GROWTH PREDICTION, DISEASES DETECTION & CLASSIFICATION SYTEM FOR ANTHURIUM PLANTS

Project Id: 17-082

Software Requirement Specification

Bachelor of Science Special (Honors) in Information Technology
Department Of Information Technology Sri Lanka Institute of Information Technology

Date of Submission May 2nd 2017

Project Title: Growth Prediction, Diseases Detection & Classification System For Anthurium Plants.

Project ID: 17 - 082

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DECLRATION

I declare that the project includes the materials which are prepared by group members and do not include materials fully or partially of any other person. Available materials don't contain in any other previously published or written by someone else with relevant to any other research. This document is a record of an original work done by research team under the guidance of Dr. Rohana Thilakumara (Supervisor) and Ms.Yashodya Wijesinghe (Co-supervisor)

Document Name	Software Requirement Specification
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Date	2017-05-02

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1. Introduction

The Software Requirements Specification (SRS) provides a proper idea for the users about the how the system works and the features included in the system. The SRS provides all the requirements related to the software in details. Also, it includes detailed information about the services offered by the system. This document will be helpful for all the software engineers and quality assurance engineers who will build and maintain the software. By purpose, scope definition of acronyms and abbreviations, references and overview guide the readers to a clear idea about this document.

1.1. Purpose

The purpose of this SRS document is to identify and analyze the functional and non-function requirements related to the Growth prediction, Disease detection and classification system for Anthurium Plants. This document contains system interface, details about technologies which will be used for the development of the system as well as it gives a proper view how the users interact with the system. Requirements specified in this SRS document will meet in the final product.

1.2. Scope

This document depicts the requirements for developing a system to predict the growth of Anthurium relevant to the prevailing environmental conditions. This describes the functionalities, software requirements, findings of previous research information and the challenges that the system should overcome during the development period. Also, it describes the objectives, goals and benefits expect to gain by the software.

Growth prediction, Disease detection and classification system for Anthurium Plants is a desktop application which helps to identify diseases and also to predict the growth of the plant. Environmental factors like humidity, temperature, and sun light will be considered in order to predict the growth of the plant.

This software provides much efficient way to check the growth of the plant. With this user can get an idea about the environmental conditions, whether it's suitable for the plant or not and make necessary changes if necessary.

Main objective of this system is to predict the growth of the plant relevant to considered environmental factors and alert the owner about the status if necessary. This will help to increase the production as well. Final goal of this is to increase the production with the help of technology.

1.3.Definitions, Acronyms and Abbreviations

Table 1.3.1 The table of Definition, Abbreviation and Acronyms

Acronyms and Abbreviations	**Definition**
SRS	Software Requirements Specification
UML	Unified Modeling Language
GUI	Graphical User Interface
SDK	Software Development Kit
RAM	Random Access Memory

1.4.References

The references relevant to the SRS document will be stated at the end of this document.

1.5. Overview

The overview of the system detailed description includes the remaining chapters.

There are three chapters more to discus in this document. Chapter 2 provides the details about the system such as product perspective, product functions and product characteristics. Chapter 3 provides the system requirements of the software and chapter 4 guides to the references.

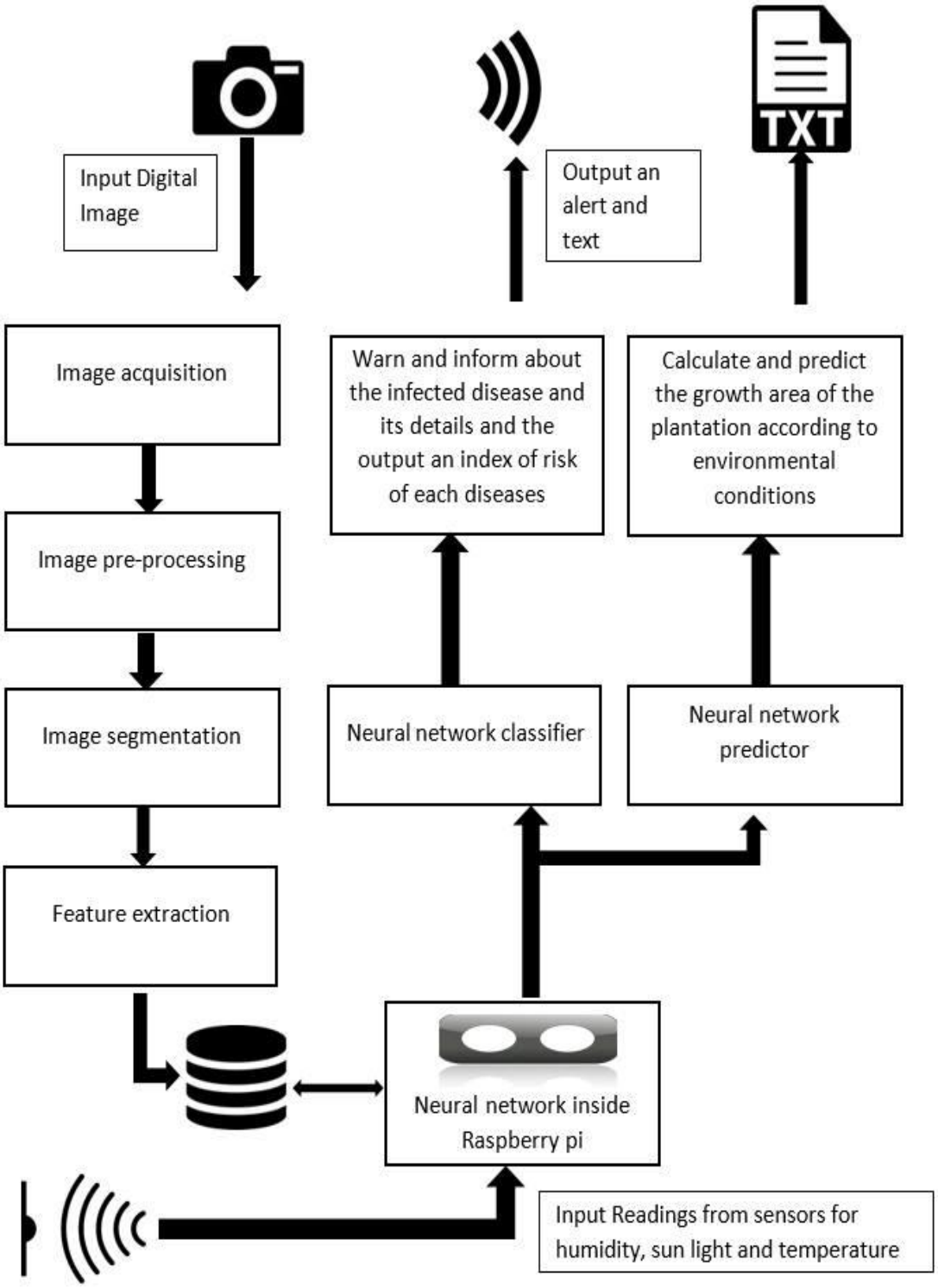

Figure: 1.5.a: Overall System

2. Overall Description

2.1.Product Perspective

In general, cultivators who are maintaining large scale plantations, always trying to minimize the damage to the crop by using technological inventions have faced for different issues due to lack of facilities in one package and difficulty of applying these inventions in a large scale plantations. Many researches have been done for the identification of diseases, classification of diseases and predicting the growth area of the plantation in research domain. They can be explaining as follows,

Title	**Publication & Year**	**Author**	**Crop /Plant**	**Consider the prediction of the growth of the plant**	**Possibility of applying to a larger scale plantations**	**Consider the environmental factors**
Potato leaf diseases detection and classification system.	IJSMC, 2016.	Mr. Girish Athanikar, Ms.Priti Badar	Potato	No	Weak	No
An Overview on Detection and Classification of Plant Diseases in Image Processing	IJSER, 2014	Nikita Rishi, Jagbir Singh Gill	Cotton leaf spot, Rice plant, Wheat and sugar beet, Orchid leaf, Apple fruit**,** Chili plant	No	Weak	No
Leaf Disease Detection using Image	IJIREEICE, 2016	Piyali Chatterjee, B. Harikishor Rao	Maize	No	Weak	No

Processing Technique						
Feasibility Study on Plant Chili Disease Detection Using Image Processing Techniques.	IEEE, 2012.	Zulkifli Bin Husin, Ali Yeon Bin Md. Shakaff, Abdul Hallis Bin Abdul Aziz, Abdul Hallis bin Abdul Aziz.	Chili	No	Weak	No
Digital image processing techniques for detecting, quantifying and classifying plant diseases	Barbedo SpringerPlus, 2013.	Jayme Garcia Arnal Barbedo	Vegetable Pathology	No	Weak	No
Agro	Not yet published		Anthurium	Yes	Excellent	Yes

Agro is a user friendly stand-alone application developed targeting the main users as large scale Anthurium growers. The main target of the application is to warn the users about the spread of the diseases, predict the outbreak of a disease with related to environmental conditions and monitoring the growth of a plantation considering humidity, temperature and sun light. The main problem addressed here are the difficulty in naked eye observation of each and every plant, difficulty in monitoring the plantation growth with the sudden changes in the environmental factors and difficulty in predicting the outbreak of a disease with related to environmental conditions.

The accuracy of the application is expected to be high. The growers can maintain a healthier plantation through the application as it covers every aspect that a grower should see when growing Anthurium currently done through naked eye observation. The security of the application is also very high and newest technologies are uses for implementation process. Therefore users have an opportunity to get familiar with the new technologies through the application.

The description of the functions of the application is as follows.

Feature Extraction

Both healthy and infected parts of the Anthurium plant like spathe, spadix and leaves are considering for the study. In order to identify the parts of the Anthurium plant as healthy or infected, segmentation techniques help to fulfill that task. The segmented parts are used to extract features like shape, texture and color for the future steps in the study.

Growth Prediction

For the growth prediction, we consider the green area of leaves relative to the environmental factors like sun light, temperature and humidity. Using sensors those factors are taken to a raspberry pi and then processing is done. Then processed data will be stored in the database. With respective to the prevailing conditions green area of leaves are calculated. Using a neural network with the available details prediction is done and measure how much prevailing factors will effect on the future growth.

Classification and quantification of the diseases

This functionality is mainly about the classification of a certain disease identified using the colour variation of the spots. When interacting with the growers, we found out that for different diseases, the colour of the spots are different. The growers also identify the diseases through naked eye observations by the spot colour. Since it is difficult to do this with every plant every time, this application helps with the classification process. The application warns the user when some colour of a spot has occurred in leaf, spathe or spadix. To quantify the disease means measuring how much the disease has spread throughout the plant. This can be stated as a percentage. Then the user is acknowledged with different treatments and pesticides that can be used to minimize the disease using text outputs. This component gives the first clue of what really happens and warn the growers which in turn leads to increase the accuracy of the proposed automatic system

Detection of Severity level of the Anthurium diseases by considering environmental conditions

Environmental conditions are a main factor that affects for the healthy growth of a plant. Main environmental conditions that affects for the healthy growth of a plant, are sunlight, temperature and humidity of the atmosphere. In the proposed system, we are considering about these factors and planning to give the severity level for diseases, caused due to the changes of the environmental factors. So for that, by considering past history of data, neural network will predict the diseases that can affects for the plantation and also it will detect the severity level of those diseases

2.2. Product Functions

2.2.1. Use Case Diagram

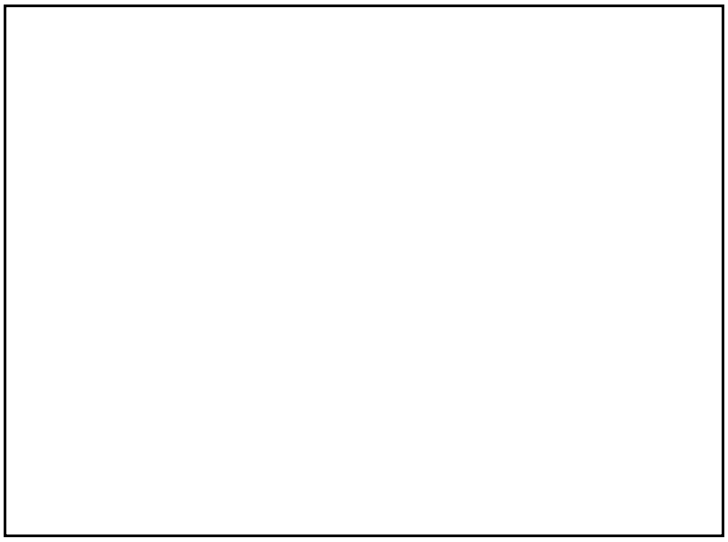

Figure: 2.2.1.a: Use case Diagram of growth prediction

2.1.1 System Interfaces

This proposed system is come into the user's hand as a standalone application installed in a personal computer or laptop which user can use anywhere easily. A standalone application for windows platform. Because Windows is the most commonly uses operating system among most of the people. Application uses **Opencv** image processing libraries for image processing procedures and TensorFlow libraries for artificial neural network processing. Mongo DB is used for database. It is a free and open source cross PyMongo is the driver used for database access. Application uses PyCharm as IDE.

2.1.2 User Interfaces

The user interfaces of the application and how the user interacts with the system are clearly described in the section 3.1.1 of the document.

2.1.3 Hardware Interfaces

A personal computer or a laptop with windows 7 or above installed. Sensors are needed to get the readings of environmental factors such as sunlight, temperature and humidity. A raspberry pi is used for storing the data which is taken from sensors.

2.1.4 Software Interfaces

MongoDB is the database that is used to run Agro desktop application because it has high security and has implemented using latest technology. PyMongo is the driver used for database accessing process. PyCharm is the IDE which is the application uses for the implementation.

2.1.5 Communication Interfaces

SD card is used to transfer the data in to MongoDB from Raspberry Pi to personal computer.

2.1.6 Memory Constraints

Minimum 1GB of Virtual Memory (RAM) and 1GB of Memory Space (Secondary Memory) will be required.

2.1.7. Operations

Users can’t find whether the prevailing conditions are suitable for the plants or not into order to get the maximum benefits. Therefore they take actions using traditional methods like growing inside green houses etc. To control the environmental factors these things are not enough because of the changes occur in the environment within the different times of the year. Owners don’t have any idea about the prevailing environmental conditions. To gain that awareness this can be used easily.

This prediction is done using neural network but final output is give to the user in a simple manner so that user can easily understand the about the current condition. Then owner can take necessary actions toward preventing the damage and increase the harvest.

2.1.8 Site Adaptions and Requirements

To install and run the application user needs a computer with windows 8 or higher, 1GB of RAM and 1GB of hard space, raspberry pi model 3, digital camera with 8GB memory.

2.2.1.1. Use Case Scenarios

Table: 2.2.2.2 Use Case Scenario 01

Use case scenario	Getting Sensor readings
Primary actor	User
Pre-Condition	1. User is already opened the application 2. Power on in raspberry pi and active sensors 3. Connection between application and raspberry pi
Basic flow of events	1. Getting the sensor reading to the raspberry pi 2. Pass sensor readings to raspberry pi 3. Do the prediction and display the output
Alternatives	2. a) If raspberry pi is not on the prediction cannot be done. b) If the sensor doesn't work properly readings can be inaccurate 3. a) If the connection between sensor and application no active output will not be shown.

2.3 User Characteristics

This system will have no complicated user interfaces, even a person with low computer literacy knowledge will also be able to this application.

2.4. Constraints

In order to use this application user should have raspberry pi with minimum model 2 and a pc or a laptop with windows 8 or higher with space of 5GB of free space. Users need internet connection to connect with the database and get the access for the images available.

This software will target on Anthurium plant growers specifically. So the complete system will be developed using open source technologies (MongoDB, Open source SDK etc).

Since the users are not well experienced and lack of knowledge about the field, the application must be developed in a simple manner. All the outputs must be given to the user in a simple form in order to understand them easily.

2.5. Assumptions and Dependencies

- Windows operation system 8 or higher.
- Active internet
- Raspberry pi model 3

2.6. Apportioning of Requirements

The requirements described in sections 1 and 2 of this document are referred to as primary specifications; those in section 3 are referred to as requirements (or functional) specifications. The two levels of requirements are intended to be consistent. Inconsistencies are to be logged as defects. In the event that a requirement is stated within both primary and functional specifications, the application will be built from functional specification since it is more detailed.

'Essential requirements' (referred to in section 3) are to be implemented for this version of 1.1. 'Desirable requirements' are to be implemented in this release if possible, but are not committed to by the developers. It is anticipated that they will be part of future release. 'Optional requirements' will be implemented at the discretion of developers.

The interfaces mention in section 3 might change, other than that this application will only have slight changes in the development process of this application.

3. SYSTEM REQUIREMENTS

3.1 External Interface Requirement

3.1.1 User Interfaces

Figure: 3.1.1.a: Growth prediction interface

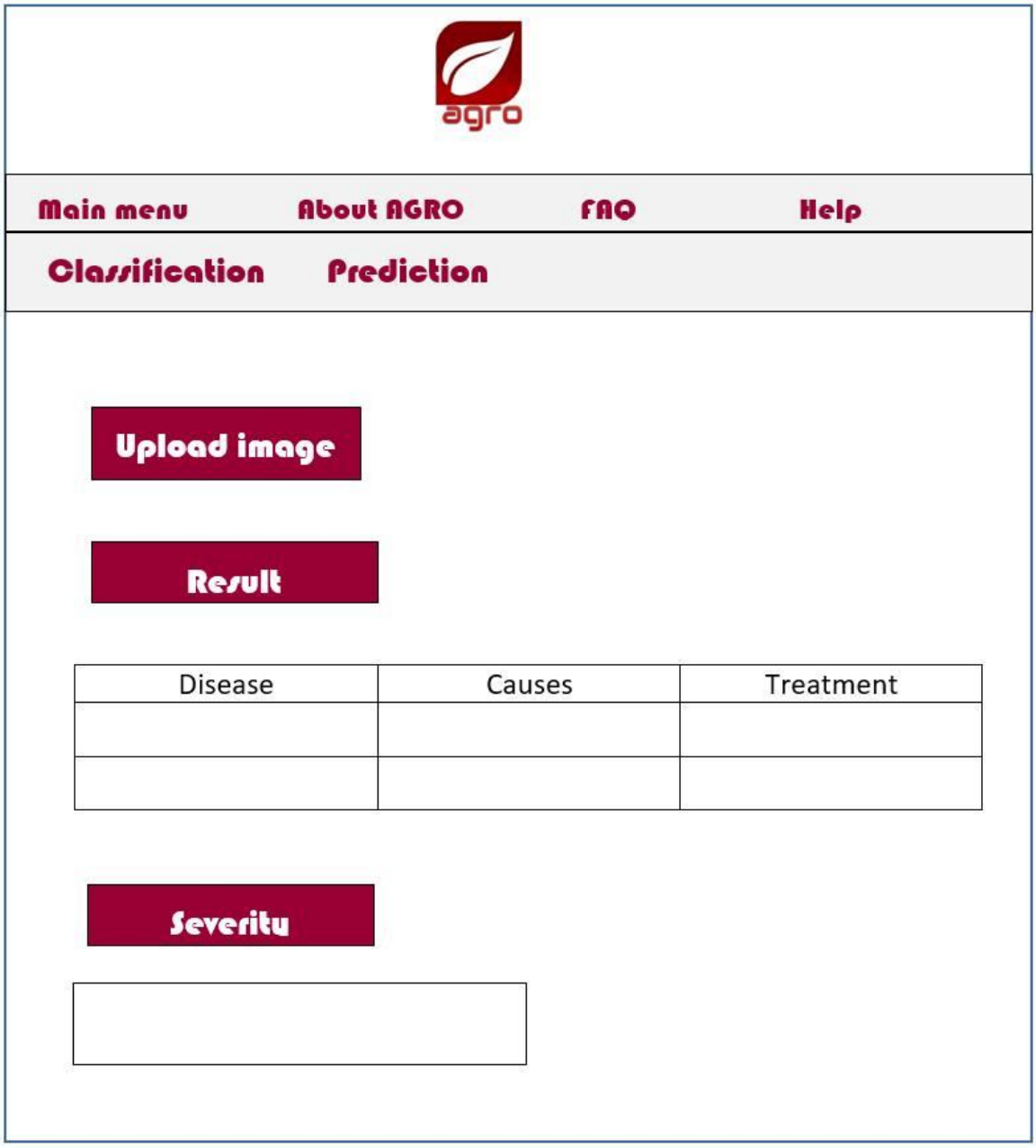

Figure: 3.1.1.c: Disease analyze interface

3.1.2. Hardware Interfaces

All the hardware interfaces are described in section 2.1.3 of the document.

3.1.3. Software Interfaces

For the implementation of the desktop application, several open source software interfaces will be used. The following illustrates the software interfaces used for each module of Agro stand-alone application.

For image segmentation and feature extraction process OpenCV image processing libraries are using for the implementation and TensorFlow libraries for Artificial neural network implementations will use for the system.

PyCharm IDE for python 2.7 will use for MongoDB database and PyMongo driver is using for the database access process.

3.1.4. Communication Interfaces

As mentioned in section 2.1.5, Agro does not need any specific communication interfaces.

3.2. Classes

The below part of the UML diagram is drawn only for growth prediction functionality.

Image segmentation and feature extraction class
Attributes: - Sensor readings
Methods: + getInput() + prediction()

3.3. Performance Requirements

- Agro supports to identify about five different diseases.
- Application should not freeze while running.
- Sensors should be active and raspberry pi must be powered.
- Internet connection should be availble.

3.4. Design constraints

The GUI s are developed attractively and in a user friendly way to attract users to the application at their first sight so that even users with a very less amount of IT knowledge can use the software application easily.

3.5. Software system attributes

3.5.1. Reliability

Agro stand-alone application will provide its service to users without any issue effecting their satisfaction of the software. It will work according to its specifications. Since users dealing with the application expect something more than doing it manually, the accuracy of the outputs should be high.

3.5.2. Availability

Application should be available in 24x7 and can use any functionality when user needed.

3.5.3. Security

High security is not needed as in other applications. Necessary security actions are taken in the developing process.

3.5.4. Maintainability

It will be easy to maintain since it will be developed in the way it can be extended.

4. References

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