Formation of 360-Degree Panorama Using Images Captured with The Portable Panoramic Image Mapping System (PPIMS)

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Abstract：The Portable Panoramic Image Mapping System (PPIMS) is a multi-sensor mapping system equipped with six single-lens cameras to capture panoramic images and a GPS receiver for positioning. This system is specially designed for rapid collection of spatial information in some difficult accessing areas by vehicle-based mapping systems, such as rugged terrains, forest areas, heavily damaged disaster areas, and crowed places etc. The relative position and orientation between each camera and the PPIMS platform has been well calibrated (Wang, 2012). For a surveying mission, the image station of PPIMS can be determined with the GPS receiver and the platform orientation with respect to the mapping coordinate system can be recovered with a network adjustment (Tsai, 2012), so that the exterior orientation parameters (EOPs) of all images can be derived. Ground coordinates of any object point can then be determined by image ray intersection.

Six images are captured simultaneously for each PPIMS image station. A user frequently needs to handle a large number of images for visualization and measurement, and sometimes could be confused with finding a target image. The motivation of this study is to form a 360-degree panoramic image with the six images captured at each PPIMS image station. Rigorous geometric projection will be considered in the formation, so that the orientation of each 360-degree panorama is associated to the platform orientation. Under this circumstance, the panoramic images are not only good for visualization but also valid for image ray intersection. This presents the principle and image resampling method for the panoramic image formation. Experiments and analysis of geometric accuracy of some test data obtained in a variety of landscapes were conducted for demonstration. The results positively validate the proposed idea.

Keyword：360-degree Panorama, Portable Mobile Mapping System, Close-range Photogrammetry, Panoramic image.