Smart Assistance for the Floriculture Industry

TMP-23-133

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Meet our Team

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Introduction to the overall project

Sri Lanka is a leading producer of floriculture, but growers face various problems due to inefficient technology.

Monitoring plant growth is currently a manual procedure, and estimating when plants will reach the required level is challenging

Challenging to identify deficiencies and mite attack through visual inspection, and recommending affected plants for export based solely on visual inspection is difficult.

Beginners in the industry lack proper knowledge sources, making it difficult to select the right plants, identify varieties and care for them properly.

Demand forecasting is crucial, but currently relies on past experience and may result in incorrect decisions, leading to losses and wasted resources

Overall research gap

- Implement system for growth monitoring and prediction system for ornamental plants in Sri Lanka
- Identify differentiate between nutrient deficiencies and mite attacks in Sri Lanka
- Recommend shipment plants before it is rejected in Sri Lanka
- Implement system for plant recommendation, variety identification, and chatbot for industry beginners in Sri Lanka
- Predict demand forecasting and supply prediction and implement system for finding nearest vendor in Sri Lanka

Research question

- How can the growth of ornamental plants be monitored, and the time required for them to reach the desired size be predicted?
- How to recommend plants for shipment and differentiate nutrient deficiencies from mite attacks?
- How to select the suitable plant to grow, identify varieties, and develop chatbot for beginners?
- How to effectively anticipate seasonal and species-specific demand, estimate supply based on purchasing data, and locate the closest vendor?

Objectives

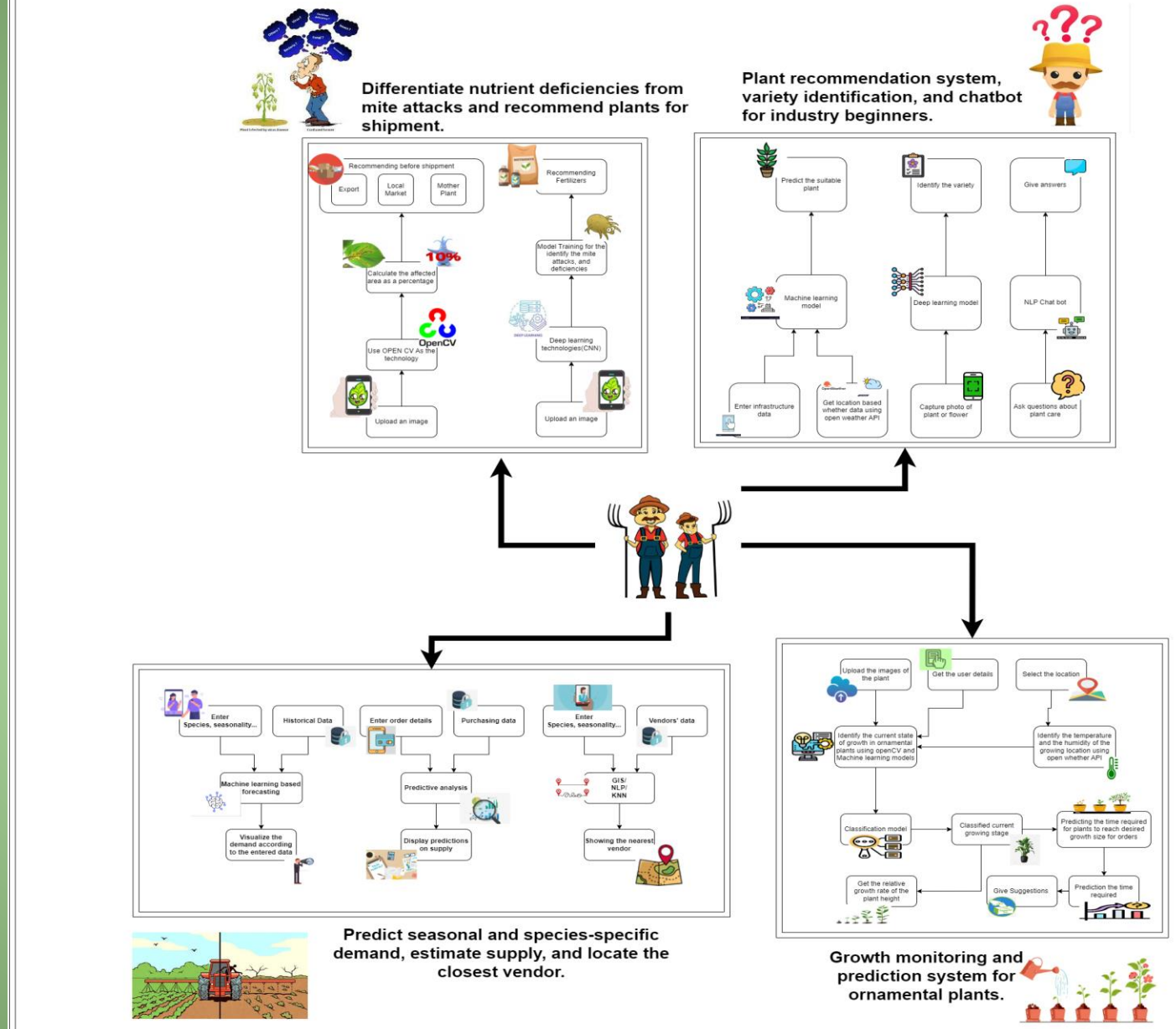
Main objective

Automated mobile application to provide smart assistance for the floriculture industry

Sub objectives

- **Growth monitoring and prediction system for ornamental plants.**
- **Differentiate nutrient deficiencies from mite attacks and recommend plants for shipment.**
- **Plant recommendation system, variety identification, and chatbot for industry beginners.**
- **Predict seasonal and species-specific demand, estimate supply, and locate the closest vendor**

Overall system diagram



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Liyanage S.R.

Specialization : Data Science

Growth monitoring and prediction system for ornamental plants

Introduction

Background

- **Importance of growth monitoring of ornamental plants to the floriculture industry**

- ✓ **The floral industry is a vital part of the economy, with high demand in both domestic and export markets.**
- ✓ **Providing a high-quality product is essential, and this requires monitoring the growth of ornamental plants.**
- ✓ **The export market, in particular, has specific requirements, such as a specific number of leaves or height, which must be met in order to be competitive.**
- ✓ **However, growing these plants also requires a significant amount of resources from the company, making efficient resource allocation crucial for profitability.**
- ✓ **Growth monitoring also helps predict the timing and yield of flowering, enabling better marketing and sales planning.**

Background

- **Important factors should consider when monitoring the growth of a plant**

- ✓ Plant name and variety
- ✓ Number of leaves
- ✓ Plant height
- ✓ Leaf width
- ✓ Leaf length
- ✓ Temperature and humidity of the growing location
- ✓ Media grown
- ✓ Shade (net house type)
- ✓ Fertilizer type and ratio applied

- **Current methods Used In the industry**

- ✓ By experience
- ✓ Using measuring tapes for height measurements
- ✓ Manual leaf counting
- ✓ Weather forecasting based on how the workers feel
- ✓ Keeping records for fertilizer types and ratios
- ✓ Visual inspection with eye-level scanning

Research problem

- **How can the growth of ornamental plants be monitored, and their current state of growth predicted?**
- **How can the time it takes for ornamental plants to reach the required growth size for an order be predicted?**

Specific & sub objectives

Specific objective

Create a smart mobile-based system to Growth Monitoring and Predictions

Sub objectives

- **Predicting the current state of growth in ornamental plants.**
- **Identification of the relative growth rate of plant height.**
- **Predicting how long it will take for plants to meet the required growth size for an order.**
- **Giving suggestions to grow up to the next level of the ornamental plant**

Research gap

Research 01- Early season prediction of within-field crop yield variability by assimilating CubeSat data into a crop model [1]

Research 02- Automation system for controlling and monitoring ornamental plants using fuzzy logic method [2]

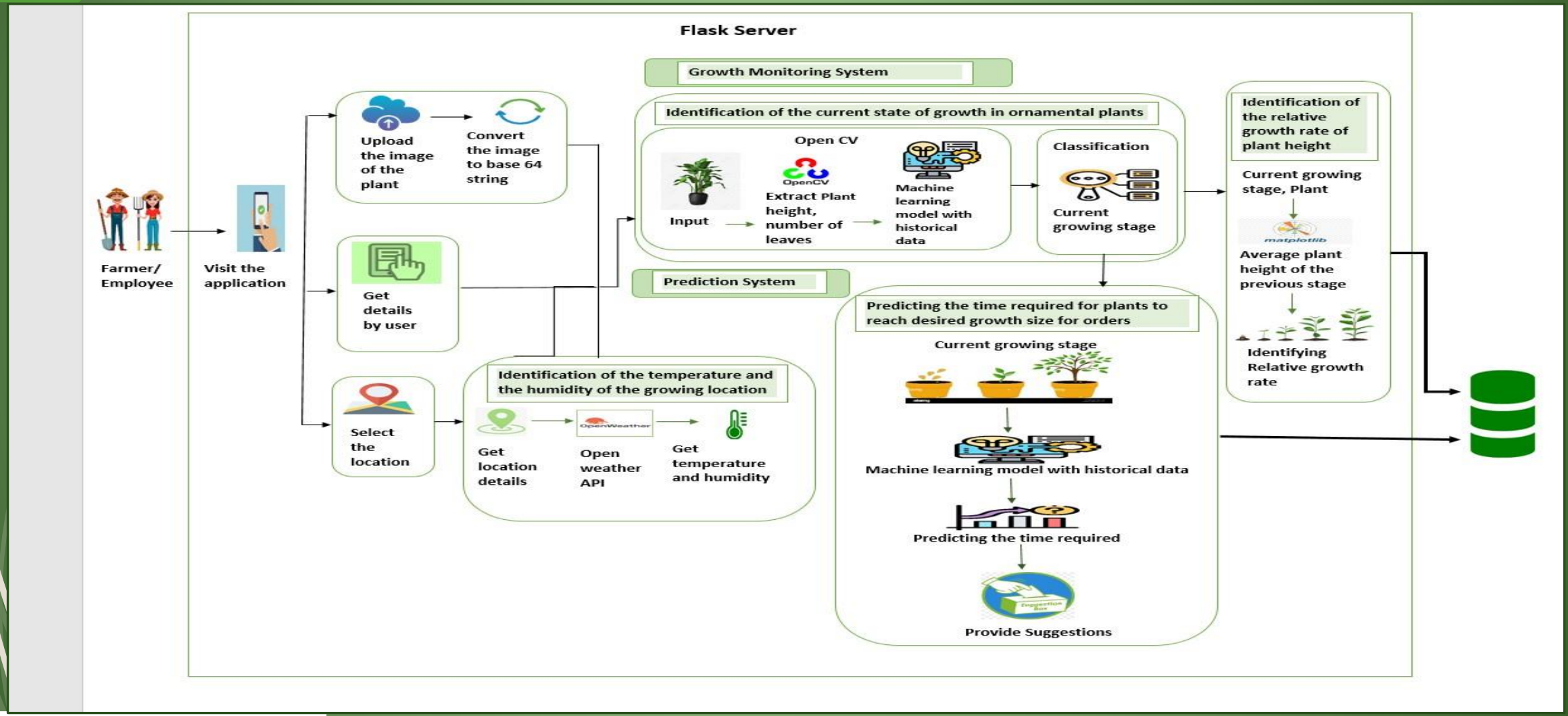
Research 03 – Deep Learning for Image-Based Plant Growth Monitoring: A Review [3]

Research 04 - Manipulation of the Rice L-Galactose Pathway: Evaluation of the Effects of Transgene Overexpression on Ascorbate Accumulation and Abiotic Stress Tolerance [4]

	Identification of the current state of growth in ornamental plants	Identification of the relative growth rate of plant height .	Identification of the temperature and humidity of the given growing location	Predicting the time required for plants to reach desired growth size for orders	Mobile app kind solution in Sri Lankan Sector
Research 01	✗	✗	✗	✓	✗
Research 02	✗	✗	✓	✗	✗
Research 03	✓	✗	✗	✗	✗
Research 04	✗	✓	✗	✗	✗
Proposed system	✓	✓	✓	✓	✓

Proposed methodology

System diagram



Technologies to be used

Technologies

- ✓ React Native
- ✓ Python
- ✓ Tensorflow
- ✓ Matlab
- ✓ Flask Server
- ✓ Open CV
- ✓ Visual Studio Code
- ✓ Jupiter Notebook
- ✓ GitLab

Algorithms & Architectures

- ✓ Machine Learning models
- ✓ CNN
- ✓ YOLO

Techniques

- ✓ Transfer learning
- ✓ Data Augmentation
- ✓ Hyperparameter optimization
- ✓ Object detection and segmentation technique
- ✓ Feature Selection

System, personnel, & software specification requirements

Functional requirements

The mobile application should:

- ✓ allow users to upload images of ornamental plants for analysis.
- ✓ be able to measure plant height, number of leaves, leaf length, and leaf width from uploaded images
- ✓ provide current state of growth prediction for the uploaded plant
- ✓ predict the time it takes for the plant to reach the required growth size for an order
- ✓ provide suggestions for improving the growth of the ornamental plant
- ✓ store user data and image analysis results in a database for future reference

Non-Functional requirements

- ✓ The application should be:
- ✓ User-friendly and visually appealing interface
- ✓ responsive and provide results in a timely manner
- ✓ compatible with both iOS and Android operating systems
- ✓ accurate and provide reliable predictions
- ✓ Fast performance
- ✓ secure and protect user data

System, personnel, & software specification requirements

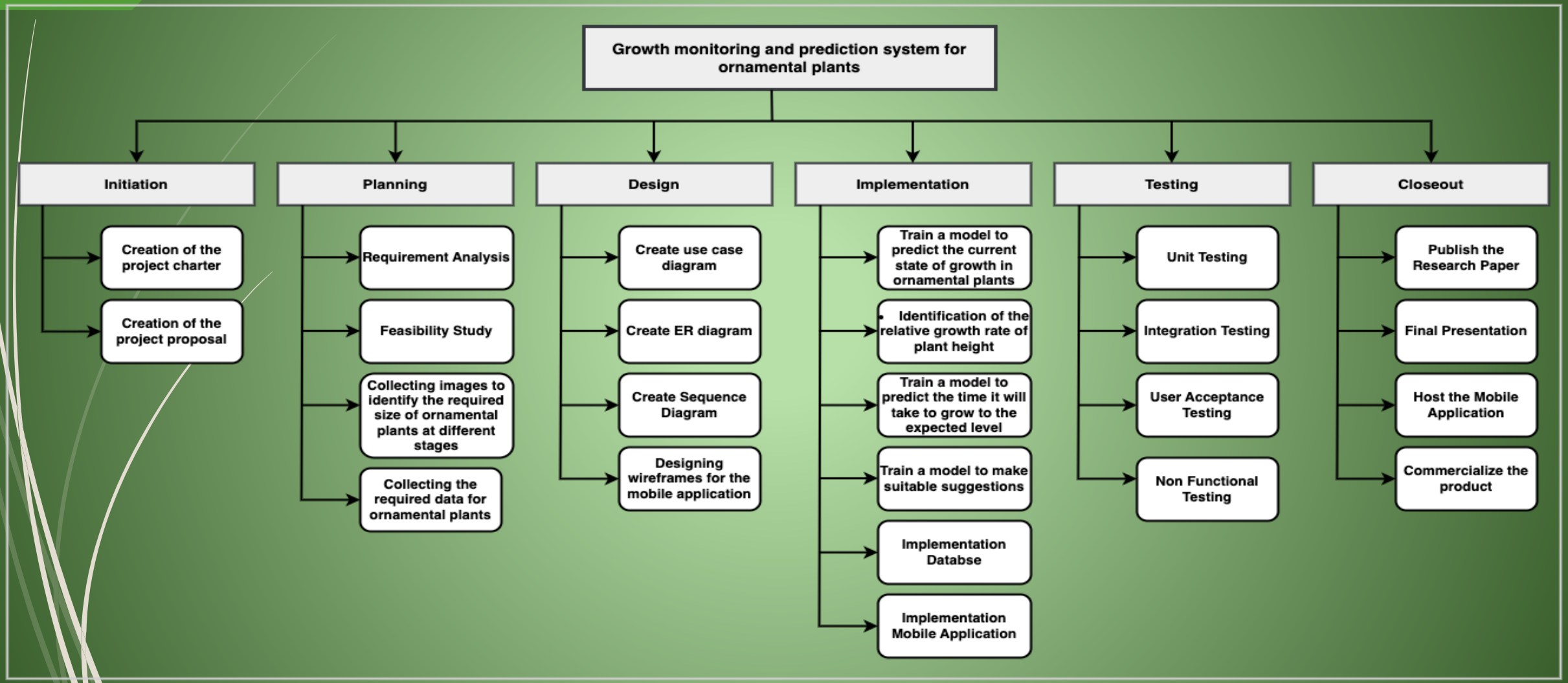
Personal requirements

- ✓ **Resources and required data sets of the ornamental plants regarding the growth monitoring.**
- ✓ **Required images of the ornamental plants at different stages.**
  -Omega Green (PVT) Ltd,Mullayaya Estate, Godigamuwa, Badalgama, Sri Lanka
- ✓ **Asistance of Mr. Anandatissa Illeperuma(Director,Retired Agricultural Officer).**

Software requirements

- ✓ **React Native**
- ✓ **Flask Server**
- ✓ **Visual Studio code**
- ✓ **Jupyter Notebook**
- ✓ **Python**
- ✓ **TensorFlow**

Work Breakdown Structure



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Specialization : Data Science

Differentiate nutrient deficiencies from mite attacks and Recommend plants for shipment

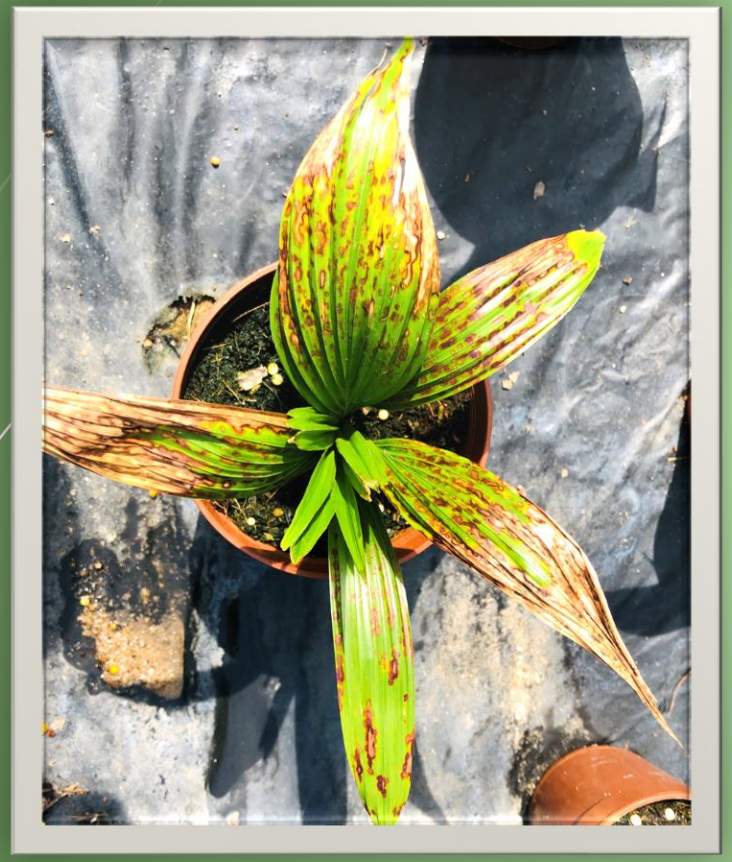
Introduction

Background

Why is it important to identify pests in floriculture?

- Prevent the spread of diseases among the plants
- Saves lots of pests control cost
- To get rid of shipment restrictions

Background



Have a look on this picture !!!

At a first glance,

- can you identify this as a pest infection or nutrient deficiency?
- Can you determine the exact percentage of the affected area?

Research problem

How to determine the correct nutrient fertilizer for the affected plant?

- **Nitrogen**
- **Phosphorous**
- **Potassium**

How to determine whether to ,

- **Export leaves**
- **Sell them locally**
- **Keep them for the mother plant**

Specific & sub objectives

Specific objective

Differentiate nutrient deficiencies from mite attacks and recommend plants for shipment

Sub objectives

- Identification difference between mite's attack & deficiency for the plant
- Recommending the nutrient fertilizer
- Calculated the affected area of a leaf in percentage
- Recommendation system for shipment
- Create a smart mobile-based identification

Research gap

Research 5
Identification of Pests on Black Orchid plants Using Naïve Bayes Method Based on Leaf Image Texture[5]

Research 6
Detection and classification of plant diseases in leaves through machine learning[6]

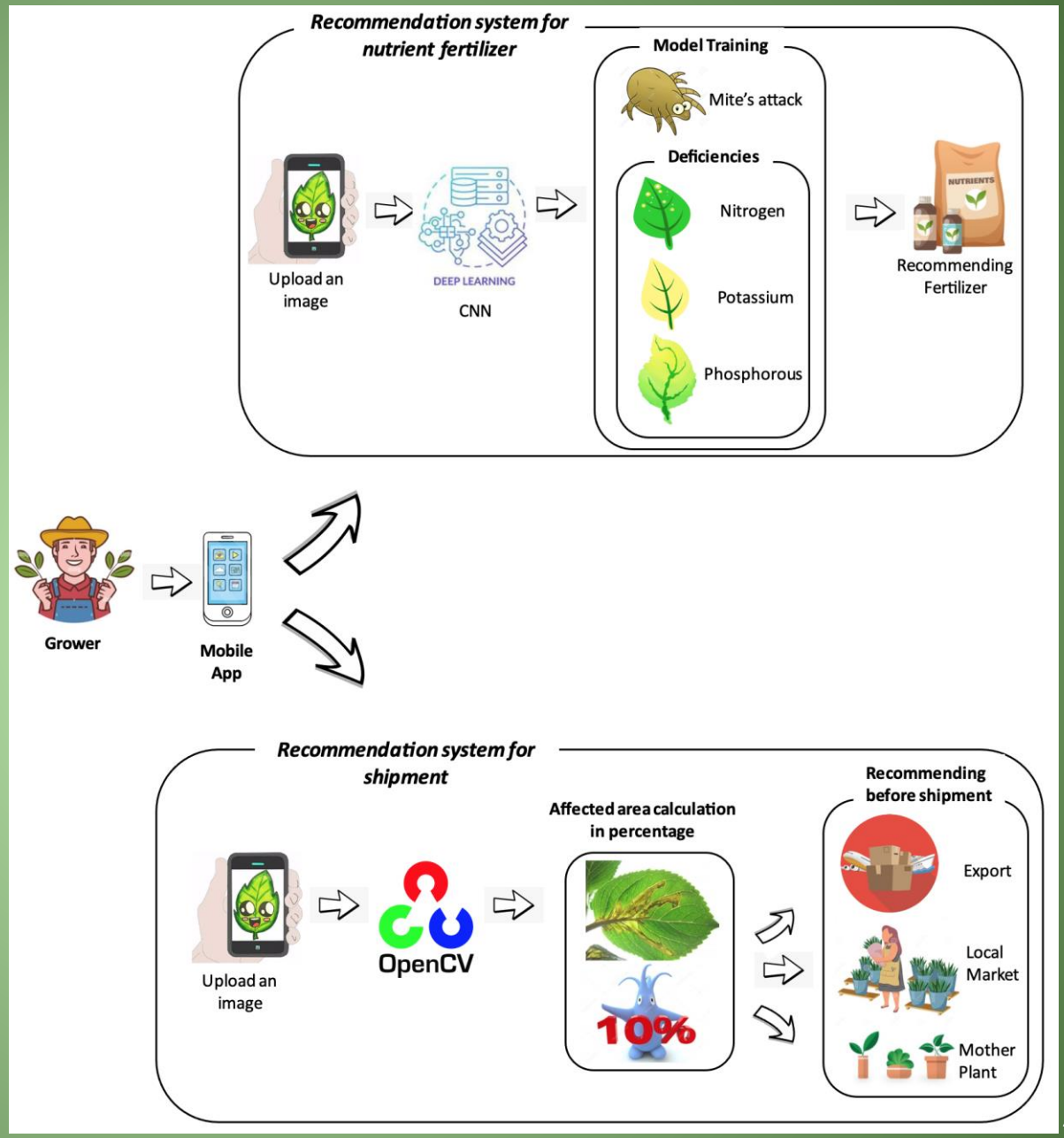
Research 7
Detection of Corn Leaves Nutrient Deficiency Using Support Vector Machine (SVM)[7]

Research 8
Detection of the affected area and classification of pests using convolutional neural networks from the leaf images[8]

	Identification difference between mite's attack & deficiency for the plant	Recommending the nutrient fertilizer	Calculated the affected area of a leaf in percentage	Recommendation system shipment	Mobile App
Research 5	✗	✗	✗	✗	✗
Research 6	✗	✗	✗	✗	✗
Research 7	✗	✓	✗	✗	✗
Research 8	✗	✗	✓	✗	✗
Proposed system	✓	✓	✓	✓	✓

Proposed methodology

System diagram



Technologies to be used

Technologies

- ✓ Flask
- ✓ Python
- ✓ Tensorflow
- ✓ Keras
- ✓ OpenCV
- ✓ Scipy
- ✓ Numpy
- ✓ React Native

Algorithms & Architectures

Algorithms
- ✓ CNN

Architecture
- ✓ VGG

Techniques

- ✓ Data preprocessing
- ✓ feature engineering
- ✓ Transfer learning
- ✓ Data augmentation
- ✓ Image thresholding
- ✓ Contour detection

System, personnel, & software specification requirements

Functional requirements

System should be able to:

- ✓ classify plant leaves as either deficient or infected with mites based on input images
- ✓ Recommend a fertilizer to be added to the plant based on the classification report
- ✓ Identify the affected area of the leaf and provide the percentage of the leaf that is affected
- ✓ recommend whether or not export the plant based on the percentage of the leaf that is affected

Non-Functional requirements

System should be:

- ✓ provide reliable recommendations
- ✓ able to process images quickly and efficiently
- ✓ Accurate in its classifications
- ✓ User-friendly

System, personnel, & software specification requirements

Personal requirements

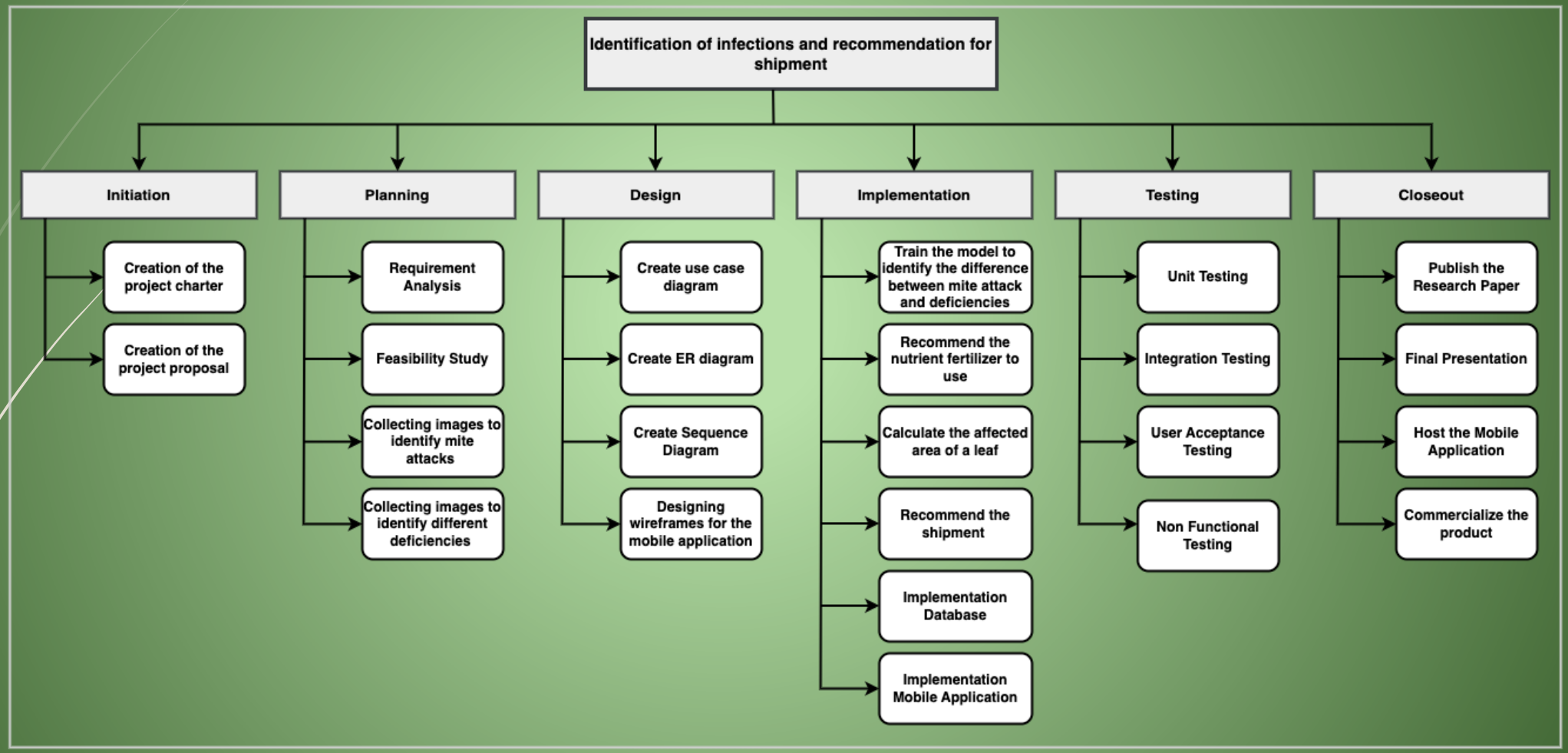
- ✓ The signs of mite attacks and nutrient deficiencies in plants can be identified using resources and images.

  - Omega Green (Pvt) Ltd,
    Badalgama,
    Sri Lanka

Software requirements

- ✓ Tensorflow
- ✓ Python
- ✓ VS code
- ✓ Jupyter notebook
- ✓ React Native
- ✓ Flask server
- ✓ OpenCV
- ✓ Scipy

Work Breakdown Structure



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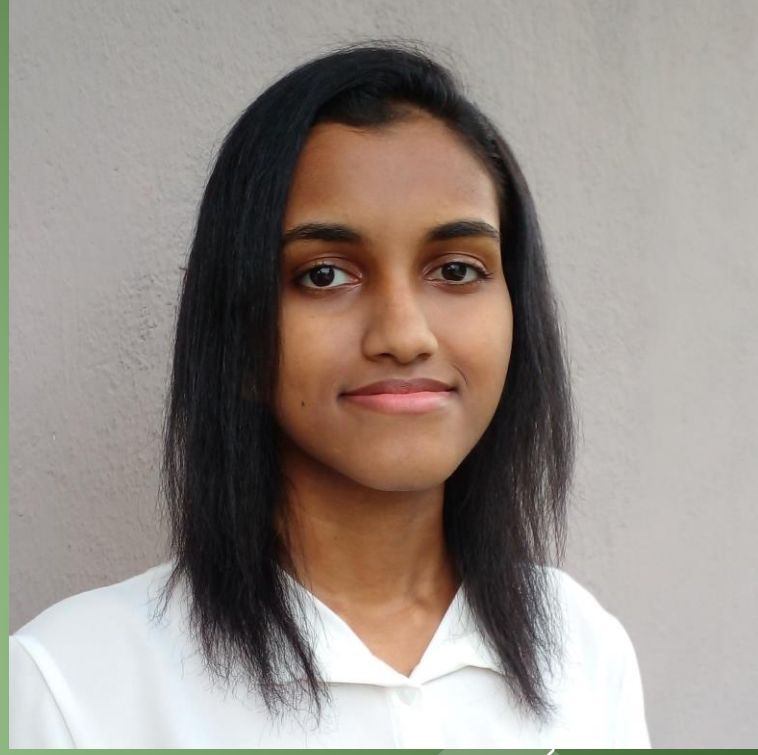

Specialization : Data Science

Plant recommendation system, variety identification and chatbot for industry beginners

3/28/2023

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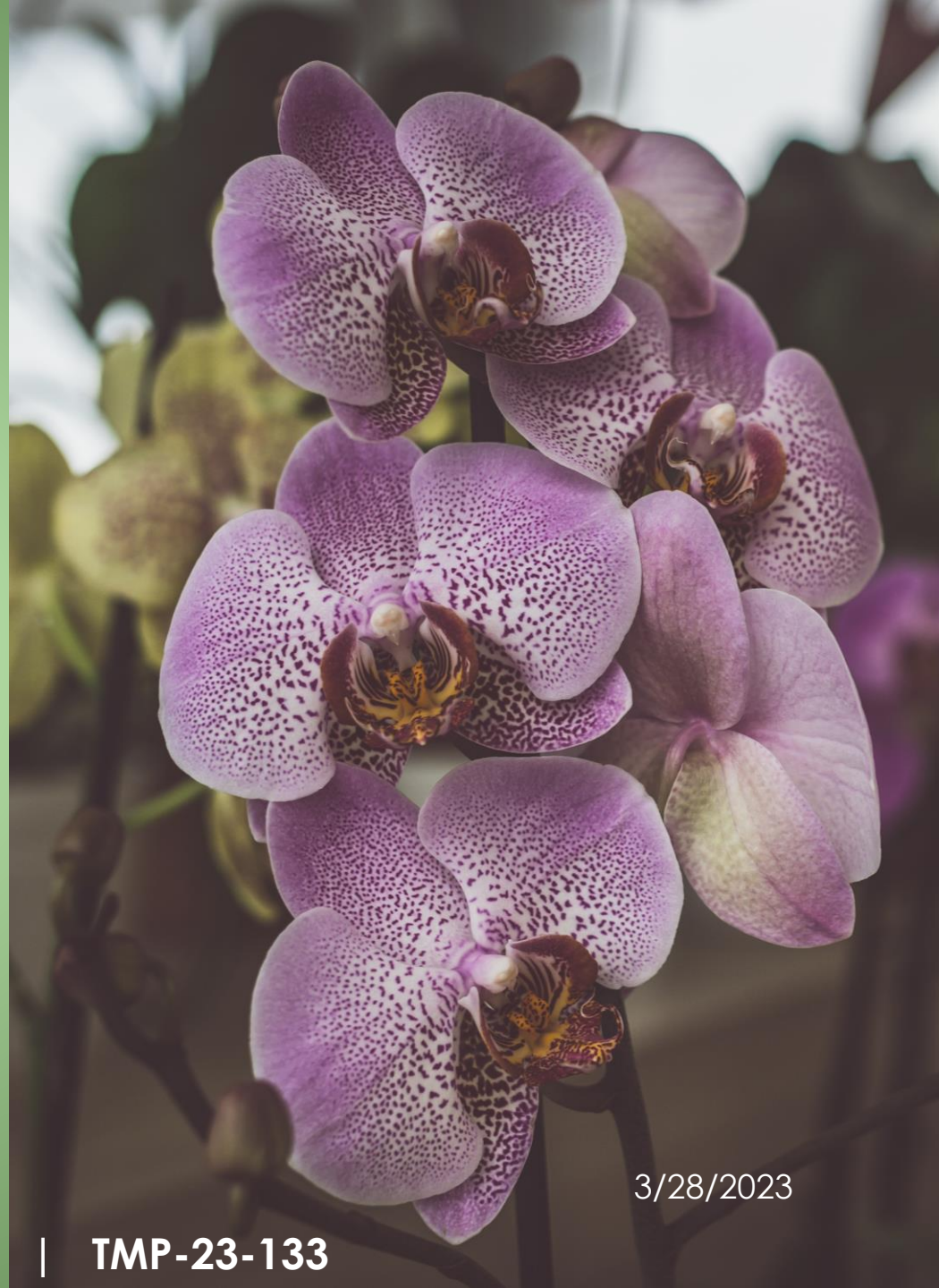
Introduction



Background

A floriculture plant should be carefully selected for growth based on the elements that impact a successful plant harvest.

The elements are weather factors and resource-related factors.

And identification is crucial when it comes to diverse species.

Also, Plants should be given the right care.

Beginners find it challenging because they don't have access to credible sources of knowledge.

Research problem

- **How to select the best floriculture plant to grow according to weather and resource factors?**
- **How to identify varieties of diverse floriculture crops?**
- **How to provide knowledge about plant care for multiple plant types?**

Specific & sub objectives

Specific objective

Plant recommendation, variety identification and chatbot for industry beginners

Sub objectives

- Obtain the climate data without hardware devices based on the grower's location
- Predict the best floriculture plant to grow
- Identify varieties of multiple floriculture crops
- Chatbot to assist in plant care for multiple floriculture crops
- Mobile application development

Research gap

Research 9
Smart Agriculture using IoT and Machine Learning[9]

Research 10
Crop Selection Using Data Analytics[10]

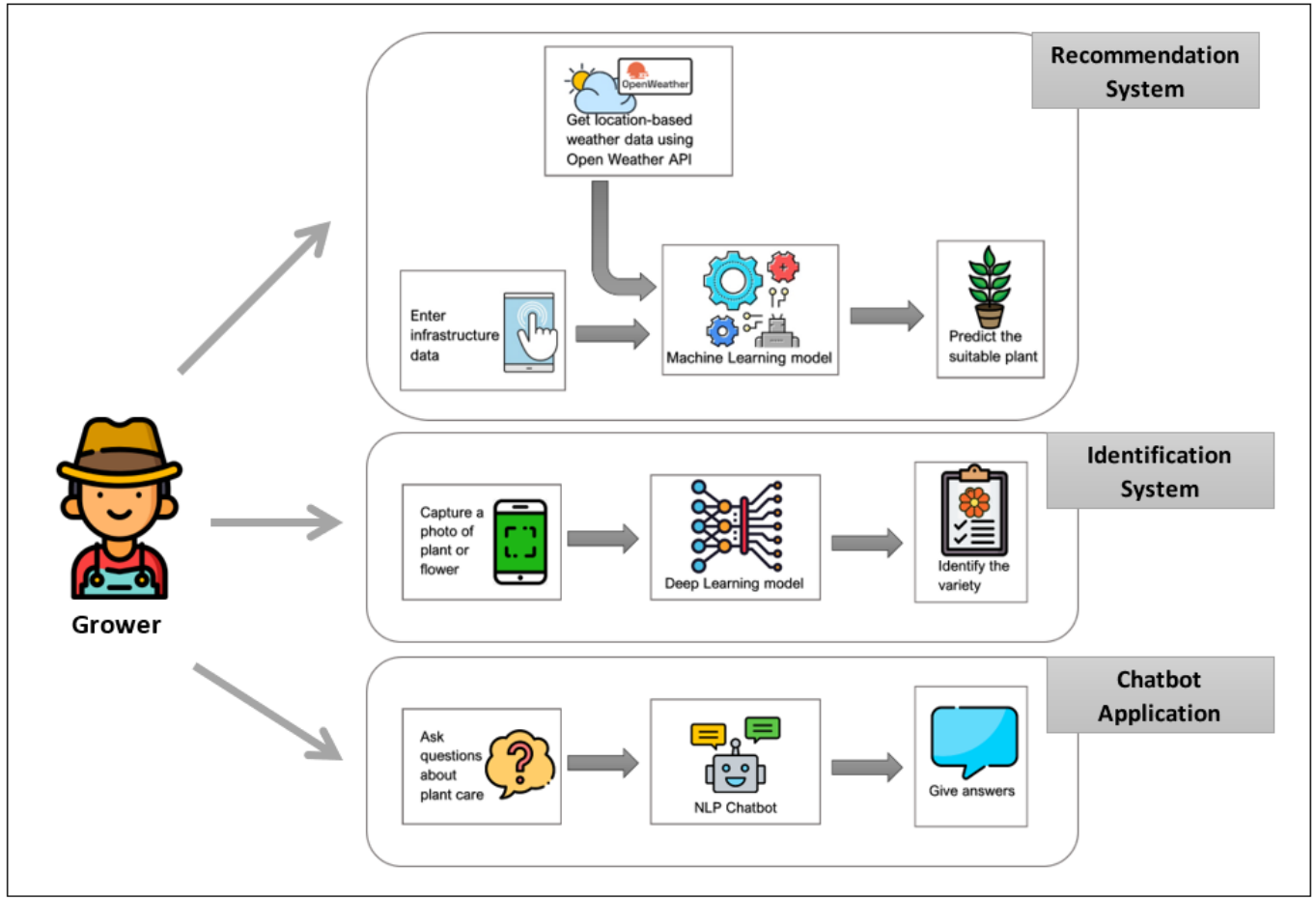
Research 11
Smart Intelligent Floriculture Assistant Agent (SIFAA)[11]

Research 12
BlossomSnap: A Single Platform for all Anthurium Planters Based on The Sri Lankan Market[12]

	Obtain the climate data without hardware devices	Predict the best floriculture plant to grow.	Identify varieties of multiple floriculture crops	Chatbot to assist in plant care for multiple floriculture crops	Mobile application
Research 9	✗	✗	✗	✗	✓
Research 10	✗	✗	✗	✗	✗
Research 11	✗	✗	✗	✓	✓
Research 12	✗	✗	✗	✗	✓
Proposed system	✓	✓	✓	✓	✓

Proposed methodology

System diagram



Technologies to be used

Technologies

- ✓ React Native
- ✓ Python
- ✓ Tensorflow
- ✓ Keras
- ✓ scikit-learn
- ✓ NLTK
- ✓ SpaCy

Algorithms & Architectures

- ✓ Supervised learning
- ✓ ANN
- ✓ CNN
- ✓ NER

Techniques

- ✓ Data preprocessing
- ✓ Feature engineering
- ✓ Transfer learning
- ✓ Data augmentation
- ✓ Intent Recognition
- ✓ Entity Recognition
- ✓ Dialog Management

System, personnel, & software specification requirements

Functional requirements

System should be able to:

- ✓ **Obtain the climate data forecast based on the location**
- ✓ **Get infrastructure data from the user**
- ✓ **Predict the best plant using the Machine Learning model**
- ✓ **Capture a photo of a plant or flower using the mobile phone camera**
- ✓ **Identify the plant or flower variety using the CNN model**
- ✓ **Get user questions and provide answers using a chatbot**

Non-Functional requirements

System should be:

- ✓ **Reliable**
- ✓ **Fast**
- ✓ **Accurate**
- ✓ **User-friendly**

System, personnel, & software specification requirements

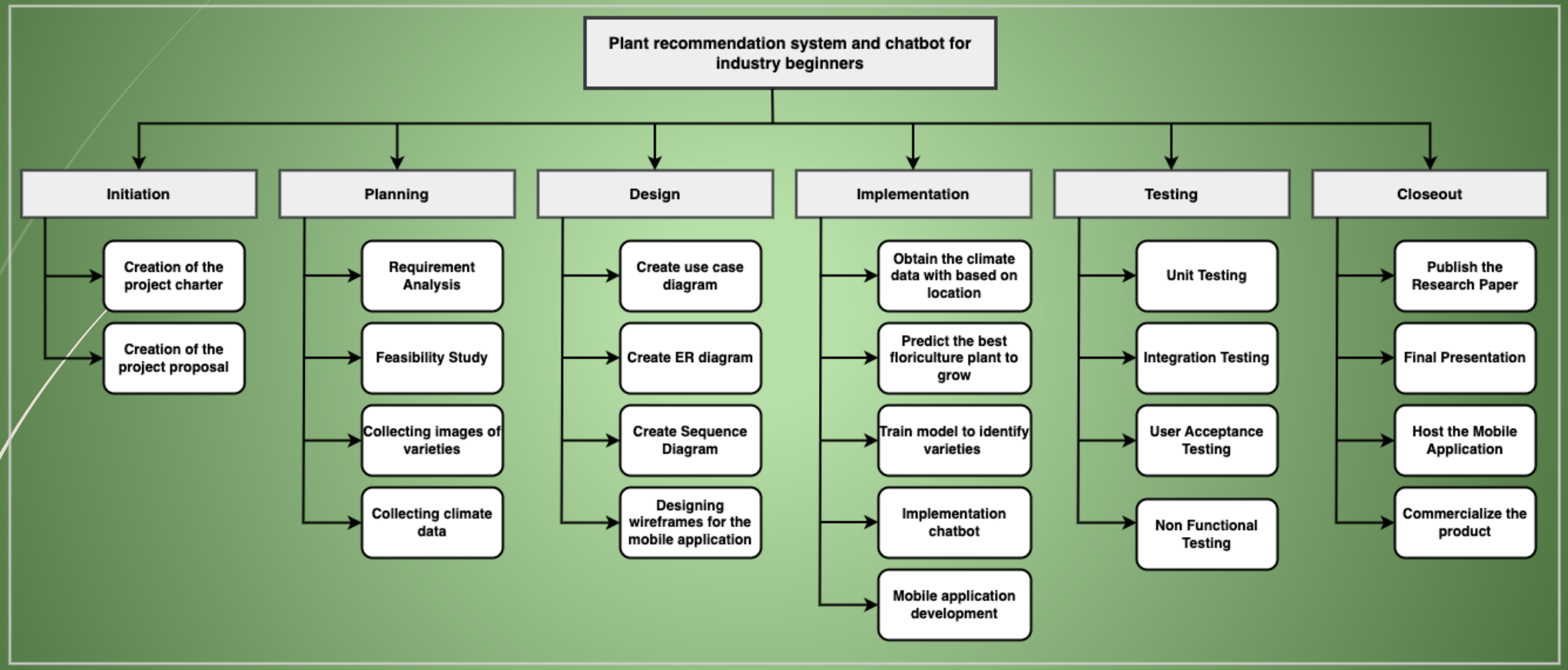
Personal requirements

- ✓ **Past weather data from Data Processing and Archival Division of Meteorological Department, Sri Lanka**
- ✓ **Images and data from Omega Green (Pvt) Ltd, Badalgama, Sri Lanka**

Software requirements

- ✓ **Tensorflow**
- ✓ **SpaCy**
- ✓ **Python**
- ✓ **VS code**
- ✓ **Jupyter notebook**
- ✓ **React Native**
- ✓ **Flask server**

Work Breakdown Structure



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Prabhashi P.A.N.

Specialization : Data Science

Predict seasonal and species-specific demand, estimate supply, and locate the closest vendor

Introduction

Background

The importance of this component

Forecasting the local and international demand for plants, seasonally and species-wise

Predicting purchasing amounts for the future:

- How the order should be supplied
- Focusing on the areas of:
  - Required output quantity
  - Nearest vendor
  - Packaging recommendations
  - According to plant life span

Research problem

How to forecast the future demand accurately according to various factors?

How to predict the amount of purchasing items precisely, considering the order and other facts?

How to find the nearest vendor easily?

How to keep the goods in better quality until the order is completed?

Specific & sub objectives

Specific objective

Improve the efficiency and accuracy of the floriculture industry

Sub objectives

- Forecasting the demand for local and international market considering multiple factors
- Predicting the amounts of purchasing considering the supply prediction
- Finding nearest vendors
- Recommending delivering and packaging information

Research gap

Research 13
Demand forecasting for the market using various technologies[13]

Research 14
Time series analysis using for forecasting depends not only on the features used but also on the trend and seasonality of the target variable[14]

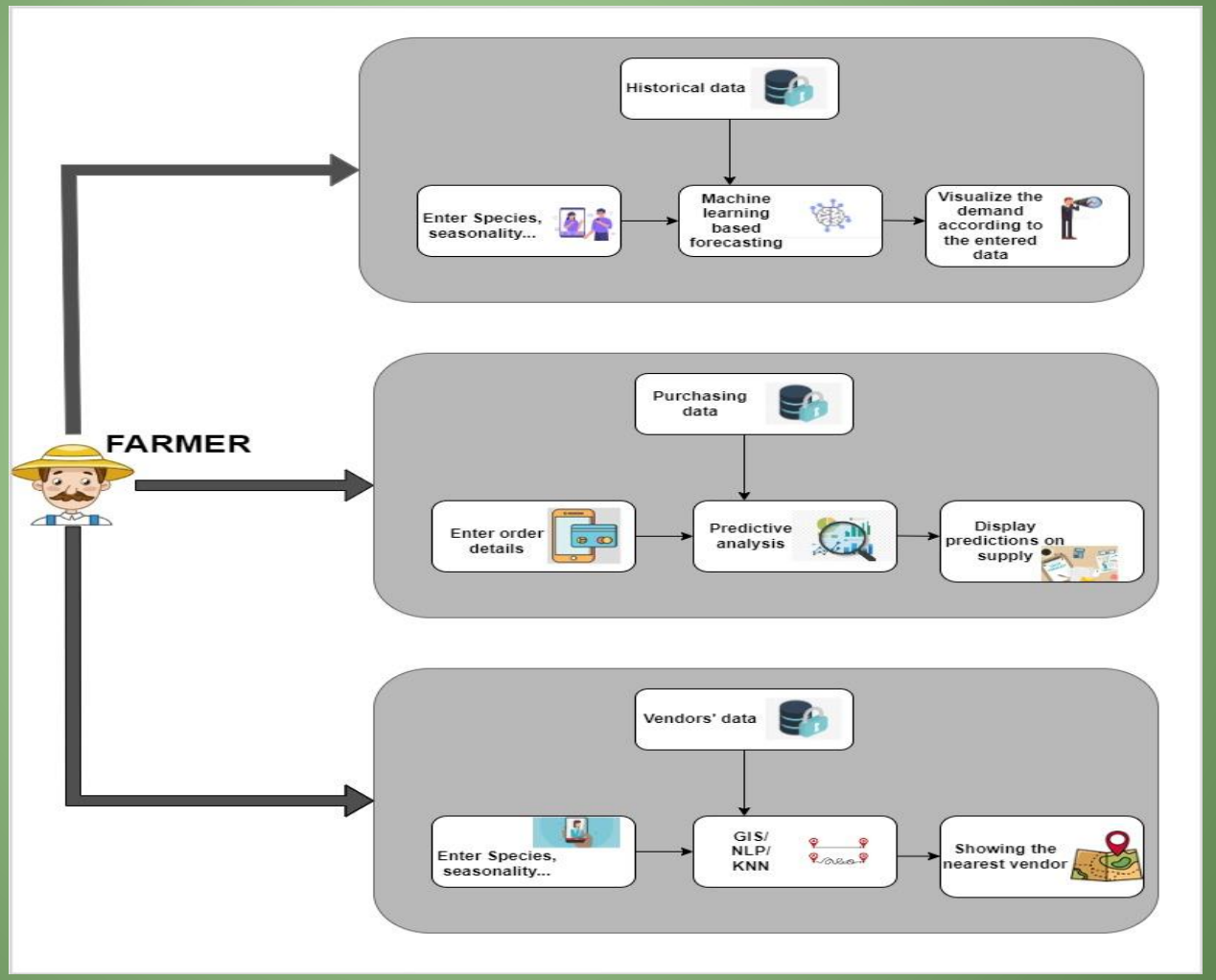
Research 15
Using LSTM model for supply prediction[15]

Research 16
Using mobile app to get optimal crop selection based on their land area[16]

	Demand forecasting according to different factors	Supply prediction using historical data	Using GPS technologies to point out the nearest and suitable supplier	Recommendation system for the packaging through out the delivery	Mobile application
Research 13					
Research 14					
Research 15					
Research 16					
Proposed system					

Proposed methodology

System diagram



Technologies to be used

Technologies

- ✓ Python
- ✓ Tensorflow
- ✓ React Native
- ✓ Geolocation API
- ✓ React Native
- ✓ Flask server

Algorithms & Architectures

- ✓ Time series analysis
- ✓ Regression analysis
- ✓ Dijkstra's algorithm
- ✓ KNN

Techniques

- ✓ Data preprocessing
- ✓ Predictive Analytics
- ✓ Location Based Services
- ✓ Recommendation System

System, personnel, & software specification requirements

Functional requirements

System should be able to:

- ✓ **Using user entered data for classified the information**
- ✓ **Predicting the demand and supply accurately**
- ✓ **Visualize the detailed information on predictive**
- ✓ **Give suggestions about the how should be the delivery done, what will be the needs**
- ✓ **Find the location of the nearest vendors**

Non-Functional requirements

System should be:

- ✓ **User Friendly interfaces**
- ✓ **Higher level of accuracy in the visualizations and the outputs**
- ✓ **Fast and responsive**
- ✓ **Reliable**

System, personnel, & software specification requirements

Personal requirements

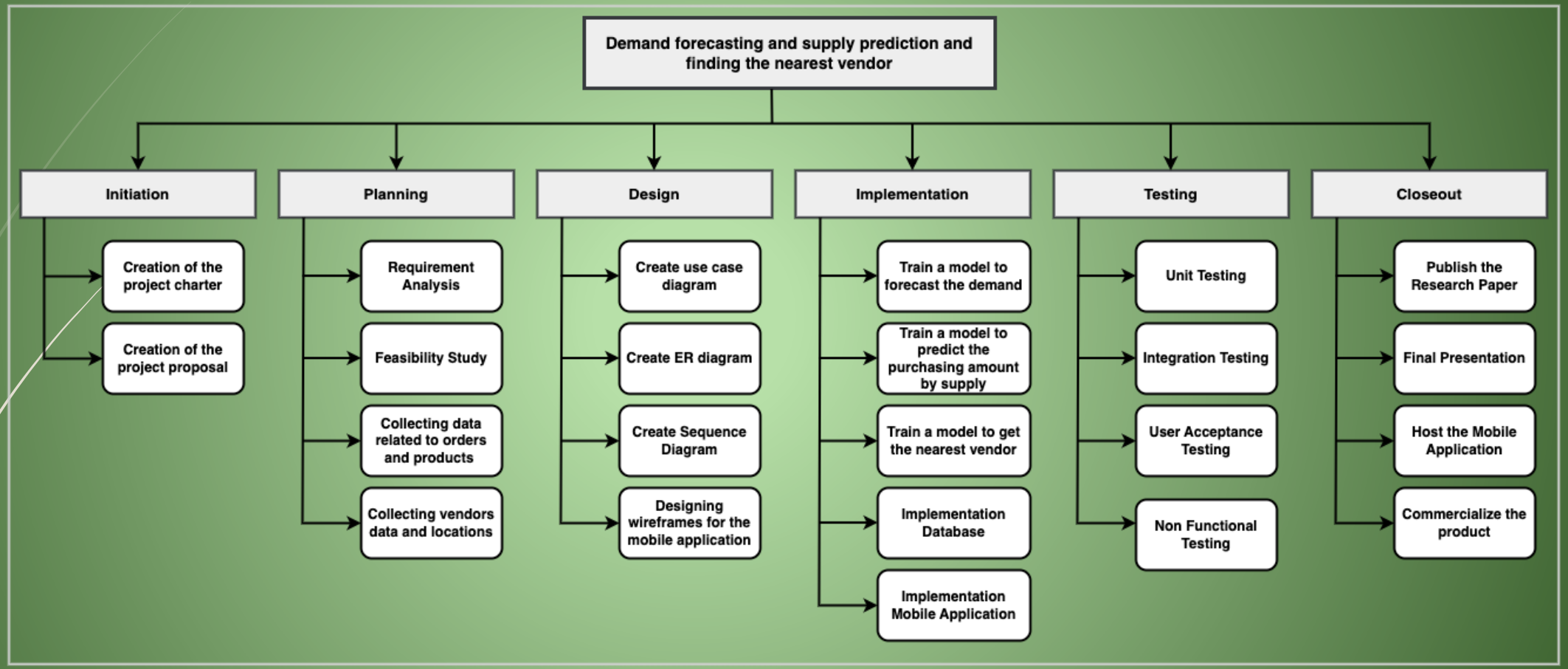
- ✓ Resources and data of the past orders and market details
- ✓ Data set on vendors
- ✓ Data set on the preservatives have been used in the procedure
- ✓ Hope to use data collected from

  Omega Green (PVT) Ltd,Mullayaya Estate, Godigamuwa, Badalgama, Sri Lanka

Software requirements

- ✓ Tensorflow
- ✓ SpaCy
- ✓ Python
- ✓ VS code
- ✓ Jupyter notebook
- ✓ React Native
- ✓ Flask server

Work Breakdown Structure



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Supporting items

Commercialization & Business plan

Commodity Version

- Prediction of the current state of growth in ornamental plants
- Identification of the relative growth rate of plant height
- Distinguishing nutrient deficiencies from mite attacks
- Identification of the most suitable floriculture plant to grow based on weather and resource factors
- Forecastination of the demand for local and international markets

Premium Version (100$ annually)

- Prediction of the time it will take for a plant to reach the required growth size for an order
- Providing suggestions to promote growth and advance the ornamental plant to the next level
- Identifying various floriculture crop varieties
- Incorporating a chatbot as a resource for guidance on growing multiple plants
- Recommendation of plants for shipments
- Predicting the optimal supply strategy for meeting the required output quantity based on geographical areas and finding the nearest vendor
- Providing packaging recommendations based on the plant's lifespan

Commercialization & Business plan

Target Audience:

- Floriculture businesses (small, medium, & large scale)
- Farmers and gardeners who grow ornamental plants
- Horticulture enthusiasts
- Research and educational institutions

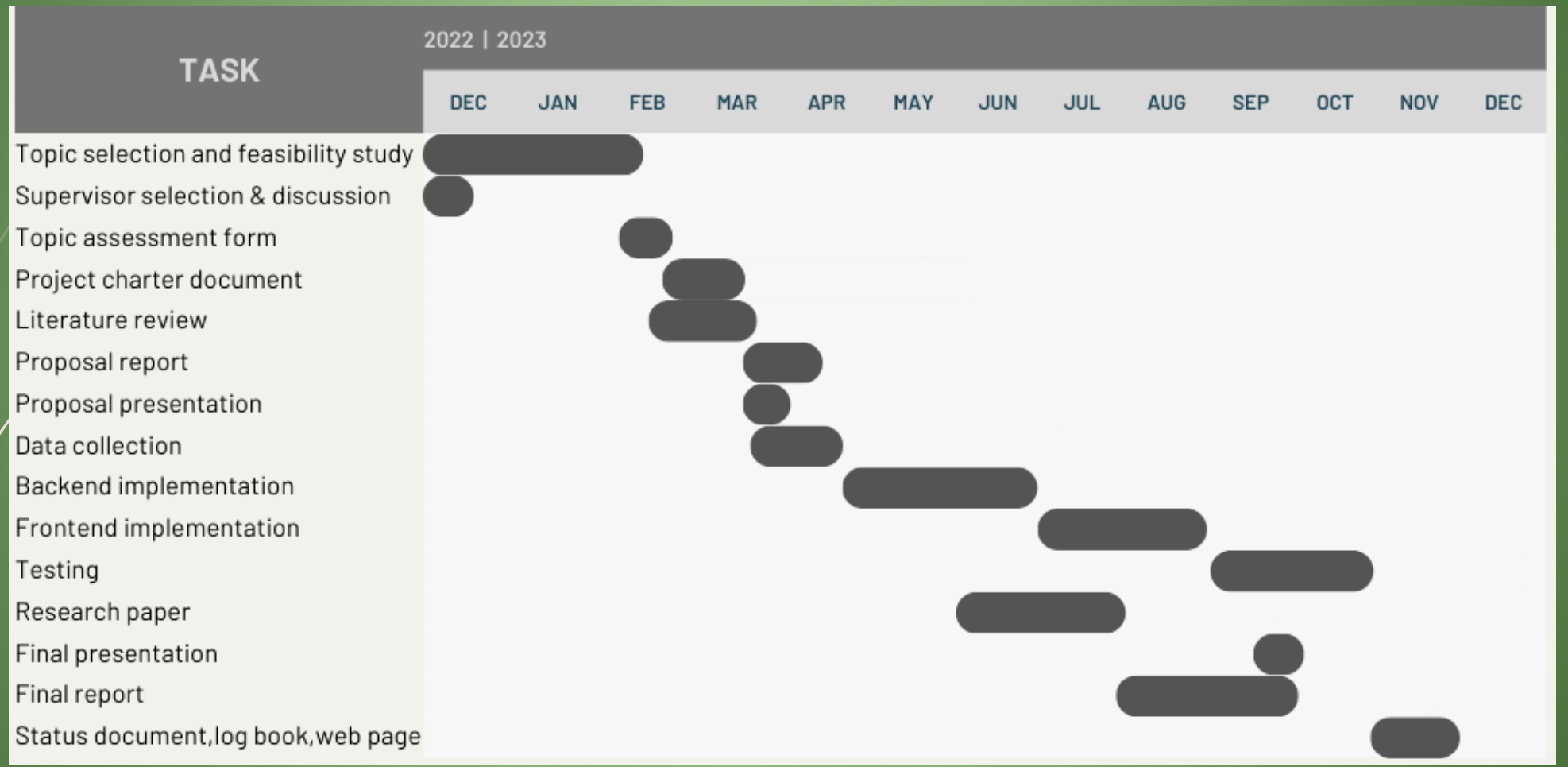
Marketplace:

- Mobile application for Android & iOS devices
- Secure & user-friendly interface for customers & vendors

Marketing Plan:

- Social media marketing (Facebook, Instagram, Twitter)
- Google Ads and search engine optimization (SEO)
- Email marketing campaigns
- Share leaflets
- Influencer marketing (garden bloggers, YouTube channels, etc.)

Gantt chart

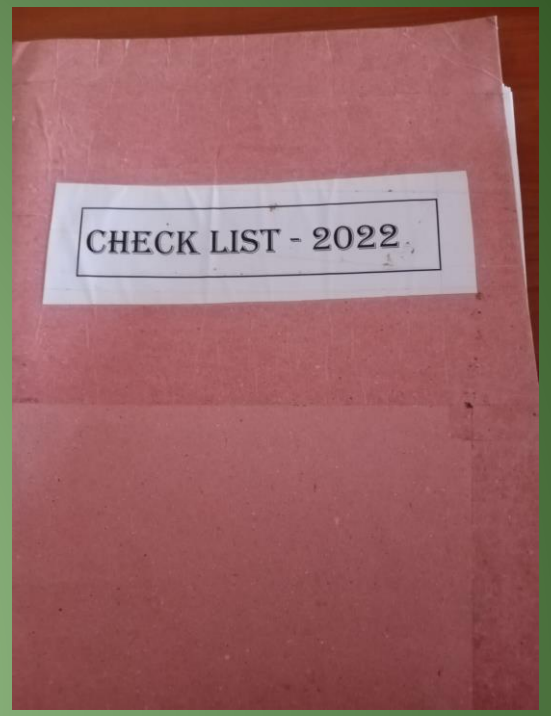

TASK
2022 | 2023
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
Topic selection and feasibility study
Supervisor selection & discussion
Topic assessment form
Project charter document
Literature review
Proposal report
Proposal presentation
Data collection
Backend implementation
Frontend implementation
Testing
Research paper
Final presentation
Final report
Status document,log book,web page

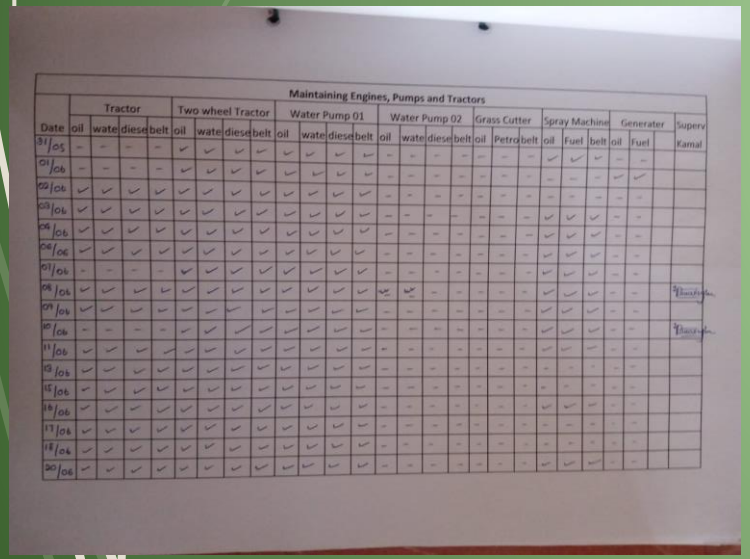
Budget

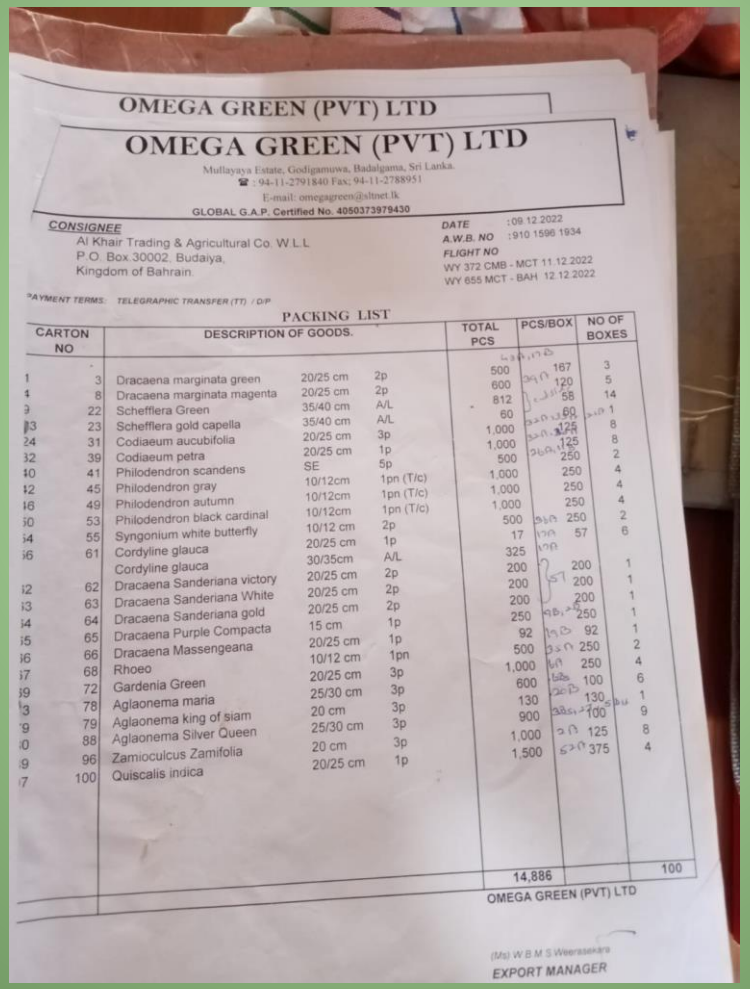
Component	Price
Travelling Cost and other expenses for the research Team	Rs. 30000
Crowdsourcing	
Deployment Cost	Rs. 8000/Monthly
OpenWeatherMap API	Rs. 1960/location
Mobile App-Hosting on play store	Rs. 8075
Mobile App-Hosting on App store	Rs. 22610/monthly

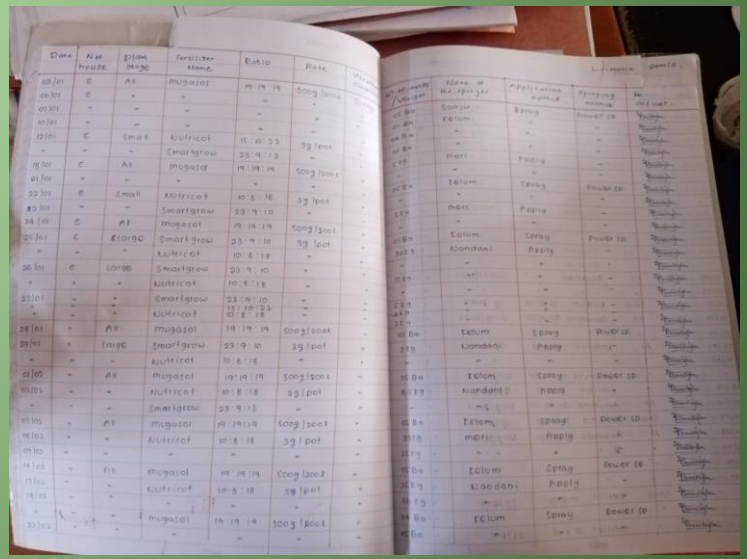
Field visit to Omega Green (Pvt) Ltd, Badalgama

Field visit to Omega Green (Pvt) Ltd, Badalgama










Thank You


Q&A