May 12, 2017

Vehicle To Android Communication Mode

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VEHICLE TO ANDROID COMMUNICATION MODE

ABSTRACT

System and method for vehicle-to-Android (V2A) communication mode is disclosed. The system includes an Android smartphone with the real time operating system (RTOS) responsible specifically for V2A communication. The RTOS-enabled device is connected to the vehicle's OBD-II port using a special cable, providing both vehicle data and power. The device reads data from the vehicle's CAN-bus and from neighboring V2X messages received by the device's WiFi module. The inference obtained is then securely broadcast to neighboring V2X systems. The information is sent to Android where it may be logged, analyzed, and displayed to the driver with insights about his/her driving patterns, fuel-economy, vehicle diagnostics, etc. The system may also notify other V2X systems in case of brake failure, etc. The system may be a critical component necessary for the widespread adoption of both semi-autonomous and autonomous vehicles and enables "smart" autonomous communication capabilities in traditional vehicles at minimal cost.

BACKGROUND

Vehicle-to-everything (V2X) communication systems will greatly improve the efficiency and safety of modern transportation by enabling motor vehicles to communicate with other vehicles (V2V), infrastructure (V2I), pedestrians (V2P), and devices (V2D). V2I enables intelligent traffic management by optimizing traffic lights based on real-time data.

Benefits of V2X include improved safety. When a car experiences a mechanical brake failure, cars within its proximity may be notified immediately avoiding a potential collision. V2X infrastructure is a critical component necessary for the widespread adoption of both semi-autonomous and autonomous vehicles. Currently, two major problems that exist in the adoption

of V2X are a formal standardization of a common protocol and the availability of vehicles equipped with V2X.

Luxury cars may release V2X capabilities in commercial vehicles. But, the benefit of this technology will be limited to only other luxury vehicles on the road. Approximately 100 million motor vehicles are sold annually and there are a total of 2 billion vehicles in the world today. Given these numbers, the global refresh of motor vehicles worldwide is very slow (20+ years). To speed up the adoption and uptake of V2X, V2X functionality in existing vehicles is needed in conjunction with the use of an accessible device.

DESCRIPTION

A system and method are disclosed that enables vehicle to everything (V2X) communication on Android. The system includes an Android smartphone with V2A compatibility and a special cable that connects the smart phone to the vehicle as shown in FIG.1.

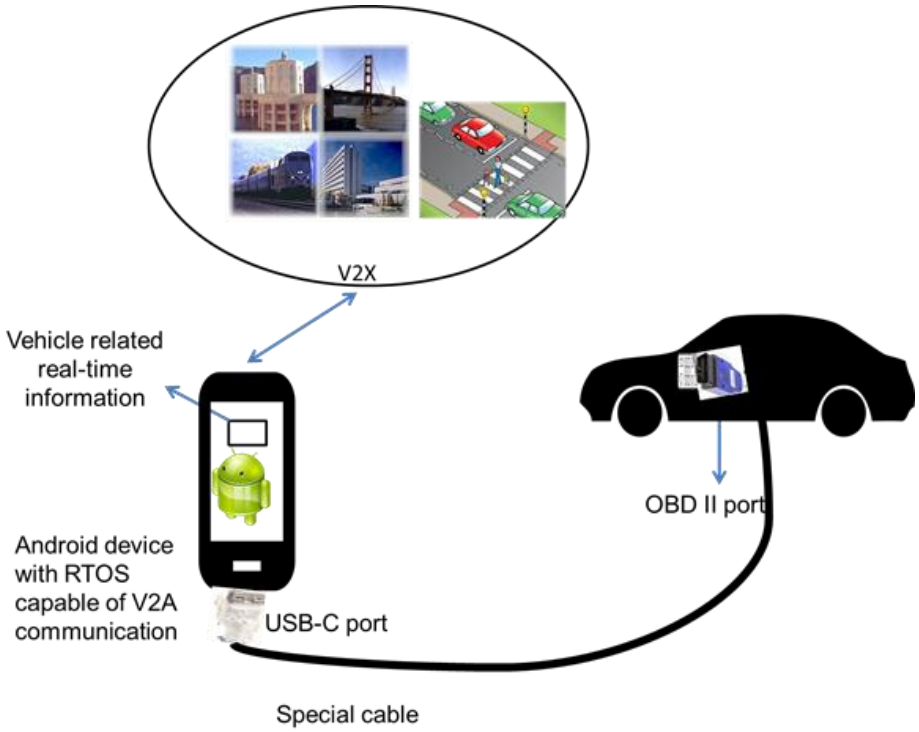

FIG. 1: Vehicle to Android communication system

The smartphone includes a real time operating system (RTOS) that is capable of reading data from the vehicle's CAN-bus and messages received from neighboring V2X devices. A special cable connects the device to a vehicle's OBD II port. OBD II allows the smartphone to read data from the vehicle's CAN-bus while charging the device. The OBD II is connected to USB-C, providing vehicle data and power to the smartphone.

Modern Android devices currently run three operating systems: Android, one for the baseband with RTOS, and another for a Trusted-Execution Environment with RTOS. The proposed system may enable a fourth operating system--a RTOS responsible specifically for V2A communication. A separate kernel space independent of Android with RTOS performance enables V2A.

The software with RTOS includes reading data from the vehicle's CAN-bus and from neighboring V2X messages received by the device's WiFi module. Inferences made from this information are then securely broadcast to nearby V2X systems (for example other cars, traffic lights, etc.). These transmissions may be encrypted and secured using standard wireless encryption protocols such as WPA2 + AES. The Android device may not have the ability to write to a vehicle's CAN-bus as a security precaution.

Additionally, data collected from the phone's sensors (accelerometers, gyroscope and cameras) may be used to augment the capabilities of the V2A system. Neighboring V2X systems will then be able to act on messages sent from the Android device. This enables "smart" autonomous communication capabilities on traditional vehicles. The obtained information is also sent to Android where it will be logged, analyzed, and displayed to the driver with insights (e.g. info about driver's driving patterns, fuel-economy, vehicle diagnostics, etc.).

The vehicle to Android communication requires a "vehicle mode" that optimizes Android

to improve the driving experience. This feature provides a car-friendly UI, disables the keyboard, controls voice, kills unnecessary background services to enhance performance, overclocks CPU cores and the like.

Alternatively, the vehicle to everywhere (V2X) communication may be executed by integrating a smart device within a vehicle. To enable V2X functionality, the sensors, computing, and connectivity of the smartphone may be utilized.

The vehicle to Android communication mode uses commodity technology to bootstrap the adoption of V2X in cars and the like. The V2X is enabled at low-cost and is easy-to-install, thus increases the likelihood of mass adoption via V2A. For instance, if a user has a device capable of Android's "car mode," enabling this functionality requires the special cable alone to connect the phone to the vehicle's OBD II port. This provides a low-cost solution for modernizing the vast majority of vehicles on the road today, which may improve both safety and efficiency.