the sensor can be manufactured in the form of polymer tape that can have several unique structures designed for different applications, from several layers to protect the tape from environmental conditions, to re-useable adhesive to allow for repositioning of the sensor. The sensor can be extruded into various size tapes or sheets, injection molded into uniquely shaped parts, or incorporated into fibers with fiber-spinning methods to make fabrics or personal protective equipment. Additionally, the sensor can be incorporated into a badge holder to be used as a point leak detector. This can be done by creating a clear, or nearly clear, polymer cap for connection points, and placing the sensing material at the end of the cap where it can be seen by a technician.

These sensors provide the capability for numerous areas to be constantly visually monitored for leaks. These sensors are easy to replace and have a very low implementation cost.

This work was done by Luke Roberson, Janine Captain, Edgardo Santiago-Maldonado, and Stanley Starr of Kennedy Space Center; and Robert DeVor of ASRC Aerospace Corporation. For more information, contact the Kennedy Space Center Innovative Partnerships Office at 321-867-5033. KSC-13351/636
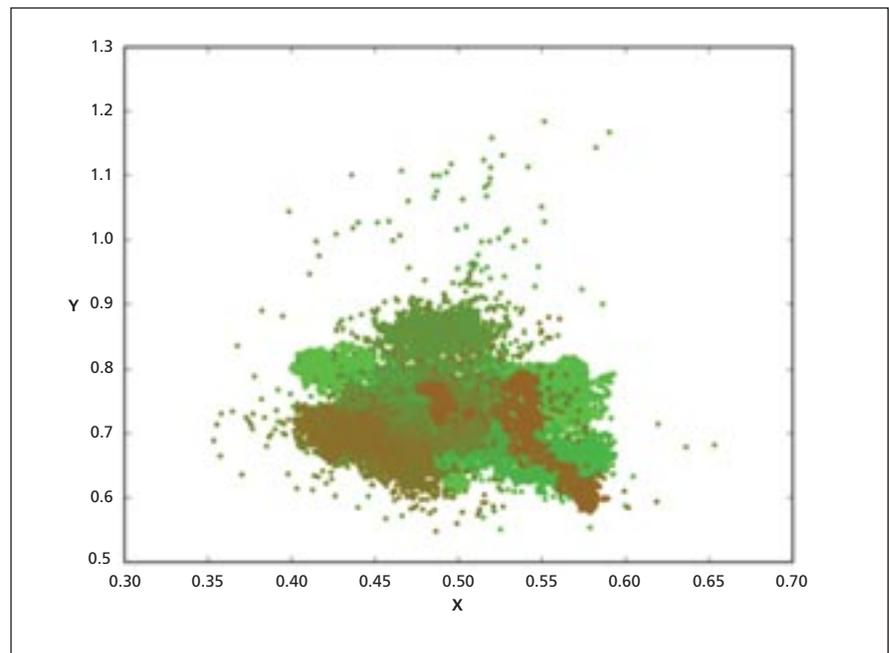
Artificial Intelligence Software for Assessing Postural Stability

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A software package reads and analyzes pressure distributions from sensors mounted under a person's feet. Pressure data from sensors mounted in shoes, or in a platform, can be used to provide a description of postural stability (assessing competence to deficiency) and enables the determination of the person's present activity (running, walking, squatting, falling). This package has three parts: a preprocessing algorithm for reading input from pressure sensors; a Hidden Markov Model (HMM), which is used to determine the person's present activity and level of sensing-motor competence; and a suite of graphical algorithms, which allows visual representation of the person's activity and vestibular function over time.

In this innovation, the Hidden Markov Model algorithm assesses center-of-force time series data. Using the Viterbi algorithm acting on center-of-force velocity, these trajectories can be classified into local equilibria separated by dynamic regions. These dynamic regions represent control failures and, ordinarily, lead into a new equilibrium. However, the local equilibria wander inside a broad "safe zone" of which the size and shape are able to be quantified (see figure). By quantifying the dwell time, size, and shape of the equilibria, the dynamic trajectories and the safe zone as a whole, sensing-motor performance can be assessed. For instance, equilibria for subjects with their eyes closed are shorter and more diffuse than those for subjects with eyes open.

This same algorithm can easily distinguish quiescent standing from squatting or

The **"Safe Zone"**: Eighteen subjects stood for two intervals of two minutes each on an EquiTest platform. Weight distribution from left foot (0) to right foot (1) is shown on the x-axis. Center-of-force in the anterior (1)/posterior (0) direction is plotted on the y-axis, normalized by foot length. Color corresponds to individual. The safe zone is elliptical in shape, but is far larger than the region encompassed by a single equilibrium or any 2-minute standing interval.

a hand raise and may be useful in checking how well an astronaut is adjusting to changes in gravitational field strength, in the context of Earth re-entry following space travel, or a Moon or Mars mission. Also, this innovation can be used to help a physical therapist gauge the progress of a stroke patient relearning skills like standing, walking, and running. The algorithm can be used as a training tool for athletes by quantifying their daily behavior (time spent running, etc) during training.

This work was a joint effort done by Erez Lieberman, MIT and Harvard; Katharine Forth, USRA; and William Paloski, NASA Johnson Space Center. Inquiries concerning rights for its commercial use should be addressed to:

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