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Single Thread Large-scale Localization and Mapping (20170194)

IP Status: US Patent Application Filed; **Application #:** 16/213,248

Vision-aided inertial navigation with single thread filtering and mapping

A new navigation method achieves simultaneous localization and mapping (SLAM) of large areas on a mobile device. This technology performs both localization (determining position and orientation of an object in 3D space) and mapping in a single computing thread using a square-root inverse form of a Schmidt-Kalman Filter (SR-ISF) within a Vision-aided Inertial Navigation System (VINS). The VINS produces images of reference frame poses along a trajectory, a motion sensor provides motion data of the poses and a processor estimates the position and orientation of the poses. This technology could be implemented as part of a VINS solution with applications in virtual and augmented reality (VR/AR) in large spaces as well as robot/human localization and navigation.

Reduced memory and processing requirements

Vision-aided Inertial Navigation System (VINS) has successfully demonstrated real-time performance on robots, spacecraft, automotive and personal localization (e.g., on smartphones or laptops). In computer vision, localization and mapping are separate processes. A Kalman filter is often used for real-time localization and navigation while maps are built offline. Currently, running both a filter and a slim mapping module on mobile devices, and particularly sharing information between the two processes, is a challenge. This new algorithm (inverse form of the Schmidt-Kalman filter) solves this problem by providing filtering and mapping in a single thread. The technology features a “dial” that allows dynamic trade-off in performance between filtering and mapping. The method reduces memory and processing requirements, critical for use on resource-constrained mobile devices. Memory requirement is linear and processing requirement is close to linear.

Phase of Development

Proof of concept: Current implementation in Matlab (simulations).

Benefits

- Filtering and mapping achieved in a single computing thread
- Allows dynamic trade-off in performance between filtering and mapping
- Reduced memory and processing requirements

Features

- Localization and mapping in a single computing thread
- Square-root inverse form of a Schmidt-Kalman Filter (SR-ISF)
- Vision-aided Inertial Navigation System (VINS)
- Implementation on resource-constrained mobile devices
- Allows dynamic trade-off in performance between filtering and mapping
- Memory requirement is linear; processing requirement is close to linear

Technology ID
20170194

Category
Engineering & Physical Sciences/Robotics
Software & IT/Algorithms
Software & IT/Image & Signal Processing
Software & IT/Transportation

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Applications

- VINS module on a mobile device/robot
- Simultaneous localization and mapping (SLAM)
- Virtual reality and augmented reality (VR/AR) markets
- Robotics
- Robot/Human localization/exploration
- AR in large spaces

Desired Partnerships

This technology is now available for:

- License
- Sponsored research
- Co-development

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