

Proposed Parking System Model for Vehicles in Smart Cities

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Abstract—Given paper highlights a proposed model to troubleshoot vehicular parking problems by developing a universal user interface platform based on cloud computing which will enable users to park their vehicles without significant problems. System will show the users their parking spaces available throughout the city; users will have their own accounts which will reflect the list of vehicles they own, their exact locations, history of allotted parked spaces and different payment methods. If the user lose their unique payment card, they will also have a backup method of payment by using their smartphones. System will also have security protocols for its protection from external threats. As smart cities are developing in India, concepts like this becomes of paramount importance. This system is capable of decongesting regular parking problems in parking lots available throughout the city, since it is based on a single platform the overall user experience will be enhanced to a greater extent. Given work attempts to explain one such model which will reduce the inconvenience for the users and their vehicles.

Keywords: Smart Parking System, Smart City, Cloud computing, smart mobility

1. INTRODUCTION

The world is growing at a very fast pace with high level of technological advancements. Globalization is now reaching to almost every corner of the world at a very rapid rate. Metropolitan cities in India are advancing and leaping the barriers, but still the development pace is in mismatch with the pace of technological advancement.

Due to this mismatch there are problems which creates a lot of chaos among the civilians. Problems such as air pollution, noise pollution, mental frustration, time wastage, wastage of resources like fuel, electricity, money etc. These problems are creating a lot of havoc in the environment of city. In addition to this, the narrower roads in cities have worsened the situation [1].

Parking of vehicle is one of the basic necessities required in a city. Globalization has increased the standard of living of the people to much greater extent. This has resulted in steep increase in sale of vehicles in past decade. User park their vehicle at a place where they feel its safety is optimum and nearest to its destination. The current status of the cities is that

the user has to spend an ample amount of time to find the spot which is both safe and near to his destination.

Nowadays, the term “Smart City” is very widely used in spatial planning literature or urban research. From literature the term is used for various aspects, which range from smart city as an IT-district to a smart city regarding the education of its inhabitants. Smart city is used to discuss the use of modern technology in everyday urban life.

This includes not only information and communication technologies (ICT) but also, and especially, modern transport technologies. Logistics as well as new transport systems as “smart” systems that will improve the urban traffic and the inhabitants’ mobility.

Moreover various other aspects referring to life in a city are mentioned in connection to the term smart city like security/safe, green, efficient & sustainable, energy etc. Finally, it can be used to identify six characteristics, see Fig. 1, as a roof for explanation of smart cities which should allow an inclusion of additional factors [2]:

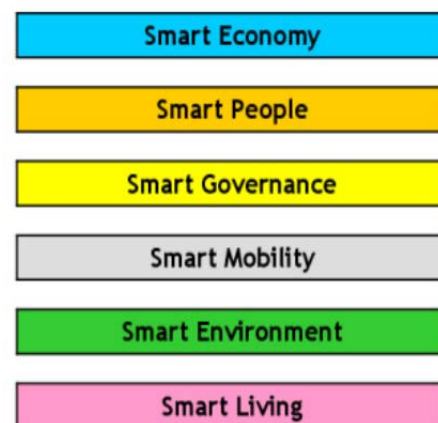


Fig. 1: Factors contributing to Smart City definition, Centre of Regional Science (2007) [3]

Proposed model is a pilot study of parking system of vehicles that involves the whole city, working on one single platform with management tool controlled by the concerning authority. The model will be based on cloud computing protected with various available cyber protection methods. **Cloud computing**, also on-demand computing, is a kind of Internet-based computing that provides shared processing resources and data to computers and other devices on demand. It is a model for enabling ubiquitous, on-demand access to a shared pool of configurable computing resources[4][5].

Proposed that the user will have its own account, which will reflect the following:

- a. **List of vehicles they own**
- b. **Funds in their account**
- c. **Parked locations of their vehicles**
- d. **History of parked spots**
- e. **Nearby available parking spots and its route from current location.**
- f. **Alternatives to various payment methods**

Locations will be shared to the user with the help of Global Positioning System (GPS). The **GPS** is a space-based navigation system that provides location and time information in all weather conditions, anywhere on or near the Earth where there is an unobstructed line of sight to four or more GPS satellites [6].

2. THE MODEL

The stake holders and the targeted market audience of the proposed system will include the customers, concerning authority personnel, government and the general public.

It is proposed that all the parking lots of the city will be integrated and included in this system. See fig. 2, each parking lot will have database (child server) of parking spots. This database will directly be shared over the internet with the main database (parent server). The data will be shared via a website and smartphone application over the internet.

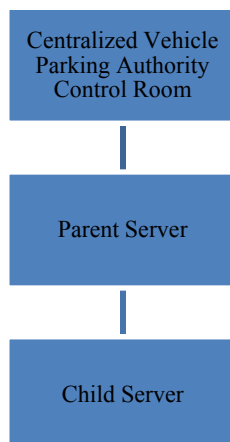


Fig. 2: Hierarchy of model for parking system

3. PARENT SERVER

The Parent Server will be situated in the control room monitored by the authority. The server will collect the data from all the parking spots throughout the city. The data will be analysed in real-time and shared over internet with the customer in user friendly format.

4. CHILD SERVER

The Child Server will be situated in every parking lot. This server will collect the data of its filled and available parking spots. This data will be sent to the parent server in real time over the internet. This server will also have its location stored which will be used by GPS. The child server will also manage and collect payments done by the users and share the database with the parent server.

5. WEBPAGE AND MOBILE APPLICATION (USER END)

Proposed that there will be web page and a mobile application maintained which will reflect the data of the parent and child servers in appropriate fashion. User can access them anytime and anywhere.

The mobile applications will access the GPS facility of the smartphone to communicate the location and route to the nearest parking spot available or the already parked vehicle.

6. USER ACCOUNT

It is proposed that every citizen in city will have its own user account. The user account accessed from either webpage or the smartphone application will reflect the following details.

7. PROFILE

The profile will show their personal details. It will show the last of vehicles they own with every detail of the vehicle which will be securely stored in parent server database. The profile will show the detailed history of vehicle parked with their location history. It will have the detailed information of the payment done and funds in the account, which will enable a hassle free smooth funds transfer.

The user will also have the choice of various methods of payments like cash, which will be considered as the alternative method of payment. It will show the locations of currently parked vehicles and their duration.

8. USER ACCESS CARD & ITS ALTERNATIVE

The user will be provided with the card which will be used to enter and exit the parking lot. The card will be punched with user profile data which can be sensed by the appropriate hardware. These entries will be recorded in the child server for real time processing. In case the card is lost user can generate a new ticket using his smart phone to enter and exit. It will ease the user from problems like ticket loss charges and mental frustration created.

Human errors are the major source of traffic accidents, therefore building in-car technologies for checking the parking lot, avoiding accidents and guidance to the parking facility is turning out to be an integral area for research. The objective of such technologies is the reduction of the burden on driver, improvement of the traffic capacity, and provision of reliable and secure car functions [7].

9. PROCESS

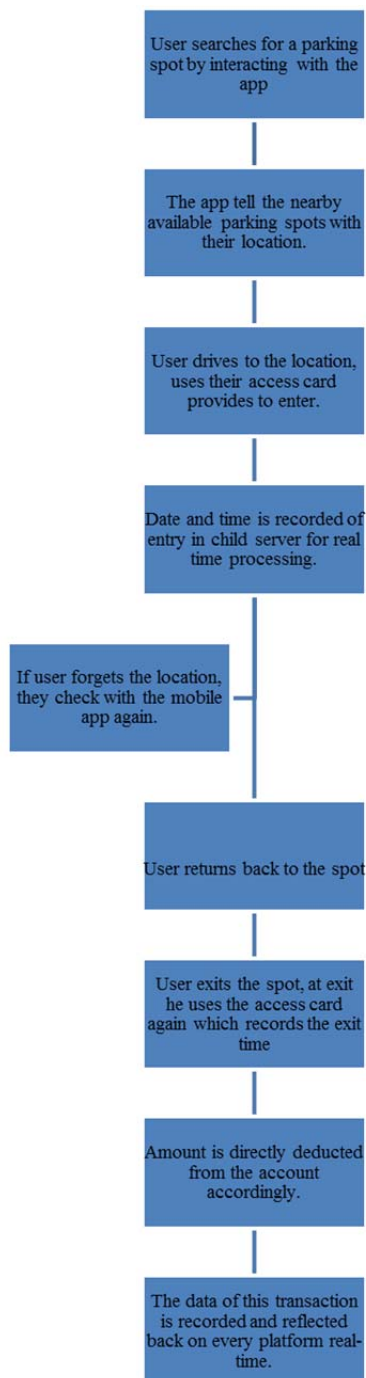


Fig. 3: Step by step process of working of model.

The fig. 3 tends to explain the step by step process from entry to exit. There will be an overall decongestion in the regular parking process following this model of parking. Proposed model for the city can decongest the parking procedure to greater extent.

The first step is when the user interacts with the application to search for the available spot nearby him. With their choice they can visit one of the parking lots using the GPS. They then will punch the given access card or smartphone to enter the lot and park the vehicle hassle free.

When the user returns back they can find the location of the lot and details of the parked spot in case they don't remember it. When exiting the lot they have to punch their access card again to exit. In case the access card does not work or is not available, user can use their smartphones as well. When the card is punched the records are updated and processed real time. The amount is calculated and deducted automatically via internet from the user's account instantly. User will also have the option of paying in different method like cash, credit and debit transfer. These smooth transitions of payment will make the whole system fluidic reducing the mental frustration and personal satisfaction. Each parking lot will be interconnected through the main parent server providing information to the customer in real time.

10. CONCLUSION

The proposed model for vehicle parking in smart cities will have following advantages:

- Finding an available parking spot nearby will be way to fast.
- Reduced wastage of time and money.
- One single fare will be applicable to all lots connected under this system.
- Reduction in air and noise pollution.
- Overall city traffic congestion will be reduced.
- Increased physical and mental stability of the citizens.
- Reduction in surface temperature of the city hence reduction in global warming.
- Paper less fast transactions will make many things easier and promote afforestation.
- Proper utilization of the space will be done, hence increased income per sq. unit of land

In this pilot study, the proposed model of parking system for smart cities has been presented. Integration and implementation of this current system to all the parking lot in the city can decongest the alleviating parking problems with the citizens.

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