

Chapter 11

Smart Roads and Parking

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ABSTRACT

The past few years, innovation and technology have reached new heights, much beyond laptops, iPads or smart phones. Innovation and technology is progressing with each passing day. The concepts of smart cities, smart homes, and smart vehicles, are being implemented all over in developed countries. Objects here can get connected to the internet, collect data, and channelize it in order to ease our day-to-day life. The current genre of vehicles is equipped with various kinds of sensors, CPUs, and a software system that has communication capabilities. The increase in population has resulted in more vehicles, congested streets, limited parking spaces, and compromised road safety. Research and industry have proposed many technological advancements, and incorporated a few, in vehicles, but improvements for roads have largely gone unexplored. Smart roads, or Smart highways, are the terms used to define roads having IoT-enabled technologies like smart sensors, wireless connectivity, big data, and cloud computing. They use Solar technology to minimize electricity consumption, making the technology energy efficient. Researchers claim that, in the near future, smart vehicles will not be functional without proper smart roads and smart parking systems. Smart roads and parking contribute to making the drive safe, green, and convenient. They provide real-time information to drivers regarding traffic congestion, weather conditions, natural emergencies, e.g. landslide on the mountains, ice on the roads on high terrain, etc. Smart parking systems help drivers with information regarding available parking spaces as well as warnings about incoming traffic. Smart roads are also conceptualised to be equipped with wireless electric-charging systems and electric-charging stations. Electrical energy generated by the vehicles can be used to light streetlights to provide safe navigation to drivers at night. In this chapter, the concept of Smart Roads and Smart Parking systems is elaborated in a comprehensive manner. Various technologies are highlighted which reduce traffic, limit electricity use, significantly increase safety on the roads, and design a way to use parking spaces more effectively without the need to build new roads/parking spaces. The chapter elaborates various technologies that will lay a strong foundation for smart roads such as transforming legacy roads to smart roads, solar road highways, etc. The chapter also elaborates on transforming traditional parking systems into smart parking systems.

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INTRODUCTION

In the era of 21st century the population has crossed almost over 8 billion with increase in people's need for transportation. With the staggering rise in the economy and affordable car price, the number of vehicles on the road have shown tremendous growth. People go on outing to movie theatres, shopping malls acquire a lot of parking spaces resulting in shortage of parking spaces. With a lot number of vehicles moving on the road, traffic jams, pollution, congestion on roads and limited spaces for parking often frustrates the commuters. To overcome these problems, the researchers have proposed technological IoT solutions incorporated on roads and parking. Various IT engineers have conducted research and developed significant technological solution in order to make our lives easy. One of the important concern that should be taken into accounting is, regular problem we face every day and how can we overcome it. The chapter discuss basic transportation problems faced by the drivers such as traffic jams, no parking spaces, etc., followed by the existing technologies that are currently used such as traffic lights and unorganised parking systems and their limitations. The next leads to the proposed technology, which include future smart roads such as rethinking roads that can examine the future of highways and transportation looking into the insights of long term drivers and produces a future vision for highways. The chapter the moves ahead with describing the possible future with innovative technologies such as the concept of autonomous cars, electric bicycle schemes, one transport etc. Next section is about various concepts like Smart pavements which include features like radio-connected sensors built on the road to monitor pavement's conditions, solar roadways project which charge the road using photovoltaic cells and applications of smart roads such as Virginia smart roads and honking roads in India. Further we will discuss about the smart parking system using RFID technology, IR Sensors etc. finally the chapter is concluded highlighting the limitations and future research of smart roads and parking system (Wang, Zeng, and Yang, 2006) (Varaiva, 1993).

Current Road Traffic and Parking Conditions

Economic and fast development has promoted rapid urbanization and introduced various changes in the metropolitan cities. Fast motorisation and lack of space are the most highlighted issues amongst the essential variables affecting the mobility and availability within a city. Extreme utilization of the private vehicles has adverse impact over the earth and human mass, in general everywhere, yet private vehicles are being favoured upon and is considered as a helpful method of communication. The present task centres around the normal issues and difficulties faced due to extreme difference in availability of parking spaces in various metropolitan cities of the world.

The vital questions here that needs to be focused are:

- Do highly populated cities of the world face any problems in parking and if so, what are they?
- What are the technological solutions to these problems?

If we carefully examine, we can easily observe that most of the private vehicles are parked for about 95% of the time duration in a day. Parking problems affect, not only vehicle owners but almost everyone. Ranging from fellow drivers to traffic controllers, pedestrians to security guards, everyone is affected from parking problems. Chaotic parking prompts traffic blockage. Disorderly parking can likewise prompt clashes between vehicle proprietors and individuals can get extremely baffled in the event when

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