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CROP HEALTH MONITORING USING AGRICULTURAL DRONE

Mr. Franklin M [1], Mr. Sheikameer Batcha.S [2], Mr. Praanesh [3], Mr. Ajay Pranesh [4], Mr. Sathyaseelan [5]

Department of Electrical and Electronics Engineering, Sri Eshwar College of Engineering, Coimbatore – 641202.

Abstract - Agriculture was the key development within the rise of inactive human civilization, whereby farming of domesticated species created food surpluses that enabled folks to measure in cities. The history of agriculture began thousands of years past. Crop health is of paramount importance to farmers; thus, careful and consistent monitoring of crop health is an absolute must. There are many challenges faced by farmers to yield a single batch of the crop they planted like, availability of water, skilled labours, organic fertilizers, storage, monsoon turnaround time, market price variation and decrease in demand of produce. Out of these many challenges crop health stands the most important problem faced by the farmers in their daily yield. Crop health decides the quality of the yield they produce and it in turn decides the market value of their harvest on which their daily living based upon. That's why this challenge stands the top most problem to any farmer and they try all their best to keep the crops healthier. And also, they are coming up with ways to monitor that health and need a lot more help from engineers as us to meet their crop health monitoring need.

***Key Words*:** Agriculture, crop health, health monitoring, farmers.

1.INTRODUCTION

At present mostly around the globe crops' health are being monitored through manual methods. This takes a lot of time for the farmer to understand the health of the crops and in turn makes it impossible for coming up with a remedial action at an earlier time. Farmers expect their crops to be monitored with their health at a faster rate so that they can pose a necessary action to increase their crops' health and thus profiting with a high market value for their good quality crops. They want to produce good quality crops not just for the sake of market value and money but the world needs it. Not only we human beings, every living thing need food and that should be highly edible and nutritional for living their daily life in a healthier life, thus keeping a crops life healthier in turn somehow keeps whole world healthier and nutritional. But there are many factors which stops farmer from attaining this goal and in turn makes every human beings' life to a less nutritional life and that's not good. And these factors are mandatory to be monitored if not, can lead to a yield of a highly low-quality crops which mutually affects the farmers and the consumers. Here are seven of the most important crop health metrics for farmers to monitor, based on the Sustainable Agriculture Research & Education (SARE) Program's guidelines.

2. PROBLEM STATEMENT

An indicator that your crops are extremely susceptible to pests and diseases would be if over 50% of the population ends up getting damaged by said factors. Under the right circumstances, less than 20% of your crops would be negatively affected by any invasion of pests or spread of disease, allowing them to easily recuperate and increase in number once more.

Building crop resistance against harmful insects and diseases can be done in a number of ways, including improving crop diversity, crop rotation, using organic pesticides such as Himalayan salt spray and eucalyptus oil, and even genetic research and enhancement.

3. OBJECTIVE

The objective of our project, "Crop Health Monitoring using Agricultural Drone" is to help out the farmers to monitor their crops they have sowed in their fields in a larger scale which reduces the labour required, increases the accuracy, sorts out with remedy to make them healthier if any damage is detected, saves the time and thus help them out in producing good quality yield which has really high market value.

4. HARDWARE COMPONENTS

In our project, the following components are used,

1. Raspberry PI 3B+
2. BLDC Motor
3. LIPO battery
4. Propeller
5. KK2 flight controller
6. FVP Camera
7. LIPO Controller

5. WORKING OF THE AGRICULTURAL DRONE

The working of the proposed project, "Crop Health Monitoring Using Agricultural Drone" can be divided namely into two main categories.

1. Flight of the Drone

2. Image Processing Technique.

FLIGHT OF THE DRONE

Drones or Unmanned Aerial Systems (UAV - Unmanned Aerial Vehicle or UAS - Unmanned Aerial Systems) are the aircrafts, which are able to fly without a pilot and passengers on board. Drone Controlling is performed remotely by radio waves or autonomously (with a predetermined route). Drones do not have a specific size or type of a drive. They are often equipped with accessories used for surveillance and monitoring, in the form of the optoelectronic heads.

The most important feature of the drones is that they do not need any additional infrastructure to quickly register and monitor a designated area or object. The basic element of a drone is a frame, which should be maximum light. The classification of frame construction is mainly based on the number of arms. Due to the number of arms and the motors used the drones can be divided into: 1. Bicopters – two engines, 2. Tri copters – three engines, 3. Quadcopters – four engines, 4. Hex copters – six engines, 5. Octocopters – eight engines. The next components of a drone are engine and propellers. They constitute the main propulsion system of a drone and are subjected to the highest loads, therefore their durability is very important. The propellers change a torque (derived from the engine) for a work used for lifting the vehicle in the air. A drone is powered by batteries, which is the major drawback, because it is exhausted after 15 minutes of flight, causing a decrease drone on the ground. In general, batteries are the sets of two or more voltaic cells of the same type, providing a current that is stronger than a single cell. These can be divided into disposable batteries and electric accumulators that can be unloaded and loaded many times

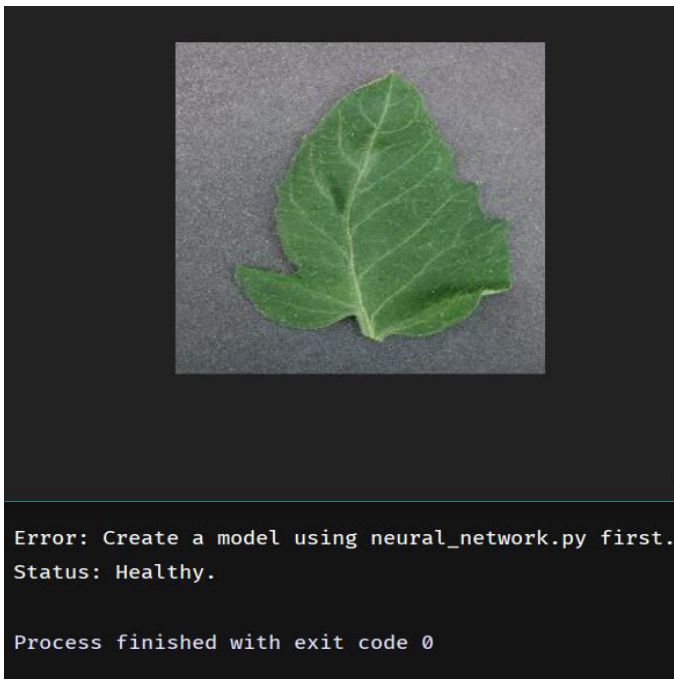
IMAGE PROCESSING TECHNIQUE

Image segmentation is the process of separating or grouping an image into different parts. There are currently many different ways of performing image segmentation, ranging from the simple thresholding method to advanced color image segmentation methods. These parts normally correspond to something that humans can easily separate and view as individual objects. Computers have no means of intelligently recognizing objects, and so many different methods have been developed in order to segment images. The segmentation process is based on various features found in the image. This might be color information, boundaries or segment of an image. It works as follows:

i) Image Acquisition from FPV Camera
ii) Image Pre-processing using OpenCV Python
iii) Image Segmentation
iv) Feature extraction of infected region and displaying the disease through TensorFlow ML.

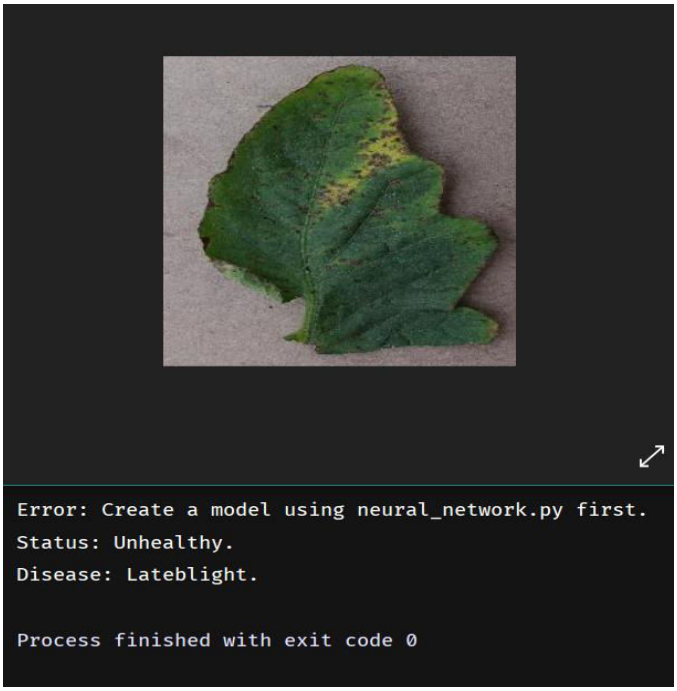
6. RESULT

➢ When checked with a green leaf taken from garden following result has been yielded:



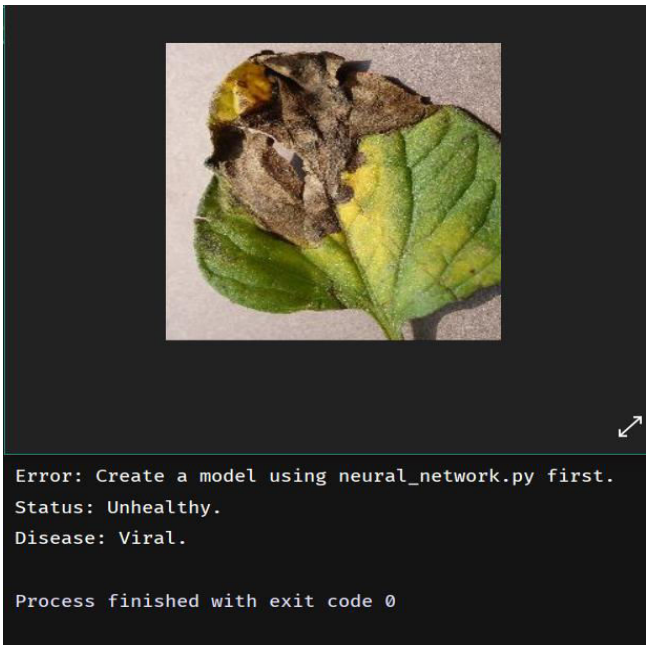
We were able to see that the leaf which we tested was in HEALTHY state.

- When tested with a pale-yellow coloured leaf taken from the garden the following result was obtained by us:



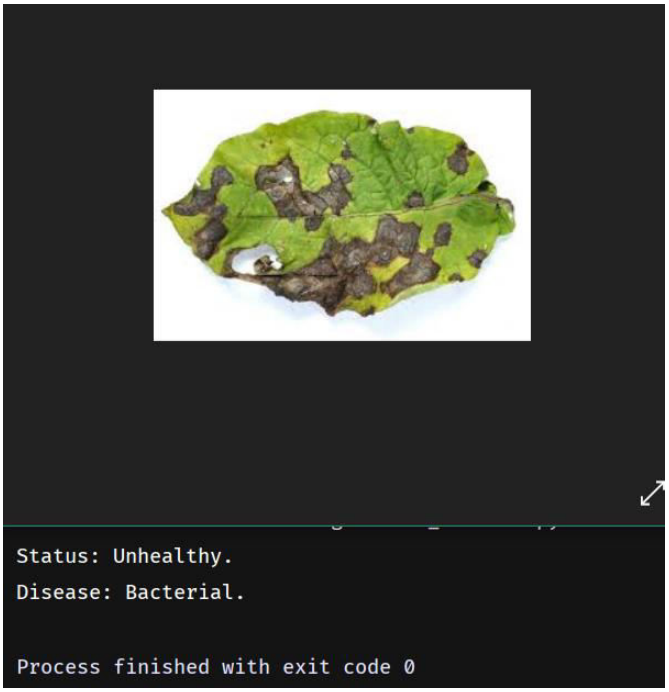
You can able to see that, the status of the leaf is shown as UNHEALTHY and the disease is also tagged along in the result.

- When experimented with a severely damaged leaf, we were able to know what the disease that the crop got affected from was and the necessary measure was taken. The result we achieved was:



You can able to see the result of the given leaf is UNHEALTHY and the kind of disease it's being affected is VIRAL, so we can try some fertilizers which are BASE in nature (like Sodium, Potassium, NPK or Sodium Nitrate) in nature to overcome the disease.

- When we tried to observe a black-spotted leaf, this was the result we were inferred with:



The result clearly shows that the crop is affected with some bacterial disease, so the farmer/gardener should try an acidic fertiliser (like ammonium nitrate, ammonium sulphate, or sulphur-coated urea) to overcome this disease.

6. CONCLUSIONS

Thus, the proposed drone system helps us to locate regions that are affected by diseases and pesticides so that lot of chemicals being used in agriculture, namely fertilizers, herbicides and pesticides can be used within sufficient amount, by particularly focus on the regions that are affected and apply chemicals only in that particular area, avoiding excessive usage of the chemicals to pollute the land and water resources. By the use of regression algorithm in TensorFlow, the infected region of the leaf is segmented and analysed. The images are fed to our application for the identification of diseases. It provides a good choice for agriculture community particularly in remote villages. It acts as an efficient system in terms of reducing clustering time and the area of infected region. Feature extraction technique helps to extract the infected leaf and also to classify the plant diseases.

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