2021-7-14	Establish this document	HL
2021-7-16	Add C# and Python interface Requirements	HL

Lecture 2. Unity Hands-on Homeworks

Instructors: Harry Li, Ph.D., and Chee Vang.

Objectives and tasks:

Based on the lecture/tutorial on Unity, conduct hands-on implementation for

(1) Importing CAD mode "109-Beward B54-1-IP2_ASS.SLDASM" which is provided in the class, see github link for downloading this file https://github.com/hualili/robotics-open_abb/blob/master/fd100/109-Beward%20B54-1-IP2_ASS.SLDASM;

(2) Create a virtual movie screen in 3D world coordinate system. Use Unity AR (Augmented reality features) to build a video display on a virtual movie screen in the 3D world coordinate system, and play back this video while integrating this with the camera model in the 3D world environment. The video clip file is:

https://github.com/hualili/robotics-open_abb/blob/master/fd100/109d-vision-agv-cti-testing-%23Stereo%202%20Color.mp4 (2.4 MB video file).

Or alernatively,

https://github.com/hualili/robotics-open_abb/blob/master/fd100/109b-%23101-5-garbage%23123-Garbage%20Detection.mp4 (larger video file)
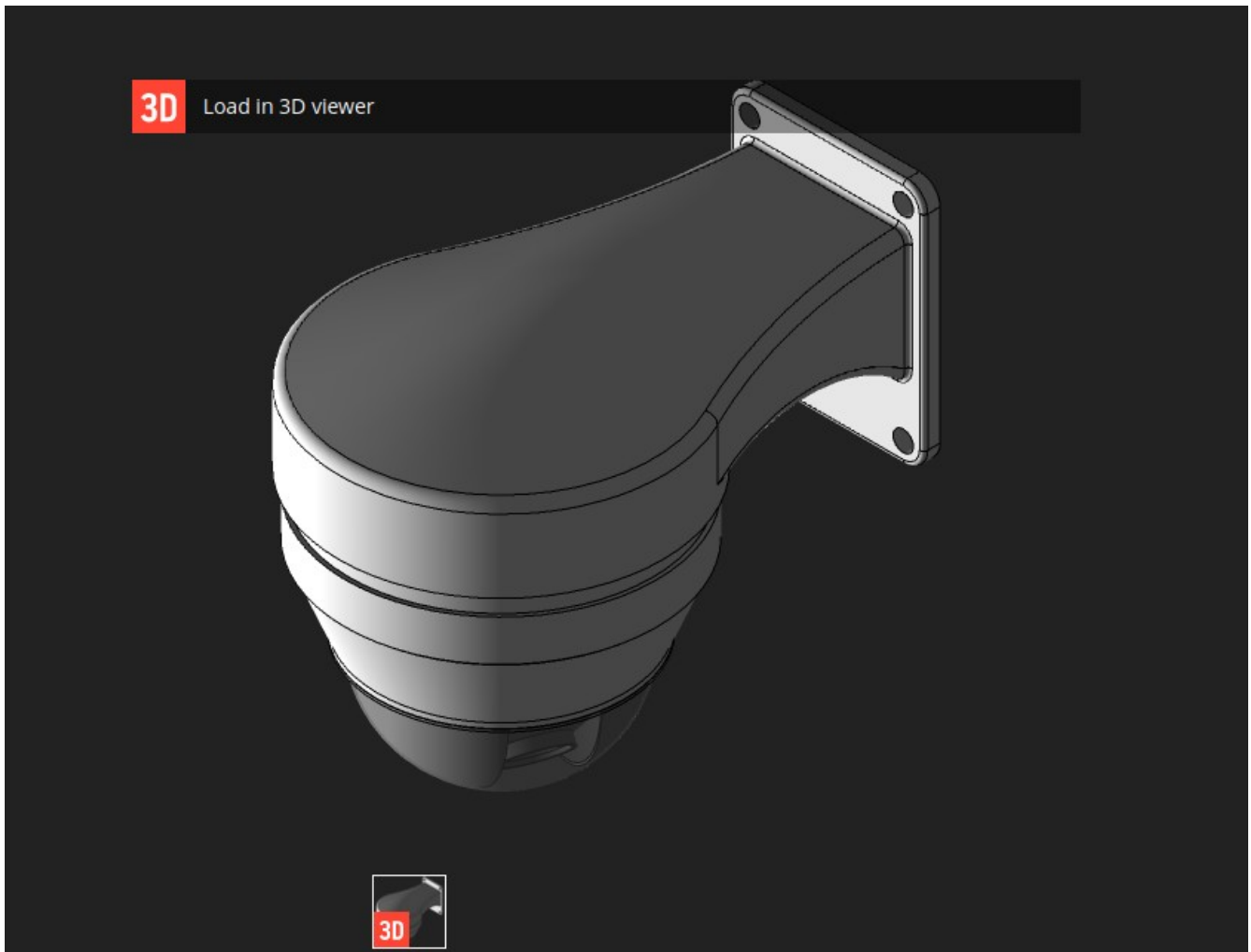
Or video

Hands-on Implementation Requirements:

(1) Form a 2 or 3 person team, or one big team for the entire class if needed;

(2) Implement tasks 1, to display the CAD model similar to the screen capture in Appendix A.

(3) Watch you tube video for Unity AR tutorial and implement task 2.

Submission: Create a report, similar as the class sample readme file (see the sample readme https://github.com/hualili/robotics-open_abb/blob/master/fd100/105-4-%23107-1-readme-%23Unity-6-DoF-Robot-Arm-ML-Agents-CV-2021-5-7.pdf) and submit your report via email once the work is done, due in 1 week.

Appendix A. CAD Model
https://grabcad.com/library/beward-b54-1-ip2-camera-1

Appendix B. Unity AR Reference
(1) Document from Unity on AR
https://docs.unity3d.com/Packages/com.unity.xr.arfoundation@2.1/manual/index.html

(2) Youtube tutorial link
https://www.youtube.com/watch?v=FuKzngwzDYI

About AR From Unity

https://docs.unity3d.com/Packages/com.unity.xr.arfoundation@2.1/manual/index.html

unity Manual

AR Foundation 2.1.18 v

AR Foundation allows you to work with augmented reality platforms in a multi-platform way within Unity.

ARCore ARKit   Magic Leap   HoloLens

AR Foundation is a set of MonoBehaviours and APIs for dealing with devices with:
1. World tracking: track the device's position and orientation in physical space.
2. Plane detection: detect horizontal and vertical surfaces.
3. Point clouds, also known as feature points.
4. Reference points: an arbitrary position and orientation that the device tracks.
5. Light estimation: estimates for average color temperature and brightness in physical space.
6. Environment probes: a means for generating a cube map to represent a particular area of the physical environment.
7. Face tracking: detect and track human faces.
8. Image tracking: detect and track 2D images

Appendix C. Virtual Movie Display

PART 2. C# and Python Interface for DNN Platform Development
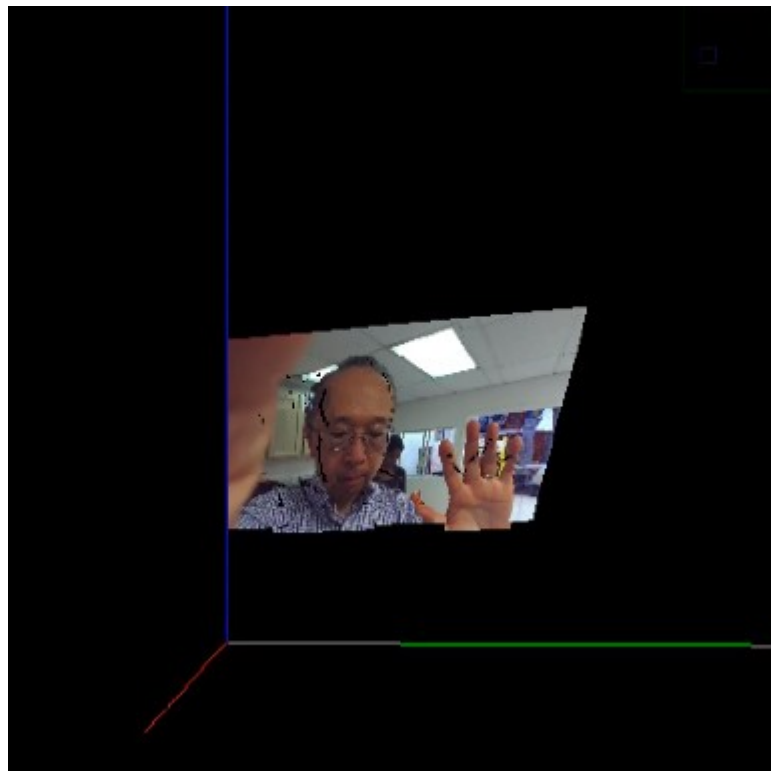
Objectives and tasks:

(1) Enable C# development platform on Ubuntu Linux;

(2) Establish C# Python Interface with 3 steps sample programs (Stage 1 to 3);

(3) Integrate 3rd party DNN in TF to Unity, phase 1 for SatMind DNN;

(4) Testing as an intermediate step with TF for handwritten digits recognition (MNIST model).

Hands-on Implementation Requirements:

(1) Implement Stage 1 – 3 programs on your machine , to display your first and last name, and last 2 digits of your phone number;

Submission: Create a report, similar as the class sample readme file (see the sample readme https://github.com/hualili/robotics-open_abb/blob/master/fd100/105-4-%23107-1-readme-%23Unity-6-DoF-Robot-Arm-ML-Agents-CV-2021-5-7.pdf) and submit your report as well as three programs via email once the work is done, due in 1 week (July 23).

(END)