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| Student ID  For group assignments, list each student’s ID | 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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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.

1. 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

1. 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.