fast facts

Project: Driver Distraction Management Using Sensor Data Cloud
Lead Organization: University of Dhaka
Country: Bangladesh
Budget: 30,100.00 AUD

situation

Distracted driving is the main cause of road accidents and highway crashes. There are many factors that can contribute to distracted driving – both inside and outside the vehicle. Together, approximately 80% of all vehicle crashes involve some form of driver distraction. Bangladesh has one of the worst road safety records worlwide, resulting in 4000 deaths and thousands of injuries annually. Drivers are often affected by underlying health conditions, such as fatigue or tension, or external distractions such as texting, socializing or paying attention to events outside the vehicle. It takes very little to negatively affect driver performance. This project aims to reduce accidents and near-accidents through an alert system intended to measure distractions and inform drivers when they may be driving unsafely.

solution

This project aims to monitor and correct driver distraction through the collection and analysis of real-time internal and external information in order to improve traffic safety in Bangladesh. This system employs audio, visual, and medical-grade health sensors to record and transmit data critical to determine the level of distraction a driver is experiencing. Under the driver distraction monitoring and controlling system, whenever the physical or mental condition of the driver deteriorates beyond an established threshold of acceptability, an alert message is played on the phone to notify the driver of potentially unsafe conditions. A 3G-enabled smart phone in the vehicle serves as the communications hub, gathering incoming sensor data and transmitting it to a cloud-based system that analyses and provides appropriate feedback to the driver when necessary in order to correct inattentive driving.

There are three major data types that are necessary to collect and monitor:

- *Biometric data*: blood pressure, heart rate, and electrocardiography sensors monitor indicators of physical and mental health in order to help determine driver fitness

- *Audio data*: sensors record the sound level in the vehicle to determine the driver's talking behaviour and instances/conditions of horn use

- *Video data*: video monitoring of driver behaviour, as well as external road and emergency conditions, helps determine attentiveness

These three factors will be used to monitor driver concentration, and reduce traffic accidents by alerting drivers to dangerous distractions caused by changes in their behavior and environment. The data is stored temporarily in the smart phone's memory, and compared against "threshold" measurements to determine when critical alerts are necessary. Data is also transmitted to remote, cloud-based datacenters for additional processing. Quality of Service (QoS) protocols are used to assign priority to sensor data in order to respond to the most critical distractions as they arise. A significant amount of research is required to determine optimal equipment and algorithms to most accurately determine attention levels, involving extensive pattern recognition and data mining.

Due to the variety of incoming sensor data and the need for real-time decision support, the cloud infrastructure requires advanced data computation, storage, data mining, and knowledge discovery and performance analysis capabilities. The goal is to collect and analyze data from hundreds of thousands of vehicles, while also considering computational load, installation costs, and energy efficiency – all important in emerging economies. The cloud interface is designed to display a rich set of information through accessible data visualization; including specific and amalgamated driver performance, longitudinal data, comprehensive parametric data and other statistical information.

While this data is intended to inform behavioral and eventual policy decisions, the immediate value of the system is in alerting drivers of their level of distraction before they become a hazard to themselves and others. Leveraging the processing power at both the level of the smart phone and the cloud, drivers can be alerted in real-time to unexpected or emergency conditions. The combination of cutting-edge sensors, low-cost wireless data communication systems, and cloud computing technologies allows for the invention of integrated systems that will accurately measure driver performance and enable correction in a manner that does not contribute to distraction itself.

The objectives of this project are to develop novel mechanisms, tools, and techniques that advance the current state of driver distraction monitoring and controlling through the use of a sensor-based data cloud solution. The proposed system aims to provide a cost-effective, highly accurate and scalable driving management system for Bangladesh as well as the greater Asian pacific region. In addition to creating the components described and performing extensive verification procedures to test the validity of the system, the primary investigators will also conduct workshops to both bring attention to the dangers of distracted driving as well as engage the larger research and policy communities around a potential solution in order to build interest in scaling this pilot project.

broader impact

The potential impact of this project is not only the lives saved, but it will be beneficial to transportation ministries, law enforcement agencies, and public health agencies. Accurate driving and road condition data will assist legal cases and help assign liability more accurately. Real-time and longitudinal driver performance data will help health officials design more effective safe driving campaigns and may provide new understanding of risks previously not recognized. Traffic data may be able to positively impact road planning and predict potential accidents, especially at peak traffic times.

contributions

Two research papers have been accepted for publication:
- "Energy-efficient Scheduling Algorithm for Data Center Resources in Cloud Computing" (IEEE HPCC 2013)
- "A QoS and Profit Aware Cloud Confederation Model for IaaS Service Providers" (ACM IMCOM 2014)

Project update… to get from the PI on notable things that have happened, like a link to an article or information about a workshop, etc…

project contact

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