TRACKING MOUNT SOFTWARE

BACKGROUND

Many military test ranges worldwide deal with the measuring of position and attitude of moving objects using dedicated tracking mounts which can follow objects at large distances. The main feature to be measured for these studies is the 3D position of the object at different times. Using the 3D position data all kinds of analysis can be performed, e.g. calculating the distance between a missile and a target. Several tracking mounts can be used, positioned at different locations. Recording the direction to the object from different angles results in high accuracy 3D positions. An important tool to obtain this accuracy is TrackEye. The program tracks objects in images automatically, handles the positions of the tracking mounts, integrate different calibrations and corresponding corrections, transforms coordinate systems and calculates the position for all objects.

SOLUTION

TrackEye handles all steps in this process from recorded image sequences and data to final presentation of 3D position and attitude of the object(s). TSPI analysis consists of five steps

Calibration of mount systematic errors (star calibration, reference markers, etc.)

- Calibration pre test (reference markers)
- Image & Data recording
- Data analysis (including corrections for systematic and other errors like refraction)
- Result presentation (text, 2D & 3D diagrams, reports, etc)

Historically, some of these steps have been performed in different software modules in different environments.

One of the major advantages using TrackEye is that the software is fully integrated; one program, one interface, one computer. The operator has full control from input to output, changes in input are immediately reflected to the output.

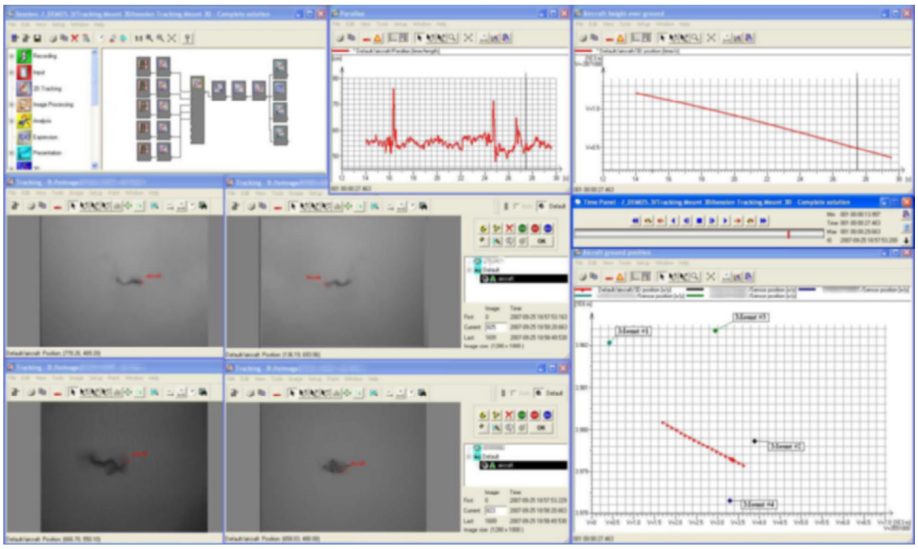
From the test there are image sequences from one or multiple tracking mounts available for processing. It is also possible to calculate 3D data from one tracking mount, only range (distance) data has to be added.

TrackEye will use all available data to calculate the final 3D data, including but not limited to images and range information.

With the complete process, including 2D tracking, in one GUI you can immediately view the chain of results, from the 2D tracking to final TSPI output data.

image SYSTEMS

MOTION ANALYSIS



OPTIONAL FEATURES

TP CAL

The TPCAL will as input use image sequences of terrestrial targets together with surveyed earth coordinates for these targets. Some of the initial calibration data will re-calculates/modified by the TPCAL. The following calibration parameters are typically re-calculated by the TPCAL:

- Azimuth & Elevation Bias
- Offset relative true north (at elevation 0 degrees). [Constant initially defined by star calibration. Refined during analysis of pre cal data.
- Offset relative local tangent plane of ellipsoid. [Constant initially defined by star calibration. Refined during analysis of pre cal data.]
- Sensor Elevation Bias [Angular misalignment of an individual sensor relative to pedestal elevation axis reference. Constant. Initially defined by star calibration. Refined during analysis of pre calibration data.]
- Skew [Angular misalignment of individual sensor relative to the transverse axis. Constant. Initially defined by star calibration. Refined during analysis of pre calibration data.]
- Offset [Physical displacement of individual sensors.]

Please note that the above listed parameters are just a sample. This is an off-line calibration. The result will be stored in the sensor individual in the TrackEye archive and can be used in a TPCOR (Tracking Mount Correction) module. Requires customer input on platform parameters and preferred calibration procedures.

TECT

At a test range several different coordinate systems are used, earth bound as well as Cartesian. The TECT module is used to convert coordinates to/from different lat/long and local xyz coordinate systems and is essential to a Tracking Mount application.

TrackEye internal calculations are always in Cartesian coordinates.

Currently supported Lat/Long earth bound coordinate systems are WGS84, ED50 & NAD72, others on request. For WGS 84 the geoid model can be specified as either geocentric or locally earth aligned.

Another support function calculates the height above the geoid, which is equivalent to height above MSL (Mean Sea Level). For Lat/Long/Height or UTM coordinates, the height over the ellipsoid is replaced with height over the geoid. For input data in Cartesian coordinates the geoid height is output as a separate sequence.

TESAC

TESAC corrects for atmospheric refraction using a mathematical model supplied by the customer.

When light passes through layers of air with different pressure and temperature, the path of travel is not a straight line. The phenomenon is called refraction and can cause severe tracking errors in a platform 3D application.

The mathematical model is based on changes in air pressure and temperature and the refraction range, which is the distance between the object and the sensor.

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