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Applied Internet of Things IoT: Car monitoring system for Modeling of Road Safety and Traffic System in the State of Qatar

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One of the most interesting new approaches in the transportation research field is the Naturalistic Driver Behavior which is intended to provide insight into driver behavior during everyday trips by recording details about the driver, the vehicle and the surroundings through an unobtrusive data gathering equipment and without experimental control. In this paper, an Internet of Things solution that collects and analyzes data based on Naturalistic Driver Behavior approach is proposed. The analyzed and collected data will be used as a comprehensive review, and analysis of the existing Qatar traffic system, including traffic data infrastructure, safety planning, engineering practices and standards. Moreover, data analytics for crash prediction and the use of these predictions for the purpose of systemic and systematic network hotspot analysis, risk-based characterization of roadways, intersections, and roundabouts are developed. Finally, an integrated safety risk solution was proposed. This latter, enables decision makers and stakeholders (road users, state agencies, and law enforcement) to identify both high-risk locations and behaviors by measuring a set of dynamic variables including event-based data, roadway conditions, and driving maneuvers. More specifically, the solution consists of a driver behaviors detector system that uses mobile technologies. The system can detect and analyze several behaviors like drowsiness and yawning. Previous works are based on detecting and extracting facial landmarks from images. However, the new suggested system is based on a hybrid approach to detect driver behavior utilizing a deep learning technique using a multilayer perception classifier. In addition, this solution can also collect data about

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every day trips like start time, end time, average speed, maximum speed, distance and minimum speed. Furthermore, it detects for every fifteen seconds measurements like GPS position, distance, acceleration and rotational velocity along the Roll, Pitch and Yaw axes. The main advantage of the solution is to reduce safety risks on the roads while optimizing safety mitigation costs to a society. The proposed solution has three-layer architecture, namely, the perception, network, and application layers as detailed below. I. The perception layer is the physical layer, composed from several Internet of Thing devices that uses mainly use the smart phones equipped with cameras and sensors (Magnetometer, Accelerometers Gyroscope and Thermometer, GPS sensor and Orientation sensor) for sensing and gathering information about the driver behavior roads and environment as shown in Figure 1. II. The network layer is responsible for establishing the connection with the servers. Its features are also used for transmitting and processing sensor data. In this solution, hybrid system that collect data and store them locally before sending them to the server is used. This technique proves its efficiency in case of Poor Internet coverage and unstable Internet connection. III. The application layer is responsible for delivering application specific services to end user. It consists in sending the data collected to web server in order to be treat and analyzed before displaying it to the final end user. The web service which part of the application layer is the component responsible for collecting data not only from devices but also from other sources such General Traffic Directorate at Minister of Interior to gather the crash details. This web service stocks all stored data in database server and analyses them. Then, the stored data and analysis will be available for end user via website that has direct access to the web services. Figure 1: Architecture of Car monitoring system Keywords: Driver Monitoring System, DrowsinessDetection, Deep Learning, Real-time Deep Neural Network, Figure 1: Architecture of IoT solution Keywords: Driver Monitoring System, Drowsiness Detection, Deep Learning, Real-time Deep Neural Network,