Viewing valuations from the sky: UAVs in the appraisal industry

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Abstract

The first reports of autonomous unmanned flight tools come from antiquity, while bibliography shows image capturing platforms from the late 19th century. Over the years, these platforms have altered leading to the present fully automated Unmanned Aerial Vehicle (UAV), which capture images of the Earth’s surface and its objects. In this paper we will present the historical evolution of the use of image capturing systems’ platforms, their disadvantages, their advantages, and their applications and use in real estate valuations and appraisal studies.

During the last years, UAVs have entered the appraisal industry massively. Unmanned aerial vehicles are typically being used to facilitate appraisers on the collection and documentation of the necessary data that need to be reported during the valuation process. The aim of this paper is to identify and report UAVs’ uses during the valuation process by documenting all their applications and useful products. In short, access to hard-to-reach places, such as rooflines and plots of sharp terrain, has been the first and yet one of the most important uses of drones during valuations. Especially in cases of litigation, the detailed description of a property is more than necessary. In addition to other uses, UAVs generally allow appraisers to conduct their jobs more frequently, efficiently, and effectively. It is crucial, however, to adhere and apply all safety targeting regulatory changes if the industry wants to continue using such systems during valuations.

Keywords: UAVs; real estate valuations

1. Introduction

Property valuation has evolved with new methods (automated valuation models etc.) and new technologies achieving breakthroughs. Valuations include the identification of a property’s condition, the documentation of its special and sometimes unique characteristics or restrictions (Garcia et al., 2008; Holms et al., 2017; Demetriou, 2018). Difficulties in documenting changes in parcels or measuring these changes, identifying special architectural characteristics of a building façade and mapping large parcels outside urban areas could not be dealt easily with traditional methods or live inspections.

Technology has been able to develop new aids in scope of achieving more precise and accurate valuations of a variety of properties, which has led to better investment decisions or advisory services. In particular, UAVs have entered the real estate industry through aerial mapping and visualization of properties. Despite the fact that only certified experts with license can fly UAV technology, small drones can be used by anyone who is simply able to handle such flights. The aim of this paper is to identify and report UAVs’ uses during the valuation process by documenting all

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their applications and useful products. In short, access to hard-to-reach places, such as rooftops and plots of sharp terrain, has been the first and yet one of the most important uses of drones during valuations.

2. Methodology

A thorough research of studies and application of UAVs in property valuation is conducted in this paper. The paper is based on literature and bibliographical research, as well as on data derived by specific sources of UAV uses. At first, the historical evolution of the use of image capturing systems’ platforms, their disadvantages and their advantages are presented. Afterwards, the research points out the vast area of applications of UAVs in various studies and highlight any research challenges of the future. The scope of the paper is to make clear that UAVs cannot only be used in remote sensing applications but in other fields of studies, such as real estate mapping and valuation.

3. UAVs and their applications on property valuation

3.1. UAVs: From then to now

UAVs, ie Unmanned Aerial Vehicles, and not drones as they are wrongly mentioned today, first appeared in antiquity. Specifically, at the end of the 5th century BC, the "steam-powered pigeon" (Fig. 1), the first autonomous flying machine, was constructed, by the Pythagorean philosopher and mathematician Archytas, from Tarantas. It was a small device in the shape of an airplane that operated through air thrust and was able to cover a distance of 200m (Kaimaris et al., 2017a).
Few steps in the UAV field have been made until the Cold War era. With the development of technology, aeronautics, and computer and software tools and systems over the past 5 decades, UAVs have made their presence felt with a variety of applications in many scientific fields. The UAV applications of Przybilla and Wester-Ebbinghaus in 1979 were among the first surveys in the field of geoinformatics in the modern era. Flight methods are currently categorized in Manual Flight Mode, Semi-automated or Assisted, and Autonomous Flight Mode (Eisenbeiss and Sauerbier, 2011).

The benefits of using UAVs and their ability to capture images of the Earth’s surface and its objects, using digital pancreatic, multi-spectral, hyperspectral, thermal and laser scanner sensors, are numerous as they collect data in
human inaccessible points, combining speed and flexibility compared to other methods. Equipped with state-of-the-art systems and sensors, such as GPS, INS, IMU, and others, their automated navigation of absolute and high geospatial accuracy is permitted (Eisenbeiss, 2004 & 2009; Austin, 2010). Some RCUs currently used in Remote Sensing (and more generally in Geoinformatics) are RC Helicopter (Fig. 4), RC Balloon (Fig. 5), Drone (Fig. 6), RC air plane, etc.

Some areas of interest of the UAV (beyond military purposes) include forestry and agriculture, archeology and cultural heritage, topography, urban and regional planning for the creation and updating of maps, cadastral applications, cartography, creation of digital surface models, environmental research for soil and water monitoring, transport for traffic monitoring, etc. (Remondino et al., 2011; Clarke, 2014; Hassanalian and Adbelkefi, 2017). This paper will present UAV applications in real estate valuation.

3.2. UAVs: Current applications on property valuations

New techniques and technologies are entering property valuation processes mainly for acquiring more accurate and reliable data. There are advantages and setbacks in using UAVs or specifically drones in appraisal practice. To begin with, UAVs can be uses by appraisers in:

- Rural properties: The valuation of rural large properties demands an inspection of the whole parcel, which sometimes is not possible from the ground. Large parcels can be easily photographed, inspected and documented as far as their terrain and their ground and vegetation condition by UAVs. Many of these cases include structures difficult to access or even structures that host dangerous animals, such as zoo parcels, bulls parcels etc.

- Commercial properties: Large malls or whole commercial complexes can be inspected by drones more closely, documenting changes within their area. Rakha and Gorodetsky analyzed how UAS helped towards the identification of anomalies and differences of the observed area between visual and UAV inspection, proving that technology can provide higher accuracies (Rakha and Gorodetsky, 2018).

- Office buildings: Skyscrapers and office buildings with inaccessible parts due to their architectural design may appear to be in a worse condition than observed from the ground. UAVs can fly at the necessary distance from the buildings so as to document its condition and special characteristics.

- Preserved / protected buildings: One of the most important applications of UAVs is the documentation and inspection in preserved or protected buildings due to their architectural, cultural or historical importance. Unfortunately, many of those buildings constantly decline in condition due to high cost of preservation, ownership issues or urban development restrictions. Therefore, their inspection might be dangerous, but for UAVs this does not impose a problem.

- Comparable data: Even in acquiring photos from similar properties, UAVs solve the problem of being unable to access such comparable data. Free satellite images can be one or two years old, but with UAVs an up to date image is possible.

- Aerial mapping: The surrounding area of a property is very important for the valuation of its value. The creation of mosaics of ortho images and Digital Surface Models as products of UAVs lead to a more accurate mapping of the surrounding area and visualization of each valued property. Franco & Macdonald (2017) proved that urban green and its interacting effect with the local ecology and the built environment must be analyzed if property values are considered, a fact that could not be proven without the use of drones (Franco and Macdonald, 2017). This UAVs can also provide aerial shots to highlight other angles, layout, and features of each property (Ali, 2017).
- Measurement of a property: UAVs help appraisers to measure properties precisely especially in the case that a laser scanner is attached on them. In such way, an extremely accurate measurement of a property’s façade, its architectural design and its possible damages is produced quickly without the need of traditional time-consuming methodologies. Meanwhile, by attaching the required sensor, thermal imaging can be conducted to determine heat loss. As far as the inspection is concerned, the condition of a property’s roof can be conducted safely through UAVs.

In contrast to their vast application area, many appraisers argue that UAVs are not necessary for their profession. Their arguments refer to privacy issues, liability, feasibly and, in general, necessity for such use.

- Privacy issues: Especially after the implementation of the GDPR and other laws regarding personal information, UAVs image capturing becomes more difficult. Constantly changing the ankle of shooting is necessary so that no one feels or is violated. Studies, such as Daly’s paper on the Australian approach to applying privacy and data protection laws to automated technologies, prove deficiencies in laws towards the protection of individuals’ rights, even in countries such as Australia (Luppicini and So, 2016; Daly, 2017).

- Liability issues: Many traditional real estate appraisers still believe in visual inspection of a property. Although this still constitutes one of the fundamental basics of valuation, UAVs can facilitate a valuation process in many cases, as mentioned above.

- Feasibility issues: Many appraisers argue that the cost of acquiring and maintain a UAV is very high and is not worth taking.

- Necessity: Free aerial imagery despite the fact that it might be one or two years old is enough for the needs of a valuation.

5. Conclusion

Despite the fact that property valuation is based on certain traditional unchanged methodologies (comparative, income etc. method), new technologies constantly enter the field with tools and ideas that facilitate and improve the valuation process. UAVs carry an equipment which appraisers can use easily during the inspection, the measurement and the mapping of a property’s surrounding area. The main advantages of safety and up to date information basically rule out arguments against the use of UAVs. Nowadays, UAVs and specifically drones are used by appraisers more often than ever, which in combination with new methodologies (mass appraisal techniques etc.) transform and reform the real estate valuation sector.

References


Austin, R., (2010) Unmanned aircraft systems: UAVs design, development and deployment. UK: John Wiley & Sons Ltd.


