**The Connected Car Laboratory at Kettering University (CCL)**

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**Vision**

A place where applied research, development, applications, education, and training involving the Connected Car converge.

**Objectives**

1. Perform significant research on the most pressing issues involving the Connected Car.
2. Perform significant development projects and applications
3. Develop top-notch education and training materials

**WHITE PAPER: Harnessing In-Vehicle Data Through the Cloud**

Imagine low cost reduced insurance rates based not on driving records from police reports but rather from actual in-vehicle data collected in real time. Also imagine cars with much improved safety and maintenance as a result of high level analytics performed on in-vehicle data available in the cloud. According to a recent McKinsey Global Institute Report, we are just beginning to harness a myriad in-vehicle data through the cloud. The potential benefits are enormous with the two most important ones being improving safety and security and condition-based maintenance. This means less accidents and hazardous situations together with improved performance and also improved vehicle reliability and longer life for our vehicles due to better maintenance.

Nevertheless, the same report identified a number of barriers. The first one is a need for low-cost, long-distance wireless data communications. The second barrier is somewhat related to the first one involves how to provide constant connectivity across long distances over land and sea and in the air. Another barrier involves improvements in technology and how data is collected and analyzed. This includes lower-cost hardware and components, such as sensors. Advances will also be needed in computational hardware and data analytics. Yet another barrier involves cooperation among many stakeholders; carriers and other operators will need to get better at harnessing data. Today only a tiny fraction of data generated by aviation machinery is actually used for decision-making.

The Connected Car Laboratory at Kettering University has been established to tackle some of the barriers identified by the McKinsey report. The laboraroty activities are consistent with the mission of Kettering University and with its long tradition of close relationships with the automotive industry, particularly in Michigan. The connected car together with other endeavors such as the “sofware defined car” is one of the use cases of a much broader effort known as the internet of Things (IoT) or Industrial IoT (IioT).

**The Connected Car concept opens the doors to hackers who can produce a lot of damage to a vehicle and introduces new significant safety hazards.**

The recent car hacking of a Jeep Cherokee done on a remote and wirelessly fashion proves that and requires the need to improve security at all levels and to begin addressing a new set of

safety hazards that were not previoulsy considered. We intend to tackle security and safety in every single Connected Car project at our laboratory.

**Connected Car Laboratory Approach for Addressing the Barries**
The following briefly explains the approach taken by the CCL for tackling these barriers and related security and safety issues.

**There is a need of low-cost, long-distance wireless data communications. For vehicles, the challenge is to provide constant connectivity across long distances over land and sea and in the air.**

Several approaches are being used ranging from WiFi access points at driver's homes and offices to other fixed access points deployed at specific locations in roads.

**Improvements in technology and how data are collected are also needed for IoT to realize maximum potential in vehicles.**
We will take advantage of real-time data logging technologies already in existance that work with several types of in-vehicle networks including CAN, LIN, Ethernet, and FlexRay.

**This includes lower-cost hardware and components, such as sensors.**
A typical vehicle has a myriad of sensors already operating in the vehicle as part of its normal operation. Thus, we plan on using these already available sensors.

**Advances will also be needed in computational hardware and data analytics.**
Cloud vendors already have the required computational hardware to handle the volume present in in-vehicle data. Likewise, the data analytics to process all of in-vehicle data is beginning to appear in the market. We plan on complementing the data anaytics software by offering a multitude of smart phone Apps that would work on subsets of in-vehicle data for specific tasks.

**A major barrier to harnessing in-vehicle data through the cloud is that it needs to be done in a secure and safe manner.**
OEMs need to protect the identity of all in-vehicle data so that it does not fall into the wrong hands because it could have serious safety implications for both vehicles and drivers. Therefore, all aspects of harnessing in-vehicle data through the cloud needs to be done with the most secure fashion that is possible. At the CCL, the most secured solutions will be used in all aspects of in-vehicle data harnessing.

**Current Set of Projects**
The CCL is currently working on the following projects:

1. Real-time data collection  of in-vehicle data.
2. In-vehicle data Classification
3. In-vehicle data Compression, and Packing
4. In-vehicle data cloud upload protocol and procedure
5. In-vehicle data unpacking at the cloud
6. In-vehicla data analytics on the cloud

**Your Involvement**

How can you get involved and contribute to Harnessing In-Vehicle Data Through the Cloud? Perhapst the best way to be a center sponsor. Sponsors will get a number of benefits detailed below together with some project deliverables that would depend on the level of involvement or sponsorship.

For each project, the following deliverables will be generated and available:

- Research report
- Detailed performance, security, or safety data and tools used.
- Specific Report and Developed Code

The following table lists the project deliverables that sponsors will get according to their level of involvement.

| | **Research Report** | **Detailed Data & Tools** | **Specific Report and Developed Code** |
|---|---|---|---|
| **Silver** | **√** | | |
| **Gold** | **√** | **√** | |
| **Platinum** | **√** | **√** | **√** |

**Levels of Sponsorship**

*Silver Sponsor:*

For this kind of sponsorship, the center will provide appropriate recognition of the sponsorship in all public relation activities, communications, and general publications. To become a Silver Sponsor, a yearly general contribution in the range of $ 10,000.00 to $ 20,000.00 is required, recognition.

*Gold Sponsor:*

For this kind of sponsorship, the center will address some particular or generic requirements in any work of the center on behalf of the sponsor. A yearly general contribution in the range of $ 25,000.00 to $ 45,000.00 is required,

*Platinum Sponsor:*

With this kind of sponsorship, the center will perform some specific projects on an exclusive basis on behalf of the sponsor. A yearly contribution of over $ 45,000.00 is required,

**Note:** For all sponsorship levels, in kind donation of equipment and/or components are also accepted as part of the sponsorship requirements.

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