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CAT304 GROUP INNOVATION PROJECT AND STUDY FOR SUSTAINABILITY

GROUP 01 (Juniq)

PROJECT TITLE:

PEDIATRIC ALLERGY LIFE SAVER (PALS) SYSTEM

For the attention of:

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Declaration

We confirm this group project is our work and is not copied from any other person's work (published or unpublished).

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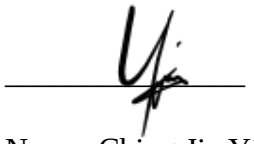

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Abstract

Allergies are abnormal responses generated by the immune system of the human body to foreign substances or foods. The triggers that cause allergic reactions can vary for every person, including the symptoms of allergies. Food allergies are particularly prevalent in children, with estimates suggesting that 3-6% of children in developed countries may be affected. Allergic reactions can have serious health consequences and are more common among children who have early onset eczema or itchy rash symptoms. Hence, the Pediatric Allergy Life Saver (PALS) application is designed to assist parents and caregivers to optimally manage and track the allergies of children. The application incorporates the Optical Character Recognition (OCR) feature in the Google Cloud Vision paired with Google Cloud Translation AI which are powered with pre-trained machine learning models to detect allergens that are present in the ingredients label of food products to help parents and caretakers identify whether the food product is safe for the child's consumption, especially for foreign food products. The goal of PALS is to assist caregivers without medical knowledge to take quick action to mitigate the consequences of an allergic reaction and provide a reliable technical service for ensuring that the situation is under control when an allergy reaction occurs.

Abstrak

Alahan merupakan tindak balas tidak normal yang dijana oleh system imunasi badan manusia terhadap bahan atau makanan luar. Pencetus yang merangsangkan tindak balas alahan ada berbeza bagi setiap individu, termasuklah gejala alahan. Alahan makanan merupakan sesuatu alahan yang lazim berlaku dalam kalangan kanak-kanak. Dalam anggaran, 3-6% kanak-kanak dalam negara-negara maju mungkin akan terjejas dengan alahan ini. Tindak balas alahan membawa kesan-kesan kesihatan yang serius dan merupakan sesuatu perkara yang biasa dalam kalangan kanak-kanak yang mempunyai eczema peringksat awal atau gejala ruam gatal. Oleh itu, aplikasi *Pediatric Allergy Life Saver (PALS)* dicipta untuk membantu ibu bapa dan penjaga kanak-kanak dalam mengurus serta menjejaki rekod alahan kanak-kanak. Aplikasi tersebut menggunakan fungsi pengecaman aksara optik yang terdapat di dalam *Google Cloud Vision* serta bergabung dengan *Google Cloud Translation AI* yang disokong oleh model pembelajaran mesin pralatih untuk mengesan alergen yang wujud dalam label bahan-bahan produk makanan untuk membantu ibu bapa and penjaga kanak-kanak memastikan bahawa makanan tersebut adalah selamat untuk kanak-kanak terutamanya produk makanan asing. Tujuan aplikasi PALS adalah untuk membantu penjaga yang tidak mempunyai ilmu pengetahuan perubatan untuk mengambil tindakan segera bagi mengurangkan kesan-kesan alahan makanan dan menyediakan perkhidmatan teknikal yang boleh dipercayai untuk memastikan situasi adalah di bawah kawalan apabila alahan berlaku.

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List of Abbreviations and Symbols

No.	Abbreviations/Symbol	Definition
1	PALS	Pediatric Allergy Life Saver System
2	OCR	Optical Character Recognition
3	AI	Artificial Intelligence
4	SDG	Sustainable Development Goal
5	UI	User Interface
6	UX	User Experience
7	WBS	Work Breakdown Structure
8	IDE	Integrated Development Environment
9	SMS	Short Message Service
10	UML	Unified Modeling Language
11	ID	Identification
12	RAM	Random-Access Memory
13	GPU	Graphics Processing Unit
14	OS	Operating System
15	HTML	Hyper Text Markup Language
16	CSS	Cascading Style Sheet
17	MMC	Malaysian Medical Council
18	PDPA	Personal Data Protection Act

1.0 Introduction

1.1 Background

It is common for parents to be protective of their children, however there are always times when children need to be left with a caretaker, more commonly seen in cases where both parents work full-time. For instance, when the child is placed at the day-care centre, left with a babysitter for the day, or if the child is already attending primary school.

A life may be saved by recognising the early symptoms of a severe allergic reaction, such as anaphylaxis, and responding quickly with the appropriate medical support [1]. The duration that it takes for an allergic symptom to be recognized after a child is exposed to an allergy can make a huge difference. Hence, it is critical to recognize the signs and always keep the action plan readily accessible to be applied in an emergency especially for young children [2]. Currently, there are a few ways to handle the problems stated above. When parents leave their children in a day-care centre, school, or with a babysitter, they will inform the caretaker verbally about their children's allergies. However, in day-care centres and schools, there could potentially be tens to hundreds of students, and it is nearly impossible to memorise every child's allergy. There is no sustainable solution to track every child's allergy for convenient reference [3].

Selecting the right food products for children with allergies is a task that should not be taken lightly. There are often food products that have long lists of complicated ingredients, which cause any dangerous allergens to be glossed over. For foreign food products that have ingredient labels written in a foreign language, it is difficult to know whether the food product is safe for the child's consumption.

We see this as an important issue to tackle to reduce the risks of children in danger of allergy attacks. In alignment with the United Nations Sustainable Development Goal 3: Good Health and Well-being, we want to develop an application as a platform for parents and caretakers to track the allergies of children, as well as detect allergens that are present in the ingredient labels of food products.

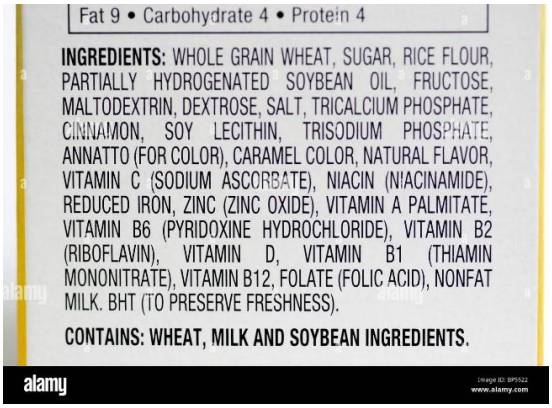
1.2 Problem statement

Food allergies are particularly prevalent in children, with estimates suggesting that 3-6% of children in developed countries may be affected [4]. Children from families with a history of allergies are more likely to be affected by allergies. Children are normally not aware of their allergies, as they might not have been discovered if the child has not yet been exposed to the allergen. Younger children might not even comprehend the meaning of an allergy. When the child is facing an allergy attack, it is challenging for them to verbally express or describe the symptoms that they are facing to their caretakers [5]. Caretakers will find it difficult to understand that the child is facing allergy symptoms, which could lead to a delay in taking action to mitigate the consequences of an allergy attack. For parents, this is an overwhelming concern when they need to leave their children with caretakers such as babysitters, nannies, day-care centres, or schools, as there is the constant worry that the caretaker is not equipped with sufficient medical knowledge to handle the situation if their child suffers from an allergy attack [6].

Food products are mandated to clearly display the ingredients used in the product along with the nutrition information. However, there are often food products that have long lists of complicated ingredients, posing a challenge to identify allergens present in the product. This may cause the allergens to be ignored which will cause an allergic reaction when the food product is given to an allergic child.


INGREDIENTS: ENRICHED FLOUR (WHEAT FLOUR, NIACIN, REDUCED IRON, THIAMIN MONONITRATE [VITAMIN B_1], RIBOFLAVIN [VITAMIN B_2], FOLIC ACID), CORN SYRUP, SUGAR, SOYBEAN AND PALM OIL (WITH TBHQ FOR FRESHNESS), CORN SYRUP SOLIDS, DEXTROSE, HIGH FRUCTOSE CORN SYRUP, FRUCTOSE, GLYCERIN, CONTAINS 2% OR LESS OF COCOA (PROCESSED WITH ALKALI), POLYDEXTROSE, MODIFIED CORN STARCH, SALT, DRIED CREAM, CALCIUM CARBONATE, CORNSTARCH, LEAVENING (BAKING SODA, SODIUM ACID PYROPHOSPHATE, MONOCALCIUM PHOSPHATE, CALCIUM SULFATE), DISTILLED MONOGLYCERIDES, HYDROGENATED PALM KERNEL OIL, SODIUM STEAROYL LACTYLATE, GELATIN, COLOR ADDED, SOY LECITHIN, DATEM, NATURAL AND ARTIFICIAL FLAVOR, VANILLA EXTRACT, CARNAUBA WAX, XANTHAN GUM, VITAMIN A PALMITATE, YELLOW #5 LAKE, RED #40 LAKE, CARAMEL COLOR, NIACINAMIDE, BLUE #2 LAKE, REDUCED IRON, YELLOW #6 LAKE, PYRIDOXINE HYDROCHLORIDE (VITAMIN B_6), RIBOFLAVIN (VITAMIN B_2), THIAMIN HYDROCHLORIDE (VITAMIN B_1), CITRIC ACID, FOLIC ACID, RED #40, YELLOW #5, YELLOW #6, BLUE #2, BLUE #1.

Figure 1: Photo of ingredients label with no allergen emphasis


Fat 9 • Carbohydrate 4 • Protein 4

INGREDIENTS: WHOLE GRAIN WHEAT, SUGAR, RICE FLOUR, PARTIALLY HYDROGENATED SOYBEAN OIL, FRUCTOSE, MALTODEXTRIN, DEXTROSE, SALT, TRICALCIUM PHOSPHATE, CINNAMON, SOY LECITHIN, TRISODIUM PHOSPHATE, ANNATTO (FOR COLOR), CARAMEL COLOR, NATURAL FLAVOR, VITAMIN C (SODIUM ASCORBATE), NIACIN (NIACINAMIDE), REDUCED IRON, ZINC (ZINC OXIDE), VITAMIN A PALMITATE, VITAMIN B6 (PYRIDOXINE HYDROCHLORIDE), VITAMIN B2 (RIBOFLAVIN), VITAMIN D, VITAMIN B1 (THIAMIN MONONITRATE), VITAMIN B12, FOLATE (FOLIC ACID), NONFAT MILK. BHT (TO PRESERVE FRESHNESS).

CONTAINS: WHEAT, MILK AND SOYBEAN INGREDIENTS.

Figure 2: Photo of ingredients label with allergen emphasis

Comparing Image 1 and Image 2, the latter has a statement to clearly indicate the allergens present in the food product. However, not all food products print user-friendly ingredients labels. For foreign food products that have ingredient labels written in a foreign language, it is even more difficult to know whether the food product is safe for the child's consumption.

1.3 Project objectives

1. To develop a children management module to allow the input of the allergies of children to be recorded.
2. To develop a caretaker management module for parents to give access to caretakers to view their children's allergy details.
3. To develop an allergy information module to display allergy symptoms and action plans.
4. To develop an allergen detector module utilising computer vision and image processing technology to identify allergens present in ingredients labels photos.

1.4 Proposed solution / project

We see a critical need for a system to be developed to solve the pain points of parents and caretakers when it comes to handling the allergies of children. Hence, Pediatric Allergy Life Saver (PALS) is developed to address these circumstances.

The application allows parents to input their children's allergies into an organized list and control access to specified people to view their children's allergy information. This information will be displayed to caretakers who have been given access to view the children's allergy information to help them recognize the symptoms and know what to look out for when an allergic reaction happens while the children are under their care so that they can take immediate action to help the allergic child. Our system also integrates the usage of computer vision and image processing technology to allow parents and caretakers to take a photo of the ingredients label of a food product to detect allergens present in the product to identify whether the product is safe for consumption.

The allergen detector and translation features involve the usage of Optical Character Recognition (OCR) to detect and extract text from the ingredients label image. The OCR tool used in PALS is Google Cloud Vision to generate the most accurate results for smartphone-captured images. The extracted text is translated to English using Google Translate AI which uses neural machine translation technology powered by Google. The translated text is then matched to a list of allergens to check if the ingredients of the food product contain allergens that are harmful to the child.

The application consists of five main modules, which are the user module, children management module, caretaker management module, allergy information module and allergen detector module.

i. User module

This module allows the user to register a new account by using their Google account through Firebase authentication. When the user is logged into the website, they can see their Google profile picture and their name appeared on the main page. Users can also visit the user profile section to view their identity (role of parent/caretaker), name, and registered email. The users are allowed to switch their identity between parent and caretaker.

ii. Children management module

This module allows parents to manage children information. Parents can view a list of their children that have been added, whereas caretakers can see a list of children under their care Besides, parents can create a new child profile or edit an existing child profile such as the child's name, gender and birthdate on the page. After the new child information is added, it will be displayed automatically in the list on the main page.

iii. Caretakers management module

This module allows the users to manage the caretakers that are responsible for each child. To manage the caretakers of a particular child, the parents can click on the child's name and add a new caretaker by clicking the 'Add Caretaker' button. The parents can add caretakers' names, emails, roles, and organisation in the section. The modules checks that the caretaker must have a registered PALS account.

iv. Allergy information module

This module allows the users to understand more about allergies. Several common allergens such as peanuts, tree nuts and soy are provided in the "Search allergy info" search bar at the top of every page. When the users selects a particular allergen, they can know more information about the allergen such as the symptoms that might occur, steps should be taken, food that must be avoided and food to be cautious around.

v. Allergen detector module

This module allows the users to upload a photo of ingredients label to identify whether any harmful allergens are present in the food product. The user needs to click on the allergen detector icon and choose a child to continue so that the detector will focus on

the allergens that are harmful to the selected child. After this, the users can upload the ingredients label photo in the file input section. The website will then display whether the food is safe for the selected child. A warning message will appear if the label contains allergens that must be avoided by the child.

1.5 Benefit or impact of the proposed solution

The development of the PALS system aligns with SDG 3, which is a significant turning point in the landscape of the current technologies used in children's health.

Our system can reassure parents that the allergies of their children are recorded and can be easily referred to by the caretakers, giving the parents a peace of mind when it is ensured that caretakers have access to know how to prevent the allergic reactions from occurring and what to do if the reactions occur.

Moreover, our system will boost the confidence of caretakers when taking care of children with allergies to help them take the right actions when an emergency happens. Normally, caretakers such as teachers and babysitters are not well-equipped with medical knowledge, hence it is common to panic when an allergic reaction happens. Now with PALS informing the caretakers of the steps to take, the situation can be handled correctly.

Our allergen detector feature helps caretakers and parents to identify whether a food product is safe for a child's consumption as the computer vision technology highlights the allergens present in the food product. This can reduce the occurrence of allergy attacks when the food products given to children are always ensured to be safe and free from harmful allergens.

1.6 Uniqueness of proposed solution

The PALS system has several outstanding features when compared to similar systems in the market.

Firstly, our PALS system introduces a mobile web-based application which is convenient for the parents and caretakers. Parents or caretakers can utilise their mobile phones to easily access allergy information such as symptoms and action plans to ensure the right steps are taken immediately. The reason that this aspect stands out from other solutions is because it is not required to download a mobile application, instead the interface and data can be accessed from any browser. This is because it is more difficult to implement the usage of PALS in schools and daycare centres if the installation of an application is required. Hence, a web-based application is developed instead of a mobile application.

This application integrates computer vision and image processing technology in the allergen detector and translation features which involve the usage of Optical Character Recognition (OCR) to detect and extract text from the ingredients label image as well as a neural machine translation technology to enable the ingredients labels of foreign food products to be translated to assist parents and caretakers to identify whether the food product is safe for the child's consumption without language barriers.

1.7 Contribution

Table 1: Table of team members' contributions

Team members	Modules	Individual tasks	Group tasks
Iris Yan Ning	- User module - Allergen detector module	- UI & UX Design - System testing - System debugging - Connect database to the system	- Report documentation - Assist each other in their respective modules
Chia Jun Bin	Children management module	- UI & UX Design - System testing	
Ching Jia Ying	Caretaker management module	- System debugging	
Yap You Quan	Allergy information module	- Search for allergy information - System debugging	

1.8 Organization of the report

This report is organised into 7 sections.

Section 2 - Competitor analysis

PALS is compared with three selected applications in the market that bear the highest similarity to our system, so that we can investigate and analyse the functionalities behind these systems to develop a unique allergy website with improved features.

Section 3 - System requirements and analysis

Project status, system capabilities, system limitations, project management techniques and the details of the development methodology are addressed.

Section 4 - Technicalities

Discussion of the system architecture, interface design and input and output design.

Section 5 - System implementation

Elaboration of modules implementation and integration of modules into one whole system

Section 6 – Testing and evaluation

Test case scenarios, system testing and system evaluation.

Section 7 – Conclusion and future works

Conclusion and also the further works that can be carried out in the future.

2.0 Background Study & Related Work

2.1 Existing System / Project / Application

There are a few existing systems in the market that has a similar concept which creates an application that keep track of allergies. The 3 selected applications that are most similar to our application concept are *Belay*, *Allergy Assist* and *Allergy Pal*. *Belay* was released on 23rd February 2018 by a passionate team of professional allergist, scientist, engineers, award winning designers and developers dedicated to United States. *Allergy Assist* was released earlier on 29th August 2014 by Tikkun Olam, the developer while *Allergy Pal* was released on 25th March 2019 offered by Murdoch Children's research Institute that run research to improve the lives of millions of kids every year only available in Australia [8].

2.2 Features Comparison of the existing System / Project / Application

Belay is an application for parents to securely share their child's essential food allergy information to all caregivers, such as teacher, coaches, babysitters, grandparents etc, without them downloading the app. Caregivers will only receive an SMS text message with a link that directs them to the child's profile. Belay's key features are listing the food safe and not safe to be eaten by a child, photo of where child's medication is located, emergency plan that is customizable, and provide pre-populated information. *Allergy Assist* uses the same approach as well by allowing parents to create and edit their child's allergy profile, and text and/or email the profiles to caregiver for quick and convenient reference. Other than that, it also provides educational information on how to prevent, spot and treat a food allergy reaction using Fare's Food Allergy & Anaphylaxis Emergency Care Plan [9]. *Allergy Pal* allows parents to share via SMS as well and it also provide extra features like getting an intuitive guide during an allergic reaction, personal notes that help to avoid a reaction, and information to get educated.

Notice that the common functionality exhibited by these applications is addressing one of the problem statements concerning the sharing of children allergies with third-party profiles to enable a systematic method of recording and tracking children's allergies. Other than that, in alignment with our project objective "displaying information like allergy symptoms and action plans", reliable information sharing on the precautions, preventions,

and action plans can be seen these applications. Hence, what makes PALS different from these applications is the AI allergen detector and translation features that accept images of ingredients labels of food products as input and list of allergens as the output [10]. Overall, PALS provides a unique and complete solution to address the concerns of parents regarding children's allergies as it can provide a platform to track the allergies, enable caretakers to view the children's allergies and has artificial intelligence features to detect allergens in the ingredients labels of food products to identify whether the food product is safe for consumption.

Table 2.1: Summary of comparison of existing solutions

Existing solutions	***PALS***	***Belay***	***Allergy Assist***	***Allergy Pal***
Available in Malaysia	Yes	No	Yes	No
AI allergen detector feature	Yes	No	No	No
AI ingredient label translation feature	Yes	No	No	No
Centralised view of children's allergies	Yes	Yes	No	No
Allow third party access to children profile	Yes	Yes	Yes	Yes
Emergency contact feature	Yes	Yes	Yes	No
Information on prevention, precautions, and action plans	Yes	Yes	Yes	Yes

2.3 Existing technique / algorithm / method

AI allergen detection process involves Optical Character Recognition (OCR). OCR is an existing method that automates content processing by detecting and extracting text from the image, converts the text to machine-readable text and compares the extracted text to a list of allergens check if the ingredients of the food product contain allergens that are harmful to the child [11]. There are various OCR tools available to perform this function. Among the tools available, Google Cloud Vision is selected as it provides the most accurate results for smartphone-captured images [12].

Table 2.2: Summary of comparison of OCR tools [12]

OCR tools	***Google Cloud Vision***	***Tesseract OCR***	***Amazon Textract***
Document image	Good	Acceptable	Good
Handwriting	Acceptable	Bad	Bad
Smartphone-captured	Good	Bad	Acceptable

3.0 System Requirements and Analysis

3.1 Status of project development

The system is newly introduced to the market. By introducing this new system, we hope to assist the parents and caretakers to equip more knowledge on the allergy reactions and the actions that should be taken if the situation occurs on their children. Besides, we also hope to form a better community in which the children are free from allergy and have a healthy childhood that suits Sustainable Development Goal (SDG) number 3 - Good Health and Well-Being.

3.2 Scope of proposed solution

The scope of the proposed solution is only targeted to three types of users, which are parents, caretakers, and children. Besides, only users with registered emails can register for a new account on the system. The proposed solution also targets the children scope that has frequent allergies.

3.3 System capabilities & limitations

3.3.1 System Capabilities

In this section, we will discuss about the capabilities of the system. The capabilities are provided in the table as shown below:

Table 3: System modules and capabilities

MODULES	CAPABILITIES
USER MODULE	• Allows the user to register for a new account.
CHILDREN MANAGEMENT MODULE	• Allows the user (parent) to manage children information. • Allows the user (parent) to add new children by adding names, gender, and birthdates.

CARETAKERS MANAGEMENT MODULE	• Allows the user (parent) to manage the caretakers that are responsible for each child. • Allows the user (parent) to add new caretakers for a child by adding names, emails, roles and organisations.
ALLERGY INFORMATION MODULE	• Allows the users to understand about the allergy information. • Displays symptoms, steps to take, foods to avoid completely and foods that should cautious about.
ALLERGEN DETECTOR MODULE	• Allows the user to upload the ingredient label on the website. • A safe message will appear if no allergens are detected. • Warning messages will appear if allergens are detected. • Foreign ingredient labels can be translated and detected.

3.3.2 System limitations

The system has a few limitations. Firstly, the users are unable to upload picture of their children on the system. The caretaker might face difficulties identifying children with the same name, or when the caretaker has a long list of children under their care.

Besides, only the information of the most common allergens is provided in the system. This will become a challenge to the parents with children that suffer from rare allergy symptoms or are allergic to rare allergens that are not listed in the system.

3.4 Project management

3.4.1 Work Breakdown Structure

Project Iteration Schedule for Juniq - Pediatric Allergy Life Saver (PALS)		
Iteration	Time estimated	Use case assigned to each iteration
1	3 weeks	1. Sign In 2. Add Child Profile 3. Add Child Allergy Information
2	4 weeks	1. Update Child Profile 2. Update Child Allergy Information 3. Add emergency contact 4. Remove emergency contact
3	4 weeks	1. View Child Allergy Information and Allergy Action Plans 2. Search allergy info 3. Give access to children's allergy information 4. Remove access to children's allergy information
4	4 weeks	1. View emergency contact 2. Changing identity 3. Detect and generate allergens 4. Translate food label
Total	15 weeks	

3.4.2 Gantt Chart

Iteration 1

Task	Start Date	End Date	Duration (Day)	First Week							Second Week							Third Week						
				M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S
1. Project Planning																								
a. Develop WBS and build schedule and then plan the work	17/10/2022	17/10/2022	1																					
2. Analysis Task																								
a. Gather and analyse detailed information from resources	18/10/2022	18/10/2022	1																					
b. Review and analyse the existing system	19/10/2022	19/10/2022	1																					
c. Define and prioritize requirements	20/10/2022	20/10/2022	1																					
d. Analyse and model the new system using UML diagrams	21/10/2022	21/10/2022	1																					
3. Design Task																								

a. Design a database scheme	22/10/2022	22/10/2022	1																					
b. Design screen layouts	23/10/2022	23/10/2022	1																					
c. Design screen layouts and cross-links	24/10/2022	24/10/2022	1																					
d. Design screen layouts and cross-links	25/10/2022	25/10/2022	1																					
e. Identify all the program classes and methods	26/10/2022	26/10/2022	1																					
4. Build Task																								
a. Build required databases	27/10/2022	27/10/2022	1																					
b. Write the front-end code	28/10/2022	29/10/2022	2																					
c. Write the back-end code	30/10/2022	31/10/2022	1																					
d. Write the back-end code	1/11/2022	2/11/2022	1																					
e. Build test data	3/11/2022	3/11/2022	1																					
f. Perform a unit test	4/11/2022	4/11/2022	1																					

g. Perform an integration test	5/11/2022	5/11/2022	1																					
h. Perform system and acceptance test	6/11/2022	6/11/2022	1																					
Test cases that will be developed: Sign In | Add Child Profile | Add Child Allergy Information																								

Iteration 2

Task	Start Date	End Date	Duration (Day)	First Week							Second Week							Third Week							Fourth week						
				M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S
1. Project Planning																															
a. Develop WBS and build schedule and then plan the work	7/11/2022	7/11/2022	1																												
2. Analysis Task																															
a. Gather and analyse detailed information from resources	8/11/2022	8/11/2022	1																												
b. Review and analyse the existing system	9/11/2022	9/11/2022	1																												
c. Define and prioritize requirements	10/11/2022	10/11/2022	1																												

d. Analyse and model the new system using UML diagrams	11/11/2022	11/11/2022	1																												
3. Design Task																															
a. Design a database scheme	12/11/2022	13/11/2022	2																												
b. Design screen layouts and cross-links	14/11/2022	15/11/2022	2																												
c. Design screen layouts and cross-links	16/11/2022	17/11/2022	2																												
d. Design screen layouts and cross-links	18/11/2022	20/11/2022	3																												
e. Identify all the program classes and methods	21/11/2022	21/11/2022	1																												
4. Build Task																															

a. Build required databases	22/11/2022	22/11/2022	1																												
b. Write the front-end code	23/11/2022	25/11/2022	3																												
c. Write the back-end code	26/11/2022	28/11/2022	3																												
d. Write the back-end code	29/11/2022	30/11/2022	2																												
e. Build test data	1/12/2022	1/12/2022	1																												
f. Perform a unit test	2/12/2022	2/12/2022	1																												
g. Perform an integration test	3/12/2022	3/12/2022	1																												
h. Perform system and acceptance test	4/12/2022	4/12/2022	1																												
Test cases that will be developed: Update Child Profile | Update Child Allergy Information | Add emergency contact | Remove emergency contact																															

Iteration 3

Task	Start Date	End Date	Duration (Day)	First Week							Second Week							Third Week							Fourth week						
				M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S
1. Project Planning																															
a. Develop WBS and build schedule and then plan the work	5/12/2022	5/12/2022	1																												
2. Analysis Task																															
a. Gather and analyse detailed information	6/12/2022	6/12/2022	1																												

from resources																															
b. Review and analyse the existing system	7/12/2022	7/12/2022	1																												
c. Define and prioritize requirements	8/12/2022	8/12/2022	1																												
d. Analyse and model the new system using UML diagrams	9/12/2022	9/12/2022	1																												
3. Design Task																															
a. Design a database scheme	10/12/2022	11/12/2022	2																												
b. Design screen layouts and cross-links	12/12/2022	13/12/2022	2																												
c. Design screen layouts and cross-links	14/12/2022	15/12/2022	2																												

d. Design screen layouts and cross-links	16/12/2022	17/12/2022	2																												
e. Identify all the program classes and methods	18/12/2022	18/12/2022	1																												
4. Build Task																															
a. Build required databases	19/12/2022	19/12/2022	1																												
b. Write the front-end code	20/12/2022	22/12/2022	3																												
c. Write the back-end code	23/12/2022	25/12/2022	3																												
d. Write the back-end code	26/12/2022	28/12/2022	3																												
e. Build test data	29/12/2022	29/12/2022	1																												

f. Perform a unit test	30/12/2022	30/12/2022	1																											
g. Perform an integration test	31/12/2022	31/12/2022	1																											
h. Perform system and acceptance test	1/1/2023	1/1/2023	1																											
Test cases that will be developed: View Child Allergy Information and Allergy Action Plans | Search allergy info | Give access to children's allergy information | Remove access to children's allergy information																													

Iteration 4

Task	Start Date	End Date	Duration (Day)	First Week							Second Week							Third Week							Fourth week						
				M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S

a. Develop WBS and build schedule and then plan the work	2/1/2023	2/1/2023	1																													
2. Analysis Task																																
a. Gather and analyse detailed information from resources	3/1/2023	3/1/2023	1																													
b. Review and analyse the existing system	4/1/2023	4/1/2023	1																													
c. Define and prioritize requirements	5/1/2023	5/1/2023	1																													
d. Analyse and model the new system using UML diagrams	6/1/2023	6/1/2023	1																													
3. Design Task																																
a. Design a database scheme	7/1/2023	8/1/2023	2																													

b. Design screen layouts and cross-links	9/1/2023	10/1/2023	2																											
c. Design screen layouts and cross-links	11/1/2023	12/1/2023	2																											
d. Design screen layouts and cross-links	13/1/2023	14/1/2023	2																											
e. Identify all the program classes and methods.	15/1/2023	15/1/2023	1																											
4. Build Task																														
a. Build required databases	16/1/2023	16/1/2023	1																											
b. Write the front-end code	17/1/2023	18/1/2023	2																											
c. Write the back-end code	19/1/2023	20/1/2023	2																											
d. Write the back-end code	21/1/2023	22/1/2023	3																											
e. Build test data	23/1/2023	23/1/2023	1																											

f. Perform a unit test	24/1/2023	24/1/2023	1																												
g. Perform an integration test	25/1/2023	25/1/2023	1																												
h. Perform system and acceptance test	26/1/2023	26/1/2023	1																												
i. Documentation and report	27/1/2023	27/1/2023	1																												
Test cases that will be developed: View emergency contact | Changing identity | Detect and generate allergens | Translate food label																															

3.4.3 SWOT Analysis

Table 9: Table of SWOT Analysis

Strength	Weakness
1. Team members come from different specialisation allows more ideas or opinions can be exchanged 2. Team communication and team leadership values are well-conducted	1. Lack of technical knowledge makes it more difficult to assist each other in the project development 2. There is a gap of expertise and knowledge level between each team member.
Opportunity	**Threat**
1. Include more features such as uploading children's pictures on the system to make it more complete 2. Parent's demand on the inclusion of rare allergen information or allergy symptoms	1. Unable to deliver or finish the assigned task before the internal due date 2. Different team members' personal schedules makes project discussion difficult

3.5 Development methodology

Our team has applied structured development methodologies in the website development process. A combination of waterfall and agile methodologies are implemented for several processes. Waterfall development model is mainly applied in identifying users' requirements, system design, coding and debugging while agile development model focuses on the team discussions and meetings to determine the progress and issues of the project development. Agile process is also involved in the UI design of the project because our team keep improvising the interface design through our continuous UX research.

3.6 Analysis of proposed solution / project

3.6.1 Identify users' requirements.

To identify users' requirements, we need to first identify and understand the perspective of the end users. According to the discussed content in the previous sections, we can identify a list of people that are involved in the system, which are parents, caretakers, children, admin, and system developers. These users are also referred as stakeholders in this project. The stakeholders can be classified into two categories which are operational and executive as the following table:

Table 10: Classification of stakeholders

Type	**Operational**	**Executive**
Internal stakeholders	System developers	Admin
External stakeholders	Parents, caretakers, children	-

Our team used several ways to identify users' requirements. Firstly, our team used questionnaires, in which these questionnaires are distributed to the public especially to our target audience parents and caretakers such as babysitters and school teachers. There are a number of questions in the questionnaires to help us to collect stakeholders' opinions from different perspectives so that we can understand users' needs in the system. Besides, we have conducted online discussions with the team to delve into the technical requirements on developing and sustaining the system. We also investigated other similar available applications on the market to understand their functionalities, operations and benefits to the users. Documentation of the similar applications have been included as well to ease the requirement elicitation process.

3.7 UML diagram

3.7.1 Use Case Diagram

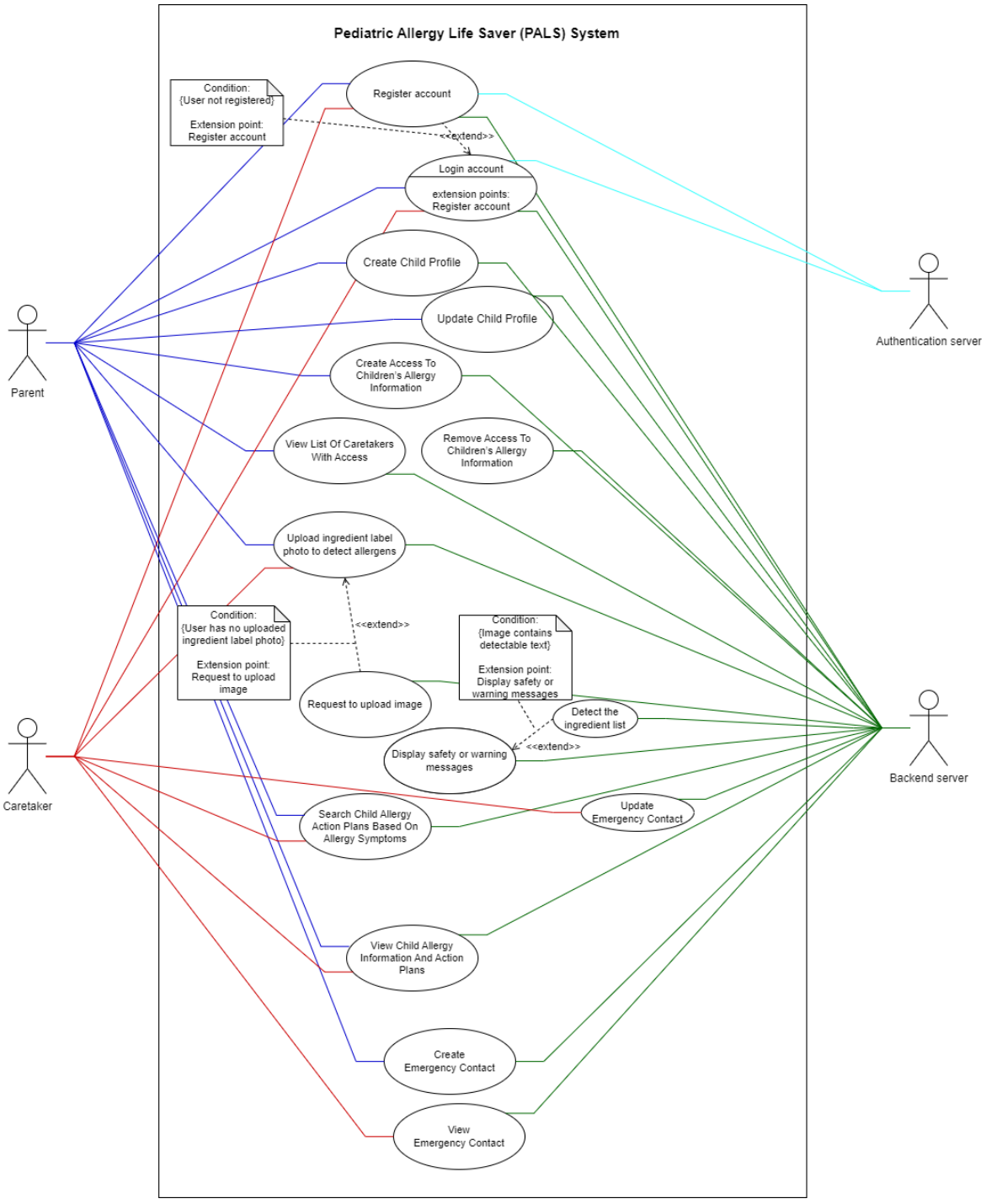


Figure x: Use case diagram

3.7.2 Use Case Description

U001: Login Account

No.		Section	Description
ID	**1.1**	**Identifier**	U001
	1.2	**Name**	Login Account
Management	**2.1**	**Author(s)**	Iris Yan Ning
	2.2	**Version**	1.0
	2.3	**Change history**	-
	2.4	**Priority**	Medium
	2.5	**Criticality**	High
Contex	**3.1**	**Sources**	Parents, Caretakers
Use Case Definition	**4.1**	**Short Description**	The user logs into their user account by using their Google account.
	4.2	**Primary actors**	Parents, Caretakers
	4.3	**Other actors**	Backend server
	4.4	**Preconditions**	- The user has a Google account. - The device of the user has internet connection.
	4.5	**Trigger**	The user taps the “SIGN IN WITH GOOGLE” button.
	4.6	**Post-condition**	The user logs into their own account successfully.
	4.7	**Results**	The homepage is displayed.
	4.8	**Main scenario**	1. The user taps the “SIGN IN WITH GOOGLE” button. 2. The system shows a pop-up of the Google authentication page. 3. The user selects a Google account to login. 4. The system verifies the Google account. 5. The system allows the user to enter the application.

	4.10	**Exception Scenario**	3(a) The user selects "Use another account" option on Google authentication. 1. The user inputs an invalid email. 2. The website displays "Couldn't find your Google account." 3. Go back to step 2. 3(b) The user selects "Use another account" option on Google authentication. 1. The user inputs an invalid password. 2. The website displays "Wrong password. Try again or click Forgot password to reset it." 3. Go back to step 2.
Relationshi	**5.1**	**Use cases**	-

U002: Add Child Profile

No.		Section	Description
ID	**1.1**	**Identifier**	U002
	1.2	**Name**	Add Child Profile
Management	**2.1**	**Author(s)**	Chia Jun Bin
	2.2	**Version**	1.0
	2.3	**Change history**	-
	2.4	**Priority**	High
	2.5	**Criticality**	Medium
Contex	**3.1**	**Sources**	Parents
Use Case Definition	**4.1**	**Short Description**	The system allows registered users (parents) add his or her child profile by entering their information such as name, birthdate and gender.
	4.2	**Primary actors**	Parents
	4.3	**Other actors**	Backend server
	4.4	**Preconditions**	- The user is logged in as parent. - The device of the user has internet connection.
	4.5	**Trigger**	The user taps the “Add Child” button.
	4.6	**Post-condition**	The child profile is created, and the information is stored in the database.
	4.7	**Results**	The system displays “Child profile created successfully” message.

	4.8	**Main scenario**	1. The user taps the "Add Child" button. 1. The user enters the details of their child including name, birthdate, and gender. 2. The user taps the "Submit" button. 3. The system performs validation of the user input. 4. The new child profile is created and stored in the database. 5. The system displays "Child profile created successfully" message.
	4.9	**Alternative scenario**	-
	4.10	**Exception Scenario**	4(a) The form of child's details has missing fields. i. The system displays an error message to prompt the user to fill in all fields "Please fill in all fields." ii. Go back to step 2.
Relationshi	**5.1**	**Use cases**	U003

U003: Update Child Profile

No.		Section	Description
ID	**1.1**	**Identifier**	U003
	1.2	**Name**	Update Child Profile
Management	**2.1**	**Author(s)**	Chia Jun Bin
	2.2	**Version**	1.0
	2.3	**Change history**	-
	2.4	**Priority**	Medium
	2.5	**Criticality**	Medium
Contex	**3.1**	**Sources**	Parents
Use Case Definition	**4.1**	**Short Description**	The system allows registered users (parents) to update their child profile by entering their information such as name, birthdate and gender.
	4.2	**Primary actors**	Parents
	4.3	**Other actors**	Backend server
	4.4	**Preconditions**	- The user logged in as parent. - The device has an internet connection. - There is an existing child profile.
	4.5	**Trigger**	The user taps the “Edit” button in the “Allergies” section of the child profile.
	4.6	**Post-condition**	The child profile is updated, and the information is stored in the database.
	4.7	**Results**	The system displays “Child profile successfully updated” message.

	4.8	**Main scenario**	1. The user taps the "Update Profile" button. 2. The user enters the details of their child including name, birthdate and gender. 3. The user taps the "Submit" button. 4. The system performs validation of the user input. 5. The child profile is updated and stored in the database. 6. The system displays "Child profile successfully updated" message.
	4.9	**Alternative scenario**	-
	4.10	**Exception Scenario**	4(a) The form of child's details has missing fields. 1. The system displays an error message to prompt the user to fill in all fields "Please fill in all fields". Go back to step 2.
Relationshi	**5.1**	**Use cases**	U002

U004: Add or Remove Child Allergy

No.		Section	Description
ID	**1.1**	**Identifier**	U004
	1.2	**Name**	Add or Remove Child Allergy
Management	**2.1**	**Author(s)**	Chia Jun Bin
	2.2	**Version**	1.0
	2.3	**Change history**	-
	2.4	**Priority**	High
	2.5	**Criticality**	Medium
Contex	**3.1**	**Sources**	Parents
Use Case Definition	**4.1**	**Short Description**	The system allows registered users (parents) input the child allergy information and the allergy action plan
	4.2	**Primary actors**	Parents
	4.3	**Other actors**	Backend server
	4.4	**Preconditions**	- The users logged in as parent. - The device has internet connection. - There is an existing child profile in the backend server.
	4.5	**Trigger**	The user taps the “Edit” button in the Allergies section of the child profile.
	4.6	**Post-condition**	The updated list of allergies of the child is stored in the database.
	4.7	**Results**	The system displays “Allergies updated successfully” message.

	4.8	**Main scenario**	1. The user taps the "Edit" button in the Allergies section of the child profile. 2. The user selects or unselects any number of allergies from the checkbox list of allergies. 3. The user taps the "Submit" button. 4. The system performs validation of the user input. 5. The updated list of allergies of the child is stored in the database. 6. The system displays "Allergies updated successfully" message.
	4.9	**Alternative scenario**	-
	4.10	**Exception Scenario**	-
Relationshi	**5.1**	**Use cases**	U006, U007

U005: View Child Allergy Information

No.		Section	Description
ID	**1.1**	**Identifier**	U005
	1.2	**Name**	View Child Allergy Information
Management	**2.1**	**Author(s)**	Chia Jun Bin
	2.2	**Version**	1.0
	2.3	**Change history**	-
	2.4	**Priority**	High
	2.5	**Criticality**	Medium
Contex	**3.1**	**Sources**	Parents, Caretakers
Use Case Definition	**4.1**	**Short Description**	The systems allow users to view child allergy information and allergy action plans
	4.2	**Primary actors**	Parents, Caretakers
	4.3	**Other actors**	Backend Server
	4.4	**Preconditions**	- The users logged in as parent or caretaker. - The device of the user is connected to the Internet. - There is an existing child profile in the system. - The selected child has existing allergies in the system.
	4.5	**Trigger**	The user selects the child profile and selected allergy.
	4.6	**Post-condition**	The users will be directed to “Allergy Details” page of the selected allergy.
	4.7	**Results**	The users are able to view all allergy information such as allergy symptoms, steps to take, foods to avoid completely and foods to be cautious around.

	4.8	**Main scenario**	1. The user selects the name of the child to enter child profile. 2. The user selects an allergy from the list of allergies in the child profile. 3. The system displays allergy information such as allergy symptoms, steps to take, foods to avoid completely and foods to be cautious around.
	4.9	**Alternative scenario**	-
	4.10	**Exception Scenario**	-
Relationshi	**5.1**	**Use cases**	U004, U005, U007

U006: Search Allergy Information

No.		Section	Description
ID	**1.1**	**Identifier**	U006
	1.2	**Name**	Search Allergy Information
Management	**2.1**	**Author(s)**	Iris Yan Ning
	2.2	**Version**	1.0
	2.3	**Change history**	-
	2.4	**Priority**	Medium
	2.5	**Criticality**	Medium
Contex	**3.1**	**Sources**	Parents, Caretakers
Use Case Definition	**4.1**	**Short Description**	The system allows users to search allergy information.
	4.2	**Primary actors**	Parents, Caretakers
	4.3	**Other actors**	Backend server
	4.4	**Preconditions**	- The users logged in as parent or caretaker. - The device of the user has Internet connection.
	4.5	**Trigger**	The user opens the “Search Allergy Info” search bar.
	4.6	**Post-condition**	The dropdown of all allergies is displayed for the user to select to display the information of the selected allergy.
	4.7	**Results**	The user is able to view the allergy information of the selected allergy such as allergy symptoms, steps to take, foods to avoid completely and foods to be cautious around.
	4.8	**Main scenario**	1. The user opens the “Search Allergy Info” search bar. 2. The user selects an allergy from the dropdown list of allergies. 3. The system displays the allergy information of the selected allergy such as allergy symptoms, steps to take, foods to avoid completely and foods to be cautious around.
	4.9	**Alternative scenario**	-
	4.10	**Exception Scenario**	-

Relationshi	**5.1**	**Use cases**	U004, U005, U006

U007: Give Caretaker Access

No.		Section	Description
ID	**1.1**	**Identifier**	U007
	1.2	**Name**	Give Caretaker Access
Management	**2.1**	**Author(s)**	Iris Yan Ning
	2.2	**Version**	1.0
	2.3	**Change history**	-
	2.4	**Priority**	High
	2.5	**Criticality**	Low
Contex	**3.1**	**Sources**	Parent
Use Case Definition	**4.1**	**Short Description**	The system will allow the logged in user (parent) to create access for the caretaker to view a specified child profile.
	4.2	**Primary actors**	Parent
	4.3	**Other actors**	Caretakers, Backend server
	4.4	**Preconditions**	- The users logged in as parent. - The device of the user is connected to the Internet. - There is an existing child profile in the system. - The specified caretaker has a registered account.
	4.5	**Trigger**	The user selects “Edit” button on the Caretaker page of the child profile.
	4.6	**Post-condition**	The caretaker is able to access the child profile.
	4.7	**Results**	The system displays “Caretaker added successfully” message.

	4.8	**Main scenario**	1. The user selects a child from the list of children. 2. The user selects the 'Caretakers' button in the Caretakers section of the child profile. 3. The user selects the "Edit" button. 4. The system displays a form with fields for the caretaker's name, email, role and organisation. 5. The user fills in all the fields. 6. The user selects the "Submit" button. 7. The system validates the user inputs. 8. The system displays "Caretaker added successfully" message. 9. The system stores the created access in the database.
	4.9	**Alternative scenario**	-
	4.10	**Exception Scenario**	5(a) The caretaker does not have a registered PALS account. 1. The system displays "Invalid email. Please ensure that the caretaker has a registered PALS account." error message. 2. Go back to step 4. 5(b) The user does not fill in all the fields. 1. The system displays "Please fill in all fields!" error message. 2. Go back to step 4.
Relationshi	**5.1**	**Use cases**	U001, U006, U009

U008: Remove Caretaker Access

No.		Section	Description
ID	**1.1**	**Identifier**	U008
	1.2	**Name**	Remove Caretaker Access
Management	**2.1**	**Author(s)**	Ching Jia Ying
	2.2	**Version**	1.0
	2.3	**Change history**	-
	2.4	**Priority**	High
	2.5	**Criticality**	Low
Contex	**3.1**	**Sources**	Parent
Use Case Definition	**4.1**	**Short Description**	The system will allow the logged in user to remove caretaker access which prevents the caretaker from viewing the child profile.
	4.2	**Primary actors**	Parents
	4.3	**Other actors**	Caretakers, Backend server
	4.4	**Preconditions**	- The users logged in as parent. - The device of the user is connected to the Internet. - There is an existing child profile in the system. - The specified caretaker has an existing access.
	4.5	**Trigger**	The user taps the “Remove” button on the card of the caretaker to remove.
	4.6	**Post-condition**	The caretaker is no longer able to access the child profile.
	4.7	**Results**	The system displays “Caretaker removed successfully”.

	4.8	**Main scenario**	1. The user selects a child from the list of children. 2. The user selects the "Caretakers" button in the Caretakers section of the child profile. 3. The system displays the list of caretakers. 4. The user taps the "Remove" button on the card of the caretaker to remove. 5. The system displays a confirmation dialog. 6. The user selects "Confirm" button. 7. The system displays "Caretaker removed successfully" message. 8. The system removes the created access from the database.
	4.9	**Alternative scenario**	6(a) The user taps on "Cancel". 1. Go back to step 3.
	4.10	**Exception Scenario**	-
Relationshi	**5.1**	**Use cases**	U001, U006, U009

U009: View Caretakers List

No.		Section	Description
ID	**1.1**	**Identifier**	U009
	1.2	**Name**	View Caretakers List
Management	**2.1**	**Author(s)**	Chia Jun Bin
	2.2	**Version**	1.0
	2.3	**Change history**	-
	2.4	**Priority**	High
	2.5	**Criticality**	Low
Contex	**3.1**	**Sources**	Parent
Use Case Definition	**4.1**	**Short Description**	The system will allow logged in user to view the list of caretakers with access to the child profile.
	4.2	**Primary actors**	Parents
	4.3	**Other actors**	Caretakers, Backend server
	4.4	**Preconditions**	- The users logged in as parent. - The device of the user is connected to the Internet. - There is an existing child profile in the system. - The specified caretaker has a registered account.
	4.5	**Trigger**	The user selects the ‘Caretakers’ button in the Caretakers section of the child profile.
	4.6	**Post-condition**	The system displays the list of caretakers.
	4.7	**Results**	The system displays the list of caretakers.
	4.8	**Main scenario**	1. The user selects a child from the list of children. 2. The user selects the ‘Caretakers’ button in the Caretakers section of the child profile. 3. The system displays the list of caretakers.
	4.9	**Alternative scenario**	-
	4.10	**Exception Scenario**	-

Relationshi	**5.1**	**Use cases**	U001, U008, U009

U010: Add Emergency Contact

No.		Section	Description
ID	**1.1**	**Identifier**	U010
	1.2	**Name**	Add Emergency Contact
Management	**2.1**	**Author(s)**	Chia Jun Bin
	2.2	**Version**	1.0
	2.3	**Change history**	-
	2.4	**Priority**	High
	2.5	**Criticality**	Medium
Contex	**3.1**	**Sources**	Parent
Use Case Definition	**4.1**	**Short Description**	The system will allow logged in users to create emergency contact for a child.
	4.2	**Primary actors**	Parents
	4.3	**Other actors**	Caretakers, Backend server
	4.4	**Preconditions**	- The users logged in as parent. - The device of the user is connected to the Internet. - There is an existing child profile in the system.
	4.5	**Trigger**	The user selects “Edit” button on the Emergency Contacts page of the child profile.
	4.6	**Post-condition**	The new emergency contact is stored in the database.
	4.7	**Results**	The system displays “Emergency contact added successfully” message.

	4.8	**Main scenario**	1. The user selects a child from the list of children. 2. The user selects the "Emergency Contacts" button in the Emergency Contacts section of the child profile. 3. The user selects the "Edit" button. 4. The system displays a form with fields for the emergency contact's name, phone number and relationship to child. 5. The user fills in all the fields. 6. The user selects the "Submit" button. 7. The system validates the user inputs. 8. The system displays "Emergency contact added successfully" message. 9. The system stores the new emergency contact in the database.
	4.9	**Alternative scenario**	-
	4.10	**Exception Scenario**	5(a) The user does not fill in all the fields. 1. The system displays "Please fill in all fields!" error message. 2. Go back to step 4. 5(a) The phone number is invalid. 1. The system displays "Phone number must be valid!" error message. 2. Go back to step 4.
Relationshi	**5.1**	**Use cases**	U001, U012, U013

U011: Remove Emergency Contact

No.		Section	Description
ID	**1.1**	**Identifier**	U011
	1.2	**Name**	Remove Emergency Contact
Management	**2.1**	**Author(s)**	Chia Jun Bin
	2.2	**Version**	1.0
	2.3	**Change history**	-
	2.4	**Priority**	High
	2.5	**Criticality**	Low
Contex	**3.1**	**Sources**	Parent
Use Case Definition	**4.1**	**Short Description**	The system will allow the logged in users to remove emergency contact for a child.
	4.2	**Primary actors**	Parents
	4.3	**Other actors**	Caretaker, Backend server
	4.4	**Preconditions**	- The users logged in as parent. - The device of the user is connected to the Internet. - There is an existing child profile in the system. - The specified caretaker has an existing access.
	4.5	**Trigger**	The user taps the “Remove” button on the card of the emergency contact to remove.
	4.6	**Post-condition**	The emergency contact is removed from the database.
	4.7	**Results**	The system displays “Emergency contact removed successfully” message.

	4.8	**Main scenario**	1. The user selects a child from the list of children. 2. The user selects the "Emergency Contacts" button in the Emergency Contacts section of the child profile. 3. The system displays the list of caretakers. 4. The user taps the "Remove" button on the card of the emergency contact to remove. 5. The system displays a confirmation dialog. 6. The user selects "Confirm" button. 7. The system displays "Emergency contact removed successfully" message. 8. The system removes the emergency contact from the database.
	4.9	**Alternative scenario**	2(a) The user taps on "Return". The system returns to the child information page.
	4.10	**Exception Scenario**	1(a) The user is not logged in.
Relationshi	**5.1**	**Use cases**	U001, U011, U013

U012: View Emergency Contacts List

No.		Section	Description
ID	**1.1**	**Identifier**	U012
	1.2	**Name**	View Emergency Contacts List
Management	**2.1**	**Author(s)**	Chia Jun Bin
	2.2	**Version**	1.0
	2.3	**Change history**	-
	2.4	**Priority**	High
	2.5	**Criticality**	Low
Contex	**3.1**	**Sources**	Parents
Use Case Definition	**4.1**	**Short Description**	The system will allow the logged in users to view the list of emergency contacts.
	4.2	**Primary actors**	Parents
	4.3	**Other actors**	Caretakers, Backend server
	4.4	**Preconditions**	- The users logged in as parent. - The device of the user is connected to the Internet. - There is an existing child profile in the system. - The specified caretaker has a registered account.
	4.5	**Trigger**	The user selects the "Emergency Contacts" button in the Emergency Contacts section of the child profile.
	4.6	**Post-condition**	The system displays the list of emergency contacts.
	4.7	**Results**	The system displays the list of emergency contacts.
	4.8	**Main scenario**	1. The user selects a child from the list of children. 2. The user selects the "Emergency Contacts" button in the Emergency Contacts section of the child profile. 3. The system displays the list of emergency contacts.
	4.9	**Alternative scenario**	-
	4.10	**Exception Scenario**	-

Relationshi	**5.1**	**Use cases**	U001, U011, U012

U013: Switch User Identity

No.		Section	Description
ID	**1.1**	**Identifier**	U013
	1.2	**Name**	Switch User Identity
Management	**2.1**	**Author(s)**	Iris Yan Ning
	2.2	**Version**	1.0
	2.3	**Change history**	-
	2.4	**Priority**	High
	2.5	**Criticality**	High
Contex	**3.1**	**Sources**	Parents, caretaker
Use Case Definition	**4.1**	**Short Description**	User is able to switch identity between parent and caretaker.
	4.2	**Primary actors**	Parent, Caretaker
	4.3	**Other actors**	Backend server
	4.4	**Preconditions**	- The users logged in as parent or caretaker. - The device of the user is connected to the Internet.
	4.5	**Trigger**	The user selects their profile, then selects the “Switch” button.
	4.6	**Post-condition**	The identity of the user is switched, and the updated identity is stored in the database.
	4.7	**Results**	The system displays a different view of the website according to the user identity.
	4.8	**Main scenario**	1. The user selects their user profile. 2. The user selects the switch button. 3. The system displays a different view of the website according to the user identity. 4. The system stores the updated identity in the database.
	4.9	**Alternative scenario**	-
	4.10	**Exception Scenario**	-

Relationshi	**5.1**	**Use cases**	U001, U002, U003, U004, U005, U006, U007, U008, U009, U010, U011, U012. U013, U015, U016

U014: Detect Allergens from Ingredients Label Photo

No.		Section	Description
ID	**1.1**	**Identifier**	U014
	1.2	**Name**	Detect Allergens from Ingredients Label Photo
Management	**2.1**	**Author(s)**	Iris Yan Ning
	2.2	**Version**	1.0
	2.3	**Change history**	-
	2.4	**Priority**	High
	2.5	**Criticality**	High
Contex	**3.1**	**Sources**	Parents, Caretaker
Use Case Definition	**4.1**	**Short Description**	User uploads a photo of ingredients label to detect and translate the allergen text from the photo.
	4.2	**Primary actors**	Parent, Caretaker
	4.3	**Other actors**	Backend server
	4.4	**Preconditions**	- The users logged in as parent or caretaker. - The device of the user is connected to the Internet. - There is an existing child profile in the system. - The selected child has existing allergies in the system.
	4.5	**Trigger**	The user uploads the ingredients label photo.
	4.6	**Post-condition**	The system accurately identifies whether the food product of the ingredients label is safe or unsafe.
	4.7	**Results**	The system displays safe or unsafe message. If it is unsafe, the system displays the list of allergens present in the ingredients label.

	4.8	**Main scenario**	1. The system selects “Allergy Detection” button. 2. The user selects a child from the list of children. 3. The user uploads a photo. 4. The user selects “Detect Allergens” button. 5. The system extracts text from the photo. The extracted text is translated to English. 6. The system matches the extracted text to the list of allergens of the selected child. 7. If allergens are detected, the system displays unsafe message. 8. If no allergens are detected, the system displays safe message.
	4.9	**Alternative scenario**	-
	4.10	**Exception Scenario**	5(a) No text is detected from the photo. 1. The system displays “No text detected in the image! Please take a clearer photo.” error message. 2. Go back to step 3.
Relationshi	**5.1**	**Use cases**	U001, U016

3.8 Technology deployed

3.8.1 Hardware Specification

1. RAM: 8GB
2. GPU: 2.0 GHz
3. Monitor resolution: 1920 x 1080 pixels
4. Internet: Wi-Fi or mobile data hotspot should be connected

3.8.2 Software Specification

1. OS system: Windows, macOS, Linux, Huawei
2. Browser: Google Chrome, Safari, Microsoft Edge

3.8.3 Programming Languages / Tools

1. Visual Studio Code

   We used Visual Studio Code as our IDE to program the system.

2. Figma

   We used Figma to design the UI/UX interfaces, as well as the prototype.

3. Vue.js

   Vue is a frontend framework that used for building the user interfaces. It is user-friendly, in which it can easily scale between a library and a framework.

4. Vuetify

   Vuetify is a UI library for Vue.js that provides components and utilities to enable speedy development of frontend elements and design.

5. Express.js

   Express.js is a backend server framework for web applications with is powered by Node to build RESTful APIs.

6. Firebase

   Firebase is used for securely handling the user authentication via Google, storage of data using real-time database for food labels photos and storage of user data using Firestore with scalability.

7. GitHub

   GitHub is a platform used to perform version control for our project and to simplify the collaboration process. The developers can easily push the latest updates to the repository and the other collaborators can pull the latest changes to their own repository.

8. Heroku

   Heroku is a cloud Platform as a Service (PaaS) used to deploy full stack applications. Our project is deployed on Heroku.

4.0 System Design

4.1 System architecture

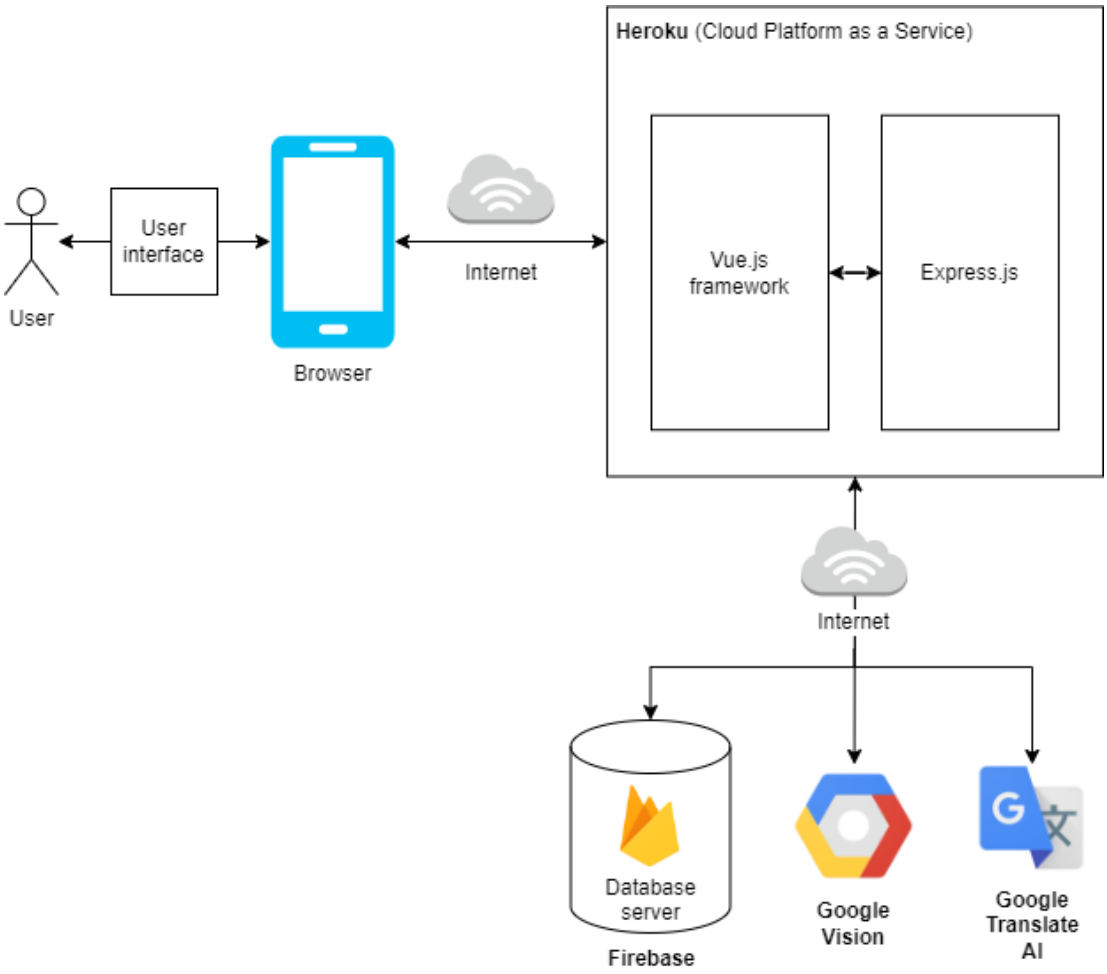


Figure 4: Architecture diagram of PALS

PALS is built on a 3-tier architecture which consists of client-side, cloud platform and data sources/3rd party integrations & services. Our service is accessible to user via a browser and consists of user interface components that supports interaction with the system. It is developed using 2 core frameworks which are Vue.js and Express.js. As long as the user has an internet connection, they will be able to retrieve their information which is stored in the backend Database server. The Database server will store all the information including their identity as different identity has different access to the features. On the other hand, we used Google Vision and Google Translate API to assist us in detection and translation of the allergens from an ingredient's label.

4.2 System components / modules

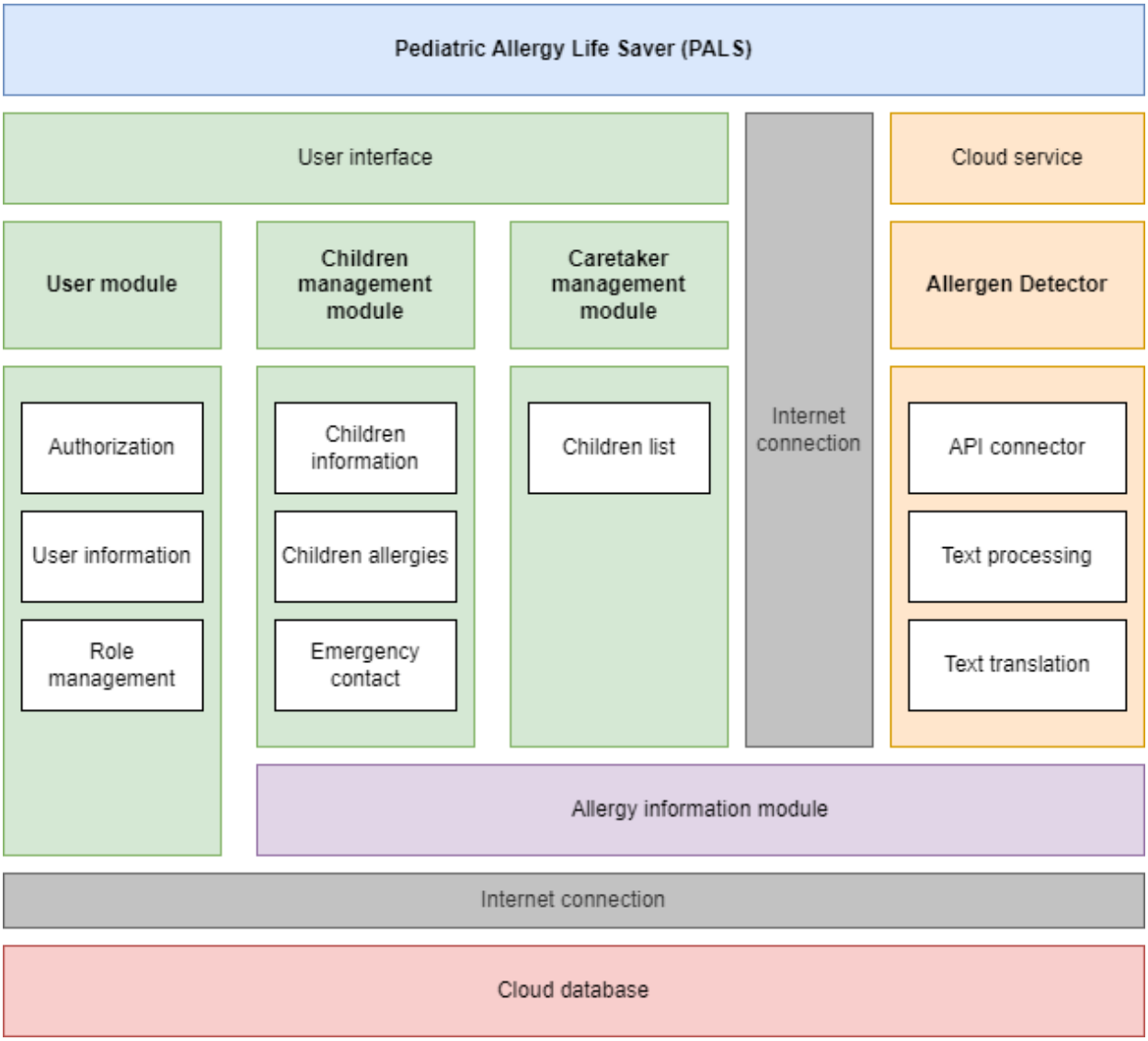


Figure 5: Module diagram of PALS

4.3 Database and class diagram

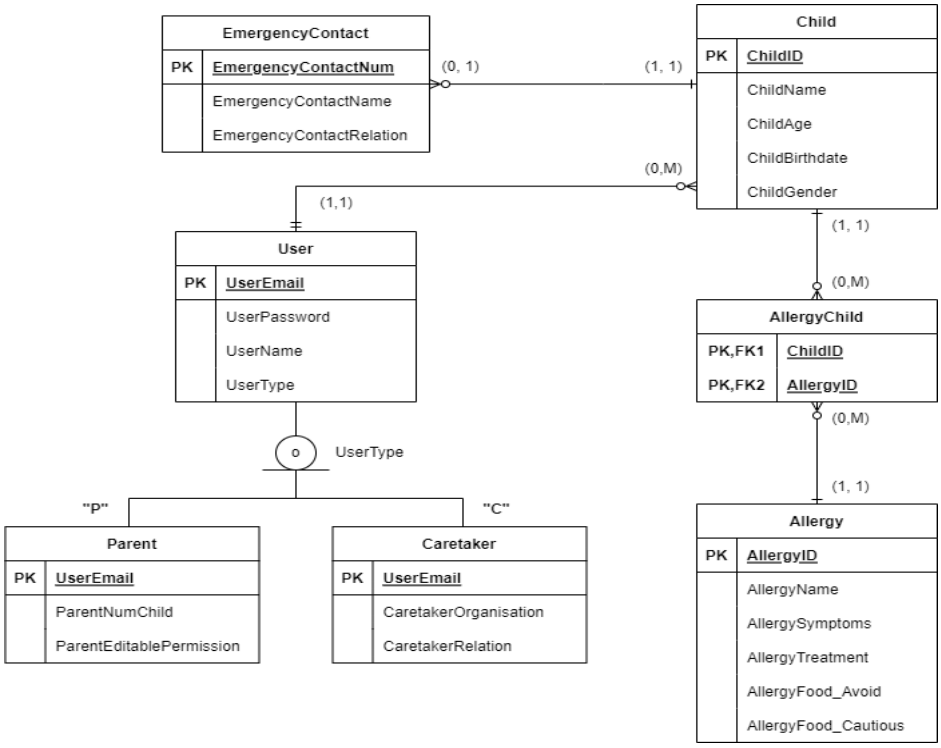
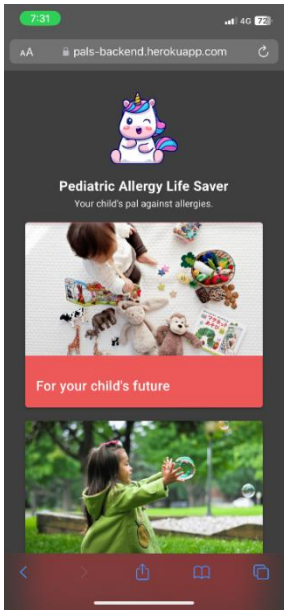
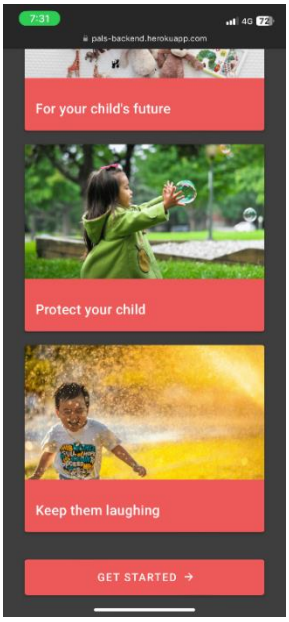
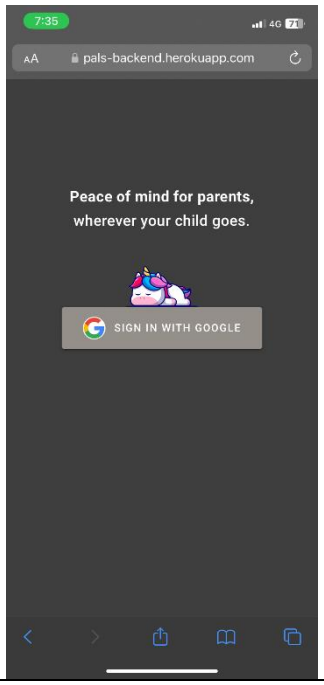


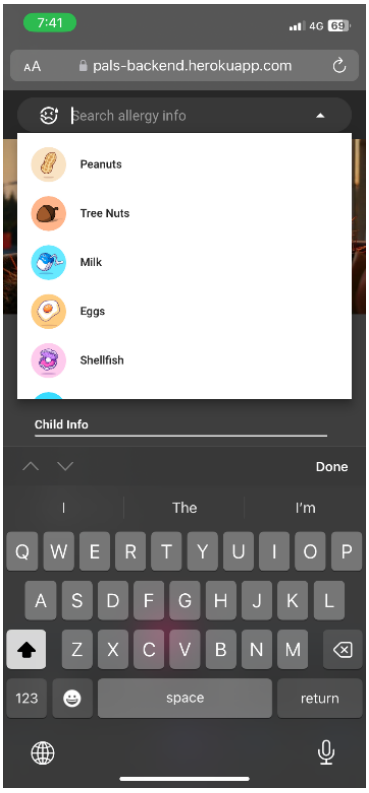
Figure 6: Entity relationship diagram of PALS

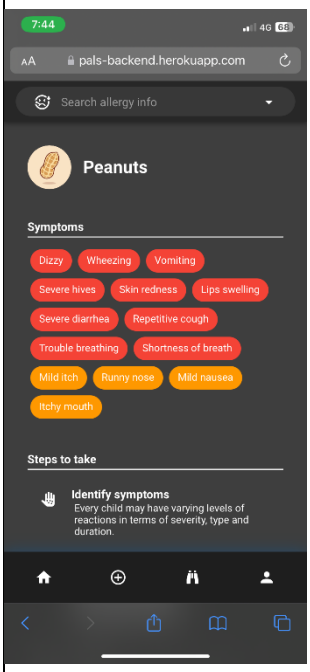
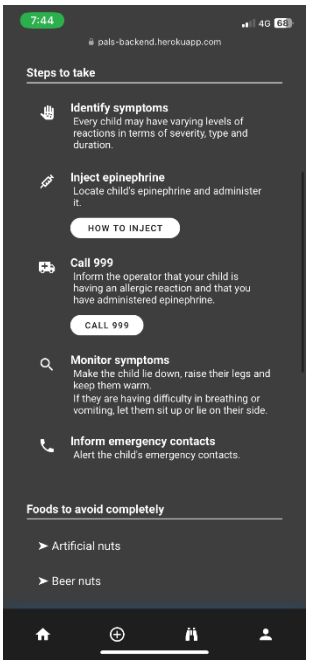
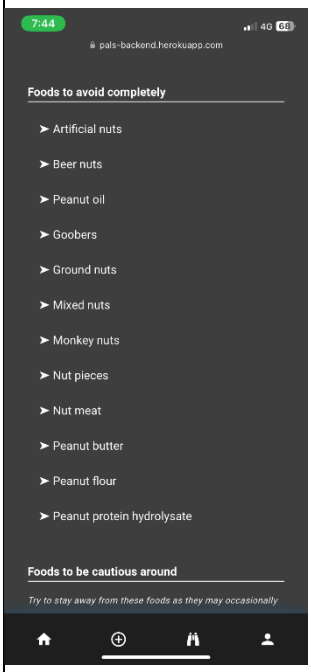
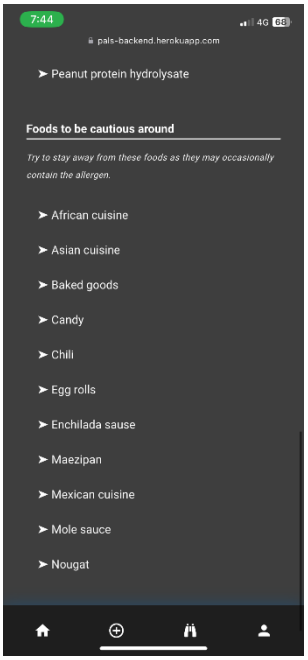
PALS is comprised of 4 main entities: User, Emergency Contact, Chid and Allergy. User entity is the supertype of the subtypes parent and caretaker. This allows the user to switch between 2 different identities when using the system. The subtypes inherit the basic user details from the User entity, but the Parent and Caretaker entities have different attributes and interaction with the system. Parents have write access in children management and caretaker management, whereas caretakers only have read access. Next, the Emergency contact entity stores the emergency contacts of children, and the attributes involved are the emergency contact name and relationship. Other than that, the child entity stores all the child's attribute including name, age, birthdate and gender, these are only editable by parents and viewable by caretaker if the access is given. Moving on, the Allergy entity stores all the allergy attributes which include the allergy name, symptoms, treatment, food to avoid and food to be caution around. This entity is directly linked to the child entity as the child allergy will be stored based on the child ID and the allergy ID. The relationship between child and allergy is many to many because a child can have zero or many allergies, and an allergy can afflict zero or many children.

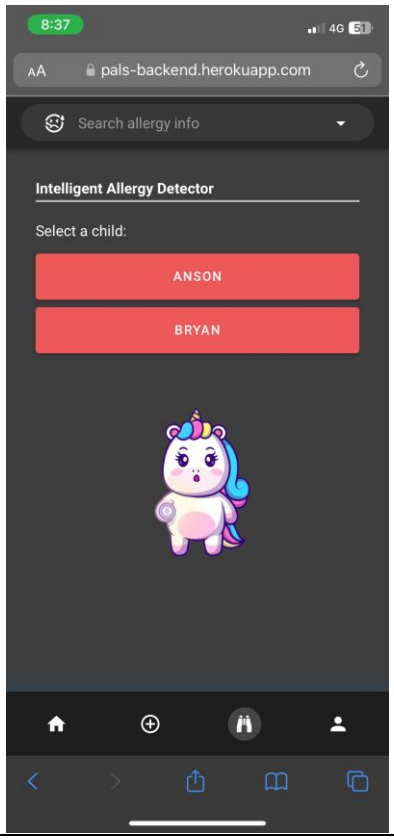
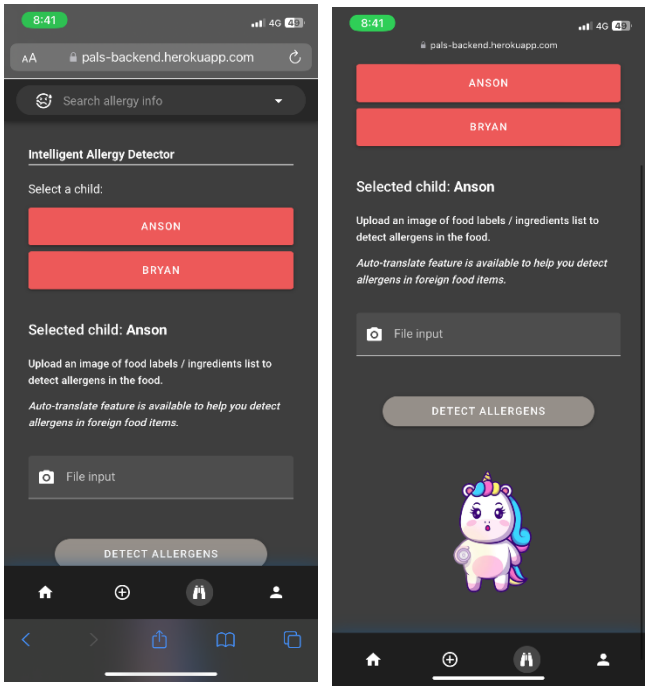
4.4 Interface Design

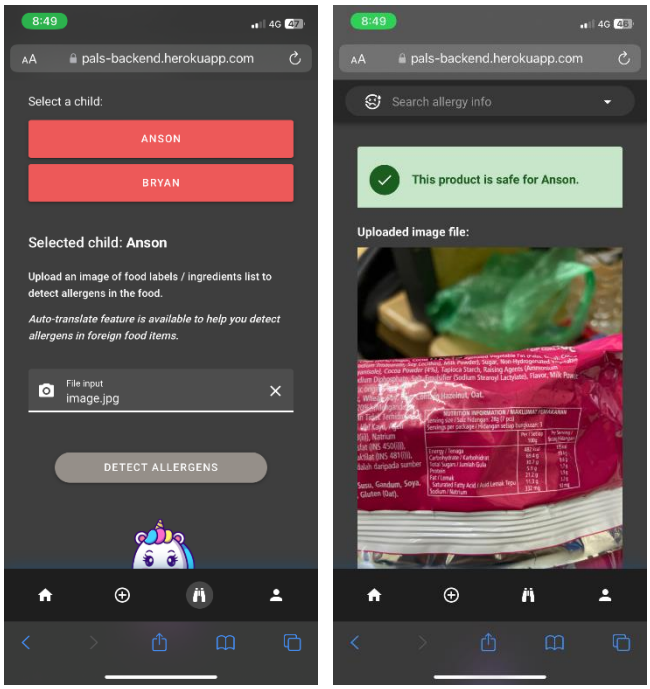
PALS has 21 interface pages in mobile web-based application along with its own functionalities. The table below explains the functionalities for every page.

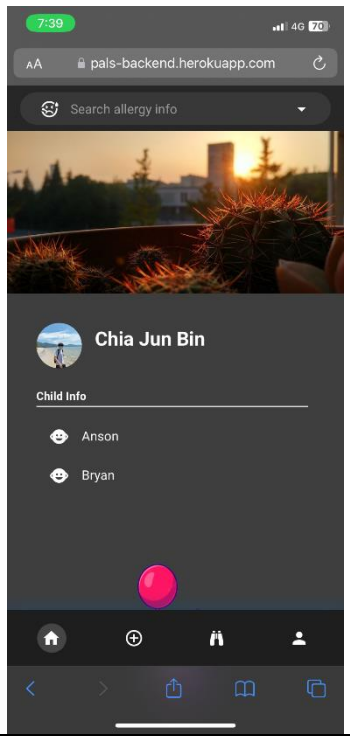
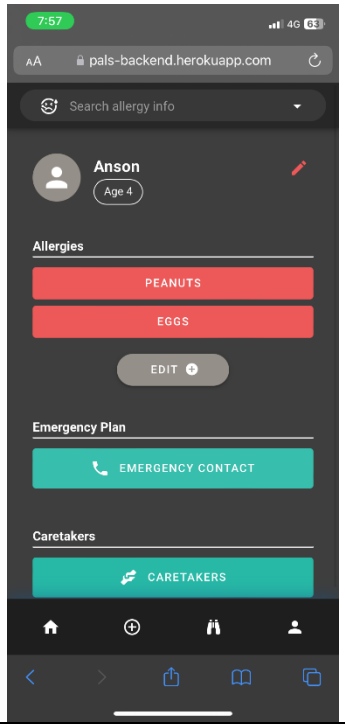
Mobile Web-Based Application		
Common Page		
No	**Page**	**Page Description**
1	Landing Page  	Display brief introduction of our application, PALS. User can click the "Get Started" button to access the system via their account.
2	Login Page 	User is able to sign in into our app using their Google account.

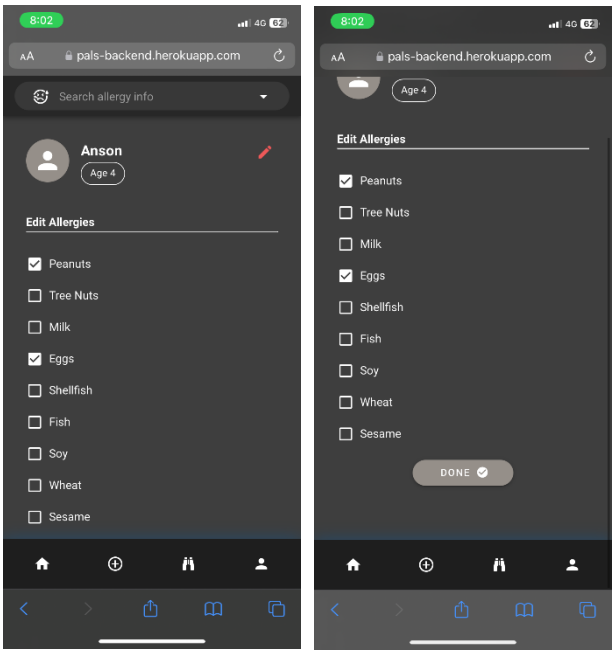
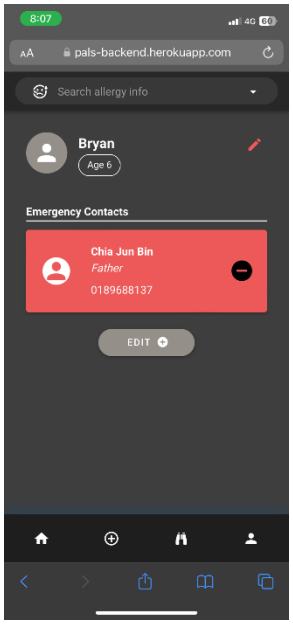
3	Search Allergy Information Feature (Pinned to the top of all pages) – Parents & Caretakers 	User is able to search allergy information by inserting the food name. If user selects the allergen name, they will be directed to the "Allergy Information Page" of the selected allergen.

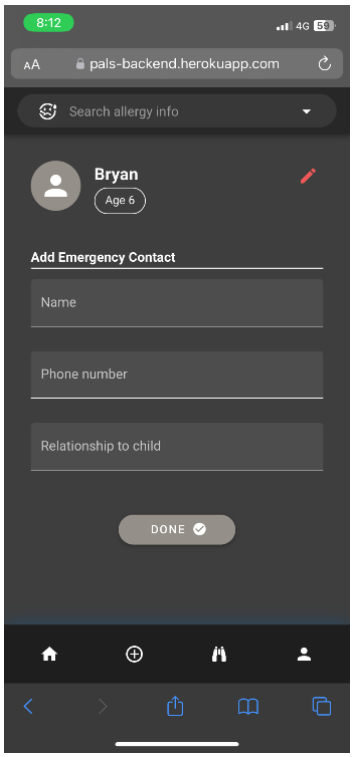
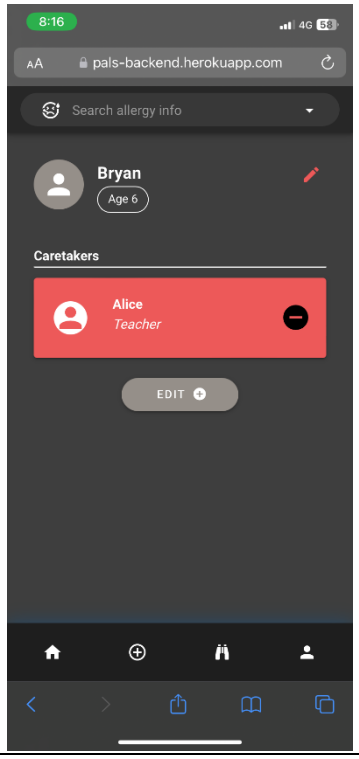
4	Allergy Information Page    	User is able to view the detail information of the selected allergen. The details information as below will be stated. • Symptoms • Steps to take (Action Plan) • Foods to avoid completely • Foods to be cautious around

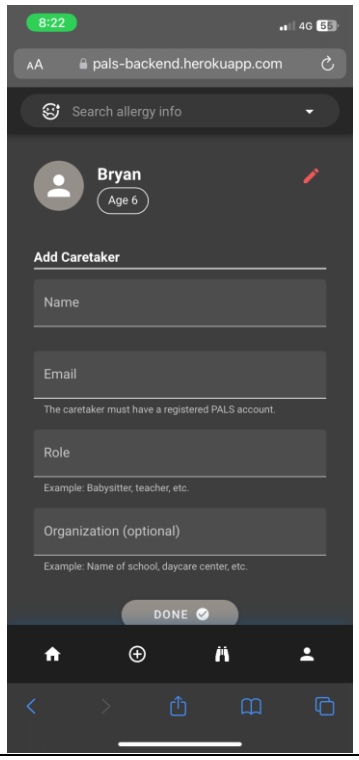
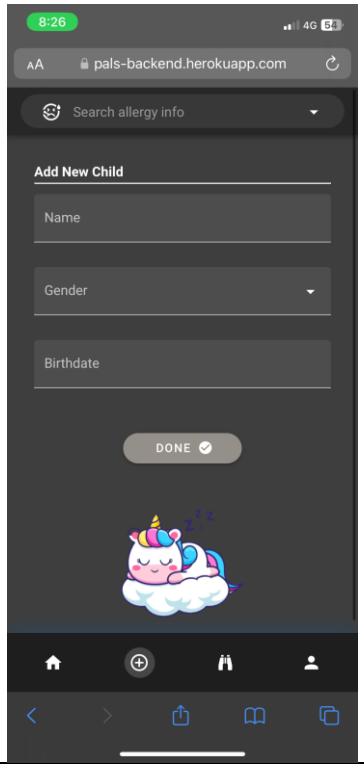
5	Intelligent Allergy Detector Page 	In this page, users are able to insert a picture of the food label. The AI will recognize allergens in the label of food products to check whether the food product is safe for consumption.
6	Intelligent Allergy Detector Page (After Selecting Child) 	After selecting the child, a section to enable image input will be shown. The detector will extract the information from the food label. The extracted information will then match the allergies faced by the child named Anson to detect whether the food is safe for the child's consumption. Steps 1. Select the "File Input" section to insert image. 2. Select "Detect Allergens" button to check the result. There are 3 methods to insert picture. • Photo Library • Take Photo • Choose File

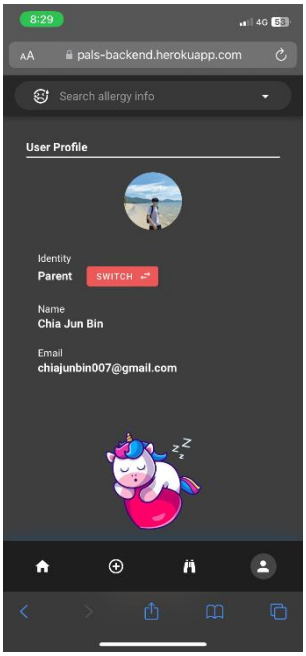
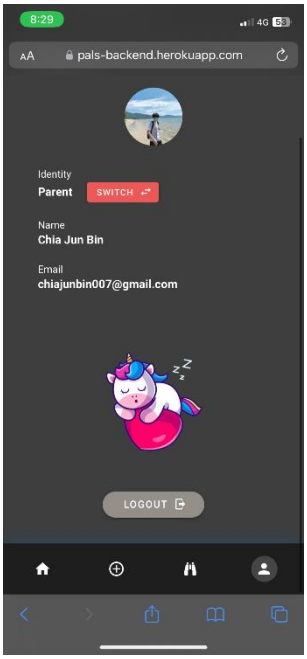
7	Intelligent Allergy Detector Page (Result) 	This is the result from the AI detector.

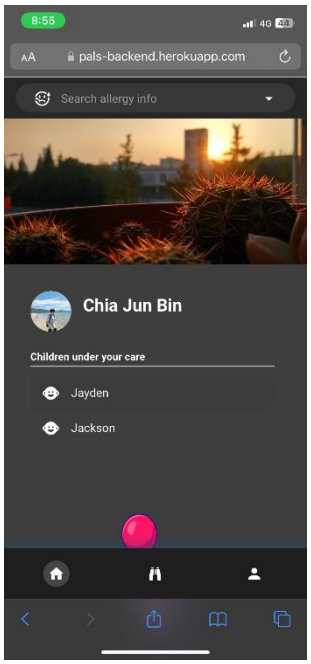
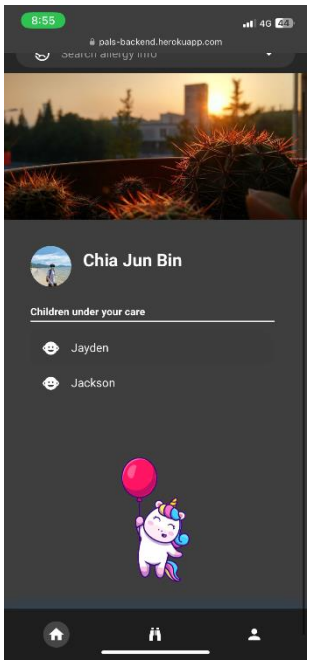
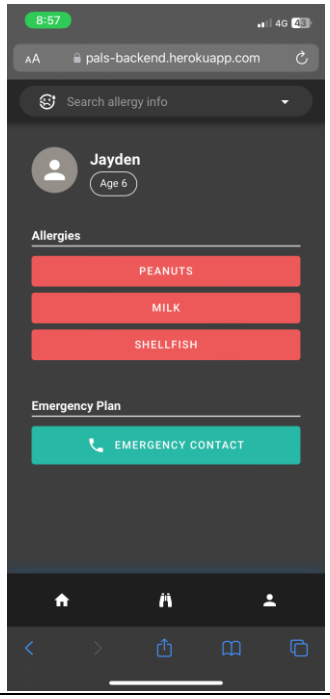
Mobile Web-Based Application		
Parents Page		
No	**Page**	**Page Description**
1	Home Page 	Parents are able to view their child information in this page. The names of their children are displayed in a list.
2	Child Information Page 	Parents will be directed to this page when the select the child's name in the Home Page. This page will display the child's details, allergies faced by the child, emergency contact information and caretakers' access. Parents able to add or edit information below: • Child details • Allergies • Emergency Contact • Caretakers' access

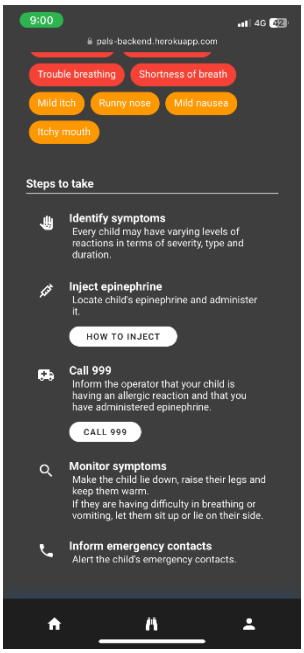
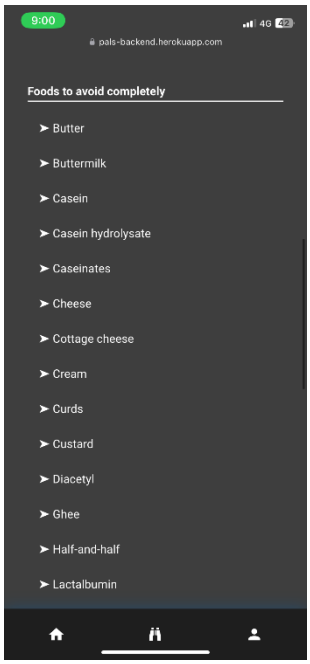
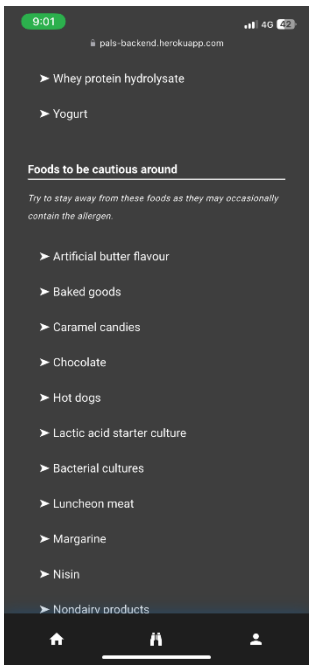
3	Edit Allergies Page 	Parents will be directed to this page when they select the "Edit" button under Allergies section in Child Information Page. In this page, they are able to tick or untick the allergies faced by their child by clicking the box. When they hit the "Done" button, the information will be saved.
4	Emergency Contact Page 	Parents will be directed to this page when they select the "Emergency Contact" button in Child Information Page. All emergency contacts for this child will be display in this page. Parents are able to remove an emergency contact by clicking the delete icon in the emergency contact card. The displayed information include: • Name • Relationship • Contact Number

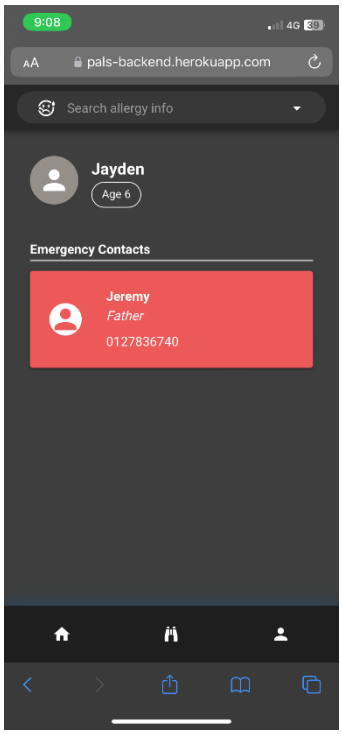
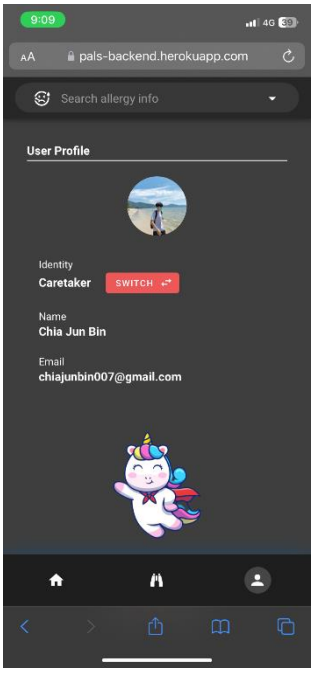
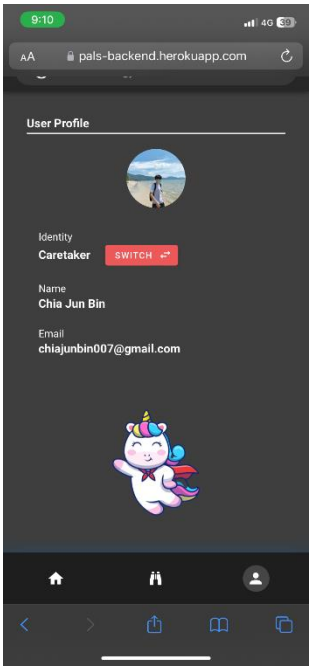
5	Edit Emergency Contact Page 	Parents will be directed to this page when they click the "Edit" button in Emergency Contact Page. In this page, parents are able to add new emergency contact for the child. The information that should be included for adding new emergency contact: • Name • Phone Number • Relationship to child When they click the "Done" button, the information will be saved.
6	Caretaker Page 	Parents will be directed to this page when they select the "Caretakers" button in Child Information Page. All caretakers that are able to access the profile of this child will be displayed. The displayed information include: • Name • Role Parents are also able to delete the access of caretakers to their child's profile by selecting the delete icon.

7	Edit Caretaker Page 	Parents will be directed to this page when they click the "Edit" button in Caretaker Page. In this page, parents add new access of caretakers to their child profile. The information that should be included for adding new access: • Name • Email (Valid PALS User) • Role (Babysitter, Teacher, etc) • Organization (Optional) When they click the "Done" button, the information will be saved.
8	Add Child Page 	In this page, parents are able to add new child profile into their account. The information that should be included for adding new child: • Name • Gender • Birthdate When they click the "Done" button, the information will be saved.

9	Parents Profile Page  	In this page, parents are able to switch their role to caretaker by selecting the "Switch" button. Users can know their current role by referring to the Identity Section. The user information will also be displayed in this page including name and email address. Users are also able to logout by clicking the "logout" button.

Mobile Web-Based Application		
Caretakers Page		
No	**Page**	**Page Description**
1	Home Page   	Caretakers are able to view the children under their care in this page. The name of the children will be displayed in a list.
2	Child Information Page  	Caretakers will be directed to this page when the child's name is selected in the Home Page. This page will display the child details, allergies faced by the child and emergency contact information.

3	Child Allergies Page     	Caretakers will be directed to this page when they click the allergies name in the Child Information Page. Caretakers able to view the detail information according to user's choice. The information below will be displayed: • Symptoms • Steps to take (Action Plan) • Foods to avoid completely • Foods to be cautious around

4	Emergency Contact Page 	Caretakers will be directed to this page when they select the "Emergency Contact" button in Child Information Page. All emergency contacts for this child will be displayed in this page. Caretakers are able to view the information as below. • Name • Relationship • Contact Number
5	Caretakers Profile Page  	In this page, caretakers are able to switch their role to parent by clicking the "switch" button. Users can know their current role by referring to the Identity Section. The caretaker's information will also be displayed in this page including name and email address. Users are also able to logout by clicking the "logout" button.

4.5 Input and output design

The input design for PALS consists of click, image and text input. We have implemented our UI design in a minimalist way where users are clearly instructed on how to use the application without spending excessive time on the learning process. Besides, there are also some pages that require users to perform text inputs which are the Edit Emergency Contact Page, Edit Caretakers Page, Edit Child Information page and Add Child Page. Apart from that, users can insert images in the Intelligent Allergy Detector Page. The detector will scan through the image and extract the information from the food label to determine whether the food is safe for consumption.

Moving on to our output design, our app will display message dialogs to notify users when they perform data-related actions such as add child, edit emergency contact, and edit caretaker access. When a create or update action if performed successfully, a success message will be displayed to inform the user that the change has taken place. If the action fails due to validation errors, an error message will be displayed to inform the user about the next steps to take to rectify the error. If a delete action is performed, a confirmation dialog will be displayed to obtain double confirmation from the user about their action as the delete action cannot be reverted. Our app will also display a list of food to be avoided in the allergic information page. Lastly, our app will display a message to tell users whether the food is safe for consumption after processing an image with the Intelligent Allergy Detector.

5.0 Implementation

5.1 Module implementation

5.1.1 User Module

This module will handle authorization and role management in our system. Besides, it will also help to store user information. For the authorization process, we use the authentication feature provided by Firebase which allows users to sign into our app using their existing Google Account. The user information will then be stored in our cloud database, Firebase. Next, the role management feature in our app allows users to switch their role between parents and caretakers.

5.1.2 Child Management Module

This module will be controlled by parents to manage their child information in our system. Parents will be able to add child in the "Add Child Page" by inserting the child's name, child's gender and child's birthdate. After successfully adding a child profile, parents are able to add and edit allergies that faced by that particular child. Besides, parents are also able to add and edit emergency contact for their child by filling in some necessary information such as name, phone number and relationship to the child. Apart from that, parents can give caretakers to access their child profile by filling in caretaker's name, email, role such as babysitter or teacher and organization (optional).

5.1.3 Caretaker Management Module

This module will be controlled by caretakers. Caretakers such as teacher or babysitter able to view all the children under their care by getting approval from their parents. Caretakers can click on the name of the child in the name list to view more detail information of the child. They are able to view their age, allergies and emergency contact. For allergies, the system will display a list of allergies that are faced by the child. If caretakers click on the particular allergy, they will be able to view the symptoms of the allergies, steps to take care

and a list of foods to avoid completely. Next, if the situation is out of control, caretaker can click the emergency contact which will direct them to a page that display all emergency contact for the child including the name, phone number and relationship.

5.1.4 Allergy Information Module

This module will store information regarding the allergies. It will store the allergies name along with its symptoms and action plan. Besides, the foods that should be completely avoid for specific allergies will also be listed in this module. For both caretakers and parents, the search feature is provided where they can use the search bar on the top of the app to search for detailed information for specific allergies.

5.1.5 Allergen Detector Module

This module integrates computer vision and image processing technology to recognize allergens in the label of food products to check whether the food product is safe for consumption. Optical Character Recognition (OCR) will be used to detect and extract text from the image and compare the extracted text to a list of allergens to check if the ingredients of the food product contain allergens that are harmful to the child. The OCR technology that is used in PALS is Google Cloud Vision because it is able to provide the most accurate result for smartphone-captured images. For foreign food products, the extracted text is translated to English using Google Translate AI which uses neural machine translation technology powered by Google.

5.2 System integration

All the modules are developed separately and integrated based on the iterations of development by use case. We use GitHub as our platform perform the integration. It allows us to work remotely on our own devices. We create branches for our respective modules pulled from the main branch. We complete the tasks given in our own devices. After every submodule is developed, we commit our changes and create a pull request to ensure merge compatibility. We will perform unit testing for each submodule before merging it to the main branch as a safety precaution to avoid some unexpected bugs on updated branches affecting the whole system due to emergence effects. After that, we perform system testing once we merge all branches to the main branch to ensure that every module is able to interact with each other and function as expected for the system to run smoothly. We perform debugging if defects and bugs are encountered during the testing phase. We then deploy our mobile web-based application to a cloud hosting platform, Heroku.

6.0 Testing / Evaluation

6.1 System testing

6.1.1 Unit testing

During the unit testing phase, we check if the components of the applications fulfil the requirements. For example,

1. Check whether user is able to login via their Google account
2. Check whether children basic information can be added
3. Check whether emergency contact can be added
4. Check whether allergy can be added

6.1.2 Integration testing

During the integration testing phase, we check if one module can interact with another module without any issue. For example,

1. Check whether allergy information can be displayed
2. Check whether caretaker can be added
3. Check whether user can switch identities
4. Check whether the allergen detector can detect and display allergen from food ingredients label
5. Check whether the allergen detector can translate the food label and display detected allergens

6.1.3 System Testing

During the system testing phase, we evaluate both functional and non-functional needs as shown below:

Use Cases (Functional requirements):

1. Login Account
2. Add Child Profile
3. Update Child Profile
4. Add or Remove Child Allergy Information
5. View Child Allergy Information

6. Search Allergy Information
7. Give Caretaker Access
8. Remove Caretaker Access
9. View Caretakers List
10. Add Emergency Contact
11. Remove Emergency Contact
12. View Emergency Contacts List
13. Switch User Identity
14. Detect Allergens from Ingredients Label Photo

Non-functional requirements:

1. Product Evaluation
    a. Performance
    b. Dependability
    c. Space
    d. Usability
    e. Portability
    f. Recoverability
    g. Security

2. Organizational Evaluation
    a. Operational
    b. Development

3. External Evaluation
    a. Regulatory
    b. Environment

6.2 Test Case

Use Case ID	Use Case Name	Description
U001	Login Account	The user logs into their user account by using their Google account.
U002	Add Child Profile	To allow user to add his or her child profile by entering the child's information such as name, gender and birthdate.
U003	Update Child Profile	To allow user to enter a new value in any field (s) in the child profile.
U004	Add or Remove Child Allergy	To allow user inputs the child allergy information
U005	View Child Allergy Information	To allow user to view the child allergy information and allergy action plans
U006	Search Allergy Information	Users search the allergy info from search bar, and the information like symptoms, steps to take, Food to avoid completely and food to be cautious around will be displayed.
U007	Give Caretaker Access	The system will allow the logged in user (parent) to create access for the caretaker to view a specified child profile.
U008	Remove Caretaker Access	The system will allow the logged in user to remove caretaker access which prevents the caretaker from viewing the child profile.
U009	View Caretakers List	User can view the list of caretakers with access that has been added to a child profile
U010	Add Emergency Contact	Parent can add emergency contact to a child profile.
U011	Remove Emergency Contact	Parent can remove emergency contact from a child profile.
U012	View Emergency Contacts List	Users can view emergency contact that has been added to a child profile.
U013	Switch User Identity	User is able to switch identity between parent and caretaker.
U014	Detect Allergens from Ingredients Label Photo	User uploads a photo of ingredients label to detect and translate the allergen text from the photo.

Test Case ID		TC001	
Use Case ID		U001	
Use Case Name		Login Account (Valid Credentials)	
Test Input	**Expected Result**	**Pass Criteria**	**Fail Criteria**
Click "Sign in with Google" *Email or Phone Number: giglepop.cs.y2@gmail.com* *Password: cs#YEARTWOOO*	User is directed to the home page	Login successfully into the system.	Login fail and cannot access the system.

Test Case ID		TC002	
Use Case ID		U001	
Use Case Name		Login Account (Valid Email with invalid password)	
Test Input	**Expected Result**	**Pass Criteria**	**Fail Criteria**
Click "Sign in with Google" *Email or Phone Number: giglepop.cs.y2@gmail.com* *Password: cs#YEARTHREE*	Incorrect password. Please try again.	System identifies the incorrect email and/or password successfully.	Systems fails to identify the incorrect email and/or password

Test Case ID		TC003	
Use Case ID		U002	
Use Case Name		Add Child Profile (Complete Info)	
Test Input	**Expected Result**	**Pass Criteria**	**Fail Criteria**
Click " ⊕ " *Name: Adrian* *Gender: Male* *Birthdate: 2014-01-24* Click "Done"	Child info successfully updated.	Child successfully added and it is directed to the child profile page.	Child has not been added.

Test Case ID		TC004	
Use Case ID		U002	
Use Case Name		Add Child Profile (Incomplete Info)	
Test Input	**Expected Result**	**Pass Criteria**	**Fail Criteria**
Click “ ⊕ ” *Name: Adrian* *Gender:* *Birthdate: 2014-01-24* Click “Done”	The warning message “This field is required”	System identifies the missing value and show the warning message.	System fails to identify there is a missing value.

Test Case ID		TC005	
Use Case ID		U003	
Use Case Name		Update Child Profile (Complete Information)	
Test Input	**Expected Result**	**Pass Criteria**	**Fail Criteria**
Click child name. Click “ ✎ ” *Name: Ali* *Gender: Male* *Birthdate: 2014-01-24* Click “Done”	Child info successfully updated.	Child successfully added and it is directed to the child profile page.	Child has not been added.

Test Case ID		TC006	
Use Case ID		U003	
Use Case Name		Update Child Profile (Incomplete Information)	
Test Input	**Expected Result**	**Pass Criteria**	**Fail Criteria**
Click child name. Click “ ✎ ” *Name: Ali* *Gender: Male* *Birthdate:* Click “Done”	Child info successfully updated.	Child successfully added and it is directed to the child profile page.	Child has not been added.

Test Case ID		TC007	
Use Case ID		U004	
Use Case Name		Add or Remove Child Allergy (Add)	
Test Input	**Expected Result**	**Pass Criteria**	**Fail Criteria**
Click child name Click “Edit” Tick allergies ✓ Peanut ✓ Milk ✓ Soy Click “Done”	Allergies updated successfully!	System successfully records allergies on the child’s profile.	System fails to record allergies on the child’s profile.

Test Case ID		TC008	
Use Case ID		U004	
Use Case Name		Add or Remove Child Allergy (Remove)	
Test Input	**Expected Result**	**Pass Criteria**	**Fail Criteria**
Click child name Click “Edit” Tick allergies ✓ Peanut ✓ Milk Click “Done”	Allergies updated successfully!	System successfully records the updated allergies on the child’s profile.	System fails to the updated record allergies on the child’s profile.

Test Case ID		TC009	
Use Case ID		U005	
Use Case Name		View Child Allergy Information	
Test Input	**Expected Result**	**Pass Criteria**	**Fail Criteria**
Click child name. Click on allergy type	Allergy information including symptoms, action plan, foods to avoid completely, food to be cautious is shown.	System successfully displays allergy information including symptoms, action plan, foods to avoid completely, food to be cautious.	System fails to display allergy information.

Test Case ID		TC010	
Use Case ID		U006	
Use Case Name		Search Allergy Information	
Test Input	**Expected Result**	**Pass Criteria**	**Fail Criteria**
Click on the allergy info search bar. Select allergy.	Allergy information including symptoms, action plan, foods to avoid completely, food to be cautious is shown.	System successfully displays allergy information including symptoms, action plan, foods to avoid completely, food to be cautious.	System fails to display allergy information.

Test Case ID		TC011	
Use Case ID		U007	
Use Case Name		Give Caretaker Access (Valid account)	
Test Input	**Expected Result**	**Pass Criteria**	**Fail Criteria**
Click child name Click “Caretakers” Click “Edit” *Name: Ching Jia Ying* *Email: chingjiaying01@gmail.com* *Role: Teacher* *Organization: USM* Click “Done”	Caretaker added successfully.	System successfully records caretaker info.	System fails to record caretaker info.

Test Case ID		TC012	
Use Case ID		U007	
Use Case Name		Give Caretaker Access (Invalid account)	
Test Input	**Expected Result**	**Pass Criteria**	**Fail Criteria**
Click child name Click “Caretakers” Click “Edit” *Name: Evelyn* *Email: eve2231@gmail.com* *Role: Teacher* *Organization: USM* Click “Done”	Invalid email. Please ensure that the caretaker has a registered PALS account.	System successfully detects invalid account and caretaker info is not recorded.	System fails to detect invalid account and caretaker info is recorded.

Test Case ID		TC013	
Use Case ID		U007	
Use Case Name		Give Caretaker Access (Incomplete input)	
Test Input	**Expected Result**	**Pass Criteria**	**Fail Criteria**
Click child name Click “Caretakers” Click “Edit” *Name: Evelyn* *Email:* *eve2231@gmail.com* *Role:* *Organization: USM* Click “Done”	Please fill in all the fields!	System successfully detects incomplete input and caretaker info is not recorded.	System fails to detect incomplete input and caretaker info is recorded.

Test Case ID		TC014	
Use Case ID		U008	
Use Case Name		Remove Caretaker Access	
Test Input	**Expected Result**	**Pass Criteria**	**Fail Criteria**
Click child name Click “Caretakers” Click on “⊖” Click on “confirm”	Caretaker successfully removed.	System successfully removes the access to the caretaker.	System fails to remove the access to the caretaker.

Test Case ID		TC015	
Use Case ID		U009	
Use Case Name		View Caretakers List	
Test Input	**Expected Result**	**Pass Criteria**	**Fail Criteria**
Click child name. Click “Caretakers”	Caretaker list is displayed.	System successfully displays the caretaker list.	System fails to display the caretaker list.

Test Case ID		TC016	
Use Case ID		U010	
Use Case Name		Add Emergency Contact (Complete info)	
Test Input	**Expected Result**	**Pass Criteria**	**Fail Criteria**
Click child name Click “Emergency Contact” Click on “edit” Name: Ying Phone Number: 011-31094298 Relationship to child: Mother Click on “Done”	Emergency contact added successfully.	System successfully records the emergency contact.	System fails to record emergency contact.

Test Case ID		TC017	
Use Case ID		U010	
Use Case Name		Add Emergency Contact (Incomplete info)	
Test Input	**Expected Result**	**Pass Criteria**	**Fail Criteria**
Click child name Click “Emergency Contact” Click on “edit” Name: Ying Phone Number: Relationship to child: Click on “Done”	Please fill in all the fields!	System successfully detects incomplete input and emergency contact is not recorded.	System fails to detect incomplete input and emergency contact is recorded.

Test Case ID		TC018	
Use Case ID		U011	
Use Case Name		Remove Emergency Contact	
Test Input	**Expected Result**	**Pass Criteria**	**Fail Criteria**
Click child name Click “emergency Contact” Click on “⊖” Click on “confirm”	Emergency contact successfully removed.	System successfully removes the emergency contact.	System fails to remove the emergency contact.

Test Case ID		TC019	
Use Case ID		U012	
Use Case Name		View Emergency Contacts List	
Test Input	**Expected Result**	**Pass Criteria**	**Fail Criteria**
Click child name. Click “Emergency Contact”	Emergency contact is displayed.	System successfully displays the emergency contact.	System fails to display the emergency contact.

Test Case ID		TC020	
Use Case ID		U013	
Use Case Name		Switch User Identity (from parent to caretaker)	
Test Input	**Expected Result**	**Pass Criteria**	**Fail Criteria**
Click on “” Click on “switch”	You are now interacting as a Caretaker.	System successfully switch user from a parent to caretaker identity.	System fails to switch user from a parent to caretaker identity.

Test Case ID		TC021	
Use Case ID		U013	
Use Case Name		Switch User Identity (from caretaker to parent)	
Test Input	**Expected Result**	**Pass Criteria**	**Fail Criteria**
Click on “” Click on “switch”	You are now interacting as a Parent.	System successfully switch user from a caretaker to parent identity.	System fails to switch user from a caretaker to parent identity.

Test Case ID		TC022	
Use Case ID		U014	
Use Case Name		Detect Allergens from Ingredients Label Photo (Safe product)	
Test Input	**Expected Result**	**Pass Criteria**	**Fail Criteria**
Click on "  " Select child, *Upload an image of food label.*  Click "Detect Allergens"	Product is safe message will pop up.	The application successfully shows product is safe for child.	The application fails to show that product is safe for child.

Test Case ID		TC023	
Use Case ID		U014	
Use Case Name		Detect Allergens from Ingredients Label Photo (Allergic product)	
Test Input	**Expected Result**	**Pass Criteria**	**Fail Criteria**
Click on "  " Select child, *Upload an image of food labels.*  Click "Detect Allergens"	"Ali is allergic to this product." and the allergen is shown.	The application successfully shows child is allergic to the product.	The application fails to show that child is allergic to the product.

6.3 System Evaluation

The application has been evaluated based on the non-functional requirements below:

a) Product Evaluation

Evaluation List	**Description**
Performance	• Every user event request and response time should be less than 3 seconds. • The application start-up time must be less than 3 seconds. • The application should be capable of handling the application process without delay even if the user opens multiple applications at the same time. • The application should be able to save current progress and return to the saved point after being interrupted. • The application should support the latest stable version for Google Chrome, Firefox, Microsoft Edge and Safari browser.
Dependability	• The application must not have downtime during normal working hours. • The application must not have more than 3 minutes of downtime per day outside working hours. • The mean time of failure of the application should be 5 minutes. • The application update process must finish within 3 hours, so data is available by 8 a.m. local time after an overnight update.
Space	• The application should be able to support the sudden spikes of the user without risking crashing the system
Usability	• The application must have a user-friendly and easy-to-understand interface in which the user errors are minimized. • The application must have a user-friendly and easy-to-understand interface in which the user errors are minimized. • The application feature should be able to run similarly in different mobile operating systems

Portability	• The application could enable users to use the system either on mobile devices, tablets, or computers.
Recoverability	• The application failure fix should be completed within 1 hour when it happens. • The application should allow users to manually backup their data from time to time. • The application should allow users to download all the personal data in the application.
Security	• The personal information and sensitive data of the user must only be accessed by authorized users.

a) Organizational Evaluation

Evaluation List	**Description**
Operational	• The authentication process for user.
Development	• The software developed using Vue.js, Express.js, JavaScript, HTML, and CSS.

b) External Evaluation

Evaluation List	Description
Regulatory	• The application should implement a privacy policy as set out in Confidentiality Guidelines published by the Malaysian Medical Council (MMC) • The application should comply with the Medical Act 1971 • The application should protect user personal data privacy as covered in the Personal Data Protection Act 2010 (PDPA)
Environment	• The application should be able to run at normal capacity without downtime during raining season

7.0 Conclusion & Future Work

In conclusion, this report presented a detailed software documentation of the PALS application. PALS was developed to ease the parents' and caretaker's task of taking care of children with allergies by recording children's allergy information for easy retrieval by maintaining a complete and organized database of children's allergy information to be able to keep track of each child's allergy information as well as allow parents to control the access to specified caretakers that can access and view the information of child's allergies. PALS is also capable of detecting allergens present in the ingredients label of food products to identify whether the food product is safe for consumption. Our project aligns with Sustainable Development Goal (SDG) number 3 – Good Health and Well-being by reducing the risk of allergy attacks in children, giving both parents and caretakers a peace of mind.

Future work in this area could include the expansion of the intelligent allergen detector feature to detect allergens present in non-consumable products such as cleaning substances, beauty products, household items and more. To fully maximize the potential of the positive implications of the project, there could also be more intelligent features added to our application to continue innovating in the healthcare industry in the paediatric field.

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