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AMI based Smart Parking System

Sandeep Singh¹, Sneha Kesarwani², Vanshi Tiwari³

^{1, 2, 3}Department of Computer Science and Engineering, Raj Kumar Goel Institute of Technology, Ghaziabad, India

Abstract: Machine learning is a method of data analysis that automates analytical model building. It is a branch of artificial intelligence based on the idea that systems can learn from data, identify patterns and make decisions with minimal human intervention. Image processing is a method to perform some operations on an image, to get an enhanced image, or to extract some useful information from it. It is a type of signal processing in which input is an image and output may be an image or characteristics/features associated with that image. Smart Parking allows us to park our vehicles in a modern fashion which is far better than the traditional pattern. This paper presents an AMI-based smart parking system, here AMI stands for Artificial Intelligence, Machine Learning, and Image Processing. This gave the client the ability to check the available parking spaces and reserve a parking spot. Image processing helps in detecting the owner's face and recognize the number plate of the vehicles, with the help of machine learning algorithms the vehicles will park successfully. We will have all the records of the customers in our database which further helps in identifying if any particular vehicle is in a category of the stolen item. This also helps in tracing and know the status of vehicles while the owner is somewhere else in the city.

Keywords: Artificial Intelligence, Machine Learning, Image Processing, Face Recognition, Smart Parking, Number Plate Recognition, Security, AMI

I. INTRODUCTION

Parking lots nowadays have become very redundant and require a lot of manpower to handle and maintain efficiently. These parking lots are not user-friendly and do not provide data regarding the availability of free spaces. Researchers' committee has contributed to this issue a lot and tried to come up with various methods to optimize the parking lots to serve the purpose. Not only that, but it also has one more dimension to it which is, increasing vehicle size in the luxurious segment and confined parking spaces in urban cities. Searching for a parking space has become a routine (and often frustrating) activity for many people in cities around the world. This search roughly burns about one million barrels of the world's oil every day. As the global population continues to urbanize, without a well-planned, convenience-driven retreat from the car these problems will worsen.[1]

1) *Fun Fact:* An "Intelligent Parking Solution" could result in 2, 20,000 gallons of fuel-saving till 2030 and approx. 3, 00,000 gallons of fuels saved by 2050 globally, if implemented successfully.



Fig 1. Objectives of AMI Smart Parking System

II. LITERATURE REVIEW

Lin et al. (2018) The proposed method can be used to identify a particular country to train the vehicle's licenses. For over 1,200 original license plate images, training, and performance review, their process achieves 90% accuracy in the license plate characters identification and 100% of the license plate in the detected video. Better than their knowledge, this is the first license plate photo/video database in Myanmar and automatically implements this automatic identification system. [6]

Dhar et al. (2018) Intelligent Transport System (ITS) plays an important role in intelligent system applications. The Automatic License Plate Recognition system is an interesting part of which in the parking lot for many real-life applications such as surveillance, traffic flow monitoring, stolen vehicle tracking, and maintenance. This article focuses on designing the Bangladesh License Platform LPR Processing System. Extreme points are used to correct horizontal tilt. After this, to extract the panel item, the acquisition of the letter is performed based on the region's specialties and academic operations. Lastly, the points are drawn by the automatic feature extract by Kazakhstani Neural networks.[7]

Zhai, W. (2017) This paper offers a citizen urban parking management platform based on the NBIO Wireless Sensor Network project aimed at the goal is to continue the full potential parking resources. After a brief briefing of the NB-IT wireless communication and license plate identification, the authors have elaborated the overall architecture and image processing algorithm for the NB-IT Civilian Parking Program. The proposed plan is again with traditional wireless communication techniques. The results proved that the proposed plan was better than the traditional plan.[5]

Farag et al. (2019) In recent years, many intelligent systems have been developed to control parking access to control and register car data. The purpose of this paper is to use image processing methods to control the smart parking door. In the case of large image size, DWT is used to extract the feature and detect the time. In the case of equality, the SVM is used to good rating. The experimental results use MATLAB software, which is considered to improve the board detection and identification rate. The detection rate is average 97.8%, the acquisition rate reaches 98%, and the recognition rate reaches 97%, recognition rate, so it will be a good method for smart parking entrance control.[4]

Paidi, & Fleyeh (2019) Parking is a difficult task in peak hours. Thermal imaging cameras capable of removing detection in all weather and light conditions of the heated car, and can also be installed in a public place. The thermal imager can detect vehicle heat without the exhaust light extrusion. The vehicle is to identify, pre-trained the vehicle detection algorithm, a gradual direction enforcement histogram detector, high-speed region convolutional neural network, and RCNN depth and implementing the fast-learning network. Compared with other investigations, a better RCNN deep learning network generates a better detection result. However, with large and more training data sets, the detection rate can be further improved. Parking is a difficult task during peak hours. Compared with other investigations, a better RCNN deep learning network generates a better detection result. However, with large and more training data sets, the detection rate can be further improved.[3]

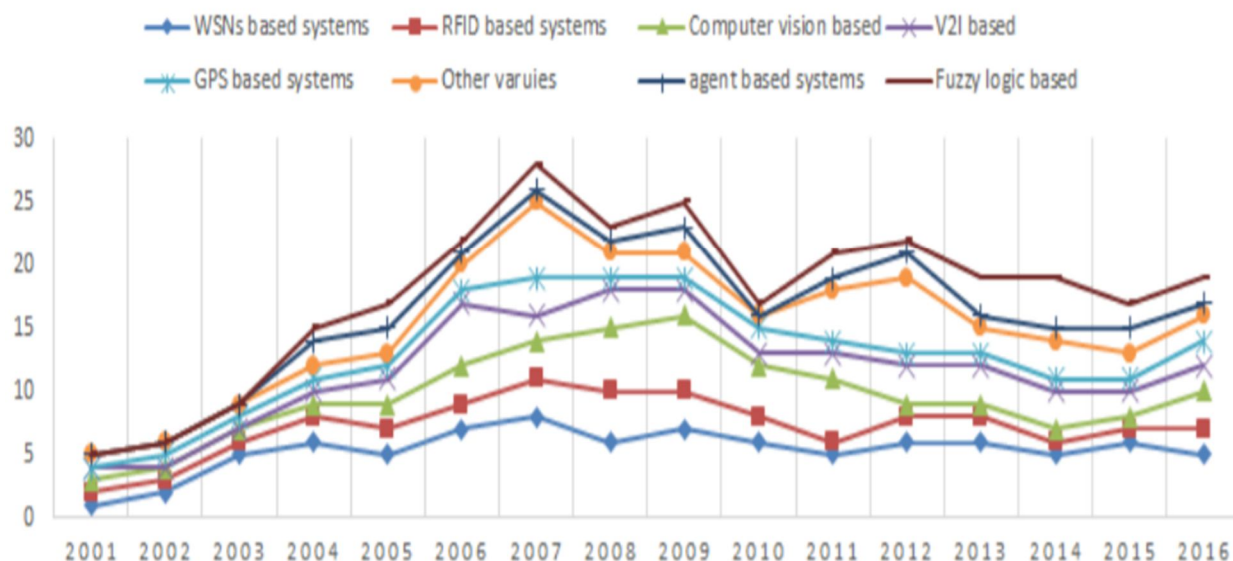


Fig 2. Trend of smart parking prototypes in academia [2]

III. PROBLEM IDENTIFICATION & CHALLENGES

Nowadays India is confronting the biggest problems in the context of space for parking the vehicle, especially in urban areas. Now, numbers of vehicles are increasing over the number of total heads of the family. It can be easily experienced that parking system in India is awfully failing to meet the current requirements. Problem is increasing at such an extent that almost 40% of the roads are being used for parking in normal working days. Now, the situation is likely to worsen as there are much more vehicles available in comparison to available space. Cities are filled with people who park their cars anywhere utilizing the available space which could have been used in a better way. Due to lack of navigable space, Indian cities are being considered as one of the worst living options by people. We can also add pollution to the existing issue and imagine how blunder the problem is. Chandigarh being an exception, no other Indian city was planned to accommodate the huge number of cars which the country is facing now. The low significance given to parking by the urban planners has only worsened the situation.

- 1) *Manual Checks:* Parking managers perform manually intensive work of counting permit and non-permit cars. There is manual checking of vehicle status and details and handwritten tickets. Such a manual procedure leads to 5% entry errors, further resulting in huge losses to the bottom line.
- 2) *Paper Records:* It is difficult to sieve through the large volumes of information. For accomplishing this task, the parking lot managers have to spend hours searching files for the exact information. So, these paper records create a lot of problems.
- 3) *High Labour Costs:* Reading, writing and entering data is labour-intensive and time consuming. Unnecessary capital expenditure is increased due to the money spent on labour that performs repetitive manual tasks.
- 4) *Waiting Customers:* The out dated mode of management troubles the customers and makes them wait in long queues when they need to enter and exit the parking lot. Due to this, precious time of the clients is wasted, and their sustainability gets shaken.
- 5) *Unauthorized Access:* The parking manager in-charge issue handwritten paper tickets that can be duplicated easily. No security alerts are raised to the authorized personnel if any unauthorized vehicle enters the parking lot.

IV. PROBLEM SOLUTION

Proposed parking system would save time and provide comfortable hazard free parking experience to the users, where we are making a fully automated parking system which is based on emerging technologies, such as Artificial Intelligence, Machine Learning and Image Processing,

Basic technologies that are supporting us in accomplishing this objective are:

- 1) Face detection.
- 2) Registered Number Detection.
- 3) Database Management System.

Integrated development Environment (IDE) used under are:

- a) Jupyter notebook
- b) Android studio
- c) VS code
- d) Adobe illustrator

A. Application Specification

We are developing an application (AMI based smart parking system) which is implied over a Artificial Intelligence, Machine Learning, Image Processing. This application is a combination of admin and user portal.

- 1) *Admin Portal:* It deals with the website which allows access only to the owner of parking lot, it offers admin login with credentials of its database, it is also accessible by the user at view level only to see the parking functionalities.
- 2) *User Portal:* It deals with an application which allow any authorized user to get access to this application for booking a slot in a parking area , An application should be multi functional and should not do rigmarole , for the same reason we have integrated other interesting features such as Occupancy detection ,Automatic car license plates recon/user verification,& Parking availability monitoring.

B. Road Map of AMI Based Smart Parking System

We have designed/invented an application which can help us to search our personal vehicle at parking areas. It is fully automatic yet simple to use application. You can get the exact location of the vehicle by entering it's registration number.

You Can See In the Attached UI Of The APP

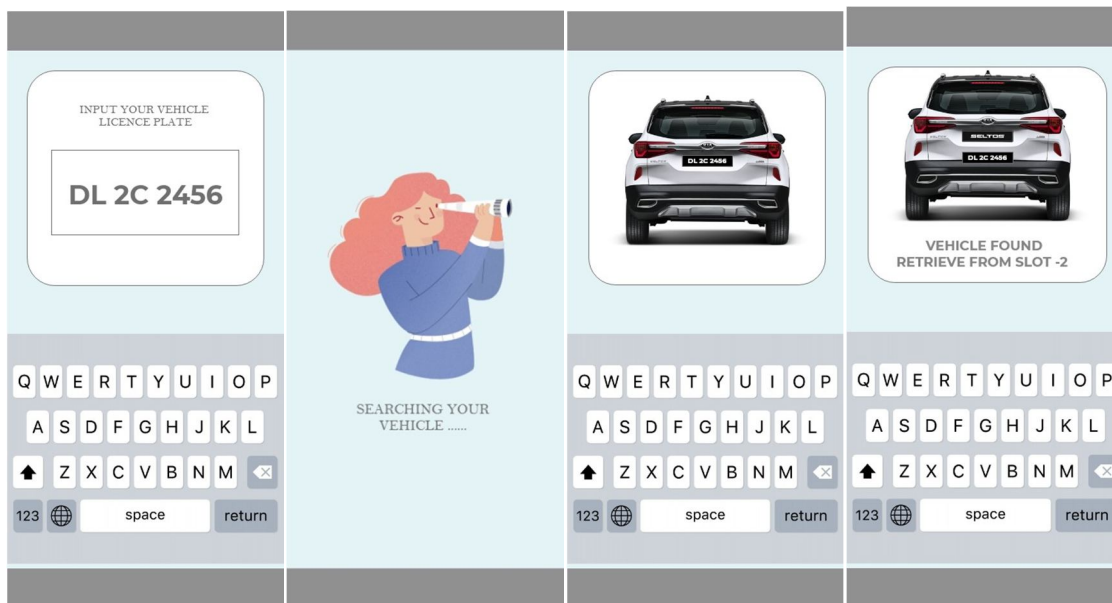


Fig 3. Occupancy Detection

Parking Area consists of following elements.

- 1) Hydraulic elevator
- 2) Parking Slot
- 3) Surveillance Cameras
- 4) System Setup,
- 5) Power Setup
- 6) Power backup for electronic systems

C. Potential Clients

We focus mainly on parking space owners. We enable power to watch and monitor parking spaces and provide real-time data as per requirements. Some of our valued clients are

- 1) Smart Cities Projects
- 2) Municipal parking
- 3) Hotel parking
- 4) Shopping mall parking
- 5) Truck parking
- 6) Hospital parking cognition
- 7) Book Parking by Mobile App
- 8) Online Payment integration
- 9) GPS tracking Automated Billing system
- 10) Authentication

V. FUTURE SCOPE

The parking industry is expected to grow as a smart and green industry with the commoditization of new technologies. With the arrival of new ecosystem players and participants, it is anticipated that the early positive disruption of this market will (or is beginning to) happen with:

Electric vehicles, which add another dimension to parking management with the need for charging (availability of charging stations, time of the day, charging duration, and pricing are becoming key decision parameters).

Autonomous vehicles, which will fundamentally change the usage of cars and their parking modality with self-parking features and robotic valet parking.

Urbanization of parking, which will create a highly reactive and real-time ecosystem connecting those who are interested in lending parking spaces with those who are searching for one

VI. CONCLUSION

The AI-based Smart Parking consists of Video summarization, Digital Image processing, Cloud Computing, Mobile Application, Automated billing system with efficient and optimized use of parking space at its core. For authentication and security measures, we can use license plate no. for tracing the path of the vehicle and further feed the same to a machine-learning algorithm to provide the most optimized path tracking. Smart Parking not only prevents traffic congestion in parking lots but also give the liberty to the end-user to book the desired parking space in advance.

We can extend this solution not only for paid parking lots but also for various other entities such as smart cities, railway stations, airports, mall parking spaces and many more. This will make the management of the parking spaces efficient by eliminating manual labour.

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