

WIMU – Wireless Inertial Measurement Unit

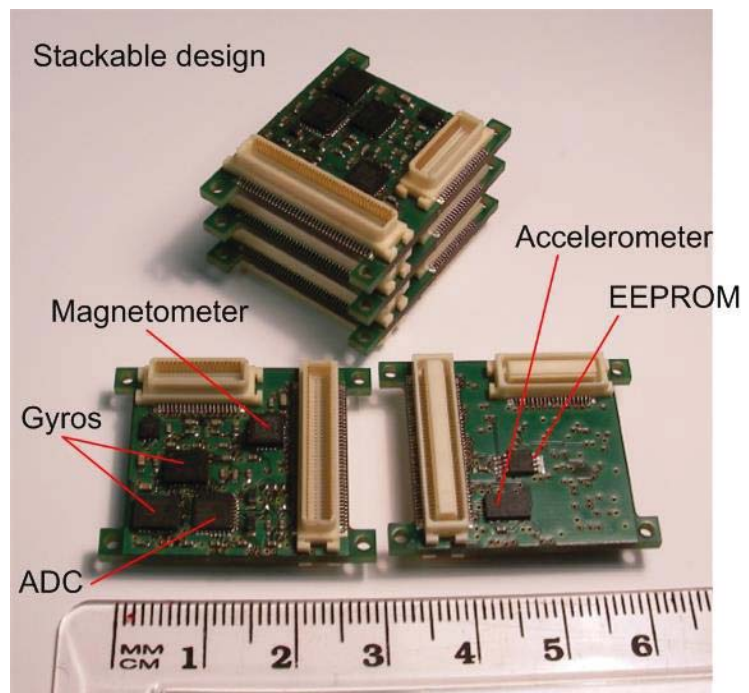
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□ Key words

Communications, Data management - Sensors / instruments / electronics - Software engineering / development

□ Description

Wireless Inertial Measurement Unit (WIMU) – Recently developed, Tyndalls' planar inertial measurement unit has been designed with the focus on various requirements. The planar WIMU coupled with the 2.4GHz transceiver, RF Nordic nRF2401, produces a very powerful customisable wireless node. Alternative implementations enable the Zigbee (IEEE 802.15.4) communications in the 25mm form factor if required. Thanks to high spec motion sensors used and variability of ranges the IMU can be used in a wide range of applications including sport player motion tracking or accuracy improvement for GPS based systems. Additional external data processing or Kalman filtering can be implemented on coupled PC or attaché microcontroller/DSP board.



25mm Wireless Inertial Measurement Unit (WIMU) – The Tyndall 25mm WIMU is a 6 DOF IMU module, which is made up of an array of inertial sensors coupled with a high resolution analog to digital converter (ADC). The 25mm WIMU module utilises the wireless communication capabilities of the 25mm wireless node to realise a fully autonomous WIMU module.

Accelerometer: 2xADXL202, analog
Magnetometer: 2xHMC1052L, analog
Gyroscope: 3xADXR150, analog
12 bit ADC

The inertial sensor array consists of three single axis gyroscopes, ADXR150 from Analog Devices, two dual axis accelerometers, ADXL202 from Analog Devices, and two dual axis magnetometers, HMC1052L from Honeywell. The sensor array was designed with a novel 3D structure, which produces the 6 required degrees of freedom (DOF) necessary to determine position. The module also has a 12-bit ADC chip, AD7490 from Analog Devices, handling the data conversion. This chip has a Serial Peripheral Interface (SPI), which allows easy interfacing to the ATMEL microcontroller.

IMU & GPS Data Merging – The IMU data can be used to improve accuracy and resolution of traditional GPS systems or provide short time localization data when the GPS signal is not available. Tyndall 25mm GPS mote can be linked to the 25mm WIMU or planar WIMU to provide a combined system where long term accuracy is given by GPS while short term improved resolution can be increased by using IMU sensor data. Both inputs can be processed using Kalman filtering technique to provide localization and orientation data with improved accuracy. The whole system can be also equipped with RF transceiver for wireless data transmission.

□ **Applicability of Technology to Maritime SMES**

WIMU is a low power, low cost solution to the more tried and tested (accurate but expensive) wave buoys. Tyndall's WIMU motion sensor is in development and further testing is scheduled for 2015. Previously it has been tested and validated in SmartBay's data buoys. WIMU provides;

- Real time, high-frequency sea state data
- Wave Measurement
- Ocean surface random wave heights, periods and directions

The device is suitable for deployment on a variety of platforms and for a number of different purposes;

- Data Buoys for wave resource assessment purposes
- Fish Farms for condition monitoring
- Novel Mooring Systems for testing and condition monitoring