System View
GoPro Trails
Images and Graphics, Project Course CDIO
TSBB11

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1 Overview

Figure 1 shows the components of the system.

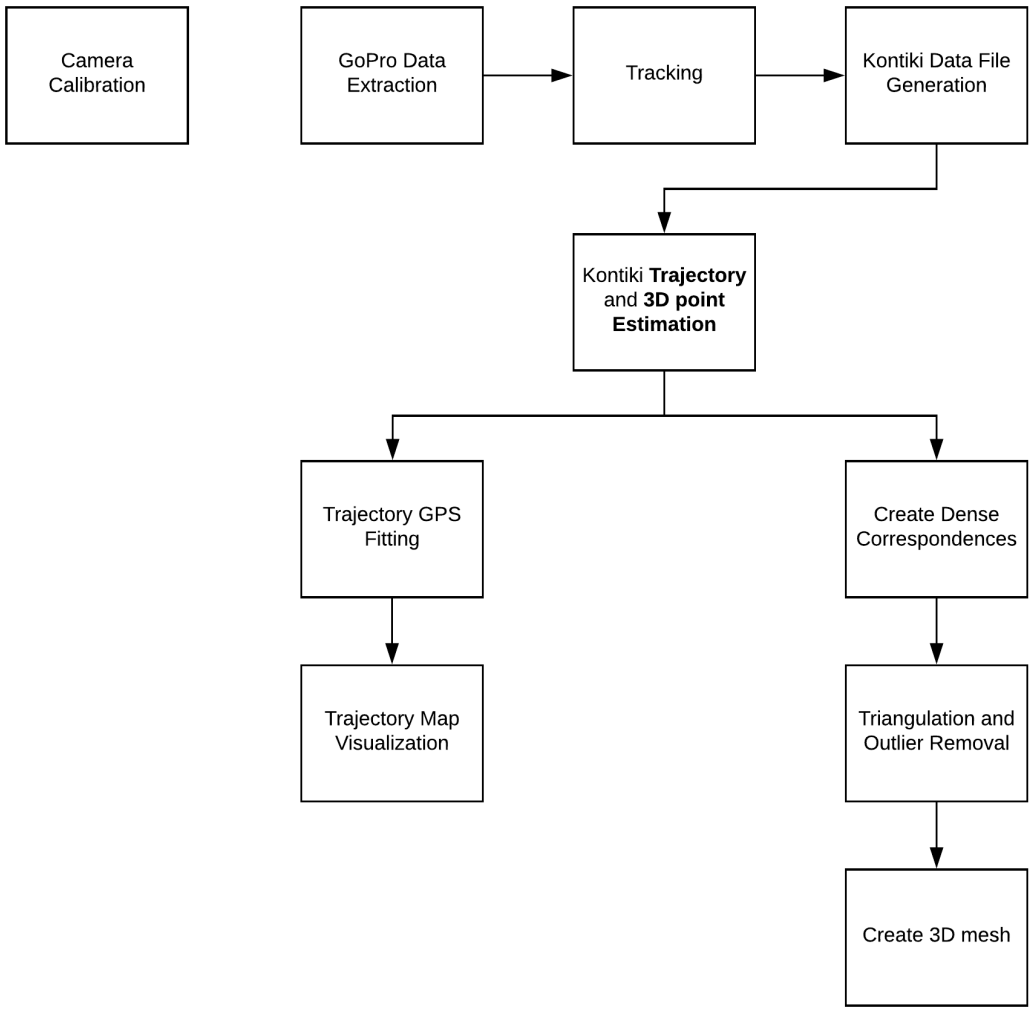

Figure 1: Flowchart of the system components.

2 Components

The different components in the system are described in this section.

2.1 Camera Calibration

In this stage the internal parameters of the camera are calculated. This only needs to be done once per camera, and is therefore not connected in the flowchart (Figure 1).

2.2 GoPro Data Extraction

The data stream containing the video sequence, IMU data and GPS data is extracted from the camera in order to be processed.

2.3 Tracking

Interest points from the video sequence are found and tracked for use in the SfM stage in Kontiki.

2.4 Kontiki Data File Generation

The data up to this point is saved to a format compatible with Kontiki.

2.5 Kontiki Trajectory and 3D Point Estimation

The tracked points and IMU data are used to generate an SfM solution with an accompanying trajectory. If time allows, the GPS data will be added into the optimization problem.

2.6 Trajectory GPS Fitting

Initially, the GPS measurements from the camera will not be used in the SfM system. The GPS data will be used to compute a transformation that maps the trajectory coordinates from the coordinate system used by the SfM system to the GPS coordinate system. Since the trajectory from Kontiki is assumed to have correct scale, the problem can be formulated as an optimization problem where the parameters correspond to a rigid transformation and loss function measures deviation from GPS data. If the GPS data is included in the optimization stage, this step will automatically be solved in the process.

2.7 Trajectory Map Visualization

Trajectory data and GPS data are combined to draw the trajectory onto a map service as visualization. The trajectory is initially points in 3D but are projected down on the 2D map in this stage. The route calculated with only GPS data will also be displayed for comparison of the methods.

2.8 Create Dense Correspondences

In order to add more points to the point cloud, a dense correspondence algorithm (eg. PatchMatch) will be applied to the 2D images. This results in a more dense 2D point correspondence between the images.

2.9 Triangulation and Outlier Removal

The 2D points, generated in the step of creating dense correspondences, are triangulated to receive 3D points from these. The 3D points will then be reprojected which makes it possible to detect and remove outliers.

2.10 Create 3D Mesh

From the dense 3D point cloud a 3D mesh will be generated and visualized using MeshLab.

2.11 User Interface

The program will have a command line interface that allows the user to specify paths to data files, configuration and run the program. If enough time is available a simple GUI might be considered.