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Research Paper

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Survey and Mapping Drones

Surveying is a part of everyday life whether it's building a road, mapping a mountain, or surveying a tower for cracks and flaws. Surveyors are always in demand. There are many different types of surveyors. There is the land surveyor that marks boundaries for roads and buildings to avoid legal disputes (What Does A Land Surveyor Do & what Does It Take to Become One). There is also the surveyor who figures out where a farmer needs to water their crops. Surveying is a broad term that covers a lot of areas. Most of these different survey jobs can be maximized by the use of a drone. Right now drones offer tons of potential to GIS Surveyors, they can carry out topographic surveys with higher accuracy and better quality compared to traditional methods (Perroud). Drones are mainly being used for topographic surveys but their potential for other kinds of surveying is so much more. There are two main kinds of drone surveys: Exterior and Interior surveys. Exterior surveys are far more common since drones can survey and map places that humans can't reach. While interior surveys help map the inside of a building which is not as common.

Exterior Drone Surveys

Topographic drone surveys are now becoming the most common way to survey a piece of property. The drones have a greater advantage over humans by how quickly they can process

data and reach places that can be in tough spots (Knisley). Most of these drones are equipped with LIDAR laser systems or they use another program called photogrammetry. LIDAR is a system that goes on the drone and beams lasers across the earth's surface. The information generated from this system gives a precise three-dimensional map. If there is any vegetation in the surveyed area the laser can penetrate through and show the terrain below. This kind of LIDAR is called topographic LIDAR. There is another type of LIDAR called bathymetric which is used to map the bottom of the sea and riverbeds (What is Lidar). Photogrammetry is the process of using 2-D pictures to create a 3-D map/model. The drone flies a path and takes tons of pictures. These pictures are then uploaded into a program where they are stitched together to create the 3-D model (Aero).

But there are some drawbacks to using photogrammetry over LIDAR. Photogrammetry is subject to the seasons more than LIDAR. If an area is covered in snow the LIDAR would be able to penetrate the snow while the photogrammetry would not. Also if any trees are covering an area, photogrammetry would not be able to see through the trees but the LIDAR would (National Institute of Building Technology Nashik). LIDAR has its disadvantages as well. The main disadvantage to LIDAR is its high operating costs. The laser system that it uses is very expensive to own and operate. The other drawback to LIDAR is its ineffectiveness with low hanging clouds or rain and is degraded at high sun angles and reflection (Advantages and Disadvantages of Lidar).

LIDAR surveys have many applications. One of these applications is in agriculture which affects everybody in the world. Everybody needs to eat no matter what kind of diet a person has, a farmer is responsible for this food. One of the agriculture applications of LIDAR is surveying a field and finding out what areas receive the most amount of sunlight. The LIDAR can also detect

what plants need to be watered or fertilized keeping the farmer up to date on how the crops are progressing (George).

Drones are being used in property surveys to determine cadastral surveys. A cadastral survey determines property taxes. A drone is not able to determine land ownership, an actual land surveyor must come and determine property boundaries. Technology just is not quite advanced enough for people to trust a drone survey to determine property boundaries. One day drones will be able to determine land boundaries but it's just not happening yet in today's world (Drone surveying applications, external and interior mapping).

Drones are also being used for structural surveys. These include surveying cell towers and buildings. Drones are used in surveying these taller structures because it costs a lot less money to send a drone up to look over the structure than have a person climb the tower or building. These surveys are just looking for any visual deformities. Once a deformity is spotted with the drone then a person would go and fix the problem. Without drones, these surveys could take days to complete (Drone surveying applications, external and interior mapping). This type of survey is typically done using photogrammetry because it gives real-time pictures.

Interior Surveys

Photogrammetry and LIDAR can be used in a variety of ways to map an interior. The main way these are used is to map the interior of larger buildings to get accurate measurements. Although the interior mapping is being done with smaller drones and the use of photogrammetry. While LIDAR can be used for bigger spaces but will cost more than the photogrammetry. These models can give accurate measurements, check shapes and sizes and also track changes in the structure (Gandillon). Interior surveying is not as prominent as exterior surveying and mapping.

Since it's much easier to use a drone outside versus inside. Plus there are also other people that have different interior mapping equipment that can work better than a drone.

In conclusion, drones are going to be the future when it comes to surveying and mapping. The ease of use and the costs are some of the major benefits that drones have over satellite or even real surveyors. Eventually, we will reach a point in our lifetime where drones are going to be the norm on how surveys are being conducted. It may not be today or even five years from now. But by the end of my lifetime surveying and mapping drones are going to be the main way to get a surveying job done. An American politician and pilot Robin Hayes said this about drones “As a pilot, I can tell you drones may be a lot of things; airplanes they are not”. Drones are the future and we just have to be ready for it.

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