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Urban, Road and Rail Transport of the Future

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ABSTRACT

This article aims to present the major innovations that should occur in land transport (urban, road and rail) in the future. Land transport means transport people and cargo within cities and carry out exchanges between surrounding cities, states and countries, contributing to the economic and social development of a country or region.

Keywords: Urban transport of the future, Road transport of the future, Rail transport of the future

INTRODUCTION

This article aims to present the major innovations that should occur in urban, road and rail transport in the future. Land transport means transport people and cargo within cities and carry out exchanges between surrounding cities, states and countries, contributing to the economic and social development of a country or region.

THE LAND TRANSPORT OF THE FUTURE

What will future land transportation look like (Baldwin, 2019; Wal, 2019; Exame, 2015; Teixeira, 2019; Qual Imóvel, 2022). In urban centers, local governments will encourage the use of means of transport that follow the trend of smart and sustainable cities, interconnected by access roads controlled by various devices that use artificial intelligence and the internet of things (IOT) to maintain agile traffic. It's safe. The prioritized means of transport will be subways, trains, bicycles, scooters, walking and Bus Rapid Transit (BRT's). Transport systems will feature technologies such as robotics, internet of things (IOT), applications and more modern collection systems. ITS (Intelligent transportation Systems) solutions will monitor in real time everything that happens in the bus system and will create an interface with other modes of urban mobility. The main function of conventional bus lines will be to connect the most distant neighborhoods in conjunction with the metro lines.

Drones and flying vehicles will fly over city streets, ensuring greater safety, mobility and speed in the delivery of products and people, respectively (Teixeira, 2019). The streets will have extensive cycle paths, in addition to numerous exclusive lanes for BRTs powered by hydrogen, which is considered by the International Energy Agency (AIE) as the fuel of the future, whose biggest challenge is the production of clean hydrogen on a large scale. Widely used, subways and trains will be essential in metropolises. Cities in metropolitan regions will no longer be isolated from capitals, taking into account that high-speed railway lines will cut through several municipalities (Teixeira, 2019). Real-time monitoring will allow control of traffic light intervals, according to traffic flow, to avoid congestion. The information will be displayed at train and bus stops, public parking lots and displays in various locations. People will be able to plan, even at home, the use of different modes of transport, thanks to the evolution of applications, including the famous Global Positioning System (GPS) (Teixeira, 2019).

The metro will be the main means of public transport in large cities, which will significantly reduce greenhouse gas emissions. One of the technologies used by this means of

transport will be Hyperloop, which will allow many people to move over a long distance in a short space of time. Trains will magnetically levitate in airless tubes, reaching speeds of 240 mph to 720 mph, and will connect different neighborhoods in metropolises, often supplying cities in metropolitan regions. Comfortable trains with fast speeds will be common and will avoid motor vehicle congestion on highways. Most railway lines in the world's main capitals will be powered by renewable energies such as solar photovoltaic and hydrogen (Teixeira, 2019; Alves, 2018).

The driverless system, that is, without a driver, will be fully operational (Teixeira, 2019). Subways, trains and buses will be driven remotely using software, providing greater safety, speed and comfort for passengers, as it will be possible to control the speed, the interval between them, and even the time the doors are opened. Using the driverless system, it will be possible for the subway to reduce the intervals between one train and another and increase passenger capacity. Furthermore, perfect synchronization of trains will avoid sudden stops and contribute to reducing energy consumption. Trains will be powered by solar energy and hydrogen with the abandonment of diesel from the railway network (Teixeira, 2019). Transport companies and suppliers will use resources such as artificial intelligence, internet of things, network speed and big data with the aim of enabling more effective payment systems and the integration of modalities so that subways and buses can be used more widely by the population (Teixeira, 2019).

Trains that operate at speeds of more than 200 kilometers per hour can be considered high-speed (Lobo, 2020; Wikipedia, 2022). The first high-speed rail system began operations in Japan in 1964 and was known as the bullet train. Twenty-seven countries around the world currently have high-speed trains, with trains that can reach more than 400 km/h. The continents of Asia and Europe have the largest fast railway networks that transport passengers and cargo. In South Korea, there are a total of 1,104.5 km of tracks for fast trains, with a further 425 km expected soon. The maximum speed for trains in regular service is currently 305 km/h. Turkey is 621 km long, the expansion of which will take the country to more than 2,000 km of tracks for fast services with trains operating at speeds of up to 250 km/h or 300 km/h. Italy is 1,467 km long and trains are operated at a maximum speed of 300 km/h. In the United Kingdom, high-speed rail has 1,527 km of track with four railway lines operating at maximum speeds of 200 km/h. In Sweden, many trains operate at 200 km/h with a total of 1,706 km of track for fast services. Japan has 2,764 km of fast train services that reach a maximum speed of 320 km/h. France has 2,647 km of tracks in addition to 670 km under construction. Germany has 3,500 km of lines, both operational and under construction, with trains reaching speeds of up to 300 km/h. Spain has 3,240 km of tracks and trains that reach speeds of up to 310 km/h. China has 35,000 km of high-speed rail.

On railway lines, preventive maintenance will be carried out by autonomous drones, there will be driverless trains traveling safely at high speeds, freight will be automatically sent to its destination and smart technology will be designed to improve the passenger experience and enable ticketless travel. There will be the improvement and dissemination of automatic steering systems on trains, which will further optimize travel times and may put an end to delays. Smart robots will build new railway infrastructure and modernize old ones. Technological advances will also be vital to improving the user experience, providing accurate real-time route information and enabling uninterrupted access to work and entertainment while traveling via 5G wireless internet networks. The exceptionally quiet and efficient magnetic levitation technology employed in the fully automated Transport System will also allow the system to serve as a space-saving and low greenhouse gas emission alternative. The system will operate at speeds of up to 150 km per hour, being able to move up to 180 containers/hour individually and completely electrically (Mobilize Brasil, 2021).

One of the problems of urban transport systems is the lack of coordination between different modes of transport. People want to know how to get from A to B as easily as possible, whether on foot, bike, motorbike, subway, bus, train, Uber or taxi - or a mix of some or all of them. In the past, we didn't have enough data. Now we have. In addition, we will be able to count on our connected smartphones at all times to help us visualize it all. The application would inform you the fastest way to reach your destination by combining all integrated means of transport, be it an electric car, subway, bus or taxi. There will be a proliferation of electric vehicles. Shared, fully electric and progressively autonomous flying vehicles, with the ability to take off and land vertically, will cut through the skies of cities. To this end, the tops of buildings belonging to partner companies in air transport services will function as take-off, landing and fueling points (Teixeira, 2019). People will increasingly use shared and/or private, fully sustainable electric scooters as an alternative to the subway or bus (Teixeira, 2019).

The automobile of the future will be increasingly autonomous, more electric, more connected and shared. Electric and autonomous vehicles appear to be the main drivers of the crucial transformation in city transportation (Exame, 2015). Autonomous vehicles, therefore, already exist and this is not a futuristic project (Wal, 2019). The idea is to strengthen public transport. So, in a smart city, people can get rid of their cars, which pose a threat to the health of the population by congesting our cities and compromising air quality with the use of fossil fuels. In many countries, buses and other driverless transport systems are being tested as autonomous vehicles. Public or private autonomous vehicles will connect us from our home to a transport hub. There are already driverless buses in the canton of Schaffhausen, Switzerland, which circulate around the city of Neuhausen am Rheinfall picking up and dropping off passengers while navigating traffic (Wal, 2019). An employee inside the bus can take control of the vehicle from a remote control, in case of any unforeseen circumstances.

In the future, highways will not be as unsafe as they are today. Vehicles will not have drivers and will not emit polluting waste into the air. Highways will be controlled by sophisticated technologies that communicate with cars, extract energy from the Sun, integrate road infrastructure and GPS systems (Qual Imóvel, 2022). The highways of the future are already being designed. The highways of the future will feature advanced solar panels that will generate clean, renewable energy and wirelessly charge moving or parked electric cars. The panels will also have LED lighting and heating elements to melt snow wherever it exists. Electric cars are expected to become common on the roads of the future, as scientific developments will greatly improve the performance of batteries and the potential for increased electricity storage. Fully automated navigation systems will also allow roads to become populated with driverless cars which could change the design and operation of highways and provide safety and environmental benefits. Vehicles will become increasingly "smart", which, with a combination of the connected vehicle and the Internet of Things, will enable cars to transmit and receive information about traffic, speed, weather and potential safety risks.

CONCLUSIONS

Based on the above, the extraordinary advances in land transport technologies that will occur in the future will contribute to the economic and social development of humanity.

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