SHOE-INTEGRATED SENSOR SYSTEM FOR WIRELESS GAIT ANALYSIS AND REAL-TIME FEEDBACK

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We are developing a suite of wireless sensors for the real-time analysis of gait variables. Our system of sensors is worn on the subject's shoes to allow gait analysis outside traditional motion labs, and provides a quantitative and repeatable method of monitoring the subject's walking manner.

Our system measures sixteen parameters on each foot and an additional two parameters between the two feet. Each foot is equipped with an insole and a removable shoe attachment at the heel. The insole contains four force sensitive resistors (coarse pressure distribution), two polyvinlylidine fluoride strips (dynamic pressure information), two pairs of back-to-back resistive bend sensors (bi-directional bend in the insole and at the ankle), and a loading-mode capacitive sensor (height of insole above the ground). The shoe attachment contains a micro-controller and wireless transceiver, a 9V battery, circuitry for the sensors, three axes of both gyroscopes (angular velocity) and accelerometers (linear acceleration), and sonar transmitters and receivers (height of heel above the ground; distance and angle between the feet). The current prototype is approximately 300 g.

The initial results show significant breadth in measurement capability. Current work is focused on the development of methods to analyze the data, including calibration and analysis of the sensor outputs and pattern recognition methods; these are being validated with commercial equipment at the Massachusetts General Hospital Biomotion Lab. Continuous wireless measurement of gait variables outside of the motion analysis lab will provide the potential to be highly informative via data collection throughout the day in many environments.

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