Chapter 11
An Overview of the Potential of UAV Applications to the Built Environment:
A Role in Sustainable Urbanisation

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ABSTRACT

This chapter presents an overview of the potential role of UAVs for monitoring, mapping, surveying, modelling, and visualising the 'built environment' and their role in sustainable urbanisation. The 'built environment' includes rural, urban, and underwater environments. Together with low-cost image processing and softcopy photogrammetry, fixed-wing and multi-rotor UAVs can collect a wide range of imagery for generating 3D models of individual buildings, and record and analyse architecture and infrastructure and terrain models. Consideration is given to non-imaging sensors carried on UAVs. Input to GIS provides a basis to create visually realistic models of the 'built-environment' for urban and rural planning and decision-making for sustainable urbanisation. 3D visualisation software, virtual, and augmented reality will allow public engagement with the spatial planning process. Safety and operational considerations are needed for UAV flights. The chapter concludes by examining how this technology will develop in the future to play a role in sustainable urbanisation.

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INTRODUCTION

Currently there is a wide range of commercial small-scale airborne platforms available for acquisition of low-cost, high-resolution aerial remote sensing data. These include kites, model aircraft, balloons or blimps, helicopters, Unmanned Aerial Vehicles (UAVs), Unmanned Aerial Systems (UASs), and Drones (Green et al., 2020a). They have recently been complemented by waterborne drones operating both on the water surface and underwater carrying hydrographic sensors to monitor underwater structures and the impact of floating structures on the environment (De Lima et al., 2015).

In the past ten years, drones, UAVs and UASs have evolved from, relatively simple 'toys' with the capability to carry miniaturised RGB cameras for aerial photography and video footage, into mature aerial photographic systems for survey. The drone industry has quickly become professional and highly respected with major developments in aerial platforms and sensors including autonomous flight software, advanced flight controllers and First Person View (FPV) systems, accompanied by flight regulations, requirements for pilot training, and competency tests. The total market value of battery powered UAVs is expected to reach over 1000 million dollars by 2023 (Harrop and Harrop, 2014).

The rapid development of microelectronics and microprocessors, GPS and navigation systems, together with reduced costs over the last five years, have all helped to trigger an unprecedented demand for, and growth in, the use of UAV platforms and sensors for civilian applications (Watts et al., 2012; Colomina and Molina, 2014). This has been aided by advances in battery technology to extend duration of flight, the range of cameras and sensors available, and both softcopy photogrammetry and digital image processing software to generate mosaics, orthophotos, and DSMs and DTMs. In a very short time, drones have been applied to many new areas of work, including applications using vertical and oblique photography, precision agriculture and viticulture, river monitoring, vegetation mapping, forest and pasture surveys, coastal surveys, archaeological sites, and other examples including the 'built-environment'. Besides traditional aerial photography, videography, and other imagery, the acquisition of stereo-photography to build surface models with the aid of softcopy photogrammetry has led to many examples where houses and other buildings have been accurately surveyed and modelled and the results viewed in an interactive environment for visual communication via the Internet.

This contribution seeks to present a contextual overview of the potential role of UAVs and the related technologies for monitoring, mapping. surveying, modelling, and visualisation of the 'built-environment' as the basis to explore their role in sustainable urbanisation.