

## Algorithms, Systems and Software Development for an Image and GNSS/MEMS based 3D Object-Referencing in Mobile GIS

Nowadays mobile phones have become an unreplaceable part of our daily life and they are getting ever more sophisticated and smarter and they are equipped with several sensors which can be adopted for geomatics applications.

A MMS (Mobile Mapping Systems) integrates navigation systems for example, Global Navigation Satellite Systems (GNSS), Inertial Navigation Systems (INS), cameras to provide the 3D coordinates of points of interest from a moving platform. In addition to their 3D mapping capabilities, the strength of MMS lies in its ability to directly georeference its mapping sensors without using any control points.

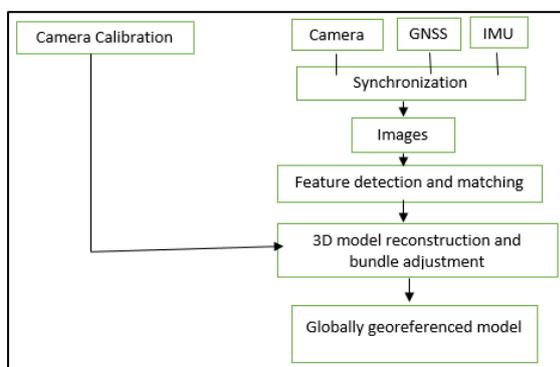


Figure 1: System description

The navigation sensors on the MMS platforms are used for the direct georeferencing. Once it is georeferenced, the mapping

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sensor can be used to determine the positions of points external to the platform in the same mapping coordinate frame, which allows for collecting geospatial information.

The final solution of MMS is accomplished in several steps. After data acquisition of the georeferenced images and spatial information, information extraction and management takes place. To determine the 3D coordinates of any object of interest, at least two conjugate images are needed for this object.



Figure 2: Point cloud

Bundle adjustment technique was used to generate the point cloud providing accurate, fast, and economical mapping solutions that increase the efficiency of spatial collection for different GIS applications.

The App development based on Android platform, making use of the open source library “OpenCV” for the implementation of images matching and features extraction as well as Android Canvas for the visualization of the generated point cloud.

