New transportation safety technology for preventing accidents due to falling asleep at the wheel

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Through advanced research & development for about ten years at the University of Liège (ULg) in Belgium under the leadership of Professor Jacques G. Verly from its Department of Electrical Engineering and Computer Science, the ULg and its spin-off company Phasya have established themselves as world leaders in the development of innovative and validated solutions in the area of drowsiness (or somnolence) monitoring. This technology can, among others, prevent transportation accidents where the operator falls asleep while driving a car, truck, or train, steering a boat, flying an airplane, etc. Most people are surprised to learn that 30% of fatal accidents on highways are due to drivers falling asleep at the wheel!

The technology developed at the University of Liège, in close collaboration with Phasya, is based on the analysis of images of the eye taken by a camera at the highest possible speed (in the range of 30 to 120 images per second and higher), and on the fact that the scientific literature has established that the behavior of the eye is one of the best indicators drowsiness. The eye is indeed directly connected to the brain, where the wake/sleep cycle is governed. While researchers initially focused on head-mounted solutions, they now also have remote solutions, e.g. with the camera mounted on a car dashboard or airplane instrument panel. Their "drowsimetry" technology has been validated through the "gold standard" of polysomnography (combining mainly electroencephalography/EEG and electrooculography/EOG), driving performance (in a simulator), and psychomotor vigilance tests (PVT). "Drowsimetry" and "drowsimeter" are terms coined in 2014 by Prof. J. Verly.

More recently, his team at the University of Liège developed the capability of predicting the evolution of the level of drowsiness in the future, which is absolutely critical for preventing accidents ! They are the only ones in the world to have this capability. Their approach is based on several years of research and on some of the most sophisticated tools of mathematics, some of which have led to Nobel Prizes. This technology has been integrated to their head-mounted and remote systems.

By contrast, the "drowsiness" monitoring systems found in some cars today rely either on cameras monitoring the crossing of "white" lines, or on analyzing the subtle motion of the steering wheel. The first approach is useless when there are no lines or when snow covers them, and in sharp curves. The second is not specific to drowsiness, and is irrelevant in autonomous cars, where the driver does not have his/her hands on the steering wheel. Perhaps surprisingly, monitoring drowsiness is paramount in autonomous cars, both to take over from the driver and to hand control back to her/him. The above systems are specific to cars and specific manufacturers; they cannot be transposed to other applications; they are not universal; they do not measure true drowsiness. In contrast to these systems, the ULg/Phasya technology has for major advantage to truly measure drowsiness based on the physiology of the operator.

"To the best of our knowledge, our technology for monitoring drowsiness/somnolence, in particular with the addition of prediction in the future, is the most advanced in the world today", says Prof. Jacques Verly. Five doctoral students in Prof. J. Verly's team at the University of Liège are currently contributing to the development of this unique and revolutionary technology that has the potential of savings lives by the thousands. The impact on safety of the introduction of this physiology-based technology in vehicles could be similar to that

linked to the introduction of the safety belt.

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