Calibration of Smartphones for the use in indoor navigation

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ABSTRACT

In the past there was only GPS available for navigation in mobile phones. Due to the rapid development of modern smart phones they are now equipped with a large number of high quality sensors in MEMS design, which can also be used for indoor navigation.

In this study, the sensors of the Samsung Nexus Galaxy are evaluated. These are firstly, the gyroscopes and accelerometers, and magnetic field sensors, and as the major innovation of smartphones a barometer.

A research focus is the potential accuracy of MEMS sensors. Test measurements are performed with two Nexus and compared with data from an earlier generation of smartphones.

A sensor board is available to investigate the undocumented filter algorithms of hardware or software manufacturer. This board is equipped with nearly the same MEMS inertial sensors, such as the Nexus. Thus, raw data are measured and then compared with the filtered data of the Nexus.

For a better accuracy of the MEMS sensors, a calibration is necessary. These measurements are carried out to identify the characteristics, the stability and the variance.

A modified Leica TCRP1105 total station will be used as a reference for most of the tests. The sensor platform (board or smart phone) can be fixed in a device which is attached to the telescope. A matlab script is used to control rotary motion in space. The total station performs a pre-set sequence of motions. This can be compared with the sensor data from the phone.

The first measurements show that an investigation of smartphones using the total station is suitable. The constant rotation speed and the exact angle measurement could be an advantage. Two-faces measurements of accelerometers can be realized easily with a horizontal mounting.

From this investigation will emerge that the Galaxy Nexus is suitable for indoor navigation and the measurement accuracy can be increased significantly by calibrating.

KEYWORDS: indoor navigation, smart phones, calibration, MEMS