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Singapore develops novel wireless sensor system for gait analysis

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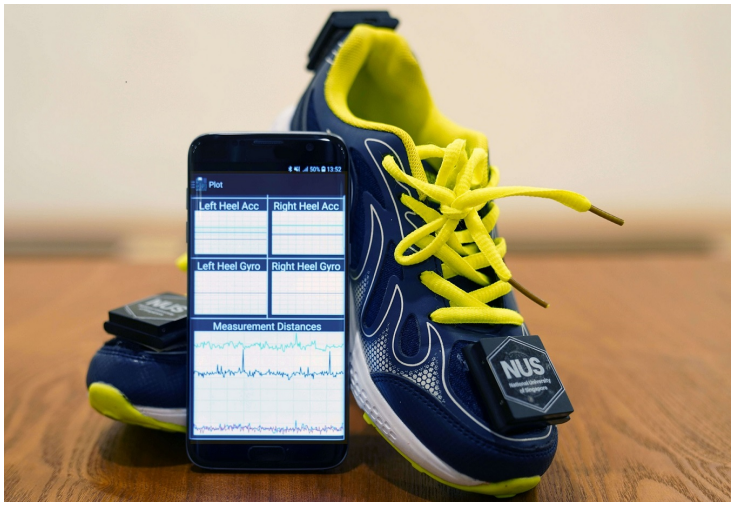
NUS researchers develop portable, accurate, and affordable wearables capable of estimating clinical gait measurements that are not available in existing wearables for gait analysis



Gait analysis is an important clinical measurement used for medical diagnosis of sports injuries, neurological conditions such as Parkinson's disease and Cerebral Palsy, and for assessing frailty and fall risk of the elderly. To obtain accurate gait measurements, a gold-standard proprietary gait measuring mat is usually used in the clinics. The mat is, however, large, heavy and expensive, and gait measurements using it can only be conducted in the clinic in the presence of a clinician.

In order to create a more affordable and portable alternative, researchers from the School of Computing at the National University of Singapore (NUS) developed a novel wireless sensor system capable of achieving clinical gait measurements with comparable accuracies to the current gold-standard mat. Called the MANA 2.0, the wireless sensor system is made up of four sensors mounted onto the user's footwear and can be linked to a mobile application where the measurements are taken.

MANA 2.0 – A hybrid wearable system for gait analysis

Conventional wearables for gait analysis are solely based on the Inertial Measurement Unit (IMU) technology which measures only acceleration and rotation rate. MANA 2.0, on the other hand, combines both IMU and UWB technologies in the sensor system. UWB technology enables direct measurement of on-body distances thereby giving MANA 2.0 the ability to estimate important clinical gait metrics that can currently only be measured using the gold-standard mat. These include step width and spatial foot placement which are key to evaluating a patient's gait abnormality and risk for fall.

The team of NUS researchers further validated the accuracy of MANA 2.0 against the current clinical gold-standard for gait analysis. Using a dataset of over 2,000 steps across 21 healthy individuals, the researchers observed that MANA 2.0 achieved an average of 97.2 percent accuracy for step width measurements and between 95 and 97 percent accuracy for

spatial foot placement measurements when compared to the measurements made by the gold-standard mat. The team took two years to develop the technology.

Given the comparable accuracies, the MANA 2.0 wearable system therefore offers a portable alternative for gait analysis.

“There is huge value in developing a portable version of the gait analysis mat as this will empower patients to make their own gait measurements anytime and anywhere without requiring the physical supervision of a clinician. A MANA 2.0 enabled wearable for gait analysis will also allow clinicians to monitor the progress of their patients remotely through the data collected on the mobile application. With the growing demand for healthcare services, such a portable technology reduces the need for physical space and manpower in the clinics while making gait assessments more efficient at the same time,” said Dr Boyd Anderson, a lecturer at NUS Computing’s Department of Computer Science, who worked on the development of MANA 2.0.

The NUS team has filed a patent for MANA 2.0. The system is estimated to cost less than S$500, a much more affordable option than the current gold-standard mat which typically costs more than S$10,000. The team is looking to collect more data to further validate the technology for clinical application.