Sri Lanka Institute of information Technology

I-DERMAT: SKIN FUNGAL DISEASE IDENTIFICATION SYSTEM

Software Requirement Specification

Project ID: 17-060

Comprehensive Design/ Analysis Project – 2017

Bachelor of Science (Special Honours) in Information Technology
Sri Lanka Institute of Information Technology

Ms. Namalie Walgampaya

(IT14119118 -T.K.H.Nimeshika)

17-060

Software Requirement Specification

(SRS documentation submitted in partial fulfillment of the requirement for the Degree of

Bachelor of Science (Special Honors)

In Information Technology)

Bachelor of Science (Special Honors) in Information Technology

Field of Specialization: Software Engineering

Department of Information Technology

Sri Lanka Institute of Information Technology

Sri Lanka

April 2017

Declaration

I declare that this is my own work and this Software Requirement Specification does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any other university or Institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

Student ID	**Student Name**	**Signature**
IT14119118	T.K.H.Nimeshika	

The above candidate is carrying out research for the undergraduate Dissertation under my supervision.

Signature of the Supervisor : Ms. Namalie Walgampaya

Date : 2nd May 2017

Table of Contents

Table of Figure(s)

1. Introduction

1.1 Purpose

This document is intended to describe accurately the capabilities that the software product I-Dermat, skin fungal disease identification system should provide to its end-users. This is a functional description of those features required to identify specified skin fungal disease (Malassezia) using image processing techniques. A short discussion accompanies each requirement, to add the background and framework necessary to explain the functionality. It also describes nonfunctional requirements and other factors necessary to provide a complete and comprehensive description of the requirements for the software.

1.2 Scope

Now a days, skin fungal diseases are mostly found in people of tropical countries like Sri Lanka. A skin fungal disease is a particular kind of illness caused by fungus. These diseases have various dangerous effects on the skin and keep on spreading over time. It becomes important to identify these diseases at their initial stage to control it from spreading.
So we are going to develop an automated skin fungal disease identification system, I-Dermat to overcome the drawbacks of manual diagnosis. This system will automatically detects fungal infections in digital images that would increase diagnostic quality, shorten the time-to-diagnosis and improve the efficiency of detection and treatment to skin fungal diseases that would finally result in successful treatment for skin fungal diseases.
Our system is capable of identifying the skin fungal diseases respectively. Dermatologist can just take a picture of infected area and upload to the system then it will clearly state the infection details with its stages and treatments. This can be done during patient contact time. Uses no special hardware devices that will make zero cost. No need of laboratory services. Due to that the system can be used by normal users. Experience of the user does not matter. Could be helpful for newly appointed doctors. The idea of skin fungal disease detection system focuses on mainly three objectives. Which are identifying the presence of a fungal skin infection, identifying the type of fungal skin infection, capturing the symptoms of the

disease that are unable to capture from image observation. This system will identify Ring Worm, Sporotrichosis, Malassezia and Onychomycosis diseases.

In this SRS describes how we are going to identify Malassezia.This system will automatically detects fungal infections in digital images that would increase diagnostic quality, shorten the time-to-diagnosis and improve the efficiency of detection and treatment to skin fungal diseases that would finally result in successful treatment for skin fungal diseases. In this section we will identify Malassezia disease.
Dermatologist can just take a picture of infected area and upload to the system then it will clearly state the infection details with its stages and treatments. This can be done during patient contact time. Uses no special hardware devices that will make zero cost. No need of laboratory services. Due to that the system can be used by normal users. Experience of the user does not matter. Could be helpful for newly appointed doctors. Main goal of this segment is to identify skin fungal disease Malassezia. The idea of skin fungal disease detection system focuses on mainly three objectives. Which are identifying the presence of a fungal skin infection, identifying the type of fungal skin infection and risk of it.We will analyse colour /texture/surface area of the infected area to identify this disease. We will develop algorithms to identify these features.

1.3 Definitions, acronyms and abbreviations

1.3.1 I-Dermat

I-Dermat is a system which is developing to identify Skin fungal disease using image processing techniques.

1.3.2 User

Someone who interacts with the web application

1.3.3 Web-Portal

A web application which can upload image and get output (disease)

1.5 Overview

This SRS document is intended to cover all the functional and non-functional requirements of this Project. Each of the requirement are clearly discussed in detail here. The description done under three chapters.

The first chapter elaborates the purpose of preparing this document. Scope describes clearly what the project will and will not do. In the overview it elaborates the organization of the SRS and describes the rest of this document content briefly.

The second chapter elaborates the overall description in a non-technical language for the understanding of the user. It includes product perspective, product functions, user characteristics, constraints, assumptions and dependencies and apportioning of requirements. The main purpose of product perspective is to find whether an existing system is available in regard for the developing application. . Product functions are also described as a summary of all major functions of the application. In user characteristics, it describes the kind of people who the application is intended to be used. In constraints sub section it describes all condition that may limit developer's options. Assumptions and dependencies describe that any assumptions being made while the apportioning of requirements describes the order in which the requirements are to be implemented when developing the application.
Under chapter three it describes the developer's point of view of proposed i-dermat skin fungal disease detection system. It uses technical words or phrases understandable by the software engineers, developers, and testers. External interface requirements, performance requirements, design constraints, application attributes and other requirements are also explained in advance.
Chapter four describes the information that is useful for the readers. This gives all the supporting information. It also contains additional diagrams and instructions of the code. Those are not directly relevant to the project but can use as additional information for readers.

2. Overall Description

This section will give an overview of the whole system. The system will be explained in its context to show how the system interacts with other systems and introduce the basic functionality of it. It will also describe what type of stakeholders that will use the system and what functionality is available for each type. At last, the constraints and assumptions for the system will be presented.

2.1 Product Perspective

This application consist of two main parts called web portal which is used to upload image and get output and the server side application which is used to process the input image and identify the infection type and its stages. We are typically following a procedure that involves different steps to do the disease identification process. When user uploading the image using web application, the server side application provide functionality to identify the disease. For our experimentation we will use well known image processing techniques to process the input skin image. The proposed Methodology for Skin Fungal disease Identification is as described in below. We are typically following a procedure that involves five main steps: Image pre processing

- Segmentation
- Feature Extraction
- Classification of the Lesion
- Identify what is the disease(Malassezia)

Features	Online Children Skin Diseases Diagnosis System (2013)	Artificial Neural Network Based Detection of Skin Cancer (2015)	Image-Processing Scheme to Detect Superficial Fungal Infections of the Skin (2016)	The Proposed i-Dermat application (2017)
User Friendly Interfaces				

Identify fungal skin diseases	X	X	X	✓
Identify the Severity of the disease	X	X	X	✓
Generate disease detection analysis result	X	X	X	✓
Display percentage of match and mismatch to disease identified	X	X	X	✓
Display initial treatments to the disease identified	X	X	X	✓

Table 1: Product Perspective

Image pre-processing basically it involves the quality enhancement of the image which is inputted to the system. For my work I can use some well-known techniques called Hair removal, noise filtering, black frame removal, equalization, contrast enhancement, non-skin masking techniques and artefact removal technique.

Region Detector - Partitioning the image which we selected into multiple segments and simplify or change the representation of an image into something that is more meaningful and easier to analyze. For this purpose there are various type of techniques namely Histogram thresholding and edge detection techniques.

Analyzer- This is divided into three main sub parts called:

- **Skin profiler –** analyze the color profile and Texture of the skin lesion area (HSV (Hue, Saturation and Value), RGB Histogram, grey level co-occurrence matrix, Relative color feature technique, Texture analysis techniques)

- **Feature Extractor –** Extract the features necessary to diagnose the disease (SURF, ABCD analysis, Applying filters, Logical operations, Template matching and etc.)
- **Classifier –** infers the most applicable disease category or class (Support Vector

  Machine (SVM) and k- Nearest Neighbor (k-NN) classifiers)
- **Infection Detector –** decide the infection type and the presence probability
- **Stage detector –** estimate the stage or critical level of the disease

Region Indicator- Mark the suspected visual symptoms in the given image

Pre-processor – Deals in further validations to increase the accuracy levels of the analysis output.

I-Dermat is meant to identify skin fungal diseases using digital images and this segment is describing how we identify Malassezia disease.
We will identify white, pink, salmon, red, tan, or brown spots that matches with Malassezia, identify the brightness of the spots(lighter /darker),identify the presence of a rash/patch which matches with Malassezia disease.

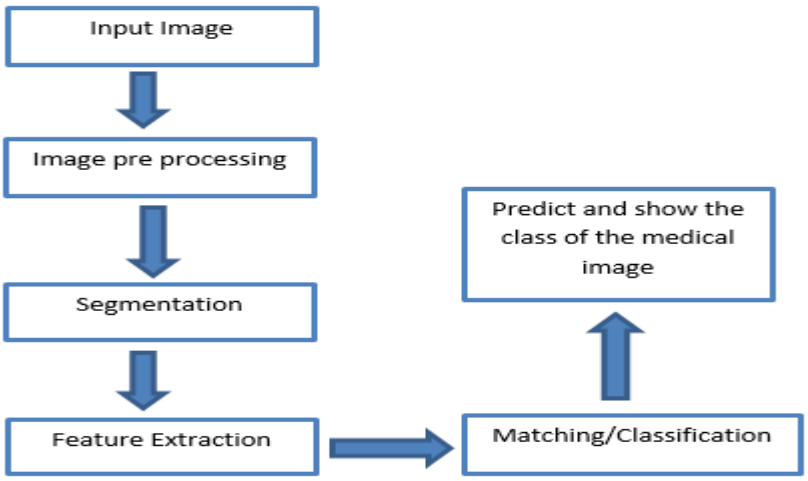

Figure 1: Overview of proposed architecture for skin fungal lesions classification

We will separately analyze input image and identify whether the disease is Ring worm or Sporotrichosis or Malassezia or Onychomycosis.

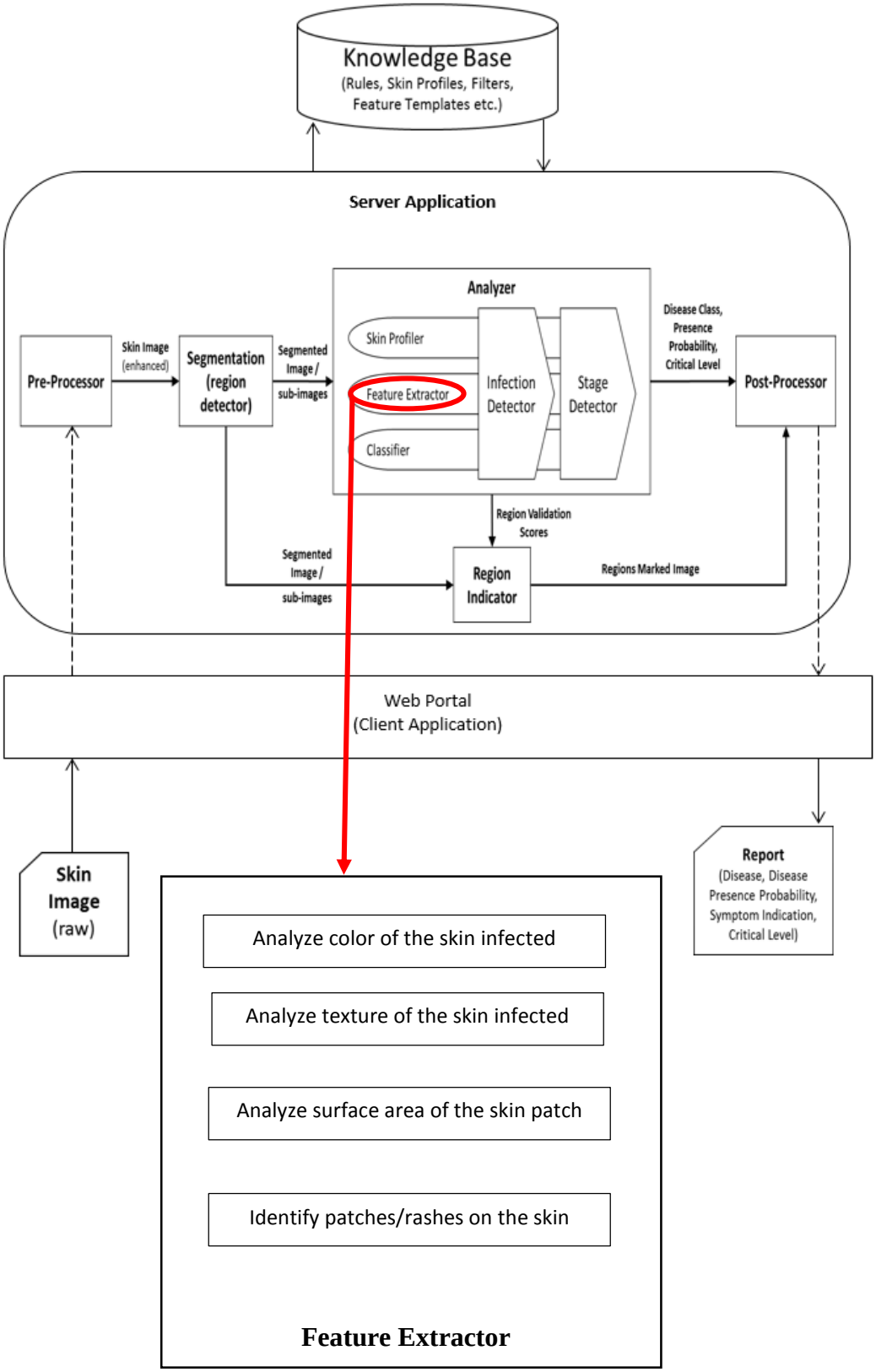

Figure 2: Block Diagram

2.2 Product Functions

This component will gather more information about Tinea versicolor through internet and field visits and will gather real images of the disease by visiting patients.
We will study about image processing techniques, identify techniques to use in this task and apply the most suitable method to receive best results.
Here we will analyze image pre-processing techniques and use them before going into analyze further techniques to identify tinea versicolor.
We will analyze color of the patch/skin and identify whether it matches with symptoms of this disease. Usually the color of the spots can be white, pink, salmon, red, tan, or brown, and sometimes the spots are lighter (sometimes darker) than the surrounding skin. We will do texture analysis / Rash detection in here.we will do this by this using Region growing, thresholding and other techniques. We will analyze skin and identify whether it has a rash/patch which matches with Malazassia disease. We will analyze surface area of the rash /patch to measure risk and differentiate tinea versicolor from other similar diseases. Main objectives of this component is to mainly identifying Tinea Versicolor fungal disease through image, to develop an algorithm to extract details of the image, to reduce the cost of examination of skin and increase the speed of skin disease diagnosis, explore and understand the modern IT techniques such working with Image understanding and processing, texture analysis, program models, data analysis; and invent innovative solutions which can be adopted for the development real world situations. We will use Image preprocessing, Segmentation, Feature Extraction, Classification of the Lesion and decision takes place that the disease found in the infected skin image is Tinea versicolor or not.
The final output given by the system will help the user to identify the disease and its stage he will decide whether it can be harmful or not or any other way to cure it and it help user to identify skin fungal diseases in early stages. Since the tool is made more user friendly and robust for images acquired in any conditions, it can serve the purpose of automatic diagnostics of the Skin Fungal Disease. Goal of this system is to design cost-effective, user-friendly system, turn image into predictions, develop an algorithm to identify the infection and provide accurate results to the user.

2.3 User Characteristics

There are two types of users that interact with the system: Dermatologists and regular users/patients. Each of these types of users has different use of the system so each of them has their own requirements.

The regular users/patients can only use the application to identify their skin disease. This means that the user have to be able to upload a digital image of their infected skin area in to the system. And system will analyze that image in backend and should give what is the disease as the output. Regular users should be able to view more details of their identified disease through system. They will get to know what the methods for the treatments are.

The Dermatologists also can use this system to identify their patients' skin fungal disease just as regular user at the hospitals. They can use this for clarification purposes. They can also add skin disease details, treatments into the site to notify/make patients aware about these diseases.

2.4 Constraints

The Internet connection is a constraint for the application. Since the application fetches data from the database and process input and give output to portal over the Internet, it is crucial that there is an Internet connection for the application to function.

2.5 Assumptions and dependencies

One assumption about the product is that since the client application is a web based application there is a need for the internet browser.

Another assumption is that the image quality is must be high resolution and it is must to get the image in very brightly because it cannot identify the features of the disease clearly when processing the image.

Another assumption is that the user will have to know basic operations to use a PC to make functional use of the "i-Dermat"

And also it is must to upload skin image to the web portal.

Another assumption about the product is that it will always be used on windows OS driven computers that have enough performance. If the application does not have enough hardware resources available for the application, for example the users might have allocated them with other applications, there may be scenarios where the application does not work as intended or even at all.

2.6 Apportioning of requirements

In the case that the project is delayed, there are some requirements that could be transferred to the next version of the application. Those requirements are to be developed in the second release.

It is possible in the future that a few additional features be implemented into this system.

Identify all skin fungal diseases which are mainly see in Sri Lanka

Get more information from the patients like non visual symptoms to validate our findings.

3. Specific Requirement

This section contains all of the functional and quality requirements of the system. It gives a detailed description of the system and all its features.

3.1 External interface Requirements

This section provides a detailed description of all inputs into and outputs from the system. It also gives a description of the hardware, software and communication interfaces and provides basic prototypes of the user interface

3.1.1 User interfaces

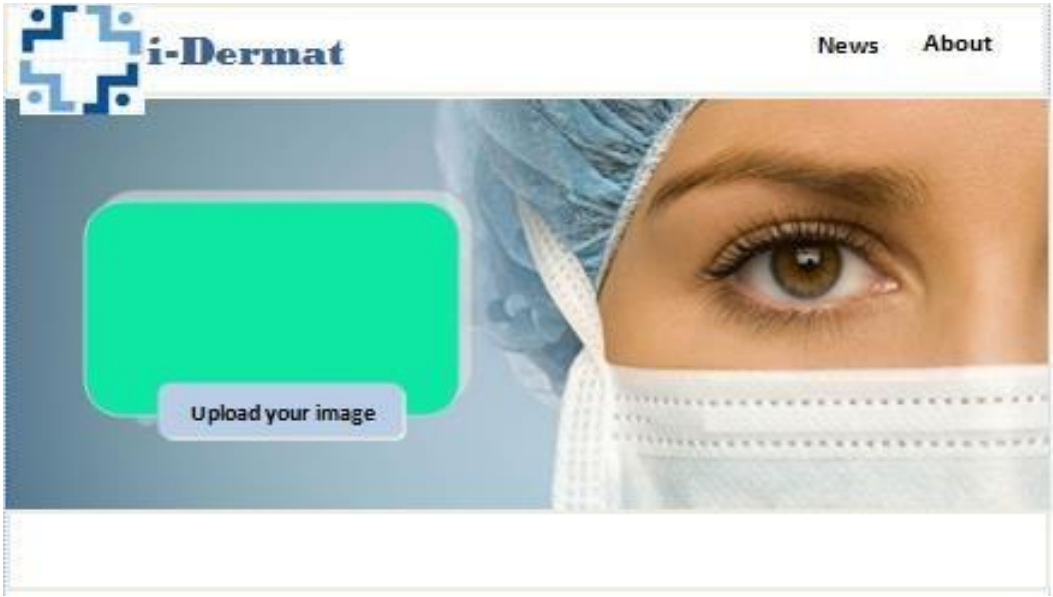

Figure 3: Web / Client Application interface which is used to upload the image

The Dermatologists and regular users both interact with the system through a webportal. A user should be able to input the digital image of their skin which is infected by the fungal on the web-portal in order to identify their skin fungal disease and possible treatments also.

Figure 4: Web / Client Application interface which is give the output to user

This interface shows the infection or disease type and the possible treatments for identified disease to the user. Also it shows the suspected visual symptoms marked image to clarify the correctness of the given results.

3.1.2 Hardware interfaces

Since neither the Web application nor the server have any designated hardware, it does not have any direct hardware interfaces. Images can be uploaded or capture from web cam.

3.1.3 Software interfaces

The I-Dermat will interface with a Database Management System (DBMS) that stores the information necessary for the process to images and other relevant functionalities.
An Apache web server will accept all requests from the client and forward it accordingly.
A database will be hosted centrally using MySQL. An OS which is capable of running a modern web browser needed to use web portal application. Cpannel – interface that is help to host the system

3.1.4 Communication Interfaces

The HTPP or HTTPS protocol(s) will be used to facilitate communication between the client and server.

3.1.5 Memory Constraints

Memory constraints will come into play when the size of MySQL grows to a considerable size.

3.2 Functional Requirements

ID: F01

TITLE: Input Digital Images

DESC: User shall upload their digital image into the system to identify disease via web portal. This will upload images or capture image through web cam.

RAT: In order to analyze the disease

ID: F02

TITLE: Color Analysis

DESC: System shall analyze uploaded image and get the color range of the infected area. The color of the spots can be white, pink, salmon, red, tan, or brown .The spots are lighter (sometimes darker) than the surrounding skin

RAT: In order to check whether the color of the infected area matches with the Malassezia disease.

ID: F03

TITLE: Match F02 Output with Disease symptoms

DESC: System shall match output of the color analysis with the color range of Malassezia disease to check whether it is the disease. We shall develop an algorithm to analyze color range and identify whether it matches with the disease.

RAT: In order to check whether the color of the infected area matches with the Malassezia disease.

ID: F04

TITLE: Texture/patch Analysis

DESC: System shall analyze the image to identify whether there is a patch /rash in the infected area. Sometimes there will be infected areas which are ring shape, with blisters etc...
But in here we will check if the infected area is a wide spread area with a rash. Texture should be smooth too.

RAT: In order to check whether the texture of the infected area matches with the Malassezia disease.

ID: F05

TITLE: Surface Area Analysis

DESC: If we could identify there is a rash that matches with the disease we shall analyze the surface area of that to analyze how fur this disease is wide spread or not. If will help to analyze the risk. This will help to differentiate Malassezia from other similar diseases.

RAT: In order to check whether the surface area of the infected area matches with the Malassezia disease and measure the risk and stage of the disease.

ID: F06

TITLE: Compare Algorithms

DESC: We should analyze color/texture/surface area of the infected area of the skin (image) using different algorithms and select most suitable method

RAT: In order to give most accurate and reliable output we should get the most suitable method.

ID: F07

TITLE: Provide Output

DESC: System shall give output as what is the disease by analyzing the output of the color a/texture /surface area analysis algorithms into web portal

RAT: In order to inform user whether he/she has Malassezia disease.

3.3 Performance Requirements

Performance requirements are the extent to which a function must be executed, and is generally measured in terms of quality, quantity, coverage, timeliness or readiness. Also the performance of the application will be measured using speed, capacity and scalability.

3.3.1. Response time for identify the disease

ID: QR1
TAG: Response time for identify the disease
GIST: The fastness of identifying disease
SCALE: The response time of an identifying disease
METER: Measurements obtained from 100 images during testing.
MUST: No more than 2 seconds 100 % of the time.
WISH: No more than 1 second 100% of the time.

3.3.2. System Dependability

ID: QR2
TAG: System Dependability
GIST: The fault tolerance of the system.
SCALE: If the system loses the connection to the server or the system gets some strange input, the user should be informed.
METER: Measurements obtained from 100 hours of usage during testing.
MUST: 100% of the time.

3.3.3. Response Time for uploading image

ID: QR3
TAG: Response Time when uploading image
GIST: The fastness of uploading input image
SCALE: The response time of an uploading image
METER: Measurements obtained from 100 images during testing. MUST: No more than 2 seconds 100% of the time.
WISH: No more than 1 second 100% of the time

3.3.4. Usage of the results in the image view

ID: QR4

TITLE: Usage of the results in the image view

DESC: Suspected visual symptoms marked image should be user friendly and it is helps to clarify correctness of the result.

3.4. Software system attributes

3.4.1. Accuracy

ID: QR1

TITLE: Accuracy

DESC: System should give 70% accurate results by identifying correct disease.

3.4.2.. Reliability

ID: QR2

TAG: System Reliability

GIST: The reliability of the system.

SCALE: The reliability that the system gives the right result when uploading infected image.

METER: Measurements obtained from 100 images during testing.

MUST: More than 98% of the images.

PLAN: More than 99% of the images.

WISH: 100% of the images.

3.4.3. Availability

ID: QR3 TAG:

DESC: The system should be available at all times, meaning the user can access it using a web browser, only restricted by the down time of the server on which the system runs. In case of system failure an error page should show.

GIST: The availability of the system when it is used.

SCALE: The average system availability (not considering network failing). METER: Measurements obtained from 100 hours of usage during testing.

MUST: More than 98% of the time.

PLAN: More than 99% of the time.

WISH: 100% of the time.

3.4.4.. Maintainability

ID: QR4

TITLE: Application extendibility

DESC: The application should be easy to extend. The code should be written in a way that it favours implementation of new functions and algorithms.

RAT: In order for future functions and algorithms to be implemented easily to the application.

3.4.5. Portability

ID: QR5

TITLE: Application portability

DESC: The application should be portable with iOS and android.

RAT: The adaptable platform for the application to run on.

3.4.6. Testability

ID: QR7

TITLE: Application testability

DESC: Test environments should be built for the application to allow testing of the applications with different images which are infected by fungal or not.

3.4.7. Internet Connection

ID: QR8

TITLE: Internet Connection

DESC: The application should be connected to the Internet.

4. Supporting Information

4.1 Appendices

Figure 5: Use Case Diagram

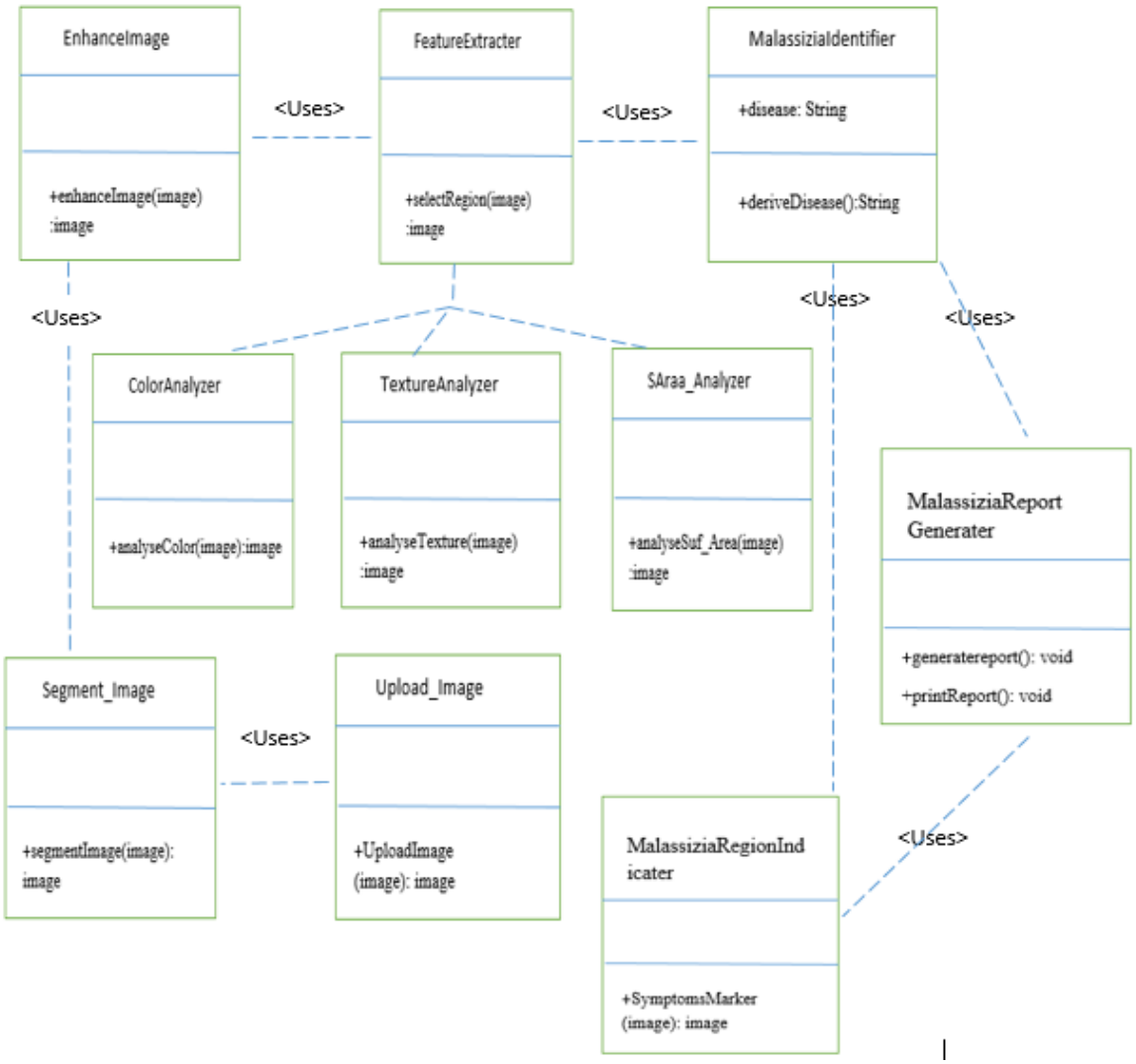

Figure 6: Class Diagram

5. References

[1]BELITSOFT, Software Requirements Specification document Example (International Standard) [Online] Available: https://belitsoft.com/custom-application-development-services/software-requirements-specification-document-example-international-standard

[2] Nisha Yadav ,Virender Kumar Narang ,Utpal shrivastava, Skin Diseases Detection Models using Image Processing: A Survey, Volume 137 – No.12, March 2016

[3] Anal Kumar MittraandDr. Ranjan Parekh - Automated Detection of Skin Diseases Using Texture Features.