CAT304
Group Innovation Project and Study for Sustainability
Initial Project Proposal

Academic Session 2022/2023

Pediatric Allergy Life Saver System (PALS)

Group 1

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Submission Date: 9 November 2022

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Abstract

Allergy is defined as a body reaction that will occur when a person's immune system reacts abnormally to a foreign substance or food that does not cause a reaction in most people. The most common allergens are peanuts, animal fur and shellfish. According to The British Society for Allergy & Clinical Immunology (BSACI), allergic reaction is more common among children compared to adults. Food allergy will bring serious effects to approximately 3% to 6% of children in the developed countries. Children that have early itchy rash symptoms or early-onset eczema have higher risk in exposing to food allergy. Approximately 1 in 8 children suffers from asthma, 1 in 13 children suffers from eczema and 1 in 8 suffers from allergic rhinitis according to BSACI. [7] With this, the Pediatric Allergy Life Saver (PALS) system is proposed. We hope to raise the awareness of both parents and caretakers when it comes to handling children's allergy attacks. By using this system, caretakers can easily keep track of the children's allergies and take the right actions when an allergic reaction occurs. This system also incorporates artificial intelligence technology which allows the caretakers to quickly identify the allergy by taking a photo of visible symptoms such as rashes. Our goal is to assist caretakers without medical knowledge to take quick action to mitigate the consequences of an allergic reaction. We expect to provide a reliable technical service in our application for the caretakers and parents to ensure that the situation is under control when an allergy reaction happens.

1.0 Introduction

1.1 Project Background

Even though most parents are protective of their children, there are always times when their 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. However, there are several points of concern, especially when it comes to children and their allergies.

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. [11] 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. [11] Hence, it is critical to recognize the signs and always keep the action plan in mind to be applied in an emergency especially for young children.

Currently, there are a few ways to handle the problems stated above. When parents leave their children under the care of a day-care centre, school, or babysitter, they will normally inform the caretaker verbally about the allergies that their child has. However, in day-care centres and schools, there could be potentially tens to hundreds of students, and it is nearly impossible to fully remember every child's allergy. This is a dangerous predicament, as letting slip just one child's allergy from the mind could put the child in danger. There is no sustainable or concrete solution to record the children's allergies for easy reference.

We see this as an important avenue 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 a system that can help give parents a peace of mind when they must leave their child with a caretaker. With the developed system, caretakers will be able to view allergic information of children in a day-care centre with respective action plans in the system and contact their parents if necessary.

1.2 Existing Solutions/Similar Applications

Table x.x Features comparison of ...

Existing Solutions/ Similar Applications	PALS	BELAY	ALLERGY ASSIST	ALLERGY PAL
Availability In Malaysia	✓	✗	✓	✗
Artificial Intelligence (AI) Allergy Analyzer	✓	✗	✗	✗
Centralised View Of All The Children's Allergies	✓	✗	✗	✗
Allow Third Party To Access Allergy Profile	✓	✓	✓	✓
Emergency Contact	✓	✗	✓	✗

There are 3 similar existing applications found in App Store and Google Play which are Belay, Allergy Assist and Allergy Pal. The three applications that mentioned above can store allergy profiles, share allergy profiles with others and view the allergy action plans.

However, there are some important features that aren't provided in their application such as giving caretakers or primary school teachers to view a centralised of all the children's allergies. Besides, another important feature that isn't provided is emergency contact which will allow caretakers or primary school teachers to contact their parents in case any emergency happens.

Apart from that, the uniqueness of our application is the Artificial Intelligence (AI) Allergy Analyzer which can detect allergies based on visual allergic symptoms. This feature does not exist in any similar systems yet.

Pals is design to accept image as input taken from ingredient list of food. Thus image processing and character recognition are required. Existing techniques , provide table of comparison on the adv and disadv..

2.0 Problem Statement

Allergies can affect any children, but the possibility for children from families with allergies history to get affected are higher. [12] **Children normally are not aware of their allergies**, as they might not have been discovered if the child has not yet been exposed to the allergen. [13] Younger children might not even know what an allergy means. 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**. 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. [12] For parents, this is an overwhelming concern when they need to leave their children with caretakers such as babysitters, nannies, day-care centers, 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.

3.0 Project Objectives

1. ~~To develop a system for parents to record and keep track of their children's allergy details.~~

2. To develop an allergy information module to display children's allergy information, allergy symptoms and action plans.

3. To develop a system with artificial intelligence to identify visible allergy symptoms.

4. To develop a caretaker management module for parents to allow caretakers such as babysitters, daycare centers, schools etc. to view their children's allergy details.

4.0 Motivation

The main motivation for Juniq to create this system − **Pediatric Allergy Life Saver (PALS)** stems from the arising health problems related to children we discovered happening in Malaysia, which could be solved with the usage of technology. We strongly believe that our system is a compelling and actionable solution to directly reduce the risks of allergy attacks in children.

Our team sees the importance in raising awareness among the caretakers and parents on the **most effective method to communicate the allergie**s faced by the children while ensuring that basic **medical knowledge is made easily available to caretakers** and parents so that they will be well-equipped with the information to know how to handle the situation when an allergic reaction occurs.

We realize that there is an overload of information about allergy action plans and many misleading information [10] on the Internet which may cause confusion to caretakers, especially in a critical situation where an allergic attack is already happening. Hence, we are motivated to create a **centralized and reliable resource center to display allergy information from verified sources**. This is to avoid the intake of inaccurate information which could potentially worsen the situation if not handled properly.

Other than that, we are keen to **explore the potential of integrating artificial intelligence** into our system to implement the skin allergy detection feature. We believe that this feature can ease the caretakers and parents to identify the allergy causing the visible symptoms and provide accurate information with the right action plans.

5.0 Proposed Solution

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, we plan to develop a mobile application named **Pediatric Allergy Life Saver (PALS)** to address these circumstances, aligning with the Sustainable Development Goal 3 (SDG 3) - Good Health and Wellbeing.

The system 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 artificial intelligence technology to allow the caretaker to **capture photos of the visible symptoms** such as rashes to help them quickly identify the type of allergy.

Our artificial intelligence technology will make use **of AutoML Vision Edge** by training our image labelling model to recognize, identify and label the skin rash caused by the allergy. To ensure proper functioning of the model, we will assemble a set of skin rash images and corresponding labels. AutoML Vision Edge will then train a model in the cloud using this dataset. This model will be used when photos of skin-related allergy symptoms are captured to help the caretaker identify the allergy faced by the child.

Figure 1: Architecture diagram of Pediatric Allergy Life Saver (PALS) ***[Refer to appendix]***

Figure 2: Module diagram of Pediatric Allergy Life Saver (PALS) ***[Refer to appendix]***

Figure 3: Schematic flow diagram of computer-aided diagnosis of skin-related allergy symptoms ***[Refer to appendix]***

6.0 SDG Alignment

By implementing the Pediatric Allergy Life Saver system, we hope to achieve **Sustainable Development Goal (SDG) number 3 – Good Health and Well-being**. This goal is designated to ensure healthy lives and promote well-being for everyone at all stages of life. [8] According to the American Academy of Allergy Asthma and Immunology, there are around 40% to 50% of school children with high sensitization rates to one or more common allergens, and this percentage has a high possibility of increase in future. [9] Since allergy attacks are a serious health condition which should not be overlooked, we hope the development of the PALS system can help the parents or caretakers to promote a healthy lifestyle and a well-being for their children when they are facing allergy reactions with the usage of advanced technology.

7.0 Benefits / Impact / Significance of Project

The development of the PALS system aligns perfectly 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 artificial intelligence feature helps caretakers and parents to **recognize the rashes and allergy even without any medical knowledge**. This project will not only assist the caretakers and parents to handle allergic children, but the greater impact is that it can also **educate the caretakers and parents perform immediate assessment of the visible symptoms**.

8.0 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 very convenient for the parents and caretakers. When the children face allergy problems, the parents or caretakers can utilise their mobile phones and access to our PALS system to report their children's allergic situation. This will save their time, as well as identify the allergic symptoms in a short time so that the right actions can be taken, and their children can be saved. The reason that this aspect stands out from other solutions is because there is **no need 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 our system in schools and daycare centers if the installation of an application is required. Hence, we developed a web-based application instead of a mobile application.

This system also consists of another unique feature, which is the integration of **artificial intelligence technology using AutoML Vision Edge**. This is a cloud-based machine learning model training system to identify the visible symptoms of allergy reactions on children, such as rashes. With this feature being implemented, we hope the parents and caretakers can utilise this feature when their children are facing allergic attacks. When the allergic symptoms start to appear, the parents or caretakers can use the analyzer to scan the symptoms and quickly identify the allergy.

9.0 Expected Outcomes

The main expected outcome from the PALS system is to record children's allergy information for easy retrieval as a mobile application. Below are the expected outcomes promised by the Juniq team:

1. A complete and organized database of children's allergy information
    a. Able to keep track of each child's allergy information.
    b. Able to control the access to specified caretakers that can access and view the information of child's allergies

2. Accurate information
    a. Able to retrieve accurate information regarding the child's allergy in a short time.

3. Smart Camera
    a. Able to recognize children's rashes and identify the respective allergy by using a deep learning approach.

10.0 Status of the project

Our proposed system PALS is an original project that is newly developed by Juniq.

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12.0 Appendix

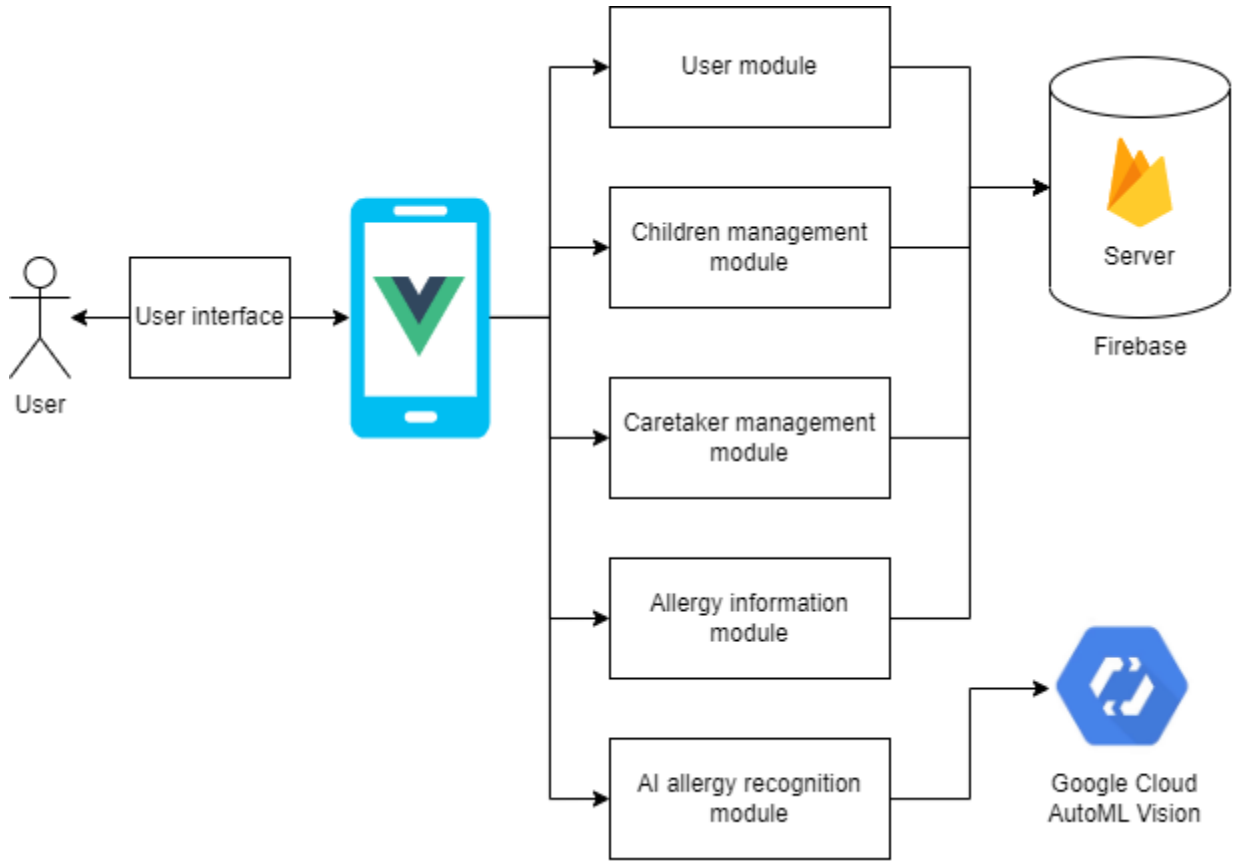

Figure 1: Architecture diagram of Pediatric Allergy Life Saver (PALS)

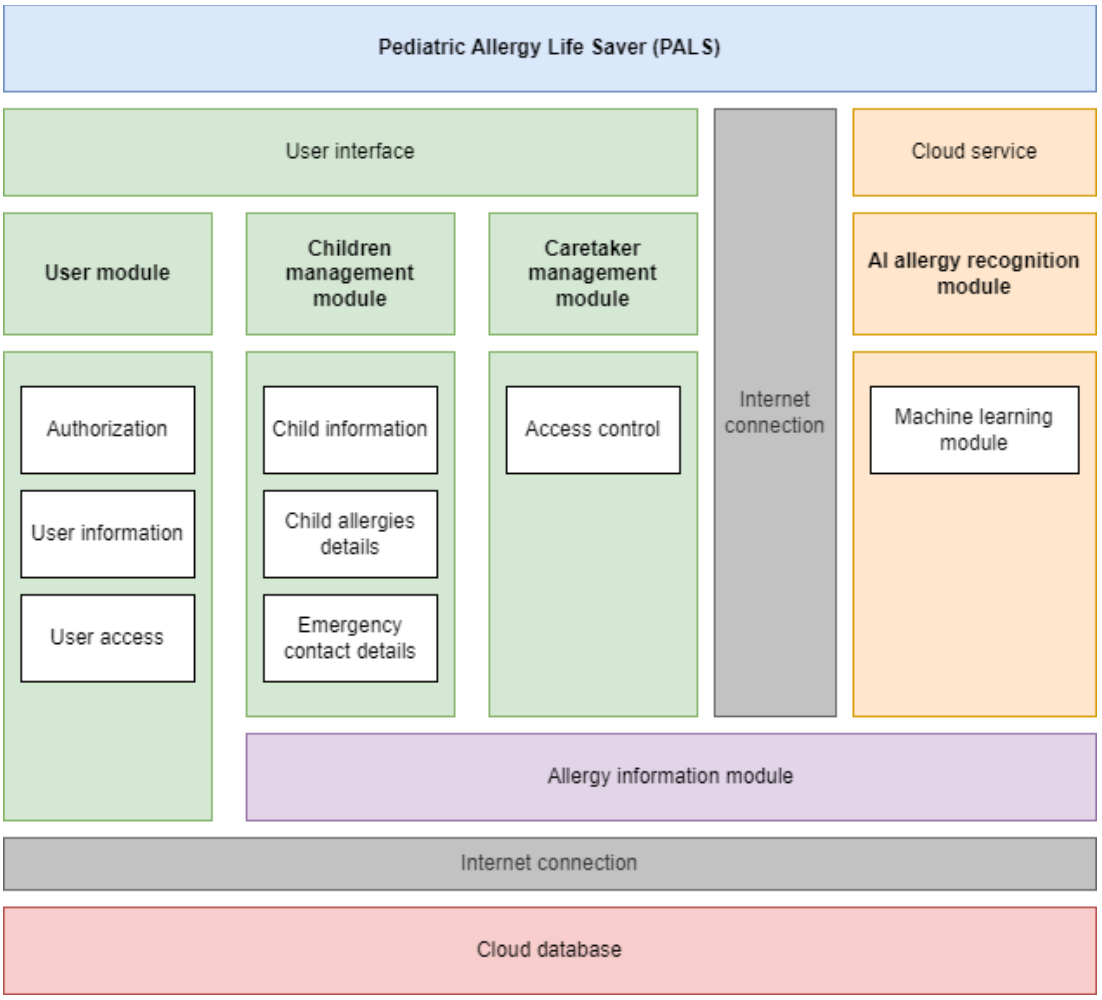

Figure 2: Module diagram of Pediatric Allergy Life Saver (PALS)

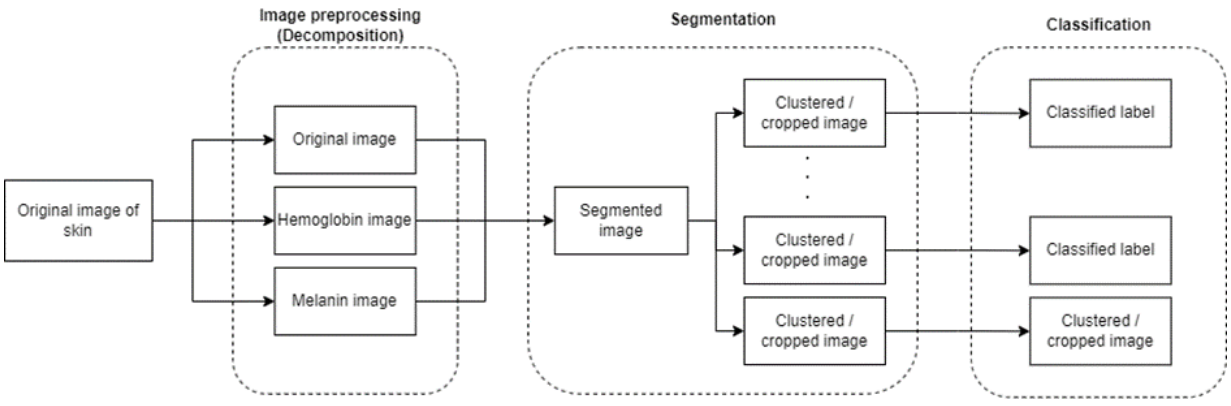

Figure 3: Schematic flow diagram of computer-aided diagnosis of skin-related allergy symptoms