



## Smart Transportation: A Primer

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DOI: 10.23956/ijarcsse/V7I3/01312

**Abstract**— *Smart transportation is an important component of the smart city. It refers to the application of information and communication technologies to road transport, infrastructure, vehicles, and users. It improves safety, increases productivity, and ensures greener environment. This paper provides the basics of smart transportation, including its enabling technologies, applications, and challenges.*

**Keywords**— *smart transportation, intelligent transportation, connected transportation*

### I. INTRODUCTION

Transportation is an important factor that affects the quality of life. Its development is regarded as the most significant driver for social progress. Transport network connects cities, nations, manufacturers, and retailers. Transportation enables mobility, allows people to interact, and facilitates the growth of economy since it enables delivery of goods and services around the world. Modes of transportation include air, sea, and land.

“To accommodate increasing transportation demands and provide safe and efficient travel in U.S. communities, it is estimated the nation’s highway and bridges will need \$290 billion in investments, transit systems \$18 billion and airports \$50 billion over the next five years” [1]. A number of cities have started using smart transportation as a solution to transportation-related problems.

Smart transportation (and its cousin, intelligent transportation system) offers a means of providing innovative services on different modes of transportation and traffic management. It is an important area in the smart grid and an extension of smart cities. Its components include infrastructure, vehicles, and users.

### II. ENABLING TECHNOLOGIES

Smart transportation is enabled by a number of technologies, Fig. 1:

- **IoT:** Smart transportation is being influenced by communications networks and the Internet of things (IoT). IoT connect billions of smart devices [2]. Connected smart cars, buses, trains, and air planes will allow people to always stay connected to the Internet. However, IoT privacy and security concerns are serious.
- **Wireless Technologies:** Several wireless technologies have been proposed to smart transportation, but there is lack of consensus as to which technology is the best [3]. Smart mobile devices are used in route planning, navigation or road guidance (GPS), carpooling, and parking information. Cellular phone systems, such as Wi-Fi, and Bluetooth, create a field of data connectivity.
- **Sensing Technologies:** With sensors, RFID, and other connected technologies, it is feasible to connect everything (traffic lights, road signs, etc.). These sensors are used in sensor-enabled consumer devices.
- **GPS:** A navigation system such as global positioning system (GPS) allows the user to find the best route based on real-time conditions. More and more vehicles have in-built GPS (satellite navigation) systems. But Google maps and similar navigation systems are replacing built-in GPS systems. Two smart cars will override the drivers and avoid collision if they know where they are.

### III. APPLICATIONS

Smart transportation applications are often large and complex since they need to handle heterogeneous, dynamic devices such as mobile vehicles and roadside units. The following are common application areas for smart, intelligent transportation, see Fig. 1.

- **Smart Cities:** Applications of smart transportation services have led to the rapid growth in smart cities all over the world. The goal of smart cities is to achieve high quality of life through the use of technology and environmentally friendly practices. The users are empowered to decide where and when they want to travel [4].
- **Smart Vehicles:** Transportation infrastructure (consisting of smart traffic lights and camera network) can help autonomous vehicles find their way. Vehicle-to-vehicle communications will enable autonomous vehicles to communicate in real time.
- **Electric Vehicles:** Electric vehicles need power charging infrastructure which will compose of charging stations and diverse vehicles. Battery-charged power sources may serve as back-up power source. Drivers can charge their vehicles at homes, offices, charging stations, public places, etc. [5].



Fig. 1. Smart Transportation's enabling technology, applications and challenges

#### IV. ISSUES WITH SMART TRANSPORTATION

Implementing smart transportation will save money, increase safety, reduce gas emissions, increase efficiency, and provide a better quality of life. It will also increase the sustainability of how goods and people migrate from one place to another [6]. Yet the technology is not without its challenges. Critics against implementing smart transportation highlight some challenges: privacy protection, security, regulation, and sustainability. Due to security, many users/drivers are hesitant to provide their credit card information to a app-based transportation service provider. Security experts claim that the system is vulnerable to attacks and hacks. This may endanger public safety [7].

Since resources are limited, transportation problems will always outweigh available resources. Awareness about smart transportation is still low in developing countries, where the infrastructure is the main obstacle for implementing smart transportation [8].

#### V. CONCLUSION

Several cities have started implementing smart transportation. Smart transportation must accommodate existing transportation infrastructure and facilitate transition from the existing to future structure. It will have an impact on our social and economic life. It will address all aspects of transportation including smart driving, smart parking, smart rapid transit, pollution, and security system. Smart transportation will provide higher efficiency of whole transport system, less traffic accident, less commute time, and better passenger experience [9]. The global smart transportation market will keep growing.

#### REFERENCES

- [1] D. Levy, "Getting smarter about transportation," *The American City & County*, vol. 112, no. 4, April 1997, pp. 28-30.
- [2] M. N. O. Sadiku, S. M. Musa, and S. R. Nelatury, "Internet of Things: an Introduction," *International Journal of Engineering Research and Advanced Technology*, vol. 2, no.3, March 2016, pp. 39-43.
- [3] "Intelligent transportation system," *Wikipedia*, the free encyclopedia, [https://en.wikipedia.org/wiki/Intelligent\\_transportation\\_system](https://en.wikipedia.org/wiki/Intelligent_transportation_system)
- [4] M. N. O. Sadiku, A. E. Shadare, E. Dada, and S. M. Musa, "Smart Cities," *International Journal of Scientific Engineering and Applied Science*, vol. 2, no. 10, Oct. 2016, pp. 41-44.
- [5] H. J. Kim et al., "An efficient scheduling scheme on charging stations for smart transportation," *Security-Enriched Urban Computing and Smart Grid. Communications in Computer and Information Science*, vol 78, 2010, pp. 274-278.
- [6] L. Schewel and D. M. Kammen, "Smart transportation: synergizing electrified vehicles and mobile information systems," *Environment: Science and Policy for Sustainable Development*, vol. 52, no. 5, Sept/Oct. 2010, pp. 24-35.
- [7] S. Greengard, "Smart transportation network drive gains," *Communications of the ACM*, vol. 58, no. 1, Jan. 2015, pp. 25-27.
- [8] A. Tedjasaputra and E. Sari, "Sharing economy is smart city transportation services," *Proceedings of the SEACHI 2016 on Smart Cities for Better Living with HCI and UX*, May 2016, pp. 32-35.
- [9] "Smart transportation: Maximize mobile network's value beyond connectivity," [http://www.huawei.com/en/industry-insights/mbb-2020/trends-insights/smart\\_transportation](http://www.huawei.com/en/industry-insights/mbb-2020/trends-insights/smart_transportation)

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