

SUMMARY OF THE INVENTION

In accordance with one aspect of the present invention, there is thus provided a method for image georegistration. The method includes the procedure of acquiring at least one sensor-image of a scene with at least one imaging sensor. The method further includes the procedure of obtaining imaging parameters of the acquired sensor-image, the imaging parameters including at least the detected 3D position and orientation of the imaging sensor when acquiring the sensor-image, as detecting using at least one location measurement unit. The method further includes the procedure of generating at least one model-image of the scene from a textured 3D geographic model, the model-image representing a 2D image of the scene as acquired in the 3D geographic model using the imaging parameters, the model-image including detailed textural image content besides edge features. The method further includes the procedures of comparing the detailed image content of the sensor-image with the detailed image content of the model-image and determining the discrepancies between them, and determining an updated 3D position and orientation of the imaging sensor in accordance with the discrepancies between the sensor-image and the model-image. The method further includes the procedure of displaying supplementary content overlaid on the sensor-image, in relation to a selected location on the sensor-image, as determined based on the updated 3D position and orientation of the imaging sensor. The method may further include the procedure of

determining the geographic location coordinates of a scene element, using the 3D geographic model and the updated 3D position and orientation of the imaging sensor. The imaging parameters may further include: the range from the imaging sensor to the scene; the field of view of the imaging sensor; the focal length of the imaging sensor; the optical resolution of the imaging sensor; the dynamic range of the imaging sensor; the sensitivity of the imaging sensor; the signal-to-noise ratio (SNR) of the imaging sensor; and/or lens aberration of the imaging sensor. The 3D geographic model may include a street level view of a real-world environment. The method may further include the procedure of updating the texture data of the 3D geographic model in accordance with texture data obtained from the sensor-image. The method may further include the procedures of: tracking the location of a scene element over a sequence of image frames of the sensor-image, and displaying supplementary content overlaid on at least one image frame of the sequence of image frames, in relation to the location of the scene element in the image frame, as determined with respect to a previous image frame of the sequence of image frames. The method may further include the procedures of: obtaining at least a second set of imaging parameters for at least a second sensor-image acquired by the imaging-sensor; generating at least a second model-image of the scene from the 3D geographic model, the second model-image representing a 2D image of the scene as acquired in the 3D geographic model using the second set of

imaging parameters; comparing the second sensor-image and the second model image and determining the discrepancies between them; determining an updated 3D position and orientation of the imaging sensor respective of the second sensor-image, in accordance with the
5 discrepancies between the second sensor-image and the second model-image; and displaying supplementary content overlaid on the second sensor-image, in relation to a selected location on the second sensor-image, as determined based on the updated 3D position and orientation of the imaging sensor respective of the second sensor-image.

10 The supplementary content may be displayed on at least a partially transparent display situated in the field of view of a user, allowing a simultaneous view of the sensor-image presented on the display and of the scene through the display. The method may further include the procedures of: comparing a new sensor-image with a previously
15 georegistered sensor-image and determining the discrepancies therebetween; and determining an updated 3D position and orientation of the imaging sensor when acquiring the new sensor-image, in accordance with the discrepancies between the new sensor-image and the previously georegistered sensor-image.

20 In accordance with another aspect of the present invention, there is thus provided a system for image georegistration. The system includes at least one imaging sensor, at least one location measurement unit, a textured 3D geographic model, a processor, and a display. The

processor is communicatively coupled with the imaging sensor, with the location measurement unit, with the 3D geographic model, and with the display. The imaging sensor is configured to acquire at least one sensor-image of a scene. The location measurement unit is configured to
5 detect the 3D position and orientation of the imaging sensor when acquiring the sensor-image. The model includes imagery and texture data relating to geographical features and terrain, including artificial features. The processor is configured to obtain imaging parameters of the acquired sensor-image, the imaging parameters including at least the detected 3D
10 position and orientation of the imaging sensor when acquiring the sensor-image as detected using the location measurement unit. The processor is further configured to generate at least one model-image of the scene from the 3D geographic model, the model-image representing a 2D image of the scene as acquired in the 3D geographic model using the
15 imaging parameters, the model-image including detailed textural image content besides edge features. The processor is further configured to compare the detailed image content of the sensor-image with the detailed image content of the model-image and determine the discrepancies between them. The processor is further configured to determine an
20 updated 3D position and orientation of the imaging sensor in accordance with the discrepancies between the sensor-image and the model-image. The display is configured to display supplementary content overlaid on the sensor-image, in relation to a selected location on the sensor-image, as

determined based on the updated 3D position and orientation of the imaging sensor. The processor may further be configured to determine the geographic location coordinates of a scene element, using the 3D geographic model and the updated 3D position and orientation of the
5 imaging sensor. The 3D geographic model may include a street level view of a real-world environment. The processor may further be configured to update the texture data of the 3D geographic model in accordance with texture data obtained from the sensor-image. The location measurement unit may include: a global positioning system
10 (GPS); a compass; an inertial navigation system (INS); an inertial measurement unit (IMU); a motion sensor; a rotational sensor; and/or a rangefinder. The display may be at least a partially transparent display situated in the field of view of a user, allowing a simultaneous view of the sensor-image presented on the display and of the scene through the
15 display. The display may include: a smartphone display screen; a camera display screen; a table computer display screen; eyeglasses; goggles; contact lenses; a wearable display device; a camera viewfinder; a head-up display (HUD); a head-mounted display (HMD); and/or a transparent display.

20 In accordance with yet another aspect of the present invention, there is thus provided an image georegistration module. The module is configured to obtain imaging parameters of at least one sensor-image of a scene acquired by at least one imaging sensor, the imaging parameters

including at least the detected 3D position and orientation of the imaging sensor when acquiring the sensor-image as detected using at least one location measurement unit. The module is further configured to generate at least one model-image of the scene from a textured 3D geographic model, the model including imagery and texture data relating to geographical features and terrain, including artificial features, the model-image representing a 2D image of the scene as acquired in the 3D geographic model using the imaging parameters. The model-image includes detailed textural image content besides edge features. The module is further configured to compare the detailed image content of the sensor-image with the detailed image content of the model-image and determine the discrepancies therebetween, and to determine an updated 3D position and orientation of the imaging sensor in accordance with the discrepancies between the sensor-image and the model-image. The module is further configured to display supplementary content overlaid on the sensor-image, in relation to a selected location on the sensor-image, as determined based on the updated 3D position and orientation of the imaging sensor. The module may be further configured to determine the geographic location coordinates of a scene element, based on the updated 3D position and orientation of the imaging sensor. The module may be further configured to update the texture data of the 3D geographic model, in accordance with texture data obtained from the sensor-image.