A Major Project Proposal on

Swastha Aalu

Submitted in partial fulfillment of the requirements for the
Degree of Bachelor of Engineering in Software Engineering at
Pokhara University.

By

ANUSHKA PARAJULI

SAURAV ADHIKARI

SUSHANT RAHAPAL

Department of Research and Development

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Supervisor

ER. PRATIKSHYA SHRESTHA

Department of Research and Development

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APPROVAL CERTIFICATE

This project entitled “Swastha Aalu” prepared and submitted by “Anushka Parajuli” , “Saurav Adhikari” and “Sushant Rahapal” under the supervision of “Er. Pratikshya Shrestha” partial fulfillment of the requirements for the Degree of Bachelor of Engineering in Software Engineering has been examined and is recommended for approval and acceptance.

Date of Evaluation: January 18, 2023

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Er. Pratikshya Shrestha

Project Supervisor

……

Er. Rajendra Bahadur Thapa

Acting Coordinator

Research Management Committee

Gandaki College of Engineering and Science

ABSTRACT

The project entitled "Swastha Aalu" will be a mobile application, which helps in detecting if a potato (*Solanum tuberosum)* plant is healthy or not. Our proposed system will capture images of potato leaves, which will act as input for the software, based on which the software will tell us whether the potato is healthy or not.

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LIST OF ABBREVIATION

Artificial Intelligence	AI
Super Virtual Machine	SVM
Convolutional Neural Networks	CNN

Chapter 1
INTRODUCTION

1.1 BACKGROUND

Since the past days and in the present too, farmers usually detect the crop diseases with their naked eye which makes them take tough decisions on which fertilizers to use. It requires detailed knowledge of the types of diseases and a lot of experience needed to make sure of the actual disease detection. Some of the diseases look almost similar to farmers, often leaving them confused. In case the farmer makes wrong predictions and uses the wrong fertilizer or wrong amount of fertilizers to use, it will mess up the whole plant and cause enough damage to plants and fields.

Swastha Aalu is an Artificial Intelligence based mobile application which is developed to help growers diagnose potato problems. The common disease of potatoes is early and late blight. Early blight's symptoms can be seen as small, black lesions mostly and late blight symptoms can be seen blistered. Three various types of processed images are accessible. They are healthy, early blight and late blight.

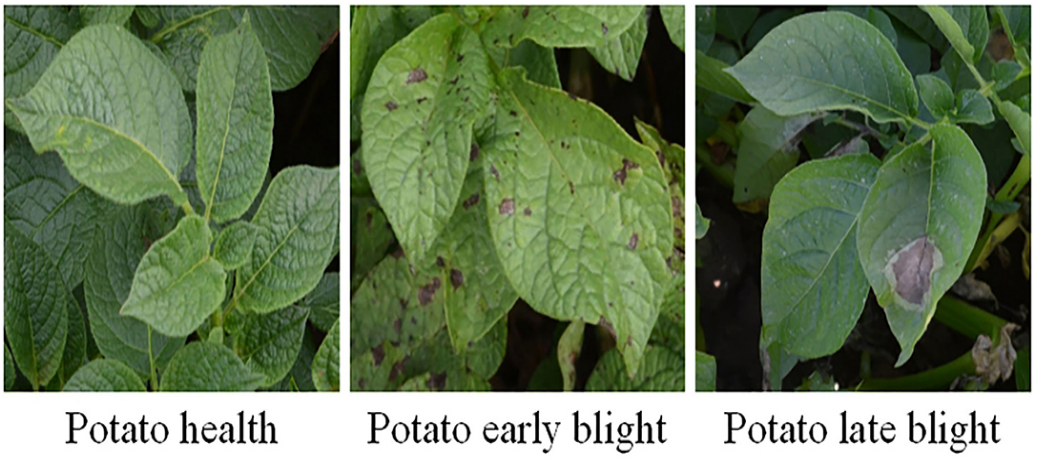

Figure 1.1.1: Potato leaves (Albahli & Nawaz, 2022)

The normal and diseased potato leaves would be classified by the proposed model. This will help farmers to detect these diseases easily and can use appropriate fertilizers to get rid of these blights in order to enhance their growth and production momentum. It helps growers to manage plant protection more sustainably as disease identification is a crucial component in the plant protection routine. We believe that it will be one of the main benefits of integrating innovations into the field.

1.2 PROBLEM STATEMENT

- Plant inspection through naked eyes is time-consuming and it often leaves growers with doubts.
- Inappropriate classification and late detection of the disease's type will drastically worsen the plant conditions.
- Due to costs and turnover time, lab tests are not a practical tool for day-to-day diagnosis.
- Potato diseases are the leading cause of the decline in the quality and quantity of the harvest.

1.3 OBJECTIVES

Swastha Aalu is an AI based mobile application that detects if the potato is healthy or not. This project will fulfill the following goals:-

- To develop a mobile application which identifies healthy/unhealthy potato plants using a machine learning approach.

1.4 IMPLICATIONS

Agriculture is the major source of livelihood for many people in our country. One issue that impacts yield and quality of cultivation is the diseases susceptible to crops. Our platform helps to detect the diseases in crops (currently Potato) and diagnose it. Our platform uses computer Vision to diagnose diseases. People get the information about detected disease and get the remedies in their device. From kitchen gardens to big tunnels, people with different scales of farming can use it for their crops. They will upload the image of the plant and our system will return diagnosed disease and corresponding remedies. The proposed system will be cost effective.

Chapter 2
LITERATURE REVIEW

- **Agrio**

Agrio is a precision plant protection solution that helps growers and crop advisors to forecast, identify, and treat plant diseases, pests, and nutrients. It is the first AI-based alert system in agriculture. (*Agrio*, 2021)

- **Plantix**

Plantix is a mobile crop advisory app for farmers, extension workers and gardeners. The app claims to diagnose pest damages, plant diseases and nutrient deficiencies affecting crops and offers corresponding treatment measures. Users can participate in the online community where they find scientists, farmers and plant experts to discuss plant health issues. (*Plantix*, 2022)

- **Leaf Doctor**

Leaf Doctor performs quantitative assessments for plant diseases on plant organs such as leaves. Users collect or submit photographs of diseased plant organs and calculate the percentage of diseased tissue. Through a user's touching of the device screen, the algorithm employs user-specified values for up to eight colors of healthy tissues in the photograph. The color of each pixel is then evaluated for its distance from the healthy colors and assigned a status of either healthy or diseased. Users may slide a threshold bar until satisfied that diseased tissues are represented accurately before the percentage calculation. (*Leaf Doctor*, 2021)

- **Tomato Diseases Identification**

Tomato Diseases Identification is the paid mobile app inorder to identify the disease of the tomato.Here,if the app can't identify the disease through the image then user can report it and the app owner will implement that thing in there update.The intended purpose of this app is help the farmers to build a better and

bigger crops, which results in a more sustainable world. (*Tomato Disease Detection*, 2021)

- **Vera: Plant Care Made Simple**

Vera by Bloomscape is a plant care management app that helps you and your plants thrive. This app helps easily to set up watering reminders and fertilizing follow-ups for every plant.It also helps to view your plant collection in one place, and create profiles for each leafy friend, with their name, adoption date, and photos you take. Log your plant care activities over time and watch your jungle thrive. (*Plant Care Made Simple*, 2020)

The research papers which are similar to the proposed project are as follows:

- **Potato Leaf Disease Detection and Classification using CNN**

Early and accurate analysis and identification of plant diseases are very helpful in reducing plant diseases and improving the quality and quantity of the food crop. Plant disease experts are not available in remote areas thus there is a requirement of automatic low cost, approachable and reliable solutions to identify the plant diseases without the lab inspection and expert's opinion. Deep learning approaches like convolutional neural networks (CNN) can be employed to identify the plant diseases. In this paper the CNN model is developed to classify potato leafs into three classes: healthy leaves, early blight and late blight diseased leaves. 1500 image dataset having 500 leaves belonging to each class is used in this paper. (Bangal et al., 2022, 10)

- **Potato Plant Leaves Disease Detection and Classification using Machine Learning Methodologies**

In this document, a methodology was proposed for the detection as well as the classification of diseases that occur for the potato plants. For this scenario, the openly accessible, standard, and reliable data set was considered which was popularly known as Plant Village Dataset. For the process of image segmentation, the K-means methodology was considered, for the feature extraction purpose, the gray level co-occurrence matrix concept was utilized, and for the classification purpose, the

multi-class support vector machine methodology was utilized. (Singh & Kaur, 2022, 15)

Table 2.1: Comparison Table

Software/Features	Paid	AI based	Mobile Application
Agrio (*Agrio*, 2021)	Yes	No	Yes
Plantix (*Plantix*, 2022)	Yes	No	Yes
Leaf Doctor (*Leaf Doctor*, 2021)	Yes	Yes	Yes
Tomato Diseases Identification (*Tomato Disease Detection*, 2021)	Yes	Yes	Yes
Vera (*Plant Care Made Simple*, 2020)	Yes	No	Yes
Research paper 1 (*Potato Leaf Disease Detection*, 2022)	No	No	No
Research paper 2 (Singh & Kaur, 2022, 10)	No	No	No
Swastha Aalu	No	Yes	Yes

Chapter 3

TOOLS AND METHODOLOGY

3.1 REQUIRED TOOLS TO BE USED

To develop the application, we will require various tools essential for the project. Our project will use the following tools:

Table 3.1.1 : Required tools to be used

Tools	Use
Hive	For Local Storage
Flutter	For Frontend design.
VScode	For IDE
Draw.io	For diagramming software
Firebase	For managing system databases
Google docs	For writing proposals and reports
Figma	For designing the prototype
Google slide	For presentations
Canva	For making Gantt chart

3.2 METHODOLOGY

Every software development methodology approach acts as a basis for applying specific frameworks to develop and maintain software. Swastha Aalu implements the iterative and incremental model. It is compatible with the size of our project and suited for the available time frame.

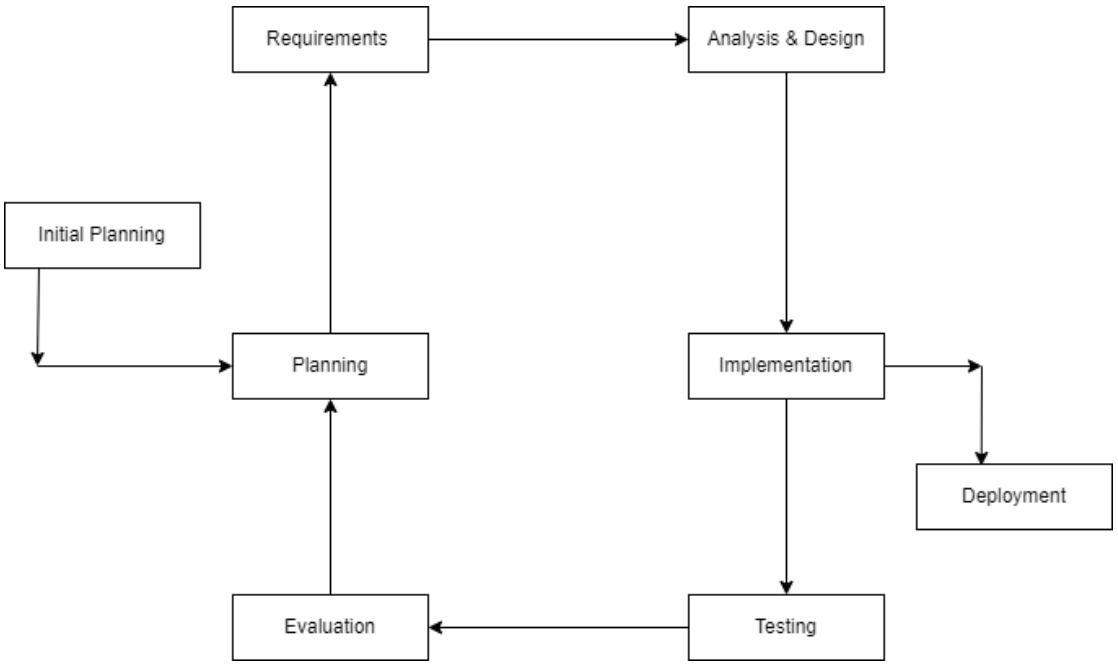

Figure 3.2.1: Iterative and Incremental Model

The workflow of the proposed system is divided into the following iterations:

Table 3.2.1: Iterations workflow

Iterations	Proposed Work to be done.
Iteration 1	UI/UX Design , Data Collection
Iteration 2	Mobile Application Development , Data Collection
Iteration 3	Data Collection , Preprocessing Data
Iteration 4	Preprocessing Data, Classification

Iteration 5	Classification
Iteration 6	Evaluation

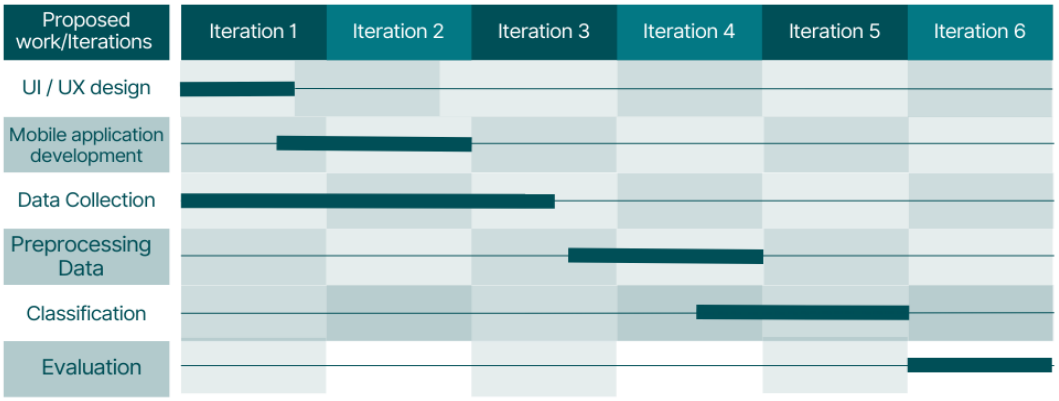

Figure 3.3.2: Iterations Workflow

In the proposed research framework, there are four stages which are as follows:

- Dataset Collection:

It deals with the acquisition of data from reliable sources to maintain the standard and stability so that it can be compared or extended for future studies.

The potato leaf dataset was obtained from different sources in Kaggle with two categories healthy and unhealthy(Early Blight and Late Blight).

Table 3.2.2: Leaf category and count in dataset

Category/Count	Source 1 Image # (*Potato Leaf Disease Dataset*, 2022)	Source 2 Image # (*Potato Leaf Disease Detection*, 2022)
Unhealthy(Blight)	1000	2000
Healthy	500	152
Total count	1500	2152

- Preprocessing Data:

  It is a very essential phase of the framework. This phase mainly deals with the denoising of the image, enhancement of the image, and maintaining standard image size for all the images. Denoising and enhancement of images are essential to get a better result while segmenting the images.

- Classification:

  Test data will be provided to the trained classifier to classify the images into two categories such as Healthy and Unhealthy(Early Blight and Late Blight).

- Evaluation:

  Depending on the obtained results from the classifier model, the evaluation metrics such as precision, recall, F1-score, and accuracy will be obtained.

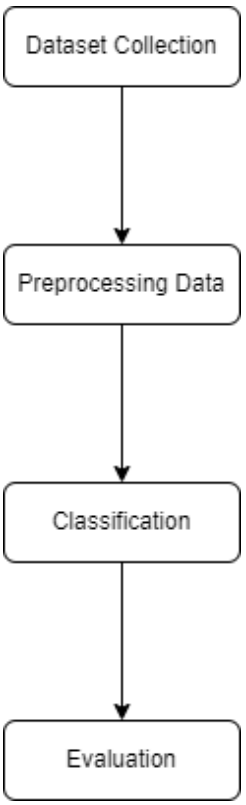

Fig: 3.2.3 : Disease detection Research Framework

3.3 ALGORITHM

The proposed system will be implementing one of the following algorithms:

- SVM:

A Support Vector Machine (SVM) is a supervised machine learning algorithm that can be employed for both classification and regression purposes. SVMs are more commonly used in classification problems.

In this algorithm, each data item is plotted as a point in n-dimensional space (where n is the number of features) with the value of each feature being the value of a particular coordinate. Then, classification is performed by finding the optimal hyper-plane that differentiate the two classes very well. Hyper-plane will be a point in case of 1 dimensional data, line in case of 2 dimensional data, plane in case of 3 dimensional data and so on. (*Support Vector Machine*, 2020)

- CNN algorithm:

A Convolutional Neural Network (ConvNet/CNN) is a Deep Learning algorithm that can take in an input image, assign importance (learnable weights and biases) to various aspects/objects in the image, and be able to differentiate one from the other. The pre-processing required in a ConvNet is much lower as compared to other classification algorithms. While in primitive methods filters are hand-engineered, with enough training, ConvNets have the ability to learn these filters/characteristics. (*Convolutional Neural Network*, 2021)

3.4 DESIGN

3.4.1 USE CASE DIAGRAM

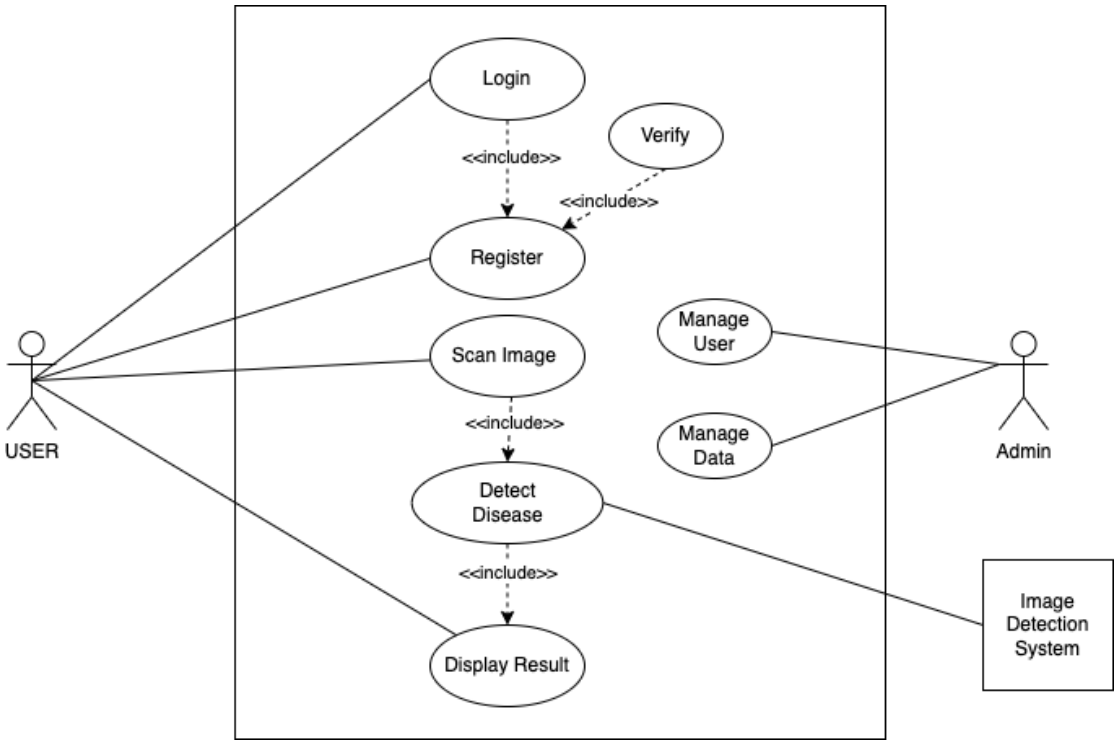

Figure 3.4.1: Use Case Diagram

Use Case UC1: Register User

Primary Actor: User

Secondary Actor: System

Precondition: The signup screen has been displayed.

Post condition: The landing page has been displayed.

Basic Flow:

- Profiles are created in the system.

Alternative Flow:

- If the desired criteria are not fulfilled, an error message is displayed and the user is redirected to the signup page.
- At any time, if the system fails, then the system is restarted

Use Case UC2: Login

Primary Actor: User

Secondary Actor: System

Precondition: The respective profiles have been created already.

Post Condition: The users are now inside the system.

Basic Flow:

- Business owners are shown their respective pages.
- Customers are shown a page with various categories of businesses.

Alternative Flow:

- If the login fails, an error message is displayed and the users are redirected to the login page.

Use Case UC3: Verify User

Primary Actor: Admin

Secondary Actor: Customer

Stakeholders:

Customer: Wants to login to the system.

Precondition: Username and password have been entered.

Post conditions: Password is verified, and authorized users are given access to the system.

Basic flow:

- User enters the username and password.

- System checks username and password and provides access to the authorized users.

Alternate flow:

- If the details are invalid, the system displays the error.
- User re-enters the email id and password

3.5 TEST CASES

Software testing is known as a process for validating and verifying the working of a software/application. It makes sure that the software is working without any errors, bugs, or any other issues and gives the expected output to the user. The software testing process doesn't limit to finding faults in the present software but also finding measures to upgrade the software in various factors such as efficiency, usability, and accuracy.

3.5.1 TEST OBJECTIVES

The main objectives of testing the application are:

- Verify that requirements are complete and accurate.
- Prepare and document test scenarios and test cases.
- To test the reliability and accuracy of the application.

3.5.2 WHAT IS TO BE TESTED?

We will be testing the following features of our application:

Business Logic Check

- Comparison with the source text.

Pages

- How effective are the pages of the app in terms of uses?
- Is every page handled correctly in terms of error handling?

Performance Check

- How accurate and reliable is the whole application?

Chapter 4

EXPECTED OUTCOME

After the continuous research in problem domain and the different research papers and journals and their future works, the expected output of the proposed project are as follows:

- It will be an AI based mobile application with proper user verification and validation.
- The proposed system will be able to detect if the potato plant is healthy or not through leaf.

Chapter 5

TIMELINE

The project events are scheduled as follows:

Table 5.1: Project Timeline

	Task name	Duration	Start	End
1	Project identification	6 days	Jan 1	Jan 6
2	Requirement Analysis	20 days	Jan 6	Jan 26
3	System Design	28 days	Jan 26	Feb 24
4	Coding	141 days	Feb 24	Jun 16
5	Testing	30days	Jun 16	Jul 16
6	Implementation	15 days	Jul 16	Aug 1
7	Documentation	240 days	Jan 1	Aug 1

Figure 5.1: Gantt Chart

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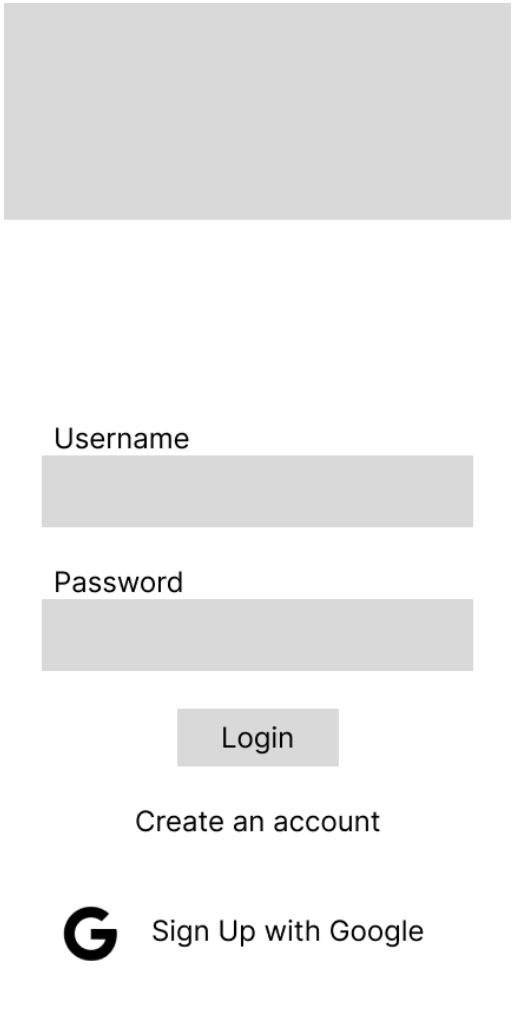
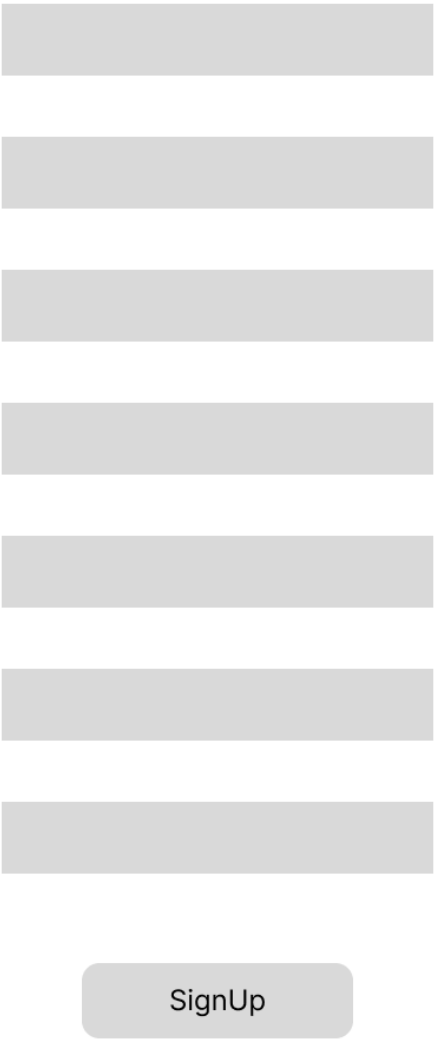
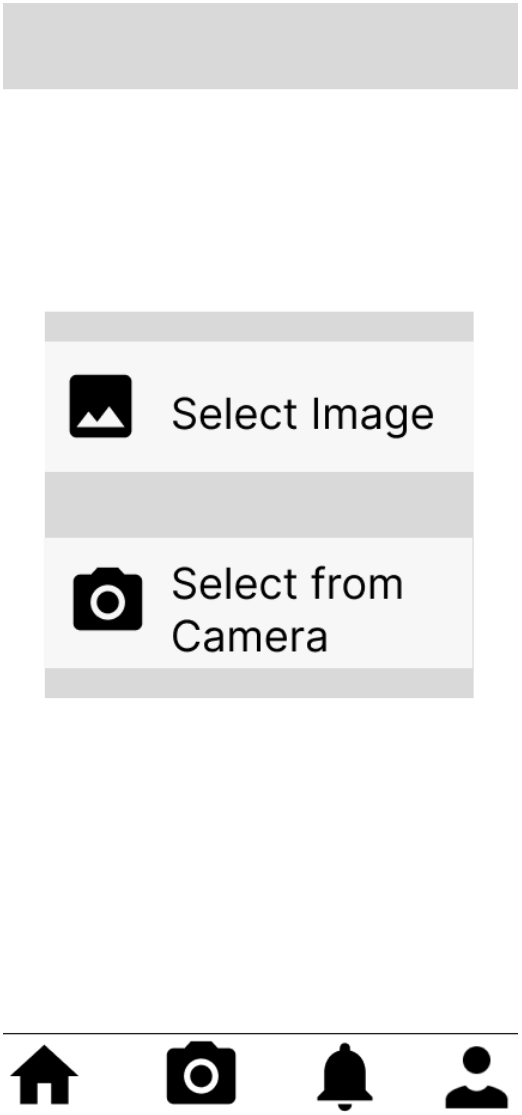
APPENDICES



Appendix I: Login Page



Appendix II: Signup Page



Appendix III: Image Upload Page

Appendix IV: Result Screen