NTU INDIA CONNECT PROGRAM

OSMind - Development of Simulation System using the Robot Operating System(ROS)

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OSMind is a software developed for facilitation of visualization, mapping and navigation on a single platform.

We have used the various frameworks like RTAB-Map, Digital Elevation Models(DEM), Unity3D and V-REP to take the input file from a stereo camera and create a Virtual 3D environment which can be used for navigation. During navigation, a video is recorded and Computer Vision can be applied to this recorded file to extract important information from the 3D environment. This includes Face Detection, Object Recognition, Colour Detection and Text Recognition.

LITERATURE REVIEW

- **Simultaneous Localization And Mapping (SLAM) using RTAB-Map,** Demonstrated use of SLAM technique to construct a map of a given environment. A 2d occupancy grid and 3d octomap was created from a provided simulated environment and a personal simulated environment was created for mapping.
- **Real-time 2d And 3d Slam Using Rtab-map, Gmapping, And Cartographer Packages,** Presented two laser-based SLAM algorithms, i.e. Gmapping and Cartographer, and one vision-based SLAM algorithm, RTAB-Map. Used TurtleBot3 Waffle platform, which is a low-cost ROS enabled wheeled mobile robot.
- **3D Simultaneous Localization and Mapping with RTAB-Map,** Showed how Real time appearance based mapping or RTAB mapping puts vision sensors to use alongside memory techniques to perform SLAM in real-time. This method was applied to a robot in a Gazebo environment and the results displayed the importance of loop closure and features

GOALS ACHIEVED

RTAB-Map : Real-Time Appearance-Based Mapping - This package is a ROS wrapper of RTAB-Map (Real-Time Appearance-Based Mapping), a RGB-D SLAM approach based on a global loop closure detector with real-time constraints. This package can be used to generate a 3D point clouds of the environment and/or to create a 2D occupancy grid map for navigation.

Digital Elevation Models(DEM) - A Digital Elevation Model (DEM) is a 3D representation of a terrain's surface that does not include any objects like buildings or vegetation. DEMs are frequently created by using a combination of sensors, such as LIDAR, radar, or cameras. The terrain elevations for ground positions are sampled at regularly-spaced horizontal intervals.

3D Visualization and Navigation through ROS Bridge on Unity3D - ROS# is a set of open source software libraries and tools in C# for communicating with ROS from .NET applications, in particular Unity. The Google Maps Platform gaming solution is a development platform for creating games that feature world scenes constructed from Google Maps geospatial data, and rendered at run-time by the Unity game engine.