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PII: S0263-2241(18)30717-6
DOI: https://doi.org/10.1016/j.measurement.2018.07.078
Reference: MEASUR 5762

To appear in: *Measurement*

Received Date: 6 January 2017
Revised Date: 10 July 2018
Accepted Date: 25 July 2018

Please cite this article as: N. Choe, H. Zhao, S. Qiu, Y. So, A Sensor-to-Segment Calibration Method for Motion Capture system based on low cost mimu, *Measurement* (2018), doi: https://doi.org/10.1016/j.measurement.2018.07.078

# A Sensor-to-Segment Calibration Method for Motion Capture System Based on Low Cost MIMU

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**Abstract**

The calibration for aligning wearable sensors with human body segments plays an important role in the realization of MIMU-based motion capture systems. This paper presents a novel calibration method using MIMU's 3-axis accelerometer, 3-axis magnetometer, and smartphone's compass (or commercial compass), which allows non-experts to easily implement the calibration procedure, because the subjects only need to face north and stand still for a few seconds after correction of the MIMU's magnetometer. The positions of the correction of a magnetometer in both indoor and outdoor environments were determined through experiments. Furthermore, the accuracy of the proposed calibration method, and the influence of the sensor's mounting positions were validated by an optical measurement system (NDI Polaris Spectra System). Finally, the accuracy of this method was evaluated by the localization and posture capture for a pedestrian. Experimental results demonstrated that the proposed calibration method can be effectively applied to human motion capture system.

**Keywords:** Sensor-to-segment, Calibration, MIMU, Motion capture

## 1 Introduction

In recent years, human motion analysis systems have been widely used in medical applications, sports, reality of the virtual environment and other fields of human computer interaction [1, 2, 3, 4, 5, 6]. In particular, motion capture technology based on magnetic and inertial measurement units(MIMU) has attracted increasing interest due to its advantages such as low cost and adaptability in both indoor and outdoor environments [7, 8, 9]. Recently, many researchers have developed their own methods for improving the accuracy and practicality of motion capture systems based on MIMU. The evaluation methods of MIMU orientation were proposed based on sensor fusion techniques, such as the gradient descent algorithm [10], Kalman filter [11], extended Kalman filter (EKF) [7, 12], and complementary filter [13, 14]. Some methods