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# Advanced Parking Slot Management System Using Machine Learning

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**Abstract:** *The continuous development of economy, personal vehicles have become an indispensable part of our daily lives. The commodity has become affordable to most working class providing comfortable way of life; however on the other hand multiple problems strike back which need to be solved. One problem is of parking spaces. A variety of sophisticated car parking systems are in use nowadays; however they all require a considerable design time, installation and maintenance cost. In many parking areas the management uses the counter at the checkpoint in order to track the number of vehicle that enter and exit the parking area. More sophisticated systems detect the exact location of the empty spaces and guide the incoming drivers accordingly. Some advanced vehicles have their own parking systems installed but still hard for the system itself to confirm whether a vacant parking area truly exists or not. Despite of all these systems, there are still places where parking facilities need to be set up on temporary or urgent bases; this application provides a cost effective, space based solution for such scenarios. It just need to mount cameras on the location to take video at regular intervals. This project focuses on developing a parking management system based on video processing to detect vacant parking slot in an area where automated systems are not installed. Camera images of the parking area are subjected to image processing algorithm which marks virtual slots in the area and extracts occupancy information to guide the incoming drivers about availability and position of vacant spaces.*

**Keywords:** Slot Management System

## I. INTRODUCTION

We have developed a simple parking space detection system using deep learning. Our project consist of three main process namely Detection of parking spots, detection of cars, calculating IoU in the images. The experimental results show that the proposed method works well under the condition of complex illumination and around-view images from different sources, with a precision of 94.5% and a recall of 92.7%. The results also indicate that it can be applied to diverse slot types, including vertical, parallel and slanted slots, which is superior to previous methods.

### 1.1 Machine Learning

Deep learning is a type of machine learning and artificial intelligence (AI) that imitates the way humans gain certain types of knowledge. Deep learning is an important element of data science, which includes statistics and predictive modeling. For many applications, deep learning models outperform shallow machine learning models and traditional data analysis approaches. We summarize the fundamentals of machine learning and deep learning to generate a broader understanding of the methodical underpinning of current intelligent systems. In particular, we provide a conceptual distinction between relevant terms and concepts, explain the process of automated analytical model building through machine learning and deep learning.

## II. RELATED WORK

With the continuous development of the economy, vehicles have become an indispensable tool in people's daily life. However, solving the 'difficult parking' task is now an emergent issue. Detecting the status of parking spaces in a parking lot is the most fundamental prerequisite in modern intelligent parking management and guidance systems. Many researchers have been trying to develop automated parking availability system which detects the available space with certain area of interest. The following text gives a brief overview.

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### 2.1. Automatic Number Plate Recognition System

Automatic Number Plate Recognition (ANPR) is a fairly well explored problem with many successful solutions. However, these solutions are typically tuned towards a particular environment due to the variations in the features of number plates across the world. Algorithms written for number plate recognition are based on these features and so a universal solution would be difficult to realize as the image analysis techniques that are used to build these algorithms cannot themselves boast hundred percent accuracy. The focus of this paper is a proposed algorithm that is optimized to work with Ghanaian vehicle number plates. The algorithm, written in C++ with the OpenCV library, uses edge detection and Feature Detection techniques combined with mathematical morphology for locating the plate. The Tesseract OCR engine was then used to identify the detected characters on the plate.

#### 2.1.1. Disadvantages

The newly registered Car cannot be recognised using this technique. This technique requires more time to recognise mass number of car entering. The implementation of sensor is not applicable everywhere.

### 2.2. Automated Vehicle Parking System using RFID

This paper considers automatic car park management, which becomes an inevitable option to rationalize traffic management in modern cities. Integration of networked sensor/actuator and radio frequency identification (RFID) technologies is explored to enable sophisticated services via the Internet in the emerging internet of things (IoT) context. Based on this integration, we propose a scalable and low-cost car parking framework (CPF). A preliminary prototype implementation and experimentation of some modules of the proposed CFP has been performed. The clustering of sensors (sensing boards) into a single mote using the standard I2C protocol has been explored in the prototype, and experimental results demonstrate considerable reduction in cost and energy consumption.

#### 2.2.1. Disadvantages

The system lacks him an application for the remote monitoring of free spaces. No navigation system or additional services to increase the scalability of the latter. The topology used is wired bus which limits the interoperability and the scalability of the system.

### 2.3. Monitoring Parking Space Availability via ZigBee Technology

With the rapid growth of vehicle availability and usage on the road in recent years, finding a vacant car parking space is becoming more and more difficult which resulting in a number of conflicts such as traffic problems. In this paper, a prototype of Monitoring Parking Space Vacancy System is introduced using wireless technologies to alleviate the traffic problems. The system includes two modules, parking lot vacancy monitoring module, and master module. Parking lot vacancy monitoring module consists of digital infrared sensor, liquid crystal display (LCD), and Zigbee module which are interfaced with PIC microcontroller. Master modules include laptop GUI display, and Zigbee modules. The user can get the status of parking lot vacancy through the LCD of monitoring parking vacancy module. The Zigbee transceiver on monitoring parking vacancy module which interfaced with microcontroller is to transmit the infrared sensor data when the digital infrared sensor detects the presence of vehicle in the parking areas and thus provide the status of the parking lot to be displayed in master module with Graphical User interface (GUI).

#### 2.3.1 Disadvantage

Linear networking is used. The system uses a display with a limited web application. The system misses him the remote monitoring of the availability of available spaces in the car park.

### 2.4. WSN Based Secure Vehicle Parking Management and Reservation System

With the rapid proliferation of vehicle availability and usage in recent years, finding a vacant car parking space is becoming more and more difficult, resulting in a number of practical conflicts. Parking problems are becoming ubiquitous and ever growing at an alarming rate in every major city. Wide usage of wireless technologies with the recent advances in wireless applications for parking, manifests that digital data dissemination could be the key to solve emerging parking

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problems. Wireless Sensor Network (WSN) technologies have attracted increased attention and are rapidly emerging due to their enormous application potential in diverse fields. This field is expected to provide an efficient and cost-effective solution to the effluent car parking problems. This paper proposes a Smart Parking Management System based on wireless sensor network technology which provides advanced features like remote parking monitoring, automated guidance, and parking reservation mechanism. The paper describes the overall system architecture of our embedded system from hardware to software implementation in the view point of sensor networks. This paper also shows that the pre existing security surveillance (CCTVs) will be used as a sensing nodes to identify vacant parking space. The captured image will be processed through the ARM7 Microcontroller and the processed data will be transmitted via ZigBee to a central computer to store and update the occupancy status of available parking space vacancies in the database. The performance of this WSN based system can effectively satisfy the needs and requirements of existing parking hassles thereby minimizing the time consumed to find vacant parking lot, real time information rendering, and smart reservation mechanisms.

### 2.4.1. Disadvantage

The system is limited for an improvement in the future in the implementation of the latter in outdoor linear car parks. The implementation of sensor is not applicable .The GSM system used for reservation of spaces which can be blocked with multiple access.

## III. EXISTING SYSTEM

The very first step in a parking space detection system is to identify the parking spots. There are a few techniques to do this. For example, identifying the parking spots by locating the parking lines in a spot. This can be done using the edge detectors that OpenCV provides. But the problem here is that all parking locations don't have these pre-defined boundaries. Another approach we can use is to assume that the cars that don't move for a long time are in parking spaces. In other words, valid parking spaces are just places containing non-moving cars. But, this also doesn't seem to be reliable. may lead to false positives and true negatives which is not acceptable in case of parking system.

The Parking Guidance and Information System (PGIS) is a system which provides information about the nearest car park and the number of vacancies available to drivers. This system can be commonly located in big urban cities. The Variable Message Display (VMS) and other methods such as radios and phones are used to provide information regarding parking spaces availability to the patrons. The information provides the occupancy status of car parks or selected car park around the city with a range of capability of displaying Full/Available at the entrance (o guide the user to the respective vacant area. In order to detect the space usage in the car park, vehicle detectors are installed at the entrance, exits and/or at individual parking space. Common choices of detector used include loop detectors, machine vision, ultrasonic, infrared, microwave and lasers. An example of PGIS has been illustrated by Seong et al. (2008) in their paper which consists of a Wireless Sensor Network (WSN) based VDS (vehicle detection sub-system) and a management subsystem.

## IV. PROPOSED SYSTEM

The proposed system is divided into four modules;

1. Insertion of union
2. Initialization of boundaries
3. Allocation of boundaries to the system
4. Tracking the vehicle using video surveillance

This project, vehicle parking management system using vedio processing aims to create a better environment for a vision-based vacancy parking area detection; providing a modern and innovative solution for temporary parking places. For example, dust ground, cemented flooring where no specific parking systems are used. The prime objective is to have maximum number of cars which can be parked in an organized manner into the temporary lot.

This project's aim is to detect and recognize the real time vacant parking space. . It comprises of a camera mounted on roof top of any nearby building or some supporting pole at certain angle where it covers the maximum area of parking lot which is being used for taking the input. The images obtained from the live stream are then fed to the processing module, which detects the region of interest (ROI) consisting of the area to be covered for parking spaces. To detect cars in a video

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we will use the Mask-RCNN. It is basically a convolutional neural network trained on millions of images and videos from several datasets, including the COCO dataset, to detect various objects and their boundaries. Mask-RCNN is built on the top of the Faster-RCNN object detection model.

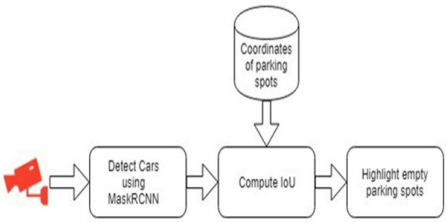


**Figure 1:** Flow chat of current model

### 4.1. Intersection Over Union

Intersection over Union is an evaluation metric used to measure the accuracy of an object detector on a particular dataset.IOU is mainly used in applications related to object detection, where we train a model to output a box that fits perfectly around an object. As its name suggests it the ratio of the area of overlap and area of intersection**.** Computing Intersection over Union can, therefore, be determined via:

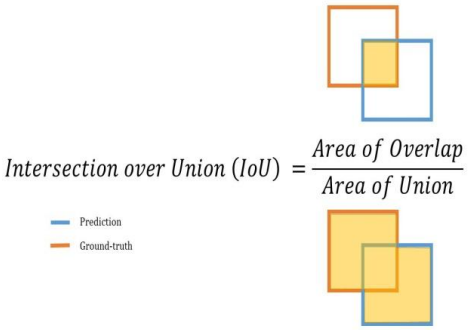


**Figure 2:** IoU formula

We will compute the IoU for every pair of parking spot coordinates and bounding box of cars. If the IoU for a pair is higher than a certain threshold, we will consider that parking spot as occupied.

### 4.2. Initializing Boundaries

The imaginary parking lines are made to achieve maximum parking, since the cars are not parked in correct way, car area needs to be calculated which resides inside a proper parking slot. Since in the image the unit of distance measurement is a pixel whereas actual distances are in the unit of feet, an equation is used as the conversion formula to find the number of pixels per metric.We will first use the Mask-RCNN object detection model to detect the cars and their bounding boxes. After getting the bounding boxes from the Mask-RCNN, we will compute the Intersection over Union (IoU) on each pair of the bounding boxes and parking spot coordinates. If the IoU value for any parking spot is greater than a certain threshold, we will consider that parking spot as occupied.


**Figure 3:** Before marking the boundaries

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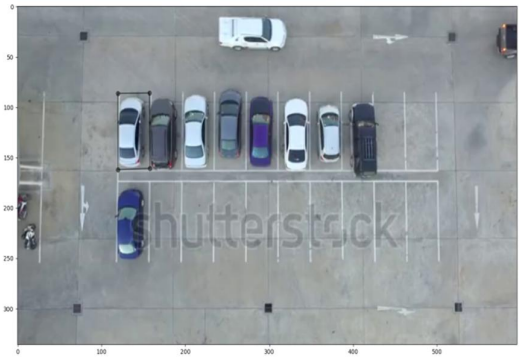


**Figure 4:** After marking the boundary

### 4.3. Allocation of Boundaries to the System

The boundaries of the parking slot is allocated to the system using the following Library;

#### 4.3.1. TensorFlow:

TensorFlow is an end-to-end open source platform for machine learning. It has a comprehensive, flexible ecosystem of tools, libraries and community resources that lets researchers push the state-of-the-art in ML and developers easily build and deploy ML powered applications. TensorFlow provides a collection of workflows with intuitive, high-level APIs for both beginners and experts to create machine learning models in numerous languages. Developers have the option to deploy models on a number of platforms such as on servers, in the cloud, on mobile and edge devices, in browsers, and on many other JavaScript platforms. This enables developers to go from model building and training to deployment much more easily.

#### 4.3.2. OpenCV

OpenCV is a library of programming functions mainly aimed at real-time computer vision. Originally developed by Intel, it was later supported by Willow Garage then Itseez. The library is cross-platform and free for use under the open-source Apache 2 License.

#### 4.3.3. Tracking of vehicle using video Surveillance

The imaginary parking lines are made to achieve maximum parking, since the cars are not parked in correct way, car area needs to be calculated which resides inside a proper parking slot. To handle with this, three classes have been defined, namely, the car class, the parking class and the intersect class. The car class contain the coordinate of car, the boolean either car is corrected parked or not and all value of all slot that car had occupied.

## V. CONCLUSION

These system can counter the parking problems that arise due to the unavailability of a reliable, efficient and modern Parking system. Such system can help the economic, social and safety based aspects of the society. It also helps in preserving the environment, fuel and time. The economic analysis can help us find the feasible project so that we can have a better parking system without making the economy suffer.

## REFERENCES

**[1].** Rahayu, Y.; Mustapa, F.N An automatic number plate recognition system using opencv and tesseractocr engine 2018,2,1

**[2].** Kalantary, S.; Taghipour, S. A survey on architectures, protocols, applications, and management in wireless sensor networks. J. Adv. Comput. Sci. Technol. 2014, 3, 1.

**[3].** Akyildiz, I.F.; Vuran, M.C. Wireless Sensor Networks; Wiley Publication: Hoboken, NJ, USA, 2010.

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**[4].** Akyildiz, I.F.; Su, W.; Sankarasubramaniam, Y.; Cayirci, E. A survey on sensor networks. IEEE Commun. Mag. 2002, 40, 102–114

**[5].** Hilmani, A.; Maizate, A. A study of self-organization protocols in wireless sensor network. Mediterr.Telecommun. J. 2017, 7. N◦ 2. 5. Rahayu, Y.; Mustapa, F.N. A secure parking reservation system using GSM technology. Int. J. Comput. 2013, 2, 518

**[6].** Yee, H.C.; Rahayu, Y. Monitoring parking space availability via ZigBee technology. Int. J. Future Comput. 2014, 3, 377

**[7].** Poojaa, A.; Glory, M.; Nathiya, P.; Ramya, R.; Sivasrinee, E.T. WSN based secure vehicle parking management and reservation system. In Proceedings of the National Conference on Research Advances in Communication, Computation, Electrical Scienceand Structures (NCRACCESS-2015), Deviyakurichi, India, 21 February 2015.

**[8].** Karbab, E.M.; Djenouri, D.; Boulkaboul, S. Car park management with networked wireless sensors and active RFID. In Proceedings of the IEEE International Conference on

**[9].** Chen, M.; Chang, T. A parking guidance and information system based on wireless sensor network. In Proceedings of the IEEE International Conference on Information and Automation, Shenzhen, China, 6–8 June 2018 Electro/Information Technology (EIT), Dekalb, IL, USA, 21–23 May 2015

**[10].** Mainetti, L.; Palano, L.; Patrono, L.; Stefanizzi, M.L.; Vergallo, R. Integration of RFID and WSN technologies in a smart parking system. In Proceedings of the 22nd International Conference on Software, Telecommunications and Computer Networks (SoftCOM), Split, Croatia, 17–19 September 2014