Paddy Cultivation

Effective management and Procurement in Telangana State

Presented by
Runtime Terror

The Problem

01

Procurement Delay

Farmers face significant delays (5-20 days) in selling their produce, causing financial stress.

02

Persistence Issue

Delays and costs have been ongoing problems for years, affecting livelihoods.

03

Lack of Facilities:

Many procurement centers lack essential infrastructure, storage, and sanitation facilities.

Issues to be tackled !

01

Paddy Cultivation Identification:

Determining whether paddy is cultivated or not in a given area and identifying the type of paddy being cultivated.

02

Stages of Paddy Growth:

Monitoring the various stages of paddy growth, from sowing to harvesting.

03

Online Procurement System Integration:

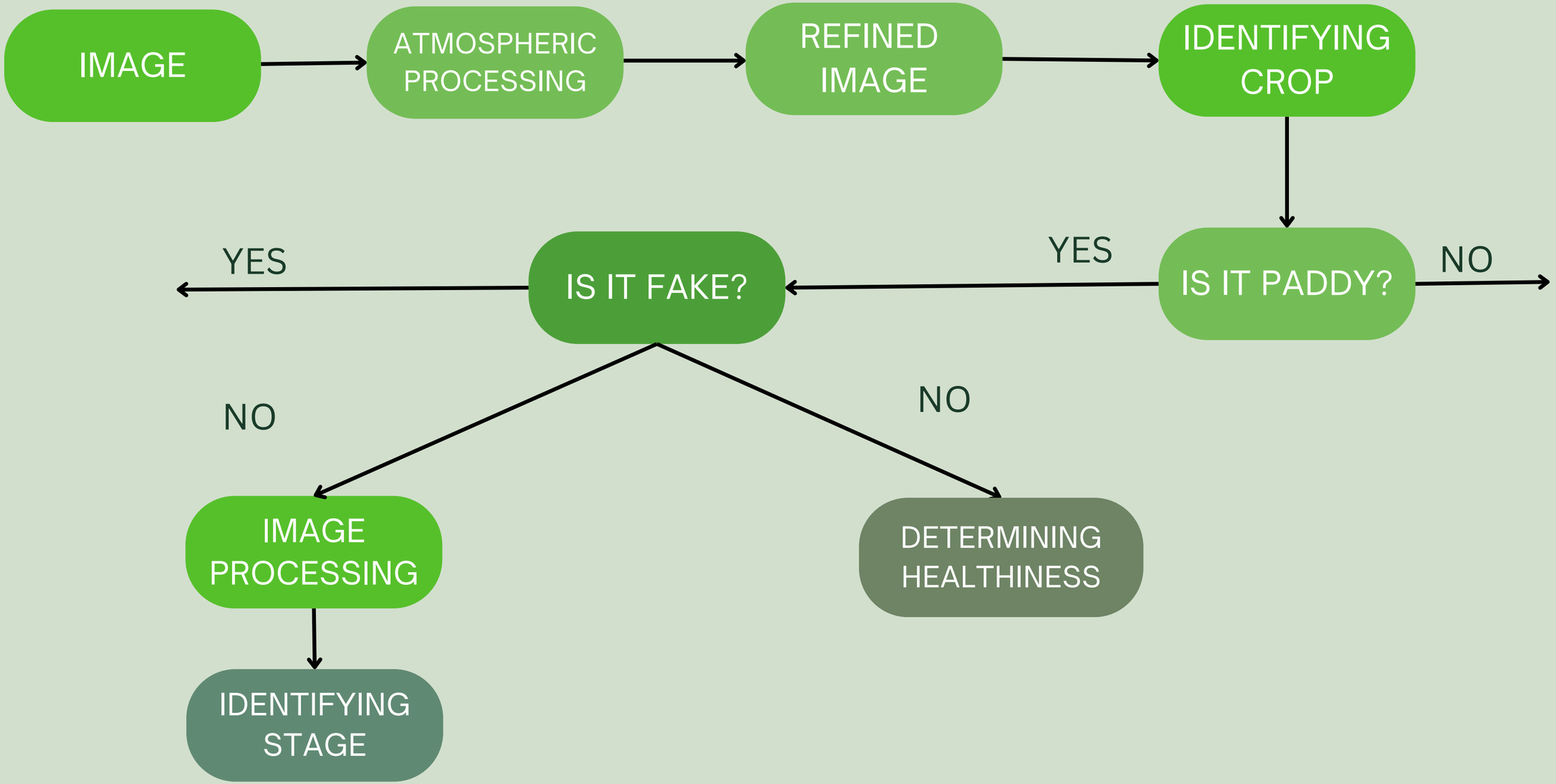
Assessing the feasibility of issuing tokens to farmers within an Online Procurement System (OPMS) based on the successful harvest, with the objective of controlling external paddy sales in Telangana State.

04

Identification of Fake Paddy:

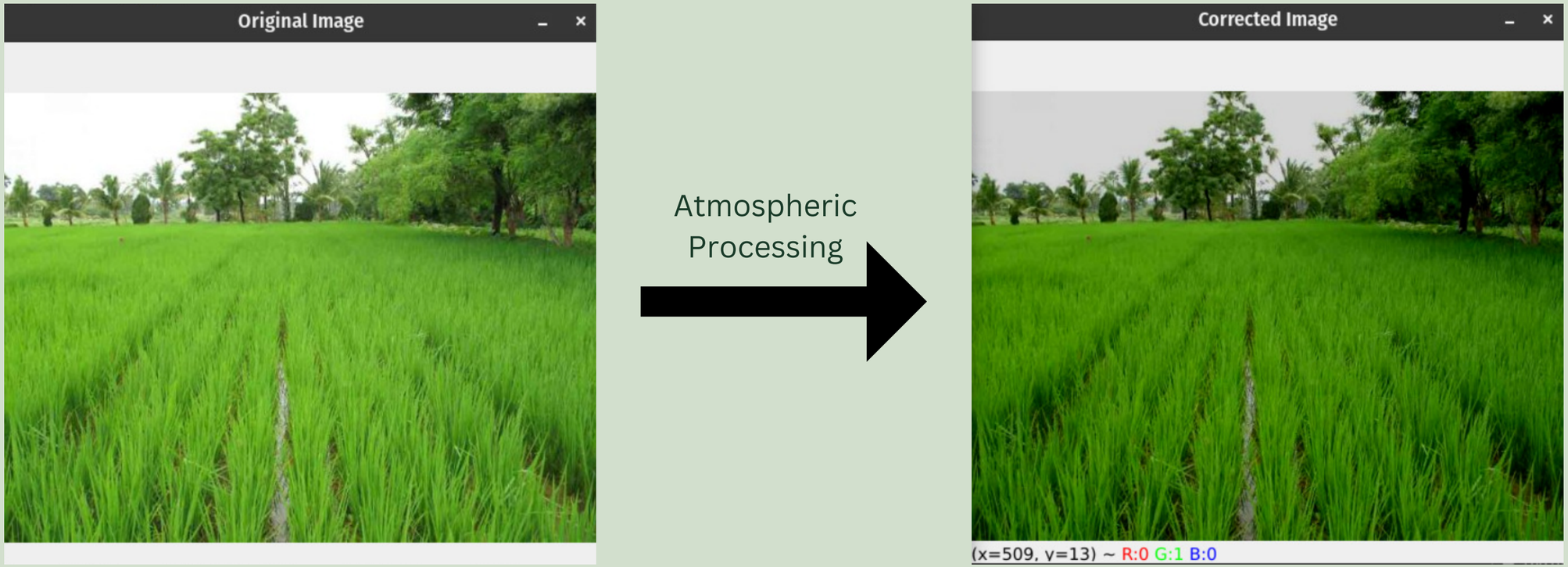
Developing methods to identify forged or substandard paddy to ensure the quality and authenticity of procured paddy

Our Approach



1. Atmospheric Processing

- 3 types of processing - atmospheric, geometric, and radioactive calibration.
- Reducing noise to get more clarity in the image.



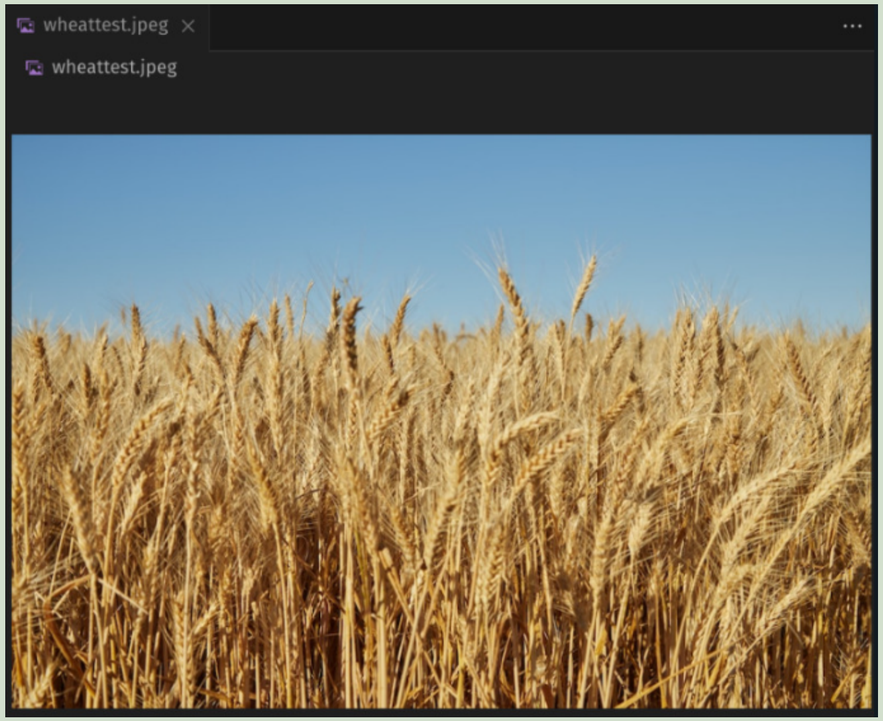
*implemented atmospheric at the moment; can also implement geometric or radioactive calibration.

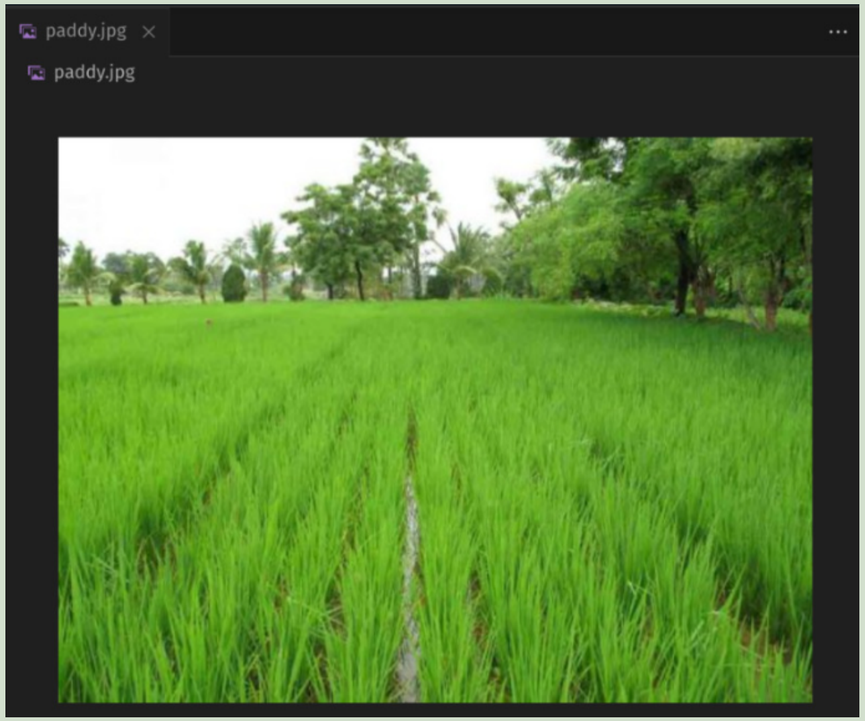
2. Crop Identification

- Trained ML model to identify and distinguish between various types of crops including rice, wheat, etc. To the right is a code snippet for the same.
- If the output is anything other than rice, then it is not considered.
- As of now, the accuracy is 54%. With an even bigger data set, can train the model to have higher accuracy.

```
# Create a CNN model
model = keras.Sequential([
    layers.Conv2D(32, (3, 3), activation='relu', input_shape=(img_height, img_width, 3)),
    layers.MaxPooling2D((2, 2)),
    layers.Conv2D(64, (3, 3), activation='relu'),
    layers.MaxPooling2D((2, 2)),
    layers.Conv2D(128, (3, 3), activation='relu'),
    layers.MaxPooling2D((2, 2)),
    layers.Flatten(),
    layers.Dense(128, activation='relu'),
    layers.Dense(2, activation='softmax')  # 2 output classes (healthy and diseased)
])

# Compile the model
model.compile(optimizer='adam',
              loss='binary_crossentropy',  # Update to binary cross-entropy
              metrics=['accuracy'])

# Data augmentation and loading
datagen = ImageDataGenerator(rescale=1./255, validation_split=0.2)

train_generator = datagen.flow_from_directory(
    'path_to_data_directory',
    target_size=(img_height, img_width),
```

2. Crop Identification






```
PROBLEMS  OUTPUT  DEBUG CONSOLE  TERMINAL  PORTS

1/1 [==============================] - 0s 86ms/step
The predicted crop is: wheat
abhi@pop-os:~/Documents/megathon$
```

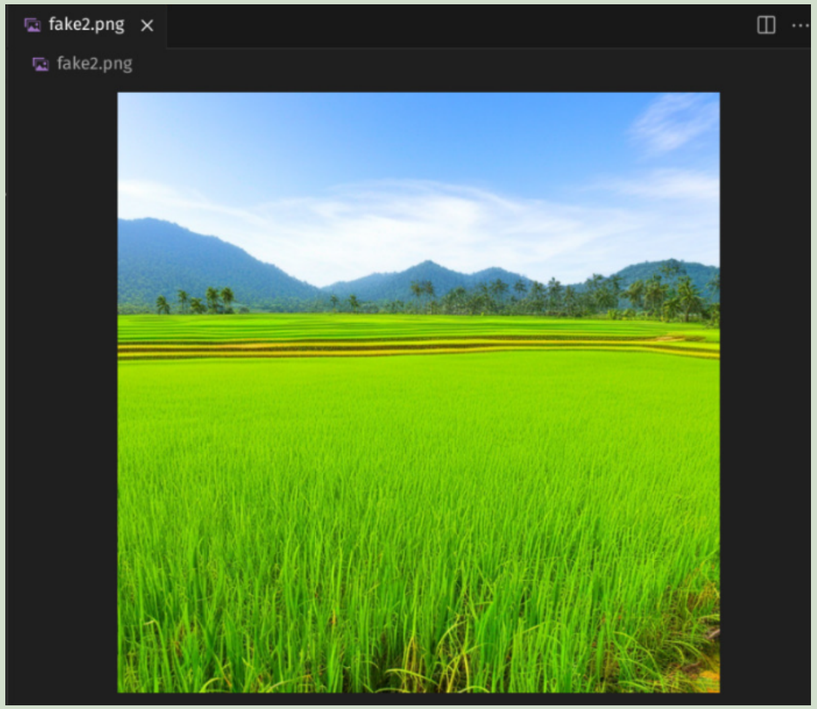
```
PROBLEMS  OUTPUT  DEBUG CONSOLE  TERMINAL  PORTS

1/1 [==============================] - 0s 92ms/step
The predicted crop is: rice
abhi@pop-os:~/Documents/megathon$
```

3. Identifying Fake Paddy

- Identifying whether the given paddy is substandard.
- Since a dataset for substandard paddy was not available, we used AI-generated images. To the right is the code snippet of the same.
- If the output is ‘fake’, then the image is not considered for further analysis and hence, is discarded.
- Accuracy is 88%.

```
# Load the trained model
model = keras.models.load_model('real_or_fake_model.h5')

# Load and preprocess the new image
img_path = 'fake2.png'
img = image.load_img(img_path, target_size=(224, 224))
img_array = image.img_to_array(img)
img_array = np.expand_dims(img_array, axis=0)
img_array /= 255.0  # Normalize the image

# Make a prediction
predictions = model.predict(img_array)

# Get the class label with the highest probability
class_index = np.argmax(predictions)
class_labels = ['fake', 'real']
predicted_crop = class_labels[class_index]

# Display the prediction
print(f"The image is predicted to be: {predicted_crop}")
```

3. Identifying Fake Paddy




```
PROBLEMS  OUTPUT  DEBUG CONSOLE  TERMINAL  PORTS

1/1 [==============================] - 0s 91ms/step
The image is predicted to be: fake
abhi@pop-os:~/Documents/megathon$
```

```
PROBLEMS  OUTPUT  DEBUG CONSOLE  TERMINAL  PORTS

1/1 [==============================] - 0s 87ms/step
The image is predicted to be: real
abhi@pop-os:~/Documents/megathon$
```

3. Determining healthiness

- Classifying the crop into one of the 4 categories - healthy, mild, moderate, and severe. Code snippet to the right.
- Trained model with a dataset sourced from Kaggle. (https://www.kaggle.com/datasets/girishkleit/riceonfiledimages)
- Outputs the healthiness of the crop given in the image.
- Accuracy is 74%.

```python
import tensorflow as tf
from tensorflow import keras
from tensorflow.keras.preprocessing import image
import numpy as np

# Load the trained model
model = keras.models.load_model('crop_health_model.h5')

# Load and preprocess the new image
img_path = 'moderate.jpeg'
img = image.load_img(img_path, target_size=(224, 224))
img_array = image.img_to_array(img)
img_array = np.expand_dims(img_array, axis=0)
img_array /= 255.0  # Normalize the image

# Make a prediction
predictions = model.predict(img_array)

# Get the class label with the highest probability
class_index = np.argmax(predictions)
class_labels = ['healthy', 'mild', 'moderate', 'severe']
predicted_crop = class_labels[class_index]

# Display the prediction
print(f"The predicted crop health is: {predicted_crop}")
```

3. Determining healthiness

moderate.jpeg

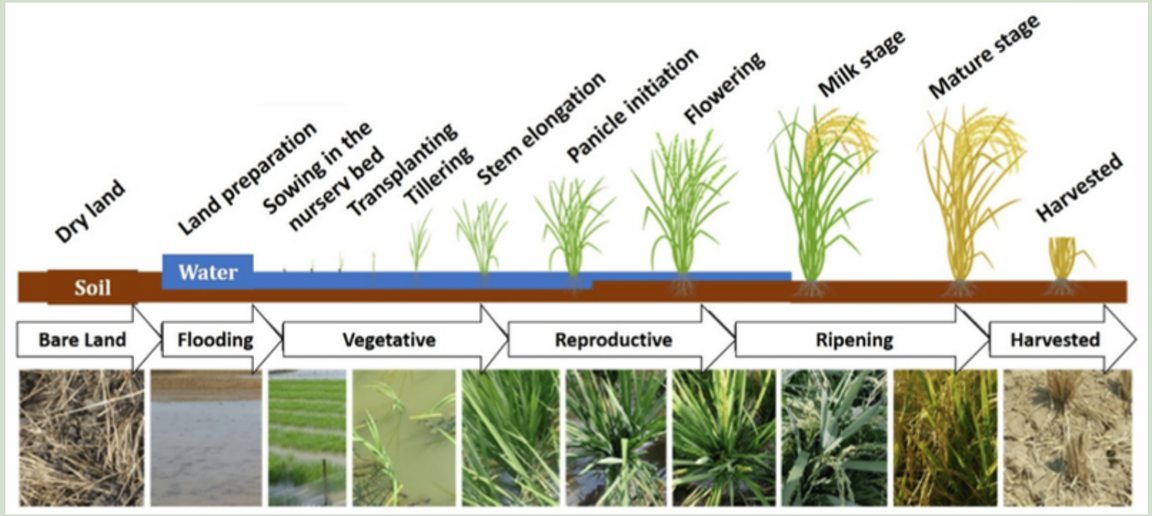
paddy.jpg

```
PROBLEMS  OUTPUT  DEBUG CONSOLE  TERMINAL  PORTS

1/1 [==============================] - 0s 88ms/step
The predicted crop health is: moderate
abhi@pop-os:~/Documents/megathon$
```

```
PROBLEMS  OUTPUT  DEBUG CONSOLE  TERMINAL  PORTS

1/1 [==============================] - 0s 88ms/step
The predicted crop health is: healthy
abhi@pop-os:~/Documents/megathon$
```

4. Identifying paddy growth stage

- Using image processing techniques to identify which stage the paddy is currently in.
- Used the **MATLAB** to determine if the paddy is young, grown, or ready to harvest.
- Outputs dark green for grown crop, yellow for ready to harvest, and light green for young crop.



4. Identifying paddy growth stage

Algorithm:

1) Loading the image matrix, i.e. the RGB value of each pixel is loaded into I which is a 3D matrix.

2) Getting the dimensions of the given image, i.e. Rows*Columns

3) Splitting the entire image into multiple smaller images in order to analyse particular blocks of fields, instead of analysing the entire image (group of paddy fields).

4) Initializing the output matrices

```
I = imread('curr.jpg');

[row_count, col_count, ~] = size(I);

num_rows = 100;
num_cols = 105;

block_height = floor(row_count / num_rows);
block_width = floor(col_count / num_cols);

block_averages = zeros(num_rows, num_cols, 3);
stage = cell(num_rows, num_cols);

color_image = zeros(row_count, col_count, 3, 'uint8');
```

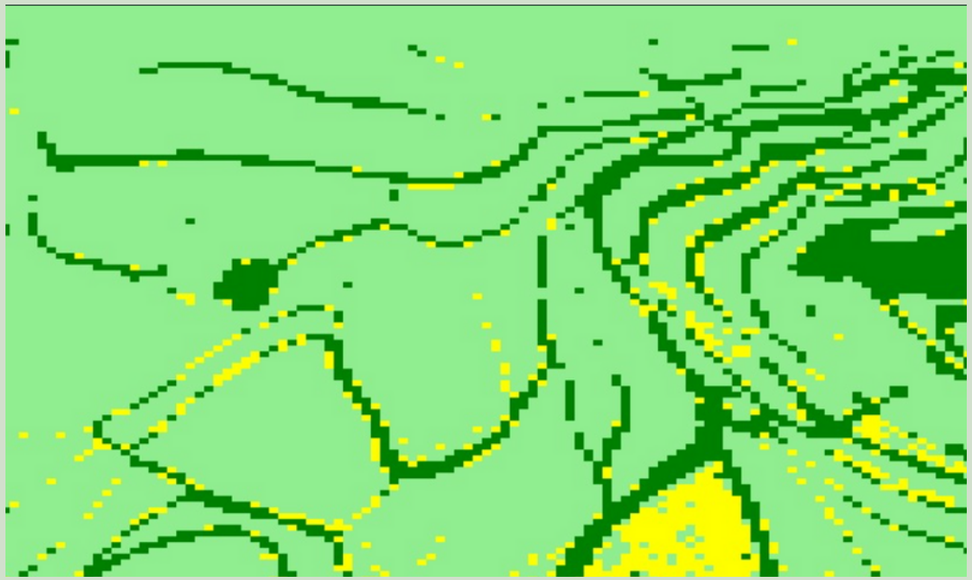
4. Identifying paddy growth stage

Calculating the average of Red, Green and blue color components in the given block of smaller image in to get an idea of the stage of crop

```
for r = 1:num_rows
    for c = 1:num_cols

        row_start = (r - 1) * block_height + 1;
        row_end = r * block_height;
        col_start = (c - 1) * block_width + 1;
        col_end = c * block_width;

        block = I(row_start:row_end, col_start:col_end, :);

        block_avg = mean(mean(double(block), 1), 2);

        block_averages(r, c, :) = block_avg;
```

4. Identifying paddy growth stage

Image Processing

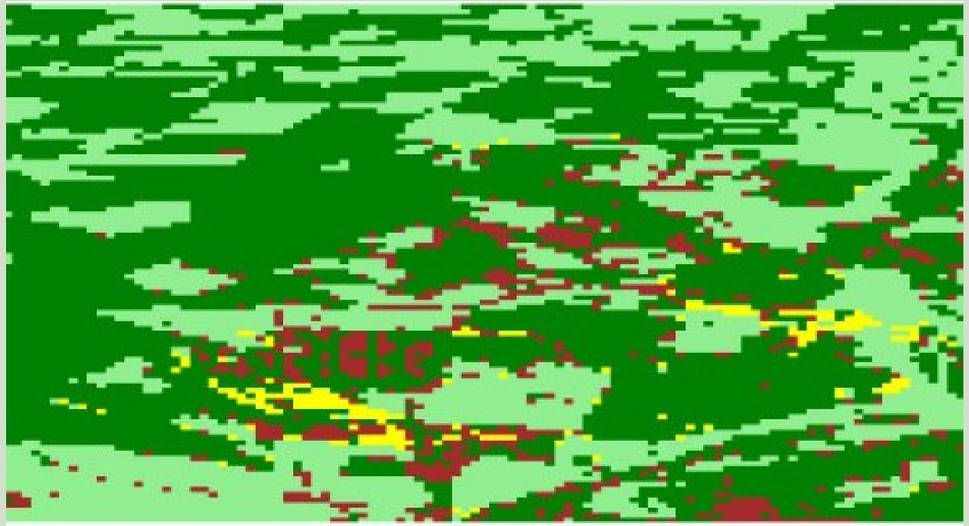


- **Light green** areas indicate the presence of young and burgeoning crops.
- **Dark green** regions represent fully grown crops.
- The **yellow** segments signify crops at the optimal harvest stage.
- **Brown** patches delineate either harvested fields or areas prepared for sowing.

4. Identifying paddy growth stage

Satellite Image

Image Processing



Processed Image

- **Light green** areas indicate the presence of young and burgeoning crops.
- **Dark green** regions represent fully grown crops.
- The **yellow** segments signify crops at the optimal harvest stage.
- **Brown** patches delineate either harvested fields or areas prepared for sowing.

4. Identifying paddy growth stage

- Using image processing techniques to identify which stage the paddy is currently in.

- Used the **Normalised Difference Vegetation Index (NDVI)** value to determine if the paddy is sowing, growing, or ready to harvest stage.

- NDVI values for different stages were observed to be:
  - barren/sowing: -0.10 to -0.04
  - growing: 0.20 to 0.36
  - ready to harvest: -0.02 to 0.06

4. Identifying paddy growth stage

```
Average NDVI Value for healthy plant: 0.3698
```

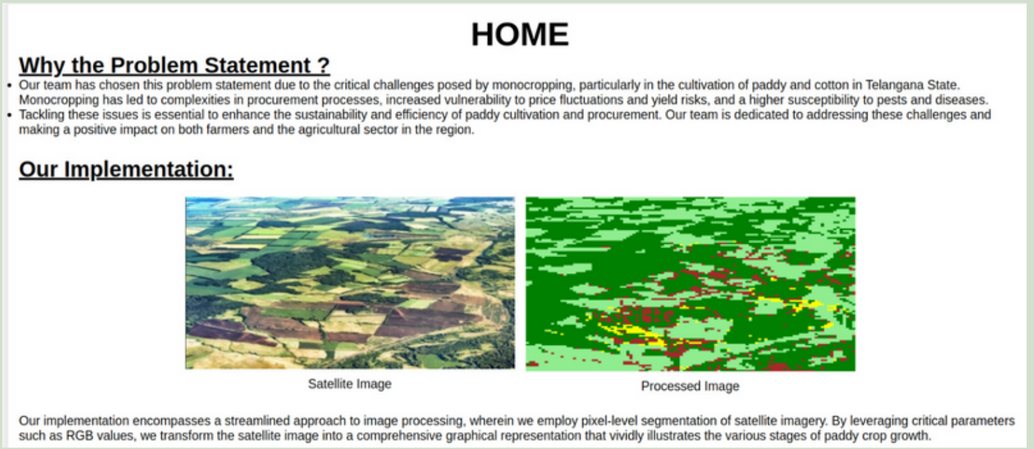
```
Average NDVI Value for sowing plant: -0.0248
```

```
Average NDVI Value for harvest plant: -0.1563
```

5. Online Procurement System (OPMS) 🌐

- An Online Procurement System (OPMS) is a digital platform for purchasing agricultural produce, like paddy, directly from farmers at a predetermined price.
- "Tokens" are certificates verifying a farmer's eligibility to sell harvested paddy through the OPMS, typically issued upon a successful harvest.
- Successful harvest indicates when paddy is ready for sale and meets quality standards, triggering the issuance of tokens.
- The aim is to regulate paddy sales by issuing tokens only to genuine harvesters, ensuring control and monitoring through the OPMS, and preventing unauthorized open market sales.

5. Online Procurement System (OPMS)



- Made for the government and the market, in order to ensure an efficient service for farmers without facing significant delays.
- Farmers can register online. With the help of image processing and ML models, we can predict the total crop and further set the price for the farmer accordingly.
- Can also predict productivity based on the sensor data provided by farmers.

Further Optimizations

- Populate the dataset with more number of images to increase the accuracy of the model.
- Populate the dataset of AI-generated images with actual images of substandard paddy, so as to get the right result.
- Suggest methods safety measures and suggestions for improving the health of the crop
- Predict income based on the health of the crop, taking the previous year’s data into consideration.
- Predict the time required for the crop to mature and be harvested based on the images given (using image processing and ML).

Our Team

Runtime Terror

D SREE YASHASWINEE

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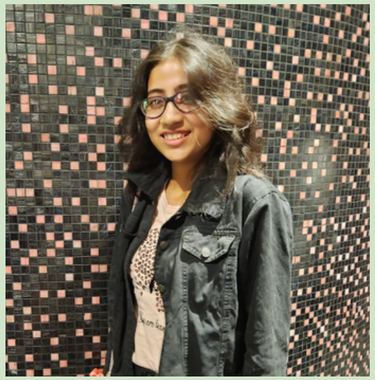

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THANK YOU