"E-KETHA": ENRICHING RICE FARMER'S QUALITY OF LIFE THROUGH A MOBILE APPLICATION.

2022-81

Final Report

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ABSTRACT

In our country of Sri Lanka, rice is the most common type of food that is consumed daily. Due to that rice farmers face a huge amount of stress to supply according to the massive demand. Identifying the growth of the paddy plant in the field of paddy cultivation is one of the most important roles in the field of paddy cultivation. The growth of paddy seedlings is a natural process and if proper care is not taken in this area it can cause severe growth retardation of paddy plants. Therefore it affects the productivity, quantity, and quality of paddy products. Some other reasons for paddy retardation are diseases, lack of water, and fertilizer not only limiting the growth of the plant but also reducing the yield of paddy and destroying it. Therefore it is necessary to identify the cause of growth reduction. Image processing is used to measure the growth of the paddy plant and the reason for the defect while machine learning will give the most suitable solution.

Keywords:- machine learning, image processing, deep learning, rice crop, height, paddy plant

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1. INTRODUCTION

1.1 Background

One of the staple food in Sri Lanka is the common rice that can be farmed in paddy fields. Due to various reasons, farmers find it difficult to reach the demanded quota. One particular reason for this is the issues when it comes to the growth of rice plants.

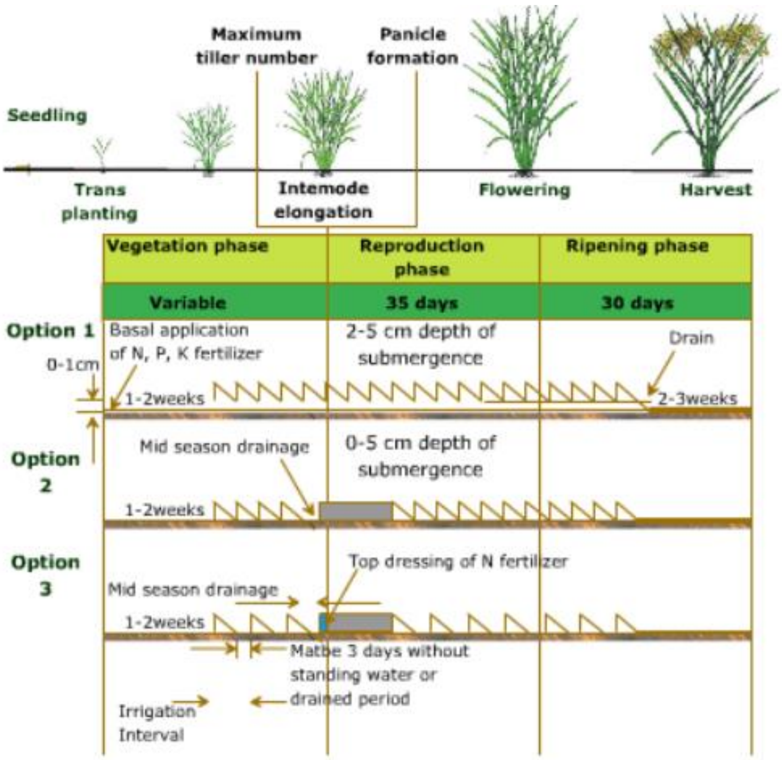
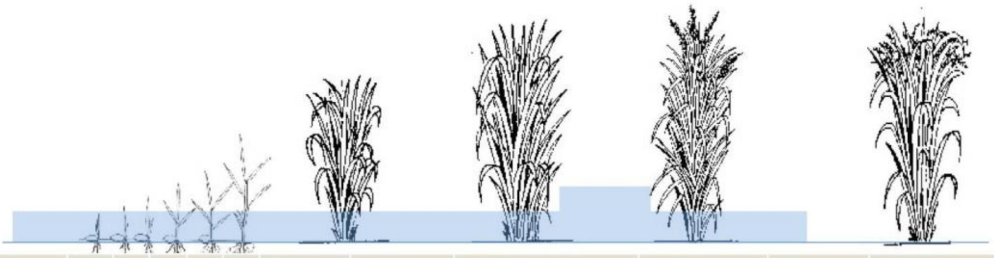


Figure 1:Rice plant growth lifecycle

As it is shown in above figure 1 [7] there are many different lifecycle stages when it comes to rice plants. These phases can vary according to the rice plant. Since the proper treatment and needs of the rice plant change frequently it could be difficult to properly treat them. Due to this, farmers lose much to produce and profit.

1.1.1 Why rice height is important?

Plant height is a central part of the plant ecosystem strategy. It is closely related to lifespan, seed mass, and time to maturity, and is a key determinant of a species' ability to compete for light. Plant height is also associated with critical ecosystem variables such as animal diversity and carbon storage capacity. However, global patterns of plant height are significantly smaller. The most effective metric height is when measuring the growth of rice plants. This is because height is the clearest and most concise way to tell a particular plant stage



Stage	Plant	Leaf 1	2	3	4	5	Tillering begins	Maximum tillering	Panicle initiation*	Heading	R7	Maturity
Days**		11	15	20	26	33	Typically begins at the 4 leaf stage		All varieties = 55	E = ≤80 VE = 80-90	E = 100 VE = 105	
Degree Days		107	160	187	246	281			All varieties = 472	E = 796 VE = 864	E = 1007 VE = 1059	
Water	Flood	Water management varies depending on pesticide programs.							Raise water between PI and heading†		Drain	

Figure 2:Rice age and growth

As shown in figure 2 [6] it is clearly evident that to get a maximum harvest out of the crop proper growth is necessary. To identify the best harvesting we need to identify the stage that the plant is in. In order to know the stage the no of days is also a necessity.

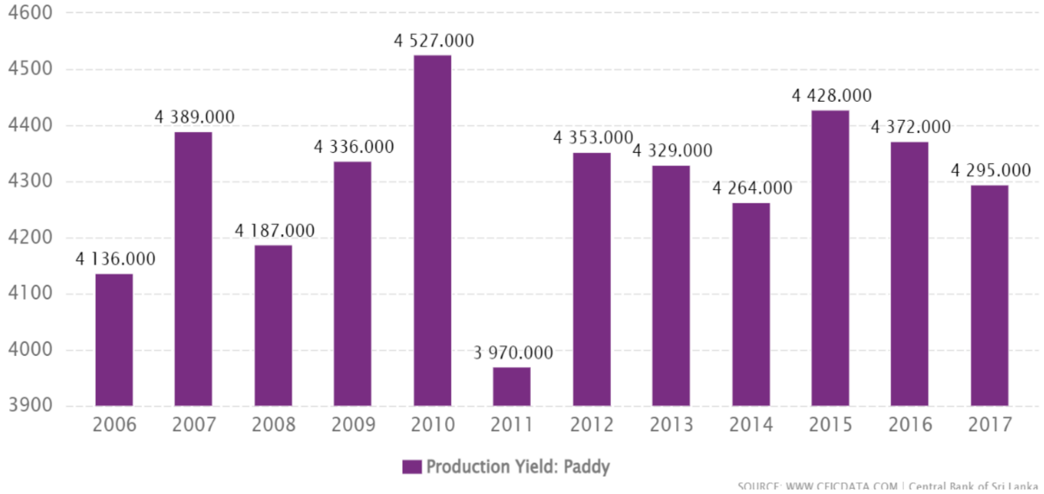


Figure 3: Paddy production in Sri Lanka

Figure 3 [8] shows the rice production in Sri Lanka throughout the years starting from 2006 – 2017. Excluding the year 2011 when paddy production was halted due to natural disasters [9], we can see a downward trend when the timeline gets nearer. According to the traditional farmer's opinion, the reason dwindled into the mismanagement of paddy crops during their growth.

1.2 Literature Survey

1.2.1 Rice Crop Height Measurement Using a Digital Image Processing

This is a plant height identification method currently in operation in Thailand. It detects the height of the plant and shows the height of the plant to the user. But it does not use a mobile app.

Here is an automatic image processing method to identify the user based on the photos taken by a digital camera mounted on a field server, including a marker bar used to describe the height of the rice plant. Height can be estimated by analyzing the uploaded image obtained by the user. Here the marker bar is used to measure the height of the rice crop and compare it with the starting point. Further, digital image processing for analysis uses four steps to automatically measure rice crop height. So you can get the height of the rice tree [3].

1.2.2 Measurement of crop height using UAV-Based Lidar

This is an application based on finding height measurements. It is considered by many plants, but not so for paddy plants. You are a farmer and it is important to conceptualize crops because of the increasing pressure on food production. Therefore, an accurate assessment of biomass during the growing season is important to optimize yield.

Therefore, UAV-LiDAR examined data availability for estimating fresh biomass and crop height for three different cultivars (potatoes, sugar beets, and winter wheat). This was done using the algorithm 3DPI to estimate the crop height using the mean height of the highest point variable number of the plant.

It does not use a mobile application for height measurement, and for maximum efficiency, it uses RGB cameras mounted on a vehicle's LiDAR-based system or UAV (unmanned aerial vehicle), plant height, LAI, and leaf cover section. Such characteristics are determined directly in the field [1] [2]

.

1.2.3 Measurement of plant heights in an agricultural field using a time-lapse camera

This is an application used to measure plant height with adequate temporal and spatial resolution. This is a low-cost and easy-to-use method for height search. Here the use of a camera is to capture seasonal and year-to-year variations in plant height that represent plant height on a site scale. This method was used to determine the height of the plant up to the nearest 1 cm from the camera images by pointing a certain scale strip at a particular field.

The obtained plant heights were corrected for vertical distortions and a good agreement on plant height was obtained by comparing them with direct height measurements for each of the target plants and site-scale plant heights averaged from the 10 samples. It does not use a mobile application and image processing but uses a sensor and a digital camera [4].

1.2.4 Measurement of heights of rice and tiller fragmentation of rice crops

This research is done by accessing the height and tiller count which is necessary for accessing a plant's phenotype. The automation of phenotyping recommended here makes it so that manual visual assessment is not needed due to the highly accurate, reproductive, and traceable image processing.

By applying HSV and thresholding for processing, Canny Edge Detection (tiller) and Zhang-Suen Thinning Algorithm (height) for the plant structure and the Euclidean Distance for measuring the height, tiller counting is done. 17.25% for height and 34.02% for tiller count were found during the testing and this may be caused by the plant not being able to fit the frame. This may be also caused by yellow leaf removal done during processing [5].

1.3 Research Gap

Features	1.2.1	1.2.2	1.2.3	1.2.4	E-Ketha
Height measurement	✓	✓	✓	✓	✓
Growth phase deduction	✓	✗	✗	✗	✓
Aerial Imagery Used	✗	✓	✗	✗	✓
classify rice plant height	✗	✗	✓	✗	✓
Propose a Solution on how to growth of the plant	✓	✗	✓	✗	✓

Table 1:Comparing existing applications and our application features

2. RESEARCH PROBLEM

Rice productivity is highly dependent on the Sri Lankan economy. Nowadays paddy growers are moving away from paddy cultivation. The main reason for this is that they are not able to earn a fair income. This is a major problem in paddy cultivation.

The growth that affected rice plants is one of the major problems in paddy cultivation. Paddy growers lose a large percentage of their annual paddy harvest due to a lack of knowledge about the growth of paddy cultivation. Farmers are not aware of the process of increasing the growth of paddy. Also, due to the lack of support from technology, the younger generation is moving away from paddy cultivation.

So the solution is to create a mobile application that works in parallel to these major problems in paddy cultivation. Using this application, paddy growers can gain knowledge about their growth of paddy cultivation and how to uplift profit

3. OBJECTIVES

3.1 Main Objectives

The main objective of identifying the growth of paddy plants is to create an Android-based mobile application that analyzes the changes in the paddy tree using image processing technology and tracks the height of the paddy tree. The Mobile-based application is used to identify the height of a paddy tree with the help of an automated algorithm. The algorithm uses the database to identify the most vulnerable and predict the most accurate outcome. In addition, the application provides treatment to a paddy grower to increase the growth of paddy cultivation.

3.2 Specific Objectives

01 The application identifies the growing height of the rice plant by analyzing the changes in the growth of the paddy plant.

The paddy grower uses a mobile phone at a specified distance from a rice plant to take an image and upload it through the application using image processing technology. The application compares the height changes of a paddy plant with the data uploaded in the database and identifies whether the paddy plant has grown or not.

02 Application Rice plants are classified according to their height.

Once the height scale is successfully identified, the rice plant is classified according to its growing size. There are stages of good, normal, low, and so on.

03. The application will treat according to height type and the current status of height.

The application will suggest treatments to enhance the growth of the paddy plant to the identified heights

4. METHODOLOGY

This section will entail the details on the techniques and mechanisms that are employed to create the Growth Detection component, belonging to the “e-ketha” application from the data gathering stage all the way to implementation. Details include how the software will be used in our project what materials and data will be required, and how they will be collected.

4.1 Height Identification of the Rice Plants

Height affects the growth of paddy. Growth for height has a life cycle of several different loves. These include seeding, transplanting, maximum tillering, panicle formation, flowering, and harvesting. Many farmers have no knowledge of growth.

Therefore create a database on paddy cultivation using data excavation techniques and model analysis. The training database is retrieved with the information provided by the user. The user uploads the tall image of the paddy plant to the mobile application system and at the same time takes the date and time as user input. The image is then analyzed and the result obtained with the date and time obtained from the user identifies how much the rice tree height has increased with the database. If it is identified as low growth, it will show the treatment methods required for paddy cultivation. The height of the paddy tree must be accurately identified for this process. The height of the paddy tree should be taken at a specific distance. Image processing, machine learning, and deep learning techniques are used for this process to give the possible solution so as to improve the growth of rice plants.

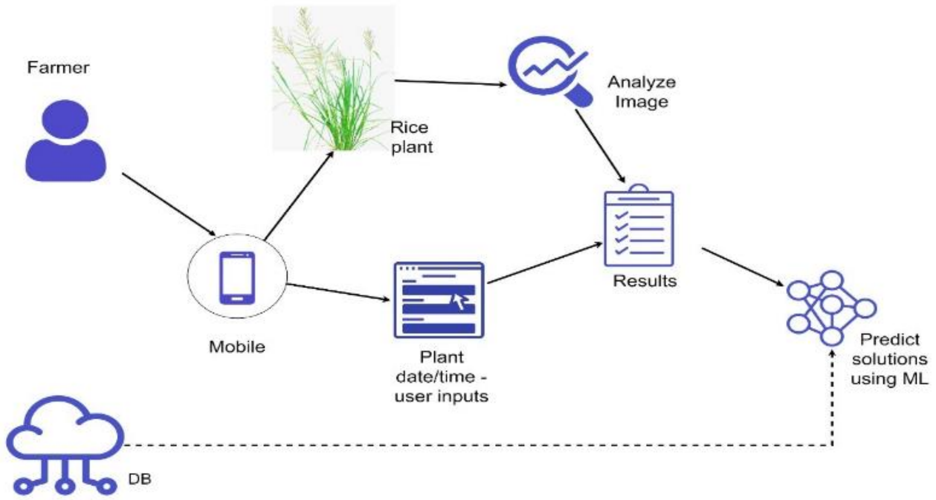


Figure 4:Growth tracker overview

4.1.1 Rese

When it comes to the research area, four features were identified. Such as Image processing activities, Classification activities, Detection activities, and finally solution prediction. In order to conduct the research, deep learning technology has been taken as the core foundation.

4.1.2 Requirement Gathering And Analyzing

Due to the importance of requirement gathering and analysis, major emphasis was put on this section. Since there is a need for this process to be strictly on the "Identification of growth deficiency and solution finding" part below mentioned approaches were used.

- Reading research papers relevant to the research problem.
- Studying existing systems related to our research area.
- Contacted experts at Rice Research and Development Institute(RRDI), Bathalagoda.
- Met with Sri Lankan paddy farmers.

To get an idea about the research problem, studying related research papers is a must. The next step was to understand what types of systems already exist, so as to see what is lacking and needs improvements. Finally, to see if the proposed solution is viable in the current environment, specialists in the field and traditional farmers were contacted.

4.1.2.1 Functional requirements

- Ability to upload rice crop imagery.
- Identify the height of the plant.
- Calculate the growth.
- Propose solutions.
- Show proposed solutions.

4.1.2.2 Non-functional requirements

- Reliability
- Accuracy
- Availability
- Performance
- User friendly

4.1.3 Design

The design phase encompasses what is needed for the estimation of hardware and system requirements by the creation of a system architecture, due to the needs and specifications being included. The architecture will entail the components separated into manageable levels according to the respective research project member. In this case, it will be the "Identification of growth deficiency and proposing solutions" component.

4.1.4 Tools and Technologies

4.1.4.1 Tools

- Android Studio
    - This is chosen due to it being the primary IDE recommended for Java mobile application development. The user-friendliness coupled with the performance, security, and feature richness also makes this the most suitable option.
- Google collab
    - Since some of the deep learning models require high amounts of computational resources a virtual environment like google collab is most appropriate.
- Google Drive
    - Since google collab is used for the model training, the dataset cannot be stored on personal computers thus google drive is needed for storing the dataset.

4.1.4.2 Technologies

- Deep learning
    - Deep learning is the only solution for image classification and identification tasks such as this. Due to there being no similar prior work, a model has to be created and trained from scratch.
- Models
    - AlexNet
        - AlexNet was identified to be the best for the identification of rice plants.

      The evidence for this is provided below within the methodology.
- Android Java

    - Since the application is initially targeted toward android devices, in order to provide the smoothest experience possible native android java is used.
- Firebase
    - Due to the application requiring a real-time online connection to the database firebase is chosen as the primary database. Since the data set mostly consists of images the need for a document-based database is further insinuated.
- Python
    - For the machine learning and deep learning parts of the application, python is used due to the wide range of libraries and frameworks available for such tasks compared to other languages. The simplicity and consistency with the large community are also a benefit.
    -

4.1.5 Data acquisition

A custom-made dataset has been created for this component which contains 3800 images split into 2 different classes with them being "rice" and "non-rice" used for rice crop growth identification and providing solutions.

4.2 Commercialization aspects of the product

4.2.1 Target audience

The primary target audience for this application will be rice farmers with rice suppliers, researchers, buyers, sellers, and any person who is connected to the rice farming process being the secondary audience.

4.2.2 Design of the app

A comprehensive and easily understandable UI and UX are created so that even non-tech-savvy users will not be confused while using the application. This will make sure that the application will reach a wide audience.

4.2.3 Gap in the market

Currently, in the play store, there is no other similar application to be found. This already makes the application unique and stand out.

4.2.4 Marketing Plan

The initial incentive will be to introduce this application to the farmers themselves. This will enable us to get feedback directly from the primary target audience which will then make it easier to enhance and optimize the application further, thus making a better product.

This application will be promoted by famous influencers and through social media platforms.

4.2.5 Pricing

Most of the functionality will be provided for free with them including,

- Pest identification
- Disease identification
- Weed identification
- Fertilizer type identification
- Weed mapping
- Growth deficiency identification

This will be with a free application.

In order for the solution providing functionality associated with the above-mentioned features to be enabled, a small price will have to be paid on a monthly basis.

4.2.6 Budget

A price will have to be allocated for the influencer and social media promotions. In order to publish the application another, sum also has been assigned. Finally, the database will also be required a monthly payment

4.2.7 WBS

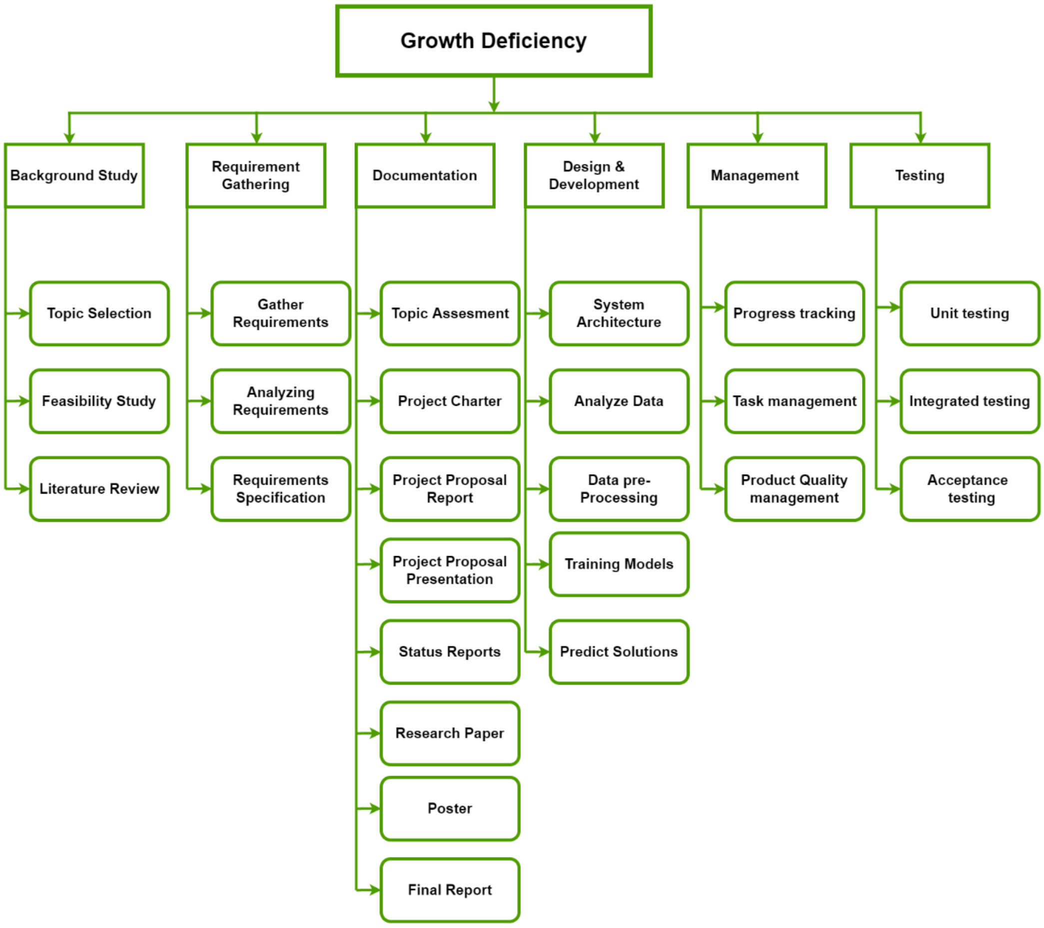


Figure 5:WBS

4.2.8 Gantt Chart

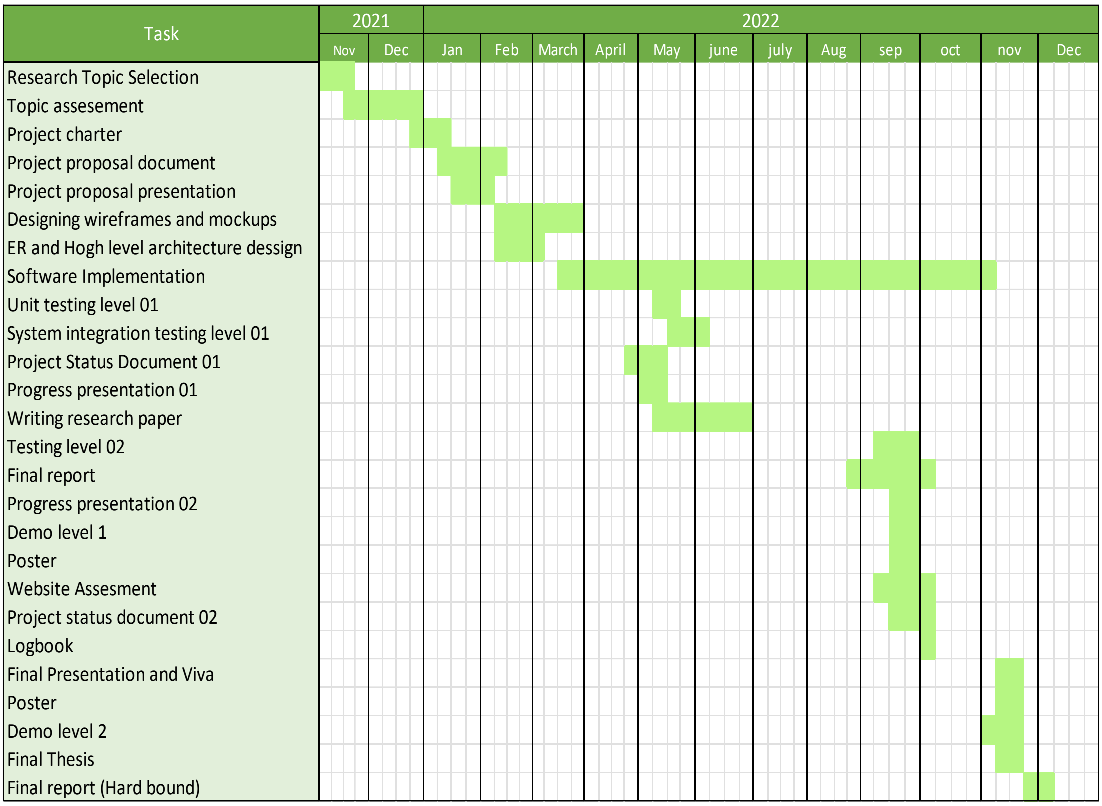


Figure 6:Gantt Chart

5. Testing & Implementation

5.1 Implementation

In this stage of the project, the implantation of the system will be started. This will be in accordance with the system architecture proposed in the previous design phase. The "Identification of growth deficiency and proposing solutions" component will be further split into three subcomponents, them being

- Identify the rice plant using imagery.
- Identify the height of the plant using imagery
- Proposing solutions.

5.1.1 Pre-processing

When it comes to pre-processing all the models that are described below went through the same process. Which includes shuffling, resizing, rescaling, and flipping horizontally and vertically. Finally, normalization was performed according to the mean and standard deviation calculated for the datasets

5.1.2 Model

5.1.2.1 RICE CROP GROWTH IDENTIFICATION AND PROVIDING SOLUTIONS:

This is done to identify whether the plant is a rice plant or not. For this, a custom AlexNet model[10] with Keras TensorFlow is used for the specification of this dataset and its special quality which is speed. Another strength this algorithm possesses is nonlinearity which is provided by Rectified Linear Unit (ReLU). This also adds to its already impressive speed.

The layers of the model have been modified accordingly in order to get maximum accuracy. 3 - Convolution2D layers with relu activation function, 3 –Max pooling layers, 2 – Fully connected hidden layers, 1 –Fully connected output layers, 1 – Flatten layer (to get output in a set of numbers), 2 – Dropout layers, and 3 –Dense layer with 'SoftMax' activation function. The images were resized to 227*227 which is the required input size of the AlexNet model.

To measure the height of the rice plant, A python code has been implemented that can measure the height when the distance to the plant has been inputted. 80% and 20% split was made for the training and testing set. Hyperparameter tuning [6] was performed for the parameters of batch size, learning rate, and epochs. Due to there being research showing that higher values for learning rate and batch size do not always provide Higher results, a lower number was chosen initially with it gradually going higher. As for the epochs, a brute force method was used to see which would be best.

Alexnet model

```
Alexnet_model.summary()
```

```
Model: "sequential"
_________________________________________________________________
 Layer (type)                Output Shape              Param #   
=================================================================
 conv2d (Conv2D)             (None, 55, 55, 96)        34944     
                                                                 
 max_pooling2d (MaxPooling2D  (None, 27, 27, 96)       0         
 )                                                               
                                                                 
 conv2d_1 (Conv2D)           (None, 27, 27, 256)       614656    
                                                                 
 max_pooling2d_1 (MaxPooling  (None, 13, 13, 256)      0         
 2D)                                                             
                                                                 
 conv2d_2 (Conv2D)           (None, 13, 13, 384)       885120    
                                                                 
 conv2d_3 (Conv2D)           (None, 13, 13, 384)       1327488   
                                                                 
 conv2d_4 (Conv2D)           (None, 13, 13, 256)       884992    
                                                                 
 max_pooling2d_2 (MaxPooling  (None, 6, 6, 256)        0         
 2D)                                                             
                                                                 
 flatten (Flatten)           (None, 9216)              0         
                                                                 
 dense (Dense)               (None, 4096)              37752832  
                                                                 
 dropout (Dropout)           (None, 4096)              0         
                                                                 
 dense_1 (Dense)             (None, 4096)              16781312  
                                                                 
 dropout_1 (Dropout)         (None, 4096)              0         
                                                                 
 dense_2 (Dense)             (None, 1000)              4097000   
                                                                 
=================================================================
Total params: 62,378,344
Trainable params: 62,378,344
Non-trainable params: 0
```

.

5.1.2.2 RICE PLANT HEIGHT FROM IMAGES

A custom python was used to measure the height here. The libraries used by the model are as follows imutils, argparse, numpy, and OpenCV. Here the height of the rice plant is determined by the rectangle drawn around it. The height is acquired by getting the distance from the phone to the object and then calculating the relative height. The distance is recommended to the user beforehand.

Imutils package is for the resizing, image translation, rotation, resizing, skeletonization, or blur amount detection and scipy.spatial.distance, a package for measuring the distance of the object.

```
from scipy.spatial.distance import euclidean
from imutils import perspective
from imutils import contours
import argparse
import numpy as np
import imutils
import cv2
import base64
import io
from PIL import Image
import os

def show_images(images):
    for i, img in enumerate(images):
        cv2.imshow("image_" + str(i), img)

def main(data):

    #decode the image
    decoded_data = base64.b64decode(data)
    np_data = np.fromstring(decoded_data, np.uint8)
    in_img = cv2.imdecode(np_data, cv2.IMREAD_UNCHANGED)
    out_img = in_img.copy()

    if len(out_img.shape) < 3:
        out_img.resize(*out_img.shape,1)

    gray = cv2.cvtColor(out_img, cv2.COLOR_BGR2GRAY)
    blur = cv2.GaussianBlur(gray, (9, 9), 0)

    edged = cv2.Canny(blur, 50, 100)
    edged = cv2.dilate(edged, None, iterations=1)
    edged = cv2.erode(edged, None, iterations=1)

    cnts = cv2.findContours(edged.copy(), cv2.RETR_EXTERNAL, cv2.CHAIN_APPROX_SIMPLE)
    cnts = imutils.grab_contours(cnts)
    (cnts, _) = contours.sort_contours(cnts)
    cnts = [x for x in cnts if cv2.contourArea(x) >2000]

    if len(cnts)>0 :
        ref_object = cnts[0]
```

5.2 Testing and Maintenance

As the final phase of the Software development life cycle(SDLC) is the testing and maintenance phase which will be done under the disciplines of functional and non-functional testing. The functional testing will mainly consider the functional requirements of the system and unit testing will be taken as the basis. Then in order to check the nonfunctional requirements such as performance and availability various nonfunctional testing will be conducted. As for the maintenance of the application after the publication, various support features will be added.

6. RESULTS AND DISCUSSION

6.1 Results

Rice crop growth identification and providing solutions:

Epoch	loss	accuracy	Val_loss	Val_accuracy
16/20	0.3699	0.8561	0.1020	0.9786
17/20	0.3874	0.8615	0.2762	0.9329
18/20	0.4067	0.8510	0.2438	0.9486
19/20	0.4546	0.8284	0.2161	0.9529
20/20	0.3642	0.8639	0.3518	0.9600

Table 2: AlexNet Model Accuracy

- Loss: 0.3518
- Accuracy:96.00%

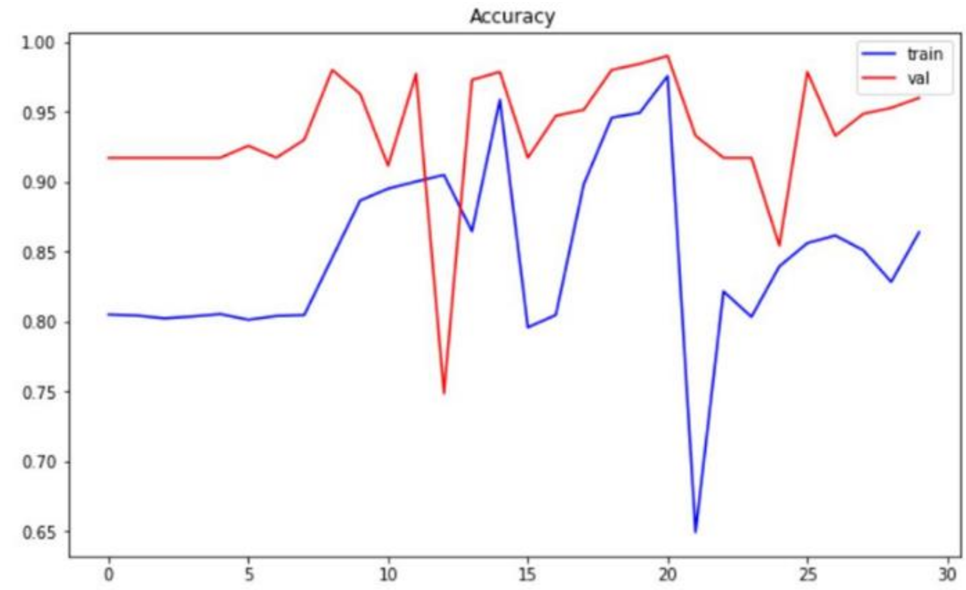


Figure 7 Training Accuracy

The above figure represents training and validation accuracy. The y-axis depicts the accuracy, and the x-axis depicts the number of epochs. This graph shows a huge drop midway through the number of epochs for both lines. But it recuperates later and gives a better result.

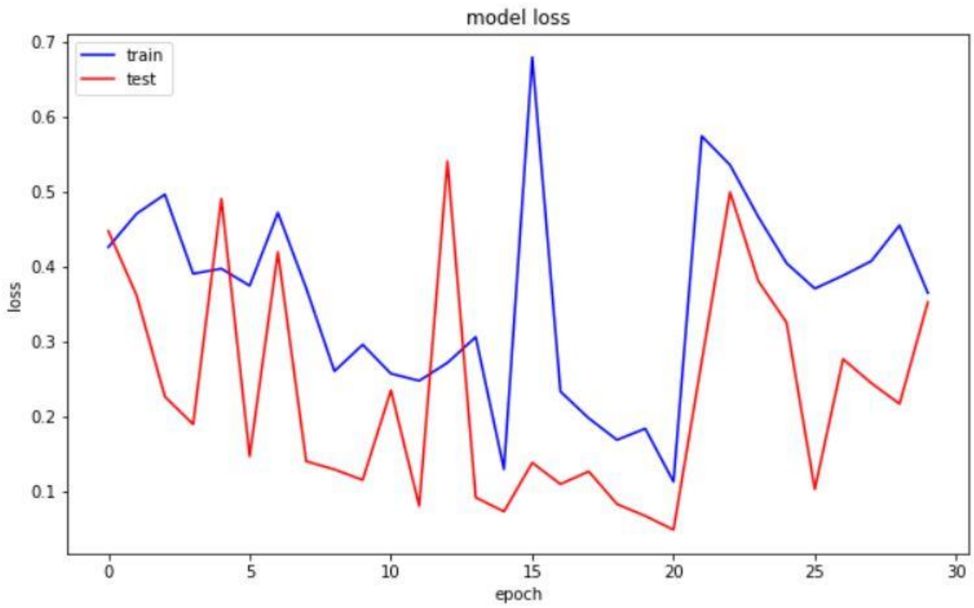


Figure 8: Training loss chart

The above figure represents training and validation loss. The y-axis depicts the loss and the x-axis depicts the number of epochs. In a manner, to the previous graph, this graph also suffers in the middle. Considering both figures 11 and 12 it is apparent that the optimal number of epochs is close to 20.

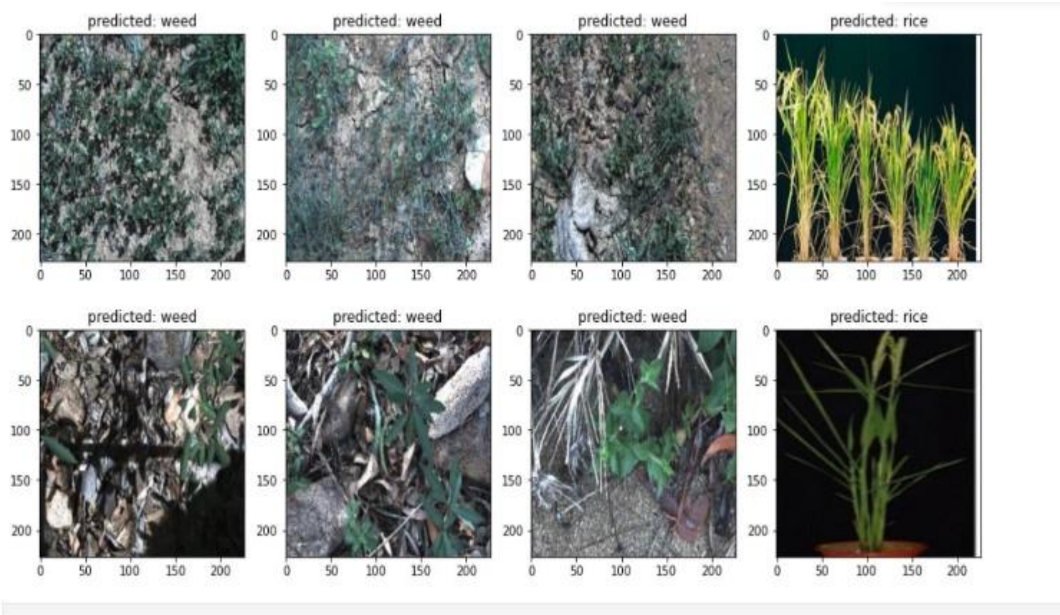


Figure 9 Rice identification output

These are some examples of measured heights using the custom python code.

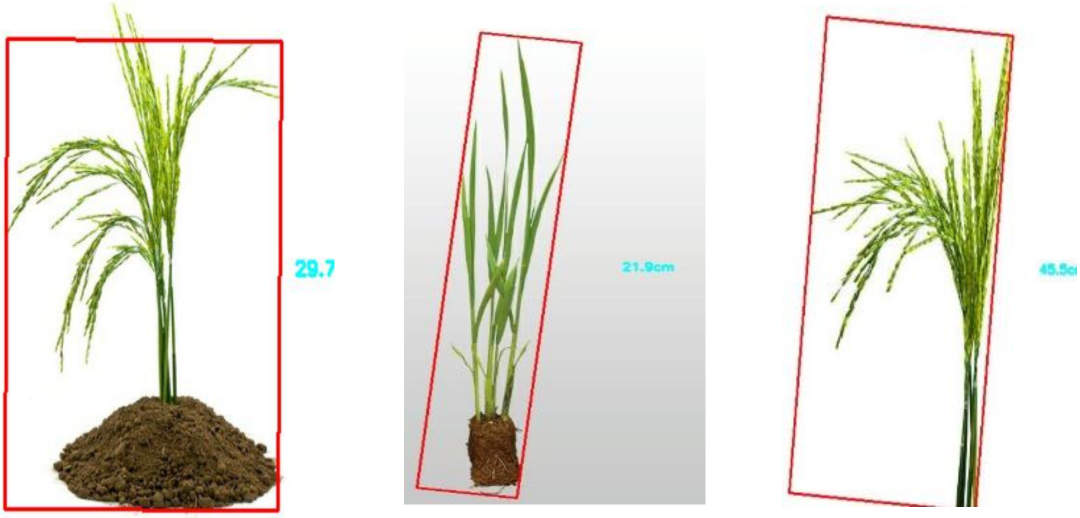


Figure 10 Height Measurements

6.2 Research Findings

86.39% training accuracy and 96.00% test accuracy were able to be reached using this particular model as shown in the examples above with the predictions for the test data shown below. As for the hyperparameters for this model, 20 epochs, and 32 batch sizes were chosen as this gives the best accuracies, while the two classes. The learning rate was then chosen to be 0.001 as the learning rate finder function gave that amount as the number with the lowest error rate.

Adam optimizer was also used here when it comes to model compilation due to the previously mentioned reasons with categorical cross entropy as this has binary classes.

6.3 Discussion

Identification of rice plants and providing solutions:

After comparing with the other models such as customized AlexNet and custom CNN models, this AlexNet model with the above-mentioned configurations was found to give the best accuracies for the rice identification task.

6.4 Summary of Each Student's contribution

- Discovering the best model for rice identification from a pool of different CNN models
- Discovering the best configurations for that said model to acquire the best results
- Discovering the best configurations in order to perform rice identification for AlexNet model
- Creating a mobile application for the created components
- Making the application as user-friendly as possible
- Find an appropriate dataset to train the models

Conclusions

This research paper was performed in order to provide rice farmers with solutions to the four major issues that they are currently facing which include pests, disease, weeds, fertilizers, and growth defects. In this research four CNN models are compared and contrasted in order to identify which one of them is best suited when it comes to rice and paddy farm datasets. Considering the outputs provided by four models which are used for image classification, the resnet50(modal 02) model performed best with it providing 99.43% for training accuracy and 97.04% for validation accuracy. Some additional research has also been done for the purpose of creating approaches for rice identification, and rice plant height measurement.

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Glossary

Abbreviation	Description
CNN	Convolutional neural network
ReLU	Rectified Linear Unit
UI	User Interface
UX	User Experience
SDLC	Software development life cycle
UAV	Unmanned aerial vehicle

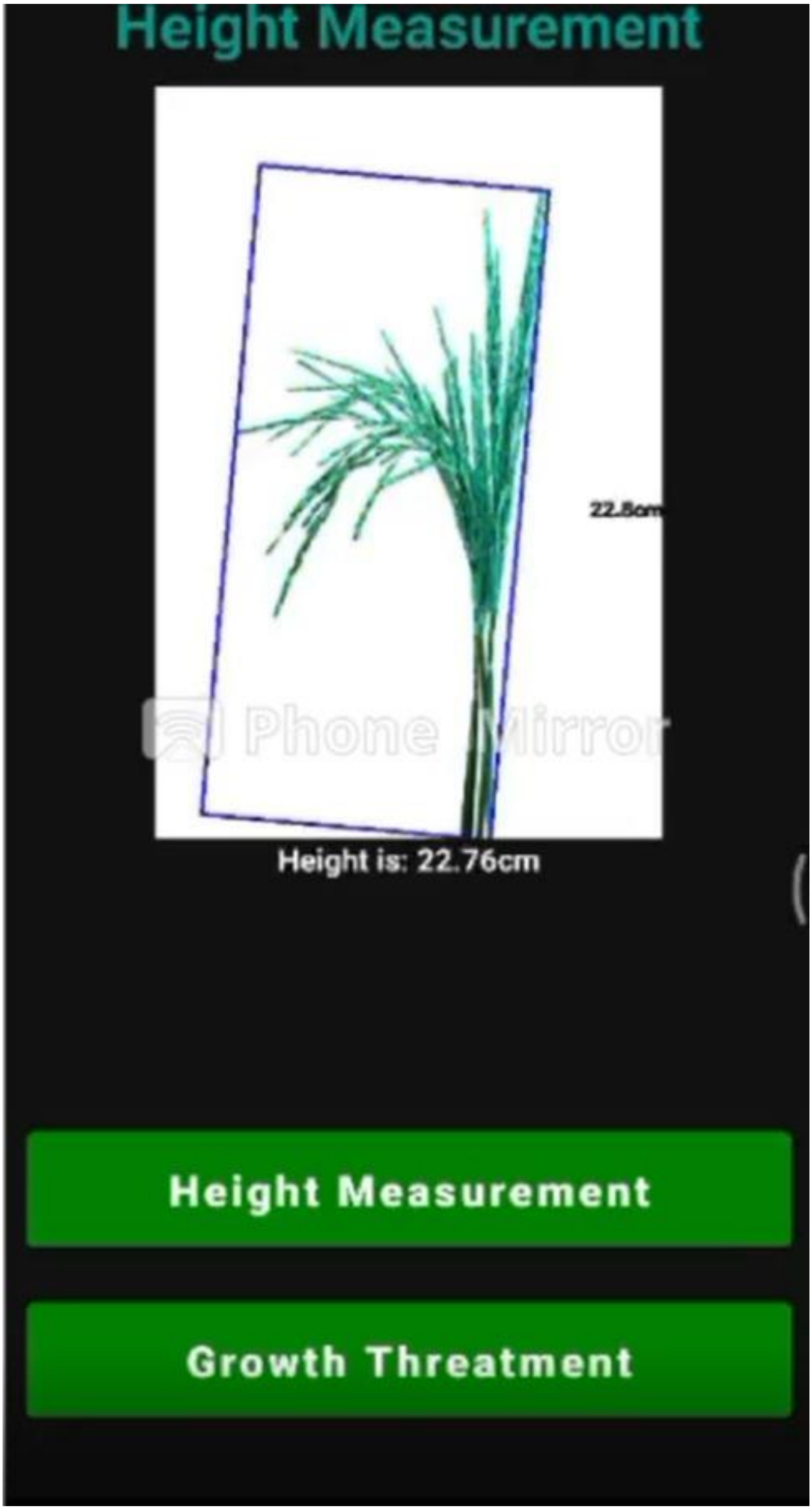
Table 3:Glossary

Appendices


කෙත
Growth Management
Rice Plant
Identification
Phone Mirror


PIANTS
Phone Mirror
OPEN CAMERA
Launch Gallery
RICE IDENTIFICATION
rice
Result

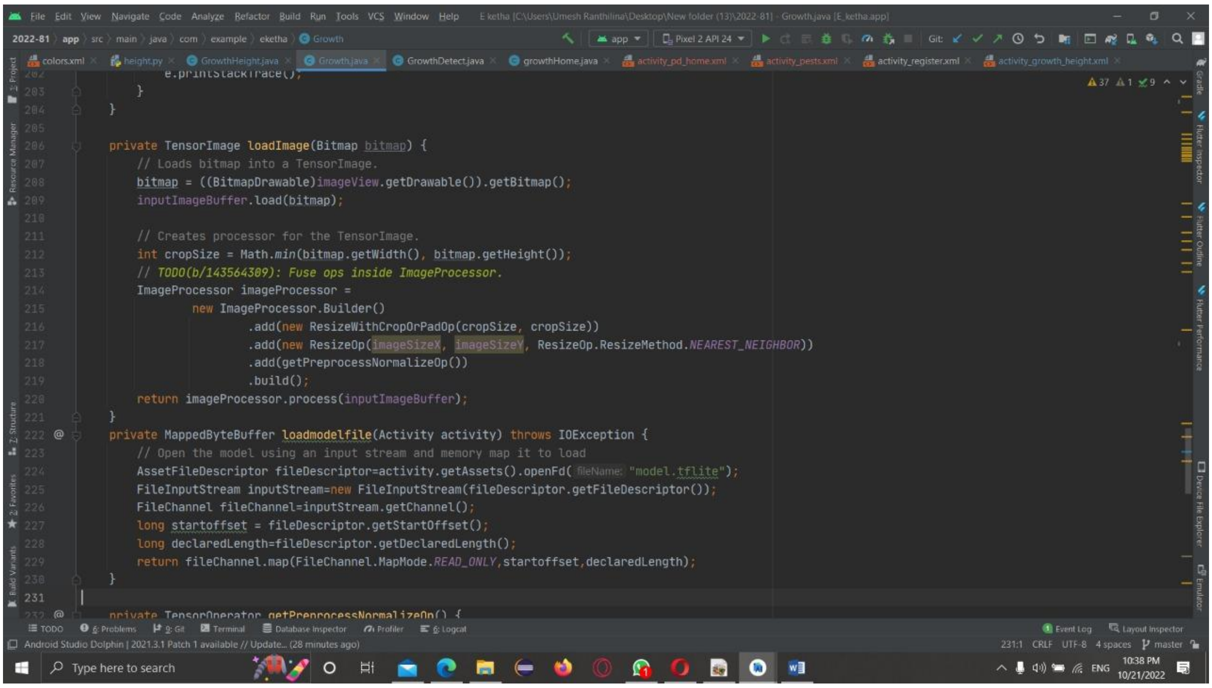

RICE PLANT RESULT
rice
Phone Mirror
HEIGHT MEASUREMENT

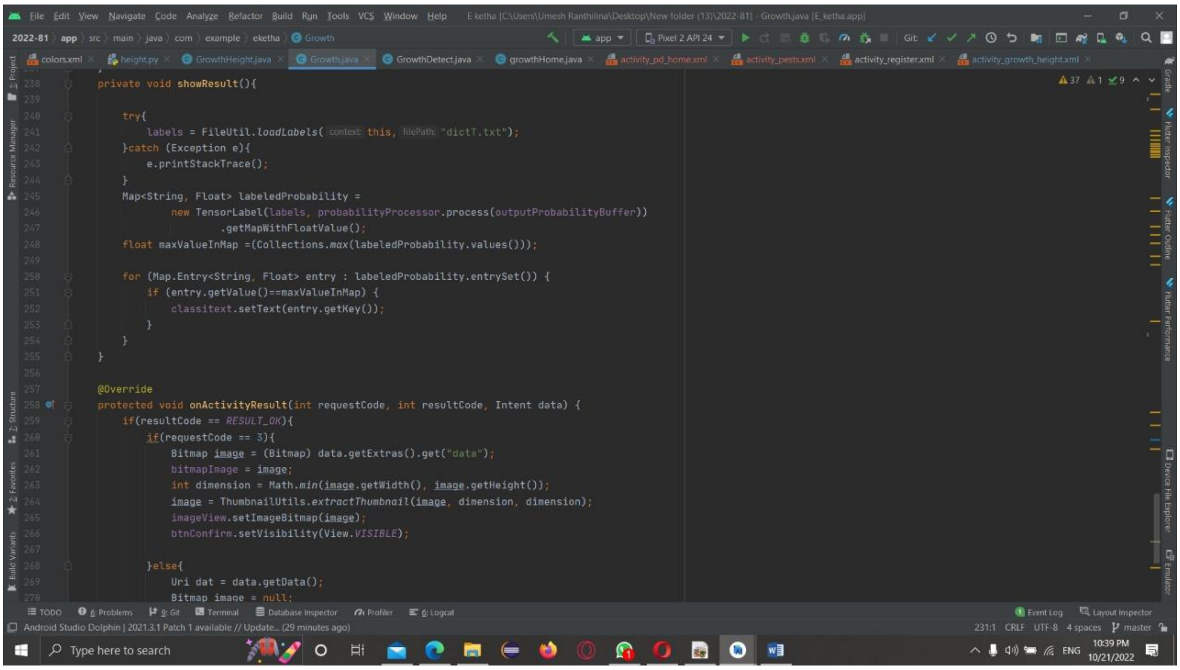

Height Measurement
22.8cm
Phone Mirror
Height is: 22.76cm
Height Measurement
Growth Threatment


Growth
Treatments
22.76
Phone Mirror
• Maintaining plant vigor. Keeping vulnerable trees healthy and vigorous allows them to resist growth and survive longer once established.
• Practice good hygiene. Dead branches due to bacterial leaf blight should be removed regularly. Severely decayed infected trees should also be removed.
• Species resistant to plant growth retardation. In affected areas, avoid planting highly vulnerable trees.
• Antibiotic injections. And increase the fertilizer

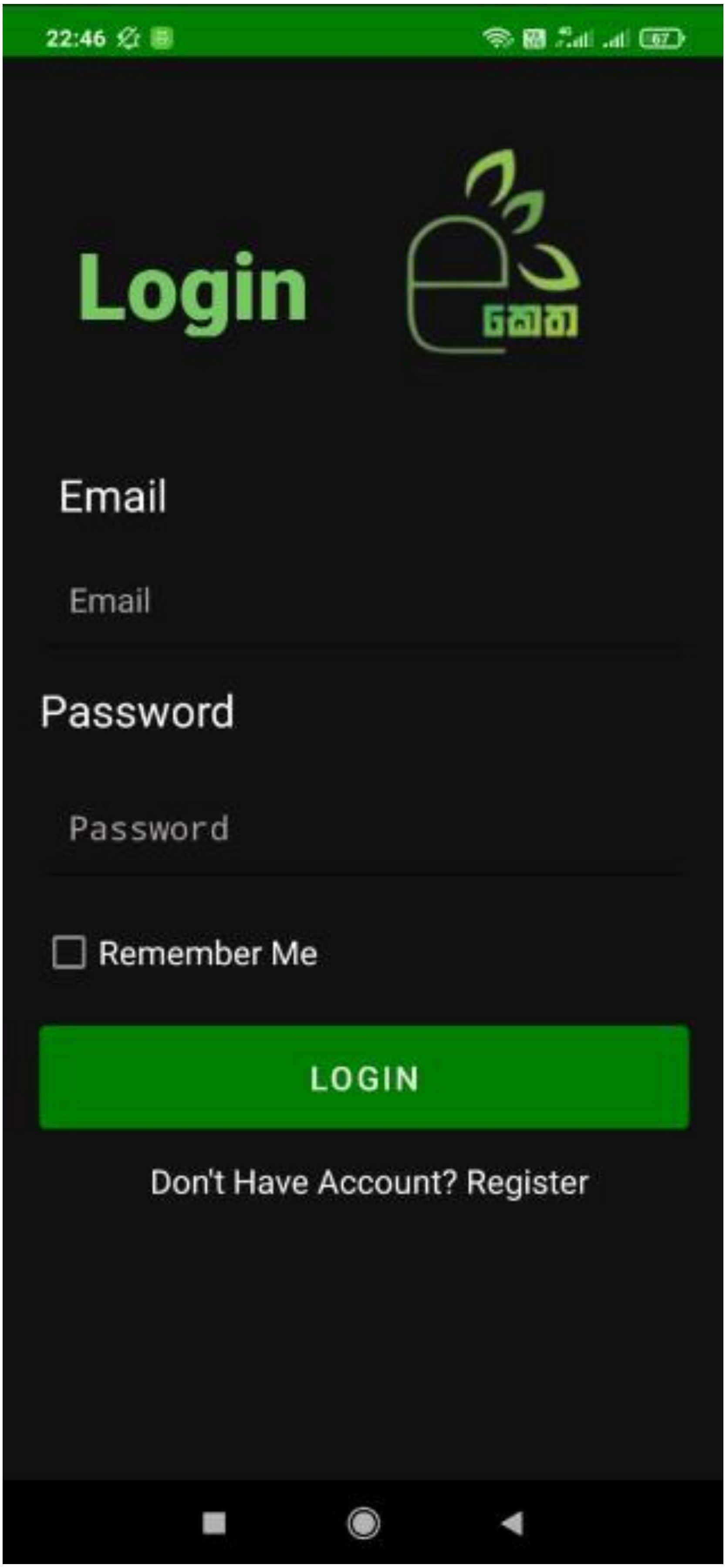
Training rice classification model

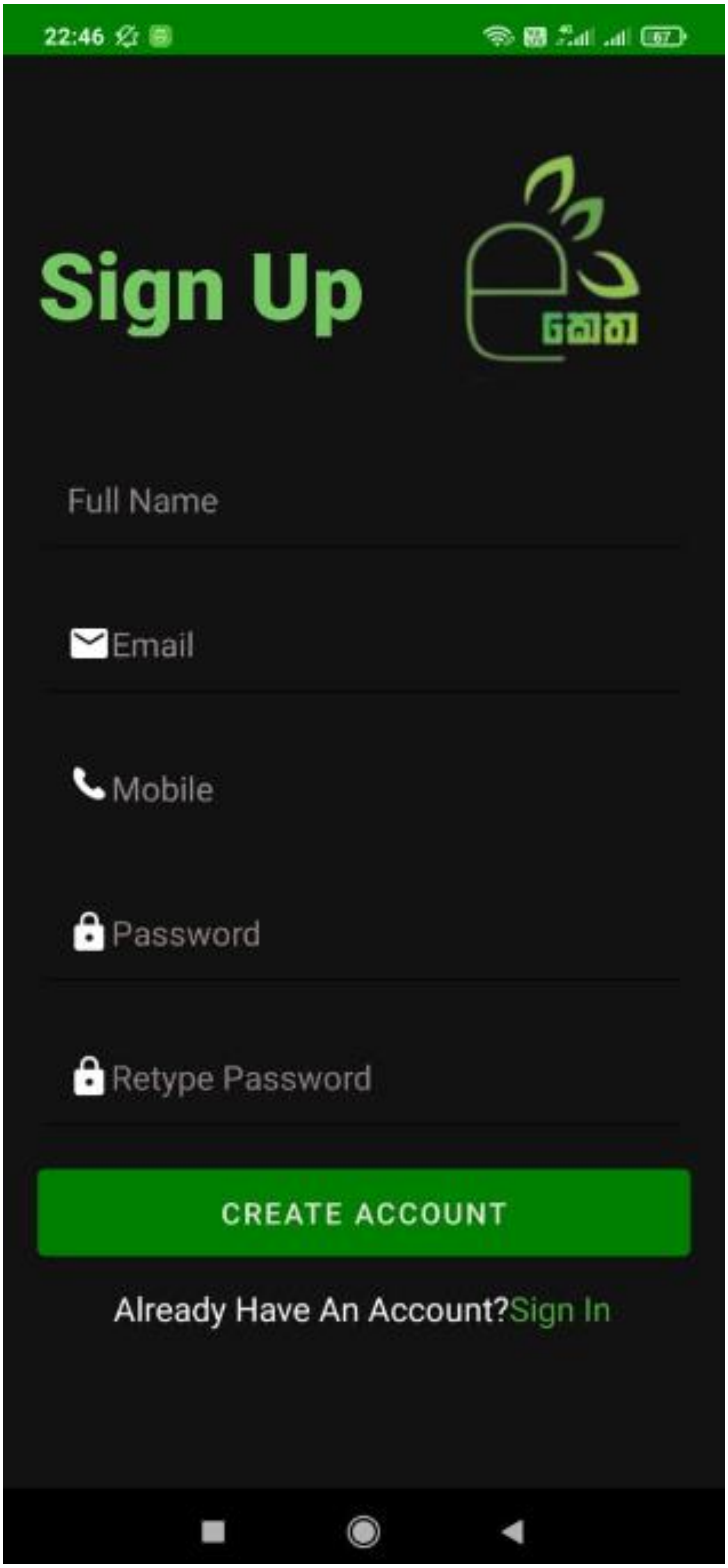
```
24/24 [==============================] - 200s 8s/step - loss: 0.1288 - accuracy: 0.9587 - val_loss: 0.0723 - val_accuracy: 0.9786
Epoch 16/30
24/24 [==============================] - 199s 8s/step - loss: 0.6790 - accuracy: 0.7959 - val_loss: 0.1375 - val_accuracy: 0.9171
Epoch 17/30
24/24 [==============================] - 201s 8s/step - loss: 0.2325 - accuracy: 0.8047 - val_loss: 0.1089 - val_accuracy: 0.9471
Epoch 18/30
24/24 [==============================] - 196s 8s/step - loss: 0.1969 - accuracy: 0.8981 - val_loss: 0.1259 - val_accuracy: 0.9514
Epoch 19/30
24/24 [==============================] - 197s 8s/step - loss: 0.1679 - accuracy: 0.9458 - val_loss: 0.0823 - val_accuracy: 0.9800
Epoch 20/30
24/24 [==============================] - 190s 8s/step - loss: 0.1831 - accuracy: 0.9492 - val_loss: 0.0665 - val_accuracy: 0.9843
Epoch 21/30
24/24 [==============================] - 189s 8s/step - loss: 0.1121 - accuracy: 0.9756 - val_loss: 0.0480 - val_accuracy: 0.9900
Epoch 22/30
24/24 [==============================] - 188s 8s/step - loss: 0.5736 - accuracy: 0.6493 - val_loss: 0.2730 - val_accuracy: 0.9329
Epoch 23/30
24/24 [==============================] - 187s 8s/step - loss: 0.5350 - accuracy: 0.8216 - val_loss: 0.4989 - val_accuracy: 0.9171
Epoch 24/30
24/24 [==============================] - 187s 8s/step - loss: 0.4657 - accuracy: 0.8033 - val_loss: 0.3801 - val_accuracy: 0.9171
Epoch 25/30
24/24 [==============================] - 192s 8s/step - loss: 0.4039 - accuracy: 0.8395 - val_loss: 0.3247 - val_accuracy: 0.8543
Epoch 26/30
24/24 [==============================] - 187s 8s/step - loss: 0.3699 - accuracy: 0.8561 - val_loss: 0.1020 - val_accuracy: 0.9786
Epoch 27/30
24/24 [==============================] - 198s 8s/step - loss: 0.3874 - accuracy: 0.8615 - val_loss: 0.2760 - val_accuracy: 0.9329
Epoch 28/30
24/24 [==============================] - 384s 16s/step - loss: 0.4067 - accuracy: 0.8510 - val_loss: 0.2438 - val_accuracy: 0.9486
Epoch 29/30
24/24 [==============================] - 198s 8s/step - loss: 0.4546 - accuracy: 0.8284 - val_loss: 0.2161 - val_accuracy: 0.9529
Epoch 30/30
24/24 [==============================] - 213s 9s/step - loss: 0.3642 - accuracy: 0.8639 - val_loss: 0.3518 - val_accuracy: 0.9600
22/22 [==============================] - 12s 548ms/step - loss: 0.3518 - accuracy: 0.9600
96.000
```

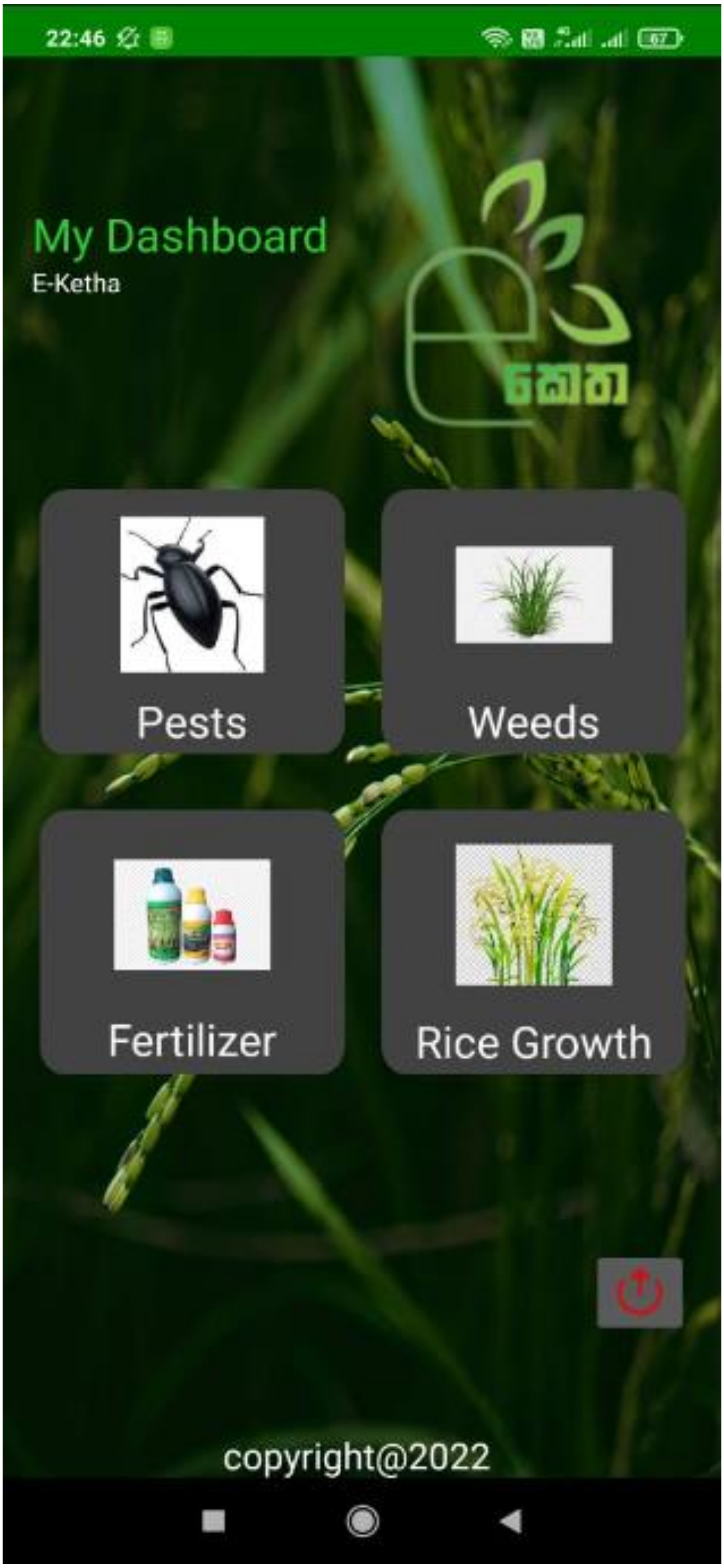


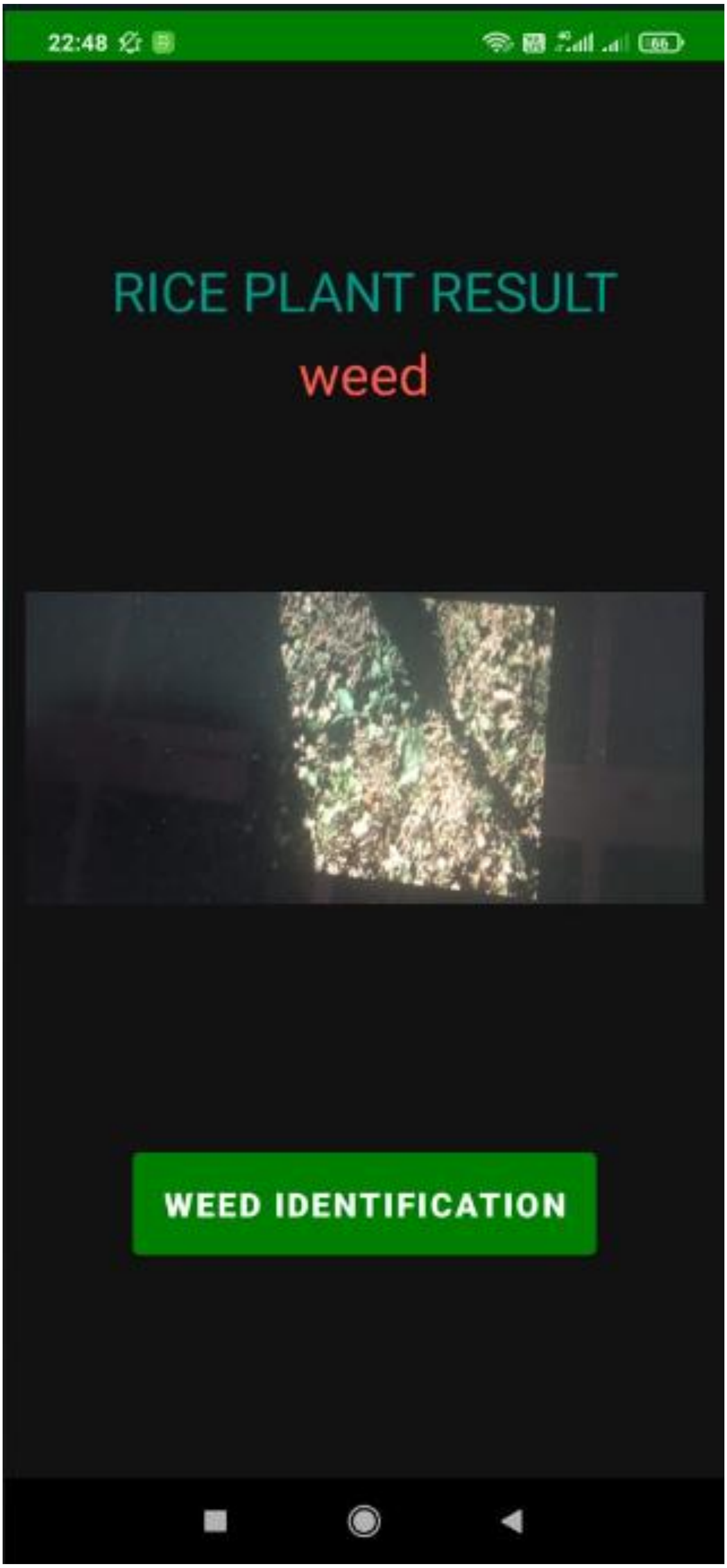

private void showResult(){
try{
labels = FileUtil.loadLabels(context: this, filePath: "dictT.txt");
}catch (Exception e){
e.printStackTrace();
}
Map<String, Float> labeledProbability =
new TensorLabel(labels, probabilityProcessor.process(outputProbabilityBuffer))
.getMapWithFloatValue();
float maxValueInMap =(Collections.max(labeledProbability.values()));
for (Map.Entry<String, Float> entry : labeledProbability.entrySet()) {
if (entry.getValue()==maxValueInMap) {
classitext.setText(entry.getKey());
}
}
}
@Override
protected void onActivityResult(int requestCode, int resultCode, Intent data) {
if(resultCode == RESULT_OK){
if(requestCode == 3){
Bitmap image = (Bitmap) data.getExtras().get("data");
bitmapImage = image;
int dimension = Math.min(image.getWidth(), image.getHeight());
image = ThumbnailUtils.extractThumbnail(image, dimension, dimension);
imageView.setImageBitmap(image);
btnConfirm.setVisibility(View.VISIBLE);
}else{
Uri dat = data.getData();
Bitmap image = null;


22:45
කෙත
WELCOME
E-KETHA


22:46
Login
Email
Email
Password
Password
Remember Me
LOGIN
Don't Have Account? Register


22:46
Sign Up
Full Name
Email
Mobile
Password
Retype Password
CREATE ACCOUNT
Already Have An Account?Sign In


22:46
My Dashboard
E-Ketha
කෙත
Pests
Weeds
Fertilizer
Rice Growth
copyright@2022


22:48
RICE PLANT RESULT
weed
WEED IDENTIFICATION