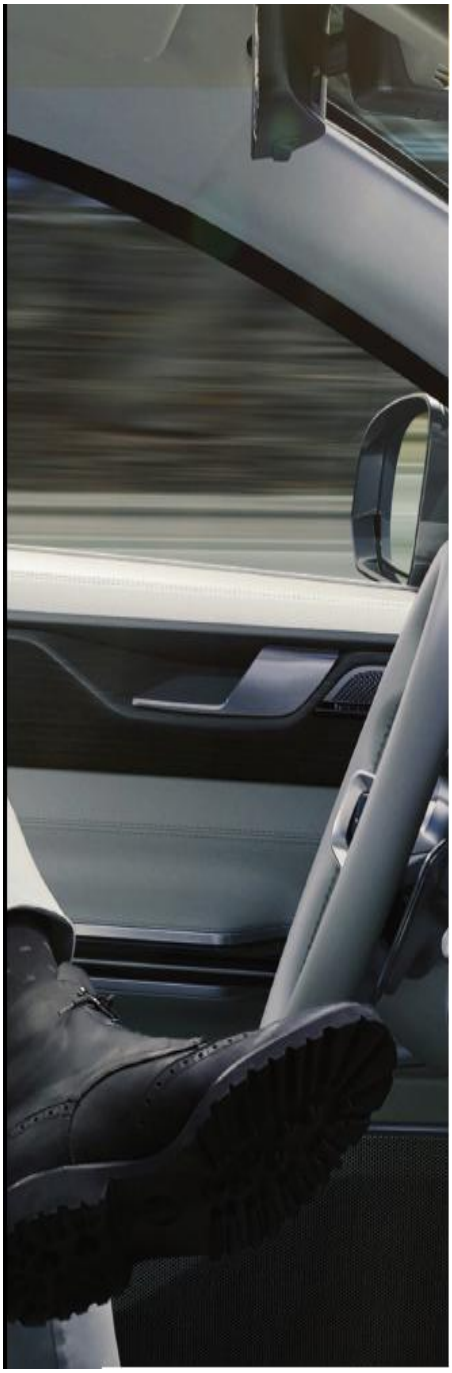
AUTONOMOUS CARS:

ARE WE READY FOR THEM?

The short answer to the question above is NO. The more than one billion drivers around the globe would never entrust artificial intelligence with the wheel control. The ones who don't have a driver's license probably regard autonomous cars as a SF thing, which might become reality somewhere around the end of this century. Well, I'm willing to bet that after reading this article, your answer to the question above will be YES.

By Oraan Marculescu



For more than half a century, the automobile become a pillar-symbol of modern society, but, for many, the car means freedom and status – which is illusive, since traffic jams involve a high level of stress, pollution and a lot of time lost behind the wheel, especially in the urban environment. These are the moments in which the drivers realize that no matter how efficient, beautiful or luxurious their car is, eventually it stands for nothing more than a means of transportation from A to B. And should they have the alternative of a personal driver, most of them would probably transfer the wheel and related risks to him.

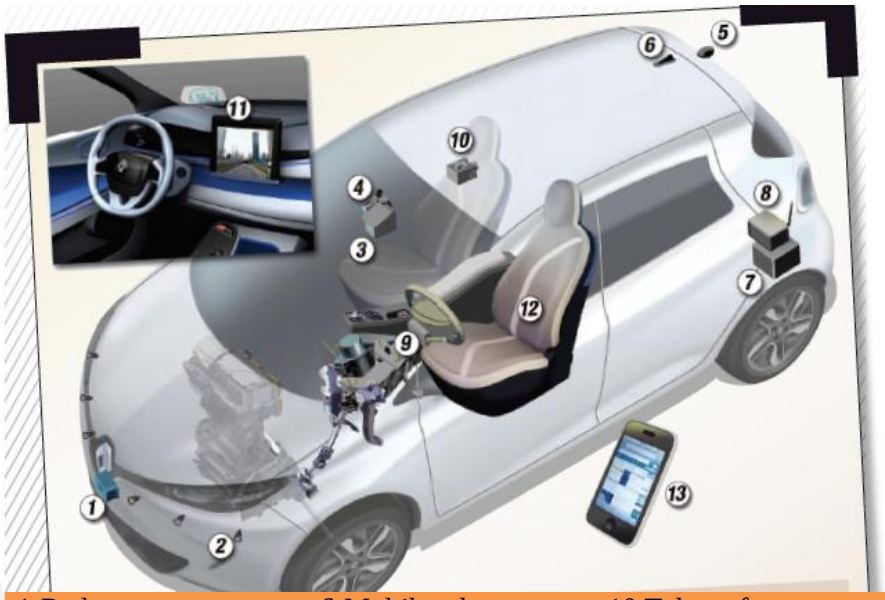
But who says that this personal driver must also be human? Or, even better, why should a person be in the driver's seat? Why can't the foot pedals and the wheel be controlled by something under the hood, such as electronic systems? Is it possible? Of course. The wheel is just an additional subsystem used to turn wheels and the foot pedals connect the specific subsystems, to determine the engine power, namely to brake the wheels.

It may be so that the pretty beetle Herbie from the Disney series or KITT, the vigilante belonging to Hasselhof or the frightening Christine imagined by Stephen King, are mere movie characters. But Google Car or Tesla Model S with Autopilot are as real as can be. It is even hilarious that in the 'middle age' of autonomous cars – around 2010 – the vehicle manufacturers estimated that they would build 'self-driving cars' only around 2050. But even starting with 2014-2015, almost all of them embarked in a race against the clock: which of them will be the first to release a completely autonomous car by 2020. That is less than 5 years from now.

RACING TECHNOLOGY

In case you were wondering how the major players will be able to build autonomous cars in such a short time, the answer is actually simpler than you thought: the necessary systems are already real. Furthermore, some of them are even installed on most new models, allowing a higher or lower level of semi-autonomous driving. As an off-topic note, Continental in Timisoara has engineers contributing to the development of such systems.

The ABS (used for the brake efficiency) became a standard since the '90s. The ESP (electronic stability control) became a standard in Europe since 2014 and controls the differential wheel acceleration and braking, especially when turning, independently from the driver.



1. Radar
2. Ultrasound sensor (front/back)
3. Front video camera for autonomous driving
4. Front video camera for navigation and augmented reality
5. Back video camera
6. Multiband antenna: GPS, WiFi, 2/3/4G
7. Control units for the management of autonomous driving
8. Secured modem
9. Automated operation for the main control systems of the car (pedals, wheel, etc.)
10. Teleconference video camera
11. Human-machine interface: semi-transparent mirror for augmented reality, large multifunctional touch screen, customizable panel
12. Connected massage car
13. Driver's smartphone

But the new automatic braking systems detect imminent danger using sensors and brake the car by themselves, before the driver even reacts. The light or rain sensors tend to become ordinary and, lately, new systems have been designed which automatically control the high beam so as to avoid the blinding of the drivers on the opposite lane, during the night.

The cruise control exceeded the phase in which it was used solely for maintaining a constant speed, a long time ago. Now it can adjust the car's speed according to the speed of the vehicles in front, due to the radar-type of sensors. These days, parking sensors are more evolved and integrated into more complex systems, which park the car alone (e.g. for side parking maneuvers). The advanced systems of video cameras can already identify traffic signs and detect if the traffic lane is exceeded involuntarily (with no signaling in advance) – case in which it warns the driver and in case of more sophisticated systems, the central computer actuates the brakes and the direction independently from the driver, to keep the car on track.

To all this we add GPS car monitoring, with a higher and higher precision. But there's more: sophisticated laser sensors are able to map the area around the car, capturing 360 degree pictures (impossible to imagine for humans!) in fractions of a second. And the ever more efficient software is able to decode these images in thousandth of a second, identifying the objects and potentially dangerous situations faster than the human 'sensors'. And we haven't even mentioned the new car-2-car and car-2-infrastructure communication systems , i.e. cars are able to 'talk' with one another and with various components of the road infrastructure. How? Due to the new technology called Internet of Things, which allows data transmission using huge speeds, either through wi-fi or mobile, or radio waves. Basically it has come to the point where Artificial Intelligence controls the street and highway network, in a sort of global strategy game.

ARE THERE ADVANTAGES?

Obviously. And even important ones. First of all, there's the safety. Computers operate all the time, they don't get drunk, they don't have their attention distracted (with the multitasking function different from humans). And, most important, they react faster than the average human can. Here are some numbers: approx. 1.2 million people lose their lives annually in car accidents and tens of millions suffer serious injuries. All due to human error.

A study carried out by Business Insider estimates that in 2020, the vehicle market with autonomous driving technology will reach 10 million units. From the legislative viewpoint, it is estimated that the completely autonomous vehicles will receive the certification for circulation starting with 2019.

Here's a list of vehicle manufacturers currently testing advanced technologies for autonomous driving:

Tesla Motors	Audi	Renault
Volvo	BMW	KIA
Ford	Volkswagen	Lexus
Mercedes-Benz	Nissan	Chevrolet

Google Driverless Car has no wheel, no foot pedals. And it is the first car in the world whose autonomous driving system officially received a driver's license (in the USA)! For now, this vehicle is only a prototype, but Google is sure they will release it on the market before 2020.

Well, in case of autonomous cars, it is estimated that the number of human victims will drop down to zero. From the statistical viewpoint, we cannot eliminate risks such as the malfunction of systems or the occurrence of situations which have not been estimated by the engineers. But even so, we would be talking about a few dozen or hundreds of victims. Which is 10,000 (ten thousand) less than now!

Is it worth the risk? I'd say it does. First of all, the comfort on board of an autonomous car is way over the understanding capacity of a regular driver. The passenger compartment becomes a place of rest or relaxation, a mobile office or communication space with the others. All of this, while the car safely drivers from A to B. Exaggerating a little, you could have the morning coffee directly in the car, on your way to the office. Or, you could take a nap while the car drives itself from Bucharest to Paris.

Basically, the modern man would gain at least two hours per day if he would replace driving with other activities. During one year, he would gain a month.

During a lifetime, approximately 5-6 years would be saved by using autonomous cars! Increasing the quality of life should be added to the advantages above, since instead of stressing out in the traffic, you just relax or become more productive. Thirdly, autonomous vehicles would substantially change the current landscape in the cities and the road infrastructures. Due to their sensors, autonomous cars can keep smaller distances between them, both on the sides and in the back/front, so traffic jams would be reduced along with the fuel consumption. Let's not forget that Artificial Intelligence does not apply the principle 'rules are meant to be broken', so any unorthodox behavior currently seen in many drivers, would be eliminated.

Urban overcrowding? It will be a thing of the past. Why?

Currently, cars represent an inefficiently used resources from the economic viewpoint: 90-95% of the time, the car is parked! In return, an autonomous vehicle could be used 90-95% of the time, so parking spaces outside the house or block of flats, office or supermarket would no longer be necessary. Autonomous vehicles would only stop to pick up /drop of passengers and luggage and then they would drive around like little ants…

Ok, so here we have a need for an extreme change of mentality: instead of buying a car (to own), you pay a fee to use it. That is a sort of combined rent-a-car + car-sharing system. Sounds outrageous? It's not. Think about the ratio between the cost of the car and hours of use. It is very small nowadays. But, using an autonomous car as indicated above, the costs would be cut back even by 80%! So, not only the rich would be able to use the services of an autonomous car, but ANYBODY, without requiring a driver's license.

WHAT ABOUT DISADVANTAGES?

I know what you are thinking: 'it sounds too good to be true. But..'. I would be a hypocrite not to think about the other side of the coin. The autonomous cars are mostly controlled outside them, using the infrastructure they depend on. Any major issue (such as technical issues or hacker attacks) could render an autonomous car basically unusable. Or even worse, it would be controlled to hurt the

The new Velodyne 'Ultra Puck' sensor has the size of a coffee cup, but includes LiDAR 3D sensors, able to capture 360 degrees panoramic images, 8 times per second, around the car, up to 200 meters (in 2015, it 'only' captured 2 such images per second). The estimated price is now USD 500, compared to USD 8,000 in 2014.

user, and some even fear terrorist attacks. What if the entire system fails? These are legitimate questions, the same as the ones regarding a possible asteroid or the rise of a super-volcano… It may seem exaggerated, but if autonomous cars become personal valets, would humans spend more time inside? There is a risk for a robotized society to end up just like in the animated movie 'Wall-E'. Or, on the contrary, if the manufacturers will build even more cars (since anyone would be able to use one), would we end up spending our lives in hellish traffic jams? And what about the right to privacy, since the permanent monitoring of autonomous cars would make us completely vulnerable against Big Brother. And let's not forget the millions of humans which would lose their jobs to autonomous cars!..

The list of complaints can go on. But in the end, I think that our major problem as humanity regarding autonomous cars is related to the attempt to delay giving up on this delusional control and freedom feeling rendered by the cars nowadays. All you have to do is consider the advantages and disadvantages included in this paper. And think about it long and hard before answering the initial question. Which could be rephrased like this: are you ready for a true transportation revolution? Since after more than a century of existence for cars, it is time to take a new step. A huge one. Which has the chance to change human society (for the better).