The Smartphone as a Professional Mapping Tool

To what extent will the smartphone become a professional mapping tool? Modern smartphones already contain many of the important functions to be used as mapping tools. However, whether they are suitable for use as such professionally depends not only on the built-in sensors, but also on the available computing power, RAM and data storage capacity.

For data acquisition, a smartphone usually has two to three cameras, a GNSS sensor, an acceleration sensor and a gyroscope for positioning the system in 3D space. In addition, a smartphone has a magnetometer which displays the orientation or north direction by a compass, and a barometer for measuring altitude. Current-generation smartphones have built-in RGB cameras of up to 108MP (e.g. the Xiaomi Mi Note 10) to take high-resolution photos. However, it is questionable whether so many pixels are generally necessary for mapping applications.

Smartphones with mapping functionality have been available on the market for a few years now and there are numerous different options, so I will limit myself to mentioning just a couple of examples here. Back in 2013, ETH Zurich published an article on 'Live Metric 3D Reconstruction on Mobile Phones' presenting an application that allows (rather small) objects to be scanned in real time using a smartphone. A point cloud is generated from photos taken in motion by the smartphone camera and shown on the display during recording, so that the user can continuously check the completeness of the scanning process. Today, the application is marketed by Astrivis and offers an easy-to-use mapping tool for when high accuracy is not the first priority.

Another interesting solution is the Spike smart laser measurement solution, which combines a smartphone with a laser distance measuring device developed by IkeGPS. With an add-on laser module, the smartphone is upgraded to a distance measuring instrument for evaluating photos and distance measurements. This takes place within the Spike app and can then be transferred to a GIS, such as ArcGIS, via the Survey123 app from Esri. Spike has many possible applications, particularly in the building and construction sectors.

A very similar solution is the Leica BLK3D, which uses photogrammetry to make precise measurements from photographs. The combination of a calibrated stereo camera, advanced algorithms and real-time calculations together with leading electronic distance measurement technology makes it possible to measure exact distances, areas and the like.

If smartphones are to gain relevance as professional mapping tools, then other features will also be of importance in addition to the criteria mentioned above. Such features include high-accuracy measurement capabilities, tools for the simple handling of data acquisition and processing, some degree of automation and interactivity in data processing and rapid data transfer via WLAN or Bluetooth to other evaluation systems. The first smartphones with time-of-flight cameras are already available. They use an infrared camera to determine depth information through point-cloud visualization, although the range and precision of these devices is currently limited.

Smartphones are in fact already being used today as a supporting mapping tool for controlling other sensors and measuring systems such as terrestrial laser scanners, total stations and also unmanned aerial vehicles (UAVs or 'drones'). The technological development of smartphones continues at a quick pace, and we can expect faster performance and more precise sensors in the future at a reasonable price. Therefore, the use of smartphones as a professional mapping tool is undoubtedly set to increase.

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