Introduction

The advent of MEMS inertial sensors has reduced the size, cost & power requirements of 6 Degrees-of-Freedom inertial measurement systems to a level where their use can be considered for wearable wireless monitoring devices. Many applications for such Wearable Wireless Inertial Measurement Units exist in the area of sports and sports science. Such a system would be critical in providing data for the analysis of the kinematic motion data of an athlete - to characterise a player’s technique or track progress and provide accurate, quantitative feedback to player and coach in near real time. A small, lightweight & low power device with the ability to sense the full range of human motion at a high sampling rate is required for such applications. It must also be robust, well sealed and comfortable to wear. Further development and miniaturisation of such devices coupled with progress in energy scavenging may lead to their use in other areas and their near ubiquity, with the potential to be embedded within clothes, buildings, materials, objects and people for health monitoring, location tracking and other purposes.

Wearable Wireless Inertial Measurement Unit

- Onboard processing and wireless connectivity
- Attached to subject to record kinematic motion data
- Inertial Measurement Unit

Wearable
- Small Size
- Light Weight
- Ruggedness
- Good battery life
- Long wireless range
- Ergonomic packaging

Current Application - TennisSense

Initial Brief
- Wearable WIMU system to monitor tennis player
- Transmit wirelessly to PC for storage/analysis
- Issues - Unsure of sensor range, sampling rate or quantity of units required

Original Prototype
- Tyndall mote modular nature and wide range of existing layers allowed a rapid development of initial prototypes
- Nordic 433MHz Transmit-Receive pair
- Standard IMU Rev 1.7 sensors - ±2g Acc. & ±150°/s Gyro.
- Issues - Insufficient sensor range for application, lack of robust device packaging, low sampling rate

TennisSense Spec System
- Upgraded IMUs sensors - ±4g Acc. & ±2000-3400°/s Gyro.
- Up to 10x WIMUs connected to 1 or 2 base stations
- Robust device packaging
- Sampling rate comparable to motion capture cameras (100s of FPS)

Potential Wearable WIMU Applications

- Kinematic analysis of individual player
- Quantitative data as coaching aid
- Location monitoring of team members
- Physiotherapy compliance monitoring

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