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ACHIEVING SUSTAINABILITY FOR EGYPTIAN WORLD HERITAGE SITES BY THE LEO
REMOTE SENSING SATELLITE CONSTELLATION

Abstract

With the use of state-of-the-art space technology, achieving sustainability for heritage sites is receiving worldwide attention. In Egypt, there are seven confirmed UNESCO world heritage sites narrating the story of civilization for ancient Egyptians. These sites are Memphis and its Necropolis—the Pyramid Fields from Giza to Dahshur; Historic Cairo; Ancient Thebes with its Necropolis; Nubian Monuments from Abu Simbel to Philae; Saint Catherine Area; Abu Mena; and Wadi el-Hitan (Whale Valley). Utilizing the modern LEO remote sensing satellite constellation is a key aspect of acquiring updated images for these sites in order to achieve sustainability. Satellite remote sensing data constitutes a convenient and accurate method for regional surveys on a scale that would not be possible from the ground, in addition to monitoring the changes over such regions with low cost (relative to ground-based sensing techniques), wide coverage, and high temporal and spatial resolution.

In this paper, the feasibility of satellite images for monitoring and detecting changes in the locations of the seven world heritage sites was investigated. A single LEO remote sensing satellite with a high-resolution multi-spectral camera is proposed as the main technology for this initial investigation to obtain a visual assessment of the seven world heritage areas in Egypt. An integrated approach features the application of replacing a single satellite by a satellite constellation of identical satellites orbiting at the same altitude but in different orbital plans. The modeling and simulation of imaging scenarios for the seven world heritage sites are demonstrated based on the Systems Toolkit (STK) simulator. Hence, the updated data from these heritage sites is expected to improve periodic monitoring and support archaeologists, organizations, and the government's efforts to protect these sites and achieve sustainability goals in Egypt.