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Airborne LiDAR For Urban Planning

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Abstract

The United Nations press release (2019) states that 68% of the future world population will live in urban areas by 2050. Consequently, the cities will need more advanced technology to help them plan and manage the city. Airborne LiDAR is a cutting-edge technology for mapping objects on the Earth's surface which is very beneficial for urban mapping. Airborne LiDAR can produce a 3D City Model which produces useful data for several applications in urban planning.

Airborne LiDAR

Airborne LiDAR (light detection and ranging), originally called Airborne Laser Scanning, is a new technology that is able to generate Digital Terrain Models (DTM) and map all geographical features above it automatically (Ackermann, 1999). There are three instruments which compose the Lidar system, namely GPS (Global Positioning System), IMU (inertial Measurement Unit) and LS (Laser Scanner) (Wehr, 2009).

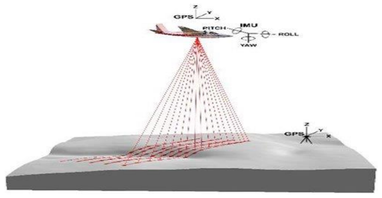


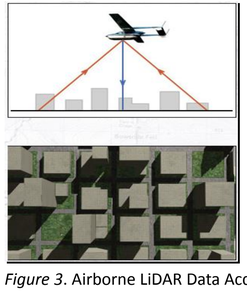
Figure 1. Airborne LiDAR System. Created by Jadhav and Gambhir (2009).

Airborne LiDAR Data Acquisition

- Flight Planning

Figure 2. Flight Plan Illustration. Created by BAKOSURTANAL (2006).(Personal Communication).

- Data Acquisition



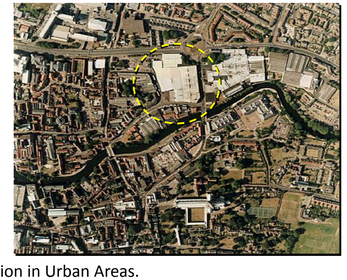


Figure 3. Airborne LiDAR Data Acquisition in Urban Areas. Created by BAKOSURTANAL (2006).(Personal Communication).

Airborne LiDAR Data Processing

- Lidar Data Processing Workflow

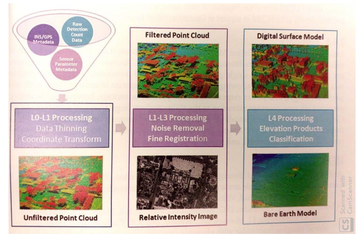
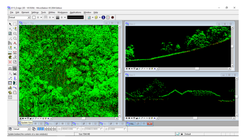


Figure 4. Workflow of Airborne LiDAR Data Processing. Created by Renslow et.al. (2012).

- Point Cloud Processing



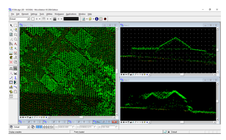
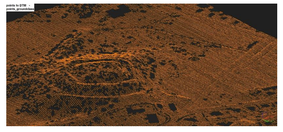


Figure 5. Airborne LiDAR Point Cloud Data Processing. Created by Martiana (2016). (Personal Communication).

- Digital Terrain Model (DTM) Generation



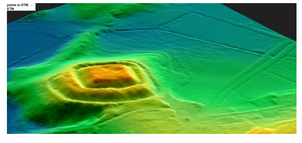


Figure 6. Digital Terrain Model (DTM) Production from Airborne LiDAR Point Cloud. Created by National Land of Survey Finland (2018). (Personal Communication).

- 3D City Model Generation

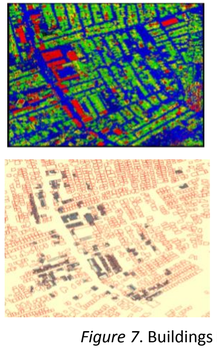


Figure 7. Buildings Extraction Process for 3D City Model From Airborne LiDAR Data. Created by Sari and Ratnasari (2016). (Personal Communication).

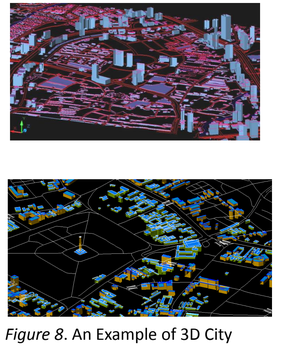
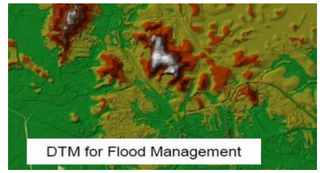
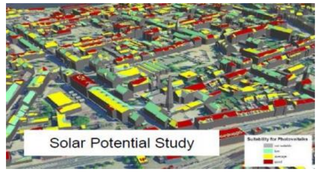


Figure 8. An Example of 3D City Model. Created by BAKOSURTANAL (2006). (Personal Communication).

Applications





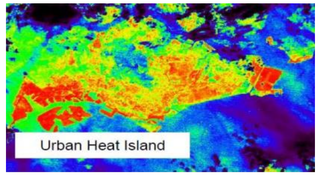


Figure 9. Airborne LiDAR Data Applications for Urban Planning. Created by GPS LANDS (2019). (Personal Communication).

Conclusion

Airborne LiDAR is a novel technology which gives added value in urban mapping. Airborne LiDAR can generate Digital Terrain Models (DTM) and 3D City Models which are useful for many urban planning applications. Airborne LiDAR is a new powerful tool that can help cities to handle future challenges in urban planning and management.

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