

# A Review on Smart Parking with IoT and WSN

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## Abstract

IoT has highly developed and a vast spectrum for research is occurring on a day to day basis. In this paper, few works on smart parking system using IoT have been reviewed. The paper also list out few applications of IoT and Wireless sensor networks (WSNs).

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## 1. Introduction

### A. The Wireless sensor Network (WSN)

With rapid growth of theoretical and practical challenges WSN is drawing worldwide attention in the recent years. This rapid and growing interest of sensors largely attributed to a vast number of new applications capable of reaping information from the physical environment, which performs unadorned processing on the extracted data and broadcasting it to remote locations.

A WSN typically has little or no infrastructure which consists of a number of sensor nodes (few tens to thousands) working together to monitor a region and to obtain data about the working environment.

### B. Internet of Things (IoT)

Now a day's IoT has highly developed and a vast spectrum for research is occurring on a day to day basis. Metropolitan cities are also implementing smart city surveillance systems using IoT for smart parking that takes internet as a fundamental part for the working, which led to the concept of Internet of Things and according to this concept objects can communicate with each other and with other users by enabling easy admittance to a broad range of devices.

### C. Smart parking with IOT

Innovative smart applications are done while coalescing WSN with IoT mostly including one of the technologies are Radio Frequency Identification (RFID) and WSN. The diverse techniques in wireless nodes with integration of sensors and IEEE communication ranges are enabling few outdoor communication features for vehicle parking.

In this paper we are focusing basically on why is the need of smart parking, for the reason that it involves some low cost sensor nodes to be deployed in combination with some applications to facilitate the users to check the

availability of the vacant slot for parking their vehicles which in turn reduces the traffic in search of parking slots..

Rest of the paper is organized as follows: In Section II, we list few different types of sensors used in smart parking system. In Section III, we describe the related work. Section IV discusses the other applications of IoT, with the conclusion in the last section.

## 2. Sensor Types

ECurrent traffic control scenario is facing many problems related to parking of vehicles and its safety, so based on geographic locations the types of sensors are categorized in two ways i.e. first category is intrusive sensors that are installed on asphalt road surfaces. Intrusive sensors are those having precision with high maintenance and high installation cost.

Fundamentally, the intrusive sensors can be classified into four sub categories as from fig.1 pneumatic road tube, inductive loop detector (ILD), magnetic sensors and piezoelectric units.

Secondly, are the non- intrusive sensors which are installed on different spaces on the road detects a vehicle travel with other parameters including vehicle speed, road coverage etc.

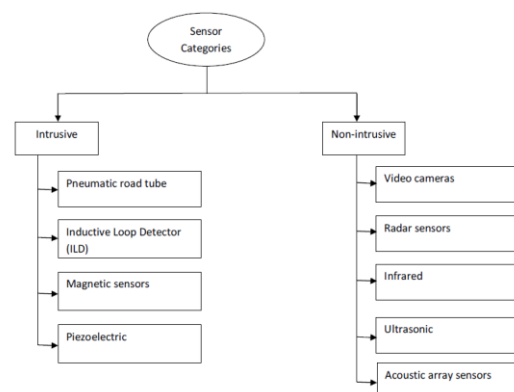


Figure 1: Layout of different sensor types

For intrusive category of sensors pneumatic road tubes are used for studying temporary traffics, while compared to pneumatic sensors other categories of

sensors in intrusive is used to study permanent traffic trends and to monitor congestion in roads.

### 3. Related Work

Following table shows the assessment between different reviewed investigations:

Table 1: Background of the proposed work

S.No	Proposed Work	Sensor used	Technology
1.	Das [1]	Distance sensor, Motion sensor, RPI camera and pager Device	To identify vacant parking slot through pager Device
2.	Kodali <i>et al.</i> [2]	ESP32, Short for Long Range (LoRa) Module, Ultrasonic Sensor	To view parking slot availability using Android App
3.	Chandra <i>et al.</i> [3]	RFID, Automatic License Plate Recognition (ALPR)	Developed to find vacant parking slot using RFID, ALPR with IEEE 802.15.4 WSN technology.
4.	Zhuang <i>et al.</i> [4]	Raspberry pi, Object detector, Camera	Proposed edge computing surveillance system to detect parking space occupancy with smartness.
5.	Sahfutri <i>et al.</i> [5]	HC-SR04 ultrasonic sensor	The parking slot can be obtained in the proposed work using ultrasonic sensor, arduino mega 2560 using the Wireless Sensor Network Xbee-Pro S2 communication.
6.	Mainetti <i>et al.</i> [6]	RFID	The proposed vacant parking slot is obtained by RFID, NFC, Android and hybrid sensing network.
7.	Zhai, W [7]	Image sensor	This work proposed an urban smart parking management platform based on the Narrow Band-IoT ( NB-IoT ) , WSN with Image processing and License Plate Recognition ( LPR).
8.	Yuan <i>et al.</i> [8]	Geometric sensor	Proposed work provided technologies like WiFi, Zigbee and RFID which are applied for indoor positioning and geomagnetic sensors are used to detect the occupation of parking spaces, and WiFi is used for navigation.
9.	Roy <i>et al.</i> [9]	Motion sensor	The proposed work for vacant parking slot focussed on ANPR (Automated Number Plate Recognition) technique to collect the basic information of the vehicle and uses optical character recognition technique to identify the Licence Plate of every vehicle.
10.	Aydin <i>et al.</i> [10]	Magnetic sensor	The proposed vacant parking slot is obtained with the integration of UHF-RFID and IEEE 802.15.4, RESTful Java and Google Cloud Messaging and with the help of these a mobile application allows the users to find a vacant parking location.

### 4. Other Sensor Network Applications

WSN includes numerous application areas which are categorized into two main type's i.e. Monitoring and tracking. Monitoring is done to analyze a traffic dilemma

for diverse areas including atmosphere monitoring, fitness and wellness monitoring, geographic monitoring and many more applications. On the other side tracking is done for vehicular movement with tracking and other applications.

### A. Atmospheric Applications

Some of the sensor applications in atmosphere or weather comprise the following:

- Monitoring the condition of crop and the productions in agriculture that are affected due to atmospheric changes
- Tracking and movement of birds and insects with the help of sensor networks
- Flood and cyclone recognition and many more.

### B. Fitness and well being applications

Sensor networking coddle in many of the applications related to health monitoring and diagnosing a patient's condition like:

- Drug supervision in hospitals

- Tele-monitoring of human psychological records.
- Tracking the activities of patient's as well as doctors in a hospital.

### C. Smart city applications

There includes many applications to make a city smarter and with that if sensor networks is combined then each and every entity present in this world will be smarter, like the applications of smart city concept can be applied to assorted areas including the following

- Tracking and monitoring the available parking slots available in the city
- Waste management within cities.
- Recognition of smart phones and many more.

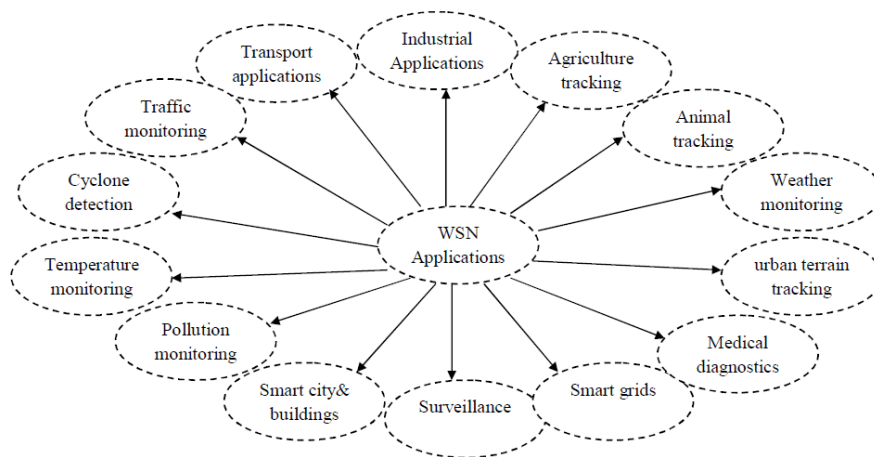


Figure 2: Applications of Wireless Sensor Networks in diverse areas

## 5. Conclusion

There In metropolitan cities, parking related issues are very high and huge traffic is making the entire city to wait and rely on time, more fuel utilization to find the vacant parking slot for parking their vehicles. Diverse approaches are employed by different researchers to address the issues related to vacant parking slots by the time passed. This paper reviewed the assorted approaches given by the researchers in this few years addressing the issues related to vehicles and mainly focused on parking together with technologies and sensors used which are addressing those primary issues with traffic congestion problems. The intent is to précis the latest technologies to assist researchers as a global resolution based on vehicle parking.

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