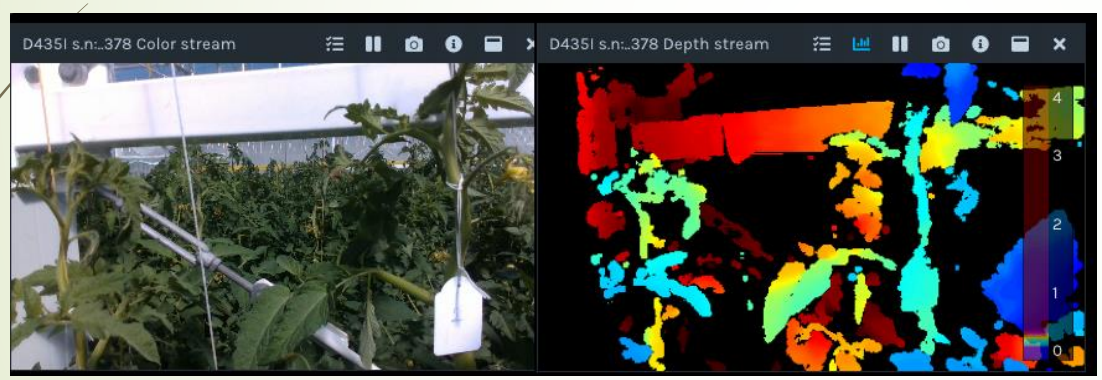
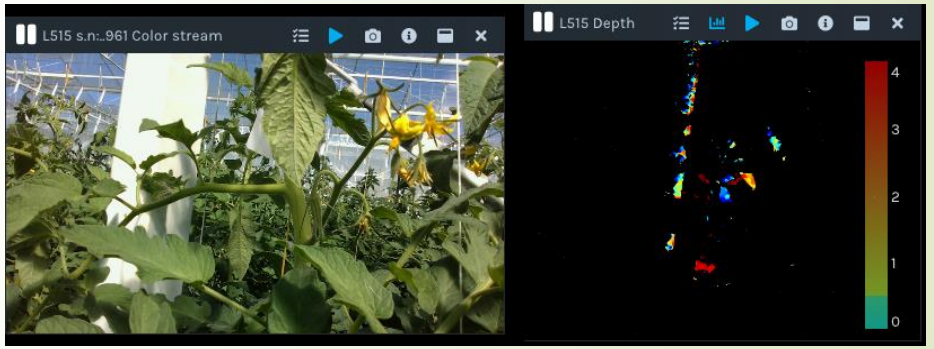
Development transfer report

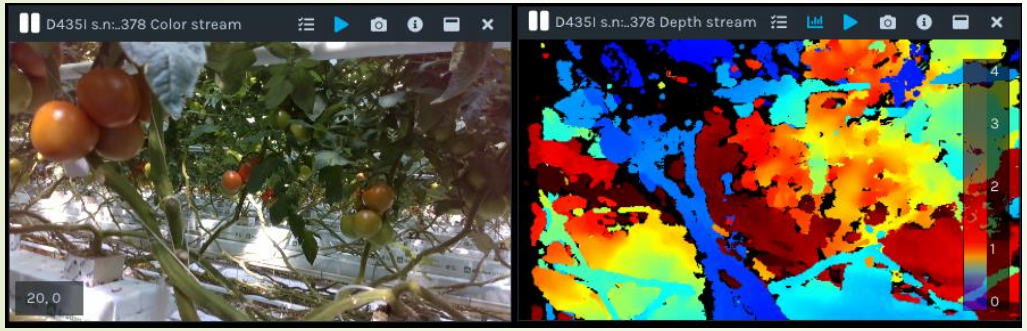
Polina Kurtser, Ekobot, March 11, 2022

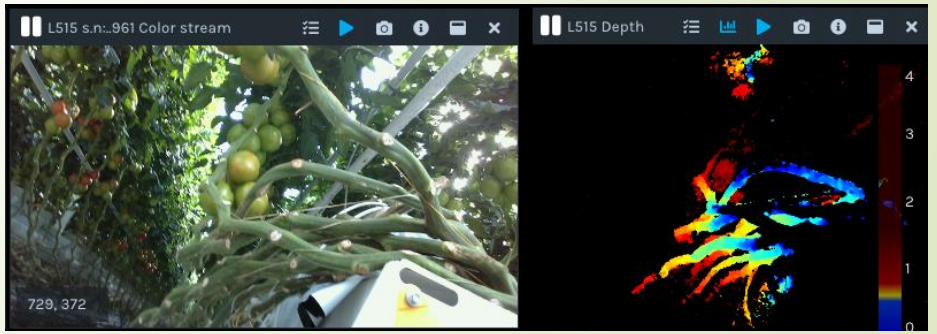
Experiment 1 – Hardware comparison

- Stereo-IR vs Lidar RGBD
- Realsense D435i vs Realsense L515









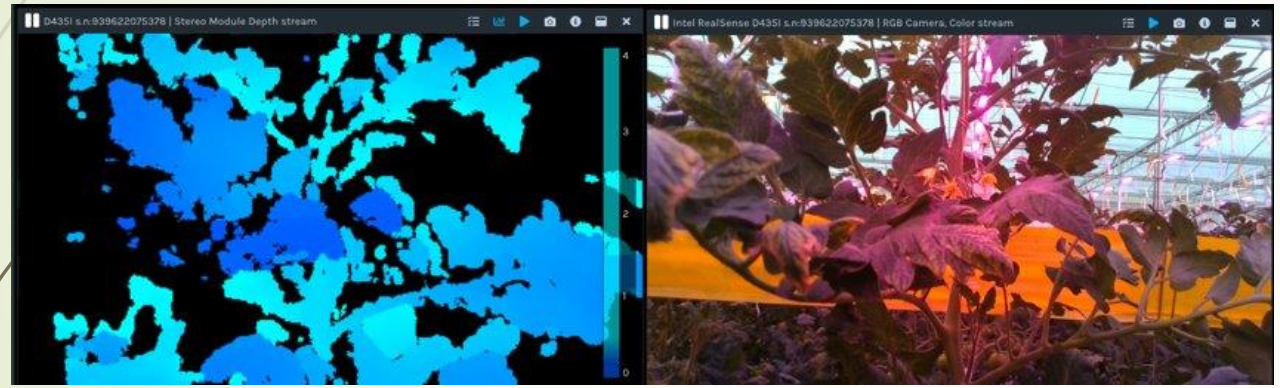
Experiment 1 – Hardware comparison Conclusions

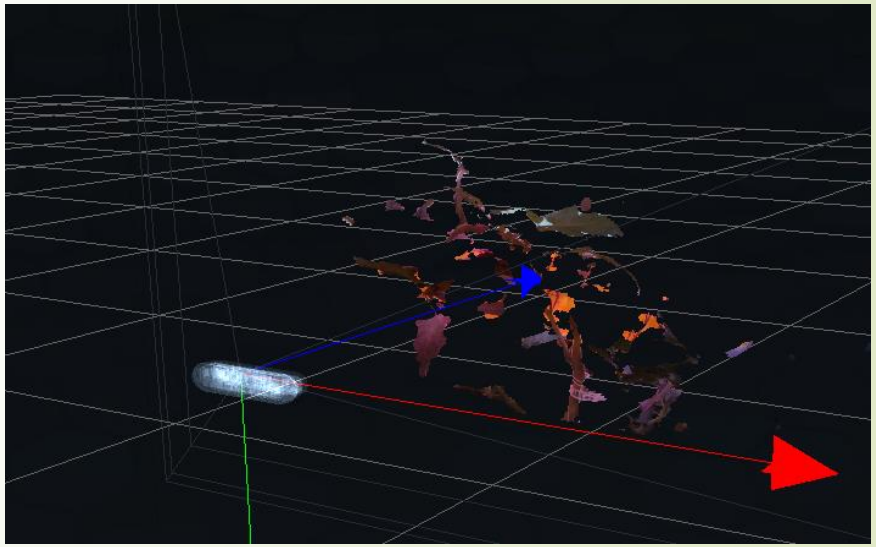
- LiDAR RGB-D dense RGB-D more suitable
- Overheating of the LiDAR sensor, not suitable for mid summer acquisition
- L515 can operate at the bottom of the foliage but not at the top during hot hours

Experiment 2 - Effect of artificial LED lighting on sensor data

LED light depth data

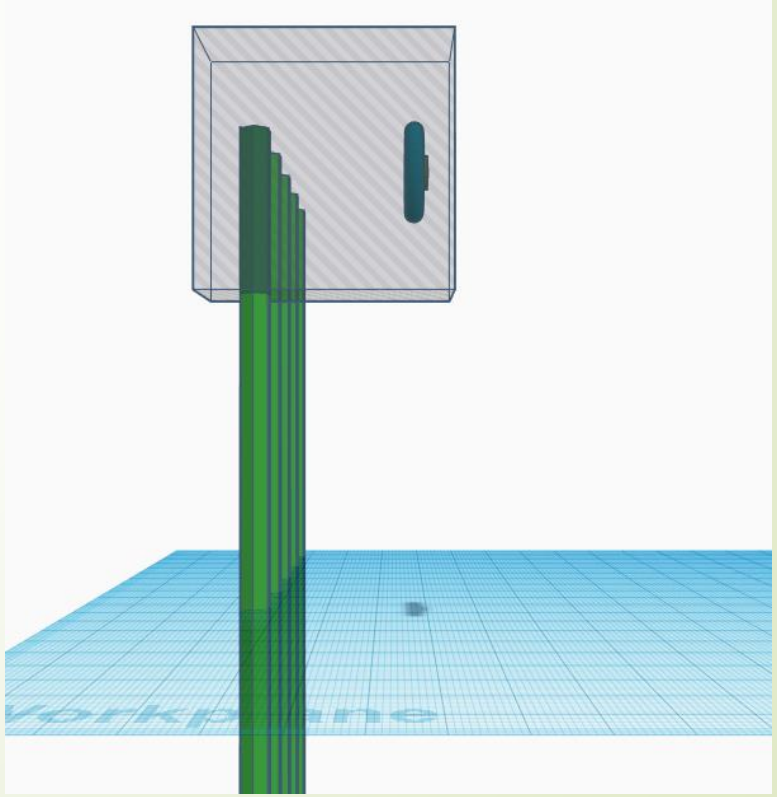
- Experimental data collection in winter conditions with LED light





Conclusions

- Operations in beginning of season or winter can be done without extra "photobox" conditions.

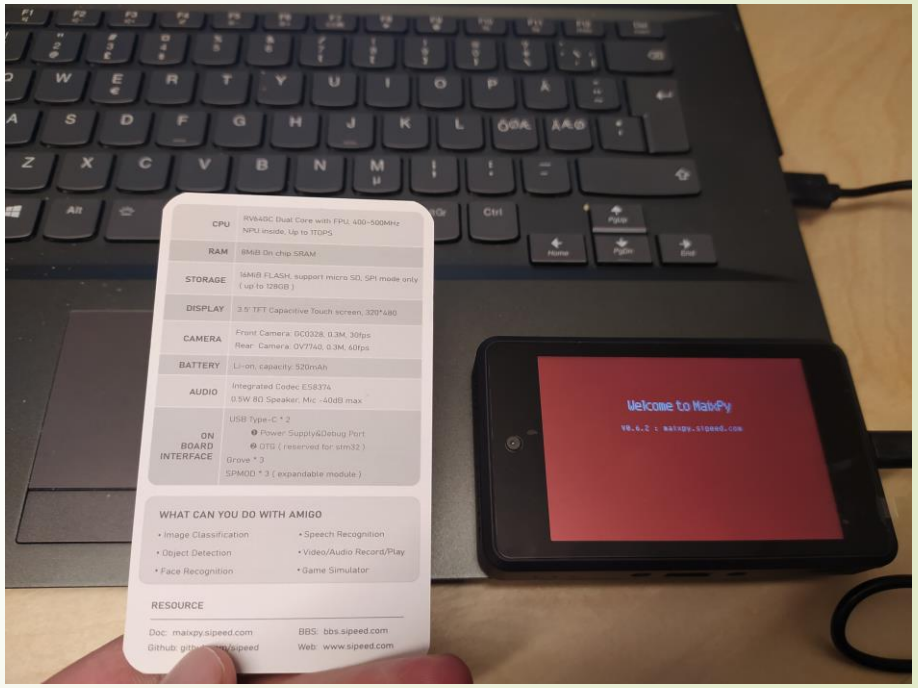


LED light depth data - Conclusions

- No direct effect on data
- Experiments can be made during the winter season with no additional occlusions required

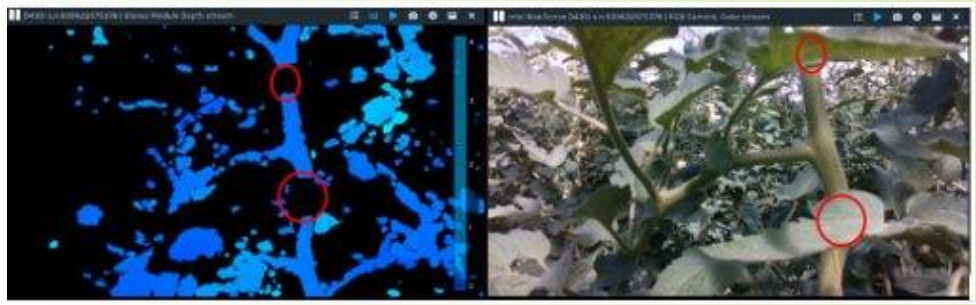
MaixPy

- Potentially can be used for color based detections (e.g., tomatoes).
- Potentially could be used for marker detection training (see last slides)
- Has no depth capabilities
- Light will be a problem
- No in depth evaluation was performed at this stage



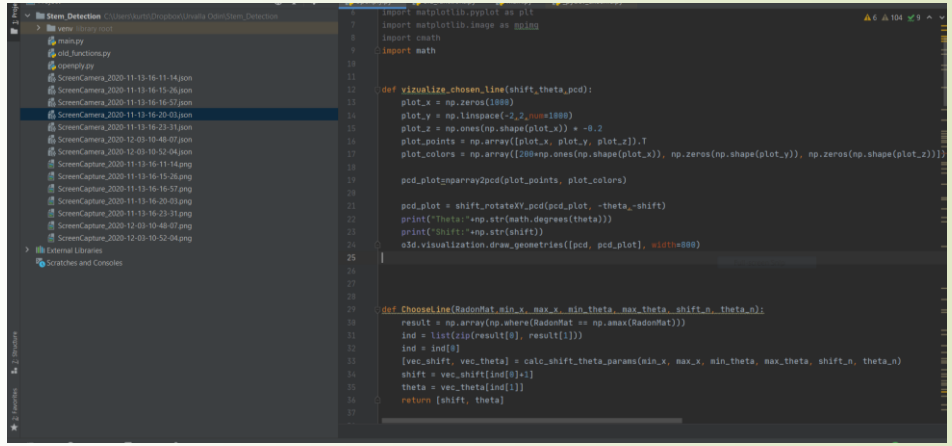
Algorithm development 1 – Stem detection

- Issues:
  - Occlusions
  - Imaging angles
  - Noise



Software package I – stem detection

- Python code
- Radon transformation based
- Algorithm:
  - Filter based on geometric features
  - Assigned most significant radon line
  - Detect stem
  - Rotate stem



Software package II – stem features extraction

- Stem width
- Stem length

Stem width evaluation

- 18 tomato stems
- Width detected c.a. 9-11 mm at direction facing camera
- Corresponding to ranges found in the field

Uge nr. 34

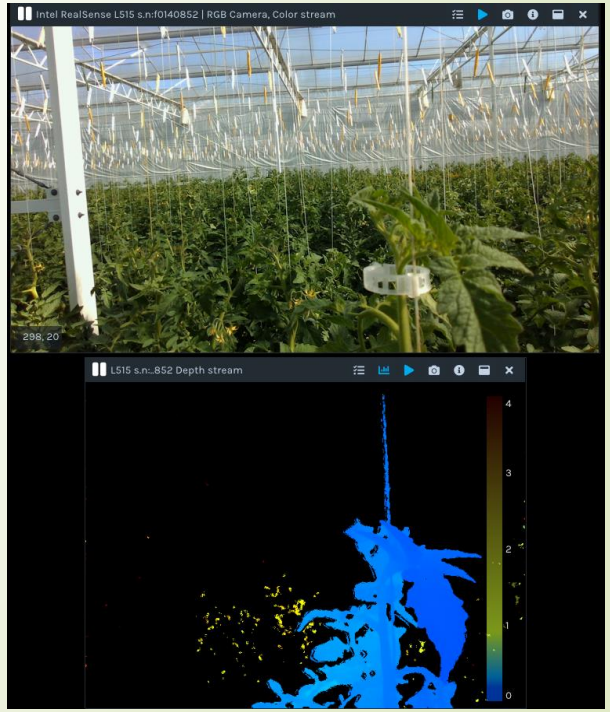
1145 Merlice AGAM	1 II	2 III	3 I
Klase, blomster nr.	24.4	24.3	24.5
klase set	24.5	23,5	23.5
Antal frugt set			
Klase højde	13,5	11,5	18
Klase længde	4	3,5	3
Vækst (cm)	17	19	19
Stængel tykkelse (mm)	9,6	9,7	9,6

Stem width evaluation – future issues

- Measurements are made manually today in the widest point which is not the plane facing the camera
- Could be mitigated if to be consistently measures along the season from the same direction
- Current solution: Acquisition protocol from a static viewpoint for each plant
- Could be evaluated: Multiple viewpoints and registration of data.

Stem length

- Current working solution – identification of full length visible to camera in single frame
- Challenges – measurements to be done in comparison to previous week measurement point.
- Mitigation - placement of markers to identify last week's measurement



Marker detection algorithm

Bad detection

OK detection

Marker detection

More data and ML based algorithms needed

- For labeling or systematic data reporting along the season