

Lab1 Answers

The answer to Question 5b is written as a comment in lab1_main.cpp, corresponding to Question 5b. Other experiment requirements are written in lab1_main.cpp. To run lab1_main.cpp once, you can get the answers to Question 5a, 5c, 5d, Question 8 and 9, as well as the animation in Rviz for Question 10.

The answer to Question 5b and some screen shots are also available here.

1. Question 5b:

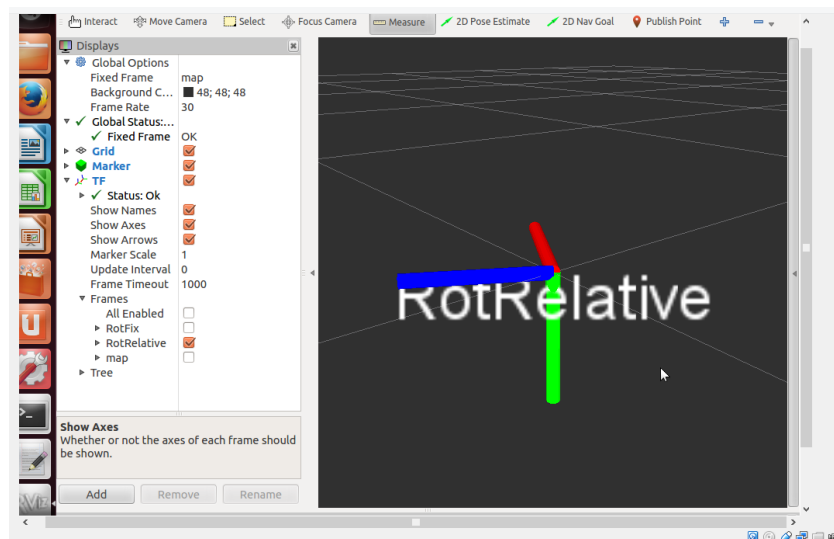
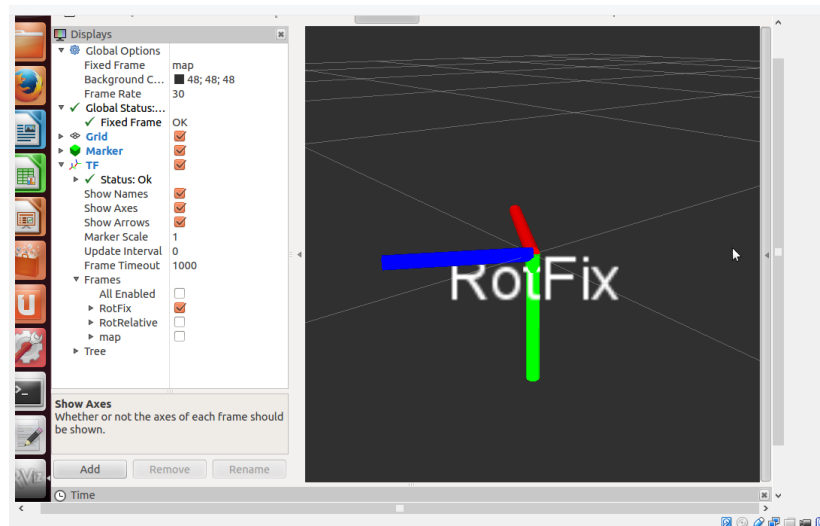
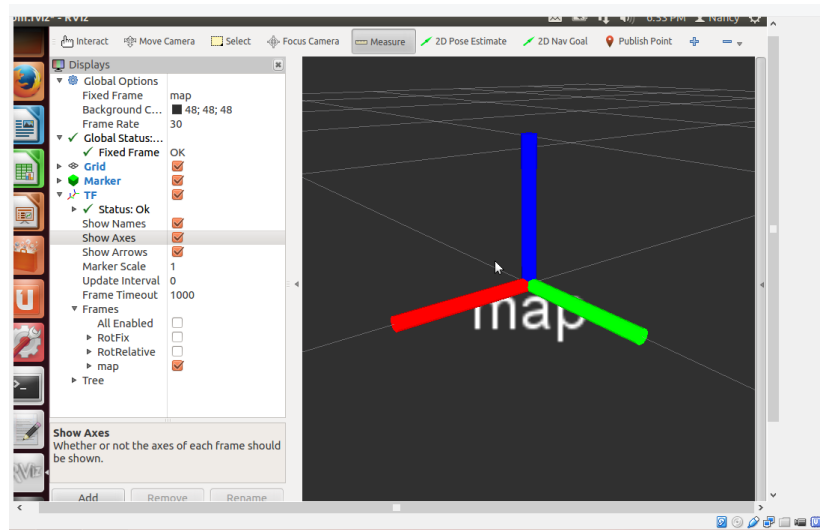
When $R(0,0)=R(1,0)=R(2,1)=R(2,2)=0$, meaning $\cos(\text{pitch})=0$:

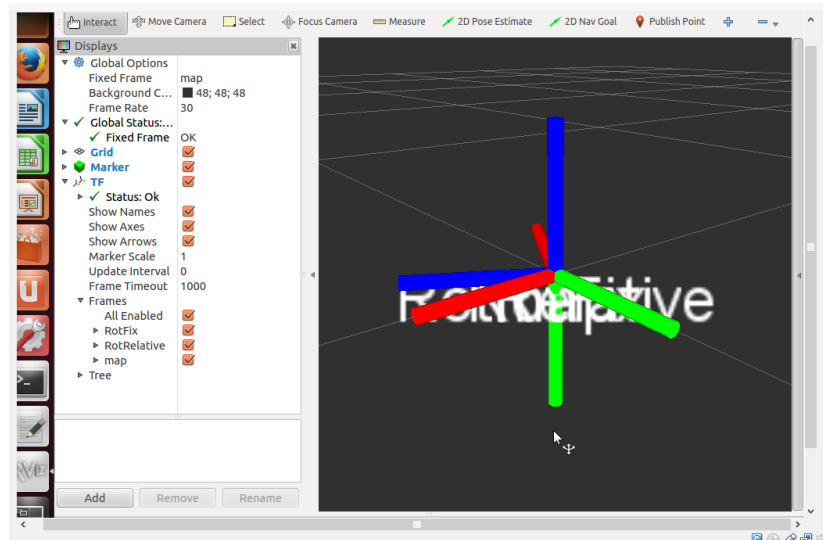
when $-R(2,0)=\sin(\text{pitch})=1$, $R(0,1)=-R(1,2)=\sin(\text{roll}-\text{yaw})$, and $R(1,1)=R(0,2)=\cos(\text{roll}-\text{yaw})$, so from the rotation matrix R we can only get the value of $(\text{roll}-\text{yaw})$, but not roll or yaw.

when $-R(2,0)=\sin(\text{pitch})=-1$, $R(0,1)=R(1,2)=-\sin(\text{roll}+\text{yaw})$, and $R(1,1)=-R(0,2)=\cos(\text{roll}+\text{yaw})$, so from the rotation matrix R we can only get the value of $(\text{roll}+\text{yaw})$, but not roll or yaw.

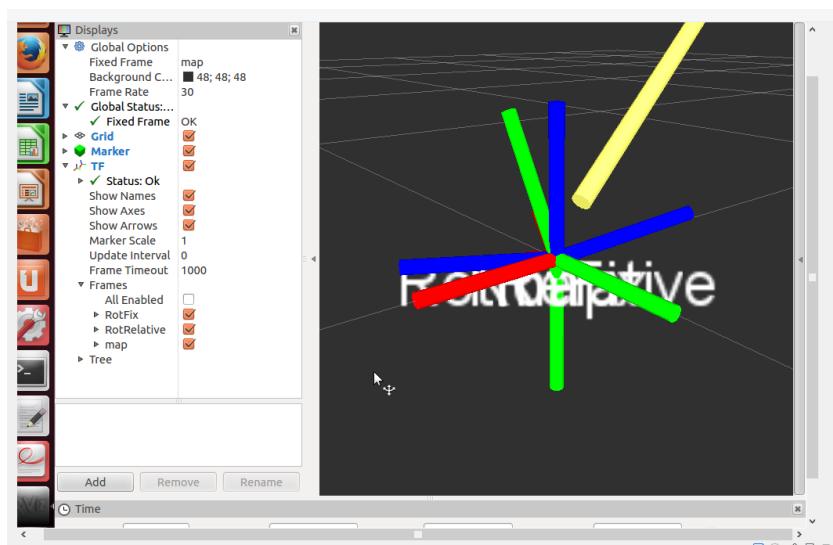
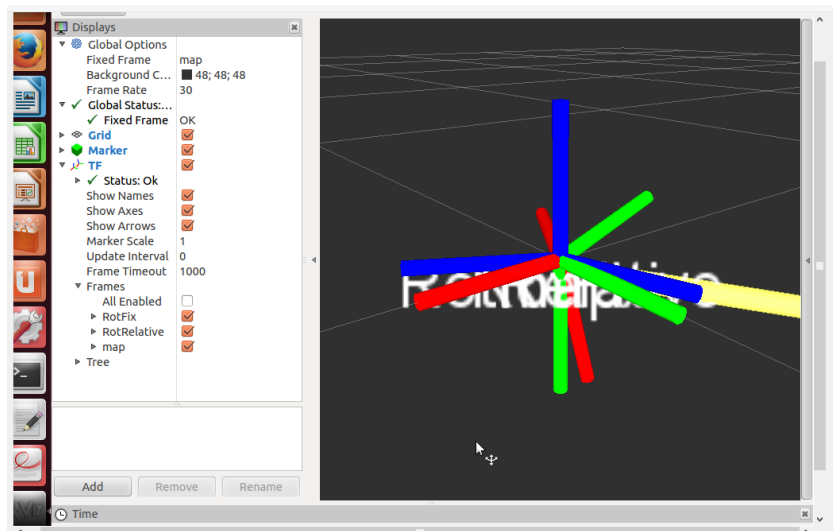
Which means when R is numerically ill-defined, in other words when it's singular, we can't find the corresponding Euler angles.

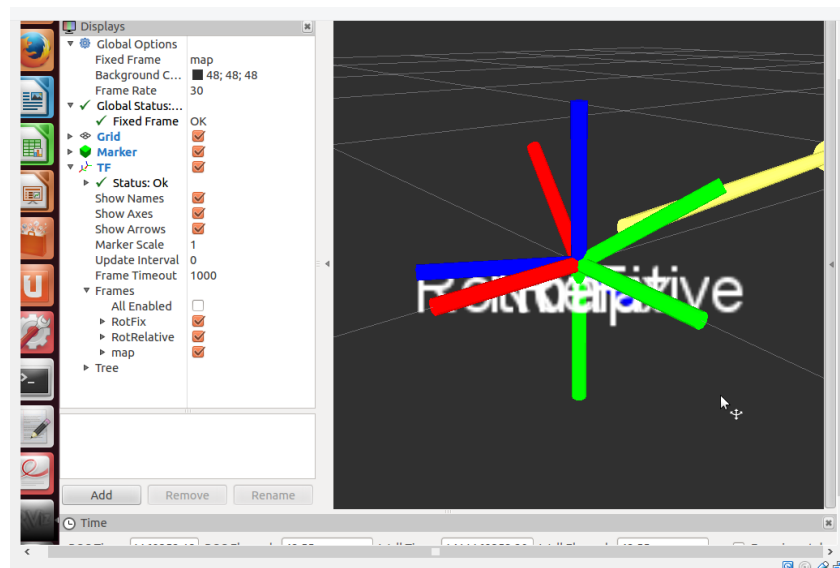
2. Screen shots to Question 8 and Question 9:





3. Screen shots to Question 10:





Notes: The rotating vector was in frame RotFix, while the other two frames shown on the image are the fixed Map frame which RotFix rotates around, and the RotRelative frame which is also the start point of RotFix frame.