Smart safety for bikers

i-Vital: Smart vital signs and accident monitoring system for motorcyclists embedded in helmets and garments
Motorcyclists are not enclosed in a protective construction like passengers in a car, nor are they protected by the on-board safety facilities that today’s cars provide. To improve the safety of motorcyclists in the event of a crash, the i-VITAL consortium is developing health monitoring and accident detection solutions that are incorporated into helmets and clothing. The system can automatically prompt the intervention of emergency services via wireless and cell technology, thereby improving outcomes for users.

16 per cent of road accident deaths in the EU involve motorcyclists – a statistic that the union has been seeking to address in recent years. One potential means of achieving this is through nurturing technologies that can enhance personal safety, an ambition that is currently being pursued by a trailblazing European project. i-VITAL, an EU sponsored consortium which has designed smart health monitoring and alert facilities for bikers, is pioneering products which could well signpost the way forward for the industry.

Harnessing the expertise of several SMEs and research centres dedicated to improving motorcyclists’ safety, i-VITAL’s principal goal is to improve eCall architecture for this demographic through recording and transmitting medical data. eCall is an active European initiative, which advocates the installation of wireless transceivers in vehicles to automatically contact emergency services in the event of accidents. Units can also relay important information about the location and severity of collisions. Following eCall’s implementation, estimates suggest that deployment of emergency teams to accidents could be hastened by 40 to 50 per cent.
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“Our partners were interested in developing a system compatible with the eCall standard, but which transcended current state of the art technology, particularly in the motorcycling sector. Commercially available technology in this area seems to have lagged somewhat behind comparable automobile solutions,” explains Rafael Maestre Ferriz, i-VITAL’s project manager. The product, which uses a mobile phone as its communications link, will exist in two formats that can be operated independently or in combination. Kit 1 consists of a helmet with electronic sensors, an integrated microphone and electronics. Kit 2 features a motorcycle jacket with integrated sensors.

Each of these configurations can be used as a self-contained system, and will establish a low power, Bluetooth link with the user’s smart phone. If potential problems are identified, a message is sent to the mobile device, which will warn the user. Emergency calls will only be automatically triggered in the case of an accident. Heart rate, heart rate variability, temperature, and consciousness will all be measured in real time by monitoring tools to assess health, using non-invasive, textile-based electrodes incorporated into the jacket and helmet. A graphical user-interface accessible through the mobile will visualise results to users and, whilst in transit, sounds amplified in the helmet or haptic feedback (vibrations) in the garment can automatically notify them of their status if a critical situation occurs.

Security is the paramount concern, but integrity is also important according to Maestre Ferriz: “We’ve aimed to realise our main objectives without compromising on the comfort, appearance or passive safety properties of the protective clothing being worn.”

CETEM (a Spanish Research Centre) has been tasked with developing sensor and electronic apparatus to obtain the relevant bio-signals from the helmet, while Fraunhofer (Europe’s largest application-oriented research organisation) is pursuing similar developmental work relevant to the jacket. More specifically, two of Fraunhofer’s bodies, the Institute for Integrated Circuits and the Institute for Industrial Engineering (IAO), are participating in the project. The former is concentrating on creating electronics and sensors, whilst the IAO’s contribution focuses on the Human Machine Interface (HMI). This integral aspect of the project will create the mechanisms through which users interact with i-VITAL, and conceive the display configurations that will present visible and audible warnings to them. Biosignal triggers that can prompt i-VITAL warnings include irregular or rapid heartbeat, reduced vital signs or high levels of stress, which can create additional risks on the road.

Two motorcycle industry SMEs with substantial experience of producing motorcycle equipment are also collaborating with the initiative. Lookwell, a motorcycle clothing firm from the Netherlands, has been involved in the field since 1974, and is assisting in the development of the jacket.
The company has engaged with several prior safety initiatives, including motorcycle airbag research. Helmet specialists NZI are contributing their own thirty years of unique expertise in R&D and manufacturing.

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One particular requirement raised by the SMEs was to guarantee i-VITAL's longevity. "Several colleagues pointed out that if the system was dependent on batteries, it might become an issue for motorcyclist's on long trips," says Maestre Ferriz. "To address this, we decided to incorporate some energy harvesting features into i-Vital. In terms of the jacket, we're using solar energy harvesting, which will use commercially available panels. On the helmet, we are exploring the possibility of incorporating wind turbines into its construction. If you're riding, you'll always have wind blowing through the helmet area. To help with this side of things, we have engaged with a Slovenian technology centre called Tecos, as well as CAP, an SME with expertise in polymers. They have a considerable history of working with synthetics and energy harvesting."

Presently, says Mestre Ferriz, the project is in the midst of an intense phase of independent developments. "We're targeting the end of August 2015 as i-VITAL's completion date, because several discrete phases of research are well advanced," he reports. "Substantial lab testing with the heart monitor has been conducted, and we’ll shortly begin to integrate this with the other components, so that i-VITAL becomes a complete, holistic system. This will enable us to demonstrate its viability and establish valuable technical precedents that we hope can benefit not only individual motorcyclists, but will prove influential to other designers and manufacturers across the sector."