EU-funded researchers have developed a driver’s seat and seatbelt from smart textiles that measure heart and breathing rates. Detecting if drivers are showing signs of fatigue behind the wheel and somehow alerting them to the fact, the system could prevent thousands of fatalities every year.

"Drowsy drivers die. Break the drive and stay alive. Drive alert, arrive alive. Road signs in Australia and the USA offer this sobering wake-up call to motorists who don’t heed the potentially fatal warning signs of tiredness while driving.

Indeed, driver fatigue accounts for some 8.3% of all vehicle crashes and up to 35% of serious accidents in the EU each year, according to the eSafety Forum. That translates to more than 7,000 fatalities annually attributable to fatigue-related collisions. Alongside the tragic human and social cost, the economic burden of road accidents is estimated at between €10 and €14 billion. The cost of a fatality may be as high as €1 million.

“However you look at it, tiredness on the road is a costly killer,” asserts Paulo Gameiro, coordinator of the EU-funded HARKEN project and R&D manager for the automotive textiles supplier Borgstena, based in Portugal. The team has developed a prototype seat and seatbelt with smart textiles that use built-in sensors to detect a driver’s heart and breathing rates, which offer tell-tale signs of driver drowsiness. The heart rate (more specifically its variability) is a strong indicator of concentration and wakefulness, while slow and deep breathing indicate a relaxed or resting state.

“What we have here is the world’s first fully functional, non-intrusive driver fatigue detector,” says Gameiro. “There are no cameras pointing in your face, no need to wear any kind of gadget. And it is universal, so requires no calibration for different drivers. You just strap in and off you drive, no thought or effort required.”

Breathe easy
The project consortium included several research institutions, small to medium-sized businesses (SMEs) in the car textile and component sector, and a biosensor manufacturer. They collaborated to develop smart sensing materials – fibres and yarns with electrical properties – which could be incorporated into the cushions of car seats and at points along seatbelts in order to pick up and process signals of a driver entering a sleepy state.

The researchers also found innovative ways to “clean up” the signals from the sensors (filtering out vibrations from the car). They studied body types, sizes and positioning in the vehicle, blood flow in the seating area as a facsimile of the heartbeat, and other parameters to design a comfortable and safe belt and seat setup with the sensors in the right location to reliably monitor the driver’s signals of tiredness.

**On the road**

Not all measures to counter driver fatigue are technological and not all are directed at drivers per se. Low-tech counter-measures, such as painted corrugations to help drivers keep in their lane, already exist. Publicity campaigns like those in Australia and USA also work by reminding drivers and their passengers to think about breaks. Legislation and enforcement measurements for truckers and bus drivers, for example, already prevent long and risky stints at the wheel through the log-book system.

Technology – in the form of in-vehicle systems that can eventually warn drivers when they are becoming fatigued – is a natural next step in the battle against drowsy driving. HARKEN has focused on the sensing material systems and how they can work in typical seatbelt and seat designs. Automakers are now in a position to integrate this ground-breaking R&D in downstream applications. For example, the sensors could trigger an alarm, a dashboard or ‘heads-up’ warning message, or even send a small pulse through the seat to jolt or remind the driver to take a break.

Since the project ended in May 2014, former partners have continued developing HARKEN’s results with the aim of getting closer to market: “We are nearly ready to hit the road. We’ve had tremendous interest from manufacturers in Scandinavia already. As soon as we have submitted our European patent application we will be able to show everything off,” Gameiro explains.

Several of the project’s SMEs have already incorporated HARKEN’s research into product upgrades of their own. Gameiro is confident about the future for the technology: “There is the possibility of selling over 100,000 units of the product in the first five years. This could be worth around €14 million for the project SMEs and help to prevent thousands of fatalities and injuries every year. We certainly won’t be falling asleep at the wheel as we steer this work towards commercial success.”

**See also:**
CORDIS [3]

**Project:**
Heart and respiration in-car embedded nonintrusive sensors

**Project Acronym:**
HARKEN

**Project website:**
http://harken.ibv.org/ [2]

**Contact:**
Contact [4]

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