

A Survey on Perspicacious Vacant Car Parking Detection System

Nita Saware¹, Sneha Waje², Mangesh Kore³, Tejaswini Patil⁴, Preeti Nanaware⁵

Professor, Dept. of Computer Engineering, Jaywantrao Sawant College Of Engineering, Hadapsar, Pune-411028, India¹

U.G Student, Dept. of Computer Engineering, Jaywantrao Sawant College of Engineering, Hadapsar, Pune-411028, India²

U.G Student, Dept. of Computer Engineering, Jaywantrao Sawant College of Engineering, Hadapsar, Pune-411028, India³

U.G Student, Dept. of Computer Engineering, Jaywantrao Sawant College of Engineering, Hadapsar, Pune-411028, India⁴

U.G Student, Dept. of Computer Engineering, Jaywantrao Sawant College of Engineering, Hadapsar, Pune-411028, India⁵

ABSTRACT: Traditional car parking needs man power at large scale. Also there is no facility for pre-booking of the slot, and no accurate bills. Therefore, there is a need to design and implement an automated, advanced and smart oriented assistance parking system to monitor the above mentioned issues and help to improve the driver parking skills and reduce the risk for car damages. There is also a need of designing a subsystem which can issue a payment receipt analyzing and calculating the time for which the parking space was acquired since the car entered in the parking space. Here it demands for implementation of various methods or techniques under the domains: Artificial Intelligence, Image Processing and Android Applications. It includes issues such insufficient illumination, complicated lightning conditions in which we have to alleviate the interference of unpredictable lightning changes and shadows. We also have to filter out the distortions appeared in the observed image due to inter-object occlusion and perspective distortion.

Secondly, for automating, guiding, reserving and notification services to the authenticated user it requires implementation of the technologies and techniques of Android.

KEYWORDS: iSCAPS, Bayesian Hierarchical Framework (BHF), PS, NFC, IoT, RFID

I. INTRODUCTION

Initially car parking were totally manual. External person had to guide the user for parking the car in the available free parking slot. As it was manual, it had many errors in the bill generation process. Later a system was developed in which an external person guided the user to the available free parking slot but electronic boom barriers were used to control the entry and exit of the cars.

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 11, November 2015

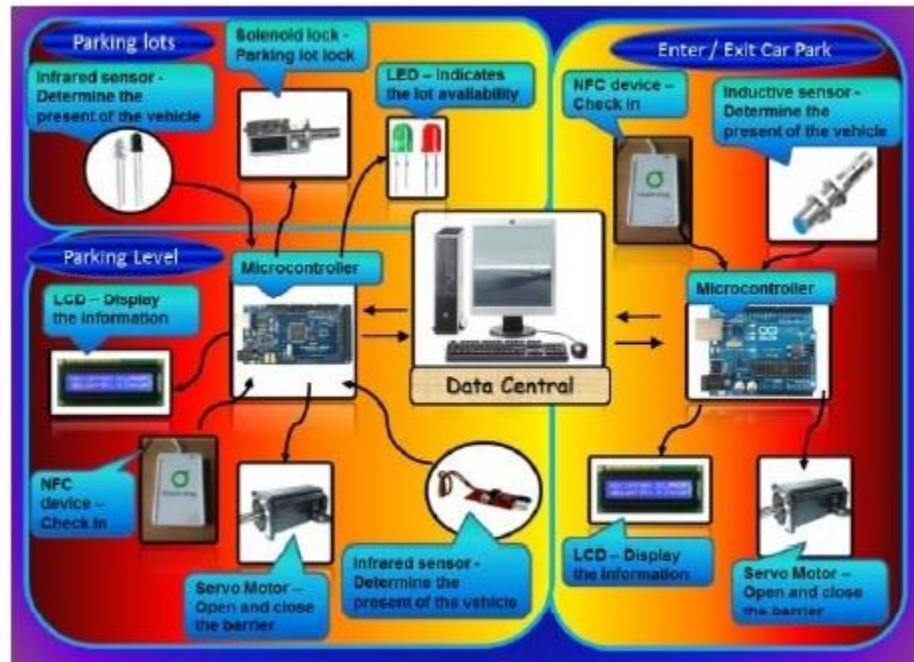


Fig. The overview of the process of iSCAPS with NFC technology

Later a system, iSCAPS, was proposed in which the concept of e-valet was used in which user can reserve the parking slot using an android application through smart phone. Instead of using conventional monthly pass or ticket, this system uses NFC(Near Field Communication). In this system, at entrance and exit sensors are used to detect the arriving car. LCD displays are used to show the number of available free parking slots at the entrance. Using these sensors accurate bill generation can be done as these sensors automatically senses the entry and exit time.

II. RELATED WORK

Vacant car parking detection have the first issue about how to obtain well exposed images for inference: For this a plane based Bayesian Hierarchical Framework (BHF) is proposed. Second issue is about how to improve the performance of vacant parking space detection and how to speed up the system for practical applications [1]. The method of combining background subtraction and vertex-edge features are followed. It uses color features and corner features, through training SVM classifier to get the result [2]. ICampus parking allocation using patterns suggests algorithms such as Pattern search (PS) and Pattern search warn(PSwarn) for solving the paring detection problem[3].Cloud-based parking uses three components as Cloud Tier,OSGi Web Servers Tier, Mobile Applications Tier but don not solve ground level issues [4].The temporal clustering and anomaly detection deals with the various algorithms and their use for clustering parking spaces[5].

Smart car parking systems with guidance and damage notification gives route to allocated parking slot and inform in case of any damage to car[6].An innovative system for car parking work separately for entrance, parking allocation and exit phenomenon[7].

The Advanced License Plate Recognition System, consists of two section: Radio frequency Identification (RFID) based detection and license plate recognition by using Open Computer Vision(CV). RFID is an automatic secure and

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 11, November 2015

convenient identifier which identifies the objects automatically. Automatic license plate recognition(ALPR) is used to obtain the license number of the vehicles written on the license plate and it possesses various applications but also many challenges[8].Parking availability based on sensor-enabled network uses the data and select some key parameters to form three feature sets to use as the input for the parking availability prediction models that we derive. The algorithms used for modeling the occupancy rate and for prediction are: 1)Regression Tree 2)Support Vector 3)Neural Networks[9]. The entering and leaving from the parking lot is commanded by an Android based application. On allocation of free slot, the car will further trace its path to free parking spot[10].

III. PERFORMANCE REVIEW TABLE

| Sr.No. | Title | Techniques | Parameters Achieved |
|--------|--|---|--|
| 1. | Vacant Parking Space Detection Based on Plane-based Bayesian Hierarchical Framework (Proposed Method) | Bayesian Hierarchical Framework (BHF) | Performance, consistency |
| 2. | A Method of Parking space detection based on image segmentation and LBP | Novel parking space detection, LBP | Better feature extraction, good detection results |
| 3. | Campus Parking Space Allocation Distribution Using Pattern Search and Particle Swarm Pattern Search Algorithms | Particle Swarm Pattern Search | Good and feasible solution for college campus place. |
| 4. | A Cloud-Based Intelligent Car Parking Services for Smart Cities | Cloud computing, IoT | Best availability and guidance to nearest parking slot |
| 5. | Smart Car Parking: Temporal Clustering and Anomaly Detection in Urban Car Parking | Farthest First(FF) Clustering, Expectation Maximization(EM) Clustering, One-Class SVM, IoT. | Reliability, low cost, maximum productivity |
| 6. | Intelligent Parking System for Car Parking Guidance and Damage Notification | Ultrasonic sensors, shock sensors | Damage notification, guidance to free space |
| 7. | iSCAPS - Innovative Smart Car Park System integrated with NFC technology and e-Valet function | NFC, Radio Frequency Identification(RFID) | Automatic bill generation, reservation in advance |
| 8. | Advanced License Plate Recognition System For Car Parking | RFID,CV | High speed, accuracy, uniqueness |
| 9. | Parking Availability Prediction for Sensor-Enabled Car Parks in Smart Cities | Regression Tree, Support Vector, Neural Networks. | Feasibility, security, robustness |
| 10. | Automated Car Parking System Commanded By Android Application | Autonomous searching method, Development of an Android application | Automation, Security |

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 11, November 2015

IV. EXPERIMENTAL RESULTS

These results includes the results and graphs related to the survey of proposed method

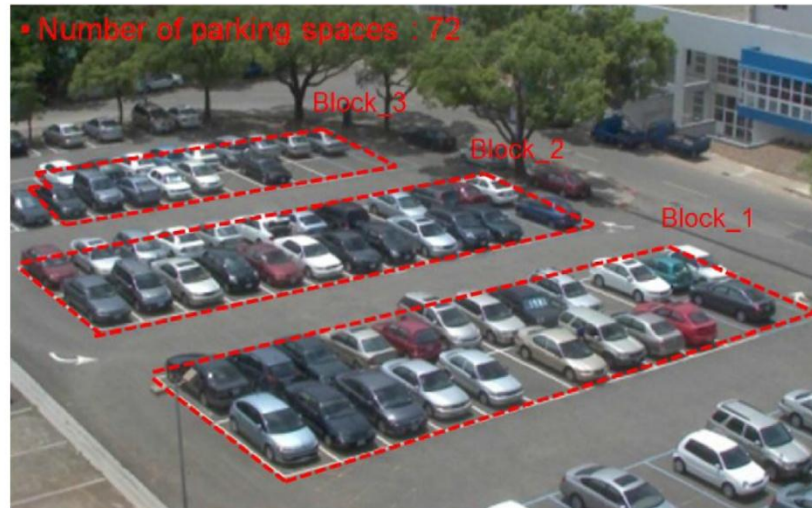


Fig. Experiment environment for evaluating the influence of perspective distortion.

To quantitatively evaluate the performance of our system, we calculate false positive rate (FPR), false negative rate (FNR), and accuracy (ACC). Their definitions are expressed as follows:

FPR = number of parked spaces being detected as vacant / total number of parked spaces

FNR = number of vacant spaces being detected as parked / total number of vacant spaces

ACC = number of correct detection in both parked and vacant spaces / total number of tested spaces

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 11, November 2015

1) Daytime Performance Evaluation:

Table1 : Space Detection Results in the Daytime

| Data Set ID | Number of tested Spaces | | | Proposed Method | | |
|---------------|-------------------------|--------|-------|-----------------|--------|--------|
| | vacant | Parked | Total | FPR | FNR | ACC |
| Typical(DS_1) | 4123 | 7397 | 11520 | 0.280% | 1.190% | 99.39% |
| Sunny(DS_2) | 8121 | 3399 | 11520 | 0.088% | 0.860% | 99.37% |
| Cloudy(DS_7) | 5353 | 6167 | 11520 | 0.047% | 0.260% | 99.85% |
| Rainy(DS_4) | 3544 | 6896 | 10440 | 0.640% | 0.370% | 99.45% |

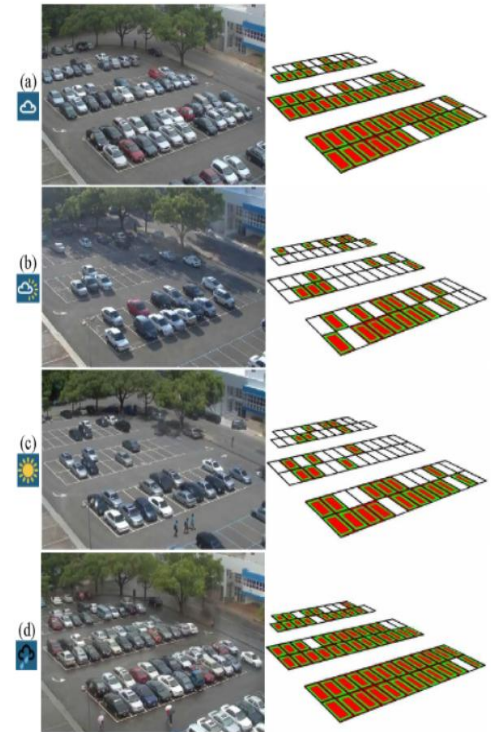


Fig: Results of vacant space detection in the daytime.
(a) Cloud day. b) Typical day. (c) Sunny day. (d) Rainy day.
Green rectangles indicate the ground truth and red rectangles indicate the detection results.

2) Night time Performance Evaluation:

| | #of tested spaces | | | Proposed Method | | |
|---------------------------|-------------------|--------|-------|-----------------|--------|--------|
| | vacant | Parked | Total | FPR | FNR | ACC |
| Low Illumination(DS_5) | 4165 | 3035 | 7200 | 1.610% | 2.420% | 97.92% |
| Medium Illumination(DS_6) | 4569 | 2631 | 7200 | 0.800% | 1.730% | 98.61% |
| High Illumination(DS_7) | 1428 | 2172 | 3600 | 0.46% | 3.29% | 98.42% |

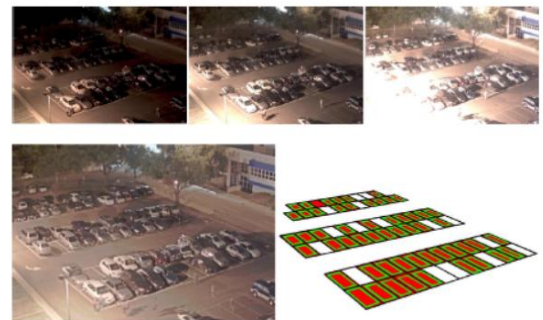


Table2: Space Detection Results in the Nighttime

Fig: Result for vacant space detection in nighttime

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 11, November 2015

V. CONCLUSION

Intelligent vacant car parking detection system is based on artificial intelligence along with Android application development. It is useful for users as it provides secure and reliable parking and pre-reservation of parking slot. Smart vacant car parking detection system will become rapid and an efficient way of parking in smart cities and projects related to it. It also simplify conflicts occurring due to absence of pre-reservation and requires minimum number of manpower. Results are quickly transferred to centralized database and ultimately to the Android application.

REFERENCES

- [1] Ching-Chun Huang, Yu-Shu Tai, and Sheng-Jyh Wang, "Vacant Parking Space Detection Based on Plane-based Bayesian Hierarchical Framework", IEEE TRANSACTIONS ON CIRCUITS AND SYSTEMS FOR VIDEO TECHNOLOGY, VOL. 23, NO. 9, SEPTEMBER 2013.
- [2] Wang Lixia, Jiang Dalin, "A Method of Parking space detection based on image segmentation and LBP", Fourth International Conference on Multimedia Information Networking and Security, 2012 IEEE DOI 10.1109/MINES.2012.27.
- [3] Aderemi O. Adewumi, Luke O. Joel and Babatunde A. Sawyerr, "Campus Parking Space Allocation Distribution Using Pattern Search and Particle Swarm Pattern Search Algorithms", SCIS&ISIS 2014, Kitakyushu, Japan, December 3-6, 2014.
- [4] Zhanlin Ji, Ivan Ganchev, Máirtín O'Droma and Xueji Zhang "A Cloud-Based Intelligent Car Parking Services for Smart Cities", IEEE, 2014.
- [5] Yanxu Zheng, Sutharshan Rajasegarar, Christopher Leckie, Marimuthu Palaniswami, The University of Melbourne, Australia, "Smart Car Parking: Temporal Clustering and Anomaly Detection in Urban Car Parking", 2014 IEEE Ninth International Conference on Intelligent Sensors, Sensor Networks and Information Processing (ISSNIP) Symposium on Information Processing Singapore, 21-24 April 2014.
- [6] Sanaa Alfatihi, Soukaina Chihab and Yassine Salih Alj, School of Science and Engineering, Al Akhawayn University, Ifrane, Morocco, "Intelligent Parking System for Car Parking Guidance and Damage Notification", 2013 4th International Conference on Intelligent Systems, Modelling and Simulation.
- [7] Jin Teong Ang, Siew Wen Chin, Jia Hui Chin, Zyn Xian Choo, Yu Ming Chang, "iSCAPS - Innovative Smart Car Park System integrated with NFC technology and e-Valet function", IEEE June-2013.
- [8] Judith Sen E, Deepa Merlin Dixon K, Ansy, Jinesh K J, "Advanced License Plate Recognition System For Car Parking", International Conference on Embedded Systems - (ICES 2014).
- [9] Yanxu Zheng, Sutharshan Rajasegarar, Christopher Leckie National ICT Australia Victoria, Dept. of Computing and Information Systems, The University of Melbourne, Australia, "Parking Availability Prediction for Sensor-Enabled Car Parks in Smart Cities", 2015 IEEE Tenth International Conference on Intelligent Sensors, Sensor Networks and Information Processing (ISSNIP) Singapore, 7-9 April 2015.
- [10] Mrs. D.J. Bonde, Rohit Sunil Shende, Akshay Sambhaji Kedari, Ketan Suresh Gaikwad, Amol Uday Bhokre, "Automated Car Parking System Commanded By Android Application", 2014 International Conference on Computer Communication and Informatics (ICCCI -2014), Jan. 03 - 05, 2014, Coimbatore, INDIA.