Dynamics Rover Project

Autonomous Planetary Exploration
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GPS Navigation(Using NMEA Data Standard)

GPS(Global Positioning System) is a satellite based navigation system which allows the ground users to determine the exact location, velocity, time (24 hours a day), in all weather conditions, all over the world. GPS basically follows NMEA data format much like ASCII is the standard for the digital characters in the computer world.

1. GPS(NMEA) data will be given as an input, which refers to the target location. With the help of this data, the rover will start traversing towards target location.

   ex: `$GPRMC,001225,A,2832.1834,N, 08101.0536,W,12,25,251211,1.2,E,A*03`

2. To continously traverse on the optimal path, **Kalman Filter Algorithm** is used, which infers parameters of interest from indirect, inaccurate and uncertain observations.

Decoding results	
Position	28.536390°N 81.017560°W
Timestamp	Sun, 25 Dec 2011 00:12:25 UTC
Movement	Speed 12.0 kts, heading 25°
Close to	Christmas, United States
Local time	Sat, 24 Dec 2011 19:12:25 EST
Timezone	America/New_York (UTC -0500)

Terrain Mapping

Terrain mapping is process of understanding the surface characteristics and generating a terrain map. A terrain map shows an area of land divided into terrain map units defined by similar elevation, slope, landform, rock exposure and thickness.

1. Terrain mapping is done by **LiDAR** technology, which uses light pulses or laser beams to determine the distance between the sensor and the object.
   - The laser travels to the object and is reflected back to the source and the time taken for the laser to be reflected back is then used to calculate the distance.
2. LiDAR generates a **LAS** dataset which is a stand-alone file and references lidar data in the LAS format along with optional surface constraint features that define surface charateristics.

Obstacle Avoidance

Obstacle avoidance is a task of rover to avoid any obstacle during autonomous traversal and mapping. This task is accomplished by LAS dataset from LiDAR.
   - To avoid the obstacle the rovers deviates towards a safer path.
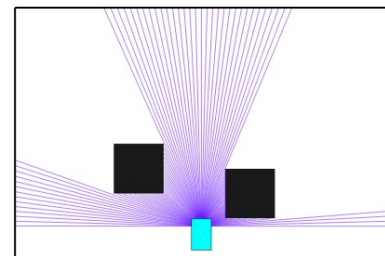

Image Processing

Computer vision is the phenomena by which the computer senses the real world objects and converts them into computer readable form.

Image Processing is the branch of Computer Vision which helps us to perform numerous operations such as color detection, object detection, face detection etc. of which we are focusing only on the object detection and obtaining the characteristics of that object.
   - The input given by camera will be analyzed frame by frame by the object detection algorithm and the user decided target will be detected.