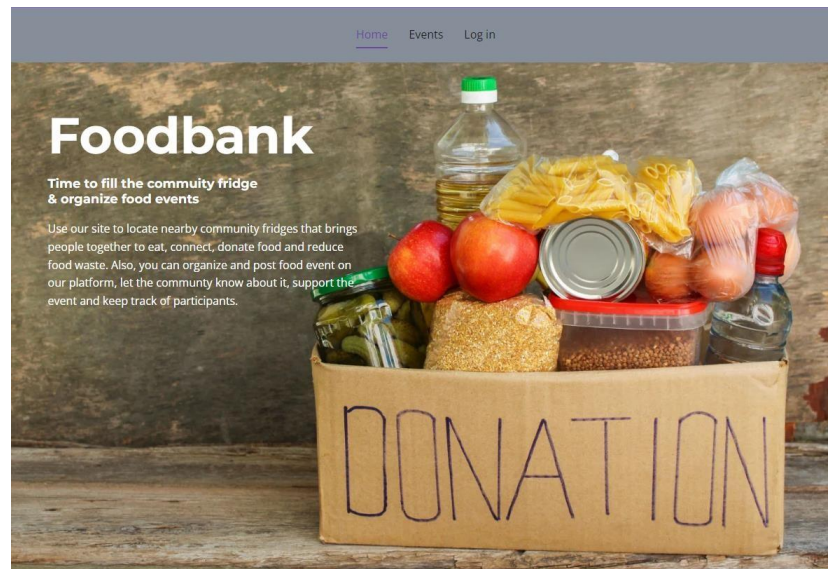


Figure 30: Land page

## ➤ Search page

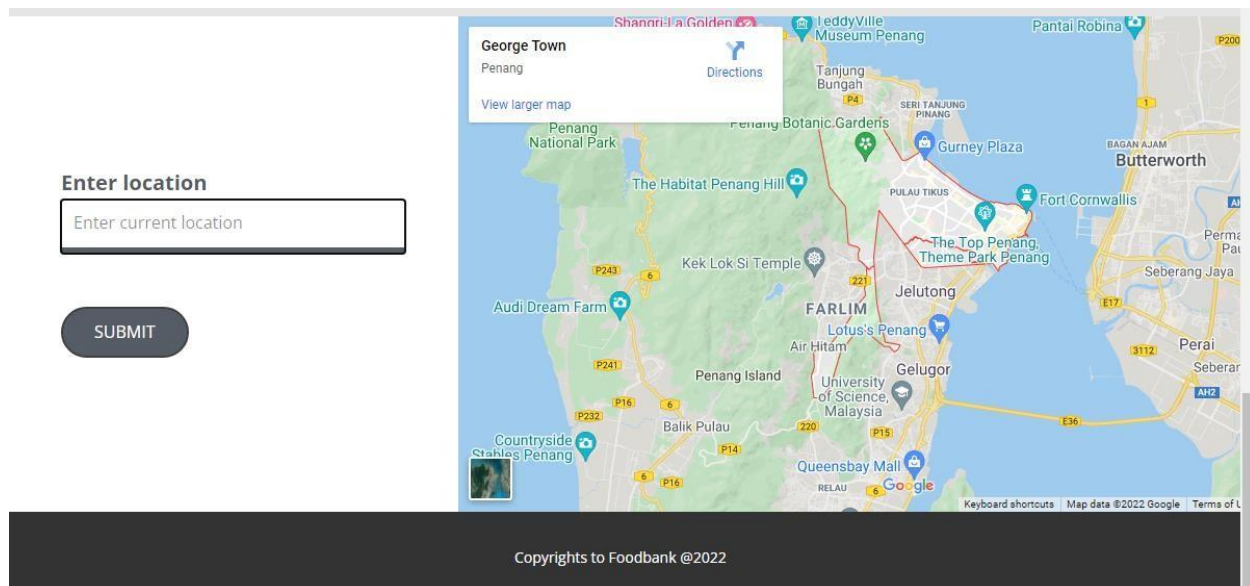


Figure 31: Search page

## ➤ Event page

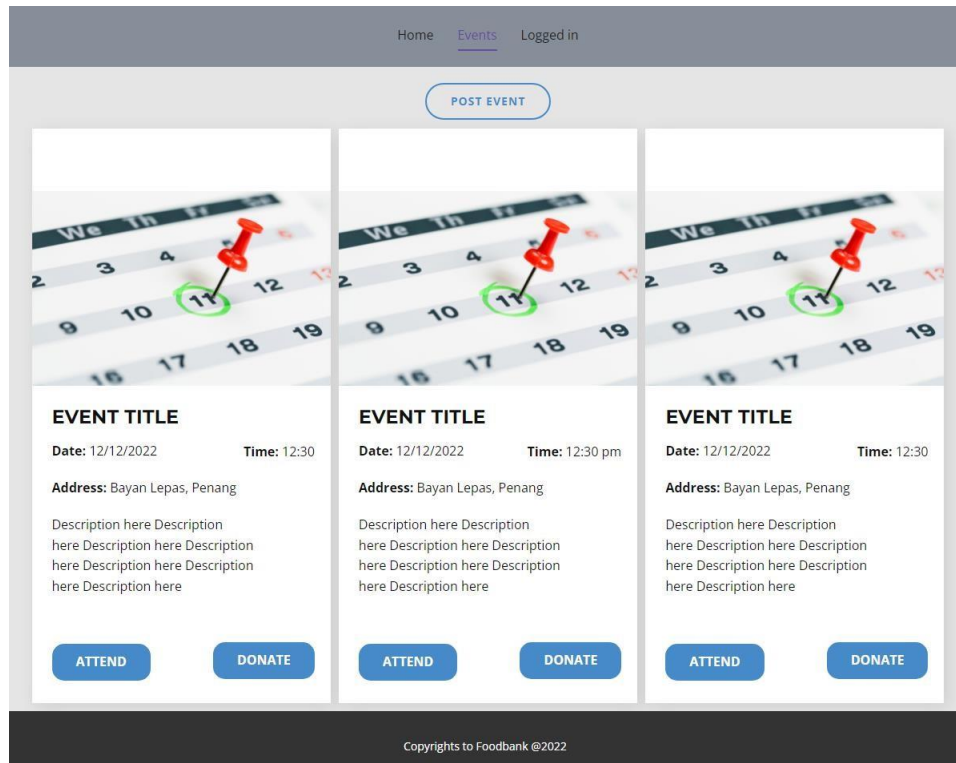


Figure 32: Event page



## Post event form

Home Events Logged in

**Event Form** ✕

Enter event title

Enter event date

Enter event time

Enter address

Enter event description

Submit Upload photo

Figure 33: Post event form

➤ **Payment page**


Debit or Credit Card

Powered by **PayPal**

×

Card number

Expires CSC

Billing address  ▼

First name Last name

ZIP code

Mobile +1

Email

Pay Now

Figure 34: Payment page

## 4.5 Input & Output Design

Inputs are accepted in the form of user clicks text inputs into text fields and text areas. The user can click on buttons to navigate the user interface that has been designed. The text fields take in user inputs like username, email, password, and etc. Outputs such as fridge locations, success and error messages and others.

## 5. Implementation

### 5.1 Module implementation

#### 5.1.1 User management:

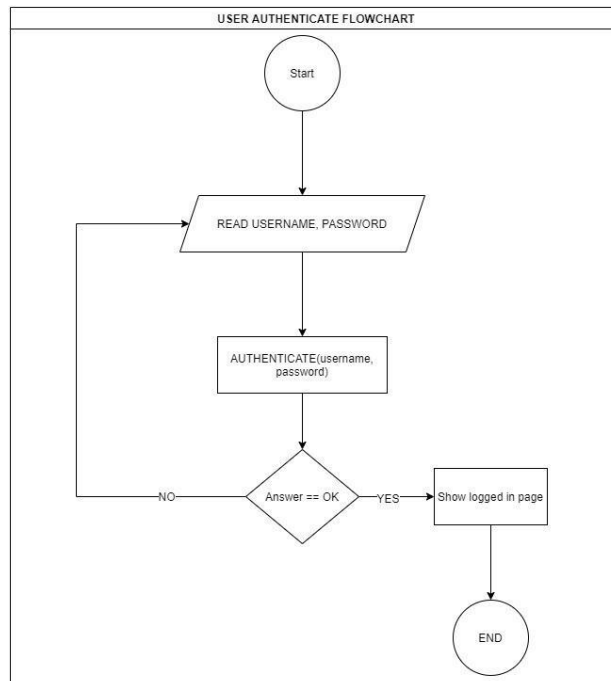


Figure 35: User architecture flowchart

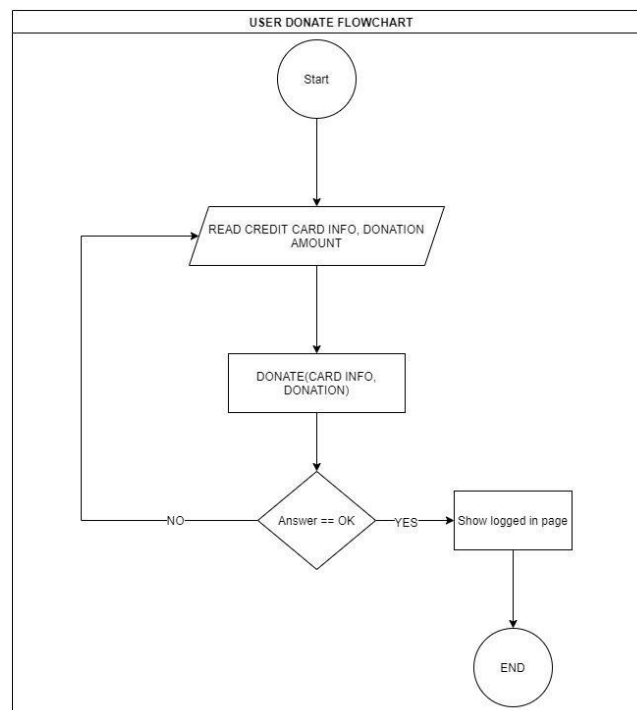


Figure 36: User donate flowchart

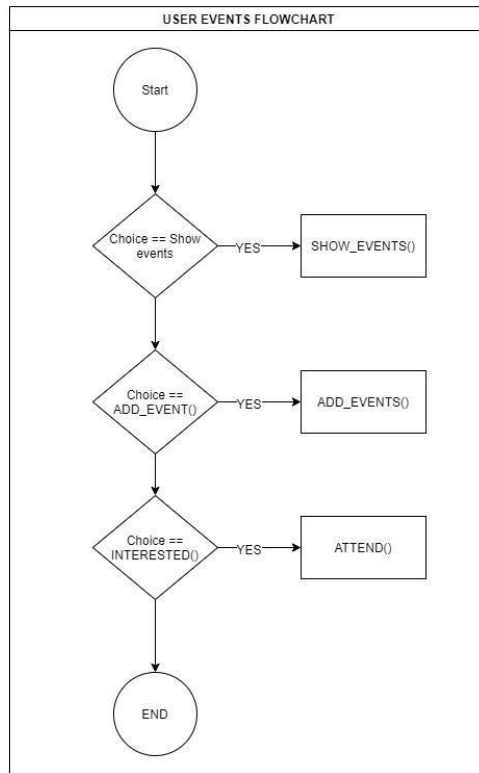


Figure 37: User events flowchart

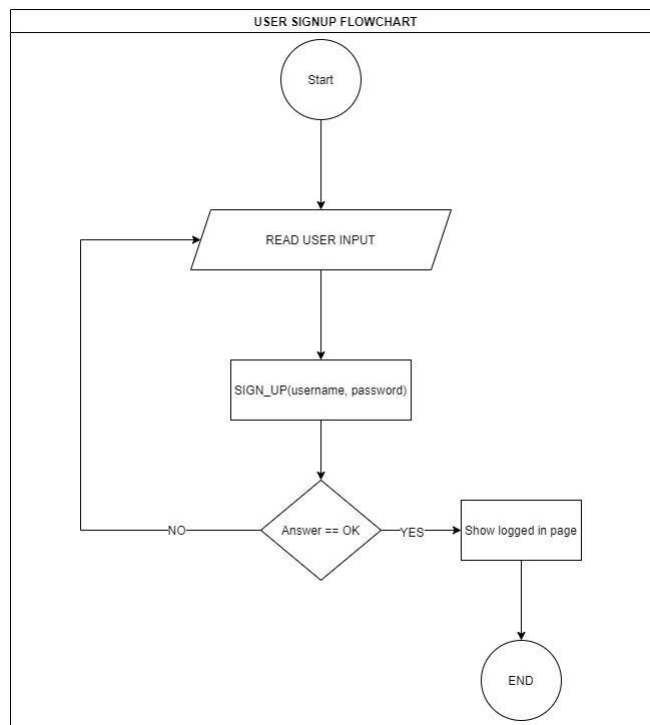


Figure 38: User sign up flowchart

This module focuses on handling user authentication and events management. This module handles:

- o User authentication.
- o User sign up.
- o User donations (Money donations through events and fridge donations).
- o User events
- o Show Fridges

#### Cloud Module:

This module is more of an abstract module, the usage of this module is to specifically handle orders coming from the control module.

- o Data manipulation and management.
- o Authentication and real-time database setup.
- o Notification's push.
- o Cloud functions and state management.

The implementation follows:

- The system calls a system call "INITIALIZE()" which sets the database and the environment ready
- Upon receiving a request from NOTIFICATIONS(), the cloud functions are triggered causing a notification to appear depending on which type.

#### Payment Module:

- o Payment submission
- o Payment check
- o Payment record

Implementing this module requires the use of the payment API.

- The system initiates an attempt to send the money
- PayPal API receives the request
- Transfers the user to a page to enter credentials
- PayPal confirms identity using a one-time password.
- Payment is confirmed, money is sent and received.
- Record is kept in the database for future reference and legal purposes.
- User is redirected back to the events page.

#### Control Module:

- o Data flow from between modules.
- o Request handling and request forwarding.
- o Intercept requests from APIs.
- o Send and receive data from the APIs.
- o Acts as an internal API of the system.



The control module is a very abstract module as it has no physical presence as a subsystem, it is ultimately a group of functions which sit in between the modules coordinating and initiating requests on behalf of the modules. A lot happens in this module, the figure below shows the coordination of all modules and how everything initiates and works

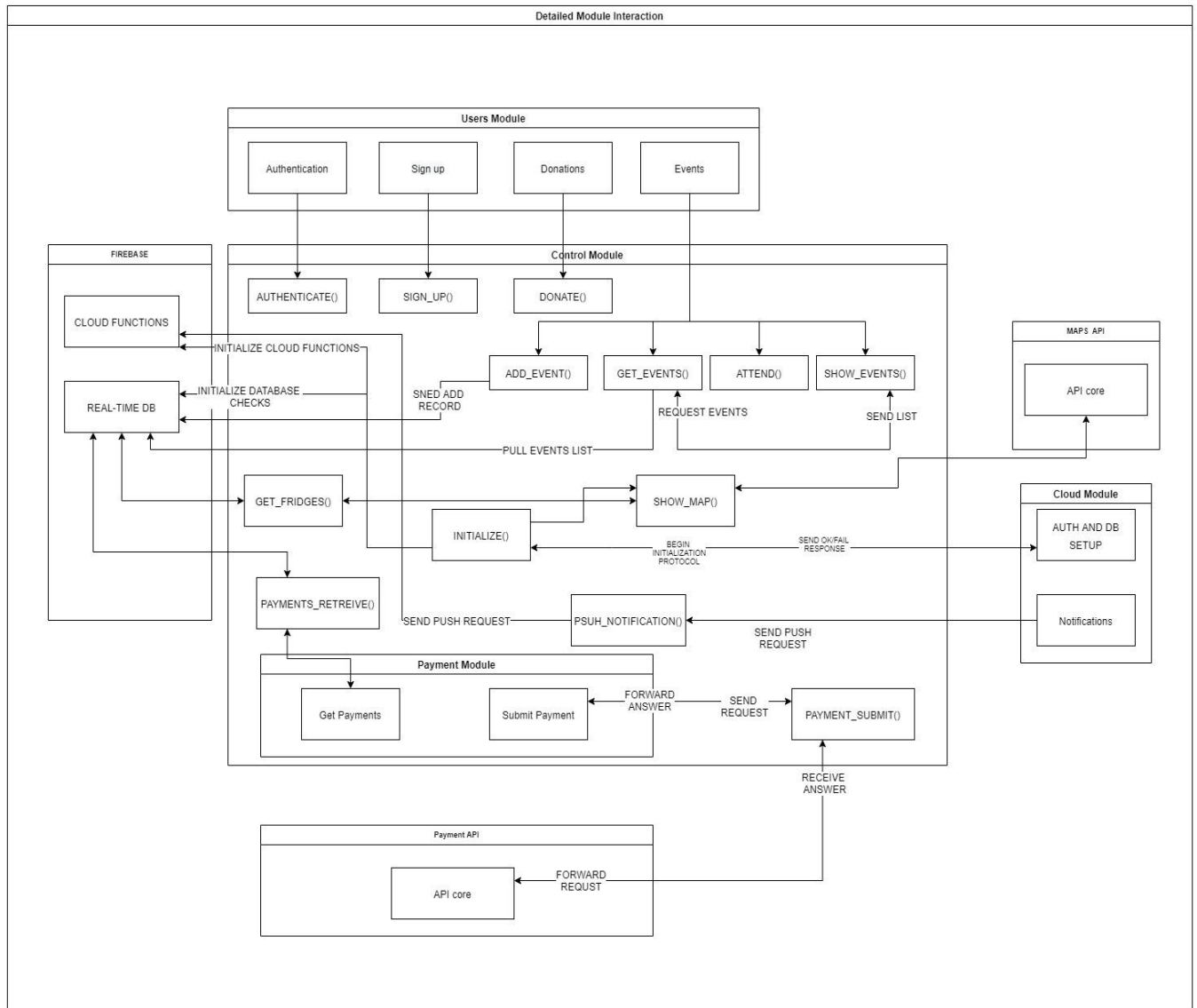


Figure 39: Detailed module interaction

## 6. Testing / Evaluation

### 6.1 System Testing

Our foodbank project has been tested from various devices to ensure that there are no problems that lead to system failure. Different laptops and different browsers were used to test the system from a different perspective. since the user's ability to use the website from the phone, the website was tested from more than one phone with different operating systems to ensure that there are no problems with the system. Also, the database has been tested to display the database store in real-time to ensure that our systems are working, In the case of any errors or bugs that we find during the compilation or execution, we have tried to debug the error and retry till it succeeds.

### 6.2 Test Case

To use the search function, user needs to visit Home page and scroll down to see the map and enter the location or open GPS then click submit. System will show the fridge location to the user.

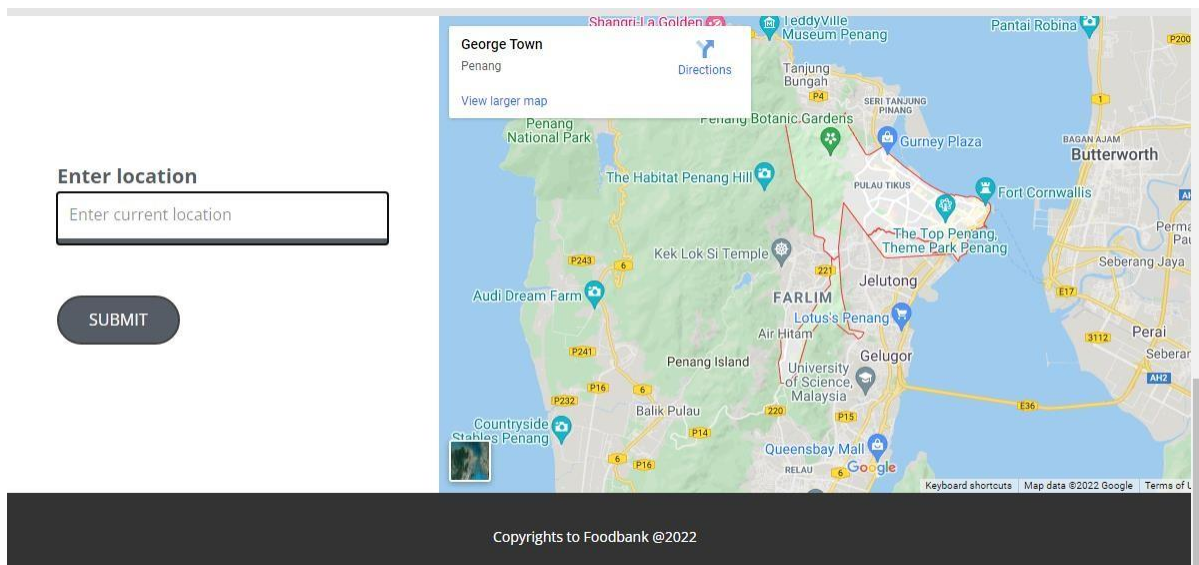


Figure 40: Search page

From the Home page user needs to click the event page, event page will display the events, user can see the details of the event and select any event to Attend. An addition. Form the same page(Event page) user can click donate button to donate.

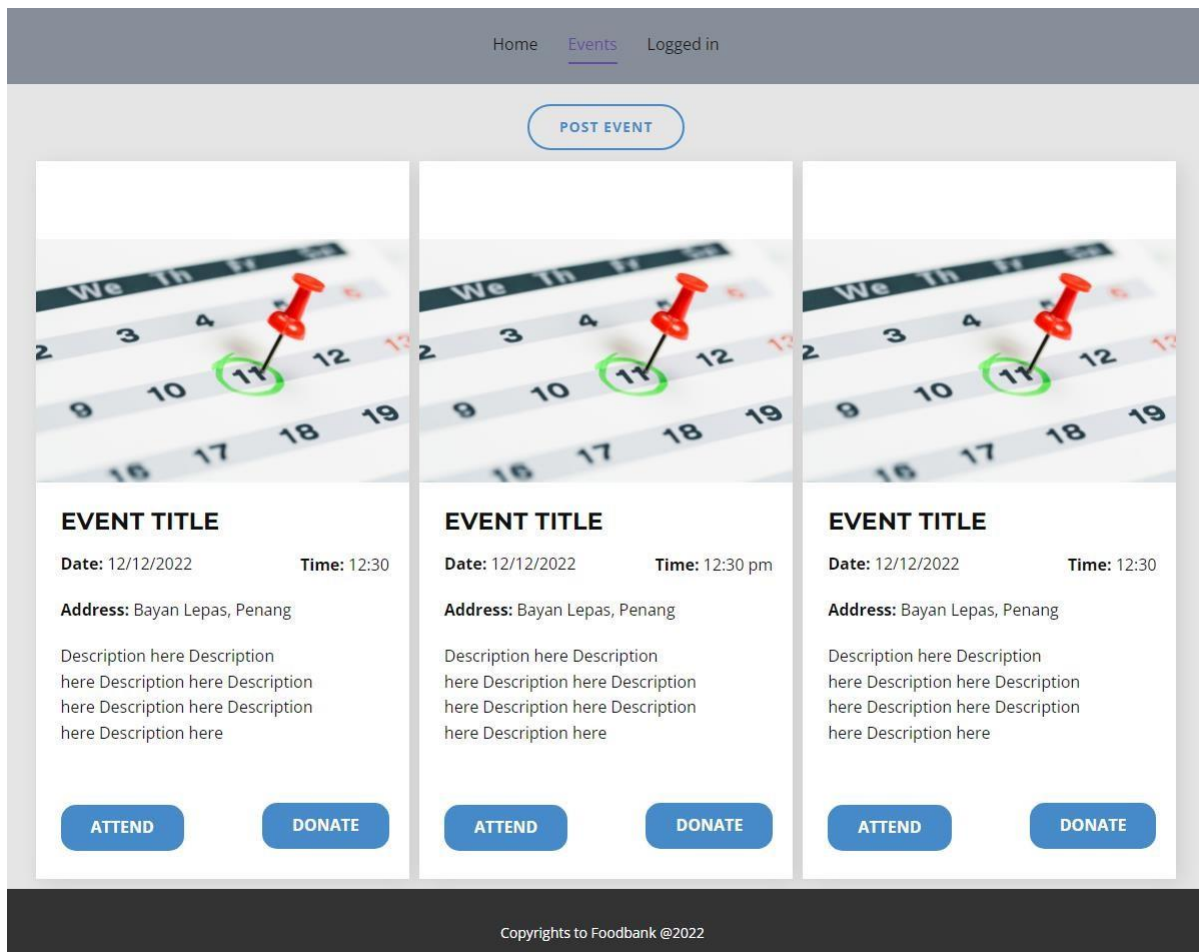
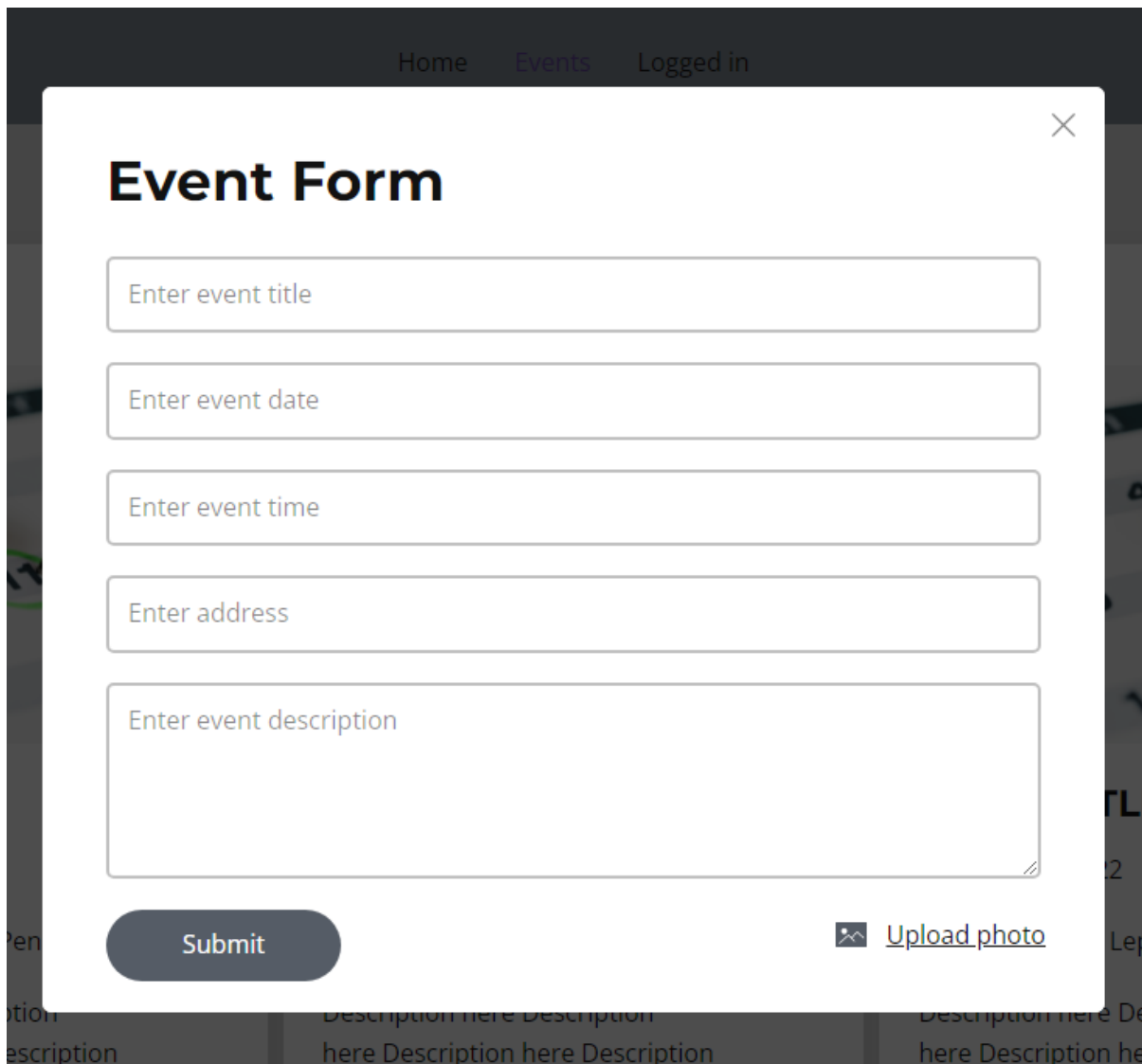


Figure 41: Event page

From Event page user will click post event to button to insert new event. After user clicked the post event button this form will be given to the user. User needs to enter event title, event data, event time, event address, event discretion and upload photo then click submit button.



Home Events Logged in

## Event Form

Enter event title

Enter event date

Enter event time

Enter address

Enter event description

Submit


 [Upload photo](#)

Figure 4: Post event form

### 6.3 System Evaluation:

#### ➤ Image redirector

The storage of the image with the requests is quite a complex task to integrate and as a result, the images uploaded are stored in the Firebase Storage instead with the requests directly.

➤ **Attending number:**

In the case of attending the events, some error may occur here, when many users visit the website at the same time and the request to attend the event is made, problems may occur in the number of people attending or setting a number that does not represent the actual attendance.

## 7. Conclusion & Future Work

Due to the time constraints and the difficulties that we faced in understanding the implementation of the functions required for our project (Foodbank), the project was reduced to be simpler than its first goal, which focused heavily on several functions, some of them are easy and some are complex which require a great time and effort to complete. However, the project succeeded in presenting the main concept that was planned during the initial phase and is able to provide its capabilities as it should to solve the problems that were raised, helping poor people and reducing food waste. This project is an initiative to improve people's lives and reduce the number of hungers in the world by taking advantage of the daily waste of food. Also encouraging the idea of donating food to create a united community that loves to help others.

In the future, we hope to improve the functions of the current system much more or add functions such as providing a camera inside the fridge that takes pictures of the contents of the fridge every period of time, which will make it easier for the user to know the contents of the fridge. Furthermore, contracting with food organizations to expand the range of refrigerators and spread to further areas, which leads to helping more poor people. In the end, we believe that our project is one of the main keys to solving two problems in the community, hunger and food waste, so we created the project, and we hope that it will help improve the lives of mankind.

## References

[1] <https://www.freedge.org>

[2] <https://foodrescue.us>

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<https://says.com/my/news/penangites-waste-700-000kg-of-food-daily>

<https://www.fao.org/news/story/en/item/196402/icode/>

<https://www.un.org/sustainabledevelopment/hunger/>