ROBOTIC ARM INSTALLED FRUIT PLUCKING UAV- BASED ON AI

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College ***:*** *Srinivas Institute of Technology, Mangaluru*
Branch ***:*** *Aeronautical Engineering*
Guide(s) ***:*** *Mr. Srinidhi Kukkila*
Student(s) ***:*** *Ms. Navneet Soni*
Mr. Naveen Kumar T M
Mr. Vardhaman R Vasawade
Mr. Nithin Kumar H K

Keywords:

Deep-Learning, Catia V5, Design & 3D printing, Raspberry Pi 3, VNC Viewer, Object-Detection, LabelImg, Matlab R 2022a, Servo-Simulation, Automation.

Introduction:

The skilled farm labor in the agriculture field is one of the most monetary-dependent factor. This is because of the other rising elements, for example, the relocation of an enormous populace from provincial to metropolitan regions, power, water systems, agrochemicals, technological advancement, and so on. Thus it puts the agro-sector under pressure with small profit margins compared to the hard work and time invested.

The advancement of a multicopter with an automated arm answers reaping organic products from levels. The proposed project comprises a multicopter with a camera on it which detect the reapness or rawness of the fruit based on that the gripper will pluck the fruit from the tree.

Objectives:

1. To reduce the manual work.
2. To overcome the scarcity of skilled laborers.
3. Reduction in harvesting period as compared to manual (labor) harvesting.
4. It is a one-time investment so that overall cost is far lower.
5. The UAV hardly requires any maintenance.
6. The repairing of UAV not too complicated.
7. In hilly region this UAV becomes great asset during harvesting period.
8. In order to make farmer more aware of technological advancement this is the great step.
9. The farmer need not be worry about the rawness/reapness of the fruit which would be taken care via Object Detection.

10. The main aim is to benefit the farmer by reducing the time, effort and money required during harvesting.

Methodology:

1. First and foremost gathered the datasets of a fruit.
2. Training the model for object detection.
3. Deploying the trained model into the hardware.
4. The mounted camera on the drone gets the real-time video feed of fruit
5. Instances from the feed were checked by trained model for accuracy of particular class i.e. raw and ripened.
6. If the desirable instances are found and has the proper accuracy then the activation of further process can be done.
7. The robotic gripper as designed in catiaV5 and then it is 3d printed.
8. This gripper then pluck and hold the fruit.

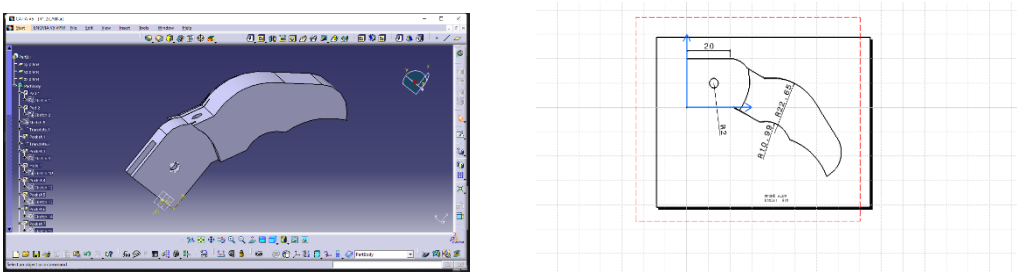

Fig. 2d and 3d view of gripper finger

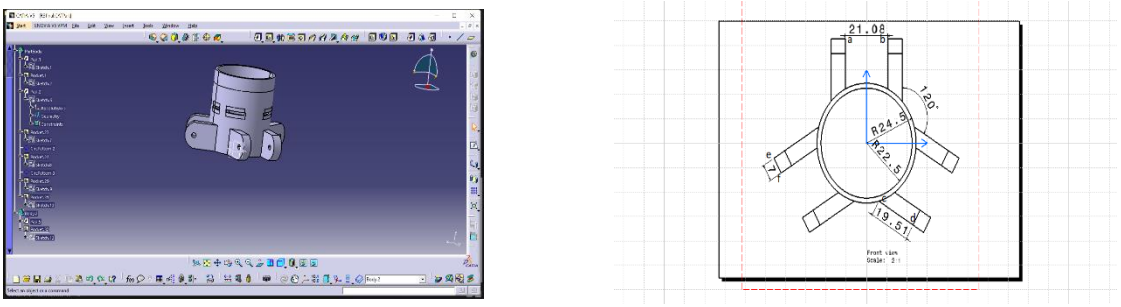

Fig. Mount assembly in 3d and 2d

Fig. Drone and its assembly

Result

- Our Object detection has almost 98% accuracy as shown in Accuracy plot**.**
- Training cycle**-** Epoch: 6
    - Iteration: 678
    - Iterations/Epoch: 113
- Here we have two classes raw and ripened which are recognized efficiently.

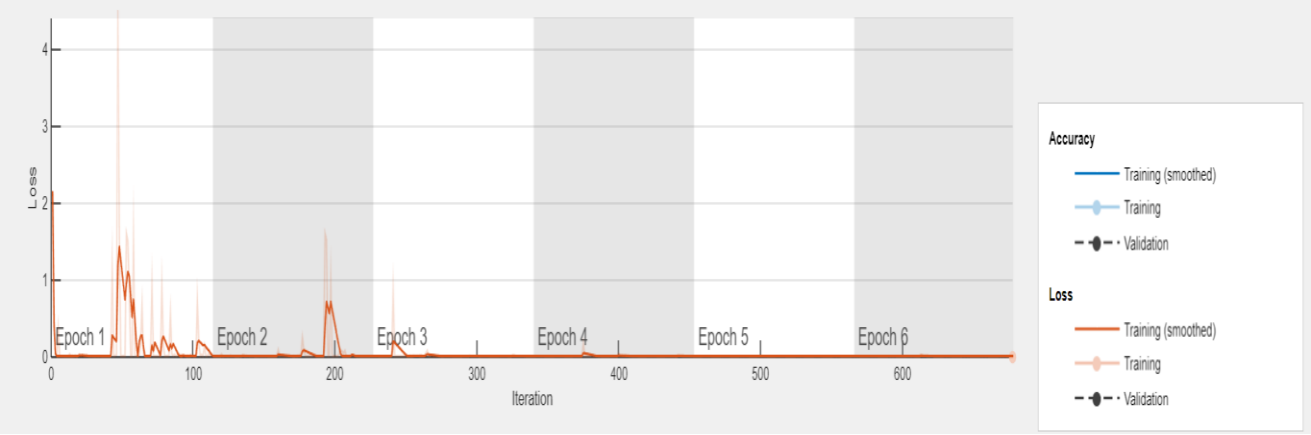

Fig. Loss plot

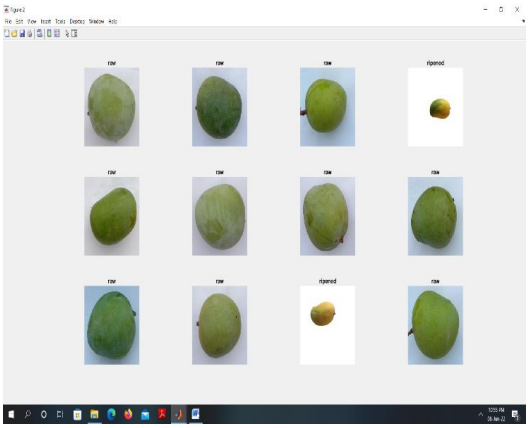

Fig. Result of Object Detection

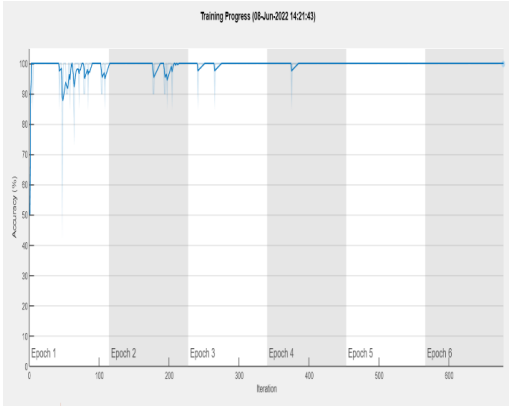

Fig. Accuracy plot

Conclusion:

This project proposes an effective fruit plucking technique by providing an object detection system and a robotic arm with a gripper can lift payloads up to 500gm. The camera module attached to the copter gives information about the fruit through object detection using the SSD model. The multi-copter has a flight duration of almost 13minutes and has sufficient flight stability. The robotic gripper has been 3-D printed to facilitate the holding of fruit. A significant amount of reduction in manual work, as well as the number of labors who are employed to do the task, can be reduced which is directly beneficial to farmers by saving their time and monetary funds.

Scope for Future Work:

- In the upcoming future, everything in agriculture will be automated so as the way of harvesting the fruit.
- This proposed UAV can be made Autonomous, so there is no need of a pilot to operate it.
- The Uav can also predict the time at which the fruit is ready to harvest based on the current situation.
- With other attachments the drone detect what kind of disease is there in particular tree and based on that it can spray the pesticide.
- In upcoming days the drone can give the information regarding sugar content.