Growth Prediction, Diseases Detection & Classification System for Anthurium Plants

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DECLARATION

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ABSTRACT

Anthurium has become one of the most cultivations in Sri Lanka because of the high income. Growers from around the country do the cultivation as their main source of income. A good income can be gained only if the plants could give more flowers. For that plants should grow well under appropriate environmental conditions for the plant. At present, there is no method of knowing the growth of Anthurium plants under the prevailing conditions.

“Agro” is the solution to know the growth of the plant. This application will help the user to get warning if there is any change in the environmental which can affect the growth of the plant. So, the user get an opportunity to work on reducing the effect. System predicts the growth relative to the Humidity, Temperature and Sun light. According to the predicted values system decides whether the condition is suitable for the growth or not and finally give the warning. System is running on a raspberry pi and uses sensors and a camera to get the necessary inputs. System runs during the start-up of raspberry pi. So, user doesn’t have to worry about whether it works or not until the power is give or after getting power failure. User interference will be minimum as it works on its own.

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LIST OF ABBREVIATIONS

Acronyms	Definition
Agro	Aplication name
SDLC	Software Development Life Cycle
UML	Unified Model Language

1. INTRODUCTION

"Agro" is a system developed for the anthurium plant which monitors the growth of the plants with respect to some environmental conditions like humidity, temperature and sun light. Also, disease prediction. This application is an standalone application which runs on the raspberry pi. This application will work on its own without any user's involvement.

1.1.Problem to be addressed

At present technology has developed to a huge state. Using technology various problems are addressed to overcome them. For the growth of any plant humidity, temperature and sun light are some of the most effective factors. These factors decide the growth and the production of the plants.

There is no method to find out the suitability of above mentioned factors for the growth of anthurium plants. Because if the growth has effected, harvest will be reduced and that can cause less income. Here, the problem is lack of methods to know the growth in future according to current conditions.

1.2. Background Context

There are several applications used developed for the purpose of monitoring the growth of plants. They have been addressing in different sectors which effect the growth of the plant.

Design and development of an automated and non-contact sensing system for continuous monitoring of plant health and growth [1]:

An automated system was designed and built to continuously monitor plant health and growth in a controlled environment using a distributed system approach for operational control and data collection. The computer-controlled system consisted of a motorized turntable to present the plants to the stationary sensors and reduce microclimate variability among the plants. Major sensing capabilities of the system included machine vision, infrared thermometry, time domain reflectometry, and micro-limiters. The system also maintained precise growth-medium moisture levels through a computer-controlled drip irrigation system. The system was capable of collecting required data continuously to monitor and to evaluate the plant health and growth.

Plant Growth Monitoring System [2]:

Advancement in technology is changing the world at great pace. New methods and systems are being developed throughout the world in different application areas. This advancement can prove as a boon to agriculture industry to meet the increasing demands of food and fodder around the world. This paper proposes a non-contact plant growth monitoring system using infrared sensors. The proposed system measures dimensions of the plant by using an infrared sensor, and generates maximum height, width and diameter of the stem of the plant as plant growth parameters, using measured data. Once the growth parameters are measured, they are transmitted to a remote server/user by using GSM technology. The proposed plant growth monitoring system has been implemented by designing a automated scanning system. Finally, the system performance is compared and verified with the measurement data that have been obtained by practical field experiments.

1.3. Research Gap

Anthurium has become one of the most popular export item of the country as well as it is widely used within the country too. Anthurium is a plant with high income for the growers. Therefore, a huge trend in the Anthurium cultivation. But there are problems in growing these plants as in other cultivations like diseases, less growth rate etc. These problems cause to reduction of income to the owner. There is no method for cultivators to know the less growth rate until the end of growth and which condition caused this problem.

For these problems, environmental factors like humidity, temperature and sun light are directly affected. There, as the solution “Agro” can be used. For the growth problem in plants Agro gives warning by considering the prevailing condition of these above mentioned factors. This will help to know the less growth before it happens and can work on minimizing to reduce the effect on the growth.

1.4. Research Problem

Due to ignorance and lack of knowledge about the plant people lose money due to the less harvest gain by the plantation due to its less growth. But still they can't figure out the problem what caused this. It's hard to find the changes in the environment. Therefore owners don't get an opportunity to reduce the effect. Problems and diseases occurred due to lack of minerals can be identified by different changes in the plant and through color changes and can overcome by taking necessary measures. But growth cannot be fixed to the suitable state like that. Also other problems might occur only to one plant or few. But this problem occur to the whole plantation and cause loss. So the growth should be predicted under the prevailing environmental conditions and warn if there is any inappropriate condition to the plantation to avoid the loss and keep the growth up to its maximum.

1.5. Research Objectives

Plantation owners always don't get a proper idea about the growth of the plant. Therefore during some harmful environment changes they don't take proper actions towards the problem for solving them. Therefore with or without their acknowledgement plants can be effected because of the change occurred. Main objective of this growth prediction is to warn the owner about the effective climate changes in harmful manner. So the owner can take measure to avoid the problem before it affects. Indirectly this helps the owner to get a good profit from the harvest he gains through the plantation as well as helping the owner to manage the work easily.

2. METHODOLOGY

This will point out the methods that the research have been planned and how to accomplish goals as planned. A methodology is a set of guidelines or principles that can be to a specific occasion. In research duration, members have to follow the methodology. A methodology could be a specific approach and testing used throughout the life cycle.

Agro consist of a desktop application which contains a neural network focused on growth of the plant. This system runs on a raspberry pi which is located in the plantation house(green house). Sensors and the camera are connected to the raspberry pi and application interact with them to get the environmental readings for temperature, humidity and sunlight. Also for the train purpose images are used. First keep monitoring the growth (area of the leaf), how it increases with the time and other factors. Continuously keep monitoring the changes in the leaf area. This gives an idea about the growth with respect to the considering factors. Images are taken and extract feature as necessary to calculate the area of the plant which be used to calculate the area of the plant and can be calculated the increased amount of the area with respect to the considering factors. Based on the prediction done by the neural network alerts are given to the owner to take actions accordingly.

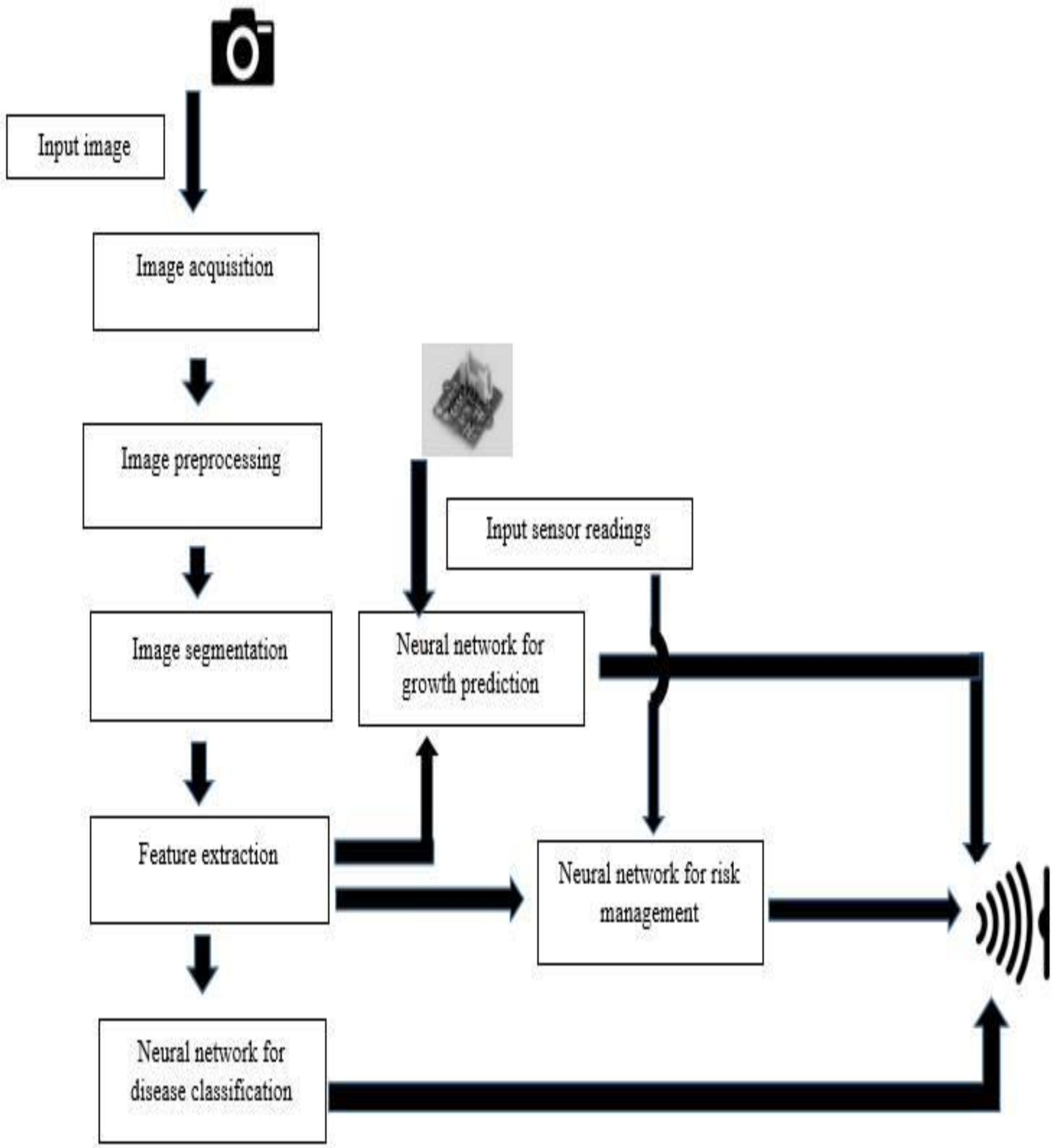

Figure 2. 1 System Diagram

2.1.Methodology

This sub section contains the procedures carried through out the software development life cycle (SDLC).

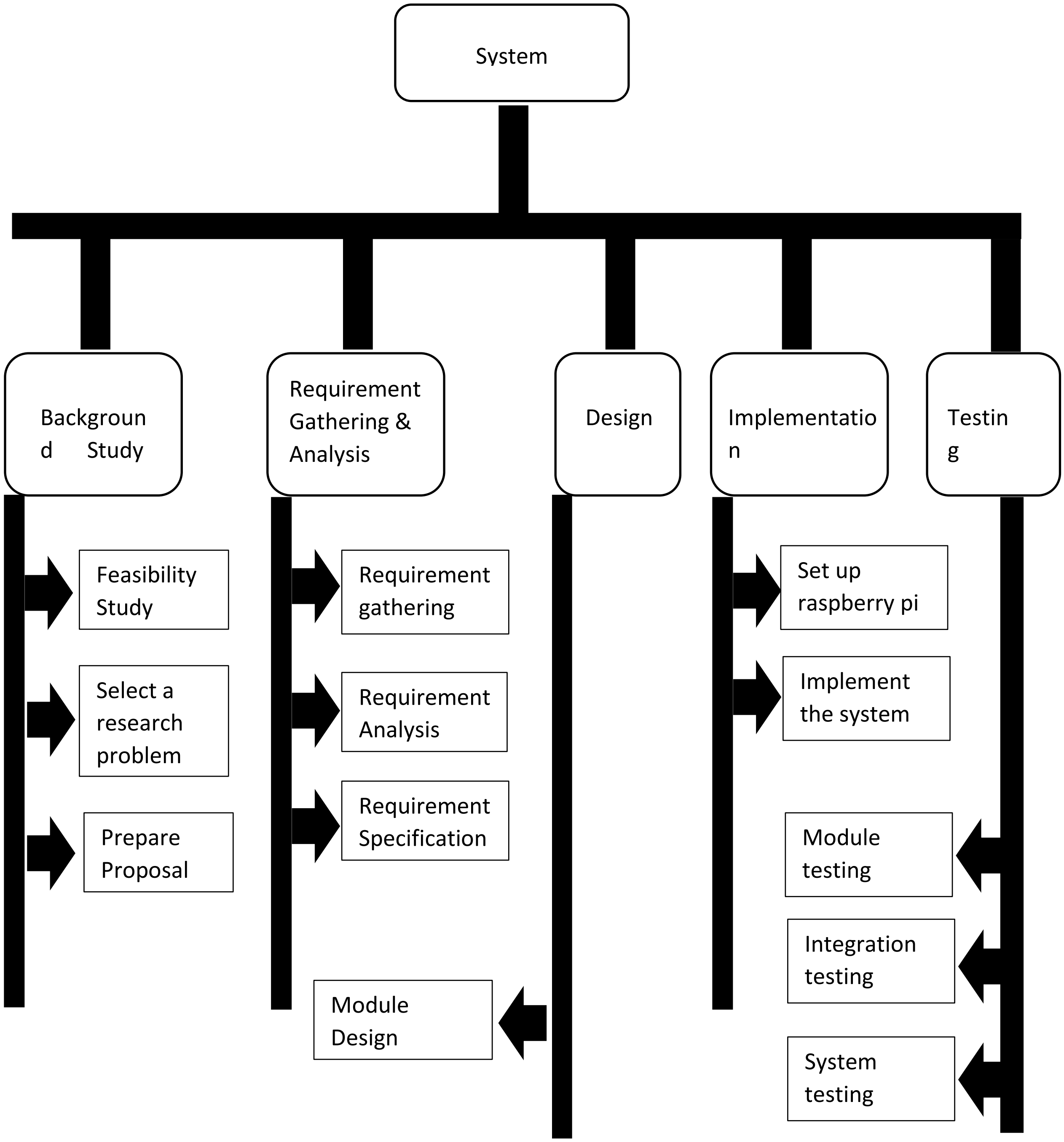

Figure 2.1. 1 Work Breakdown Structure

2.1.1. Background study

At the beginning a feasibility study had to be conducted in order to clarify how far this can be done using the existing technology. Therefore, under technical feasibility, selected most suitable technologies and the equipment needed, work load for the task. Also, the algorithms could be used to address and resolve the research problem. In order to accomplish the goals machine learning techniques and image processing techniques had to be used.

Cost for the research was major concern. It should be within a budget that can be afforded as well for the user should be able to use it with a minimum cost. Also, use of the system has to be considered and the benefits from the system. In this, realized that anthurium growers can use this easily for the advancement of their production.

2.1.2. Requirement Gathering

Every system has its own unique features. These features have to be collected from experts. Requirement gathering process helped to get an idea about the needs of the system and over roll system such how it should be implemented what kind of tools and technologies should be used to solve the problem and get the maximum benefit from the system. It helped to clarify the problems facing and how to solve them using the system. Team had to pay a lot of attention on preparing the dataset which is essential to train the neural network. Also in image processing requirement gathering helped decide what kind of feature have to be extracted in order to achieve the goal as planned.

To gain the knowledge about the Anthurium team had to meet a specialist at botanical garden and talk about the problems occur in the cultivation and how humidity, temperature and sunlight effect the growth of the plant, what are the most suitable conditions for the plants to grow.

2.1.3. Design

System design is a very crucial part because the implementation and the final results depends on it. Unified Modeling Language (UML) has been used to design the system and followed object oriented concepts. Use case diagram was drawn in order to clarify the tasks. Using the scenarios all the goals to be covered were highlighted. User interfaces were not designed in order to reduce the user involvement with the system and instead alarm system was introduced to warn the users. Goal of removing the interface was to familiarize the user to the system in a simple way.

2.1.4. Implementation

Using the object oriented concepts system was created. All the inputs were stored globally as every member can access the them and do their own tasks easily. Finally warning are given after the predicting the output values accordingly. For the growth prediction leaf area was calculated using image processing techniques and that value is used with other sensor readings to do the predictions. DHT 11 sensor was used to get the humidity and the temperature readings and the light-dependent resistor (LDR) to get the sun light intensity.

2.1.5. Testing

System was tested as unit testing, integration testing and finally system testing to check the ability of the working.

2.2. Research Findings

Existing systems don’t provide the predicted growth by considering the environmental factors like humidity, temperature and sun light. Also, there is no system which was developed by targeting the Anthurium plant.

But this system’s main concern is how above-mentioned factors affect the growth of the plant under the prevailing situations of the climate.

3. RESULTS AND DISCUSSION

3.1. Results

The following subsection provides evidence of results and the solutions provided for the research problems. As planned user interfaces are not implemented but alarm system has implemented to avoid user the interaction with the system. System runs automatically even after a power failure so the user doesn't have to worry about the system execution. Following figure depicts the results gained by predictions.

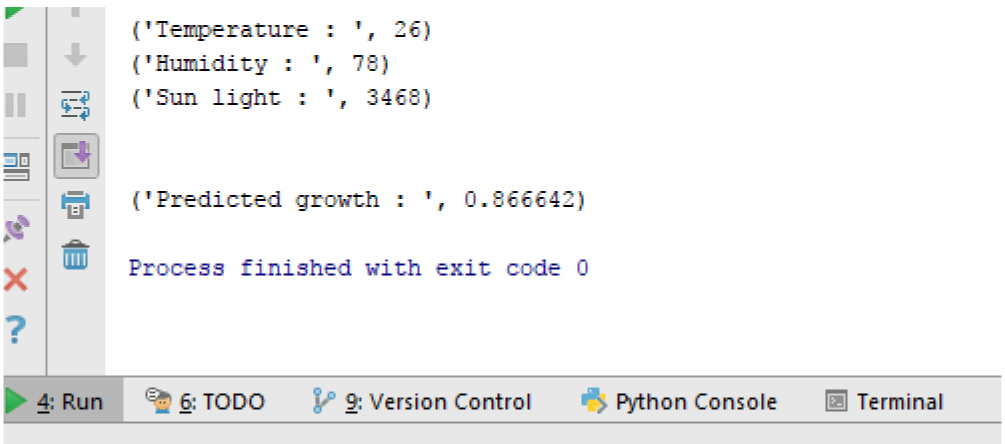

Figure 3. 1 Predicted values

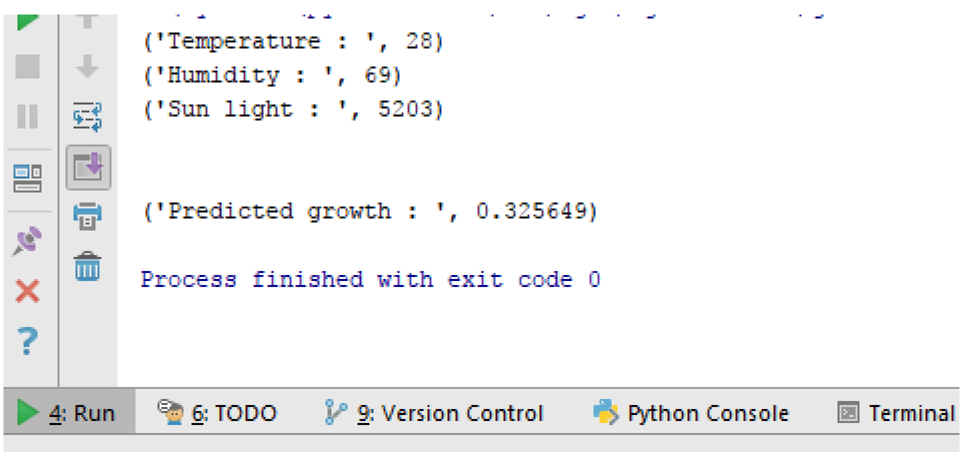

Figure 3. 2 Predicted value

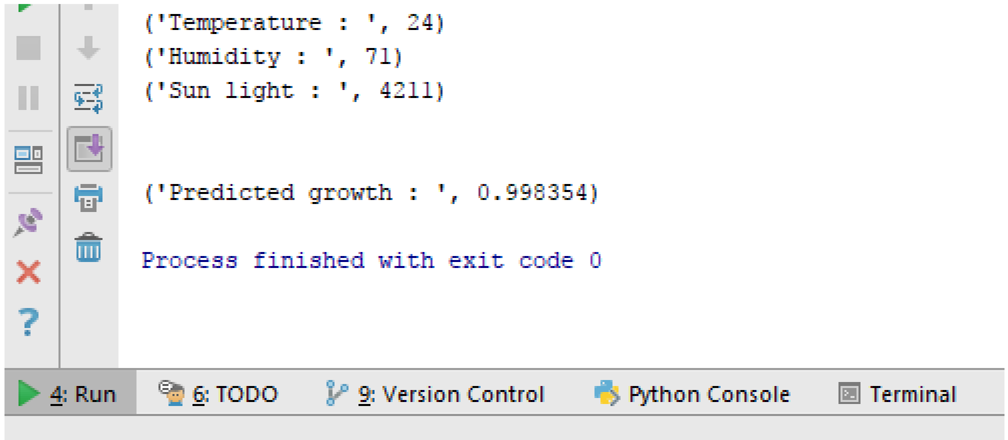

Figure 3. 3 Predicted value

3.2. Discussion

Main concern was to make the system easy to use and predict with high accuracy. Therefore alarm system introduced as user can easily understand. In order to use this application user have to download the system into the raspberry pi and connect sensors and camera suitably and connect to a power source. Also a speaker will be needed as the warning are given using the audio format. No internet connection needed after setting up the raspberry pi.

4. CONCLUSION

Anthuriums is a major plant for cultivation with a high income. There is a trend among growers for the anthurium. It has become a popular plant because of the high income and also the market for the plants and flowers. It is essential to have good healthy well grown plants to get a good harvest. Therefore considering about the growth of plants is an essential task for the users.

Using this agro application its easy for the user to understand the effects on the plants due to climate changes and they can rely on the give waring and reduce the damage. Due to the ability of the easiness of using the app and the low cost it can help from the user side.

5. REFERENCES

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