MEMS Sensors – State of the Art and Future Trends in Mapping and Navigation Applications

Dr. Naser El-Sheimy, PEng, CRC
Professor and Canada Research Chair
Scientific Director, TECTERRA
President, ISPRS Comission I on "Sensor and Platforms"
Department of Geomatics Engineering, The University of Calgary
2500 University Dr. N.W. Calgary, Alberta, Canada T2N 1N4
Tel : (403) 220 7587, Fax : (403) 284 1980
E-mail : elsheimy@ucalgary.ca
University of Calgary, Canada

ABSTRACT

Cost and space constraints are currently driving manufacturers of positioning, Mobile Mapping Systems (MMS) and Location Based Services (LBS) to investigate and develop next generation of low cost and small size navigation systems to meet the fast growing mobile mapping and location services market demands. Advances in Micro-Electro-Mechanical Systems (MEMS) technology have shown promising light towards the development of such systems. MEMS are integrated micro devices or systems combining electrical and mechanical components whose size ranges from micrometers to millimeters. MEMS is an enabling technology and the MEMS industry has a projected 10-20% annual growth rate to reach 240 billion US$ market by 2012. Advances in MEMS technology combined with the miniaturization of electronics, have made it possible to produce chip-based inertial sensor for use in measuring angular velocity and acceleration. These chips are small, lightweight, consumes very little power, and extremely reliable. It has therefore found a wide spectrum of applications in the automotive and other industrial applications. MEMS technology, therefore, can be used to develop next generation Direct Georeferencing (DG) systems that are inexpensive, small, and consume low power (microwatt). However, due to the lightweight and fabrication process, MEMS sensors have large bias instability and noise, which consequently affect the obtained accuracy from MEMS-based IMUs. For land MMS, introducing auxiliary velocity update in the body frame, (e.g. non-holonomic constraint and odometer signal) is an option to solve the problem. This presentation will introduce some of the development of MEMS IMU/GPS navigation system by the Mobile Multi-Sensor Systems (MMSS) Research Group at the University of Calgary and Trusted Positioning Inc. (a spin off from the same research group). The development objective was to develop a fully integrated system with price range of US $100 – 200 using low-end (surface micromachined) MEMS inertial sensors. Some of the developed system's accuracy performance will be demonstrated through land/airborne vehicles and personal units tests.

Bio of Dr. Naser El-Sheimy:

Dr. Naser El-Sheimy is Professor at Department of Geomatics Engineering, at the University of Calgary. He holds a Canada Research Chair (CRC) in Mobile Multi-sensor Systems and the scientific director of Tecterra Research Centre. He is also the CEO of Trusted Positioning Inc. (TPI), a spin off from the University of Calgary. His research expertise includes GPS/INS integration, multi-sensor systems, and mobile mapping systems. Prior to joining the University of Calgary, Dr. El-Sheimy held the position of VP R&D with VISAT Technologies Inc., a high-tech company in Montreal.

Dr. El-Sheimy published two books and over 350 papers in academic journals, conference and workshop proceedings, in which he has received over 30 national and international paper awards. He organized and participated in organizing many national and international conferences. Dr. El-Sheimy is the president of Commission I on "Sensors and Platforms" of the International Society for Photogrammetry and Remote Sensing (ISPRS). Dr. El-Sheimy is currently a member of the Editorial Board of Journal of Survey Review, Journal of Applied Geodesy, and Coordinates. He served as a member of the Alberta Geomatics Group Board of Directors, Geoide NCE Board of Directors, Technical Committee Member of the ASPRS Direct Georeferencing Committee, regular reviewer for the Journal of Geodesy, Journal of Photogrammetric Record, the Photogrammetric Engineering and Remote Sensing Journal and other scientific journals.