OPTALERT™

Overview

Optalert.
When drowsiness
is not an option.

Table of Contents

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1. Fast Facts

1. The Optalert system has been developed by Dr. Murray Johns, who is a leading professor in the area of sleep studies. Dr. Johns has been treating patients for over 30 years and is the founder of the Sleep Centre at the Epworth Hospital, Melbourne.

2. Sleep Diagnostics Pty Ltd is a private Australian company with its head office in Melbourne. Sleep Diagnostics' corporate mission is to save lives and reduce serious injury, and cost associated with drowsy related accidents.

3. Optalert has been developed to continuously monitor drowsiness in drivers and warn them to their early signs of drowsiness, before it becomes dangerous, and usually before the driver becomes aware of it. This enables the driver to manage their own drowsiness to prevent a drowsy crash.

4. Each pair of Optalert glasses is unique to the individual and is as robust as any other standard pair of sunglasses. Prescription lenses are also able to be fitted by your local Optometrist.

5. Driver research groups, that have included TWU members, have tested and acknowledged the "set and forget", "plug in and go" technology of the Optalert system.

6. Research shows that 90% of professional drivers already wear some form of glasses when behind the wheel.

2. Introduction

Optalert is an entirely new device that measures the alertness/drowsiness of drivers continuously while they drive. This gives drivers objective information that they would not otherwise have, and enables them to manage their own drowsiness safely. All the driver has to do is wear a special pair of Optalert glasses.

Most drivers are happy to wear sunglasses at times when they drive in bright sunlight. Optalert glasses look like ordinary sunglasses, but they are specially designed to measure the driver's eye and eyelid movements. Optalert can detect drowsiness from the pattern of those movements, even at the very beginning of drowsiness. Whenever Optalert detects drowsiness, a loud beeping noise and a voice-message will warn the driver to take immediate action to stay safely alert, potentially saving their life and/or the lives of others in the process.

A **drowsy crash** is likely to occur when an episode of drowsiness, that may only last a few seconds, coincides with the need for a critical response by the driver (e.g. responding to a stop signal).

Drowsy crashes are a world wide problem. It doesn't matter if you are 20 or 50 years old, male or female, a professional driver or an office worker out for a Sunday drive with the family, you can still become very drowsy behind the wheel within a relatively short period.

Research has shown that a driver does not have to be driving for long periods in order to be too drowsy to drive; in fact, accident statistics illustrate that many drowsy driver accidents occur within the first hour behind the wheel.

At 100 km/h a vehicle travels almost 28 metres every second. At this speed, a brief 4 second micro sleep, if cruise control is active, will result in a vehicle traveling further than the length of a soccer or rugby field (100 metres).

One of the keys to successful management of drowsiness and fatigue is understanding they are NOT one and the same; drowsiness is not fatigue, and visa versa.

3. What is Drowsiness?

Drowsiness is the intermediate state between alert wakefulness and sleep.

We all go through this state whenever we fall asleep, but we are seldom aware of it because it is a state of reduced awareness. Drowsiness typically lasts only a few minutes when we are lying in bed intending to go to sleep, but if we intend to remain awake, as when driving, it can last much longer.

3.1. The dangers of drowsy driving

Drowsy drivers cause about 20% of all highway crashes, and the figures may be even higher for heavy vehicles, but this is hard to prove because, until now, drowsiness could not be measured while driving.

It is often difficult for drivers to assess the risks of their drowsy driving at the time, because drowsiness impairs their mental processes and decision-making ability. Drivers will not be aware that they are dozing at the wheel until after the next time they rouse, and suddenly recognize what has been happening. Having dozed off once, it is very likely that they will do so again, soon, unless remedial action is taken.

Because of the very nature of the drowsy state, it can be difficult for drivers to decide when to take remedial action. Optalert provides drivers with objective information about their state of alertness/drowsiness continuously, and warns them when the early signs of drowsiness appear, so that dangerous levels of drowsiness can be avoided.

The consequences of drowsy crashes are often the most serious in terms of death, injuries, and property damage because the drowsy driver makes no attempt to avoid the impending crash (e.g. no brakes applied and no reduction of speed before the crash).

3.2. Differences between fatigue and drowsiness

Many people use the term "fatigue" to mean what we are calling drowsiness. There are important distinctions between these two states and we emphasize that Optalert measures drowsiness, not fatigue (no one can measure fatigue objectively). However, for practical purposes, the term "fatigue" used by others in this context can be assumed to mean drowsiness.

Fatigue is a subjective state that includes feelings of weariness, muscle aches, irritability, and often a disinclination to continue with the task at hand. Fatigue gets

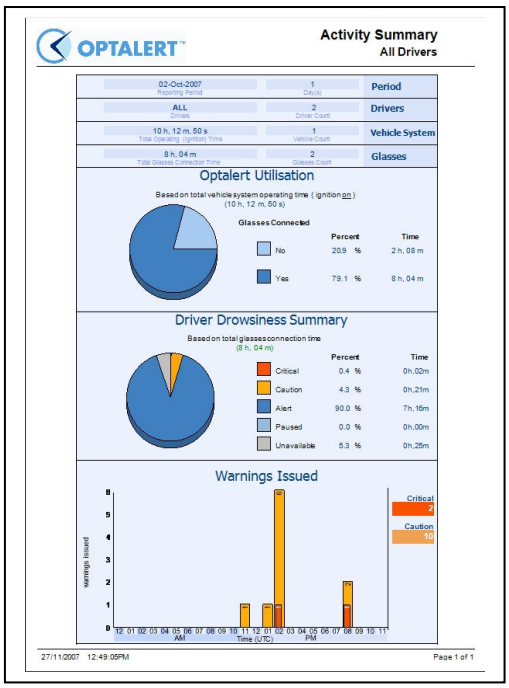
progressively worse the longer you have been doing something and the more effort, both physical and mental, required to do it. You are very aware of being fatigued. If you have been driving for several hours without a stop, you will probably feel fatigued, but you will not necessarily be drowsy. The intermittent lack of awareness that characterises drowsiness is not caused by fatigue. Consequently, drowsiness is much more dangerous than fatigue from the point of view of driving safety.

The level of your fatigue does not change very quickly, within seconds, in the way that your drowsiness can. Fatigue is relieved by rest and inactivity, but that will make drowsiness worse. Conversely, increasing your physical and mental activity will overcome drowsiness temporarily, but not fatigue.

4. What is Optalert?

Optalert is a simple and highly effective device that can assist in detecting the early signs of driver drowsiness.

The Optalert technology works by measuring tiny changes to a driver's eye and eyelid movements whilst wearing fitted Optalert glasses that they would not normally be aware of. Whenever Optalert detects the danger-signs, a voice-prompt will warn the driver that they are about to reach a cautionary or critical level of drowsiness. The driver can then take immediate action to manage their drowsiness, before falling asleep at the wheel and possibly crashing.



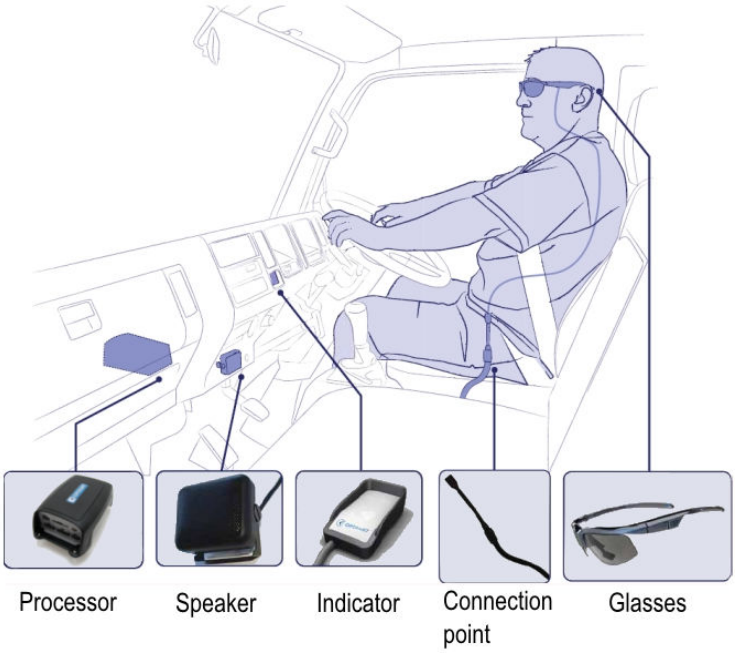
Each pair of Optalert driving glasses is unique to the individual and is as robust as any other standard pair of sunglasses. Prescription lenses are also able to be fitted by an Optometrist.

The Optalert Reports program creates a variety of reports (see left example) from information gathered from the driver, their Optalert Glasses and the John's Drowsiness Scale (JDS) that is produced by Optalert. The Optalert Reports program can also act as a database to manage all your Optalert installations and users.

Optalert is not intended to prevent drowsiness and should always be used as part of an approved drowsiness / fatigue management plan.

5. Overview of the Optalert System

The Optalert Vehicle System components and sample positioning within a vehicle:



5.1. Glasses

Optalert Glasses are worn like ordinary glasses or sunglasses. They contain sensors that monitor eye and eyelid movements. This information is digitised by a miniature computer in the arm of the glasses which then transmits the data to the Processor via the Connection Point.

5.2. Processor

The Processor is the information hub of the system; it is a computer that processes all the data about the eye and eyelid movements obtained from the Glasses to calculate a measure of the driver's level of drowsiness.

5.3. Connection Point

This is where the driver connects his/her Optalert Glasses to the Vehicle System. The Connection Point is flexible, and can be positioned to whatever position the driver chooses. The glasses can be easily and quickly disconnected, simply by pulling on the cable.

5.4. Speaker

The Speaker emits beeps and voice warnings when the driver's drowsiness level approaches or exceeds a dangerous level.

5.5. Indicator

The Indicator on the dash-board displays the operating On/Off/Signal status of the system continuously. It indicates normal operation with a blue light, "caution or critical drowsiness warning" with a red light, and a "check glasses warning" with an orange light.

6. How Optalert works

Optalert measures drowsiness continuously from minute to minute on the Johns Drowsiness Scale (JDS) which ranges from 0 to 10, where 0 = fully alert and 10 = very drowsy. For alert people, JDS scores are usually within the range 0 to 4.5. Optalert does this by measuring how quickly the eyelids close and reopen during blinks, and for how long the eyelids remain closed at a time. When we are drowsy our eyelids move more slowly than when we are alert, and the eyelids also tend to stay closed for longer during blinks and other eyelid closures.

Blinks can be modified voluntarily if we think about them, but this requires conscious effort that cannot be maintained for long and interferes with driving. Most blinks are spontaneous and are controlled by reflexes that we are not aware of, but which are very similar in all of us. Those reflexes are influenced by our level of alertness/drowsiness at any particular time.

Optalert measurements are made on only one eye. Having a "lazy eye" doesn't matter. Optalert comes with its own sunglasses attachment with non-polarizing lenses. There are yellow lenses that some people like to use when driving at night. Wearing contact lenses does not interfere with the operation or performance of Optalert. If you require prescription lenses while driving, you can have your lenses fitted into the Optalert lens-holder provided. The Glasses are fitted to a single person and are not transferable to other people, but they will work for you in any vehicle fitted with Optalert.

When the glasses are connected and the system is working properly, the blue indicator on the dash-board Indicator lights up and remains on.

Different levels of drowsiness on the JDS have been calibrated against changes in the ability to perform a simple test; recognizing brief changes in the shape of symbols on a computer screen. Anyone can do this very easily when alert. However, when you become drowsy you respond more slowly and, more importantly, you sometimes fail to respond at all. The drowsier you become, the more often you will fail to respond and the longer the periods of non-response become.

Drowsiness that causes repeated lapses (failures to respond) in this test will cause similar lapses when driving. A lapse in visual attention while driving, that may only last a few seconds, will markedly increase your risk of crashing. That is what makes a drowsy driver unfit to drive.

With a JDS score of 5 or more, drivers have significantly increased risks of doing dangerous things that they would not do when alert, such as of simply driving off the road and hitting a tree or another vehicle, etc. Drowsy crashes are often the most serious in terms of the damage done to people and property because the driver makes no attempt to avoid or mitigate the consequences of the impending crash. This is what makes drowsiness so dangerous in drivers.

7. Optalert functionality

7.1. Detects Drowsiness

Optalert detects two levels of drowsiness and plays the appropriate warnings: Caution and Critical.

7.1.1 Cautionary Drowsiness Warning

When the driver's JDS score is within the range of 4.5 to 4.9, the Optalert system issues a cautionary warning - a beep followed by a voice message, ***"Caution, you are showing signs of drowsiness"***. This is an indication that the first signs of drowsiness have been detected. The driver may or may not be aware of this from the way he/she feels at the time.

With a cautionary warning, the driver would be expected to implement a strategy to deal with drowsiness, thereby avoiding a drowsy crash with all its dire consequences. If the JDS score then decreased, the driver may be able to keep driving for some time, with Optalert continuing to monitor his/her drowsiness.

7.1.1 Critical Drowsiness Warning

If the driver's JDS score ranges from 5.0 upwards a critical warning is given, which is a beep followed by a different voice message, ***"Danger, you are now too drowsy to drive"***. Driving with this level of drowsiness involves greatly increased risks of a crash. With this critical drowsiness warning, the driver would be expected to follow their drowsiness management strategy and to stop driving as soon as it is safe to do so.

7.2. Inattention

Optalert detects inattention and eyes closed when drowsiness is above a Caution level (JDS 4.5). Optalert then plays a message to remind drivers to concentrate on driving.

7.3. Glasses Off

Optalert detects when the glasses have been taken off.

7.4. Driver Warnings

Optalert provides both an audio and visual warning to the driver via the Indicator and Speaker.

7.5. Glasses fault monitoring

Optalert detects and warns of broken flex and signal clipping in the Glasses. Optalert then plays a "Check Glasses" message to the driver.

7.6. System Monitoring

Optalert continually monitors all the key components of the system and reports any issues which require maintenance.

7.7. Data logging

The Optalert processor records the last 720 hours (30 days) of warnings and system events, and the last 4-12 hours of raw information in a rolling buffer. These data are available for download and reporting.

7.8. Interfacing

A number of external devices, such as existing in-vehicle telematic systems, can be connected to Optalert using the 4 digital lines and/or the serial RS232 output included on the Processor. These interfaces allow the Optalert Processor to supply a range of notifications of driver warnings and system events in real time to the connected computers.

In the standard configuration both of these interfaces are used. The serial interface supplies notifications of the minute by minute Johns Drowsiness Scale (JDS) values of the drivers, and the digital lines immediately flag any Caution or Critical warnings they may receive, which can be transmitted via the connected in-vehicle computer to designated Company personnel e.g. dispatchers.

7.9. Vehicle Motion

In the Mining version of Optalert, vehicle movement is monitored.

7.10. Field Maintenance system

A built in tool is available to collect data and update the software on the Vehicle System via a USB key. Specifically it supports:

- Self-Test - This key provides a means to test the installation and review the log for any maintenance issues.
- Software Update - This key allows the software to be upgraded when a new version becomes available.
- Download - This key allows the systems and driver events to be downloaded.

7.11. Prescription lenses

Optalert glasses come with a prescription lens adapter. The adapter fits onto the front of the glasses and can hold most standard prescription lenses. The adapter has enough depth to take bi-focal and multi-focal lenses, and once the adapter is fitted to the glasses they should be worn just like any other prescription spectacles. You cannot attach sunglasses as well the prescription lens adaptor to Optalert frames. In this situation an alternative set of prescription lenses made with the appropriate tint, should be used instead of the sunglasses provided in each Optalert kit.

We recommend that drivers take their fitted Optalert glasses and prescription lens adapter to an optometrist for lens insertion. The optometrist should do a vertex distance measurement with the fitted Optalert glasses on the driver.

8. Testimonials and Statements

"Here seems to be a product which when we did our research on it, our analysis, was going to meet the market need in a very comprehensive and scientific way."

"Australian Product, Australian Innovation… the technology, that we have here will soon become standard, I think certainly in heavy vehicles and without too much fuss in the future it will be in your average passenger car."

Alan Evans,
President, NRMA Motoring and Services

"You have to weigh it up; if you have a family that you want to go home to, Safety is Paramount."
Brad Ibriham,
Driver, Toll Liquid Distribution

"Last year we lost 27 drivers, and that was 27 too many."
Trevor Martyn,
Chairman, Australian Trucking Association

"We can see Optalert rolled out across all our operations, right from Cairns across to Perth, as a safety tool for our drivers."
David Apps,
Manager, Safety Policy, Risk and Accreditation, Pacific National

9. Key Benefits

The Optalert Vehicle System (OVS) will provide the following key benefits:

- As a key component of an integrated, approved fatigue management plan which applies safe work practices and fatigue regulations, Optalert can dramatically reduce the risk of a drowsy/fatigue related accident, by providing drivers with a continuous objective measure of their drowsiness.
- Provides the driver with timely information to assist with the management of drowsiness, regardless of the cause.
- Designed for drivers, Optalert glasses were developed with input from professional drivers on all aspects of the design to ensure they are easy to wear, simple to use, accurate and reliable.
- Reduce direct and in-direct costs associated with drowsy driver vehicle accidents.
- Optalert is driver assistance technology and contributes to "risk control" by providing the most effective control measure, elimination of work place hazard, i.e. equipment that ensures a driver stops driving before becoming impaired by drowsiness.
- Optalert can interface with existing in-vehicle telematic systems, to allow Optalert data to be transmitted along with "standard" vehicle telematic data. (Note that this may require configuration of your existing in-vehicle telematic system).
- The Optalert Reports program can be used to create a variety of reports from the information gathered, as well as a database to manage all your Optalert installations and users.