FRUIT RECOGNITION, QUANTITY AND QUALITY ESTIMATION USING A ROBOTIC VISION SYSTEM

Presented by,
SAI SADHAN SARAVANAN

Guided by,
Dr. M.V.KARTHIKEYAN, M.E., PhD
Associate Professor

OBJECTIVES

- To recognize the type and to estimate the quantity and quality of fruits.
- To detect the disease from the processed image if any.

EXISTING SYSTEM

- The existing system approach consists of two sub-systems:
  1. Detection ripeness estimation subsystem
  2. Tracking subsystem.
- Uses Deep Fruits technique.
- Pre-trained FRCNN network (based on the VGG-16 architecture).
- The tracking sub-system - tracking via detection approach.
- Tracking via detection - a simple framework to count the number of fruits using off-the-shelf cameras.

DISADVANTAGES

- Results can vary considerably due to human differences in color perception and human error.
- Available light quantity and quality can influence color perception.
- Since it uses VGG-16 architecture it’s accuracy is very low.

EXISTING SYSTEM vs PROPOSED SYSTEM

Parameters	Existing system	Proposed system
Algorithm	VGG-16	CNN-Alexnet
Techniques	The existing system approach consists of two sub-systems: 1.Detection ripeness estimation subsystem 2.Tracking subsystem. Uses Deep Fruits technique. Pre-trained FRCNN network.	The system is divided into the following steps 1.Image acquisition 2. Image Pre-processing 3.Feature Extraction 4.Classification.

PROPOSED SYSTEM

The system is divided into the following steps:

(1) Image acquisition

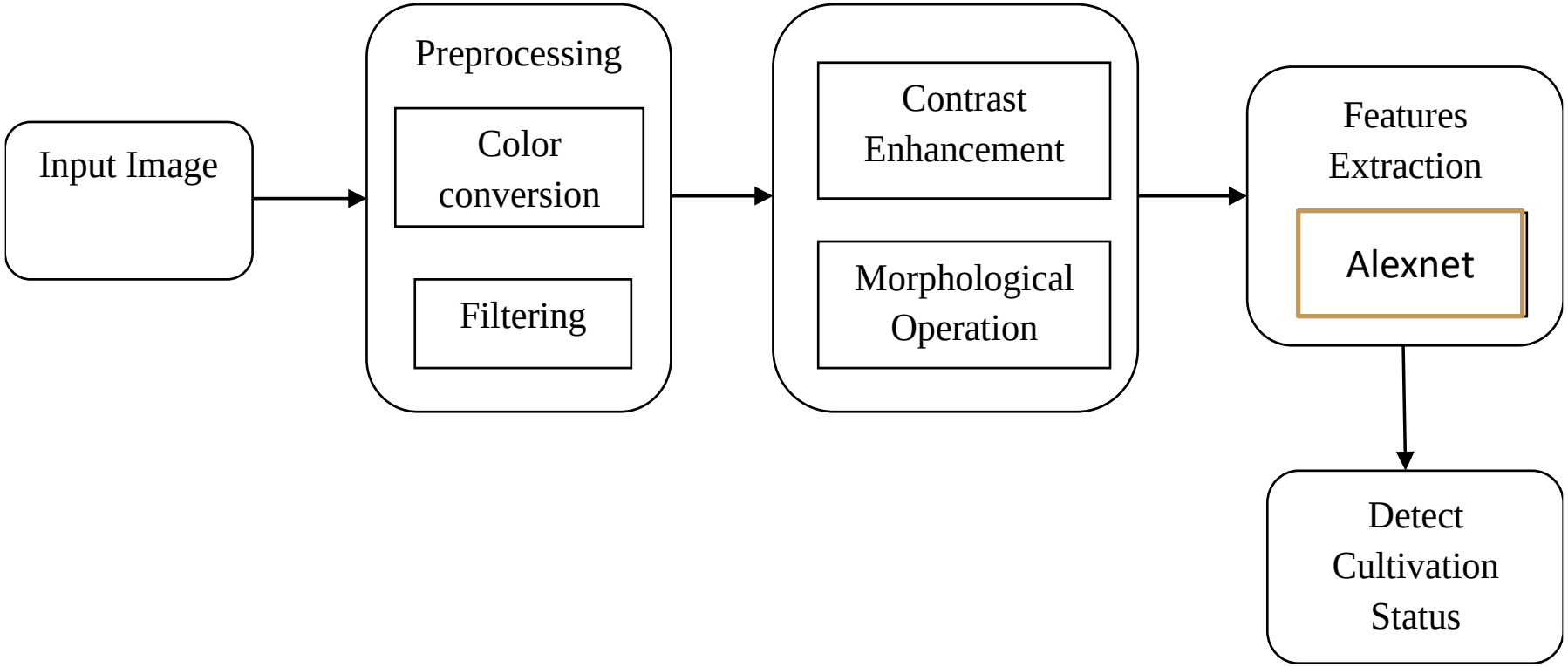
(2) Image Pre-processing

(3) Feature Extraction

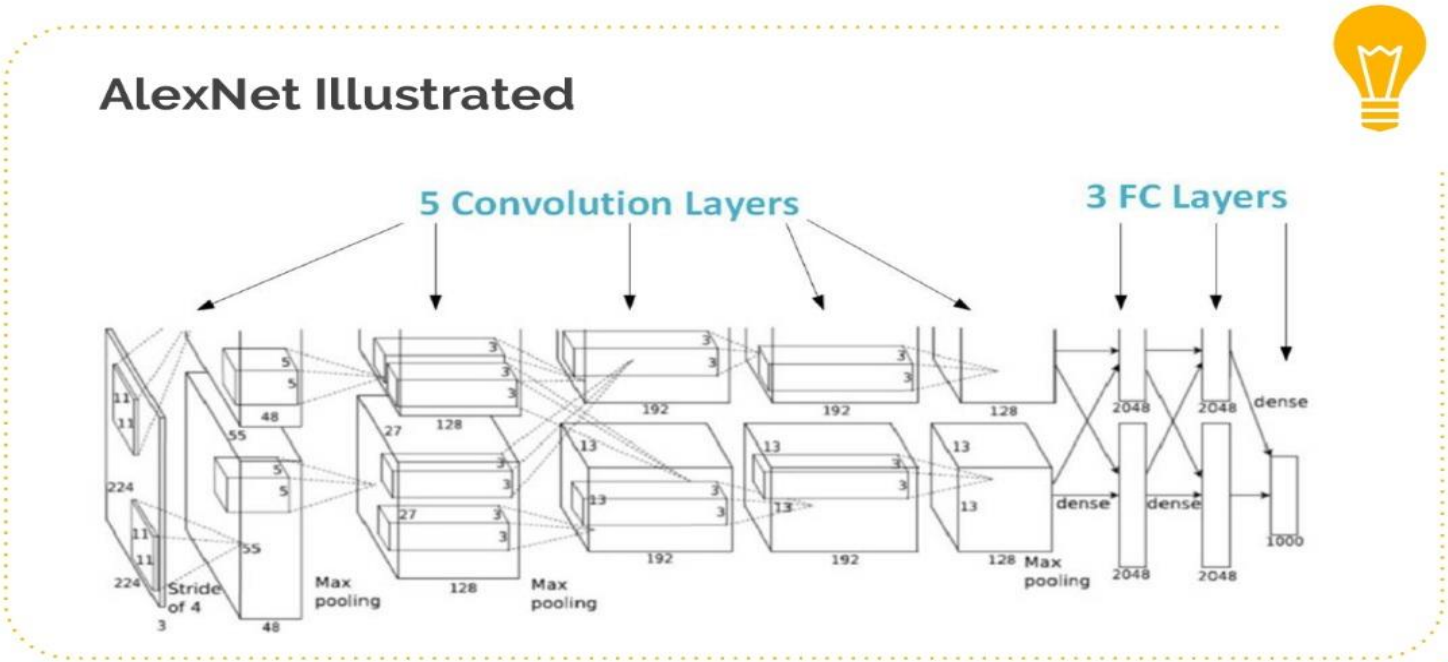
(4) Classification.

- Images undergo pre-processing steps - filtering and segmentation using morphological operations.
- Texture and color features extracted from the processed image.
- Feature extraction - procedure to opt for the important characteristics of an image and transforming input data into set of features.
- The key features give specific range for each disease.
- Feature values are fed as input to the classifier to classify the given image.

BLOCK DIAGRAM



AlexNet architecture



BLOCK DIAGRAM DESCRIPTION

- **STAGE I(INPUT IMAGE):**

The input image will be feed into the system using pi camera.

- **STAGE II(PREPROCESSING):**

It is the preprocessing stage in which the color conversion and filtering of the input image is done to get better accuracy

- **STAGE III:**

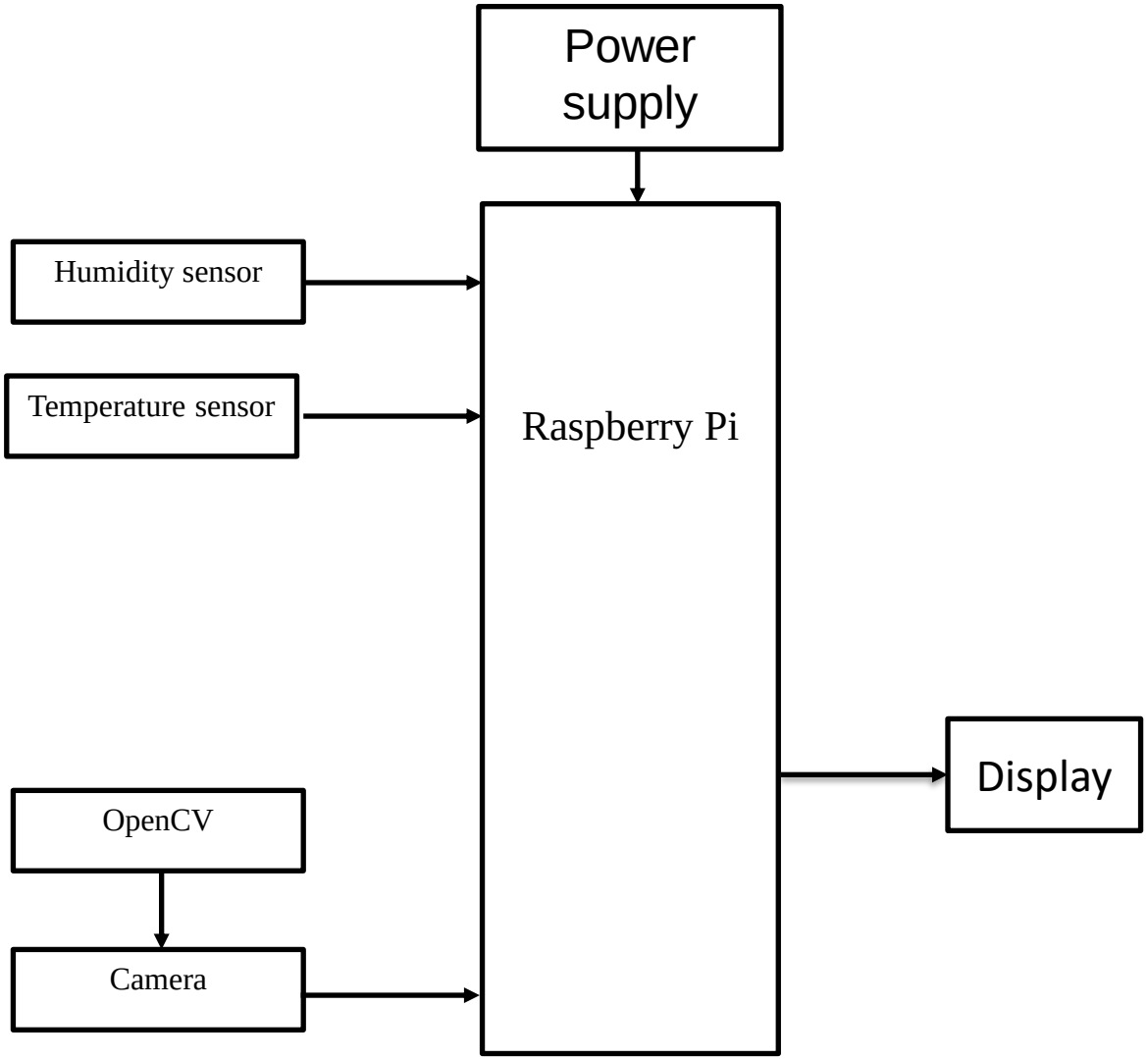
In this stage the **color enhancement and morphological** operations are done with the input image fed to the system.

- **STAGE IV:**

In this stage using Alexnet the required features are extracted from the input image.

Then finally the output will be displayed in the monitor which includes cultivation status and quality and quantity of the fruit.

BLOCK DIAGRAM



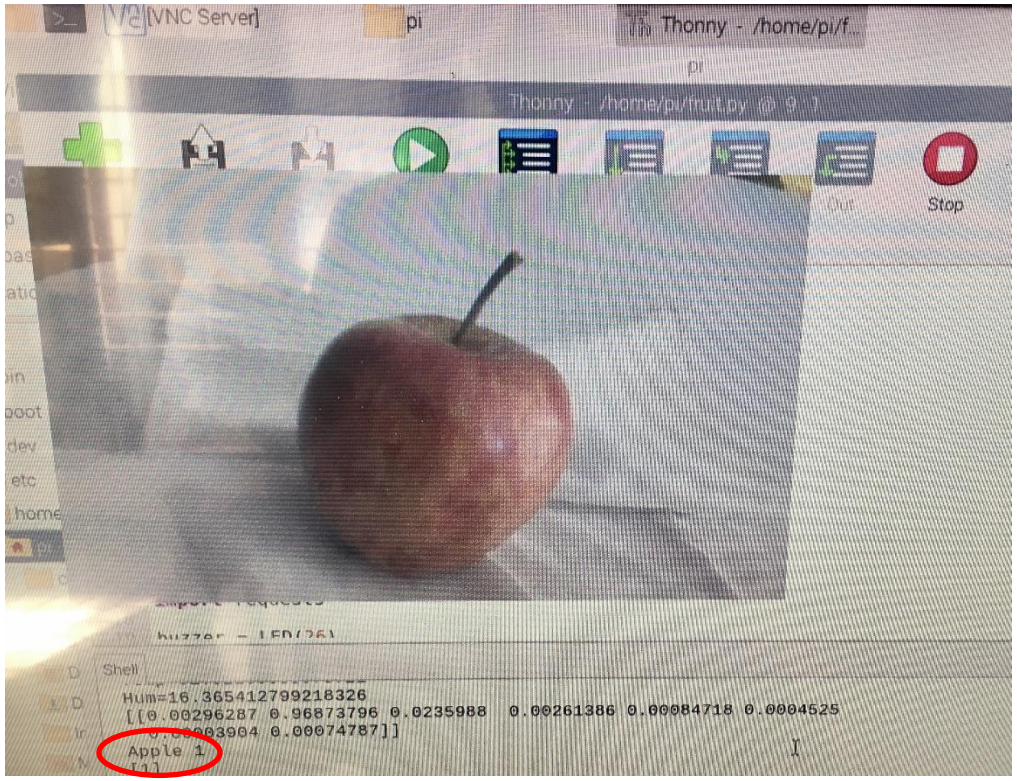
SOFTWARE REQUIREMENTS

- Raspbian
- Python
- Keras
- Tensor flow

HARDWARE REQUIREMENTS

- Raspberry Pi
- Pi-Camera
- Power cable
- Memory card
- Connecting cables
- Pi-protection case
- Temperature Sensor
- Humidity Sensor

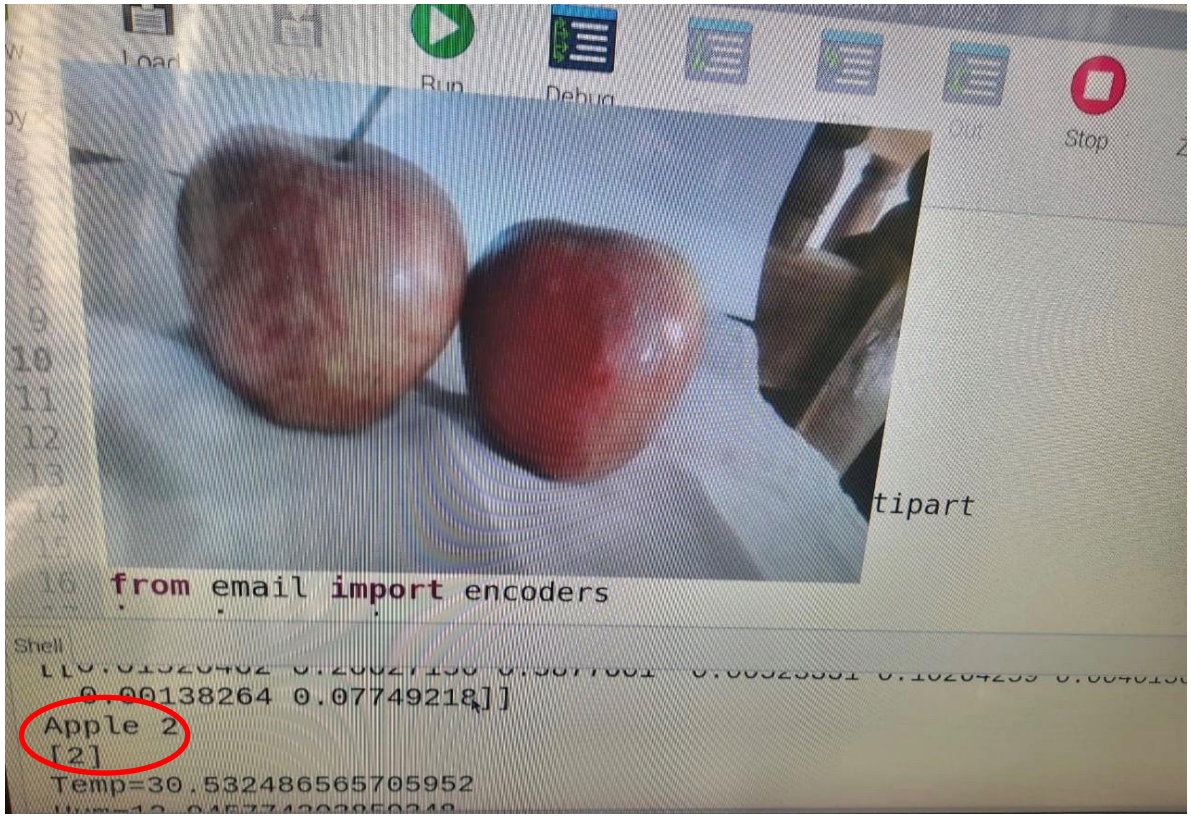
EXPECTED OUTPUT



sample.1 Sample output of the apple

It shows such that **“apple=1”** the name & count of the fruit in the window

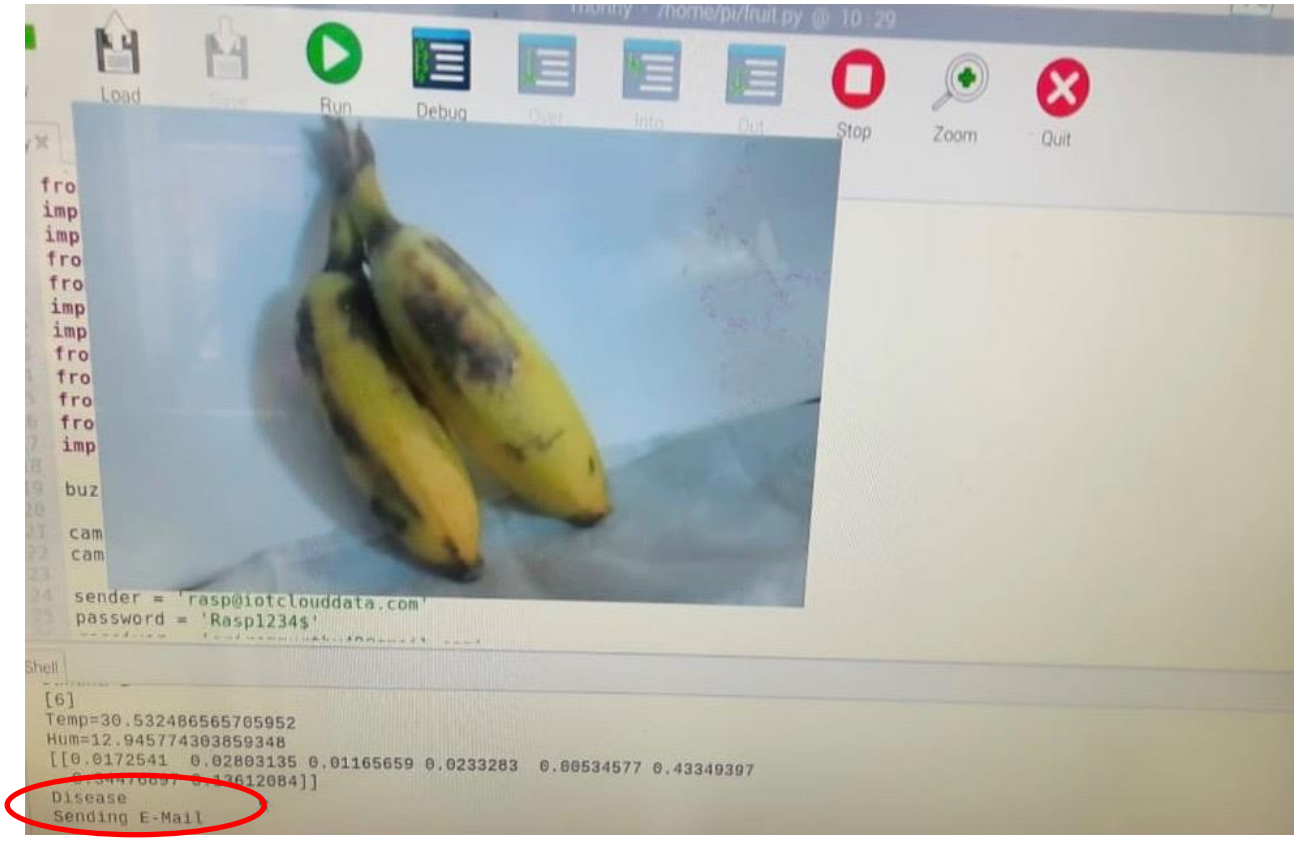
EXPECTED OUTPUT



Sample.2 sample output of two apples

- It shows such that **“apple=2”** the name & count of the fruit

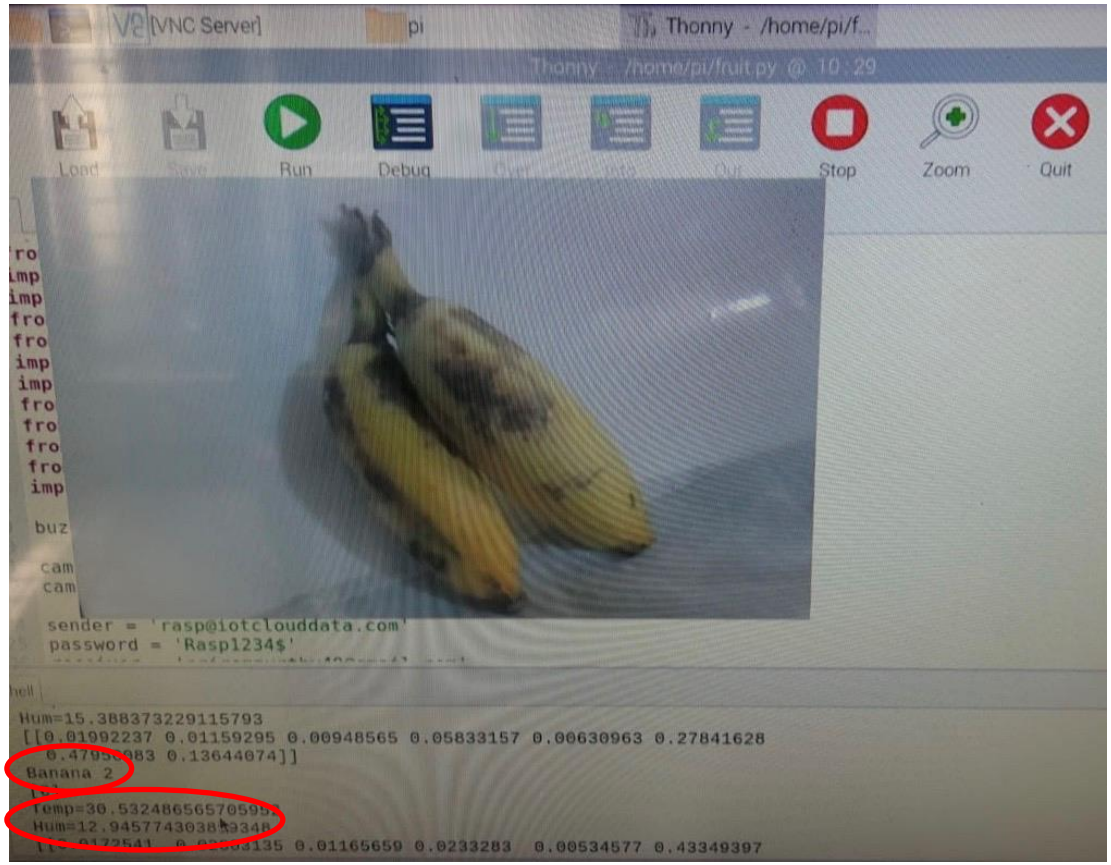
EXPECTED OUTPUT



Sample.3 sample output of two diseased banana

- It shows such that **“disease”** , **“sending E-Mail”** if fruit is found diseased.

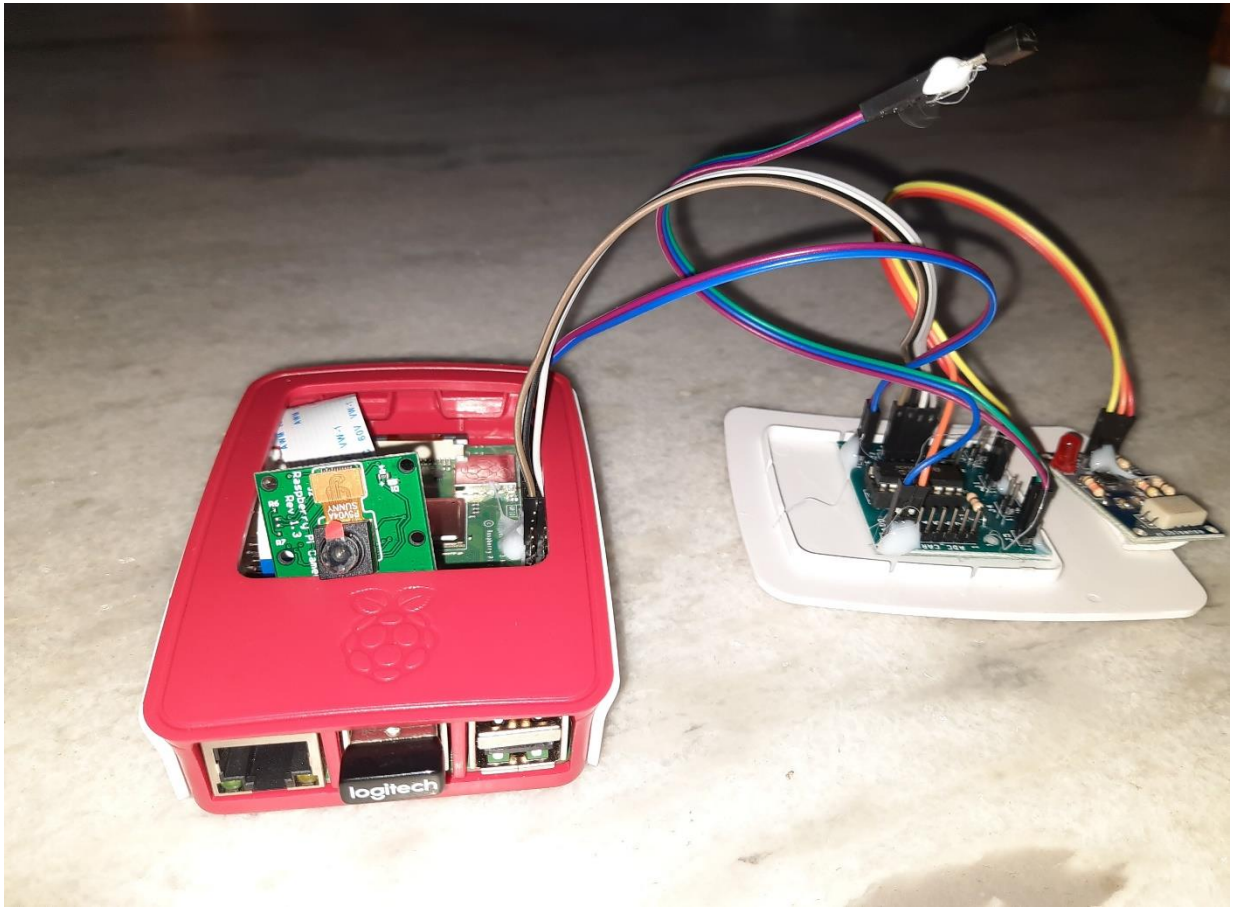
EXPECTED OUTPUT



Sample.4 sample output of two bananas

- It shows such that **“Banana=2”** the name & count of the fruit.
- It also shows the **“temperature” and “humidity”** of the atmosphere.

Final product



ADVANTAGES

- This method helps in speed up the process and reduce time.
- It improve accuracy and efficiency.
- Best suited for different illuminant condition.

CONCLUSION

- Finally, the feature values are fed as input to the classifier to classify the given image from which the type , quantity and quality of fruits are determined.
- The environmental conditions are closely monitored and actions are taken if necessary.

APPLICATIONS

- In the food industry to segregate healthy fruits from diseased fruits and can only the healthy fruits be further processed.
- Harvesting Good and healthy fruits in the farm.
- Segregating fruits based on quality and grade for marketing.
- Grouping fruits according to quality for export

Future enhancement

- For future enhancement to this project, the trained data can be tuned further and the extraction of more features other than that are mentioned in abover report will assist in increasing the prediction accuracy.
- The enhanced one will be as bot version in which the product is incorporated.
- There will also be software user interface in the mobile application paltforms for the user convenience.

REFERENCES

[1] Michael Halstead , Christopher McCool , Simon Denman , Tristan Perez , and Clinton Fookes “Fruit Quantity and Ripeness Estimation Using a Robotic Vision System” IEEE ROBOTICS AND AUTOMATION LETTERS, VOL. 3, NO. 4, OCTOBER 2018

[2] Jnaneshwar Das , Camillo J. Taylor, James Underwood “Monocular Camera Based Fruit Counting and Mapping With Semantic Data Association” in IEEE ROBOTICS AND AUTOMATION LETTERS, VOL. 4, NO. 3, JULY 2019

[3] Xu Liu, Steven W. Chen, Shreyas Aditya, Nivedha Sivakumar, Sandeep Dcunha, Chao Qu, Camillo J. Taylor, Jnaneshwar Das, and Vijay Kumar “Robust Fruit Counting: Combining Deep Learning, Tracking, and Structure from Motion” in 2018 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS) Madrid, Spain, October 1-5, 2018.

[4] Chi Cuong Tran , Dinh Tu Nguyen , Hoang Dang Le , Quoc Bao Truong "Automatic dragon fruit counting using adaptive thresholds for image segmentation and shape analysis" in 2017 4th NAFOSTED Conference on Information and Computer Science

[5] Susovan Jana, Ranjan Parekh "Automatic Fruit Recognition from Natural Images using Color and Texture Features "in 2017 Devices for Integrated Circuit (DevIC), 23-24 March, 2017, Kalyani, India.

[6] Manali R. Satpute ,Sumati M. Jagdale "Automatic Fruit Quality Inspection System " in 2016 IEEE conference.

[7] Anisha Syal, DivyaGarg, Shanu Sharma "Apple Fruit Detection and Counting Using Computer Vision Techniques "in 2014 IEEE International Conference on Computational Intelligence and Computing Research

[8] Hongshe Dang, Jinguo Song, Qin Guo "A Fruit Size Detecting and Grading System Based on Image Processing"in 2010 Second International Conference on Intelligent Human-Machine Systems and Cybernetics