Technology Focus: Data Acquisition

Medical Signal-Conditioning and Data-Interface System

Lyndon B. Johnson Space Center, Houston, Texas

A general-purpose portable, wearable electronic signal-conditioning and data-interface system is being developed for medical applications. The system can acquire multiple physiological signals (e.g., electrocardiographic, electroencephalographic, and electromyographic signals) from sensors on the wearer's body, digitize those signals that are received in analog form, preprocess the resulting data, and transmit the data to one or more remote location(s) via a radio-communication link and/or the Internet. The system includes a computer running data-object-oriented software that can be programmed to configure the system to accept almost any analog or digital input signals from medical devices. The computing hardware and software implement a general-purpose data-routing-and-encapsulation architecture that supports tagging of input data and routing the data in a standardized way through the Internet and other modern packet-switching networks to one or more computer(s) for review by physicians. The architecture supports multiple-site buffering of data for redundancy and reliability, and supports both real-time and slower-than-real-time collection, routing, and viewing of signal data. Routing and viewing stations support insertion of automated analysis routines to aid in encoding, analysis, viewing, and diagnosis.

This work was done by Jeffrey Braun, Charles Jacobus, Scott Booth, Michael Suarez, Derek Smith, Jeffrey Hartnagle, and Glenn LePrell of Cybernet Systems Corp. for **Johnson Space Center**. *For further information, contact the Johnson Commercial Technology Office at (281) 483-3809.*

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:

Charles J. Jacobus, Ph.D.
Cybernet Systems Corporation
727 Airport Boulevard
Ann Arbor, MI 48108
Phone No.: (734) 668-2567
E-mail: cjacobus@cybernet.com

Refer to MSC-22969, volume and number of this NASA Tech Briefs *issue, and the page number.*

Instruments for Reading Direct-Marked Data-Matrix Symbols

Contrast is enhanced through oblique viewing and illumination.

Marshall Space Flight Center, Alabama

Improved optoelectronic instruments (specially configured digital cameras) for reading direct-marked data-matrix symbols on the surfaces of optically reflective objects (including specularly reflective ones) are undergoing development. Data-matrix symbols are two-dimensional binary patterns that are used, like common bar codes, for automated identification of objects. The first data-matrix symbols were checkerboardlike patterns of black-and-white rectangles, typically existing in the forms of paint, ink, or detachable labels. The major advantage of direct marking (the marks are more durable than are painted or printed symbols or detachable labels) is offset by a major disadvantage (the marks generated by some marking methods do not provide sufficient contrast to be readable by optoelectronic instruments designed to read black-and-white data-matrix symbols). Heretofore, elaborate lighting, lensing, and software schemes have been tried in efforts to solve the contrast problem in direct-mark matrix-symbol readers. In comparison with prior readers based on those schemes, the readers now undergoing development are expected to be more effective while costing less.

All of the prior direct-mark matrix-symbol readers are designed to be aimed perpendicularly to marked target surfaces, and they tolerate very little angular offset. However, the reader now undergoing development not only tolerates angular offset but depends on angular offset as a means of obtaining the needed contrast, as described below.

The prototype reader (see Figure 1) includes an electronic camera in the form of a charge-coupled-device (CCD) image detector equipped with a telecentric lens. It also includes a source of collimated visible light and a source of collimated infrared light for illuminating a target. The visible and infrared illumination complement each other: the visible illumination is more useful for aiming the reader toward a target, while the infrared illumination is more useful for reading symbols on highly reflective surfaces. By use of beam splitters, the visible and

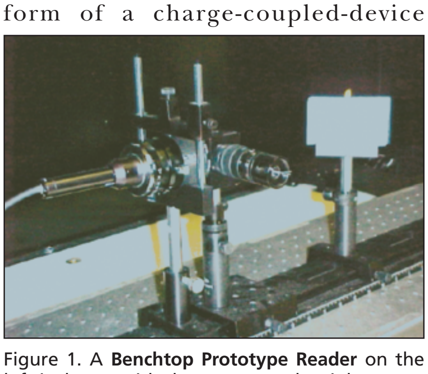

Figure 1. A **Benchtop Prototype Reader** on the left is shown with the target on the right.

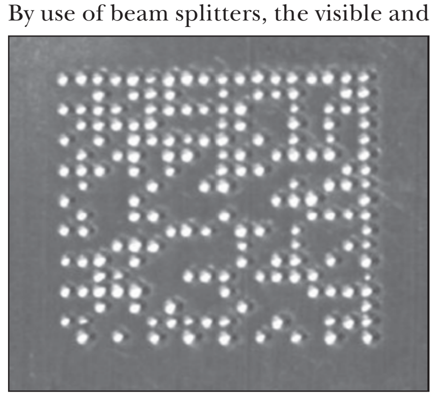

Figure 2. A **Data-Matrix Symbol** marked with no contrast using a dot peen process on a smooth aluminum target was imaged in the prototype reader at a viewing angle 15° off the perpendicular to the target surface.