Universiteit Antwerpen

Progress Report Week 9

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Abstract

Optimisation of wireless networks is critical for the localisation of wireless devices. For this purpose, a wave propagation model of the environment can be created. Such a model contains a map of the environment combined with RF measurements that are obtained within that map. In this paper, we compare several visual SLAM algorithms such as LSD SLAM [1] and RGB-D SLAM [2] that can be used to render an accurate 3D map of an indoor environment. In order to test these algorithms, simulation software is used to navigate a drone around a room. A camera that is mounted on the drone provides necessary data for the algorithms. After finishing a SLAM algorithm, the resulting point cloud can be implemented in an OctoMap [3] to generate a volumetric representation.

1 Progress

1.1 Camera drivers

In order to use a Microsoft Kinect camera, drivers have to be installed. For Ubuntu, this is a simple process:

- `sudo apt-get install libfreenect-dev`
- `sudo apt-get install ros-indigo-freenect-launch`

Afterwards, the open-source freenect driver can be launched by executing `'roslaunch freenect_launch freenect.launch'`. However, installing these drivers on the Erle-Brain is not as straightforward. The freenect_launch package and its dependencies have to be installed in a different way, as I will explain below.

The Erle-Brain 3 is a Raspberry Pi 3. Therefore I based the installation process for freenect on chapter 4.2 at http://wiki.ros.org/ROSberryPi/Installing%20ROS%20Kinetic%20on%20the%20Raspberry%20Pi.

In order to install al required dependencies, I generated rosinstall files. This is done by executing: 'rosinstall_generator <package> --rosdistro kinetic --deps --wet-only --tar > <package>.rosinstall', where *"package"* is the dependency that has to be installed. The freenect_launch package and its recursive dependencies for which I generated rosinstall files are listed below:

- freenect_launch
- rgbd_launch
- smclib *(dependency of* ***bond****)*
- bond *(dependency of* ***nodelet****)*
- bondcpp *(dependency of* ***nodelet****)*
- nodelet
- image_proc
- libfreenect
- freenect_camera

For example, to create a rosinstall file for nodelet, go to the catkin workspace and execute:

- rosinstall_generator nodelet --rosdistro kinetic --deps --wet-only --tar > nodelet_ros.rosinstall

Then, the src folder in the catkin workspace has to be initialised for rosinstall files:

- wstool init src

In order to import the rosinstall files in the src folder, execute the command below for every rosinstall:

- wstool merge -t src <package>

When this is done, the src folder has to be updated. If this command renders errors, just try to execute it again.

- `wstool update -t src`

Now, the catkin workspace can be built. Execute the command below for every package, in the order listed above.

- `catkin_make_isolated --pkg <package> --install`

If the `libfreenect` package can not be built, try to execute `sudo apt-get install libxmu-dev libxi-dev` first.

The freenect driver should be succesfully installed now. It can be launched by executing `'roslaunch freenect_launch freenect.launch'`. Make sure to source the correct ROS workspace first. However it is possible that the LC_ALL environmental variable has to be set first:

- `sudo locale-gen en_US en_US.UTF-8`
- `export LC_ALL="en_US.UTF-8"`

The second command can be put in `~.bashrc`, so that the environmental variable will be set at all times.

1.2 Camera mount

As we do not need the camera to rotate, the Kinect is mounted to the Erle-Copter with tie-wraps.

1.3 Communication

ROS topics from the Erle-Copter can be viewed on an external PC. In `~.bashrc` on the Erle-Brain, the following lines have to be added:

- `export ROS_MASTER_URI=http://10.0.0.1:11311`
- `export ROS_IP=10.0.0.1`

For the external PC, add these lines in `~.bashrc`:

- `export ROS_MASTER_URI=http://10.0.0.1:11311`
- `export ROS_IP=10.0.0.2`

Note that the PC has to be connected on the Erle-Brains' WiFi network. ROS topics can now be viewed in the terminal or with RViz.

2 Planning week 10

- Indoor test flight with Kinect
- Record a bagfile
- OctoMap
  - Research
  - Initial guess algorithm

References

[1] Jakob Engel, Thomas Schöps, and Daniel Cremers. LSD-SLAM: Large-Scale Direct Monocular SLAM. *Computer Vision ECCV 2014*, pages 834–849, 2014.

[2] Felix Endres, Jurgen Hess, Nikolas Engelhard, Jurgen Sturm, Daniel Cremers, and Wolfram Burgard. An evaluation of the {RGB}-D {SLAM} system. *2012 {IEEE} International Conference on Robotics and Automation*, 2012.

[3] Armin Hornung, Kai M Wurm, Maren Bennewitz, Cyrill Stachniss, and Wolfram Burgard. {OctoMap}: an efficient probabilistic {3D} mapping framework based on octrees. *Autonomous Robots*, 34(3):189–206, 2 2013.