

A Review on Smart Parking Systems

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Abstract- In recent years parking has become costly resource in the practically any significant urban areas on the planet, and its limited availability is the simultaneous cause of urban traffic blockage and air pollution. The common strategy for finding a parking space is manual where the driver usually finds a space in the city or on the streets through his / her experience or luck. This process requires time and effort and may prompt to the worst scenario of failing to discover any parking space if the driver is driving in a city with high vehicle density. Here, an endeavor has been done to computerize the vehicle as well as the vehicle parking framework with a Smart Parking System (SPS) which is based on the integration of an Android app and QR Code reader. The presentation of a novel calculation that expands the proficiency of the current smart- parking framework and builds an android application to gather information about the occupancy state of parking spaces, and to advise the drivers to the closest vacant parking spot. The going into or leaving the parking slot is constrained by an Android-based app. The algorithm improves the likelihood of successful parking and minimizes the user waiting time.

Indexed Terms- Android app, Car Parking, QR-Code, Smart Parking, IoT, Smart City

I. INTRODUCTION

Significant urban communities all around the globe are confronting another difficult these days with absence of adequate parking spot. With families getting smaller and the total number of vehicles is more than the total number of heads per family, the leaving situation is woefully missing the mark concerning the present prerequisites in the nation. The situation with the end goal that on any given working day around 40%

of the roads in urban India are taken up for just parking the cars. The issue has been additionally exacerbated by the fact that nowadays even individuals from the low-salary group are able to own cars. Especially in the cities and the big towns, there is a problem where the supply and demand ratio make parking a problem for parking space providers, the drivers or both. Here comes the importance of a smart car parking system (SPS) framework. The idea of Internet of Things (IoT) began with things with identity communication devices. The devices could be tracked, controlled or monitored utilizing remote computers connected through Internet. IoT broadens the utilization of Internet providing the communication, and thus inter-network of the devices and physical items, or 'Things'. The two prominent words in IoT are "internet" and "things".

Here we propose to develop a system that resolve the congestion and queuing issues of finding spot for parking on street. The proposed system allows users to reserve a parking lot by using their mobiles, before reaching at destination. An Android app has been developed to serve this purpose. An app requires just an internet connection. Initially, user will have to run the Android app on their smartphone, and select the level that he/she prefers to park the car. Once the selection is completed, an empty parking lot will be reserved for the user throughout the time. At the same time, a QR-Code is generated. The user then can enter the car park by using the QR-Code. Indirectly, this also helps to reduce the use of ticket or paper work.

Before the user exits the car park, he/she is just required to run the Android app, then the new QR-Code will be generated for user to exit the car park. Also, it helps to remove the hassle of queuing up to pay for the parking, users are no longer required to

search for small notes or coins when paying as well. In addition to the Android app, a car park management system has been developed to govern the entering and exiting of cars in the car park.

This management system is used to verify the validity and integrity of the QR-Code.

Proposed system not only targeted on the aforementioned issues, but also security measure is taken into consideration. In this case, the security measure is referring to how good the system can prevent the user from cheating on the car park charges. This is also one of the aspects that determine whether the car park management will choose to adopt the system. Furthermore, the system also attempts to minimize the amount of data communication required. For example, users are only required to go online when making reservation, or while scanning the QR Code. It is not necessary for them to stay online for the management system to determine whether they have pay for the correct amount or whether a valid QR-Code has been used.

The section I explains the Introduction. Section II presents the literature review of existing systems and Section III present proposed system architecture Section VI concludes our proposed system. While at the end list of references paper are presented.

II. LITERATURE REVIEW

Various methods are used to improve the intelligent parking mechanisms. Study of these existing systems shows that these systems need little or more human intervention for the functioning. One of the existing systems is [1] Intelligent Systems for Car Parking with Image Processing. In this paper, a brown rounded image on parking slot is captured using the camera and it is used to detect the free parking slots. The currently available parking spaces are displayed on the seven-segment display. First, the image of the parking slot with the brown rounded image is taken. Then create the binary images according to the brown rounded images. Due to this, we have to remove the noise of the images and identifies the object boundaries. The image detection module determines which objects are round, by determining each objects area and perimeter. Accordingly, the free parking slots are allocated.

Another Existing method is Integration of [2] RFID and WSN Technologies in a Smart Parking System. Basically, the SPS provides innovative services for the automatic supervision of paid parking spaces through the deployment of an IEEE 802.15.4-based WSN able to collect and deliver the data to the central server. A customized application on the server analyzes the received information and also sends an alert message to the mobile application of the traffic cop in case of unauthorized use of a reserved space or expiration of a parking receipt. Drivers can also use the system to pay the fee. The framework of the system consists of WSNs, Smart Gateway (SG), Central Server (CS) and two different mobile applications, called Parking App and Policeman App, designed for vehicle drivers and traffic cops, respectively. The main peripherals of the deployed Zigbee network are Router (R) and Coordinator (C) nodes. The R nodes provide forwarding and routing capabilities, where the c node collects the received data and forwards them to the Central Server. In the RFID- WSN integrated system, the Router Reader (RR) node typology has been introduced, which identifies an R node interfaced with a UHF RFID reader. The designed system consists of a WSN with some R node and RR nodes are spread out in the parking area. In particular, R nodes, equipped with a light sensor, are placed on each parking slot to monitor their state, while the RR nodes are on poles located their neighboring reserved parking space.

The information retrieved by the nodes is delivered, in a multi-hop manner, to the C node, which delivers them to the Smart Gateway. This last one, in turn, tests the collected data and sends them, together with the position of the parking zone, to the CS. the SG provides also an NFC way to finalize user's payment for their parking fee. The main function of the RR nodes includes control the reserved parking space and fill that space by using only authorized cars, labeled by UHF RFID tags. More specifically, when the CS receives the information that a reserved parking space has been occupied, it checks if a new RFID tag has been read by the RR node responsible for controlling that specific reserved space, and, in such a case, it verifies its authorizations. The CS maintains a database handling a lot of information about parking spaces available and user's payments.

In case of improperly use of a reserved space or

expiration of parking receipt, a parking monitoring application on the CS informs the traffic staff, exploiting the Google Cloud Messaging (GCM) [3] a vision-based car parking system includes 2 type of images. The positive image and negative image. The positive image contains images of cars from various angles but the negative image does not contain the images of cars, based on these two images parking slots are reserved.

As been stated in [4], this involves renting a special number to receive the SMS. If the system was to allow users to pay for the parking through SMS, part of the income may have to go to the local mobile operator as well. Indirectly, this can lead to increase in implementation cost and time.

Besides SMS, few companies have started to use QR-Code in their parking system as well. However, these systems are developed for the on-street parking, and QR- Codes are mainly being used to replace parking meters. For example, [5] and [6] have been working on replacing the mechanism of paying through the parking meters, with a new mechanism that uses QR-Code and mobile application. In this case, user is just required to scan the QR-Code on the parking meter, and settle the payment through the mobile application. This allows users to extend their session easily and remove the hassle of searching for coins. Overall, the idea of using QR-Codes for gated parking is still very new.

The basic idea is to reserve and/or pay for the parking by using SMS. For example, [7], has proposed a system that allows user to reserve a parking lot by using SMS. After a SMS is received, the system will reply the user through SMS, the parking lot allocated, password to enter the car park, as well as date and time. User then can enter the car park by using the password given.

Another system that uses SMS to reserve a parking lot is proposed in [8]. In addition to SMS, it also incorporated a Breadth First Search (BFS) algorithm to determine the parking lot that will be allocated to a user. Although the use of SMS can be very convenient, the deployment of such system requires the support from local mobile operator.

One of the intelligent systems for car parking has been proposed by making use of Image processing [9]. In this system, a brown rounded image on the parking slot is captured and processed to detect the free parking slot. The information about the currently available parking slots is displayed on the 7-segment display. Initially, the image of parking slots with brown-rounded image is taken. The image is segmented to create binary images. The noise is removed from this image and the object boundaries are traced. The image detection module determines which objects are round, by estimating each object's area and perimeter. Accordingly, the free parking space is allocated. A vision-based car parking system [10] is developed which uses two types of images (positive and negative) to detect free parking slot. In this method, the object classifier detects the required object within the input. Positive images contain the images of cars from various angles. Negative images do not contain any cars in them. The co-ordinates of parking lots specified are used as input to detect the presence of cars in the region. Haar-like features are used for feature detection.

However, limitations may occur with this system with respect to the type of camera used. Also, the co-ordinate system used selects specific parking locations and thus camera has to be at a fixed location. Limited set of positive and negative images may impose limitations on the system. Number Plate Recognition technique [11] for developing autonomous car parking system uses image processing basis to process the number plates of the vehicles. In this system, the image of the license number plate of the vehicle is acquired. It is further segmented to obtain individual characters in the number plate. Ultrasonic sensors are used to detect free parking slots. Then the images of number plate are taken and analyzed. Simultaneously, the current timing is noted so as to calculate the parking fees. The LCD displays "FULL" sign to indicate that a parking lot is not available. However, some limitations with the system include background colour being compulsorily black and character colour white. Also, analysis is limited to number plates with just one row.

Scientists with MIT constructed a good sensor bundle [12] with 2000 of which in important cars and trucks, measures typical pace, in addition to picking up the rocks or normal water while traveling. These people

find vehicles using disturbances within earth's magnet niche as a result of vehicles. People examine diverse approaches to depend on new or used cars. Most are in-road inductive loops, probe vehicles within site visitors, entry to permanent magnetic devices, us going for wise streets studs, some machine eye sight solutions (with problems) and using info because of mobile or portable mobile phone network. The job objectives are solving the efficient potential customers' operations and road safe practices obstacle by providing some assembly to get customer info.

Hsiao-Kuang, et al. (2014) proposed WSN-based traveling facts range along with communication process. These people engineered in addition to prototype hardware in addition to applications WSN themes. Additionally, they establish you are the different parts of ITS for the reason that security sub-system, approach sub- system, execution subsystem in addition to communication sub-system. That they produced some nodes choices: vehicle machine (mobile nodes), roadside equipment (static nodes) along with intersection item (sink). One's own success targets solving that successful supervision and additionally road safety practices struggle by giving the composition to collect traffic knowledge [13].

Qing, et al, (2014) studied a good VANET that includes roadside entrance nodes. Their particular inter-vehicle conversation (IVC) process offers a couple of categories of connection; routine together with aware primarily based. Their specific purpose should be to improve safe practices. They were proven their specific criteria working with Matlab simulators and lastly accomplished concerning appliance applying smallish rural autos. Additionally, they highlight several other VANET implementations. You succeed targets curing the successful potential customers operations together with highway safe practices challenge by giving a good structural part to recover traffic data [14].

Venkateswaran et. al, (2014) provide some traffic monitoring process implemented as a result of WSN using the essence some bendable, efficient, low-cost in addition to low-maintenance Wi-Fi solution concerning choosing traffic related info to get generating safety warnings for black color sites down the road mobile phone network. Ones own WSN is

made of a particular Entrance Node (GN) together with n Sensor Nodes (SNs) implemented on the roadside as per some close to linear topology [15].

Data within the SNs is usually collected from the GN in addition to delivered to Road Side Equipment (RSU) to blame for fusing the idea by means of traffic-related data files produced just by free options. Their system has become tested using quite a few serious use-case circumstances. Their report comprises addition particulars by using TelosB. The work marks solving the useful traffic organization test by giving a good framework to get traffic data.

As per study by Chen, Na, et al. (2016) the necessities for a successful WSN construction designed for ITSs. These people surveyed WSN architectures and additionally stated a principal amount of HER projects. They've already labeled all of them straight into monitoring parking lots, traffic supervision in addition to influence, and traffic evaluation. They will talk about the main element aspects that will generate the model of WSN because of its. They are particular succeed targets solving this effective traffic organization obstacle together with improving upon buyer working experience by providing a competent WSN engineering [16].

Srinu, M. Venkata, and B. Shiva Shankar (2016) concentrate on detailed analysis of the mobile phone network topology, energy conserving and additionally stability in addition to integrity. These people seal the deal electronic style and design associated with multilevel sensor node and additionally mobile phone network methods suited to urban open take strategy via the internet travel and leisure buses, could be administered with real- time, to achieve the purpose of intelligent operations. It offers higher cost performance look when placed against today's Navigation Systems applied to general public transit strategy. People present their particular answer, however, certainly no comparison created from by using prevailing treatments. Their work objectives curing this powerful traffic organization concern by providing an assembly to accumulate traffic facts [17].

Merriman et. al, (2016) studies show a powerful construction to enhance the safe practices from road travel around applying WSN and Wireless Bluetooth.

Most people additionally discuss an ad-hoc mobile phone network creation relating to vehicles in addition to facts trading sensed as a result of detectors. Their simulation effects demonstrate which Wireless Bluetooth along with sensor systems can be used collaboratively to increase wellbeing with streets travel around. Additionally, they highlight a lot of pattern factors for its. You will get the job done targets at curing the street welfare challenge by giving some knowledge selection structural part determined by WSN in addition to Bluetooth [18].

Chen, Xiaohong, et al. (2016) speak about heterogeneous wireless sensor network to get traveling system functions. Inside their daily news, WSN uses inside The Country's, that transportation techniques along with the employ middleware to help you combine heterogeneous Wi-Fi cooperative subjects usually are talked over [19]. They describe various hardware tools which might be utilized since mobile cooperating toys within the prototype functions. Some functions from each hierarchical stage along with an inter-hierarchical stage practical application have with results from those tests around researching the feasibility of using middleware inside actual take program applications.

Inside their proxy newspaper, Xiaohong, et al, provide a fantastic comparison associated with mobile technologies and some more ITS jobs on their extension daily news. Both of their functions aim at helping you out with the useful traffic direction struggle by providing a good assembly to accumulate traffic data files choosing heterogeneous WSN.

Zips, Patrik, Martin Böck, and Andreas Kugi (2016) additional analyze the number of choices associated with exploitation the technological know-how from WSN within A. In-depth detailed description from sensor node developed for sensing the intensity of magnetic discipline in addition to velocity is commonly given. By way of example, an offered sensor is needed to help sense the acceleration involving moving vehicles so to classify the vehicles' corresponding their predicted proportions [20]. You succeed targets in clearing up that efficient traffic direction test just by keeping track of vehicles in addition to classifying these in line with one's own span shape.

Sabnam et. al, (2016) in the Double Abdullah University or college involving Scientific discipline together with Knowhow work with unaggressive infrared along with an ultrasonic sensor to help you classify new or used cars and additionally discover flooding at pavements. Their own operate targets helping you out with this effective traffic direction in addition to roads essential safety difficulties by checking vehicles, classifying him or her and additionally discovering flood upon streets [21].

It can be described as suite associated with the wise transfer, streets essential safety along with logistics solutions perfectly engineered inside Qatar as a result of Qatar Movability Originality Target. Masaryk relies on getting involved in collecting real-time traffic data files out of a variety of sources then gives the traffic tender data files as a result of their Labeeb base to produce real-time traffic information. This post is commonly employed through the several apps and products and services around Masaryk, such as itrafficMon (traffic monitoring within real-time), iTripPlanner (trip planning service choosing real-time information), iFleet (intelligent navy manager), iDispatch, iChildSafety, and others [22]. Their particular suit associated with solutions aim for effective traffic management, safe road practices together with maximizing visitor knowledge.

Jannati et. al, (2016) can be some other loaded and additionally accommodate stage by way of QMIC that will work with real-time monitoring of quality of air as well natural world circumstances. The idea will allow users to get into these kinds of information and facts by way of innovative functions which can be reached because of various programs including portable shipping, world-wide-web, TXT, and approach partnership. The following base can provide other improvements to be able to end user knowledge [23].

This info is usually useful to establish the intelligent assistance and additional uses which tackle the needs of numerous user segments. This device provides a framework to accumulate facts for useful traffic operations. San Francisco's Municipal Travelling Service proven SFpark to use cutting edge solutions along with plans to boost parking around San Francisco Bay area by lessening traffic by facilitating

drivers look for parking rewards most people. SFpark functions applying intelligent costs to make sure that owners can quickly see offered spaces. This approach mission provides a system to improve customer practical experience further.

Protected Route Train engines for any Setting can be a Euro Commission-funded task to check out along with trial technological know-how and tips for this protected platooning associated with highway vehicles, some travelling process when various vehicles usually are in electronic format coupled together in a very “road train”, with solely that steer operator around practical influence. The studies in addition to advancement have been carried out by a few car or truck manufacturers along with Volvo within the guide. This SARTRE platooning program imagines the platoon all the way to six vehicles associated digitally, along with the steer automotive regulated using a specific person, avoiding consequently people pursuing, for the reason that servant vehicles.

Focused at commuters in autos, but probably industrial vehicles and additionally chartering, drivers could become a member of together with going away the platoon for the can. So that you can bring down any costs, the technological know-how for the method is to be reached through from the corner elements, and specifically not having necessitating expensive modifications so that you can be interstate infrastructure. This undertaking supplies methods for properly manage traffic and increases practical user experience despite the fact that driving a motor vehicle autonomously within a road show.

Chatzigiannakis (2016) studied Valeo will be an assisted parking method that will application a few devices and various factors that can help people fit their vehicles straight into perhaps even a smallest parking attraction. The car theme parks again but without the driver’s involvement. This product discusses making improvements to visitor working experience by way of concept to help on the autopilot woodland car. BMW’s Recreation area Tool is usually the section of its Attached Generate initiative [24].

The Recreation area Tool looks for the ideal parking house. It accelerates to be able to 34 km/h as well as a

top distance of 2.0 km with the strip of left vehicles for the side, that ultrasonic sensor from the BMW quantify potential parking areas, which the program, in that case, features to help operate. As soon as taxi driver selects a good parking room or space, the system subsequently picks the apparatus on its own, manuals this prescribing in addition to automatically accelerates or even brakes. This product moreover is focused on making improvements to buyer encounter by using automatic parking concept.

The device has a user interface designed for owners to evaluate together with arranging that parking space, and designed for parking lot owners to anticipate the income with a birth-death stochastic system exploration. This delivery occurrence fits the affair with vehicle typing in along with occupying a spot for a little period. This death event symbolizes case involving automotive leaving which means parking see starting to be vacant. In order to find beginning rate along with fatality rate with the vehicles in parking lots, the machine presumed the city to help be provided prognosis traffic platforms, light beam protection in addition to camcorder which often identify this traffic move and additionally stash the data with the additional IT’S app wearing.

A simulation will show possibility from utilized parking rooms concerning various birth/ death costs. Many devices apply this queuing model to help you recreate this parking habit. However, getting a turning up level and the parking time would likely require even more value such as the construction of traffic recognition facilities in locations or video cameras within parking lots, which are often expensive.

III. SYSTEM ARCHITECTURE

A. System Architecture

Following Fig. 1 Shows the proposed system architecture.



Fig 1. System Architecture

The system will require a Node MCU with various IR sensors attached to it. The IR sensors will determine the parking status. The microcontroller of the Node MCU is at Mega and to see the status of the parking in the parking lot we use the display unit for monitoring and an Android App. The parking lot setup (Node MCU and IR sensor) will be accessible to the server over Internet of things. The Android App will be used by users to check the parking status on their cell phones, and hence it will be the User interface of our project. The Node MCU is interfaced with the IR sensors to determine the parking status will be the hardware setup of the project. Hence the Node MCU becomes the hardware module of the system. Figure 1 shows the block diagram of the system.

The main components used for the implementation of the system are as follow:

- Arduino NodeMCU
- Wi-Fi Module ESP8266
- IR Sensor
- Servo Motor for elevator
- 5V Supply for NodeMCU
- 12 V Supply for Speed Motor and Controller

IV. CONCLUSION

In this paper, we have discussed about various parking and vehicle reservation system, for the management of the off-

street parking spots in consolidated cities. Various systems put the management of parking spots into a different perspective that goes over the simple automation of parking system through the use of advanced technological solutions, such as wireless networks and sensor communication. In fact, it is concerned with

- 1) The quality of life in modern cities, in terms of the amount of pollution and effects of the urban traffic congestion on the abilities of the drivers.
- 2) The quality of mobility in urban areas. On further modification, we are looking forward to implementing an intelligent parking assistant (IPA) architecture aims at overcoming current public parking management solutions. Future modifications the SPS system will include the following points:

- Considerations would be made about the evaluation of the revenue of the parking site.
- A module for the Smartphone App to navigate the users to the assigned parking spots using a vocal guide.
- A module to use Bluetooth technology to complete the check-in process.

REFERENCES

- [1] R. Yusnita, Fariza Norbaya, and Norazwinawati Basharuddin "Intelligent Systems for Car Parking with Image Processing".
- [2] L. Mainetti, L. Palano, L. Patrono, M. L. Stefanizzi, and R. Vergallo, Integration of RFID and WSN technologies in a smart parking system," in Proc. 22nd Int. Conf. Softw., Telecommun. Comput. Netw. (SoftCOM), 2014, pp. 104110.
- [3] Hamada R. H.Al-Absi, Justin Dinesh Daniel Devaraj, Patrick Sebastian, Yap Vooi Voon "A vision based car parking system"
- [4] A Cloud-Based Smart-Parking System Based on Internet-of-Things Technologies. Novomax (2013) http://www.parkbysms.net/files/activities_on_implementation.pdf
- [5] Parkmobile (2013) <http://parkmobile.com.au/>

- ParkNOW! (2013)
<http://www.nowinnovations.com/solutions/on-street-parking>
- [6] Hanif NHHM, Badiozaman MH, Daud H (2010) Smart parking reservation system using Short Message Services (SMS). In: International Conference on Intelligent and Advanced Systems (ICIAS), pp 1–5
- [7] Khang SC, Hong TJ, Chin TS, Wang S (2010) Wireless Mobile-Based Shopping Mall Car Parking System (WMCPS). In: IEEE Asia-Pacific Services Computing Conferences (APSCC), pp 573–577
- [8] Hamada R.H. Al-Absi Patrick Sebastian Justin Dinesh Daniel Devaraj Yap Vooi Voon. “Vision-based automated parking system.” 10th International Conference on Information Science, Signal Processing and their Applications (ISSPA 2010) 2010.
- [9] M.M. Rashid A.Musa M.Ataur Rehman N.Farhana A.Farhana. “Automatic parking management system and parking fee collection based on number plate recognition.” International Journal of Machine Learning and Computing, 2:93- 98, 2012.
- [10] M.O. Reze M.F. Ismail A.A. Rokoni M.A.R. Sarkar. “Smart parking system with image processing facility”. I.J. Intelligent Systems and Applications, 3:41-47, 2012.
- [11] Amba James Garba Adamu Murtala Zungeru, Adamu Murtala Zungeru. “Design and implementation of a short message service based remote controller”. Computer Engineering and Intelligent Systems, 3:106- 119, 2012.
- [12] Zhang, Zusheng, et al. "A street parking system using wireless sensor networks." International Journal of Distributed Sensor Networks 2013 (2013).
- [13] Wu, Eric Hsiao-Kuang, et al. "Agile urban parking recommendation service for intelligent vehicular guiding system." Intelligent Transportation Systems Magazine, IEEE 6.1 (2014): 35-49.
- [14] Tian, Qing, et al. "Design of intelligent parking management system based on license plate recognition." Journal of Multimedia 9.6 (2014): 774- 780.
- [15] Venkateswaran, V., and N. Prakash. "Intelligent approach for smart car parking reservation and security maintenance system." IJRET: International Journal of Research in Engineering and Technology 3.02 (2014).
- [16] Chen, Na, et al. "Parking Survey Made Efficient in Intelligent Parking Systems." Procedia Engineering 137 (2016): 487-495.
- [17] Srinu, M. Venkata, and B. Shiva Shankar. "Real Time Car Parking System and Parking Fee Display Using Raspberry Pi." International Journal of Research 3.4 (2016): 421-426.
- [18] Merriman, Peter. "Mobility Infrastructures: Modern Visions, Affective Environments and the Problem of Car Parking." Mobilities (2016): 1-16.
- [19] Chen, Xiaohong, et al. "Effect Analysis of Parking Price and Egress Time on Parking Choice and Car Usage at Airport." Transportation Research Board 95th Annual Meeting. No. 16-4559. 2016.
- [20] Zips, Patrik, Martin Böck, and Andreas Kugi. "Optimisation based path planning for car parking in narrow environments." Robotics and Autonomous Systems 79 (2016): 1-11.
- [21] Sabnam, Masiha, Mousumi Das, and Parismita A. Kashyap. "Automatic Car Parking System." ADBU Journal of Engineering Technology 4 (2016)
- [22] Wang, Yu, and Xiaoxi Zhu. "A robust design of hybrid fuzzy controller with fuzzy decision tree for autonomous intelligent parking system." American Control Conference (ACC), 2014. IEEE, 2014.
- [23] Geng, Yanfeng, and Christos G. Cassandras. "A new “smart parking” system infrastructure and implementation." Procedia-Social and Behavioral Sciences 54 (2012): 1278-1287.
- [24] Rajabioun, Tooraj, Brent Foster, and Petros Ioannou. "Intelligent parking assist." Control & Automation (MED), 2013 21st Mediterranean Conference on. IEEE, 2013.