Automated Building Model Rendering Project Summary

Sponsor: Industrial Assessment Center

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Alternatives in energy generation have become a widely discussed topic recently in the United States. However, green technologies are still many years away from being proven economical options for large scale energy generation. Until switching to these technologies is an economically viable option, cost savings can only be realized through conservation and efficient use of the energy resources currently available.

Buildings make up approximately 40% of all energy usage in the United States, and therefore are a prime target for reductions in energy use. The Industrial Assessment Center (IAC) at Texas A&M University is dedicated to providing free services to companies in the area specifying ways that these companies can reduce their energy usage. Under this premise, the IAC intends to develop a series of unmanned autonomous aerial and ground vehicles capable of conducting energy audits of commercial buildings. By applying a range of sensors to the vehicles, the IAC will gain the capabilities to collect and analyze a wide range of data during energy audits, and do so in a fraction of the time it would take a team of human auditors.

The objective of the Automated Building Model Rendering Project is to construct an integrated UAV and sensor system capable of conducting a building survey and creating a 3D model of the building. The system will have to take measurements of the exterior and interior of the building, identify key features such as doors and windows, and be compatible with building rendering and analysis software such as Google SketchUp and EnergyPlus. Google SketchUp acts as a 3D CAD tool which can generate building models from the data points provided by the sensor package. EnergyPlus is an energy audit software which runs simulated energy analysis and can be seamlessly integrated with Google SketchUp for accurate results based on building model data. The team will be required to deliver a prototype system and all associated software programs. The team will also be required to conduct field tests of the completed system to demonstrate effectiveness and limitations. One member of the design
team will be tasked with piloting the UAV during demonstrations. This semester, the team conducted research into UAV systems, simultaneous location and mapping technology and software applications for the project. The vehicle that was selected for use was the DJI F550. This is a 6 rotor copter with the capability of carrying the sensor throughout commercial buildings effectively. The sensor system is a laser range finder which uses emitted light to determine the distance from the vehicle to features in the building. By using an inertial measurement device, the data taken from the laser range finder can be matched with the location of the vehicle to create a building model. The laser range finder produces a matrix of sensor data which can be uploaded to Google SketchUp and a building model is generated from the data points and corresponding location points. Google SketchUp has a built in interface with EnergyPlus to conduct simulated energy analysis on the building. By combining each of these processes into a single system, the engineers conducting the energy audits will be able to save both time and money to provide results to the company.