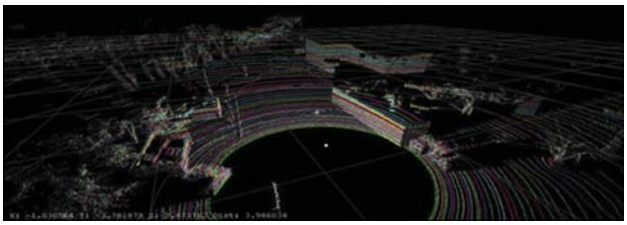
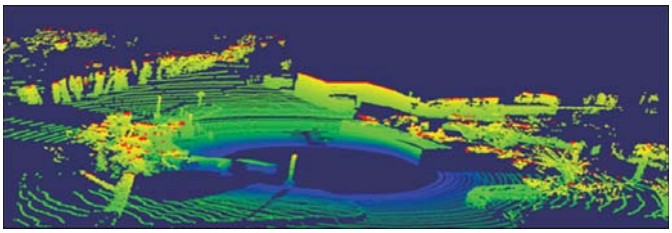
RSC
REMOTE SENSING CENTER
at the Naval Postgraduate School

LIDAR

Online Primitive Feature Extraction from LIDAR Range Data

PROBLEM: Augmented Reality (AR) systems register computer generated models with real world objects. For AR systems to be useful, the generated objects must be accurately registered with the environment in both position and orientation. The primary objective of this research is to evaluate methods for online processing of 3D LIDAR data for real-time construction of a virtual environment model that can be used for AR registration.





SOLUTION: Process the LIDAR range data for features that can be used to build a 3D map of the environment and identify distinct features or shapes that can also be detected in camera images. Matching identified features is used to register the two sets of data.

RESULTS:

1. LiDAR DATA Output Format and Sequence

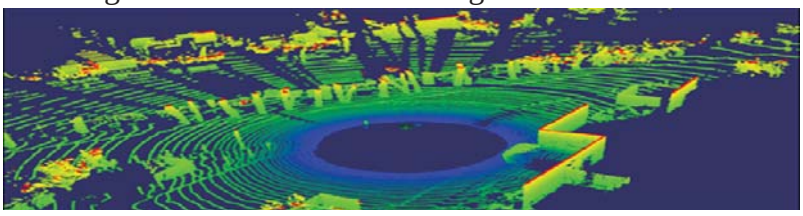
   The LiDAR output data format and sequence affects the efficiency of system processing. A reordering method was developed to accommodate feature extraction methods.

2. Extraction algorithm implementation

   Extraction algorithms for circular arcs were implemented for detection of circular cross section objects such as spheres, cylinders, and cones.

3. System Integration with Spherical Camera

   The LiDAR was successfully mounted on a vehicle for dynamic data capture of street enviroments. Co-located with the Lady Bug 2 spherical camera, data captures were made of both LiDAR points and camera video for further testing of feature extraction algorithms and cross sensor registration methods.



METHODS:

3D Primitive Extraction Algorithm

Choose 3D point feature definitions and extraction algorithms based on complexity, robustness, and real-time implementation for:

- Discontinuous ranges
- Line segments
- Circular arc segments
- Planar polygonal surfaces
- Cylindrical surfaces

3D Reference Markers

- Cylinders
- Spheres
- Cones

Model Visualization and Texturing

- Visualization model created from primitive features

For Further Information Contact:
Remote Sensing Center
Naval Postgraduate School
remotesensing@nps.edu

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