

# Parking Management System using Wireless Sensor Networks

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**Abstract**— Parking is costly and limited in almost every major city in the world. Innovative parking systems for meeting near term parking demand are needed. This paper proposes a novel, secure and intelligent parking system based on secured wireless sensor network (PSWSN). From the point of users’ view, PSWSN is a secure and intelligent parking service. The parking reservation is safe and privacy preserved. From the point of management’s view, PSWSN is an intelligent parking system. The parking process can be modeled as birth-death stochastic process and the prediction of revenues can be made. Based on the prediction, new business promotion can be made, for example, on-sale prices and new parking fees. In Smart Parking, new promotions can be published through wireless network. We address hardware/software architecture, implementations, and analytical models and results. The evaluation of this proposed system proves its efficiency.

**Key words:** PSWSN, MAX232, RFID

## I. INTRODUCTION

Parking system on wireless sensor network was utilizing parking system. It can help to minimize the car parking space solution. In the modern world, where parking-space has become a very big problem and in the area of miniaturization, it become very crucial to avoid the wastage of time and space shopping mall, big companies and apartments etc. In places where more than 100 cars need to be parked, this system proves to be useful in reducing wastage of space and time. In large parking lots, a driver may exit the lot without knowing about new spots that have just become vacant. Finding an empty parking spot may also lead to driver frustration if another car takes the spot before the driver can reach it.

This Parking System using wireless sensor network (PSWSN) enables the parking of cars without much manual intervention, which results in reduction of manpower & providing an enjoyable parking experience. Also, this system drastically reduces time spent by customers to locate free spaces & retrieve the car from a large number of cars. This system provides efficient parking of cars, floor after floor and thus reducing the space used. Here any number of cars can be parked according to the requirement. This makes the system organized and evens a space-saving one. This idea is developed using wireless sensor infrared and magnetic, 89c51 microcontroller, MAX232. Here program is written according to this idea using 89c51.

Thus, innovative parking systems for meeting near-term parking demand are needed. With wireless communications, computer, control, and electronics technologies, intelligent service-oriented parking management can improve parking space utilization and improve driver experience while decreasing drivers’ frustration. Our motivation is to fill the near-term parking demand using the wireless technology.

The contributions of our system include:

- 1) Increasing space utilization
- 2) Improving drivers’ experience
- 3) Providing intelligent management.

From the point of users’ view, Parking system which is a secure and intelligent parking service. Parking information, order information, and vehicle information are collected and transported by sensor detection and the wireless network. The proposed infrastructure prevents most security/privacy attacks.

## II. PROJECT IMPLEMENTATION

### A. Project Overview:

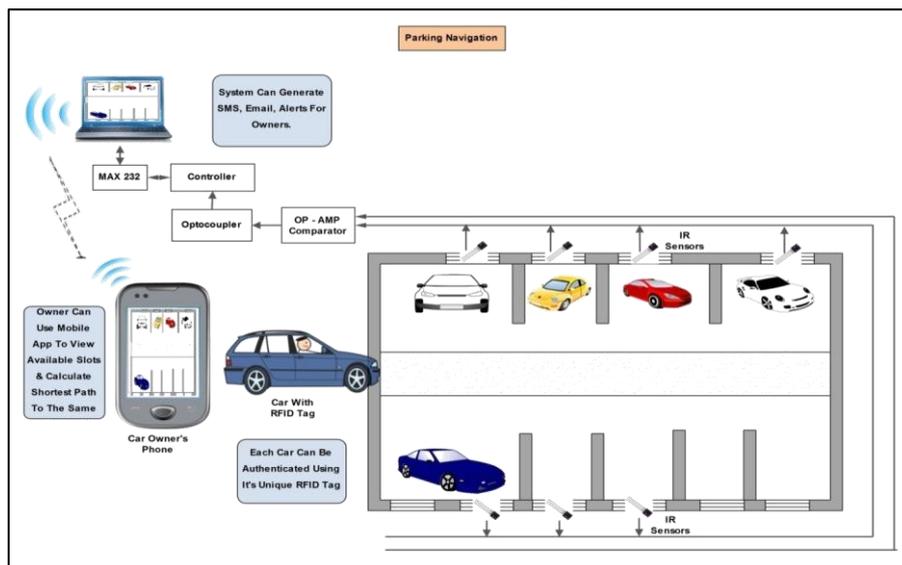


Fig. 1: Project Layout

The above figure depicts the flow of information in this particular project. The information about the location and availability of a parking space near the destination is provided to the drivers by the current GPS-based vehicle navigation system. The information of the current state of the parking facility is provided. That's why they can't guarantee a parking lot when the driver reaches the facility. A scientific solution based on utilization of the past and current status of the parking lot is proposed in. Poisson process is used for modeling the availability of a parking lot. An intelligent algorithm which helps the driver in choosing the slot with maximum probability of being vacant is presented in as well. Various methods and different cities were used for demonstrating these issues. It also highlighted different challenges of on-street parking such as peer-to peer exchange and storage of parking information.

The Server is responsible for storing all the information related to sensor values that is, parking vacancy. When the vehicle arrives at the checkpoint, the Radio Frequency Identification (RFID) will be used to check the authentication of the car to make sure that the vehicle has been registered previously on the system. The RFID is swapped and simultaneously, the in-time is noted on the server and a notification is sent to the user regarding his entry to the car park. The user is also allocated a parking slot depending upon the amount of time the user needs to park his car. This type of car allotment is done using an intelligent algorithm which takes input as the amount of time the driver needs to park his car and the closest parking slot, calculates it and send a specific parking slot according to the driver's needs.

This kind of parking management system is very effective as it avoids chaos at the car park, the amount of labor required is much less and the parking system is well managed and maintained.

### III. MATHEMATICAL MODULE

#### A. NP-Complete:

A problem is NP-complete if the problem is both:

- 1) NP-hard
- 2) NP

A technical point:  $O(n)$  actually means the algorithm runs in asymptotically linear time, which means the time complexity approaches a line as  $n$  gets very large. Also,  $O(n)$  is technically an upper bound, so if the algorithm ran in sub linear time you could still say it's  $O(n)$ , even if that's not the best description of it. Deterministic and nondeterministic Turing machines can compute exactly the same things, since every nondeterministic Turing machine can be simulated by a deterministic Turing machine (a "regular computer"). However, they may compute things in different amounts of time.

#### B. Mathematical Proof:

Suppose  $ps$  the set of PSWSN indicates values of function

- $PS = \{U, L, T, sd, rc, pa, mp, sc\}$ ;

Where,

- $U$  = set of users it goes to the 1 to  $n$ ;
- $L$  = set of location to provide parking location;
- $T$  = set of RFID tags to provide by users;
- $Sd$  = sending message parking place available or not;
- $Rc$  = receiving message from user is car park or not;
- $Mp$  = show on mapped on mobile app or server;
- $Pa$  = indicates parking slot to  $n$  no of user;
- $Sc$  = scan every time on system;
- $Ps = \{(U_1, U_2, \dots, U_n) \cup (L_1, L_2, \dots, L_n) \cup (T_1, T_2, \dots, T_n)\}$ ;
- $Ps = \{(U_1, L_1, T_1), (U_2, L_2, T_2), \dots, (U_n, L_n, T_n)\}$ ;
- $Ps = (U, L, T) = 0$  // Parking place available
- $Ps = (U, L, T) \neq 0$  // Parking place not available

### IV. UML DIAGRAM

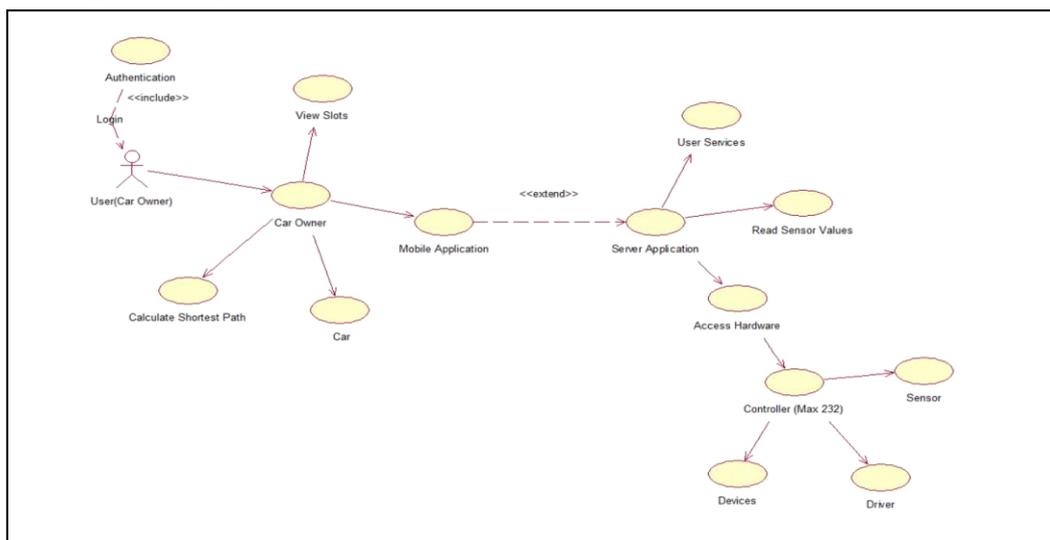


Fig. 2: UML

## V. LITERATURE REVIEW

A Car Parking Monitoring System Using Wireless Sensor Networks by Jung-Ho Moon, Tae Kwon Ha, published in World Academy of Science, Engineering and Technology International Journal of Electrical, Computer, Electronics and Communication Engineering Vol:7, No:10, 2013.

They proposed a car parking monitoring system using wireless sensor networks. Multiple sensor nodes and a sink node, a gateway, and a server constitute a wireless network for monitoring a parking lot. Each of the sensor nodes is equipped with a 3-axis AMR sensor and deployed in the center of a parking space. Each sensor node reads its sensor values periodically and transmits the data to the sink node if the current and immediate past sensor values show a difference exceeding a threshold value. The sensor nodes and sink node use the 448 MHz band for wireless communication. Since RF transmission only occurs when sensor values show abrupt changes, the number of RF transmission operations is reduced and battery power can be conserved. The data from the sensor nodes reach the server via the sink node and gateway. The server determines which parking spaces are taken by cars based upon the received sensor data and reference values. The reference values are average sensor values measured by each sensor node when the corresponding parking spot is not occupied by a vehicle. Because the decision making is done by the server, the computational burden of the sensor node is relieved, which helps reduce the duty cycle of the sensor node.

RFID-based Parking Management System, published in International Journal of Advanced Research in Computer and Communication Engineering Vol. 3, Issue 2, February 2014 by Poorva Parkhi<sup>1</sup>, Snehal Thakur<sup>2</sup>, Sonakshi Chauhan<sup>3</sup> Student-BE, Department of Computer Engineering, Sinhgad Academy of Engineering, Pune, India. In this project, a solution has been provided for the problems encountered in parking-lot management systems via RFID technology. RFID readers, RFID labels, computers, barriers and software are used as for the main components of the RFID technology. The software has been handled for the management, controlling, transaction reporting and operation tasks for parking lots located on various parts of the city. Check-ins and check-outs of the parking-lots will be under control with RFID readers, labels and barriers. Personnel costs will be reduced considerably using this technology. It will be possible to see unmanned, secure, auto-mized parking-lots functioning with RFID technology in the future. Check-ins and check-outs will be handled in a fast manner without having to stop the cars so that traffic jam problem will be avoided during these processes. Drivers will not have to stop at the circulation points and parking tickets will be out of usage during check-ins and check-outs. Vehicle owners will not have to make any payments at each check-out thus a faster traffic flow will be possible. The slot availability details are collected using an RFID system and are updated periodically into a Web server via Internet for a registered user. If needed, the user can reserve his parking slot either way since we have both website application and Android app. Since there won't be any waiting during check-ins and check-outs the formation of emission gas as a result of such waiting will be avoided.

Smart Parking: A Secure and Intelligent Parking System, by Gongjun Yan<sup>1</sup> Weiming Yang Indiana University Kokomo

Parking is costly and limited in almost every major city in the world. Innovative parking systems for meeting near term parking demand are needed. This paper proposes a novel, secure and intelligent parking system (Smart Parking) based on secured wireless network and sensor communication. From the point of users' view, Smart Parking is a secure and intelligent parking service. The parking reservation is safe and privacy preserved. The parking navigation is convenient and efficient. The whole parking process will be a non-stop service. From the point of management's view, Smart Parking is an intelligent parking system. The parking process can be modeled as birth-death stochastic process and the prediction of revenues can be made. Based on the prediction, new business promotion can be made, for example, on-sale prices and new parking fees. In Smart Parking, new promotions can be published through wireless network. We address hardware/software architecture, implementations, and analytical models and results. The evaluation of this proposed system proves its efficiency.

## VI. DISCUSSION

This paper proposed a parking management system integrated in the platform Wireless Sensor Network. The model developed takes into account the user's and resources' constraints, providing a solution for the Parking problem. This is done by taking advantage of the properties of a parking zone, to satisfy the user's requirements in the best possible way. The method of evaluation of a list of parking places followed in this paper, refers to the fact that one satisfied criterion, having the importance Mandatory, can replace a larger number of satisfied criterion, that are considered less important. However, prioritization of criteria might be adapted, as a large number of satisfied low priority criteria could be preferable to a single high priority criterion. This could be achieved by using an agent per criterion, in order to negotiate with the other agents. But this may require the user to be able to prioritize his criteria more specifically. Smartphone's are a very convenient way to interact with the users. Such a deployment could be done using the Android, which provides a framework for developing parking systems on Android devices. There should be a difference between the distance separating a driver from his destination and the time he should take to arrive to his destination. Taking into consideration the real time traffic information, can be a suitable solution to show these two properties (distance and time) in the presented system. Moreover, using the system can be extended to the use of multimodal transport and other resources of smart cities. The infrastructure of Parking System allows the use of actuators and barriers. An agent can be added to the system to assure the reservation of a place for the drivers by the barriers.

## VII. CONCLUSION

In almost every major city in India and other countries, parking problems are ubiquitous. The present day metropolitan areas have seen a sprouting growth in human population as well as vehicles. This is directly proportional to the requirement of parking lots. The advent of multilevel

car parks has made the parking management and revenue the topmost priority. In this document, we described the Parking management system using wireless sensor networks. Based on the requirement analysis for existing car parking management systems, we implemented a fully fledged prototype model as a proof of concept to realize and understand the real time scenarios in parking management systems. Through our prototype system we demonstrated that the proposed architecture can effectively satisfy the requirements of a car park management system and we believe that wireless sensor networks can be a promising technology to solve future parking hassles.

#### VIII. ACKNOWLEDGMENT

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