Solar energy potential assessment and mapping in high-rise building area with UAV spatial modeling

*Myeongchan Oh[1], Jin Son[1], Hyeong-Dong Park[1]

1.Seoul National University

Assessment of renewable energy potential in urban areas is treated as important information in many energy design projects and engineering projects due to a surge of interests in global energy issues. Especially, with spatially restricted areas for energy production corresponding to increasing energy demands, photovoltaic (PV) panels sourced by solar energy can be the one of the most promise alternatives. In this study, we calculated solar energy potential, one of the renewable energy, specifically in urban area, which are fulfilled with artificial objects, with applying UAV (unmanned aerial vehicle) to building spatial model. A variety of spatial data to calculate the solar energy potential are required: environment, orography, and climatology factors. In particular, orography in complex area like cities with many high-rise buildings can be highly influenced as shading effect of these area is significantly affected solar energy potential. In past, these data highly consume both time and expenses to be obtained, however, by recent development of UAV technology, spatial model in high resolution can be easily produced. Because of advantages of UAV, such as easy accessibility to the target site, high resolution sensor, GPS (Global Positioning System) and IMU (Inertial Measurement Unit), it is convenient to generate aerial map and DEM (Digital Elevation Map) with lower expenses. DEM is extracted from overlapped aerial images by stereo depth calculation. With the spatial database, which consist of the spatial model obtained by UAV and other factors directly measured or offered from Korean Meteorological Administration, solar energy potential can be estimated. The analysis module is design with Matlab, which introduces multi-variables such as local solar irradiation data, annual cloud ratio, weather, solar orbit, solar panel information and shadow effect. As a result, the map with total solar irradiation map and solar irradiation map considering panel information are composed, which can be used in the stage of decision-making, such as site optimization for PV power plant system and its potential power generation estimation. To summarize, we designed the potential solar power estimation module, particularly for urban areas with the forest of high-rise buildings. It is expected that this study will help people working in renewable energy area calculating solar energy potential and mapping.

Keywords: Solar energy, Energy assessment, UAV