The Future in a Blink of an Eye...

The Innovative EC7T System

The Eye-Com Biosensor, Communicator and Controller (EC7T), designed and developed by Eye-Com Corporation, is an advanced eye tracking platform that uses frame-mounted micro-cameras to not only record eyelid and pupil activity, but also to track head movement. The integrated, wearable system is a versatile device with all video, lighting, and electronic components encased within the uniquely designed, unobtrusive eyeframes.

What is Eye Tracking?

Eye tracking technology detects eye movement by identifying the pupil and tracking its motion. This is accomplished with microcameras and complex software algorithms to determine precisely where an individual is looking. The eye has unique functions and movement patterns identifiable with eye tracking technology that can be linked to behavior and mental focus.

Functions of the EC7T

Eye Tracking

Accurate pupil detection allows for the user’s eye movements to be tracked for precise identification of gaze location. The EC7T has the ability to track one or both eyes simultaneously.

Head Tracking

Head tracking detects the wearer’s head movement relative to a computer monitor. This not only improves the accuracy of gaze tracking, it can also be used to control the viewing angle of an image on the screen as it appears from the wearer’s perspective.

Mouse Emulation

Both eye and head tracking can be used to control the movement of a computer mouse. Clicking or icon selection occurs with just the blink of an eye or prolonged fixation.

Oculometric Data Collection

The EC7T system can function as a biosensor that captures dynamic ocular measures (oculometrics) that can be used for drowsiness detection, medical research and diagnostics.

Among the EC7T oculometrics are:

- Pupil area
- Pupil area to iris area ratio
- Pupil constriction rate
- Pupil diameter
- Saccade velocity
- Eye open/closed
- Blink rate
- Blink duration
- PERCLOS
- Center of Pupil X,Y coordinates
- Pupil Rotation
Features of the EC7T System

**Light Weight, Wearable Device**

The unique wearable design of the EC7T minimizes interference from external lighting sources. Weighing only 37 grams, it is minimally obtrusive and causes nominal fatigue from long periods of wearing the device.

**Tethered or Wireless Operation**

The EC7T is a plug-and-play device using high speed USB 2.0 connectivity to interface directly to a PC. Without a battery requirement, the system has sustained high data transfer capacity that permits realtime video streaming for up to 4 cameras simultaneously. There is the potential for a wireless design that would enable complete freedom of motion.

**Integrated Hardware Design**

The custom designed eyeframes encase all microelectronic components, including 3 microcameras, 8 infrared LEDs, and an advanced circuit board, making it a compact, integrated unit.

**Versatility**

The optical and microelectronic components of the EC7T system can be integrated into other head-mounted devices, such as a SCUBA mask or Pilot helmet, for use in just about any domain or environment. The advanced features of Eye-Com technology can be used in a fixed laboratory or drive/flight simulator setting, or in the real world in land, underwater or aerospace environments.

**Safety Approved**

The EC7T was tested and safety approved as a non-hazardous ophthalmic instrument. The Orb Optronix risk assessment found the optical radiation intensity of LEDs of the EC7T at close proximity to the eye to be significantly below risk limits and was determined to pose no health or safety threat.

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### EC7T Hardware Specifications

<table>
<thead>
<tr>
<th>Eye-Frame</th>
<th>Weight: 37 grams</th>
</tr>
</thead>
<tbody>
<tr>
<td>Micro-Cameras</td>
<td>Frame rate: 30 frames per second</td>
</tr>
<tr>
<td></td>
<td>Visual resolution: VGA</td>
</tr>
<tr>
<td></td>
<td>Position: vertical angle 34°, horizontal angle 0°</td>
</tr>
<tr>
<td></td>
<td>Distance from eye: ≈ 1 in (2.54 cm)</td>
</tr>
<tr>
<td></td>
<td>Chip: IR sensitive CMOS video chip</td>
</tr>
<tr>
<td>LEDs</td>
<td>LEDs per eye: 4</td>
</tr>
<tr>
<td></td>
<td>Adjustable drive-current: min 0, max≈ 27.5 mA</td>
</tr>
<tr>
<td></td>
<td>Wavelength: 840 nm</td>
</tr>
<tr>
<td></td>
<td>Distance from eye: 2 to 3 cm</td>
</tr>
<tr>
<td>Cable</td>
<td>30 pin connector</td>
</tr>
<tr>
<td></td>
<td>Full speed USB 2.0</td>
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</tbody>
</table>
Current Capabilities of the EC7T

Extensive research and development efforts have lead to major advancements in Eye-Com technology capabilities. The current features and functions of the EC7T system have a wide range of applications.

Assistive Technology

The EC7T is capable of performing eye-based computer control that can be applied to assistive communication software programs. Beyond communication facilitation, the EC7T can be used for control of a variety of electromechanical devices. For example, a user can maneuver an electric wheelchair with eye-based directional controls and can turn household appliances on or off with the blink of an eye.

Eye-Controlled Computers and Robotics

Remote control of robotic toys and electronic devices with eye movement is just the beginning of the EC7T system’s capabilities. Taking a step toward revolutionizing human-computer interaction, eye and head tracking mouse emulation will make the EC7T the next generation of Human Interface Devices. Controlling operating system and software program interfaces with the EC7T will replace the need for a mouse or even a keyboard.

Drowsiness Detection

Sleep deprivation and long hours on the job influence vehicle operator awareness and performance, creating hazardous conditions on the road and in the workplace. The EC7T can detect oculometrics, like Eye Blink Duration and Percentage of Time Eyes are Closed (PERCLOS), which are proven indicators of drowsiness and fatigue. Upon identifying the onset of sleep, the system triggers a vibrating seat or alarm to alert and awaken the driver. It saves lives by preventing impaired driver performance.

Medical Research

The EC7T collects several oculometrics, listed above, that can be used for research investigating the correlation between eye movement patterns a variety of human health-related and behavioral conditions.
Future Applications for the EC7T System

Eye-Com Corporation is committed to becoming an industry leader by advancing capabilities and expanding applications of eye tracking technology.

- **Video Gaming Peripheral**
  The EC7T system will eventually combine eye tracking and head tracking mouse emulation to create a whole new level of immersion to a 3D video gaming experience.

- **Complete Biometric Monitoring System**
  The EC7T can be integrated with additional biometric technologies like brain-wave (EEG) and cardiac (EKG) sensors for comprehensive biomonitoring purposes.

- **Medical Diagnostics**
  The results from Eye-Com’s oculometric research could lead to the EC7T being used as a diagnostic tool for physical, mental, and behavioral disorders.

- **Military Simulation Training**
  The EC7T system may be used to assess target recognition and gaze behavior during tactical situations in military simulated training scenarios.

About Eye-Com Corporation

Located in Reno, Nevada, Eye-Com Corporation is dedicated to the development of eye tracking technology to improve and save lives, support the advancement of research, and revolutionize human-technology interaction.

Eye-Com Corporation was founded by Dr. William C. Torch, an internationally recognized neurologist and sleep specialist with a passion for improving the quality of life of disabled individuals.

Over the past decade, through the diligent research and product development of an experienced management team and diverse engineering teams, Eye-Com technology has evolved from primitive blink detection to the powerful eye tracking platform of the EC7T.

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