



A Pandemic-Resilient Transportation System Paradigm

In the Winter 2020 issue of this magazine, I wrote about COVID-19 and the constraints that it brought to our lives, including obstacles to the meaningful and purpose-led operations of our transportation systems. At that time, I stated, “Why not turn such an occasion into a challenge to envisage and embrace a transformation in transportation systems toward enabling sustained, disturbance-tolerant mobility services? This should become our ultimate goal and the new norm while designing, developing, and implementing the next generation of intelligent transportation system technologies, products, and services.”

Since then, I have not stopped thinking about the scale of the impact of the current pandemic on all aspects of our lives, including transportation systems. This is because many countries are still heavily affected by the COVID-19 pandemic, while other countries have remained on their current trajectory of low infections and can see signs of new infections being promptly contained. As I write this editorial (in November 2020), a few

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“lucky” countries believe that they can hold a firm grip on the virus’ chains of transmission and that the virus is even more likely to die out rather than be spread within their boundaries in the immediate future.

However, some epidemiologists warn that suppression rather than elimination is our new reality, and so we have to learn how to live with the virus whether its

occurrence is on an epidemic or pandemic scale. If such a view is accepted as a rational opinion on the realism of our contemporary civilization, then it would make sense to start thinking about making our transportation systems pandemic resilient. To be socially acceptable, such a system should be pandemic compliant in the context of accommodating requirements for social distancing and infection-transmission compliance.

Thus, the main guiding principles of the pandemic-resilient transportation system paradigm that I am proposing in this editorial include:

- The system is to be fully functional, decentralized, and distributed spacewise.
- The system’s human constituents—pedestrians, drivers, and autonomous vehicle passengers, also called *transportation participants*—are situated at the lowest level of the

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system hierarchy, which can be, for the time being, named the *mobility navigation level*. It is anticipated that transportation participants will be either managing their own mobility or carried by their autonomous driving platforms (i.e. autonomous bicycle/bikes and/or driverless vehicles)

- To protect themselves from being affected by a virus or avoid transmitting their virus to others, transportation participants should be surrounded by physical barriers, i.e., encapsulated in a space that completely surrounds and moves with them
- If transportation participants are to ride in driverless vehicles, then their vehicle platforms are either single-seat or family cluster driverless vehicles. The design of mass transport carriage should be pandemic and epidemic compliant
- Transportation participants are also equipped with transmitters and receivers to communicate with the higher levels of the system's hierarchy, i.e., the "supervision, coordination, and decision-making" level.
- The supervision, coordination, and decision-making level is to be cloud based. All of its functions should

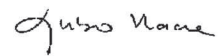
be fully automated, and their execution should be led by intelligent control and artificial intelligence-based decision-making algorithms.

- This pandemic-resilient transportation system paradigm represents not just one of the possible embodiments of cyberphysical systems (CPSs) but is, at the same time, an essential element of CPS systems (CPSSs) [1]
- Since the global society must be prepared to deal with new, yet unknown, emerging epidemic and pandemic situations, the research into the pandemic-resilient transportation system paradigm should start now. A pandemic-resilient transportation system must be designed, developed, and made ready for the global society to use immediately. This development should take place simultaneously with the further development of contemporary intelligent transportation system products and services, in particular as parallel driving and digital quadruplets for CPSS concepts have already been well defined [1], [2]. Such a commitment is seen both as an act of realization and as a result of the accomplishments of parallel emergency management systems, and thus, financial investment in

the design, development, and prototyping of a pandemic-resilient transportation system is socially acceptable and justifiable.

The fine details of each of these guiding principles, which, of course, are yet to be addressed, are outside the scope of this editorial and will be subject to rather deeper scientific consideration in the future. Thus, I leave the idea of the pandemic-resilient transportation system paradigm to your scrutiny, hoping that it will motivate your future work and submissions to our magazine.

Please contact me if you are interested in sharing your thoughts or would like to provide an expert opinion on this topic with the ITS community and/or composing a special edition of our publication, accordingly. I am just a phone call or an email click away.



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