

Drone Mapping and Its Capabilities

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Drones or UAV's, unmanned aircraft vehicles, are special devices derived from the WWII drone concept in the British military. Within the last 10 years, sUAV's have flooded the market and established themselves into a multiple-use tool. There have been iterations and iterations of different drones to get where we are now. We have an expansive list of drone models for a multitude of different jobs. Drones' sizes from few inches to multiple feet in length. The uses range from rescue operations, border control, storm tracking, photography, and mapping (Insider Intelligence). The factor I would like to focus on is mapping and what it offers. From creating elevation maps and 3D models, 2D pictures, and more.

Before UAVs, virtual mapping had been using satellites and GPS hand units with overlaid photos. With the introduction of sUAS, a new generation of people can map faster and in more detail. Acquiring accurate satellite photos was an expensive venture and took multiple rounds to get accurate depiction (Budiharto). Budiharto also says that using drones is more accurate than using satellites when distinguishing land use and land cover.

3D modeling is a major feature of why drone mapping is becoming a must in the private sector. Depending on the size of the acreage and the amount of overlap of photos the time can vary between a few hours and multiple batteries or just a few minutes. Photogrammetry, or "the science of taking measurements from photographs" (A Beginners Guide to Drone Mapping Software), is a key part of 3D modeling. The drone has a flight plan premade before the flight. That flight plan tells the drone where to fly and in what direction. As it follows its plan to take photos; each pixel is marked with a GPS tag and a key point. When the images are overlaid in a GIS software the GPS tags align themselves with overlapped photos and key points (Madawalagama).

These GPS tags stitch together and create elevation data throughout the worksite. Once the elevation data is set and the map is stitched, many GIS software's can create the maps. QGIS is one of them. It is an open-source program similar to R statistical software. In the GIS software workflows can be created to manufacture the product of a 3D map. In the use of agricultural fields, 3D maps help distinguish where irrigation and soil health (Puri).

More uses of 3D maps that can be created from drones' data are city planning and wind farm planning. Elevations maps created for the respected areas help with both planning operations. City planning needs to know the current elevations and how their plans will affect current living conditions. How water will flow, sewer, gas lines be placed regarding terrain. Wind farms are important to know elevations as well. Slope and aspect of the terrain are important for wind turbine construction. The drone 3D map can also be turned to be used in viewsheds. What can be seen from certain locations? 3D mapping has a bright future with the use of drones (4 uses of 3d GIS).

Another use of drone mapping is in NDVI. Identification of vegetation by the color reflected off plants. These maps are also made with post-processing in GIS software. The colors are ranked from -1 to +1. The reflection comes from the chlorophyll in the cells. The brighter the color to healthier it is considered (A Beginners Guide to Drone Mapping Software). It is derived from sensing differences in the visible and near-infrared light reflections. NDVI can tell the difference between clogs, Nutrient deficiencies, Regulator errors, and Damaged drip lines (Ceres Imaging). NDVI has changed the game for a lot of farmers. This new and more accurate way to identify poor crop health will increase bushel size, in the form of proactive management for crops health.

A study was done by Pietro Mattivi “Can Commercial Low-Cost Drones and Open-Source GIS Technologies Be Suitable for Semi-Automatic Weed Mapping for Smart Farming?” to find how useful low-cost commercial drones can be in the identification of weeds with the use of GIS software. The study was done in Italy inside the Venice Lagoon. The crop field under study was a maize field. They took a standard commercially viable drone; one that had a comparable sensor and took orthomosaic photos. From these photos, they entered them in GIS software and created a workflow that identified weeds. This identification map would help reduce the use of pesticides and herbicides. This will help many industries except the herbicide and pesticide industries.

Unlike the sUAV, a larger mapping technique is called Synthetic Aperture Radar or SAR. SAR is primarily used by militaries with the use of military drones. The benefit of this mapping is that it can be done at night and in rough or unideal weather for most other mapping. It uses a combination of taking ranges and azimuths to create 2D images of the terrain (Pathfinder radar ISR Systems).

Another form of mapping drones can utilize is Lidar. It stands for Light detection and ranging (Gatziolis). Lidar has a range of uses with the help of mapping software. The Forestry service uses it to map out the ground, understory, and vegetation structure. It works by sending beams of light out and receives them back (Gatziolis). Like radar, the time it takes for the pulses to return gives the sensor the distance it is away from the device. The Forest Service primarily uses planes to scan large areas of land that a drone wouldn't be ideal for. New drones are being decked out with higher quality sensors to create the lidar elevation, vegetation, and city maps smaller projects need (Lidar).

Overall, there are many uses and applications of drone imaging and mapping. It sets to a factor of 10 when in the addition of GIS software. Though mapping has never been easier and more accessible until the new developments of sUAV. Elevation, NIVD, and orthomosaic maps are just the beginning. In a short time, we will have cost-friendly drones shooting in the highest resolution being able to automate 3D maps themselves that find their way to your phone. Mapping with drones is the new and best thing, it won't be going away for a long time.

Citations

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