

Designing a Miniature Gait Lab

Remley, Michael (School: Northern Utah Academy for Math, Engineering and Science)

According to the Centers for Disease Control and Prevention's 2015 Summary Health Statistics, over 18 million Americans find it very difficult, or cannot, walk a quarter mile. Of those, 52% live in small cities or rural areas. Globally, the situation is much worse. People with physical disabilities who do not live in large metropolitan areas have limited-to-no access to medical facilities with sophisticated gait laboratories. This project is creating an inexpensive and highly portable system to enable human gait measurement, especially for people in places where robust measurement is otherwise inaccessible. The Miniature Gait Lab (MGL) consists of an array of seven inertial magnetic sensor units (IMUs) on the lower limb segments and pelvis. The MGL collects and processes data to provide gait kinematics data as a battery-powered system storing data on a microSD card. Each IMU is a 9-axis sensor and its data are processed with a Madgwick quaternion filter algorithm. The prototype collects and stores raw data from all seven IMUs at 260 Hz thus providing smooth motion capture. The IMUs have been calibrated using a precisely measured rigid pendulum with results in agreement to the limits of the measuring system. With the MGL worn by the author, the system will be tested against a professional gait laboratory and videography system for motion capture with preliminary work showing the expected motion patterns.