kriativ.tech

Edição Nº 8 – 02 de Julho de 2020
ISSN Print: 1646-9976 | ISSN Online: 2184-223X

http://www.kriativ-tech.com

DOI 10.31112/kriativ-tech-2020-06-30

Sustainable and Intelligent Mobility
Mobilidade Sustentável e Inteligente

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Abstract

Sustainable mobility and smart mobility are undoubtedly interconnected. With the increase in the population in urban centers, new solutions can be improved. This article explores the current mobility environment and the most relevant solutions being developed.

Keywords*:* Electric Vehicles, Autonomous Vehicles, Intelligent Mobility, Shared Mobility, Micromobility.

Resumo

A Mobilidade sustentável e a mobilidade inteligente estão sem dúvida interligadas. Com o aumento da população nos centros urbanos, novas soluções precisam de ser melhoradas. Este artigo explora o ambiente de mobilidade atual e as soluções de maior relevância que estão a ser desenvolvidas.

Palavras-Chave*:* Veículos Elétricos, Veículos Autónomos, Mobilidade Inteligente, Mobilidade Partilhada, Micromobilidade.

Introduction

Today, more than one billion cars and trucks move people and goods. It is remarkable that this scale was achieved with few changes to the modern car that was invented by Karl Benz and popularized by Henry Ford over a century ago. The principle of basic functioning of cars today is the same as in 1900: powered by combustion-powered fossil fuels, mechanically driven by a person and intended for various purposes.
However, road transport, as we know it, is unsustainable. More than 1.2 million people die

on the road each year, the equivalent of some of the worst epidemics, according to the World Health Organization[10]. Ninety-five percent of motor vehicles rely on fossil fuels for energy. The gases emitted by the engines of these vehicles account for more than one fifth of the world's carbon dioxide emissions, making them one of the most significant contributors to climate change. Average speeds in congested cities can reach 20 kilometers per hour, causing stress and productivity losses.

The current road transport model has remained stable due to its complexity. With a mix of public and private services, the automotive industry has strong interests and entrenched business models. Therefore, it is necessary to redesign the entire system to overcome the problems. The solution must meet the needs of all users, including business. Fortunately, technologies are being developed to build an integrated network of autonomous, connected, coordinated and shared electric vehicles. [7]

Connected Vehicles

These vehicles communicate with each other and with infrastructure through the digital cloud to enable hands-free calling, navigation, emergency response and personalized services. These services have been growing rapidly, the first unit of the Global Positioning System appeared in a private car in 1995 and is now a core technology, such as GM's OnStar and Ford's SYNC that have already been installed on tens of millions of cars. Logistics companies such as DHL and UPS use vehicle connectivity solutions to improve their fleet operations.

Sustainable and intelligent mobility

Intelligent mobility represents a conceptual model of urban development based on the use of human, collective and technological capital to increase development and prosperity in urban agglomerations. However, strategic planning for a intelligent mobility development in an urban area is a complex system because it encompasses many interrelated and interconnected human activities and interactions. Therefore, a competent transport system that can accommodate various travel needs efficiently is often desired. In the past, to improve the efficiency of a transport system, reliance was placed on providing transport such as building new roads, expanding road networks and increasing the number of means of transport. As a result, urban mobility has been suffering several consequences, such as urban sprawl, the high use of the private car with the corresponding congestion, making it unsustainable in many respects. In recent years, the intelligent sustainability of transport systems has become extremely important, mainly due to growing concerns about environmental issues and climate change. Vehicle emissions contribute to concentrations of carbon dioxide, sulfur dioxide, nitrogen dioxide and fine particles. In addition to environmental issues, other complex problems of a ground transportation system translate into traffic deaths and injuries, congestion, noise pollution, scarce resources and inaccessibility to facilities. Traffic accidents and congestion place a huge economic burden on society. Congestion also results in increased emissions of greenhouse gases and air pollutants.

Coordinated vehicles

These systems choreograph the movement of people and goods. Real-time data availability enables optimized traffic flow and parking. Most major cities, and publicly available services, already provide traffic information to help drivers avoid traffic jams. Intelligent parking systems such as SFpark and LA Express Park already allow drivers to use mobile applications to check parking availability and cost.

Shared vehicles

These vehicles serve several people over a day, in contrast to personal vehicles that are parked 90% of the time [8]. There are already dozens of companies that offer shared vehicles, such as Zipcar, Uber and RelayRides in the United States, Buzzcar in France and Car2Go in Germany and Portugal. Daimler Group recently acquired Car2Go and DriveNow, founding ShareNow. [9]

Vehicles autonomous

The companies that developed these products - Google, Tesla, Uber, and normal manufacturers such as Daimler, Volvo, GM, Toyota, Volkswagen, BMW - claim that the evolution of technology is happening and it will arrive in the near future. Google, for example, has a fleet of modified Toyota Prius and Lexus vehicles that have traveled millions of miles on public roads. [1]
Self-driving cars will free drivers' time and as these cars are less accident prone they need less safety features and therefore can be smaller and lighter than today's vehicles making them more efficient.
Convincing consumers and regulators that autonomous vehicles are safer in all situations, in road traffic, snow roads, building areas and schools is the biggest hurdle this solution will face. But increasing computer processing power, nanotechnology-optimized sensors and improved machine learning algorithms through 'big data' analysis will continue to accelerate progress. [2]

Electric Vehicles

Electric vehicles use battery-powered electric motors, which are usually lithium, or fuel cells, such as hydrogen ones.
Although the use of lithium-ion batteries has improved plug-in electric vehicles, their popularity is still limited by range, charging time and cost. Additional battery advances and reductions in vehicle weight will be required if plug-in cars have the same appeal as conventional cars. While there are commercial plans to launch hydrogen powered electric vehicles, developing a hydrogen refueling infrastructure remains a challenge.

Specialized vehicles

Specialized vehicles are designed for specific types of mobility and occupant numbers, making them more energy, space and cost efficient than most cars, which are often over-specified for their type of use. For example, 90% of US car trips carry one or two people, but most vehicles have four or more seats. While cars can travel at speeds of over 160 kilometers per hour, average speeds in cities are less than 50 kilometers per hour.
Autonomous vehicles specializing in the delivery or transport of passengers of various sizes are emerging, as by being adapted to a task, they can do it more efficiently.
Two-passenger light vehicles are ten times more energy efficient than a typical car. Autonomous and shared vehicles free up the time people currently spend driving and trying to park.
Connected and driverless vehicles prevent collisions, meaning fewer deaths, injuries and less property damage. Shared fleet vehicles reduce the need for parking, and lead to less intense traffic flows.

Micromobility

The last-mile problem refers to an issue that can affect even cities with the best public transport systems. Not everyone can live or work within walking distance of a metro or train station or a bus stop. Thus, cities still suffer from congestion, parking problems and excessive emissions of polluting gases.
Regulators know that they cannot always add more lines or stops, because that would cost too much or bring other undesirable results. At the same time, the distance problem discourages many passengers from using public transport. An integrated transport system that includes public transport and flexible alternatives such as micro mobility vehicles can help bridge the gaps.
Bicycles are a micromobility vehicle, but the vehicles that are conquering entire cities are electric scooters. They are easy to use, fast, and fun.
Companies have created small vehicle sharing options that allow people to “rent” transportation with convenient applications, with the user himself making the reservation, locating the vehicle and making the payment.

Emerging strategies in Portugal

In Lisbon, the City Council, the Portuguese Government and the Japanese organization NEDO - “New Energy and Industrial Technology Development Organization”, are collaborating to afirm the city as a samrt city, focusing on the areas mobility and energy efficiency.

In Coimbra, the Coimbra City Council and the University of Coimbra have launched a strategy called "Coimbra, Intelligent and Creative City" to place ICTs at the service of citizens in the areas of energy, mobility, health, tourism and governance.
In Oporto, the Municipality of Porto and the Competence Center for the Cities of the Future, of the Faculty of Engineering, University of Oporto are collaborating on a project within the EC Framework Program to transform the city into a living lab for experimenting with mobility, security and safety solutions. quality of life.
Faro was one of the cities elected to receive IBM support under the "Smarter Cities Challenge" with a view to defining a strategy and implementing actions related to smart cities focusing on the sea economy.

Conclusion

Many people simply like to drive or do not like to share their vehicles. Others feel that we should invest in public transport such as trains, buses and micro mobility mobility systems (such as bicycles and scooters). Still others wonder whether the reliability and safety of autonomous systems can even offer driverless travel.
Even though connected, coordinated, shared and driverless vehicles are not the perfect choice, they are modes of transport that should be explored. The market will eventually determine which of these models can succeed, in the future.
Technology is no longer the biggest obstacle. We need to implement prototypes in representative cities so that we can learn the general principles of operation. This learning process is essential to ascertain what is possible, to identify what consumers like and dislike, to determine which business models are attractive and to avoid less desirable consequences. [6]
This is a universal opportunity to assess the safety benefits and reliability of real road connected vehicle systems.
Once proven and regulated, prototype systems must scale quickly.
Sustainable and smart mobility is a team sport. We must bring together technology, systems design methods and business models to provide the best mobility at a low cost to consumers and societies. After years of struggling to reinvent the car, the question that remains to be answered now is: *How do we achieve what is already possible*?

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