Car as a Sensor – Paying people for providing their car data

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Paying people for providing their car data

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***Abstract*— Most modern cars are equipped with a lot of sensors that exchange data in high frequencies. So far, the sole purpose of this sensor network has been to enable the car to drive. However, in a world of the Internet of Things it makes sense to extend this network of information exchange from within a car to many cars and other objects. A car could then be seen as a sensor that shares its data to become truly part of an Internet of Things. The Car-as-a-Sensor could be of high value to realize or improve many use cases. In order to incentivize car owners to share their car data, we propose direct monetary rewards. Results of a survey that asked for people's willingness to accept money to share their data are presented and discussed.**

I. Introduction

Almost every part in a modern car is controlled by the automotive's electronics, and most of these parts are interconnected via the car's electronic networks [1]. To improve the car's efficiency, comfort and safety while driving, today's cars are equipped with many sensors and electronic control units (ECU) that generate, process and share data [1]. The primary purpose of this network is, of course, to make sure the car does what it is supposed to, i.e. transport its passengers in a safe and convenient way. With the rapidly increasing interconnectivity as a main characteristic of the Internet of Things, the data that is generated by today's cars is becoming more and more interesting for the development of use cases that go beyond simply driving a car. Seeing the car as not only a means of transportation, but also as a source of data, one could conclude the following: there are currently more than a billion sensor platforms driving around every day [2]. Let's connect and use them!

Information System (IS) solutions that rely on car data could be divided into two categories: (1) non-driving related and (2) driving related. An example of a non-driving related use case could be taking weather related data from the car, like outside temperature, using the windshield activity as an indicator for rain or the brightness sensor of the car's headlights as an indicator for cloudiness to improve current weather maps and forecasts. A driving related use case could be to detect the road conditions using information from the car. For example, road friction [3] could be estimated using a combination of accelerometer values and ESP/TCS[1]-information, extended by weather data (see above) to distinguish between black ice and aquaplaning. Road conditions might also include damage to streets, like potholes or bumps [4]. Drivers could be provided with warnings when they approach dangerous street conditions. Additionally, street authorities might be better able to manage road maintenance and winter services. Another example for a driving related use case is the detection of accident hot spots, i.e. parts of roads, where drivers particularly often show accident related behavior, like heavy breaking or abrupt steering.

[1] Electronic Stability Program (ESP) / Traction Control System (TCS)

To make this work, car drivers would have to be willing to share their car data. People tend to share their data as long as they can expect something in return [5]. In most cases, this is some kind of service. To use Facebook, for example, you have to share your data and allow Facebook to use it for their purposes. Unfortunately, there are cases where a service provider cannot offer a service in return for data. This often applies when a service requires a critical mass of data to work [6]. Many of the driving related use cases fall in this category. For example, a pothole-warning feature that does not have enough cars providing data will not be able to warn the driver reliably. This is even worse for warnings of temporary road conditions, such as black ice or aquaplaning, and an accident hot spot warning will likely need a huge amount of driving data in order to detect accident related behavior.

So, the question remains on how to motivate drivers to share their data. We propose a rather simple solution that follows the Sensor-as-a-Service approach [7]: incentivize the user with money for their data. This approach raises two critical research questions:

1) *What is the minimum pay people would accept, i.e. their Willingness to Accept (WtA) for sharing their car data?*

2) *What are determinants of the WtA?*

II. Survey on WtA for sharing car data

A. *Survey – Method and Sample*

To answer the above stated research questions, we conducted a small online survey. Therefore, we recruited a total sample of 127 participants via Amazon Mechanical Turk [8]. Participants were rewarded a small amount of money. We described the idea of a simple plug-and-play solution for cars that reads and sends car data to "establish a map of road conditions and dangerous traffic spots". Once plugged in, the system described would seamlessly transmit data so that the users would not "have to care about anything". After making sure that the participants understood the description of the system, we asked them for their WtA with the following question: 1) "What is the minimum amount of money we would have to pay you per month, so you would accept sharing your car-data with us?". To check the participant's need for transparency of data collection, we asked 2) "How important would it be for you to have transparent information on the amount and type of data we would gather?". And finally, we wanted to assess their need for control, asking 3) "How important is it to you that you could always turn off the data transfer (either by turning off the app of unplugging the dongle)?". Questions 2) and 3) were answered using a 5-point Likert scale from "not important at all" to "extremely important". Participants had to state whether they owned a car (only car owners were considered for analysis), how many kilometers they drove per year on average and to what extend they were commuting. Finally, we asked for demographic data like age, gender and education.

After excluding non-car owners and participants that did not state any WtA, the sample considered for analysis had a size of N=91. The mean age of the sample was 32.9 years (SD=26.7) and 34.8% participants stated being female. Asked for their highest education, 10.9% stated having a high school degree, 2.2% a technical degree, 31.5% had 1-3 years college experience, 44.6% a bachelor's degree, and 10.9% had a graduate degree. The participants drove 11902 kilometers (SD=13010) per year on average.

B. Results

The mean WtA in our sample was $97.24 (SD=165.07). As the distribution of the WtA was quite right skewed (v=4.06) we also looked at the median, which was $50. The mode was $20. 31.9% of the sample stated a WtA of $20 or lower (figure 1). The second-order mode was at $50. 64.8% of the sample stated a WtA of $50 or lower.

Participants stated a high need for transparency of information gathered (M=4.09; SD=1.11) as well as a high need for control (M=4.34; SD=1.00). 50% of the participants stated that less than half of their driven distance was due to commuting.

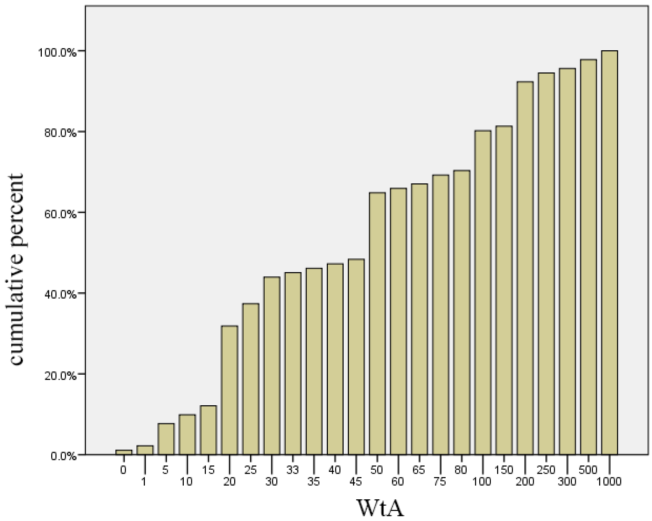

Fig. 1. Cumulative percent of partipipant's WtA in $.

In order to explore determinants for the WtA, we tested the following variables for significant correlations with WtA: age, gender, education, need for transparency, need for control, kilometers per year and commuting. As the variables were not normally distributed, we used Kendall's Tau for correlations. WtA did not correlate with any of the variables significantly.

III. Discussion and Conclusion

For use cases that require a critical amount of data to work, incentivizing people with money for their provision of data might be a promising approach. In the case of the Car-as-a-Sensor, this might be because there is no service offered in return for data provision that is attractive enough for users. Alternatively, paying people for their data could be used as a temporary solution as long as a service lacks the critical amount of data that it needs to work. As soon as such a service is established people could be incentivized to provide data by using the service itself. In our survey, over 30% of the participants stated a WtA of $20 or less. We think, 30% of all cars would be enough to establish use cases like the ones described earlier in the paper. Paying people directly to make a use case that struggles with network effects successful, can be seen as an investment. This will bear some risk, as it cannot be guaranteed that a service or product will pay off in the long run. On the other hand it might help to grow a necessary data foundation faster than with traditional approaches. Future research will have to have a closer look on the user acceptance of direct payment for data.

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