

using the attitude/position instrumentation. This resulted in providing test and validation of an imaging lidar, and has the capability to test other types of surface terrain imaging sensors during aerial field tests. This task thus provides data and truth measurements to

algorithms for a variety of applications including precision Lunar landing algorithm development.

This work was done by James Alexander, Hannah Goldberg, James Montgomery, Gary Spiers, Carl Liebe, Andrew Johnson, Konstantin Gromov, Edward Konefat, Raymond

Lam, and Patrick Meras of Caltech for NASA's Jet Propulsion Laboratory.

The software used in this innovation is available for commercial licensing. Please contact Karina of the California Institute of Technology at (626) 395-2322. Refer to NPO-44581.

Robot Electronics Architecture

Key features are modularity and expandability.

NASA's Jet Propulsion Laboratory, Pasadena, California

An electronics architecture has been developed to enable the rapid construction and testing of prototypes of robotic systems. This architecture is designed to be a research vehicle of great stability, reliability, and versatility. A system according to this architecture can easily be reconfigured (including expanded or contracted) to satisfy a variety of needs with respect to input, output, processing of data, sensing, actuation, and power.

The architecture affords a variety of expandable input/output options that enable ready integration of instruments, actuators, sensors, and other devices as independent modular units. The separation of different electrical functions onto independent circuit boards facilitates the development of corresponding simple and modular software interfaces. As a result, both hardware and software can be made to expand or contract in modular fashion while expending a minimum of time and effort.

To ensure modularity and reconfigurability, the architecture incorporates the PC/104 standard [an industry standard for compact, stackable modules that are fully compatible (in architecture, hardware, and software) with personal-computer

data- and power-bus circuitry]. This feature also enables minimization of development costs through selection of off-the-shelf PC/104 components whenever possible.

Particularly notable is a capability for modular expansion to enable a single central processing unit (CPU) to supervise the simultaneous operation of a practically unlimited number of actuators. For this purpose, the architecture provides for each actuator a modular real-time control subsystem, independent of other such subsystems. The subsystem contains dedicated electronic hardware that drives the actuator to execute continuously updated arbitrary motions. The architecture includes a provision for control feedback in the form of outputs from any or all of a variety of sensors. Any or all actuators can be run independently and motions updated instantly, without reference to any prior motion profile.

A custom actuator-driver circuit board has been developed for this architecture to satisfy some power and mass constraints pertaining to a specific application. This board is capable of driving 12 motors simultaneously under computer control and is built on a standard

PC/104 footprint.

The architecture includes several user- and system-friendly features: Two independent inputs for panic buttons or watchdog functions enable manual, computer, or watchdog disablement of any or all boards, without affecting the computer. An independent circuit holds all actuators inactive until the computer sends an enabling signal. A single switch overrides all functions to enable manual control. Lights, test points, and outputs enable both the user and the computer to independently monitor the state of the board and internal circuit functions.

This work was done by Michael Garrett, Lee Magnone, Hrand Aghazarian, Eric Baumgartner, and Brett Kennedy of Caltech for NASA's Jet Propulsion Laboratory.

In accordance with Public Law 96-517, the contractor has elected to retain title to this invention. Inquiries concerning rights for its commercial use should be addressed to:

Innovative Technology Assets Management, JPL, Mail Stop 202-233, 4800 Oak Grove Drive, Pasadena, CA 91109-8099, (818) 354-2240, E-mail: iaoffice@jpl.nasa.gov.

Refer to NPO-41784, volume and number of this NASA Tech Briefs issue, and the page number.

Optimized Geometry for Superconducting Sensing Coils

Design would minimize measurement time in magnetic resonance imaging.

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An optimized geometry has been proposed for superconducting sensing coils that are used in conjunction with superconducting quantum interference devices (SQUIDS) in magnetic resonance imaging (MRI), magnetoencephalography (MEG), and related applications in which magnetic fields of small dipoles are detected. In designing a coil of this type, as in designing other sensing coils, one seeks

to maximize the sensitivity of the detector of which the coil is a part, subject to geometric constraints arising from the proximity of other required equipment. In MRI or MEG, the main benefit of maximizing the sensitivity would be to enable minimization of measurement time.

In general, to maximize the sensitivity of a detector based on a sensing coil coupled with a SQUID sensor, it is necessary

to maximize the magnetic flux enclosed by the sensing coil while minimizing the self-inductance of this coil. Simply making the coil larger may increase its self-inductance and does not necessarily increase sensitivity because it also effectively increases the distance from the sample that contains the source of the signal that one seeks to detect. Additional constraints on the size and shape of the coil and on the