TRAFFIC MONITOR

Below, Craig Sullender of Intelligent Vision Systems, Inc. (InVision™), Houston, Texas is running a test on the company's TDS-200 Traffic Detection System, which is being produced commercially and is in operational service at various locations in the U.S. The TDS-200 incorporates NASA technology originally developed for Earth observing imaging satellites.

Traffic monitoring is a difficult task requiring a wide range of sensors and functions that must operate under rigorous environmental conditions. Monitoring devices range from simple push buttons to very complex computer based systems. InVision's approach involved development of a multipurpose unit capable of handling the whole range of sensing, from the simplest task to very complex functions.

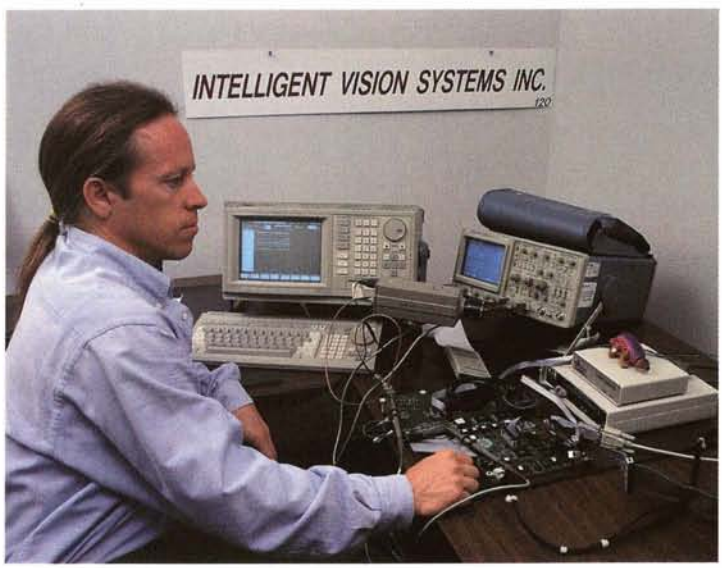
Sensing is performed by identifying shapes (vehicles, pedestrians), detecting movement or the lack of it, counting individual objects in their respective lanes and calculating their speed; information of this type is important to highway control engineers. The sensor employed in the system **(top right)** uses NASA CCD (charge coupled device) technology in which silicon chips convert light directly into electronic or digital images, which can be manipulated and enhanced by computers.

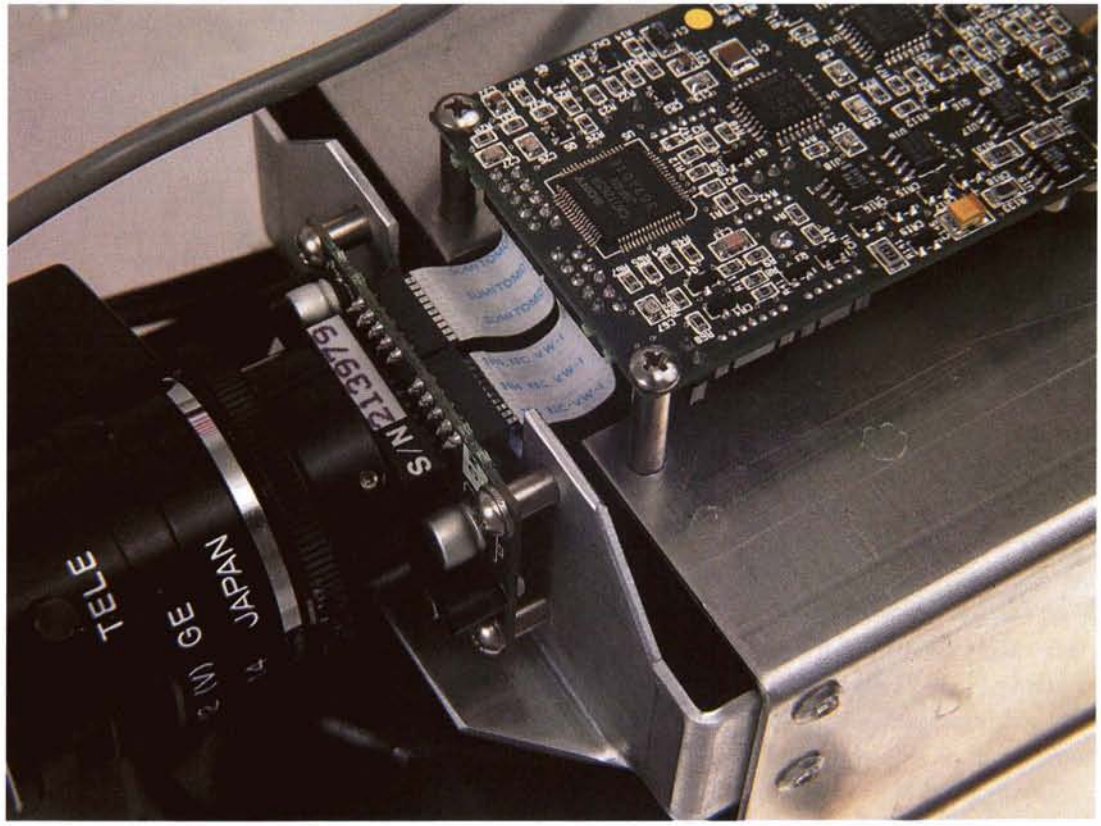
The InVision system's sensors are mounted above the traffic on poles or span wires, enabling two sensors to view a standard intersection. A special feature of the TDS-200 electronically compensates for "swing and sway" movement and rotational error of the sensors; the sensor can swing and still identify and differentiate among moving and fixed objects in their correct positions.

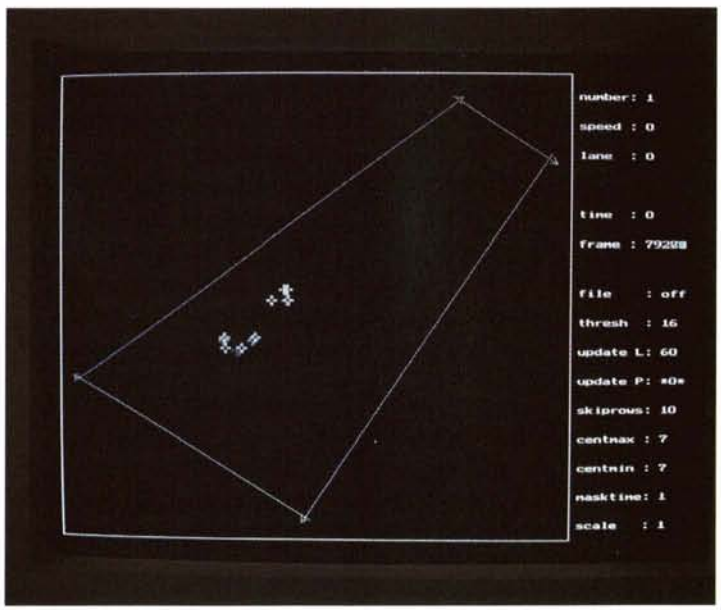
A proprietary combination of electronic shutter and gain control provides exceptional dynamic range from extremely low light to direct sunlight with excellent picture clarity. Sensor output provides signals to the image digital signal processor (DSP), still frame video and optionally live video.

The TDS-200 selects several light wavelengths of the viewing area, processes the images and stores the information. The DSP performs several processing tasks concurrently in real time. Problems related to shadows, adjacent vehicles and wet street reflections are eliminated. The fixed background of the image is removed so that only changed or detected objects remain for processing. The photos **at right** display objects as "seen" by the computer after processing. A company-developed tracking algorithm, coupled with high speed parallel processing, enables tracking all objects in the field of view.

InVision president Paul Mayeaux credits NASA technology with the breakthrough







that solved the principal problem in the development: getting reliable image recognition in rain, fog and other bad weather. Says Mayeaux: "After three years of limited R&D success and dwindling enthusiasm, our research group (five partners sharing time and capital) realized that we had to find another image sensing approach. We had an economical computer, super signal processing hardware and software, but poor imagery. The problem was unreliable image acquisition in harsh environmental conditions."

In an issue of *NASA Tech Briefs* (see page 137), the researchers found an article describing a NASA technology developed for satellite imaging that utilizes multiple electromagnetic frequencies to improve image acquisition in all weather conditions. The InVision group requested and received from NASA a Technical Support Package containing more detailed information. The technology, plus advice and consultation provided by Johnson Space Center, proved to be the solution to the problem after modification of the technology to meet InVision's special design requirements. InVision subsequently applied technology from two other *Tech Briefs* articles that described related work accomplished by Jet Propulsion Laboratory and Lewis Research Center.

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