RealSense T265 SLAM Testing

Mitchell Cooke — cookem4@mcmaster.ca

May 2019

Contents

1 Introduction

The errors seen between the T265 and the ground truth data in the previous testing document was due to the camera facing upwards toward the ceiling. The documentation for the RealSense T265 states that the camera on the device can be blinded by bright lights that can affect the positioning algorithm. The previous tests were performed with the camera on the device facing upwards. The lights on the ceiling can therefore affect the accuracy of the positioning algorithm. The lights are also aligned with the Z axis of the device. Therefore, when the device moves along the Z axis, it moves in a row between the lights and the cameras on the device are not blinded by the light. When moving along the X axis, the device passes underneath the lights and the positing algorithm is therefore affected by the light. This is likely the reason for the orientation problems seen only on the X axis. The tests performed in this document involve motion with the cameras on the device facing forwards and not upwards towards a light source.

2 Testing

2.1 Motion Along X Axis

Figure 1 compares the trajectory between the T265 and ground truth data when being moved along a path on the X axis.

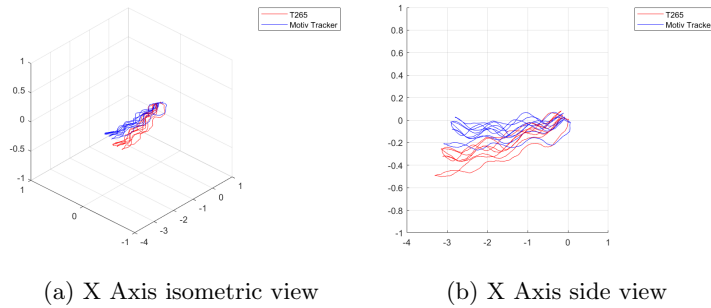(a) X Axis isometric view   (b) X Axis side view

Figure 1: Figures of X Axis Trajectory.

The result of motion along the X axis shows some error due to the initial heading of the device that builds as the device moves further away from the origin.

2.2 Motion Along Y Axis

Figure 2 compares the trajectory between the T265 and ground truth data when being moved along a path on the Y axis.

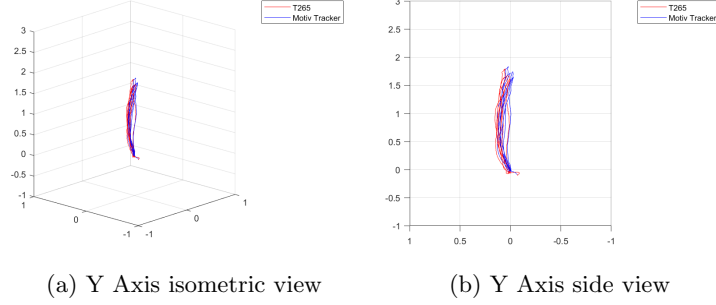(a) Y Axis isometric view   (b) Y Axis side view

Figure 2: Figures of Y Axis Trajectory.

Motion along the Y axis with the T265 compares very well to the ground truth data. The device is able to accurately track position with error of just a few centimetres.

2.3 Motion Along Z Axis

Figure 3 compares the trajectory between the T265 and ground truth data when being moved along a path on the Z axis.

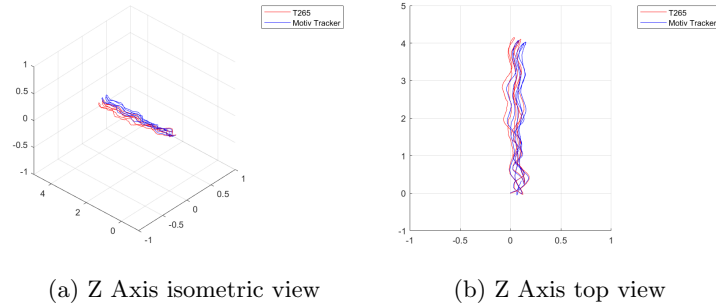(a) Z Axis isometric view   (b) Z Axis top view

Figure 3: Figures of Z Axis Trajectory.

The T265 is able to accurately determine its position in the Z axis. The error between the device and the ground truth data is around a few centimetres and can be quantified in future tests. Note that the lateral motion of the path is due to the device being held while walking.

2.4 Motion Along a Square Path

Figure 4 compares the trajectory between the T265 and ground truth data when being moved along a series of square loops.

4

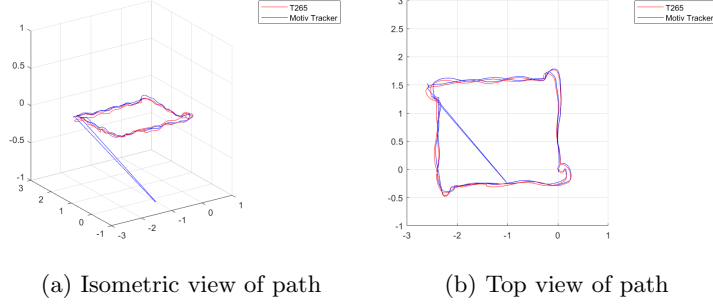(a) Isometric view of path   (b) Top view of path

Figure 4: Figures of square path trajectory.

The results are promising and show accuracy down to a few centimetres between the T265 and ground truth data. The line off of the square on the ground truth data is from a brief moment when the markers were not fully detected.

2.5 Summary of Results

When the T265 is not facing any light sources the localization capability is accurate down to several centimetres and is promising for use on drones when paired with the D435 camera. Having no light sources shining in the onboard cameras allows the device to find its heading accurately. The amount of error present can be quantified with future tests.

3 Next Steps

The next steps for analysing the performance of the T265 camera is to quantify the error between a point collected by the T265 and the corresponding point on the ground truth data. This error data can the be plotted and analysed. The accuracy of heading data of the T265 can also be analysed and graphed in time. To do this, the frame containing the T265 must be expanded to contain more markers so that noise in finding the heading is reduced.