

# Internet of Things (IoT) Based Smart Parking System

Kunj Oza, Raj Mehta, Yash Sayani, Sinu Mathew

Department of Computer Engineering, University of Mumbai, Atharva College of Engineering, Malad, Mumbai, India.

## Publication Info

### Article history:

Received : 16 February 2020

Accepted : 25 May 2020

### Keywords:

Car park, Improper parking directional signage, IoT, SPS, Ultrasonic sensors.

### \*Corresponding author:

Kunj Oza

e-mail: kunjozajain@gmail.com

## Abstract

*With the development in vehicle creation and all-out populace, progressively parking spots and workplaces are required. At this moment new leaving structure called the smart parking system is proposed to assist drivers with discovering void spots in a vehicle leave in two ticks. The new framework utilizes ultrasonic (ultrasound) sensors to perceive either vehicle leave inhabitation or less than ideal leaving exercises. Assorted recognition progress are evaluated and appeared differently in relation to choose the best development for making Smart Parking System (SPS). Highlights of SPS fuse void parking spot discovery, identification of not recommended halting, show of open parking spot, and directional pointers toward void parking spots, installment workplaces, and different sorts of parking spaces empty, involved, spared and impeded utilizing unequivocal LEDs. This paper moreover depicts the usage of a SPS structure from the way into a parking structure until the finding of an unfilled parking spot.*

## 1. INTRODUCTION

The keen city utilizes the data, correspondence, and advances to improve the operational proficiency for general society helps in quickening towards the improvement of personal satisfaction for residents. The internet of things (IoT), automation, and machine learning are the rising patterns that drive towards shrewd city reception. Any city can be considered for brilliant city activity, by presenting framework like, savvy stopping framework utilizes a versatile application to assist the drivers with locating stopping spaces, shrewd traffic the executives to follow and break down the traffic streams, sharing data electronically, screen nature changes empowered sanitation and so forth vital part of creating keen city strategic, savvy development, vitality, keen transportation, savvy traffic light, programmed road light, brilliant stopping, keen advancement on speculation, and so forth.

Any savvy applications incorporate sensors, which are sent in condition, gathers the data from gadget/sensor are handled, and dissected to deal with the applications. This methodology would lessen the cost of labor and increment profitability. The internet of things (IoT) is a set of physical gadgets, machines, embedded with equipment, programming, sensor, actuator, and system network which empower to interface and trade information. It encourages associations past machine-to-machine interchanges, including different conventions, spaces, and continuous applications. Sensors can be arranged together to detect a few physical wonders, for example, soil, vegetation, water

bodies, environment observing, object following, and so on. Shrewd stopping framework is an exemplary model that exhibits how the IoT will be viably and effectively used to make life simple for a typical resident.

The primary reason for a brilliant stopping framework is to lessen time to find the stopping regions. Subsequently, it decreases fuel utilization. Sensors would be sent in the stopping territory and through the versatile application, client books for the stopping space, and permits online installment choice too.

Creating nations like India face issues for a huge free parking spot on the board. Ordinary stopping the board frameworks use sensors and other correspondence modules, however, does not address answer for both open and shut parking spot. A portable application that is utilized to discover a stopping opening uses GPS associates through the Google map API to discover free parking spot areas; however, it does not locate the free stopping space area precisely. The principal downsides of parking spot discovery frameworks are low exactness, light, and climate condition. Right now, to actualize Mobile application to discover parking spot use IR sensor to discover empty space.

The association of the paper is given as follows: Section I manages the presentation, area II surveys the current work for a brilliant stopping framework. Segment III layouts the framework design, and area IV depicts the modules created. Exploratory outcomes are talked about in segment V. Area VI gives the outline of the keen stopping application.

## 2. LITERATURE REVIEW

Brilliant stopping has proposed a framework that utilized Google map application. Ultrasonic sensors and information gathered are put away in the cloud. Android application map gives easy to understand data with respect to an empty spot. Each opening has one LED show, which helps to locate the correct stopping place. IoT based stopping framework utilizing Google was proposed to permit the client to save the stopping place. The versatile application finds the present stopping place. Right now, the sensor is utilized to locate an empty spot and is shown on the application. Propelled car parking system utilizing Arduino and Raspberry PI to recognize the free openings. This framework utilizes a web server for booking, Global Positioning System GPS. [1] Successful vehicle leaving framework was proposed, which utilizes IR sensors; validation is finished utilizing RFID tag. ZigBee is utilized for correspondence. Android-based application acquires data about accessible void stopping opening. The android application would have client detail, including zone, state, vehicle number. Application having clients enter and leave time and picking a stopping area. Client subtleties are put away in the MySQL database. Driven shows to show the stopping openings are unfilled or filled. The camera is utilized to catch the vehicle number plate and convert the picture to check whether the vehicle is approved client vehicle or not smart parking system dependent on embedded system utilizes shrewd leaving framework utilizing inserted and sensor arrange which utilizes android and windows application.

Right now, PI is utilized, the IR sensor is accustomed to finding an empty leaving slot. Vehicle to infrastructure (V2I) correspondence to driver sending the leaving demand giving, client data status of acclimating reservation. Foundation to vehicle (I2V) correspondence is utilized to save leaving place application and shows bearing. JSON group used to entomb changing the information. [9] QR code is utilized for the security reason, webcam used to check the code and approved to show the parking area course.

A privacy-preserving pay-by-phone stopping framework was proposed. The stopping framework can be saved by pay by telephone strategy. Versatile application utilizing Visa installment strategy is executed. [10] New client can enroll, and the new client contacts the framework server and to buy new e-coins. Every e-coin is having a stopping term time of space. Stopping official inquiries of on-board gadgets by performing RFID inquiry. Smart stopping direction framework proposed the stopping direction and data. Framework gives driver data and accessibility of stopping opening through the VMS on the web. This framework can be grouped into two

distinctive sorts rough terrain and on-street. Rough terrain utilized Pneumatic cylinder, circle deducted, Pneumatic cylinder to deduct nearness of vehicle, Acoustic sensor-commotion level to the nearness of vehicle, piezoelectric sensor- vibration to distinguish the nearness of vehicle security reason utilized RFID. On-road way ultrasonic sensor-transmit wave to recognize, IR sensor-transmitting reflected wave to distinguish vehicle is available or not. [11] India's capital New Delhi from 2015 began intending to gather every single significant datum about parking area and stopping territories' current infra-structure of stopping place possession. A website page or versatile application is utilized for booking stopping.

## 3. EXISTING SYSTEM

### 3.1. Vision-based Frameworks

The halting control and pay structure in huge urban regions are relying upon devices, for instance, coins or token-based halting meters, which requires force change and work for watching the parking structures, making it unfavorable. So a continuously capable arrangement for automated halting meter and driver help is presented. It is associated with a united traffic control authority, which assembles all the charges, and besides keeps up the utilization of halting principles. This structure has different subsystems, specifically an Ad-hoc subsystem, a leaving entry subsystem, a vehicle area subsystem, and a video picture processor sensor subsystem. There are two classes of vehicles which are considered by this building.

- Class 1 vehicles are those who do not have any inserted remote framework
- Class 2 vehicles are those vehicles that have an implanted remote gadget with ad-hoc organizing capability. This makes these procedures much confused.

### 3.2. Remote Sensor-based Frameworks

Various simplicity sensor center points make up a wireless sensor network (WSN). They arrange themselves for making an off the cuff framework through the remote correspondence module present on center points. Different sorts of sensors, figuring units, and limit devices are accessible on each center. For the social event, taking care of and transmitting information, the valuable parts let the sensors to be presented quickly and no issue by any means. They have a magnificent future since WSNs are adequately presented in the common condition, and they give the data to arranging and surveillance. There are two burdens related to the video sensors. The first is that video sensors are exorbitant. Likewise, sensors produce huge data from time to time, whose transmission by methods for the wireless network is hot.

### 3.3. GPS Based Frameworks

The data about the area and accessibility of a parking spot close to the goal is given to the drivers by the ebb and flow GPS-based vehicle route framework. The data of the present condition of the stopping office is given. That is the reason they cannot ensure a parking area when the driver arrives at the office. A wise calculation that helps the driver in picking the space with the most extreme likelihood of being empty is introduced too. Cerreo had a yearlong report on road stopping, which concentrated on various issues worried about on-road stopping in a particular strategy, arranging, the executives, and tasks. Different techniques and various urban areas were utilized for showing these issues. It likewise featured various difficulties of on-road stopping, for example, shared trade and capacity of stopping data.

## 4. DRAWBACKS OF PARKING LOT

### 4.1. Inconvenience in Locating Vacant Spaces

Quickly locating a vacant spot in a stunned stopping territory is irksome if absolutely achievable, especially on parts of the bargains or open events. One examination demonstrated that 86% of drivers face inconvenience in locating a parking spot in amazed parking structures. [3] Fields or malls are pressed at top periods, and inconvenience in discovering void spaces at these spots is a critical issue for customers. [4] Lacking vehicle leave spots leads to a traffic stop up and driver dissatisfaction. [5]

### 4.2. Unseemly Parking

In the event that a vehicle is left with the objective that it has two leaving openings as opposed to one, this is called wrong leaving. A wrong ending can happen when a driver is not

careful about another driver’s advantages. The driver may see his off-base leaving following to leaving his vehicle, yet he may not be happy to open his vehicle, restart it, and change it to be inside the lines. This issue exasperates different drivers, and generally speaking, a driver who needs to stop in a touch of leftover space will surrender and feel confounded. Figure 1 presents a tactless stopping condition.

### 4.3. System Architecture

To develop the SPS building, a couple of bits of rigging are required: ultrasonic sensors, LED pointers, indoor feature sheets, outdoors show board(s), zone control unit (ZCU), central control unit (CCU), orchestrate switch, telephone connection, and the board programming. The ultrasonic locator transmits its status message through a phone connect to the zone control unit (ZCU), which assembles and progresses the information to the central control unit (CCU) through Cat5 joins. The CCU structures the data and sends requests to the ZCU and LED board. The ZCU is the inside layer of SPS and is responsible for controlling the ultrasonic identifiers. Each ZCU manages a social occasion of 40 to 60 ultrasonic identifiers, sending the appropriate information to the CCU. The ZCU relates through an RS-485 port to the indoor introduction board and ultrasonic sensors and talks with the CCU through framework switch and LAN affiliations. The CCU is responsible for the combination of parking space information and for getting ready data for the whole stopping zone. The CCU transmits requests to the LED demonstrate board to revive the parking space information. Simultaneously, assembled data can be saved in the parking structure server’s database, which will allow a chief to screen, manage, and control stopping region information. Each CCU can reinforce around 40 to 60 center

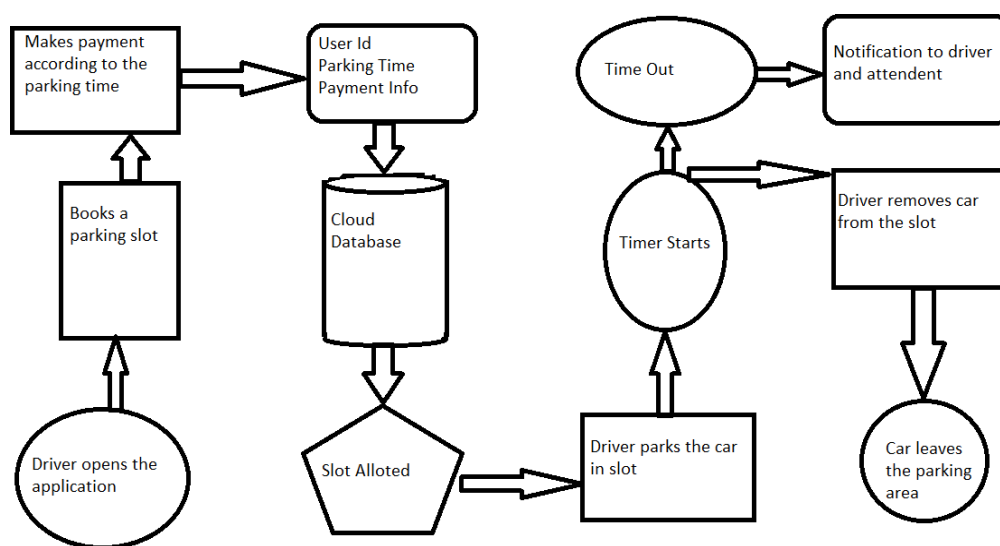


Figure 1: System architecture

points, fuse ZCU(s), and outside feature board(s). For an inexorably capable structure, it is proposed that a constraint of 40 center points be related to each ZCU.

#### 4.4. Halting Charge Installment

Halting the cost portion can be a repetitive development for people. Since various back and forth movement portion machines basically recognize little notes and coins, finding the particular aggregate and coating for the portion is not magnificent for drivers. Right now, sorts of help that make portion accommodating are appealing. One diagram showed that arranging for portion and finding coins for halting charge portion is maddening. Furthermore, most respondents concurred that utilizing Touch' n' Go (a structure that licenses basically swiping a card and subtract costs from inside credit) is appropriate and will reduce line-up time. [3]

### 5. USAGE

#### 5.1. Versatile App: Parking App

The flexible application is made using the Android pack, and the Android Studio application organize is used. Application modules are registration, login, picking date and timing, or to what extent, parking space assurance, price tally, and portion. The application also underpins current booking and advance booking elective. In case the booked vehicle does not enter, leaving opening inside fifteen minutes of cutoff booking is normally dropped.

#### 5.2. Identifying Free Parking Slot

Free space recognizable proof is confirmed utilizing infrared (IR) sensors. The IR sensor utilized for each stopping space. The IR sensor distinguishes the vehicle in IR waves reflected and covers short separation. A beat of IR light is produced by the IR sensor and transmitted by the producer. Identified the data will be sent through the Wi-Fi module to move the data to the Arduino board, and the results are showing an LED screen.

##### 5.2.1. Authenticating User Vehicle

It is accepted that every vehicle has worked in an RFID tag, and the vehicle is validated by RFID peruser. First-time clients need to enroll to benefit the office. The confirmed vehicle would get a go for section, and the opening number would be designated.

##### 5.2.2. Classifying Parking Slot

The leaving spaces may oblige enormous or little size vehicle. During confirmation, the client fills the clients' detail in the sort of vehicle.

##### 5.2.3. Navigation to Stopping Slot

One of the primary components of this application is route

administration designated to stopping opening. The versatile application would begin exploring from the entryway to the apportioned stopping opening. Google map is connected with GPS and application to give way route to the stopping opening.

##### 5.2.4. Visualization

The proprietor of the stopping community can envision the booking subtleties, time to schedule opening accessibility, charge subtleties occasionally. The website page is made utilizing PHP and leaving data (client input, parking ID, vehicle number, leaving period, charge sum, and graphical portrayal of the leaving zone). At the back end, the MySQL database is utilized to store the data. The site page contains nearby host and worldwide host availability territory.

##### 5.2.5. Experiment Details

Arduino Uno is a smaller scale controller, in view of ATmega328P, 14 pins computerized input/output pins, 6 simple pins, USB association, and so forth. Arduino IDE is utilized for programming and interfacing with the sensors.

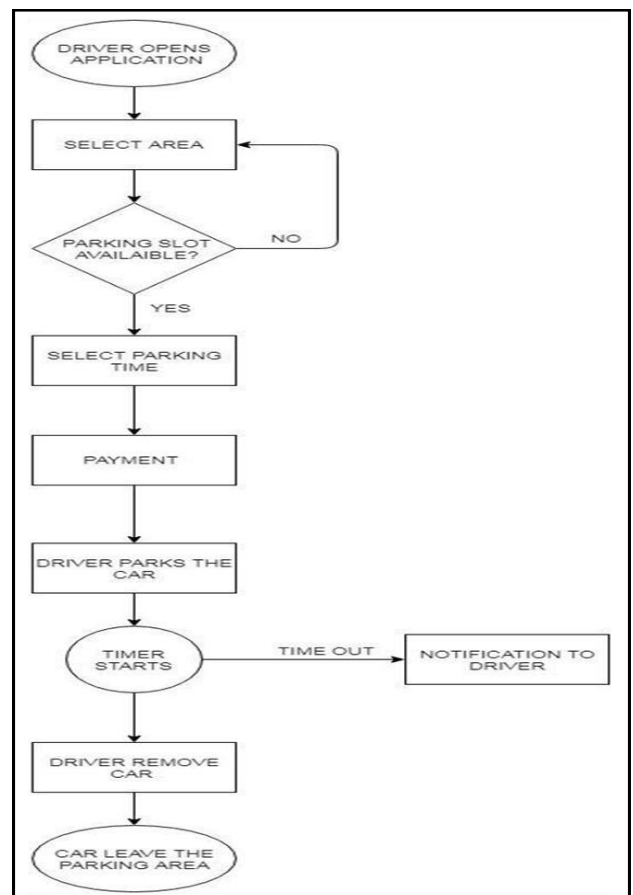


Figure 2: Control flow diagram

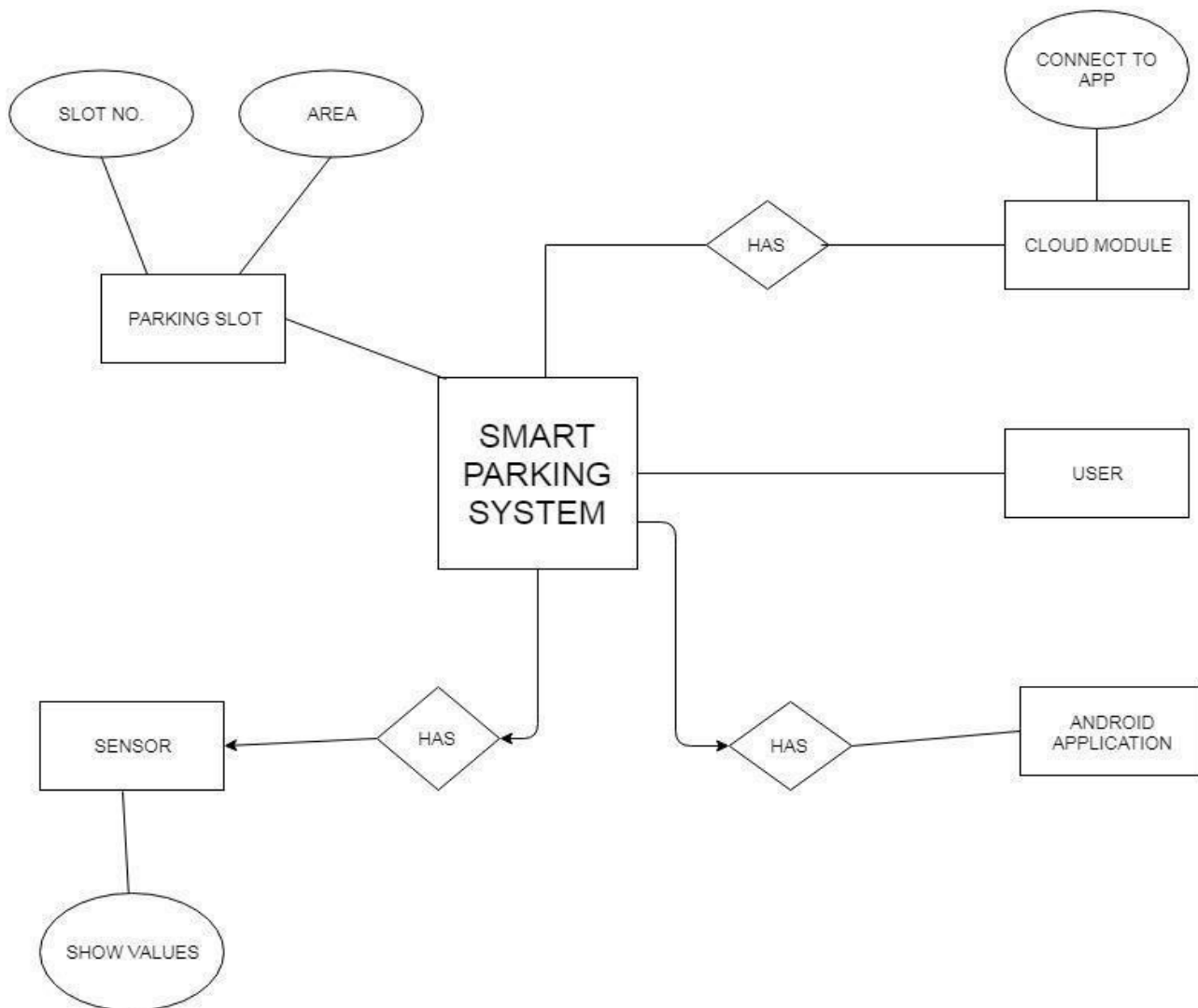


Figure 3: ER diagram

## 6. FUTURE SCOPE

Our undertaking is presently an android-stage versatile application. It tends to be reconstructed in a multi-stage structure with the goal that windows and iPhone clients can likewise utilize this application. The application is in a model form. Along these lines, it probably would not have the option to deal with numerous clients simultaneously. Taking care of progressively concurrent clients through improving application execution is a future extension. At first, we will take input from the clients in an antiquated manner. Live discussion highlights can be fused to the application.

## 7. CONCLUSION

A fruitful usage of this venture would bring about less traffic and bedlam in jam-packed parking spots like shopping

centers and business structures where numerous individuals share a stopping zone. The mechanized stopping expense framework would permit individuals to go without money. It gives drivers also, as it would decrease the holding up time, long lines, pressure, stress, and increment the productivity of the stopping framework. As the smart car parking system requires insignificant labor, there are the least possibilities for human blunders, expanded security, notwithstanding a quick and benevolent vehicle leaving experience for drivers.

## 8. ACKNOWLEDGMENT

We want to thank our venture control, Prof. Sinu Mathew, for her huge collaboration and direction. We have no words to offer our thanks for an individual who wholeheartedly upheld the task and gave uninhibitedly of her important time while making this undertaking. All the sources of

information given by her found a spot in the undertaking. The specialized direction given by her was more than valuable and made this a triumph. She has consistently been a wellspring of motivation for us. It was an extraordinary encounter learning under such an exceptionally inventive, excited, and dedicated teacher. We are likewise grateful to our head Dr. S. P. Kallurkar, and HOD of Computer Department, Prof. Suvarna Pansambal, venture facilitator Prof. Mamta Meena and Prof. Shweta Sharma, and all the staff individuals from the Computer Department who have given us different offices and guided us all through to build up this undertaking thought. At long last, we might want to thank instructors of the school and companions who guided and helped us while we took a shot at this undertaking thought.

## 9. REFERENCES

- [1] A. Kianpisheh, N. Mustaffa, J. M. Y. See and P. Keikhosrokiani, "User Behavioral Intention toward Using Smart Parking System," Proceeding of ICIEIS, (2011) Kuala Lumpur, Malaysia, pp. 732-747.
- [2] J. Scheeling, "Car Park Monitoring System," University of Queensland, (2002).
- [3] L. E. Y. Mimbela and L. A. Klein, "A Summary of Vehicle Detection and Surveillance Technologies used in Intelligent Transportation Systems," Southwest Technology Development Institute (SWTDI) at New Mexico State University (NMSU), (2000).
- [4] Parking Consultants International, Parking Guidance Systems[Online]. Sydney: Parking Consultants International, (2009).
- [5] D. B. L. Bong, K. C. Ting and K. C. Lai, "Integrated. Approach in the Design of Car Park Occupancy Information System (COINS)," IAENG International Journal of Computer Science, IJCS, vol. 35, no. 1, (2008).
- [6] M. Y. I. Idris, E. M. Tamil, N. M. Noor and K. W. Fong, "Parking Guidance System Utilizing Wireless Sensor Network and Ultrasonic Sensor," Information Technology Journal, ISSN 1812-5638, (2009).
- [7] M. Fishbein and I. Ajzen, "Belief, Attitude, Intention and Behaviour: An Introduction to Theory and Research" (1975).
- [8] P. W. H. Coopers, "From Beijing to Budapest - Winning Brands. Winning Formats", (2005), pp. 126.
- [9] K. Yamada and M. Mizuno, "A Vehicle Parking Detection Method Using Image Segmentation," Electronics and Communications in Japan, Part III: Fundamental Electronic Science (English translation of Denshi Tsushin Gakkai Ronbunshi), vol. 84, (2001), pp. 25-34.
- [10] C. C. Huang and S. J. Wang, "A Hierarchical Bayesian Generation Framework for Vacant Parking Space Detection," Circuits and Systems for Video Technology, IEEE Transactions, (2001), pp. 1.
- [11] I. Masaki, "Machine-vision Systems for Intelligent Transportation Systems," Intelligent Systems and their Applications, IEEE, vol. 13, (1998), pp. 24-31.