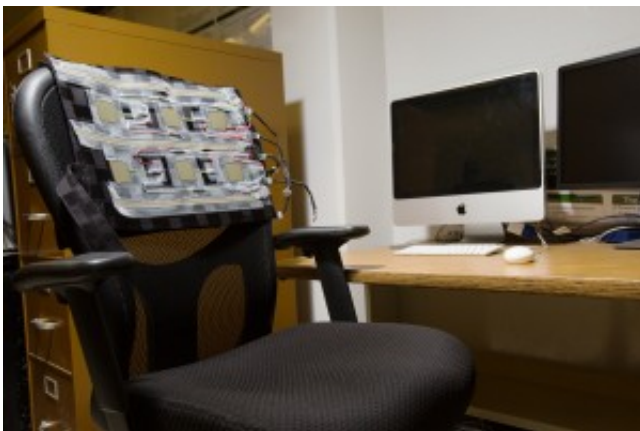


## 'Care Chair' helps detect patients' movements, mental state

September 1 2016, by Joe Mccune

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Debraj De, a postdoctoral fellow at Missouri S&T, and S&T professor Sajal Das developed a chair sensor device that can detect a person's daily behavior — and their mental state. Credit: Sam O'Keefe/Missouri S&T

The utilitarian chair. Its simple structure and function haven't changed in millennia. But researchers at Missouri University of Science and Technology have made the humble chair a portal into not only a person's movements, but also their mental state.

Dr. Debraj De, a [postdoctoral fellow](#) at Missouri S&T, and Dr. Sajal K. Das, the Daniel St. Clair Endowed Chair and department chair of computer [science](#) at Missouri S&T, have developed a chair that could help detect the daily behavior and mental health of [elderly people](#) at home or in assisted-living facilities—specifically rehabilitation patients

and elderly people susceptible to levels of dementia. The "Care Chair" employs sensors to detect a user's functional and emotion-based activities throughout a normal day. The device, which uses four sensors, slips over a chair's backrest and back so that it's unobtrusive.

"When we move, subtle movements can indicate our [mental state](#)," De says. "We can detect these subtle movements through these sensors. It's almost like a lie detector."

It uses the same principle as law enforcement interrogators or customs agents who detect micro facial expressions that last only a fraction of a second but can reveal a person's true emotions.

For the study, De had participants engage in 19 sedentary activities in the chair. De tested static activities like napping and sitting still; and movement-based activities like looking back left, looking back right, moving their head side to side, head nodding and waving hands. He also tested user-functional activities like talking, sneezing, coughing, drinking, eating and hiccups; and emotion-based activities like crying, laughing, shouting, weeping, yawning and yelling.

Each activity activated the sensors in unique ways, giving the [researchers](#) a baseline for comparison.

"To the best of our knowledge, this is the first time that user-functional activities and user-emotion-based activities are detected—in addition to static and movement-based sedentary activities and postures—using just four sensors on a chair backrest," Das says.

Working with Dr. Mignon Makos at Phelps County Regional Medical Center (PCRMC), the team is using the [chair](#) for sensing and data analytics designed for cognitive health assessment in elderly people who are prone to different levels of dementia, and in slowly rehabilitating

patients with cognitive impairments, such as stroke and cancer survivors.

"Dementia remains a global health challenge," Makos says. "Currently, the diagnosis of Alzheimer's disease relies on documenting mental decline. What if we could diagnose Alzheimer's disease before the dementia was clinically evident?"

On a wider scale, the Care Chair sensors could give doctors, nurses and home healthcare providers a better understanding of their patients' activity level, which in turn could help determine the best level of care needed.

"Doctors and nurses don't have time to see what their patient's state is every 20 minutes," De says. "At the end of the day, they can see simplified but actionable visualized information."

The work is partially funded through a National Science Foundation I-Corps grant and a Missouri S&T innovation grant. And the work also is part of the Ozark Biomedical Initiative, a partnership between Missouri S&T and the hospital designed to promote collaboration in research and education and to facilitate the exchange of ideas.

Provided by Missouri University of Science and Technology

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