L A B   R E P O R T   C O V E R   S H E E T

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Student ID
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U 6366102

Course Code	ENGN 6627
Course Name	Robotics
Assignment number	
Assignment Topic	
Lecturer	Dr. Viorella Ila / Dr. Rob Mahony
Tutor	
Tutorial (day and time)	
Word count	Due Date 23/09/2018
Date Submitted	23/09/18 Extension Granted

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- ✓ upholds the principles of academic integrity, as defined in the ANU Policy: Code of Practice for Student Academic Integrity;
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1. The strategy used by the implemented to detect the red tape mark on path was detecting the color of the tape apart from detecting the path color using multiple masks. When the robot is sensing only the path color (blue tape), it moves at speed of 0.3 ms^{-1} and when the red tape is detected the robot moves with speed 0.2 ms^{-1} and moves over 0.465m, stops and plays the three blind mice song. The blue and red colors are detected using different masks with same kernel.

2. When the robot drifts away from its path, it autocorrects using the error factor between its current center of mass and ideal center of mass. Implementing this algorithm caused aggressive corrective measures to the robot's movements. So, we implemented the robot to keep the path always in its field of vision (i.e., the angular correction speed was low) to reduce the error factor generated.

3. In task 1, The algorithm subscribes itself to "camera/rgb/image_raw" [1, 2] (type – sensor_msgs/Image, uint32 seq) to get the image from the vision sensor (Kinect).
   - The received image is converted to HSV format and respective masks for blue and red are created.
   - The images are cropped, and masks are applied to identify the colors and moments are calculated.
   - Depending on the moment's value, the robot moves around its path (control loop).

   In task 2, the algorithm subscribes itself to "camera/rgb/image_raw" and "cylinderTopic/cylDataArray". Here "cylinderTopic/cylDataArray" provides data of cylinder (label, Xrobot/ Zrobot (distance/ orientation from the cylinder). Later, it uses message from "camera/rgb/image_raw" to orient itself to desired cylinder and move into the control loop.

4. Bumper – Exteroceptive/ Passive [3]
   CCD Camera - Exteroceptive/ Passive
   CMOS Camera - Exteroceptive/ Passive
   SICK Laser Scanner - Exteroceptive/ Active
   Gyroscope – Proprioceptive / Passive
   Wheel encoder – Proprioceptive / Active
   Compass – Exteroceptive/ Passive
   GPS receiver - Exteroceptive/ Active

5.
   1. Advantages of cameras:[3-5]
      - Inexpensive compared to LIDAR, SONAR
      - High resolution over a wide field range compared to LIDAR
      - Easier to collect meaningful data from color images (like signs, lights)

   2. The drawbacks of Kinect sensors [3-5] are,
      - The sensors on Kinect are prone interference (between RGB camera and depth sesors) causing noise/ misleading data creation.

- The background light / environmental lighting conditions may affect the accuracy of the data.
- It is much suited for even surfaces and indoor conditions to perform with high efficiency.

References:

[1]   B. G. Morgan Quigley, and William D. Smart, *Programming Robots with ROS.* 2015.
[2]   *ROS Documentation*.
[3]   Roland Siegwart, Illah R Nourbaksh, *Introduction to Autonomous Mobile Robots*. MIT Press, 2004.
[4]   R. Szeliski, *Computer Vision: Algorithms and Applications*. 2010.
[5]   Richard Hartley, Andrew Zisserman, *Multiple View Geometry in Computer Vision*, Second ed. Cambridge University Press, 2004.