TATRC Highlighted Research News Article:
Soldier Mounted Eye-Tracking and Control Systems: Eye-Com Biosensor, Communicator & Controller

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In the Blink of an Eye

Wireless Drowsiness Detector Will Soon Be Preventing Accidents

The Eye-Com™ is an unobtrusive, wireless electronic device on an eyeglass-type frame that monitors and records head tracking and 20 eye measures.

Nevada neurologist Dr. William Torch is wearing the Eye-Com™ Biosensor Communicator and Controller he developed, which can detect drowsiness and trigger an alert to avoid an accident.

Photos courtesy of Eye-Com Corporation

It's another routine nighttime surveillance. But the Black Hawk helicopter pilot has been pulling long shifts due to the nature of the mission. As he begins to blink drowsily, the small, electronic biosensor within his goggles detects the change in eye movement and triggers an alert. The pilot turns over the controls to his partner, and instead of becoming another fatigue-related crash, the flight is completed without incident.

This scenario is now possible through an unobtrusive, wireless electronic device on an eyeglass-type frame that is easily worn or fits conveniently under a helmet, visor or night-vision goggles.

The device, the Eye-Com™ Biosensor Communicator and Controller, is the brainchild of Nevada neurologist Dr. William Torch. It has great potential in averting accidents because it takes action before a driver or machine operator actually drifts into sleep.

The Eye-Com uses pulsed infrared light, such as that used in a TV remote, to distinguish the longer blinks that accompany drowsiness from normal blinks. It then triggers an arousal alarm, which could be a vibrating seat or voice synthesizer. It can also send the alarm to a remote source such as 911 in case of loss of consciousness.

Torch expects the Eye-Com will be in the field for all uses within two years. It received airworthiness certification for Black Hawk helicopter use after Army tests proved it could identify drowsiness in sleep-deprived pilots. The Air Force found that in simulated high-altitude, low-oxygen conditions, it predicted jet pilots' loss of ability to both accurately control their planes and discriminate enemy from friendly aircraft. The Navy put it in scuba masks and showed that it could identify Navy SEAL swimmer fatigue.

Torch explains, "The Eye-Com is simply more reliable in more situations than a dashboard-mounted system, which fails when the driver turns his or her head away, has a lot of head movement or wears sunglasses or contacts. And it uses a nontrackable wideband signal, which ensures privacy."

The device uses microchips and newly developed software to wirelessly monitor and record head tracking and 20 eye measures, from blinks and eye gaze to the size and speed of pupil dilation. It is showing promise in diagnosing sleep disorders as well as studying the side effects of medication and the effectiveness of various wakefulness treatments.

Through translating eye blinks into the dots and dashes of Morse code or linking with an accompanying Eye Mouse™ to move a cursor, the Eye Com can also operate any computer-based program. The possibilities include enabling seriously injured Soldiers to operate wheelchairs and speech devices by simply gazing in a certain direction. It could also enhance target selection and detection and the use of robotics in the field through eye-controlled mechanisms.

The Eye-Com is one of the many promising biomonitoring technologies supported by the U.S. Army Medical Research and Materiel Command's (USAMRMC) Telemedicine and Advanced Technology Research Center. TATRC coordinates a variety of research

projects at private and public organizations throughout the country in order to put the latest medical technology to work for the nation's warfighters and veterans. It is supporting approximately 500 ongoing research projects.

Dr. Eva Lai, who manages the Biomonitoring Technologies portfolio at TATRC, notes, "The Eye-Com technology is different from other eye-tracking systems because it's wearable, portable, easy to use and works in all lighting conditions. It has potential to benefit our Soldiers, not only by enabling them to perform their duties more efficiently and effectively, but also by saving their lives. Additionally, Dr. Torch is using the technology to detect the effects of jet lag and shift work fatigue that reflect conditions in battlefield operations. This way we can predict when drowsiness may occur, taking prevention a step further."

She adds, "There is a lot of excitement about the many potential applications to be derived from this technology, such as its possible development for diagnosing traumatic brain injury. Accurate detection and treatment is a high priority in light of estimates that some type of brain injury could affect up to 70 percent of U.S. troops injured in Iraq. Alternatively, just think of what it would mean to a Soldier with limb loss to be able to continue contributing in some way—to still be a Soldier—through the use of eye-controlled assistive devices."

Adds Dr. Sylvain Cardin, who is managing this effort for TATRC, "The beauty of TATRC is that we can connect technology such as the Eye-Com with research in other fields in order to greatly expand its use." In the near future, Eye-Com will be working with the U.S. Army Research Institute of Environmental Medicine and UC Santa Barbara to further advance this technology and leverage the skills and expertise contained in this collaboration.