Temporal Plant Modeling Of Cauliflower using Virtual Reality

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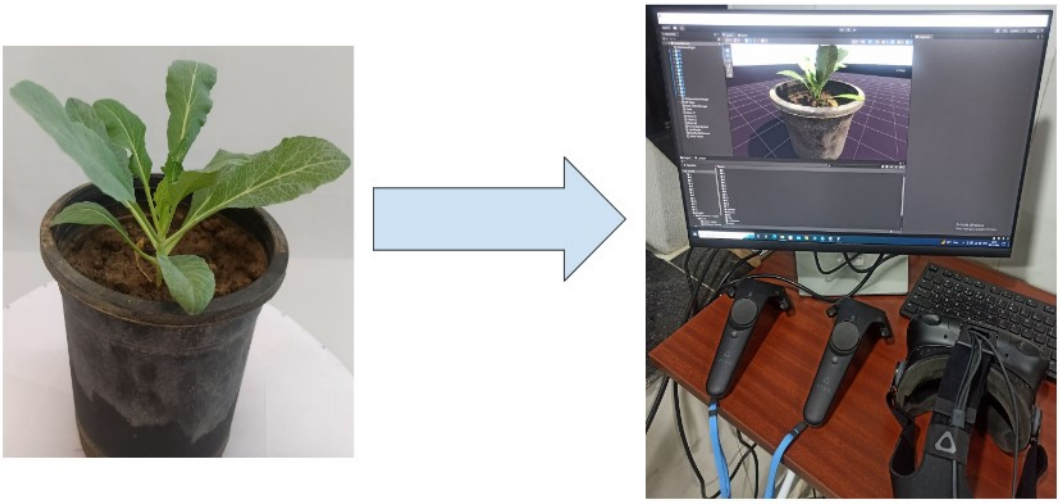
December 2, 2022



1 Motivation

Agritech has a lot of unexplored areas, one of them is agriculture in the VR domain. As there is no previous work done on temporal modeling of plants in VR. So, we tried to explore this direction, which provides technical assistance in the agriculture field.

2 AIM

- Visualizing the growth of natural plant in VR
- Train about the growth of plant

3 Overview

The plant under our observation was cauliflower. The sapling was transplanted from a nearby farm into a pot which had an appropriate amount of cocopeat. We brought the plant to our lab and provided the required environment as follows

- LED Light (100 Watts) - 10 hours/day
- Watered the plant - every alternative day
- Placed the plant at well ventilated place

The observations of the plant were taken for 21 days. Each day, a 3D model of the plant was made by photogrammetry, where we acquired plant images from different poses, which were further controlled by

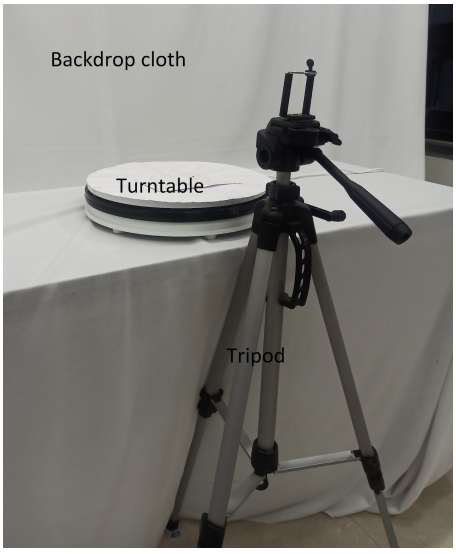
- Turntable Rotation to get 360-view of the plant
- Tripod tilt and height to get level views above the horizon

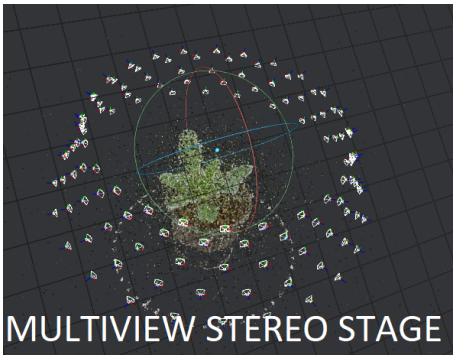
The images captured were fed into MeshroomCL. We get a 3D model after the meshroom pipeline gets over. The computation process takes about 8-10 hours depending on the images.

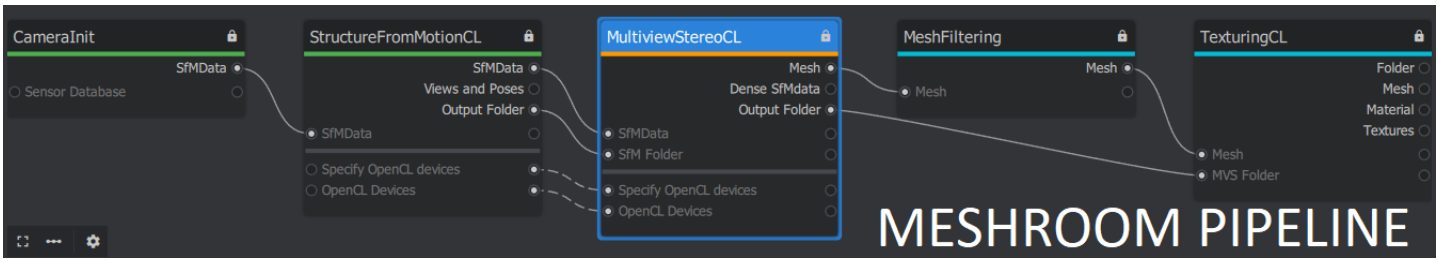
Afterward, all the 3D models were aligned in meshlab using its native Align tool. The models were finally imported to a unity VR project with the following interactions which can be controlled by the HTC Vive controllers

- Move around the scene and view the plant from all the angles
- Switch between the different plant models

4 Setup For Photogrammetry

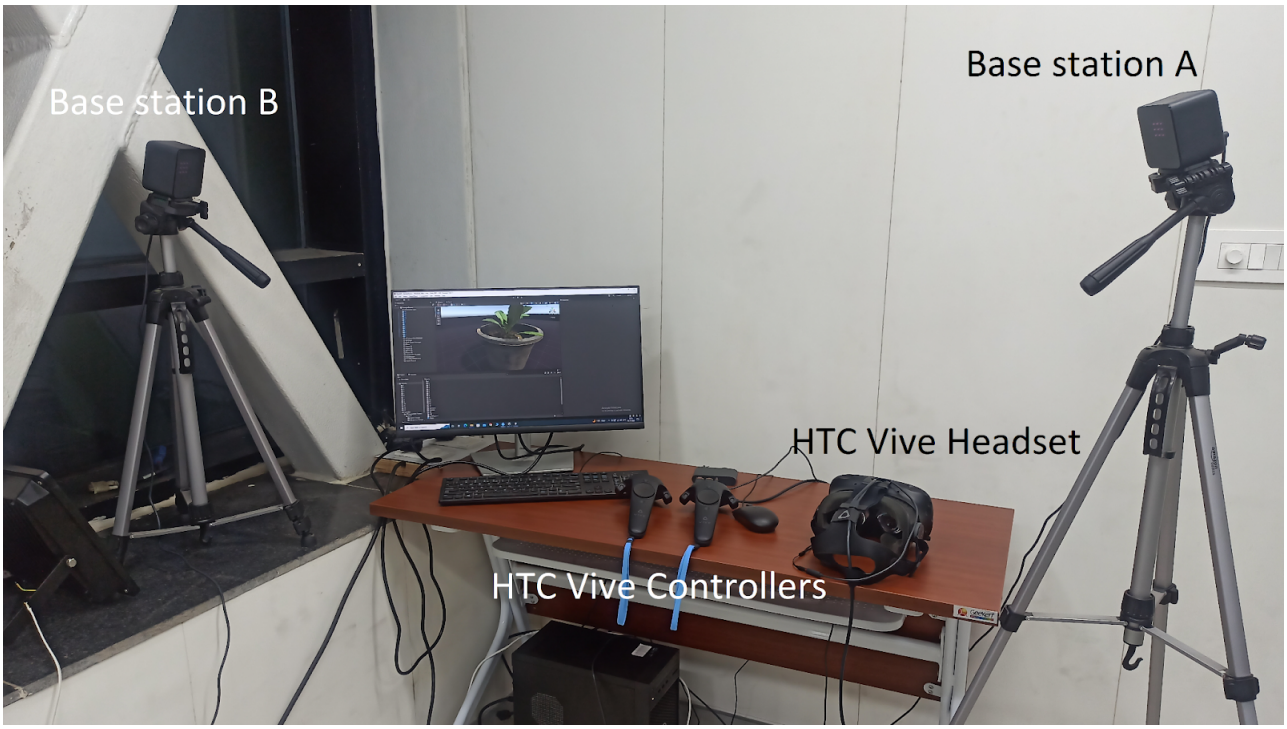






5 VR Setup

The complete figure of the VR setup was shown in below figure



6 Fusion Aspect

- Fusion of images from different poses (spatial component)
- Fusion of images at different time (temporal component)

7 Challenges

- Lack of symmetry in plant growth
- Initial alignment of the plant on the turntable
- Noise in the 3D model due to occlusion of certain parts

8 References

- MeshroomCL Dowload Link `https://github.com/openphotogrammetry/meshroomcl/releases/tag/v0.9.0`
- Special thanks to the following UnityVR tutorials `https://www.youtube.com/playlist?list=PLX8u1QKl_yPDn0-_fMYjJ_5hIA397L-z6`