Biometrics wave poised to transform future driving

Joe Praveen, Frost and Sullivan

Traditionally, the core biometric technologies — fingerprint, palm print and hand geometry, iris, retina and facial recognition — have been used for access control and authentication in industries such as banking, law enforcement and aviation. But now advances in bio-sensors and analytical software are paving the way for biometrics to be adopted in a whole host of new sectors, including automotive. This article highlights the most significant innovations in the use of biometrics across the car industry.

The primary application of biometrics in cars is for vehicle security, which involves both secure entry into the vehicle and authentication to start the ignition. This is for good reason. Worldwide, criminals are becoming increasingly tech-savvy. According to criminologists, the average time it takes to steal a car is currently 10 seconds, which is six times faster than a decade ago. In London alone, in 2014 6,000 high-end vehicles fell prey to thieves who managed to circumvent electronic security mechanisms. In response, component suppliers have acknowledged that car theft is a major menace and have started incorporating biometric-based security measures into vehicles.

Automotive manufacturers (OEMs) are using biometric technology in a number of innovative ways to ensure secure vehicle entry. At this year’s CES show, Continental showcased a fingerprint authentication system that adds an extra layer of security on top of the traditional key. Volvo is capitalising on the proliferation of smartphones to improve car security. Using the fingerprint readers that are incorporated into most mobiles, it has developed an app that uses Bluetooth to unlock the car door as you approach the vehicle.

In addition to car OEMs, other technology ‘disruptors’ are set to bolster secure vehicle entry. They include Ontario-based Nymi, which has developed a wristband that captures a person’s unique heartbeat signature and uses this to authenticate the individual for entry into a vehicle. Once a heartbeat signature is registered to the Nymi band, it cannot be exploited by anyone else, creating a tamper-proof identification system.

Vehicle security is also being made more foolproof by the use of biometric authentication for starting the car. For example, Ford is working with Intel on Project Mobii, which uses front-facing cameras coupled with facial recognition software to determine the authenticity of the person sitting in the driver’s seat. The facial features of legitimate car users are captured and stored in the vehicle’s database. Each time a person enters the driver side, the car compares their features with the stored images. If it finds a match, it allows the person to start the ignition. If not, the vehicle takes a picture of the person and sends it to the vehicle owner’s mobile phone for their permission.

Similarly, Toyota recently introduced a Driver Lock In feature in its DARV 1.5 (Driver Awareness Research Vehicle). This measures the body dimensions of the person in the driver’s seat and automatically enables control functions if they are a valid user of the vehicle. If the system doesn’t recognise the person from their body dimensions, it will lock them inside the car. And just as Ford is using front-facing cameras mounted on the dashboard, automotive supplier Gentex has developed a rear-view mirror that incorporates an iris recognition system for driver authentication and ignition.

**“Nymi has developed a wristband that captures a person’s unique heartbeat signature. It uses this to authenticate the individual for entry into a vehicle, creating a tamper-proof identification system.”**

Biometrics for comfort and safety

While biometric technologies are making their presence felt most in the vehicle security area, the advent of wearables, smartphones and advanced sensors is helping to extend biometric...
adoption into other areas, such as health and comfort. Advanced driver monitoring features now being developed include iris scans used to determine driver fatigue level and heartbeat patterns used to monitor the driver’s health.

One key reason for this focus is the proliferation of lifestyle diseases, which are now a major concern the world over. In the US alone, more than 29m people suffer from diabetes, and acute back pain accounts for 40% of all missed work days. With people spending more time commuting in their personal vehicles than ever before, automotive vendors have recognised that this is a crucial area, to actively monitor the health of their customers. It has spurred several OEMs and Tier-1 suppliers to engage in R&D in the health and wellness space, developing biometric sensor-based products that deliver pre-emptive healthcare notifications to vehicle occupants.

“Jaguar is working on a steering wheel embedded with sensors that can read the driver’s brain waves to determine their fatigue, stress and concentration levels. If it finds the driver is becoming drowsy, it can vibrate the steering wheel or trigger sound notifications to alert them.”

Among these initiatives, Jaguar is working on ‘wellness seats’, which continually monitor vital signs such as the heartbeat and respiration rate of the passengers in the vehicle, to detect any anomalies in health in real time. Jaguar aims to incorporate these seats into its XJ model sedans in the future. BMW, meanwhile, is collaborating with a German university to integrate sensors into the steering wheel, which unobtrusively monitor the driver’s blood pressure. The sensor system uses an infra-red ray projected onto the driver’s finger to measure their heart rate, oxygen saturation level and electrical skin conductance. Toyota is also in the race to develop a biometric sensor-based steering wheel. It has demonstrated a Prius car equipped with a steering wheel that incorporates contact sensors. These detect any abnormalities in the driver’s heart rate through their hands and show the readings on the vehicle’s ‘infotainment’ screen.

A key ‘disruptor’ in the health and wellness market segment is wearables technology. Wearables are moving beyond fitness trackers and sleep monitors, with technology specialists now developing clinical-grade biometric-driven products that can accurately detect health issues. One such company, Empatica, has developed a wristwatch that aims to detect the onset of seizure attacks by precisely analysing the user’s electro-dermal activity. If it spots the signs of a seizure, it will immediately warn the wearer and send out alerts to caregivers through an automated phone call and an SMS. Empatica is working on enhancing the detection capabilities of the watch, which could be a boon to drivers with a history of epilepsy.

Another key application area for biometrics in this market is advanced driver monitoring for safety. The proportion of vehicle accidents and fatalities caused by human factors – such as distracted driving, driver fatigue, speeding or drunk driving – are steadily on the rise. In the US alone, in 2014 there were 3,179 fatalities due to distracted driving and at least 100,000 caused by driver fatigue. OEMs are working to address these issues by developing sensors that continuously monitor the condition of drivers, and alert them to potential anomalies. For example, Lexus has recently launched in-cabin cameras to detect driver stress. Volkswagen has created a system which monitors steering wheel inputs to detect fatigue, and BMW has incorporated gesture recognition into its cockpit to enable drivers to control various dashboard functions without taking their eyes off the road. In addition to the wellness seat discussed earlier, Jaguar is working on a steering wheel embedded with sensors that can detect and read the brain waves of the driver, to determine their fatigue, stress and concentration levels. If the system finds the driver is becoming drowsy, it can vibrate the steering wheel or trigger sound notifications to alert them. Similarly, if it detects elevated stress levels, the technology could play soothing music or adjust ambient lighting to calm the mood of the driver.

As well as OEMs, Tier-1 suppliers have recognised the opportunity to use biometric feedback on the driver in order to enhance safety. Among them, Harman has developed an industry-first system that monitors the driver’s pupils to determine their cognitive workload. An in-cabin camera tracks pupil dilation and an advanced software algorithm processes the data to identify pupil reflexes that are caused by extreme cognitive workload. The result obtained is used to automatically filter out stress triggers, such as incoming phone calls or high-decibel music.

When it comes to wearables for driver monitoring, Optalert, an Australia-based company, has developed a smart-glass system, which uses low-intensity infrared rays to continuously monitor the driver’s eyes. The glass captures a whole host of variables, such as the speed of eyelid movements and variability of blinks. This data is processed to detect the onset of drowsiness and warn the driver.

Another focus area for automotive OEMs is to provide as much comfort as possible for the driver on entering the vehicle, so they feel stress-free and relaxed; biometric authentication technologies are also being used to give drivers a customised experience. So in cars of the future, once the biometrics system has recognised and authenticated the driver, it can automatically adjust its rear-view mirror, seat height and steering position based on their physical dimensions. Infotainment systems will be personalised to play music from the driver’s favourite list automatically, and climate control will adjust based on their body temperature. Volkswagen recently unveiled a biometric system in its Sports Coupe Concept GTE that determines the optimal route to a destination based on the driver’s vital signs. If the system detects a higher heart rate, it will recommend a route with minimal traffic to cut down stress levels, and vice versa.

The future

As biometric technologies steadily penetrate the automotive sector, they are fostering increased collaboration between different players in this market. OEMs are partnering with technology specialists to develop and incorporate the latest biometric innovations in their vehicles. For example, Toyota is working with Microsoft to develop advanced gesture recognition technology for its cars, and Ford is working with Intel to incorporate interior-facing cameras, sensors and facial recognition software in its future vehicles. Also, OEMs are either developing their own wearable devices or collaborating with wearables companies to introduce these devices into their future cars. These include Audi, which showcased a wearable platform, the Audi Fit,
دریافت فوری متن کامل مقاله

امکان دانلود نسخه تمام متن مقالات انگلیسی
امکان دانلود نسخه ترجمه شده مقالات
پذیرش سفارش ترجمه تخصصی
امکان جستجو در آرشیو جامعی از صدها موضوع و هزاران مقاله
امکان دانلود رایگان صفحه اول هر مقاله
امکان پرداخت اینترنتی با کلیه کارت های عضو شتاب
دانلود فوری مقاله پس از پرداخت آنلاین
پشتیبانی کامل خرید با بهره مندی از سیستم هوشمند رهگیری سفارشات