Topographical Surveying using Unmanned Aerial Systems/Drones

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Abstract

The latest generations of emerging technologies have one similarity that makes them strike out, their miniature status. This is what led to the rise of unmanned aerial vehicles informally referred to as drones. Their penetration into the Geospatial world is what has elevated them into being a contemporary method of carrying out aerial mapping. African countries have risen to the challenge on partaking projects that are performed using these sophisticated miniature planes. The purpose of the project was to obtain the general alignment of the ground for the purpose construction. Hence, drone mapping and topographical survey were executed to generate the surface and terrain models for construction work. Using the DJI Phantom 3 drone a flight height of 120 Meters was maintained in order to capture aerial images of 3-centimeter spatial resolution across the area of interest. The drone captured high resolution images covering the entire project area within 15 minutes. A total of 77 images were captured. Subsequently, the raw images were post-processed into Ortho-mosaic maps using Pix4D software. This enabled the creation of digital surface models of higher accuracy (Iizuka, 2018). Since the area was entirely covered by tree canopies, it was not possible to obtain ground elevation data from drone images hence Stonex S800A GNSS was utilized for topographical survey work. The topographic map and contours obtained aided in the ascertaining the drainage pattern of the area.

Keywords: Unmanned Aerial Systems, Ortho-mosaics

1 Introduction

Drones have taken the 21st century by storm having initially been reserved for use only by the military in the past decades. Due to their vast application in espionage by some of the world's intelligence agencies, they have acquired the nickname 'eyes in the sky' There are various drones that exist in the market today all with varying applications. Higher resolution satellite imagery that generate images with a spatial resolution of less than 1.0 meter have become very expensive to acquire especially when it comes to large area coverage. This has forced specialists to use airplanes for aerial photography only to acquire the same type of images but at a higher spatial resolution and a cost-effective manner. This is where the drone technology has picked up. From the effortless flight planning to the autonomous accurate data acquisition, these may just be some of the reasons as to why most experts see it as an alternative remote sensing platform subsequently revolutionizing the norm in carry out aerial mapping. According to (Mosly, 2017) the adoption of innovative technologies in the construction industry is necessary for the industry development. They provide a bird's eye view for supervising construction site personnel as well as providing live feedback on actions taking place on-site

2 Materials and Methods

Equipment and software used in the project include:

- DJI Phantom 3
- DJI GO
- Pix4D Software
- Stonex S800A GNSS
- Registry Index Maps.

2.1 Flight Planning

The DJI GO mobile app was used in the calibration of the drone's imaging resolution to 3cm, camera lighting, camera megapixels and imaging bands in the RGB spectrum.

Similarly, the app was used in the planning of the flight. The 7-acre area was defined with a computed flight path. Since a 3cm spatial resolution was required, the drone was to fly at an approximate height of 120 m within a span of 15 minutes bringing up a total of 77 images.

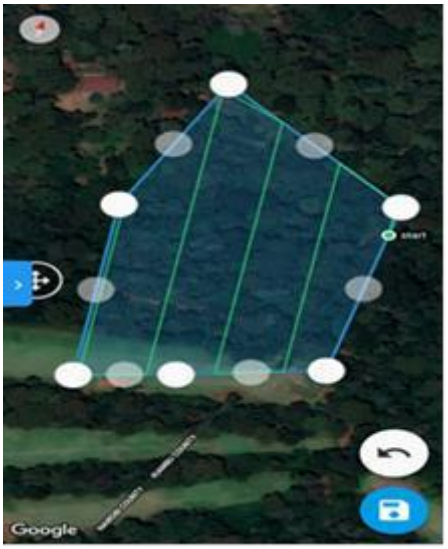

Figure 1: Flight plan of area of interest

2.2 Image Processing

The images were later post processed using Pix4D software. We were tasked with coming up with Ortho-mosaic image, DSM and a topographic map of the area and the outputs are illustrated in the results section.

2.3 Results

The output of the project was a 3cm resolution Ortho-mosaic, a DEM, DSM, topographic map and contours. The purpose of the topographic survey was to obtain the alignment of the ground and its levels since the region is a highly forested area. The contours generated were at an interval of 50 centimeter. The DEMs and DSMs were required for further GIS processing such water flow analysis. The Orthomosaic image is accessible online via the link below:
http://www.orbital.co.ke:8080/geoexplorer/viewer/#maps/4

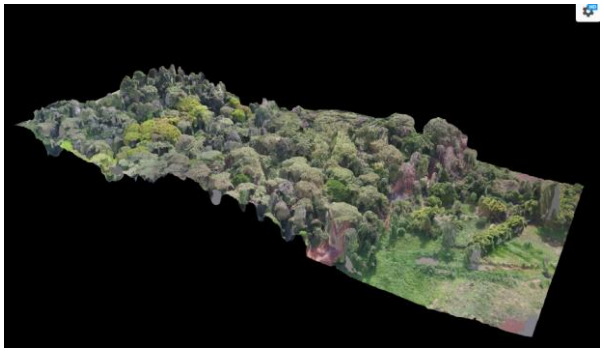

Figure 2: a DSM of region

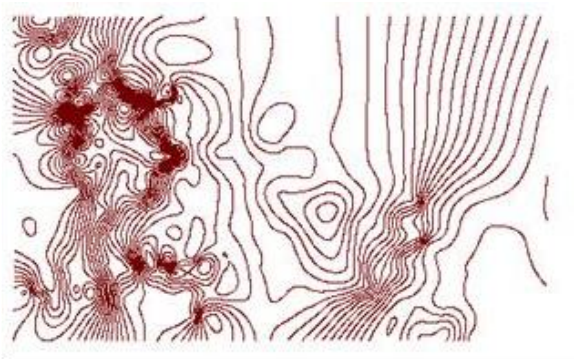

Figure 3: Isolines

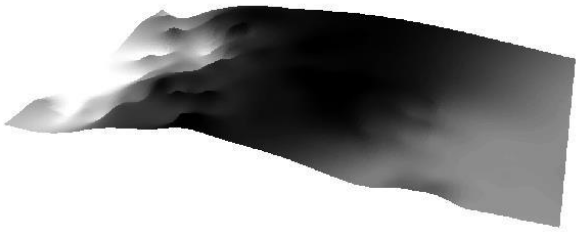

Figure 4: DEM

3 Conclusion and Recommendations

The scientific contributions brought about by this project was to highlight on the efficiency that the UAV technology has brought to the surveying field. UAV solutions contains the potential to enormously reduce time and monetary investment. Surveyors can not only increase their productivity by being able to carry out more projects in the same amount of time, but they can also work with a more qualitative dataset, which makes it possible to conduct better, more thorough planning as compared to the conventional survey that involve huge cost, labor, and time (Tahar, 2017).

4 References

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