freeWalker: A Smart Insole for Gait Analysis

Gait analysis is a systematic study of human locomotion through investigating the walking pattern of a person. Traditional gait analysis is carried out in a gait lab equipped with multiple cameras, motion capturing systems and a platform that measures ground reaction forces. The subject's/patient's gait patterns are captured by the camera and the sensors embedded on the floor of the platform. Trained experts then analyze the walking pattern manually. The high cost of these equipments makes gait analysis prohibitive for wide adoptions. It also limits the gait analysis to the lab and makes tracking of the progress of a patient across multiple visits difficult.

freeWalker is a smart wireless insole which measures pressure distribution, acceleration and motion sequences, translating them into various gait features and patterns to facilitate visualization and interpretation of the wearers walking patterns. FreeWalker's design enables cost effective, real-time remote gait analysis. By freeing the subjects from the lab confinement, freeWalker allows continuous monitoring of persons walking patterns. This in turn enables detection of emerging pathological patterns that could lead to various health risks.

Identifying normal and pathological walking patterns is a complicated process. It requires analysis of various gait features like cadence, stride height, stride length and speed. To extend such analysis to serve the purposes of foot and ulcer prevention in diabetes or fall prevent in elderly, measurement of pressure distribution and pressure balances between 2 feet are crucial. freeWalker is designed to meet the requirements of medical applications.

Market Trends and Opportunities

It is projected that 22% of the world's population will be above 60 years by 2020. Falls and injuries related to falls are common among older persons with approximately 28-35% of those 65 years and older falling each year. The cost of falls is high. It causes disability, loss of independence and premature death. In Singapore, about one-third of older persons aged 60 and above has fallen more than once. These falls could have been prevented. Studies have shown that falls are a major cause of hip fractures, especially among women. More than 20% of patients die in the first year after suffering from a hip fracture, while 25% of older persons require a higher level of long-term care after a fracture. The potential benefits of the increased usage technology in the aged care market can range from economic benefits by reducing the cost of service and improving overall profitability, to non-financial benefits that improve the quality of life and care experience for residents, consumers, and care workers. The global advanced remote patient monitoring market size was $29.7 billion in 2014. Robots in the healthcare is projected to be another major market. EU market for robots and devices assisting

Technology Features & Specifications

The smart insole consists of pressure and motion tracking sensors, on board data acquisition and storage, and wireless transmission, followed by data processing and graphical interface. It is capable to identify in real time the key stages of a gait cycle, which include swing, contact, midstance and propulsive. It is also able to determine various gait features that are required to analyze a persons walking pattern. The pressure sensors are positioned in a unique manner, which detect and measuring relative change in the force or applied load allowing extraction of spatial pressure distribution of the whole feet. It also consists of motion tracking sensors including 3-axis accelerometer and 3-axis gyroscope for measuring stride height, stride length, cadence and foot orientation.

freeWalker is equipped with onboard data storage. All these sensors are connected to a controller and integrated with a customized wireless system equipped with high data sampling rate of about 1.5KHz. The insole also features efficient power management system, enabling a battery back up of over 24 hours with continuous data transmission over a distance of about 20m.

Potential Applications

- Fall Detection
- Foot ulcer prevention in diabetes patients
- Rehabilitation
- Gait tracking in patients suffering from Visual field defect
- Virtual Interactive Gaming (HCI)
- Sports and fitness tracking

Customer Benefits

freeWalker, with its simple design, high usability and wearability offers a natural way of monitoring wearer's gait patterns in daily life. The ability of continuous remote monitoring with a high wireless data-sampling rate enables extraction of more detailed gait information which serves as a huge advantage to deploy this technology into various applications.

For more information on technologies we have to offer, please visit our

www.ipi-singapore.org
the senior population is estimated to reach 14.7 billion by 2016.

website at https://www.ipi-singapore.org or enquire at techscout@www.ipi-singapore.org