



Smart Transportation System

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Abstract

Due to the importance of the transportation system and its impact on the general situation of the city, the purpose of this paper was to explain the transportation system, its importance, how it works, and the problems it may face, as well as to explain the urban transportation plan that can be followed to reduce the problems of the transportation system.

The paper concludes the importance of introducing of different techniques in transportation planning and implementation of the smart transportation project, which applied depends on several issues, like: the need for a legal framework that supports smart applications and services, ensure a strong ICT infrastructure and encourage foreign and local investments to raise the city's economy and support the development of smart transportation project.

Keywords: *Transportation System, Smart Urban Transportation Plan, Traffic jams.*



1. Introduction

The sectors and systems in the city differ in their importance in influencing the general situation of the city in economic, social and environmental aspects, but the transportation system is one of the most important systems and most influential of the city development. This could be explained due to its ability to link all the systems of the city and its parts and residents, which ensures the continuity of the work of each system or sector and its effectiveness in providing services to citizens.

The advent of the industrial revolution and the noticeable increase in population numbers, resulting in increased pressure on the transport network and the emergence of many problems with deficiencies in the services that provided by it, this adversely affects the rest of the city's services and also significantly affects the economic growth and the natural environment of the city.

Given the importance of this system; a greater attention and focus should be given to the development of solutions that help in support and ensure the continuity of the system work in a manner that achieves the goals of sustainable development and the welfare of the members of society. Since we are in the era of information and communication technology (ICT), the so-called smart cities emerged, where we can take advantages from its smart projects such as smart transportation project, in solving the several problems that facing the transportation system in less time, effort and cost (Sadek and Saffour, 2013).



The purpose of this paper is to highlight the city's transportation system, in terms of:

- 1- Explain the transportation system, its importance and how it works.
- 2- Explain the problems that facing the transportation system, its causes, and how it affects the nature of the system's work.
- 3- Explain the Smart urban transportation plan that can be followed to reduce the problems of the transportation system.

2. Transportation System

The transportation system is one of the most important systems in the city. It is similar to the network of nerves in the human body that connects all parts of the body to each other. It connects all parts and systems of the city and its inhabitants to each other, thus can lead to facilitate the movement of the population and goods, and improve the status of different sectors in terms of the efficiency of services that provided to citizens and the possibility of achieving sustainable development in the environmental, economic and social aspects, The basis for the success and development of any city depends on the existence of an effective transportation system capable of meeting the needs of present and future generations(Dumitru *et al.*, 2016).

The benefits of transportation system can be achieved through the depending on these three basic components (Boyce, 2009):



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- Transport vehicles: move of people and goods from one place to another in a way that reduces traffic jams and traffic accidents and also saves the environment from toxic emissions.

- Space or roads: a network of roads that connected to each other to facilitate movement from one place to another

- Instructions or procedures that helping in control the movement of people and vehicles in the roads.

2.1 Transportation system problems

While the transportation system has positive effects, it has many negative effects that lead to many failures and problems in the system (traffic jams are the significant example of these problems).the occurrence of traffic jams affect all aspects of the city such as state of the road and deteriorating the social, economic and environmental conditions in the city (Boyce, 2009).

So what is the meaning of traffic jams and its impact on the city and traffic situation?

What are the causes of traffic jams and the failure of the transportation system?

All of these questions will be answered in this research paper as follow;

2.1.1 Traffic jams and its impact on the state of transport and traffic



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Traffic jams means a rise in the number of vehicles on the roads and the inability of these roads and intersections to absorb traffic flow precisely at peak hours. The occurrences of this type of problems depends on a number of factors, such as increasing the number of public and private transportation means, as well as the increase in the number of social, recreational and economic activities in urban cities. The appearance of these problems leads to increased pressure on roads and thus deterioration in the level of road services, the forms of this deterioration are (corrieia and wuenstel, 2011):

- High running cost for different transportation methods.
- Disables access of emergency vehicles to their destination.
- High levels of noise and air pollution caused from vehicles.
- Increase the arrival time of goods and passengers to their destination.
- Increase the probability of accidents.

2.1.2 The causes of traffic jams and the failure of the transportation system

One of the most important aspects that negatively affects the transportation system and leads to its failure, is the existence of defects in how to manage all aspects of the system, and these defects represent as (corrieia and wuenstel, 2011):

- Poor regulation of signal time commensurate with the volume of traffic.
- Lack of commitment in the tracks that specific for roads.
- Non relying on digital techniques in regulating the traffic.
- Designing road in a wrong way.



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- Ignoring of land uses regulation.
- Neglecting the regulation of public transport.
- Lack of public parking spaces especially in commercial places.
- Weak of policies and procedures that controlling road traffic.
- The lack of commitment of drivers to the speed specified in the roads and thus increases the probability of traffic accidents.

3. Smart Urban Transportation Plan

To reduce the multiple problems that facing transport and traffic, a smart and innovative plan based on a study of the traffic situation in the city must be followed, and this is done by collecting data and managing, organizing it using different databases and then getting the existing situation reports, after obtaining these reports we can determine the traffic situation in the city and the nature of the roads, the uses of surrounding lands and places of concentration of traffic jams, then, either do preventive planning and immediate treatment of problems which do not require a feasibility study and the high financial costs, or do the long-term planning and treatment, which depends on the development of a smart urban transportation plan which includes the development of smart transportation project, the determination of what it need of information and communication technology, and the key performance indicators (KPIs) ,through which it is possible to ensure that the smart plan is implemented effectively depending on a set of principles such as comprehensiveness, comparability, availability, independence, simplicity and timeliness.



And this plan can be done only after the adopted of the political approval of the plan, figure (1).

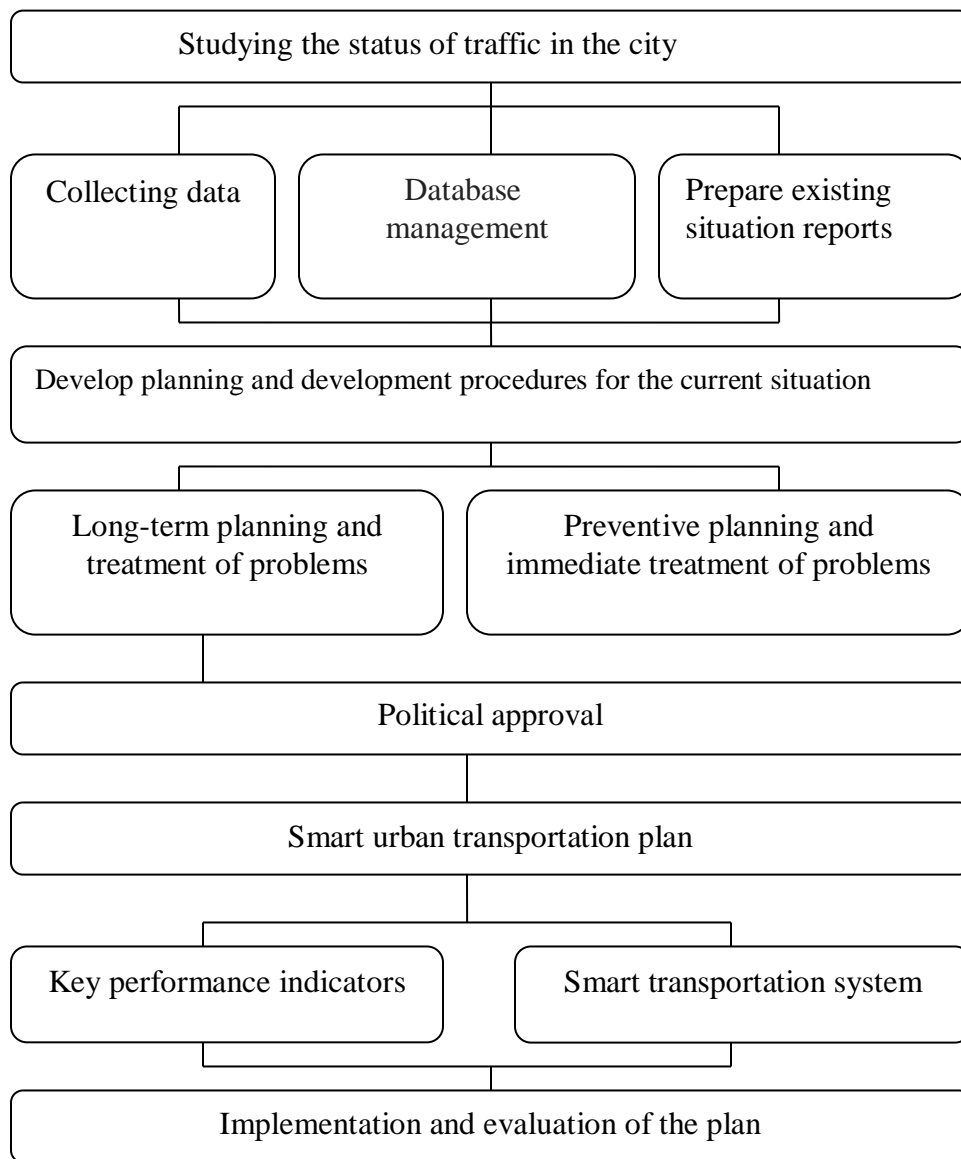


Figure (1): Suggested approach to Smart transportation planning



So what is the smart transportation project and what are its requirements and the challenges it can face?

3.1 Smart transportation project

The Smart Transportation project is based on a modern, innovative system that integrates ICTs in roads and vehicles to get different information of the performance of transportation facilities and transportation demand as well as information on weather, environmental conditions, traffic accidents and places of its occurrence, in order to access safe and sustainable transportation systems that rely through its work on modern electronic systems (Kueper, 2008).

This type of project focuses on the development of transportation services in the city and access to smart services that meet the needs of citizens and their desires and in this project must identify of the necessary investments and develop feasibility studies and costs related to its implementation.

3.1.1 Smart transportation project requirements

In order to implement the Smart transportation project efficiently, there must be many digital technologies, such as (corrieia and wuenstel, 2011):

- Data collection techniques, such as monitoring cameras and sensors.
- Data processing technologies that are hardware and software that process the data collected.



- Information transfer technologies such as smart traffic lights that transmit data processing results on the ground, and this is done by linking traffic lights to its control systems such as Sydney Coordinated Adaptive Traffic System(SCATS), which depends on the sensors that are placed near parking line in the roads and collects data and sent it to the control center, and thus the ability to control the time of light signal commensurate with traffic density, then traffic jams can be minimized and reduce emissions of air pollutants (Wilson *et al.*, 2006).
- Geographic Positioning System (GPS), which helps in positioning while driving.
- Geographic Information System (GIS), which helps to analyze road networks and find the best tracks.

3.1.2 The Challenges of creating an smart transportation project

There are many challenges that may face the creation of smart transportation project, such as (Sadek, 2013):

- The need for a national vision and a legal framework to support the implementation of smart projects.
- Challenges related to security concerns, such as hackers and manipulators with software, viruses, and hidden programs.
- Challenges of the costs of some ICTs.
- Poor ability of individuals to deal with technologies in the early stages.



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- Weak ICT infrastructure, such as quality and speed of communication, information transmission and electronic connectivity.
- Weak communication and integration between the stakeholders involved in the implementation of smart projects.

4. Conclusion and recommendations

One of the most important problems affecting any city development economically, socially and environmentally is the problem of traffic jams. There are actually many solutions that can limit this problem such as traditional solutions, which expand existing roads, built new roads or build tunnels and bridges. But with the importance of the role of these solutions in addressing the problem of traffic jams and the negative effects on the city and the surrounding environment, it takes a long time and very expensive costs when applying it. Therefore, it is necessary to think about developing innovative solutions that are distinguished by easy, fast and low cost when applied it. These solutions are called as smart solutions that make the new transportation system smarter than the traditional one, and this is depends on the use of ICTs which are integrated into the planning of transportation systems for access the more efficient and effectiveness systems, and this is as a competitive advantage for these systems and it makes it more flexible and responsive to the increasing of demand on transport.

So there are some issues that we need to pay attention to when shifting from traditional to smart transportation systems such as; The need for a legal framework that supports smart applications and services, Preparing a smart urban plan that includes how to exploit the different technologies in serve and develop the transportation system, Ensure a strong ICT infrastructure, as well as the need of Awareness campaigns that help officials and citizens understand the importance of smart transportation project in the city and teach them how to deal with different applications, Encourage foreign and local investments to



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raise the city's economy and develop smart project, Provide ways for cooperation and communication between stakeholders and clarify the objectives and responsibilities of each, and the development of strategies to ensure the security and privacy of the information on which the smart project are based.

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