

Providing intelligent vision and improved navigation to the Mars rover could vastly improve future missions.

All Eyes on **Mars**



Scientists at NASA are working to solve a problem with driving robotic rovers on the planet Mars and an Oklahoma State University-Tulsa professor may have the answer.

Jay Hanan, assistant professor of mechanical and aerospace engineering, is working with scientists at NASA's Jet Propulsion Laboratory (JPL) to create new technology that would make self-directed driving for rovers possible on the surface of Mars.

"Visual landmark tracking enables a vehicle to more precisely determine its position, heading and velocity and to hone in on desired targets or waypoints," Hanan said. "Basically, we're putting artificial intelligence into a robot so that it can drive itself on Mars. With our technology, the robot can recognize rocks in its field of view and change course."

Hanan said current systems are heavily dependent on "dead reckoning," which is the process of estimating navigation using speed, time and distance of travel based on counting wheel rotation. This method leads to navigation errors including problems such as driving into rocks and other obstacles.

Due to Mars' sandy surface, slipping and speed are also major concerns for current rovers. Obstacles in the path of rovers must be detected and avoided as much as 20 minutes in advance.

"The rovers move slowly to compensate for uncertainty in the environment and the dead reckoning system. Small errors can be catastrophic," Hanan said.

Providing intelligent vision to the rover could vastly improve the missions. With Hanan's technology, the machines could cover much more ground, saving time and efficiently gathering additional data in a given day.

▲ OSU-Tulsa assistant professor Jay Hanan (center) tests new technology that could provide intelligent vision and improved navigation to rovers on Mars. Researchers Ambrus Csaszar (left) and Chris Assad from California Institute of Technology are assisting with the research.

"Each day the dead-reckoning system provides an inaccurate arrival at a target can cost around \$250,000," Hanan said. "Visual landmark tracking could reduce those costs and allow scientists to spend funds on science measurements rather than repositioning."

Researchers from JPL and California Institute of Technology have been collaborating with Hanan on the project since December 2005. Hanan said their research could be utilized for multiple NASA/JPL mission applications, including rover and spacecraft navigation.

NASA's current Mars rovers, "Spirit" and "Opportunity," have been exploring the red planet for nearly four years to help scientists better understand its environmental conditions.

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