Image-Based Target Detection and Tracking Using Image-Assisted Robotic Total Stations

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SUMMARY

Robotic total stations are modern geodetic multi-sensor systems measuring horizontal and vertical angles as well as distances using time-of-flight methods, thus delivering 3D-coordinates for static as well as moving objects. Automatic target detection (by rough and fine pointing techniques) and tracking are standard techniques if the objects are signalized with reflectors and the total station is motorized. Nowadays these instruments are additionally equipped with one or two cameras to generate images mainly for documentation purposes. This paves the way to detect and track objects that are not signalized by reflectors. Photogrammetric techniques as SURF (Speeded-up Robust Feature) or SIFT (Scale Invariant Feature Transform) are applied for the detection of special, recognizable object features in the images. The pixel coordinates of these features result in vertical and horizontal angles if the parallaxes between the camera optical center and the total station origin are known or calibrated. If the features are extracted in a sequence of images the movement of any object can be tracked automatically. For the position determination reflectorless distance measurement from the total station to the object is required additionally. Currently this can be realized only for static objects.

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