

7.2 Connected Mobility, Autonomous Mobility

7.2.1 Big Data : Electric... and Connected Vehicles (1/2)

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This section and the next one introduces the notions of electric vehicle and connected vehicle as well as the use of electric vehicle data. This presentation will be split into three parts. First, we will address the data feedback technologies. Then, we will address data uses, both the users' duties and the specific uses of these data. Finally, in the next section, we will extend the use of data towards the future with two main elements : preventive maintenance and smart charging.

Which services do connected and electric vehicles provide ?

Connected services can be split into three main parts.

First, navigation. Navigation becomes smarter to minimize the user's travel time.

The second group is the group of charging services. It is obvious for electric cars.

We will get back to the services that can be added to it.

The third group is that of connected services to remotely supervise and control the vehicle. We will see that it is a way to consider innovations in terms of business and services.

Technologies and related services

On which technologies do these services rely ?

Of course, navigation services rely on the GPS technology which locates the vehicle.

With the addition of GSM data, navigation becomes smart and can integrate services connected to charging terminals to improve the use of electric vehicles and extend their autonomy by including the charging time and the most adapted terminals on the customer's journey.

Then, charging services are separated in two main technologies. The current technology is based on pilot control. This control is established between the terminal and the vehicle to define the maximum power the vehicle can request by taking into account the power limitations the cable, the terminal and the vehicle can bear. This is the first technology for charging services. A second technology is appearing. It is established by the ISO 1518 standard. This standard relies on the power-line communication technology, PLC.

Finally, I previously mentioned services to remotely supervise and control vehicles. These services are of course based on GSM data. These services are extremely rich. They allow users to use their car in an optimal way. We will see that it is particularly well adapted for electric cars.

Collected data

Data users Who uses the data collected from electric vehicles ?

Of course, the classic user of a vehicle first. Let us take the example of an electric car. The user seeks information regarding charge, autonomy, travel planning. These are standard services.

The second type of user is the operator or the manager of an electric fleet, i.e. mobility operators. Mobility operators want to maximize the turnover rate of their fleet by using connected services and data to optimize this turnover rate.

Finally, we will talk about the manufacturer itself. Automotive manufacturers use data throughout the whole design, manufacturing and sales cycles of the vehicle.

Duties of data users What are the duties of data users ?

Data users depend on the user who owns them in the first place, that is to say the vehicle owner who uses it. As a data user, objectives must be set for the studies to be undertaken.

Then, it is necessary to check if the collected data are relevant to the objectives of the study.

We cannot collect data that are not related to the study. This is supervised by an organization called the CNIL. A declaration must then be submitted to the CNIL. Of course, data retention time must be limited and specified upon declaration. The persons' rights must be respected, that is to say they must be informed that their data will be collected and of the studies' objectives. The collected data must be protected. The easiest way to do this is to anonymize them first, that is to say separate them from the identity of the person who sent the data.

Then, data must be secured to avoid hacking. Of course, the remote control of the vehicle must also be secured to avoid anyone taking control of the vehicle instead of the user.

We will now talk about the services associated with each user. I told you that there were three main user groups : the users themselves, mobility operators, and manufacturers. We will start with the users.

Data for vehicle users

Users have a major issue. When they use an electric vehicle, they are worried : they constantly want to know their charge level and autonomy. This will remain true as long as the autonomy remains lower than that of thermal vehicles. This first part can be easily ensured. The charge and autonomy levels as well as the information related to the charging time of the electric car simply need to be sent frequently enough.

But to go further and extend our customers' electric mobility, we must help them plan their travel. To plan their travel, we use slightly more advanced connected data which will take into account charging terminals, their power and availability, potentially their average occupancy rate. It is a way to have a smart navigation to optimize and reduce charging time by avoiding unnecessary detours for the customer and unnecessary waiting times at the terminals. Thanks to this smart travel planning, electric mobility is getting closer to the mobility associated with a thermal vehicle.

These are the two main current uses for the users of electric vehicles. Of course, they will later benefit from preventive maintenance services. We will see that in the next section part.

Internal use for mobility operator

The second type of users are mobility operators. Mobility operators have one main goal to reduce the operating cost of their fleet. They need to optimize the turnover rate of their fleet. To optimize the turnover rate of their fleet, they must choose the best-suited vehicle considering the needs of their customers. It is quite simple for thermal vehicles. They just need to look for the filled-up vehicle which is available during the necessary time frame. For electric vehicles, there is an additional component. The autonomy level of the vehicle must be considered. It can be different depending on the car's battery type. The need of the customer in terms of mobility must also be considered. An electric vehicle with a rather high autonomy must not be given to the first customer of the day in order to keep it for a customer who will need a higher autonomy compared to the first customer. The issue is to adapt the provided vehicle to the required needs of the customer. The data considered by the mobility operator are the distance the customer wants to travel, the vehicle's autonomy, and potentially the maintenance date if an optimization function of the fleet turnover rate must be added by considering immobilization times for maintenance.

Internal use for vehicle manufacturer

Finally, the third data users are the car manufacturers. The connected services for the vehicle manufacturer are extremely diverse. The easiest way to understand the range manufacturers must consider is to target three main steps of the car's life for manufacturers. The first step is the design. The second step is the manufacturing. The third step is sales.

Once again, we will limit ourself to some examples because the use of data can be extremely diverse and grows day after day.

For the design, we can easily understand that specifications are required when a vehicle is designed. To define these specifications, we are interested in targeted customers. Thus, customers must be targeted to design a vehicle. The easiest way to target customers is to question them. We can question them as we usually do through telephone or written surveys. But these surveys are always incomplete and subjective. The use of data completely revolutionizes the definition of these specifications by using objective data related to the use of the vehicles. This is a major step for design.

Then, during the design, a second step can also be considered : remotely approving the car. The design center is at a given location while the approving center can be located in another country. The automatic feedback of the data when the vehicle is approved is a way to save a lot of time and have better accuracy during the approval step.

Let us then take the example of manufacturing. During manufacturing and to follow the vehicles' quality, it is very useful to have a feedback on the data related to potential defects during manufacturing in order to know the precise and optimal

state of the vehicle when it leaves the assembly line. And to potentially be able to make improvements before the final delivery to the customer.

Finally, for sales, I will take a typical example for fleet sales. For fleet sales, we have previously seen that it was necessary to optimize the turnover rate of the vehicles. Once this turnover rate has been optimized, it would be a pity if the mobility operator realized that it was sold too many cars, that the eleventh car of an 11-car-fleet is never used. Big data tools will adjust the sales offer submitted to the mobility operator in order to set the exact number of cars needed. It will bring over a precise description thanks to the data collected during the previous drives. From the collected data, we can provide a fleet perfectly adapted to its uses.