VE/VM450 Cargo Volume Estimation Manual

Base Environment

- Ubuntu 16.04 LTS

Library Installation

1. Opencv

- Prerequisite

```
sudo apt-get -y remove ffmpeg x264 libx264-dev
sudo apt-get -y install build-essential checkinstall cmake pkg-config yasm
sudo apt-get -y install libopencv-dev
sudo apt-get -y install libtiff4-dev libjpeg-dev libjasper-dev
sudo apt-get -y install libavcodec-dev libavformat-dev libswscale-dev libdc1394-22-dev
libxine-dev libgstreamer0.10-dev libgstreamer-plugins-base0.10-dev libv4l-dev
sudo apt-get -y install python-dev python-numpy
sudo apt-get -y install libtbb-dev
sudo apt-get -y install libqt4-dev libgtk2.0-dev
sudo apt-get -y install libfaac-dev libmp3lame-dev libopencore-amrnb-dev libopencore-amrwb-
dev libtheora-dev libvorbis-dev libxvidcore-dev
sudo apt-get -y install x264 v4l-utils ffmpeg
sudo apt-get -y install libgtk2.0-dev
```

- Core

  Download https://github.com/opencv/opencv/archive/3.3.0.zip and extract.

```
cd opencv-3.3.0
mkdir build
cd build
cmake -D CMAKE_BUILD_TYPE=RELEASE -D CMAKE_INSTALL_PREFIX=/usr/local -D WITH_TBB=ON -D
BUILD_NEW_PYTHON_SUPPORT=ON -D WITH_V4L=ON -D INSTALL_C_EXAMPLES=ON -D
INSTALL_PYTHON_EXAMPLES=ON -D BUILD_EXAMPLES=ON -D WITH_QT=ON -D WITH_OPENGL=ON ..
make -j8
sudo make install
sudo sh -c 'echo "/usr/local/lib" > /etc/ld.so.conf.d/opencv.conf'
sudo ldconfig
```

- Test

```
python
import cv2
```

2. Libfreenect2

- Configure Libfreenect2 according to the instruction in **https://github.com/OpenKinect/libfreenect2**
- Note:
  - Remove `-DCMAKE_INSTALL_PREFIX=$HOME/freenect2` when running `cmake`.
  - Add `sudo` when running `make install` if permission error is encountered.

3. Pylibfreenect2

- Install

```
pip install setuptools numpy cython
pip install pylibfreenect2
```

- Test (Kinect is required to connect to computer vis USB 3.0 port)

```
git clone https://github.com/r9y9/pylibfreenect2.git
cd pylibfreenect2
sudo python examples/multiframe_listener.py
```

4. Mayavi (Visualization)

- Install: Follow the instructions in **https://docs.enthought.com/mayavi/mayavi/installation.html**.

5. TraitSui (Visualization UI)

- Install: Follow the instruction in **http://docs.enthought.com/traitsui/**.

Run

1. Device List

- Computer x 2
  - Computer 1:
    - Collect data from Kinect Camera 1
    - Receive data from computer 2
    - Visualization
  - Computer 2:
    - Collect data from Kinect Camera 2
    - Send data to computer 1
- Kinect V2 x 2
- Router x 1
- Conveyer belt x 1

2. Download Source Code

- Download using `Git`. (For both computers)

```
git clone https://github.com/WangZesen/Cargo-Volume-Estimation.git
```

3. Run

- Both computers connect to the router (or under the same LAN), and check the IP (using `ifconfig` of computer 1)
- For Computer 1

  Edit `.../Cargo-Volume-Estimation/socket/socket_recv.py`, replace the IP address in Line `13` with the IP of Computer 1.

```
# Open a terminal under the root of source code .../Cargo-Volume-Estimation/
cd socket
python socket_recv.py
# Open a terminal under the root of source code .../Cargo-Volume-Estimation/
cd work/plot
python plot_new.py
# Open a terminal under the root of source code .../Cargo-Volume-Estimation/
cd work
python main.py device2
```

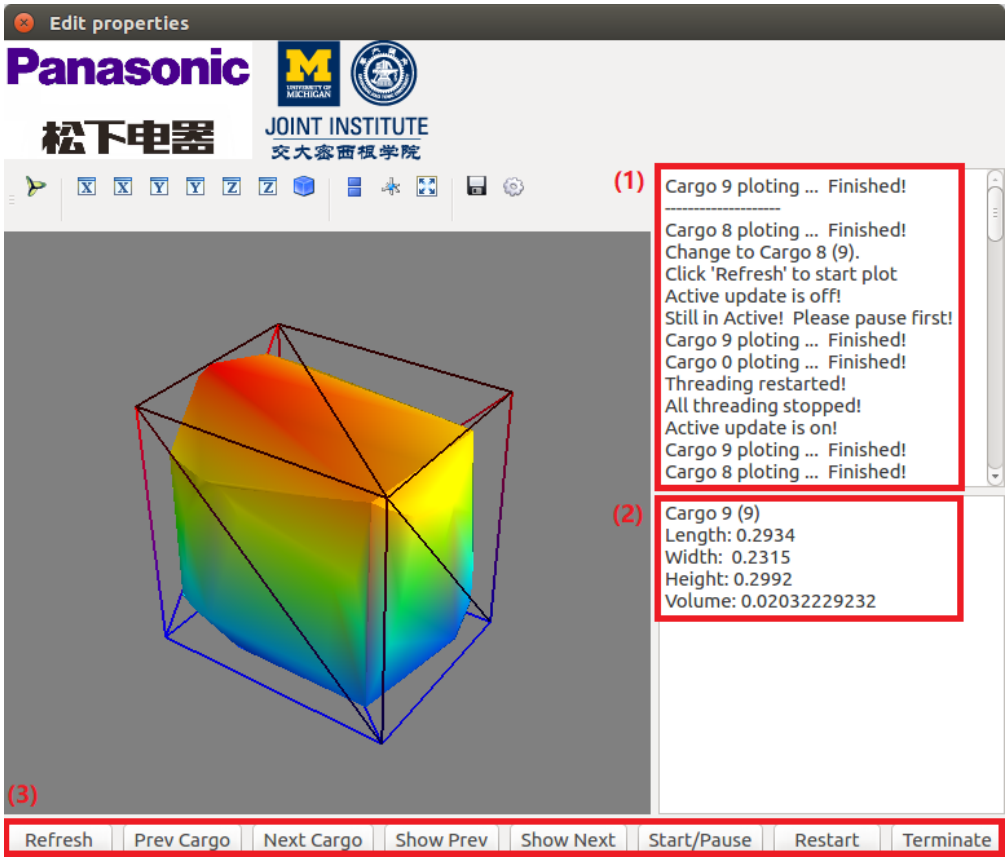
- For Computer 2

  Edit `.../Cargo-Volume-Estimation/work/main.py`, replace the IP address in Line `78` with the IP of Computer 1.

```
# Open a terminal under the root of source code .../Cargo-Volume-Estimation/
cd work
python main.py
```

- Note (for **main.py**):
  - Adjust the positions of the angles of Kinect cameras according to the auxiliary line shown in the figures.
  - Press `r` to reset the data
  - Press `q` to quit the program

4. UI



- UI Declaration
    1. Logging
    2. Statistics of current cargo (`Cargo x(y)` means the current one is the x-th cargo and there are y cargos in total, and statistics is in `m` unit for length, width and height, and the volume is in `m^3` unit)
    3. Function buttons
- Usage
    - The program will automatically update to the latest cargo if no operations is performed.
    - To see the previous cargos:
        - Press `Start/Pause` then press `Prev Cargo` until it's on the selected cargo then press `Refresh` to show the result.
        - **OR**, Press `Start/Pause` then press `Show Prev` until it's on the selected cargo. (`Show Prev` leads to 1s blocking for each pressing, recommend to use `Prev Cargo` when seeking for the cargo which is several times before).
    - To terminate the program: press `Terminate` and close the window.