TELEMATICS CONTROL UNIT.

Vehicle Plus

Supervised by

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Introduction About the project

A telematics control unit (TCU) that provide various tasks using edge technologies. The TCU connects the vehicles together via V2V standards, providing a full 360-degree awareness of the surrounding vehicles within the VANET can ensure a more precise reaction of Advanced Driver Assistant Systems (ADAS). The telematics control unit connects the vehicle to the internet to utilize cloud services (V2Cloud) that enhances its performance and allows it to do more complex tasks. The solution also provides a companion mobile application to allow user to view his vehicle and interface with it in a user-friendly manner. The cloud services mentioned above will be implemented using REST API web services which will be implemented and hosted as a part of our solution scope.

Problem statement

Road accidents take the life of many people in the world each year, and much more people have been injuring and maiming. Statistical studies show that accidents could be avoid by 60% if drivers were informed only half a second before the accident (C. D. Wang and J. P. Thompson, 1997). The main reason of these accidents is a limitation in view of roadway emergency events that can be due to the distances, darkness, and existence of an inhibiter in the road. Road and traffic safety can be improved if drivers have the ability to see further down the road and know if a collision has occurred.

Web and cloud-based applications became a necessity in almost every system. Major vendors now look forward to making benefits of these technologies and integrating them with their systems. The tycoons of the automotive industry have started taking some steps for this to happen like forming the e-Sync alliance for creating a high-confidence multi-vendor path to create end-to-end secure OTA and data services for the connected car through a global network of co-operating suppliers. Also, all automotive software requires a software update management system to monitor the update process and ensure efficient distribution of the update. UN-R156 standard illustrates the importance of creating a software update management system for any software before it's published to the market and each version identification requirement.

Proposed Solution

The main motivation for our project is to provide features that aids to minimize road accidents and try to secure the car from thefts this goal can be achieved by providing the car with 360-degree awareness of similarly equipped vehicles within a range. This can become possible if the drivers and vehicles communicate with each other. It is possible to build a multi-hop network among several vehicles that have communication devices. These vehicles would form a mobile ad-hoc network and could pass along basic safety messages about intersection collision warning, emergency brake warning, road conditions, accidents and congestion.

Technical Description of the solution

Regarding the Vehicle-to-Vehicle (V2V) communication continuous broadcast of Basic Safety Messages (BSMs) is shared using DSRC transceivers. The BSM contains information about vehicle position, heading, speed, brakes, and other information relating to a vehicles state. Sharing this information has the potential to prevent up to 75% of all roadway crashes through active safety applications. Basically, BSM(basic safety messages) are shared using V2V communication to provide a safer driving journey. The data is gathered from various sensors and is transmitted to the TCU through ethernet. The TCU collects the readings from different sensors, placing them in a compact payload to be shared via DSRC among the surrounding vehicles. In addition, some of the gathered data is shared with the cloud server. Each payload is timestamped at the TCU at each transmission, the TCU synchronizes its time periodically using either internet or GPS according to availability. Information gathered from the vehicle’s sensors and the BSMs of the surrounding vehicles is then passed to active safety applications on the main ECU to be processed to prevent potential road problems.

Our solution also a cloud hosted system for Providing services for the automotive owner to facilitate its usage and continuously updating him about his vehicle and Prevent hazards that he might face due to bad usage of his vehicle. Also, this system aid the TCU in increasing its efficiency and Creating a SUMS system for the TCU software updates management. That system consists of 3 modules. First, the Admin console that allows the Vehicle manufacturer to Connect the vehicle owner's primary device to vehicle on purchase and Register that a new software update has been released. Secondly our system contains a number of REST API’S that are hosted and implemented using a micro-service based architecture that Allows users to Connect his smart device to his vehicle's TCU from multiple devices. Share vehicle access with other devices using the primary device, Request a live location of his vehicle. Access live diagnostics information from his vehicles. Be warned if the vehicle is being accessed when his phone is away from his vehicle. Monitor his vehicle's TCU software updates and get notified whenever a new update is launched. Lastly a companion mobile application to provide a user friendly interface for the users

Project Plan & Timeline

In October

- reseached about the topic

- read realated research paper.

- looked for suitable hardware components

In November

- decided on the hardware to be used

- implemented hardware diagram

In December

- Implemented code for the ESP transceivers (DSRC module)

- Implemented drivers for the spi to ethernet module

- Tested data transmision of the spi to ethernet module

- Tested data exchange between different ESP module (DSRC module)

By the end of February it's expected to

- A small model vehicle occupied with the hardware required for the TCU

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- A backend web application is running on cloud service platform

- Vehicle's TCU has multiple containerized services that

- GPS data

- communicate with the DSRC

- fetch data from DSRC and pass them to other pipelines to give certain action on the vehicle ( for now only buzz warnings )

- services that read data from ECU connected to the Automotive ethernet

- test DGPS on one vehicle

Deliverables from October - December 2022

Deliverables status

⃣ On track

⃣ Behind Schedule (What is the estimated Percentage?)

⃣ Ahead of Schedule (What is the estimated Percentage?)

The Expected deliverables from February - April 2023