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In- and Outdoor IMU System

AI-enabled, time-synchronized IMU array to measure inertia and position.

Reference: IMU System

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IP Status

Patent application submitted, Know-how based, Copyright

Seeking

Development partner, Commercial partner, University spin out

About **University of Cape Town**

UCT aspires to become a premier academic meeting point between South Africa, the rest of Africa and the world. UCT is committed, through innovative research and scholarship, to grapple with the key issues of the natural and social worlds.

Background

Currently, motion tracking systems are either based on Optical Systems to capture and analyse movement or they use sensors such as Inertial Measurement Units (IMUs).

Optical systems employ several cameras to capture images of the moving body of interest. From these images, kinematic models may be built that gives insight into the movement of the object. These systems are typically very accurate but are expensive and tracking can only occur within the facility where the cameras are installed. An example of an optical system is the Vicon motion capture system.

IMU systems, on the other hand, include sensors which are placed on the body parts of interest. These sensors measure the inertia of the moving parts from which kinetic models can be developed. IMU systems are potentially cheaper and more portable than optical systems and do not limit the study subject to a specially-fitted facility, but they are less accurate than optical systems and time synchronization with multiple sensors is difficult.

The trend in the “biomechanics market” in movement and sports sensors is the use of AI (machine learning and neural networks) to diagnose the performance of athletes and train them using the information generated. The quality of the AI trained database depends on the data points required to improve accuracy.

Tech Overview

Our invention consists of an array of IMU sensors that are synchronized with one another. The IMU sensors measure inertia and position of the subject within a space. The IMUs’ output is their collective measurement of inertia and forces, generating big data. The data serves as input into a personalized kinematic model for the test subject. The kinematic model can estimate the Ground Reaction Forces (GRFs) and a torque profile of the test subject around a specific sensor or in relation to one another.

There is no limit to the number of sensors that can be used on a test subject or on multiple test subjects of locations.

Our sensors are 5 centimeters in diameter, 10 millimeters thick and independently powered. The sensors synchronize with one another wirelessly, and the user can use as many as needed to on the test subject- animate or inanimate.

Benefits

The system can measure the subject outdoors.

The accuracy of our sensor is below one centimetre.

Our sensor's sampling rate is 2kHz.

The sensors are time-synchronized with an independent clock.

A single, or cluster of sensors, communicates with a base station unit wirelessly. The connection range between the sensors and bases station can be within 10 kilometres.

The system is also capable of dynamic, continuous calibration which removes position drifting on the sensor. This feature removes the need for the subject to remain still to re-calibrate.

There are no visual markers and can be used independently of a visualization system as an option.

Applications

One application of the technology could be in sports or biomechanics where the system can be used to estimate joint kinematics and give physicians insights into performance, impact of an injury, tracking recovery and even the prevention of injury; while the test subject is training outdoors. The sensors can be placed on athletes at various joints and muscles to give insight into the force and motion experienced in their bodies together with other force and motion information.

Another application of the technology is to track the movement of swarming drones, autonomous vehicles or any body moving in synchronization with another.

Opportunity

The University of Cape Town would like to explore the commercialization of the IMU array with a company.

The commercialization path could take a number of routes, or combinations thereof:

- a license arrangement to use the technology and adopt it for the company's own use.
- a co-development partner arrangement where the development team could assist the company with the adaptation and use
- a spin-out company route where the development team could supply the company with the hardware units and a license to use the software

The invention includes hardware and a software component to estimate the kinematic model.

Patents

- PCT/IB2019/052087