

# Advance Prediction of Parking Slot Availability with Traffic and Pollution updates for Car parks in Smart Cities

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**Abstract** - In order to efficiently manage the critical infrastructure and services of a city, there is need to evolve into a smart city. Finding or Searching an available parking spot in the city is always troublesome for drivers. It tends to become harder with the increasing number of private car users. Searching for a free parking space is not only a tedious task, but also a challenge to mobility, since up to thirty percent of traffic in urban scenarios is generated by vehicles looking for parking spaces. So there is a need to solve this problem of parking space availability, traffic congestion and air pollution problem. A smart parking exchange system will solve these problems and reduce the wastage of fuel while finding space for parking.

**Key Words:** Prediction, Internet of things, Prediction models, Smart city, Congestion

## 1. INTRODUCTION

Today we are living in a technology world. Along with the technology we have face some socio-economic as well as other problems with are indirectly related to technical advancements. To solve these problems again technology comes to our help. It is predicted that about 70% of the world's population will start living in cities and surrounding regions by 2050 [1]. In order to efficiently manage the critical infrastructure and services of a city, these need to evolve into a 'smart city'. A smart city [1] according to Forrester, is one that uses information and communications technologies (ICT) to make the critical infrastructure and services of a city, such as public safety, transportation and utilities, more aware, interactive and efficient [1], [2].

The implementation of the Smart City is now becoming possible with the emergence of the Internet of Things (IoT), which radically evolves the current Internet into a network of interconnected objects, such as sensors, parking meters, energy measuring devices and actuators [3]. Finding parking space, traffic congestion and air pollution are the major problems which every city commuter has to face. One study reveals that 30% of the congested traffic in the city is contributed by cars that are searching for parking spots [2]. If the drivers can be informed in advance about the availability of parking spaces at and around their intended destination, the traffic congestion can be efficiently controlled. This requires intelligent sensors to be deployed

in the parking lots for monitoring the occupancy as well as intelligent data processing to gain practical insights from the vast amount of data collected. Indeed, a massive amount of fuel is wasted just due to parking finding, leading to an additional production of CO<sub>2</sub>. Moreover, the time spent for finding free parking space is also a cause for stress and frustration for drivers. So here smart parking slot vacancy detection system along with traffic and pollution updates is presented.

### 1.1 Need of System

It will help people plan their trip and facilitate the way to find the available parking spaces. It can also be built into car navigation systems to help drivers choose parking slots based on their destination. It will save time and efforts.

### 1.2 Organization of Paper

The rest of the paper is organized as follows: Section 2 presents previous work carried out related to parking system. Section 3 formulates the problem statement and the proposed system. Section 4 describes experimental results. Section 5 concludes with conclusion and further research direction.

## 2. LITERATURE REVIEW

M. Caliskan, A. Barthels, B. Scheuermann in 2007 [5] presented the issue of automation and modernization of car parking management by proposing a Car Parking Framework (CPF), and assessing its relevance with respect to the engineering and economic efficiency. It fails to use historic data for analysis. Bei Chen, Fabio Pinelli, Mathieu Sinn, Adi Botea and Francesco Calabrese in Oct 2013 [8] a class of algorithms which use Generalized Additive Models (GAMs) for demand and availability prediction on various time scales. There is no provision of advance reservation of parking slots. S. Pullola, P. K. Attrey and A. El Saddik in 2007 [6] demonstrated GPS based vehicle navigation system for finding parking lot. The prediction is based on the information about different historic contents and actual information about parking availability is given by sensors. These approaches are based on the finest granularity of parking data, because each parking lot is described by a prediction model. This approach models the

probability of parking spaces to be free at a given instant of time[5].

Evangelia Kokolaki, Merkouris Karaliopoulos in 2013[11] systematically explored the impact of the information. This systems make available on the efficiency of the parking search process and resource utilization when the parking resource allocation is not controlled by a centralized entity, e.g., through a reservation mechanism. There is uncertainty about human behavior in this system. Tooraj Rajabioun, Brandon Foster, Petros Ioannou developed new parking guiding and information system [10] in 2013 .The system assists the user to find the most suitable parking space based on preferences and learned behavior. The system takes into time, destination, type preference, cost preference, driving time, and walking distance as well as time-varying parking rules and pricing.

### 3. PROPOSED SYSTEM

The primary goal of the intelligent parking systems is to find, allocate, and reserve the best available car parking lot for a user who is driving a car in a particular area, and to provide him/her with navigation instructions for reaching this lot. The existing car parking systems are not very efficient as they do not provide the best service, e.g. finding the nearest available car parking lot. A car parking lot detection method is proposed based on combination of hardware and software platform; as the image processing algorithms are more costly, a hardware solution is suggested for sensing different activities and software for user based application.

In this system Arduino based interface is made in order to communicate with sensor devices. It keeps the track of three different parameters. They are 1) Vacant parking availability slot, 2) Traffic update in required area, 3) Pollution update in required area. Sensors are placed on road track as well as parking area. At the sensor layer, most of researchers today focus on detecting the car parking lot occupancy. A car parking lot detection method consists of arduino board interfaced with PC, IR sensor, LDR sensor and smoke sensor.

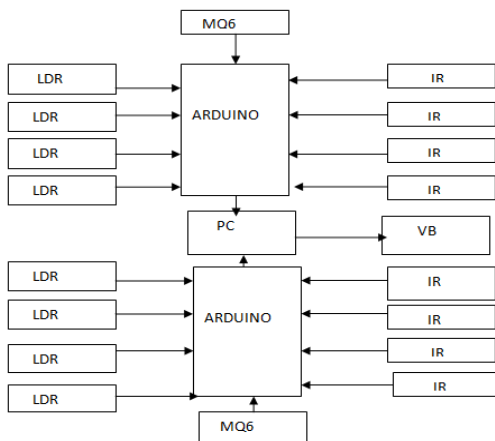


Fig -1: Block diagram of Smart Parking System

#### A. Arduino

The Arduino microcontroller is an easy to use yet powerful single board computer that has gained considerable traction in the hobby and professional market. The Arduino is open-source, which means hardware is reasonably priced and development software is free. For advanced Arduino users, prowl the web; there are lots of resources. The Arduino project was started in Italy to develop low cost hardware for interaction design. The Arduino hardware comes in several flavors.

#### B. Light Dependent Resistor(LDR)

LDRs or Light Dependent Resistors are very useful especially in light/dark sensor circuits. Normally the resistance of an LDR is very high, sometimes as high as 1000 000 ohms, but when they are illuminated with light resistance drops dramatically. A photoresistor or light dependent resistor (LDR) is a resistor whose resistance decreases with increasing incident light intensity. It can also be referred to as a photoconductor or CdS. Here LDR sensors are used to detect vacant parking space in particular area.

#### C. Infrared sensor

Infrared sensors are used in order to monitor traffic in a particular area which is required. It shows the percentage of traffic in that area.

#### D. Visual basic platform

Visual Basic was designed to accommodate a steep learning curve. Programmers can create both simple and complex GUI applications. Programming in VB is a combination of visually arranging components or controls on a form, specifying attributes and actions for those components, and writing additional lines of code for more functionality. Since VB defines default attributes and actions for the components, a programmer can develop a simple program without writing much code. VB application is used to monitor all the three parameters viz; parking slot availability, traffic update and pollution update

### 4. EXPERIMENTAL RESULTS

Following figures show the experimental results carried out. Figure 2 shows VB based application for smart parking system. By clicking on enter the system, system application process begin. After that we can choose city and required area of interest.

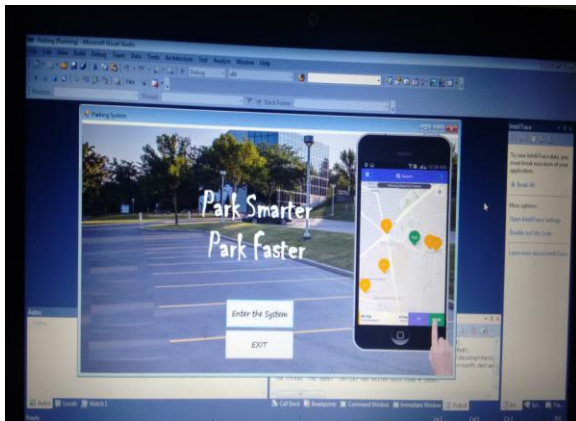


Fig -2: Smart parking System Application

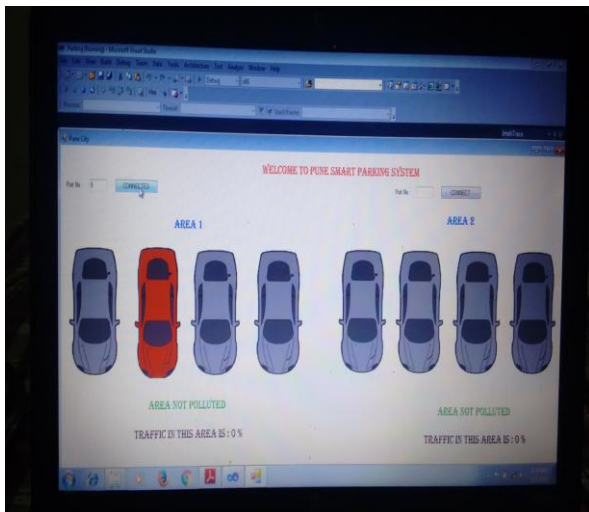


Fig -3: Status of vacant and already parked slots

Above figure 3 shows overall status of acquired and vacant parking slots. Figure 4 gives us traffic as well as pollution update.

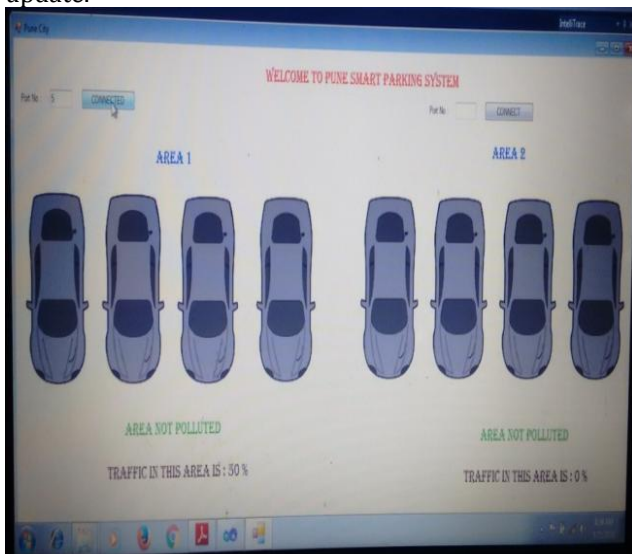


Fig -4: Pollution and traffic update

## 5. CONCLUSIONS

The system presented can be used to find parking availability space, determine traffic and pollution updates. The Smart Parking solution proposed a system to emphasize pervasiveness, energy efficiency and security for IoT by bundling and integrating IoT technologies and services to transparently learn and infer the behaviors and needs of users, acting on their behalf of and protecting them so as to improve their quality of life. Traffic update can prove more efficient for following track or route which has least traffic and it will definitely reduce air pollution. In the future, additional factors can be incorporated into the model that may affect the parking availability predictions, such as events (e.g. social and economic) and the effect of nearby parking slots.

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