Advanced Knowledge Enablement (CAKE)

Florida International University, Naphtali Rishe, 305.348.2025, rishen@cs.fiu.edu

Florida Atlantic University, Borko Furht, 561.297.3180, borko@cse.fau.edu

Dubna International University, Evgenia Cheremisina, 7.49621.22.683, e.cheremisina@geosys.ru

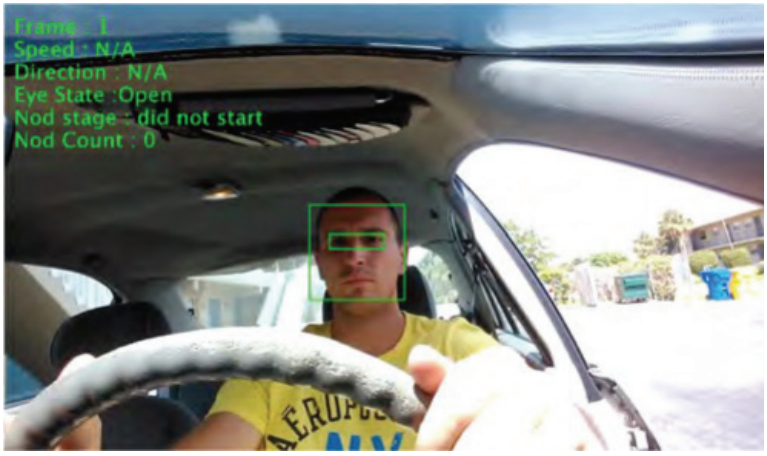
Driver's Drowsiness Detection System

In this project, CAKE researchers at Florida Atlantic University developed a driver drowsiness detection system. This research combines smartphones with machine learning to detect driver drowsiness in real time. The system is based on visual input that includes the position of a driver's face and head/eye position.

This innovative algorithm combines software components for face detection, human skin color detection, and a classification algorithm for the eye state (open vs. closed). The system uses commercially available smart phones to monitor drivers. Visual inputs are then used to detect signs of drowsiness. When signs of drowsiness are detected the system issues an alert.

The system uses innovative machine learning algorithms that continuously monitor driver behavior and alerts the driver in real time when certain thresholds are met. The high speed algorithms provide continuous, real-time analyses of driver imagery without consuming an undue of battery power.

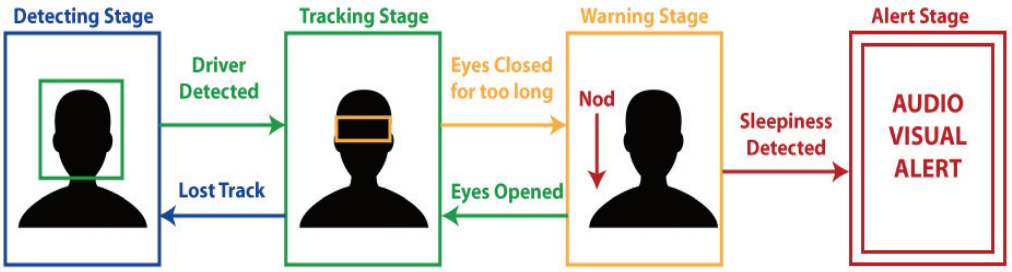
In order to capture a clear view of the driver's face the device is mounted securely and aimed precisely at a specific distance. Once mounted, the device begins a training process to determine the baseline head position and eye movement. After this calibration, real time monitoring begins, sending an alarm if the head dips or eyes close for prolonged periods; both can be indicators that the driver is falling asleep. The system has been demonstrated to be applicable in real time, easily portable to different platforms, highly accurate, and robust.



A screenshot of the driver detection video. Image provided by CAKE.

The advantage of being able to use the ubiquity of smartphones instead of relying on built-in products makes it feasible to deploy the system in any vehicle. With today's inexpensive infra-red cameras the device can operate in poor lighting conditions.

The CAKE team has developed and tested the software prototype for Android smartphones. The next step is to port to iOS platform for iPhones. Soon the system will be commercialized as a general smartphone application. Soon an embedded system with an infra-red camera will be completed. It will use the same algorithms so it can be mounted on the car's dashboard. These two systems, one using smartphones and another using a device, will be universally-applicable to all cars, and at very low cost. Eventually, the systems can be built in into newly manufactured cars.



The four stages of the Drowsiness Detection System. Image provided by CAKE.

With the high rates of accidents caused by drowsy drivers the need for these products is obvious. Beyond passenger vehicles, drowsiness alert systems can be expected to be applicable to public transportation modalities because taxies, buses, trains, subways, and long-haul truckers all face the same risks from driving drowsy. Adoption in these sectors could be driven by regulatory agencies as part of safety requirements.

> **Economic impact**: There is significant statistical evidence that there is a commercial need for driver drowsiness detectors. There are alarming numbers of road accidents. Worldwide, over a million people die on the road every year with 6% being linked to driver drowsiness. It has been estimated that nearly 75,000 deaths could be avoided by alerting drivers, either startling them awake, or indicating that they should pull over and sleep instead of continuing to endanger themselves or other on the road. Though almost impossible to estimate precisely, the economic impact of driver drowsiness detection algorithms and related products substantial.

For more information, contact Borko Furht at Florida Atlantic University, bfurht@fau.edu, Bio http://www.cse.fau.edu/~borko/, 561.297.3180.