

**PROJECT REPORT
ON
“Automated Car Parking Detection”**

SUBMITTED BY

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SAVITRIBAI PHULE PUNE UNIVERSITY

MASTER IN COMPUTER APPLICATION



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Institute of Management & Career Courses (IMCC)

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CERTIFICATE

This is to certify that the Project Report entitled

Automated Car Parking Detection

is prepared by

Mihir Shashank Kudale

M.C.A. Semester IV Course for the Academic Year 2021-22 at M.E. Society's Institute of Management & Career Courses (IMCC), Pune - 411038.

M.C.A Course is affiliated to Savitribai Phule Pune University.

To the best of our knowledge, this is original study done by the said student and important sources used by him/her have been duly acknowledged in this report.

The report is submitted in partial fulfillment of M.C.A Course for the Academic Year 2021-22 as per the rules and prescribed guidelines of Savitribai Phule Pune University.

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CERTIFICATE

This is to certify that **Mihir Shashank Kudale** has completed the project work entitled “***Automated Car Parking Detection***” under my guidance. The report is submitted in partial fulfillment of M.C.A. Course for the Academic Year 2021-2022 as per the rules & prescribed guidelines of Savitribai Phule Pune University.

His/her work is found to be satisfactory and complete in all respects.

Dr. Ravikant Zirmite
(Internal Project Guide)

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CHAPTER 1

INTRODUCTION

1.1 Institute Profile

Institute of Management and Career Courses (IMCC) is a premier Management Institute, established in 1983 by Maharashtra Education Society (MES) for providing quality education and technical expertise at the Post Graduation Level in the Fields of Computers and Management. The Institute is recognized by SPPU under Section 46 of Pune University Act, 1974 and Section 85 of Maharashtra University Act, 1994 and Approved by AICTE New Delhi to conduct MCA and MBA programmes. The Institute is located at 131, Mayur Colony, Kothrud, Pune-411038 having 30,000 sq.ft built area & totally independent campus.

IMCC is recognized as a Ph.D. Research Center under the Faculty of Management, SPPU. IMCC has 38 years standing & it is well-known for its conducive educational atmosphere. IMCC focuses on the all-round development of its students. Thus, apart from excellence in academics, students develop their inner potential by way of active participation in co-curricular & extra-curricular activities. IMCC has developed excellent rapport with Industry by way of Guest Lectures, Seminars, Workshops, Industrial Visits & Placements. The main motto of the Institute is to instill the concepts of total personality development in the students. The emphasis is laid on ‘Teacher Disciple Relationship’ in place of ‘Boss Subordinate’ relationship at their assignments.

The preamble of IMCC “FACTA1-NON-VERBA” lucidly means

that the Institute produces the new breed of professionals, who's deeds will speak and there could be no requirement of pomposity. The zooming enthusiastic, rational and excellent external endeavors are being imbibed in the students to prove their mettle. The conducive milieu of the Institute molds the budding managers to reveal in managing flexibility, integration, change and transformation. These 'would be' professionals are channelised in such a way to 'orchestrate' and deploy business and technological management skills in a synergistic manner to grab the tangible success. The faculty members put their relentless efforts in educating the students to synthesize business management acumen and technology insights in a creative manner.

1.2 Abstract

Searching a suitable parking space in populated metropolitan city is extremely difficult for drivers. Serious traffic congestion may occur due to unavailable parking space. Automatic smart parking system is emerging field and attracted computer vision researchers to contribute in this arena of technology. The **Automated Car Parking Detection** is a web-based system which specially designed for Inter-Communication between Parking Space Operator and Customer (Car Drivers). In our system we have presented a vision based smart parking framework to assist the drivers in efficiently finding suitable parking slot and reserve it. Initially, we have segmented the parking area into blocks using calibration. Then, classify each block to identify car and intimate the driver about the status of parking either reserved or free using SMS. This System will help the operator to view the free and empty spaces after detection according uploaded video feed and then alert the car driver. User will be able to view notices/blogs about car parking. This system will provide to the user to feedback to site. Potentially, the performance accuracy of recommended system is higher than state of the art hardware solutions, validating the supremacy of the proposed framework.

1.3 Existing System and Need for System

The existing system was professionally very weak. Now a day's most of the parking areas are manually managed by human manpower and there is no automatic system to manage the parking area in an efficient way. There is great analogy that when a driver enters any of the parking lot, he must look for some kind of information board that tells him about the status of the parking lot that whether it is fully occupied, partly occupied or vacant. Most of the times the drivers have to circle around the parking area in search of the free parking space. This kind of problem mostly occur in cities near the shopping malls, hospitals etc., where the number of vehicles is greater as compared to the parking spaces. The process for searching the free parking space is time consuming and also wastage of fuel. Most of the times the parking spaces remain unoccupied, however the total occupancy is low because of bad management of parking lot. This causes ineffective use of the parking area and also results in traffic jams and congestion near the parking lots. To properly manage the parking lot and display each parking division's information to the drivers before entering the parking lot have become an important issue to be resolved.

In the existing system we can see that some supervision is required for the parking system and it not fully automated. The driver has to make sure that the car is parked in a spot without disturbing the convenience of others. In most cases the main problem is finding the spot and trying to secure the spot for parking which in turn leads to increased stress level for the person driving the car. The existing system was lacking of transparency in it.

Also, there will convenience will more. **Automatic Car Parking Detection** system uses the advanced level of digital technologies. the work will be done faster & there will be no mistake during the work.

1.4 Scope of System

With the increase in vehicles on the road and current infrastructural challenges, the need for efficiencies when it comes to mobility and parking becomes more and more apparent. Even though autonomous vehicles are becoming a thing these days, the need for parking does not appear to be diminishing. At this moment in time, cities need to manage the potential impact of all changes the future might bring. This can be done through precise and future proof planning with the help of **Automated Car Parking Detection** to collect and analyse data ultimately leading to a healthier city.

How many times has it happened to you that you are searching for a parking spot by driving around and around the parking lot. How convenient would it be if your phone could tell you exactly where the closest parking spot is!

It turns out that this is a relatively easy problem to solve using deep learning and OpenCV. All that is needed is an aerial shot of the parking lot. So, to solve our problem we are going to make real time automated car parking system with web application using image processing.

1. Easy to use and Efficient
2. We use video-based data to count the free/available/empty as well as occupied spaces of parking lot.
3. Alert through SMS to car owner if parking space is empty or full as well as spots availability.

The proposed system consisting of following modules:

1. **Admin:** will be able to view video footage from his login, annotate parking spaces, send the video for detection and alert the user using SMS.
2. **User:** The customer will be able to read the blogs/notices on site. The customer will also be able to provide feedback or contact on site.

1.5 Operating Environment - Hardware and Software

Software Specification:

- **Front-end Technologies:** Flask
- **Back-end Technologies:** Python, Image Processing, Computer Vision, Twilio API
- **Software Used:** PyCharm, Visual Studio Code

Hardware Specification:

- **Operating System:** Any device which has browser.
- **Processor:** Intel Core i3 or AMD Athlon 64x 5600+
- **Monitor:** 1920 x 1080 Resolution Colour(minimum)
- **RAM:** 8 GB (minimum)
- **Hard Disk:** 520 GB or higher

1.6 Brief Description of Technology Used

- **Computer Vision**

Computer vision is a field of artificial intelligence (AI) that enables computers and systems to derive meaningful information from digital images, videos and other visual inputs — and take actions or make recommendations based on that information. If AI enables computers to think, computer vision enables them to see, observe and understand. Computer vision works much the same as human vision, except humans have a head start. Human sight has the advantage of lifetimes of context to train how to tell objects apart, how far away they are, whether they are moving and whether there is something wrong in an image.

Computer vision trains machines to perform these functions, but it has to do it in much less time with cameras, data and algorithms rather than retinas, optic nerves and a visual cortex. Because a system trained to inspect products or watch a production asset can analyse thousands of products or processes a minute, noticing imperceptible defects or issues, it can quickly surpass human capabilities.

Computer vision is used in industries ranging from energy and utilities to manufacturing and automotive – and the market is continuing to grow. It is expected to reach USD 48.6 billion by 2022.

- **Image Processing**

Before we jump into image processing, we need to first understand what exactly constitutes an image. An image is represented by its dimensions (height and width) based on the number of pixels. For example, if the dimensions of an image are 500 x 400 (width x height), the total number of pixels in the image is 200000.

This pixel is a point on the image that takes on a specific shade, opacity or colour. It is usually represented in one of the following:

1. Grayscale - A pixel is an integer with a value between 0 to 255 (0 is completely black and 255 is completely white).
2. RGB - A pixel is made up of 3 integers between 0 to 255 (the integers represent the intensity of red, green, and blue).
3. RGBA - It is an extension of RGB with an added alpha field, which represents the opacity of the image.

Image processing requires fixed sequences of operations that are performed at each pixel of an image. The image processor performs the first sequence of operations on the image, pixel by pixel. Once this is fully done, it will begin to perform the second operation, and so on. The output value of these operations can be computed at any pixel of the image.

Image processing is the process of transforming an image into a digital form and performing certain operations to get some useful information from it. The image

processing system usually treats all images as 2D signals when applying certain predetermined signal processing methods.

There are five main types of image processing:

1. Visualization - Find objects that are not visible in the image.
2. Recognition - Distinguish or detect objects in the image.
3. Sharpening and restoration - Create an enhanced image from the original image.
4. Pattern recognition - Measure the various patterns around the objects in the image.
5. Retrieval - Browse and search images from a large database of digital images that are similar to the original image.

Fundamental Image Processing Steps

1. Image Acquisition

Image acquisition is the first step in image processing. This step is also known as preprocessing in image processing. It involves retrieving the image from a source, usually a hardware-based source.

2. Image Enhancement

Image enhancement is the process of bringing out and highlighting certain features of interest in an image that has been obscured. This can involve changing the brightness, contrast, etc.

3. Image Restoration

Image restoration is the process of improving the appearance of an image. However, unlike image

enhancement, image restoration is done using certain mathematical or probabilistic models.

4. Color Image Processing

Color image processing includes a number of color modeling techniques in a digital domain. This step has gained prominence due to the significant use of digital images over the internet.

5. Wavelets and Multiresolution Processing

Wavelets are used to represent images in various degrees of resolution. The images are subdivided into wavelets or smaller regions for data compression and for pyramidal representation.

6. Compression

Compression is a process used to reduce the storage required to save an image or the bandwidth required to transmit it. This is done particularly when the image is for use on the Internet.

7. Morphological Processing

Morphological processing is a set of processing operations for morphing images based on their shapes.

8. Segmentation

Segmentation is one of the most difficult steps of image processing. It involves partitioning an image into its constituent parts or objects.

9. Representation and Description

After an image is segmented into regions in the segmentation process, each region is represented and described in a form suitable for further computer processing. Representation deals with the image's characteristics and regional properties. Description deals

with extracting quantitative information that helps differentiate one class of objects from the other.

10. Recognition

Recognition assigns a label to an object based on its description.

- **Python**

Python is an interpreted, object-oriented, high-level programming language with dynamic semantics. Its high-level built-in data structures, combined with dynamic typing and dynamic binding, make it very attractive for Rapid Application Development, as well as for use as a scripting or glue language to connect existing components together. Python's simple, easy to learn syntax emphasizes readability and therefore reduces the cost of program maintenance. Python supports modules and packages, which encourages program modularity and code reuse. The Python interpreter and the extensive standard library are available in source or binary form without charge for all major platforms, and can be freely distributed.

Often, programmers fall in love with Python because of the increased productivity it provides. Since there is no compilation step, the edit-test-debug cycle is incredibly fast. Debugging Python programs is easy: a bug or bad input will never cause a segmentation fault. Instead, when the interpreter discovers an error, it raises an exception. When the program doesn't catch the exception, the interpreter prints a stack trace. A source level debugger allows inspection of local and global variables, evaluation of arbitrary expressions, setting breakpoints, stepping

through the code a line at a time, and so on. The debugger is written in Python itself, testifying to Python's introspective power. On the other hand, often the quickest way to debug a program is to add a few print statements to the source: the fast edit-test-debug cycle makes this simple approach very effective.

- **Flask**

Flask is a web framework, it's a Python module that lets you develop web applications easily. It's having a small and easy-to-extend core: it's a microframework that doesn't include an ORM (Object Relational Manager) or such features.

- **MySQL**

MySQL is a relational database management system (RDBMS) based on the SQL (Structured Query Language) queries. It is one of the most popular languages for accessing and managing the records in the table. MySQL is open-source and free software under the GNU license. Oracle Company supports it.

Key capabilities of MySQL:

1. **Open-source:** MySQL is free to use and modify under the GPL (GNU Public License). That license determines the free users' rights. The commercial license is also available – it allows using MySQL software in commercial applications, and you aren't subject to the GPL regulations.
2. **Scalable and fast:** The MySQL architecture allows this system to support the most powerful applications.

It provides appropriate speed and has a very low memory leakage problem. Also, it can manage almost any volume of data in a table (50+ million rows). The initial file size limit is 4 GB, but it can increase to the maximum of 8 TB data.

3. **Platform-independent:** MySQL Server is compatible with Microsoft Windows, Apple Macintosh OS X, Ubuntu, and multiple Unix options, such as AIX, BSDI, FreeBSD, HP-UX, OpenBSD, Net BSD, SGI Iris, and Sun Solaris.
4. **Client/Server Architecture:** The client/server system involves the primary database MySQL Server and multiple clients – application programs. MySQL Server creates the database and defines the relationship of each table. The clients communicate with the server to request and manipulate the data with the specific SQL statements. The tasks may include querying the data, adding and saving changes, etc. The server application provides the requested information on the clients' side. The server and clients can be both on the same computer or different machines. In the latter case, they communicate via the network (local or the Internet). The client/server architecture is typical of all large database systems.
5. **Data dictionary:** MySQL includes countless objects and huge information volumes about those objects. That's why it introduced the dedicated data dictionary storing all the information about those MySQL database objects. It is a crash-safe, centralized, and more optimized format than the previous file-based

metadata storage. Also, it is much more convenient to access and work.

These are only several examples of MySQL features.

When you start working with this RDBMS more thoroughly, you will note countless additional options to make your activities simpler. Besides, there are professional tool.

- **HTML**

HTML stands for Hypertext Markup Language. It is used to design web pages using a markup language. HTML is the combination of Hypertext and Markup language. Hypertext defines the link between the web pages. A markup language is used to define the text document within tag which defines the structure of web pages. This language is used to annotate (make notes for the computer) text so that a machine can understand it and manipulate text accordingly.

Most markup languages (e.g., HTML) are human-readable. The language uses tags to define what manipulation has to be done on the text.

Key Features of HTML:

HTML is the most common used language to write web pages. It has recently gained popularity due to its advantages such as: -

1. It is the language which can be easily understood and can be modified.
2. Effective presentations can be made with the HTML with the help of its all-formatting tags.
3. It provides the more flexible way to design web pages

along with the text.

4. It is platform-independent.
5. It can be integrated with other languages like CSS, JavaScript, etc.
6. Images, videos, and audio can be added to a web pages.

- **CSS**

Cascading Style Sheets, fondly referred to as CSS, is a simple design language intended to simplify the process of making web pages presentable. CSS handles the look and feel part of a web page. Using CSS, you can control the color of the text, the style of fonts, the spacing between paragraphs, how columns are sized and laid out, what background images or colors are used, layout designs, variations in display for different devices and screen sizes as well as a variety of other effects.

Key Features of CSS:

1. **CSS saves time** – You can write CSS once and then reuse same sheet in multiple HTML pages. You can define a style for each HTML element and apply it to as many Web pages as you want.
2. **Pages load faster** – If you are using CSS, you do not need to write HTML tag attributes every time. Just write one CSS rule of a tag and apply it to all the occurrences of that tag. So, less code means faster download times.
3. **Easy maintenance** – To make a global change, simply change the style, and all elements in all the web pages will be updated automatically.

4. Superior styles to HTML – CSS have a much wider array of attributes than HTML, so you can give a far better look to your HTML page in comparison to HTML attributes.
5. Multiple Device Compatibility – Style sheets allow content to be optimized for more than one type of device. By using the same HTML document, different versions of a website can be presented for handheld devices such as PDAs and cell phones or for printing.
6. Global web standards – Now HTML attributes are being deprecated and it is being recommended to use CSS. So, it's a good idea to start using CSS in all the HTML pages to make them compatible to future browsers.

- **JavaScript**

JavaScript (JS) is an interpreted computer programming language. It was originally implemented as part of web browsers so that client-side scripts could interact with the user, control the browser, communicate asynchronously, and alter the document content that was displayed.

JavaScript is a prototype-based scripting language that is dynamic, weakly typed, and has first class functions. Its syntax was influenced by the language C. JavaScript copies many names and naming conventions from Java, but the two languages are otherwise unrelated and have very different semantics. The key design principles within JavaScript are taken from the Self and Scheme

programming languages. It is a multi-paradigm language supporting object-oriented, imperative and functional programming styles.

JavaScript's use in applications outside of web pages-for example, in PDF documents, site specific browsers, and desktop widgets-is also significant. Newer and faster JavaScript VMs and frameworks built upon them (notably Node.js) have also increased the popularity of JavaScript for server-side web applications.

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- **Bootstrap:**

Bootstrap is an HTML, CSS & JS Library that focuses on simplifying the development of informative web pages (as opposed to web apps). The primary purpose of adding it to a web project is to apply Bootstrap's choices of color, size, font and layout to that project. As such, the primary factor is whether the developers in charge find those choices to their liking. Once added to a project, Bootstrap provides basic style definitions for all HTML elements. The result is a uniform appearance for prose, tables and form elements across web browsers. In addition, developers can take advantage of CSS classes defined in Bootstrap to further customize the appearance of their contents. For example, Bootstrap has provisioned for light- and dark-colored tables, page headings, more prominent pull quotes, and text with a highlight.

Bootstrap also comes with several JavaScript components which do not require other libraries like jQuery. They provide additional user interface elements such as dialog boxes, tooltips, progress bars, navigation drop-downs, and carousels. Each Bootstrap component consists of an HTML structure, CSS declarations, and in some cases accompanying JavaScript code. They also extend the functionality of some existing interface elements, including for example an auto-complete function for input fields.

The most prominent components of Bootstrap are its layout components, as they affect an entire web page. The basic layout component is called "Container", as

every other element in the page is placed in it. Developers can choose between a fixed-width container and a fluid-width container.

- **Git/GitHub:**

To sum up the difference between git vs GitHub: git is a local VCS software that enables developers to save snapshots of their projects over time. It's generally best for individual use. GitHub is a web-based platform that incorporates git's version control features so they can be used collaboratively.

- **Twilio API:**

Twilio's Programmable SMS API helps you add robust messaging capabilities to your applications. Using this REST API, you can send and receive SMS messages, track the delivery of sent messages, Schedule SMS messages to send at a later time, and retrieve and modify message history.

CHAPTER 2

PROPOSED SYSTEM

2.1 Study of Similar Systems

There is multiple system available for car parking management but there is no dedicated system for car parking detection that is based on image processing and gives alert to user about space availability.

2.2 Feasibility Study

The purpose of the feasibility study is not to solve the problem, but to determine if the problem is worth solving. This helps to decide whether to proceed with the problem or not. It involves the analysis of the problem & collection of all relevant information relating to the product. The feasibility study concentrates on the following, such as Technical Feasibility, Economic Feasibility, and Operational Feasibility.

Technical Feasibility

Technical feasibility evaluates the technical complexity of the expert system and often involves determining whether the expert system can be implemented with state-of the-art techniques and tools.

The technologies and tools are associated with this system are:

- Flask
- Python
- OpenCV
- Image Processing
- MySQL

Technical feasibility report: Since the college already has the required hardware and a supporting Operating System, it is technically feasible.

Operational Feasibility

Operational feasibility study tests the operational scope of the software to be developed. The proposed system is fully web based that is very user friendly and all inputs to be taken are self-explanatory. All the operations will be well described and easy to access. A simple training might be required to demonstrate the full functionality of the system. Other than this, the system is operationally feasible and no other extra efforts will be required to use the system.

Economic Feasibility

The website is economically feasible, as it only needs server space, all the dependencies of the website are open-source, only the hosting cost needs to be paid, and hence the website is economically feasible.

2.3 Objectives of Proposed System

What are the benefits of smart parking for drivers?

Below, we break down some of the major benefits that a smart parking provides to drivers.

- **Less fuel is wasted**

Drivers are directed straight to an available parking spot. Therefore, they waste fewer kilometers driving around in circles looking for vacant parking space.

- **Save money**

Obviously, by driving more efficient when in search of parking space, you will save on fuel waste. Resulting in spending less money on petrol.

- **Save time**

Additionally, by driving fewer kilometers when in search of parking space, you will save valuable time which can be spent on work, fun or hobbies. Resulting in spending less money on petrol.

- **Lowering individual environmental footprint**

Another benefit of wasting fewer kilometers by searching for a parking spot is that you reduce individual pollution. Fossil fuels, petrol, diesel, and most alternative fuels all produce emissions, especially carbon dioxide (Co2). This pollution will not directly harm human life. However, Co2 is the most significant contributor to greenhouse gases and therefore contributor to climate change.

- **Increase in safety.**

Drivers are less distracted looking around for a spot because they know where they can park their car. They will have their full attention on the road. By having their eyes on the road, accidents will decrease and safety will increase for themselves, other drivers and pedestrians.

- **Smart parking reducing stress while searching for a parking space**

Driving through the same street over and over again, cars breathing down your neck and no parking spot to be seen. Having uncertainty and pressure to find a parking spot near your destination can be very stressful. With the use of smart parking, you know where the available parking space is located. You can drive straight to an open parking spot, stress-free.

- **Smart Parking takes away the unpredictability of finding a parking spot**

Not visiting a particular (part of a) city because you do not want the hassle of finding an available parking spot.

Knowing you are going to drive around for many minutes and probably are going to find a place far, far away from your destination can be very discouraging. Smart parking will allow you to see where you can park your car, and at what time it is the busiest.

- **Smart parking will reduce search traffic on the streets.**

Smart parking will make sure there are fewer cars on the streets that drive slowly, circling for ages, looking around for a spot. This will benefit traffic flow and will reduce congestions in neighborhoods with an under capacity in parking space. Therefore, there are fewer traffic jams, and drivers will benefit by having less traffic on the streets.

2.4 Users of System

System users will be:

- Admin
- User

CHAPTER 3

ANALYSIS AND DESIGN

3.1 System Requirements (Functional and Non-Functional requirements)

Functional Requirements:

Functional requirements define the internal workings of the system, that is, the calculations, technical details, data manipulation and processing and other specific functionality that show how the use cases are to be satisfied. Functional requirements specify particular behavior of a system.

The main functional requirements of the system are as follows:

1. Define new parking areas, specify number of parking lots, the parking cost per minute/hour and other details.
2. Modify data of existing parking areas.
3. View the data of all registered parking areas.
4. Webcam

Non-Functional Requirements:

Non-functional requirements are requirements which specify criteria that can be used to judge the operation of a system, rather than specific behaviors. Typical non-functional requirements are reliability, scalability, and cost. Non-functional requirements are often called the utilities of a system.

The basic non-functional requirements of the system are:

1. Usability

Usability is the main non-functional requirement for a Service Tracking system. The UI should be simple enough for everyone to understand and get the relevant information without any special training. Different languages can be provided based on the requirements.

2. Accuracy

Accuracy is another important non-functional requirement for the Service Tracking system. The data stored about the books and the fines calculated should be correct, consistent, and reliable.

3. Availability

The System should be available for the duration when the service data operates and must be recovered within an hour or less if it fails. The system should respond to the requests within two seconds or less.

4. Maintainability

The software should be easily maintainable and adding new features and making changes to the software must be as simple as possible. In addition to this, the software must also be portable.

5. Security

Nobody should be allowed to tamper with data; Enhanced Security for sensitive data. It should be made sure that only users who are given specific rights can access data and all actions are logged, thus providing an extensive role-based authorization.

6. Backup

There should be an easy back-up feature for the entire data, to prevent losing any data.

7. Platform/Browser independence

The system should be able to work on any of the modern browsers like Firefox / Explorer / Opera /Chrome, and any of the common Operating Systems like Linux, Windows and Mac OS.

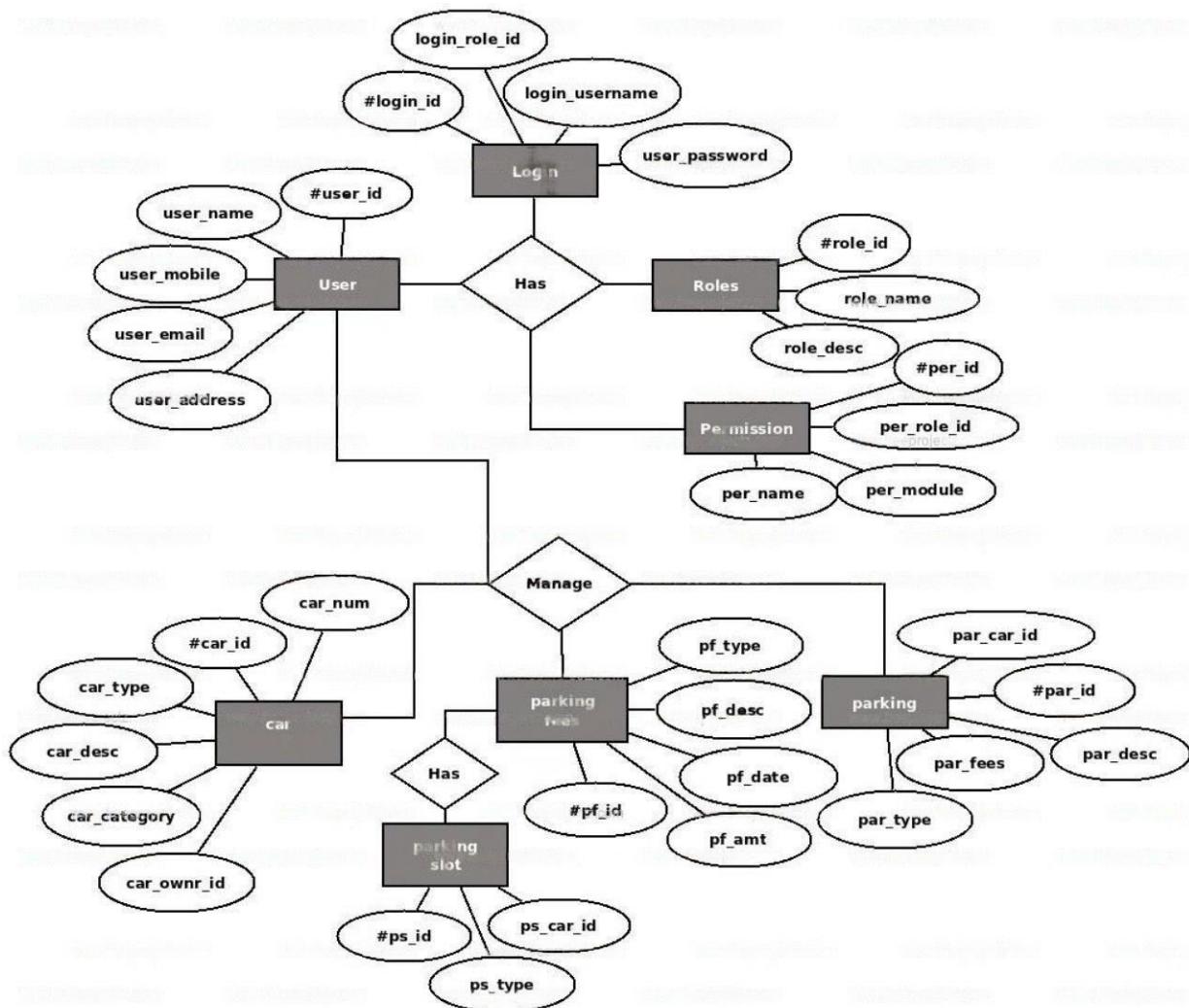
8. Performance

The system should handle the simultaneous usage of almost 100 users at a time

9. Ease of use and Documentation

1. The software should be designed for extensive customizability, even for people who are not used to computer programming.
2. The user-interface should be intuitive and easy to navigate.
3. There should be a proper documentation of the system. This document should be so simple yet precise so that a newly appointed faculty should do all the things on one's own and distinguish all the features. This could be given in the form of a 'help' menu associated with every activity.

3.2 Entity Relationship Diagram (ERD)



3.3 Table Structure

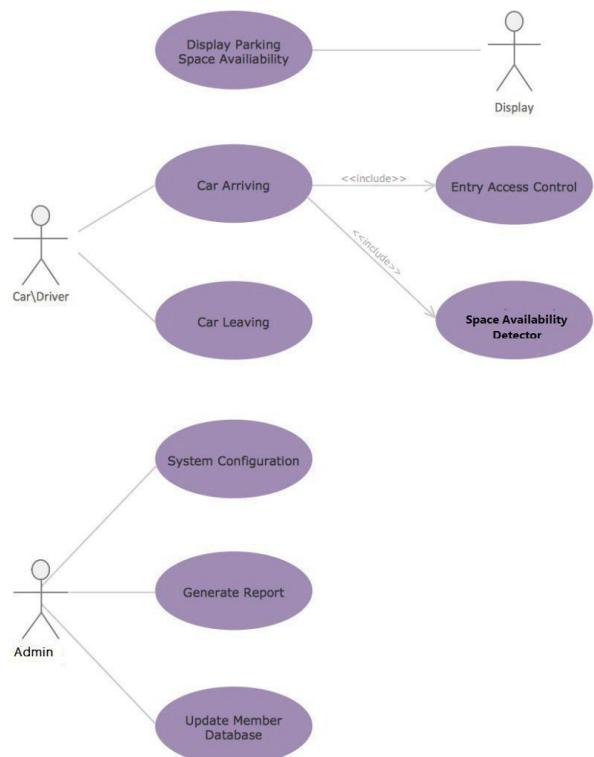
admin login:

Description	Data type	Size
uname	text	-
pass	password	-

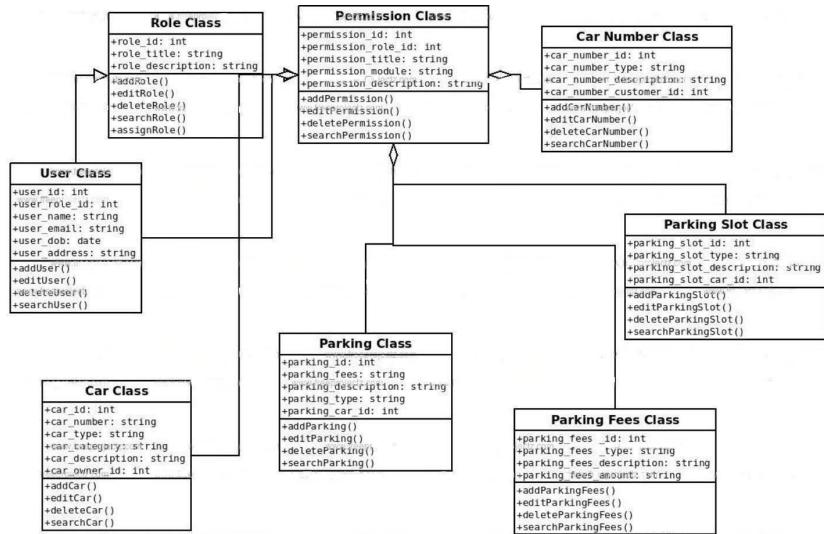
contact:

Description	Data type	Size
sno	int(primary key)	-
name	text	-
phone_num	varchar	50
msg	Text	-
date	datetime	-
email	varchar	50

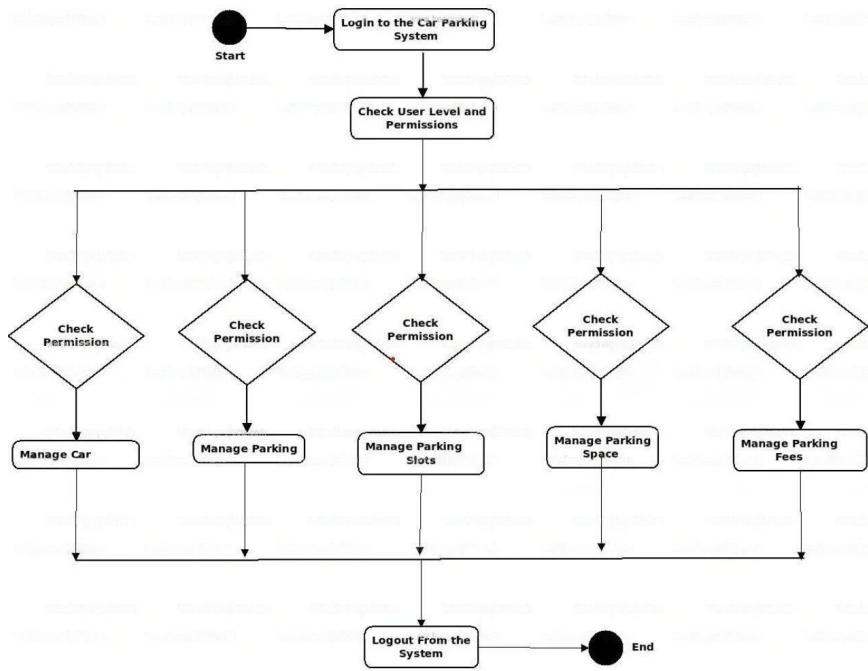
3.4 Use Case Diagram



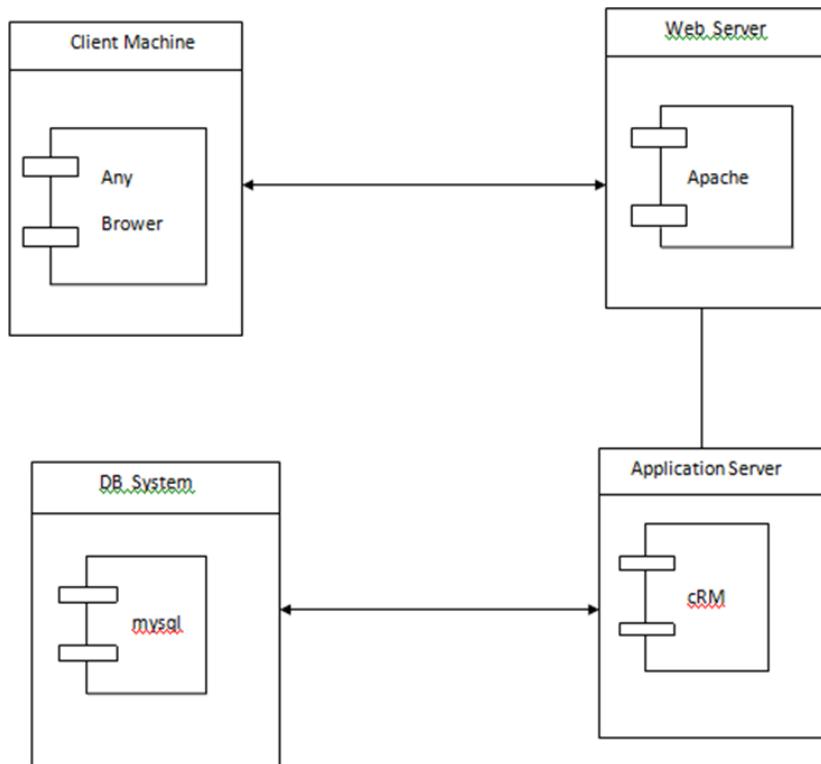
3.5 Class Diagram



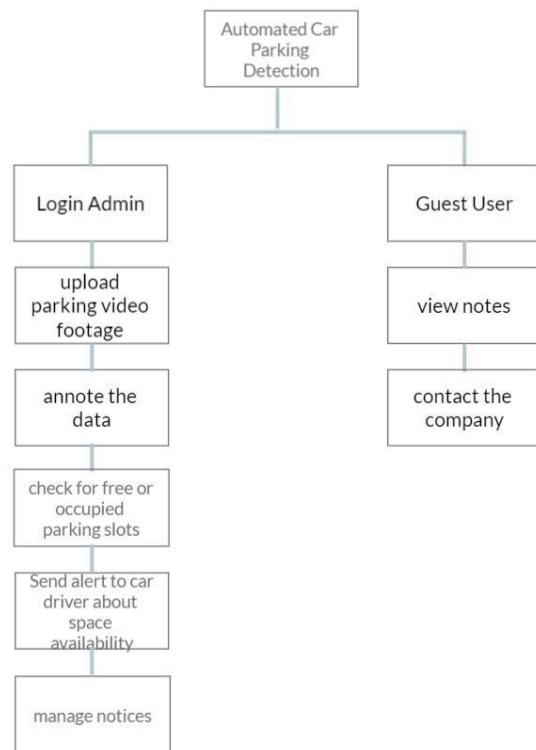
3.6 Activity Diagram



3.7 Deployment Diagram

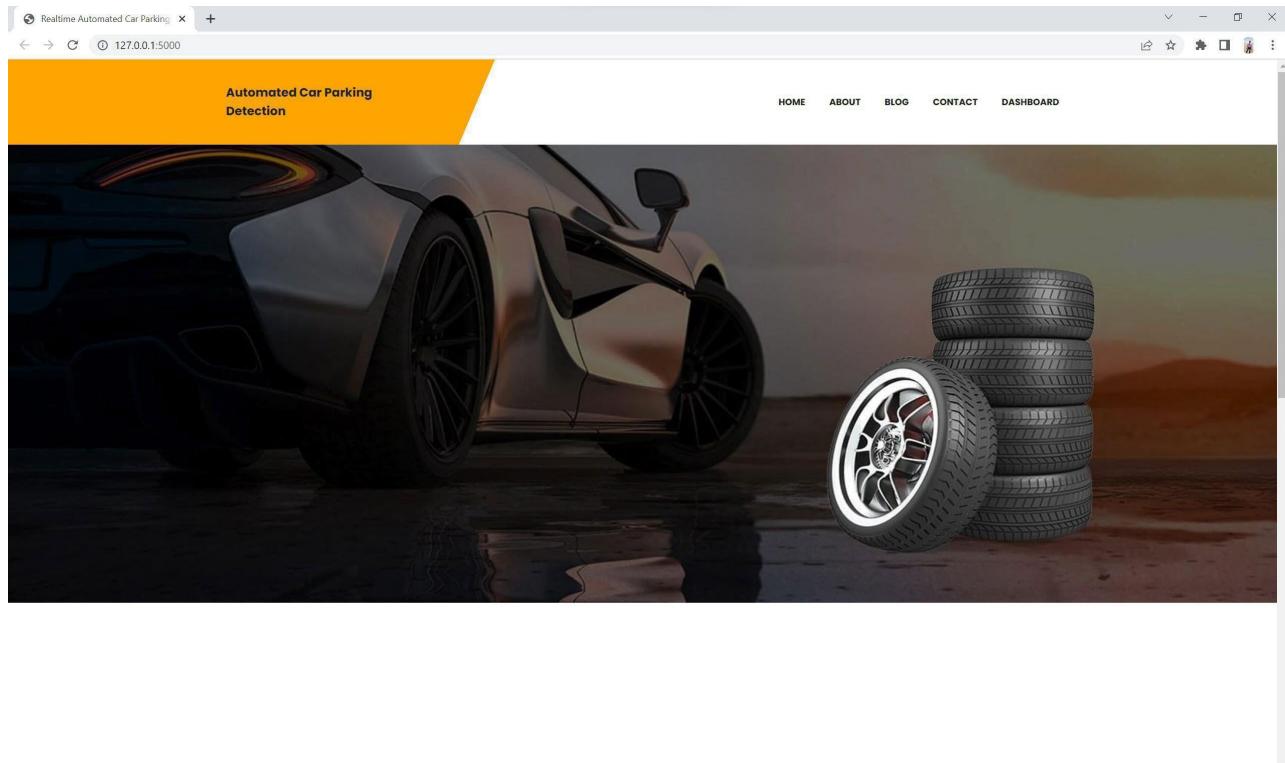


3.8 Module Hierarchy Diagram



3.9 Sample Input and Output Screens

Home Page

A screenshot of a web browser showing the "About Project" page of the same car parking detection system. The title bar and address bar are identical to the home page. The header has a yellow bar with "Automated Car Parking Detection". The main content area features a section titled "About Project" with a short description: "In Urban Areas Car Parking Is A Big Issue For Public Places. Due To The Shortage Of Parking Space, High Traffic Visitors Face Parking Issues Every Day. To Reduce These Problems, Build An Automatic Web App Which Will Predict Whether The Nearby Place Is Suitable For Parking Or Not And Alert The User Upon Availability Of Parking Space." To the right of the text is a photograph of a parking lot filled with many cars, viewed from an elevated angle. The footer is black and contains four sections: "CONTACT Us", "Links", "Latest Blog", and "Follow Us".

- CONTACT Us**
 - ✉ mihirkudale197@gmail.com
 - 📍 Pune, Maharashtra, India
- Links**
 - » HOME
 - » ABOUT
 - » CONTACT
 - » DASHBOARD
- Latest Blog**
 - HOW TO FIND THE RIGHT SPOT FOR YOUR CAR PARKING?
7 AUGUST, 2022
 - A GUIDE ON DIFFERENT CAR PARKING TECHNIQUES
ON 7 AUGUST, 2022
- Follow Us**
 - [G](#)
 - [in](#)

About Page



Our MISSION

Automated Car Parking Detection

In Urban areas Car parking is a big issue for public places. Due to the shortage of parking space, high traffic visitors face parking issues every day. To reduce these problems, build an automatic web app which will predict whether the nearby place is suitable for parking or not and alert the user upon availability of parking space.



Our VISION

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The screenshot shows the 'About Me' page of a web application. At the top, there's a yellow header bar with the title 'Automated Car Parking Detection'. Below it, a white main content area starts with a section titled 'About Me' and a subtitle 'Data Science Enthusiast'. This is followed by a 'Introduction' section containing a bio about the developer, Mihir Kudale, and his experience. At the bottom of the page is a dark footer bar with sections for 'CONTACT Us', 'Links', 'Latest Blog', and 'Follow Us'.

Blog Page

The screenshot shows a blog post titled 'ABOUT' on the Realtime Automated Car Parking Detection website. The post is located on a page featuring a large image of a parking lot with several cars. A sidebar on the right contains two blog posts: 'FINDING RIGHT PARKING SPOT' and 'DIFFERENT CAR PARKING TECHNIQUES'.

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Automated Car Parking Detection

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Guide to Spot the Best Space for your Car Parking

reliancegeneral.co.in/Insurance/Knowledge-Center/Blogs/How-to-Find-the-Right-Spot-for-your-Car-Parking.aspx

RELIANCE GENERAL INSURANCE

Video Chat Login

+91 22 48903009 (Paid Number)

Home > Knowledge Center > Blogs

How to Find the Right Spot for your Car Parking?

As more and more vehicles crowd the streets, it's harder to find a place to park your car. This is especially true for large shopping complexes and during busy days. You could be driving round in circles for an hour, hoping to find an opening, only to have it snatched by someone else.

When streets and parking spaces get too crowded, a lot of people, especially in India, lose patience. And that's when you find cars squeezed in small uncomfortable spaces that would be impossible to get out of, or cars jutting out into the streets, all of which is very dangerous. We're sure that the image we're painting here isn't alien to you. Anyone who's driven on Indian roads knows how frustrating the process of parking can be.

If you're not careful about where you park your car, you could end up with a broken taillight as another car rams into you. In fact, even if you do choose a spot carefully, you might still find your car damaged because of someone else's mistake, but the chances are a lot lower. Either way, you should be armed with a good car insurance so that such an accident doesn't cost you dearly.

Here are some tips on how to find the right spot for you to park your car.

Picking a Row

If you're looking for space in the crowded parking lot of a shopping complex or mall, you can go about your search in two ways:

1. You can actively drive up and down all the rows, searching for the spot that's closest to the door.
2. You can enter a row and use the first vacant spot, no matter how much you might have to walk.

The problem with the first approach is that you spend way too much time looking for a vacancy, and in that time you could have easily walked to the door. Furthermore, eventually when you do park, you still don't have a guarantee that you're in the closest spot as it depends on availability.

As such, if you're concerned about saving time, use the first vacant space you find.

When the Parking Lot is Full

What do you do when there's no space at all? In that case, most people simply leave and try to find space elsewhere. However, it's a lot more rewarding if you sit and wait for one of the spaces to be vacated. This approach has a lot stronger chance of success.

According to studies, those who patiently wait for a parking space find one in 8-12 minutes whereas those who simply leave take thrice as long, and sometimes still don't find a spot.

Parking in Unknown Spaces

Most people park where they're supposed to park. If you're going to an office, you'll park in the official parking spot, and the same goes for malls and other areas. However, if possible, take time to scout the neighborhood. Is there some area,

Other interesting reads!

- Steps To Fix Your Car's Punctured Tyre
- How to Cure Acidity and Heartburn?
- Guide On How To Control Yourself and Avoid Speeding A Car

Ask BroBot

Contact Us Page

Realtime Automated Car Parking

127.0.0.1:5000/contact

Automated Car Parking Detection

CONTACT

Home/ Contact Us

Want to get in touch? Fill out the form below to send me a message and I will get back to you as soon as possible!

Name

Name

Email Address

Email Address

Phone Number

Phone Number

Message

Message

The screenshot shows a contact form titled "Automated Car Parking Detection". The form includes fields for Name, Email Address, Phone Number, and a large Message area. A "Send" button is at the bottom. The page has a header with links to HOME, ABOUT, BLOG, CONTACT, and DASHBOARD.

Want to get in touch? Fill out the form below to send me a message and I will get back to you as soon as possible!

Name

Name

Email Address

Email Address

Phone Number

Phone Number

Message

Message

Send

CONTACT US

mihirkudale197@gmail.com
Pune, Maharashtra, India

[View larger map](#)

Links

- » HOME
- » ABOUT
- » CONTACT
- » DASHBOARD

Latest Blog

HOW TO FIND THE RIGHT SPOT FOR YOUR CAR PARKING?
7 AUGUST, 2022

A GUIDE ON DIFFERENT CAR PARKING TECHNIQUES
ON 7 AUGUST, 2022

Follow Us

Dashboard Page

The screenshot shows an "ADMIN LOGIN" overlay on a dashboard background featuring a car in a parking lot. The overlay contains fields for User Name and Password, and a "Sign in" button. The page has a header with links to HOME, ABOUT, BLOG, CONTACT, and DASHBOARD.

Automated Car Parking Detection

HOME / Admin Login

User Name

Password

Sign in

CONTACT US

mihirkudale197@gmail.com
Pune, Maharashtra, India

[View larger map](#)

Links

- » HOME
- » ABOUT
- » CONTACT
- » DASHBOARD

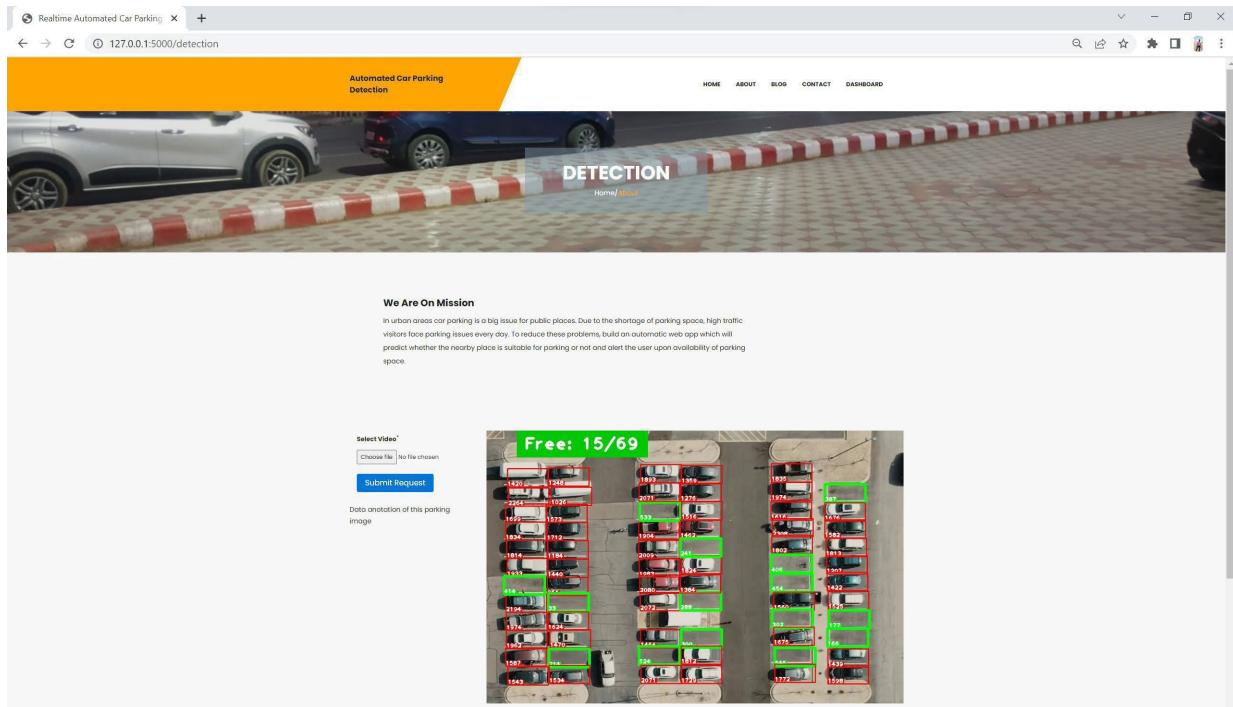
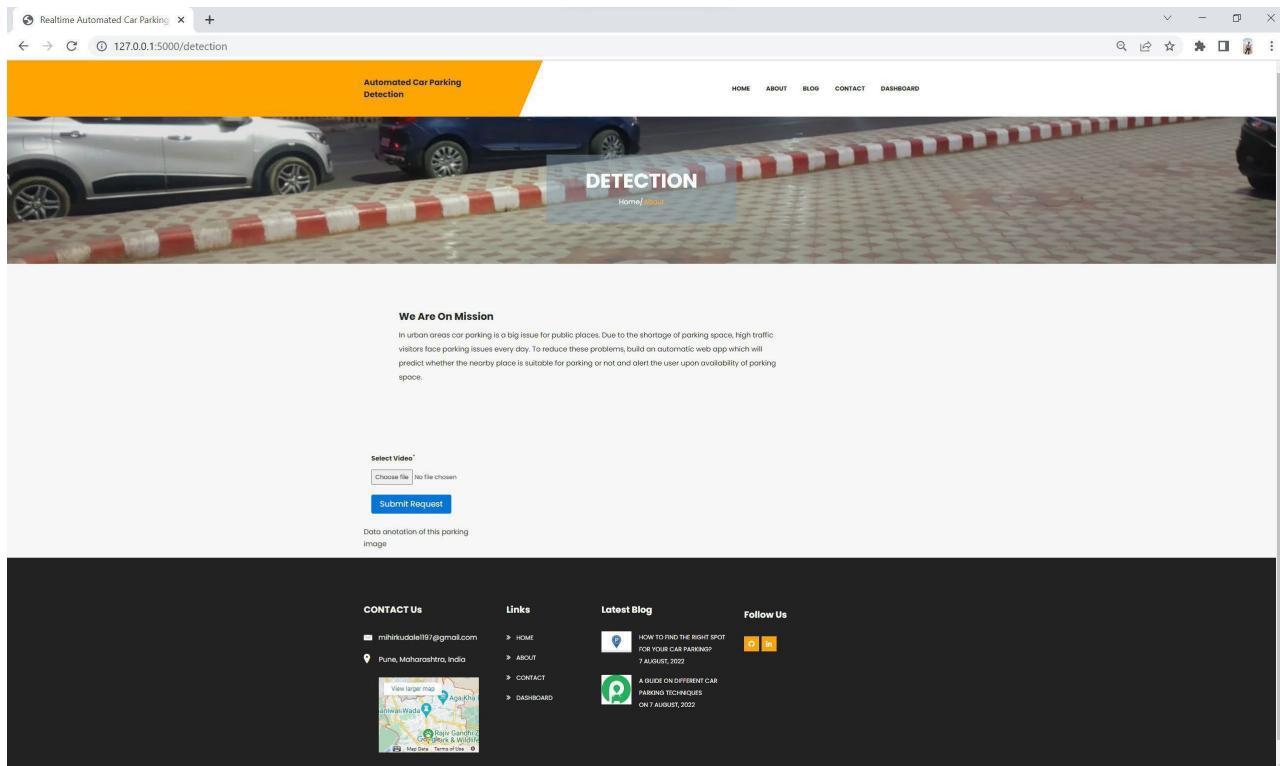
Latest Blog

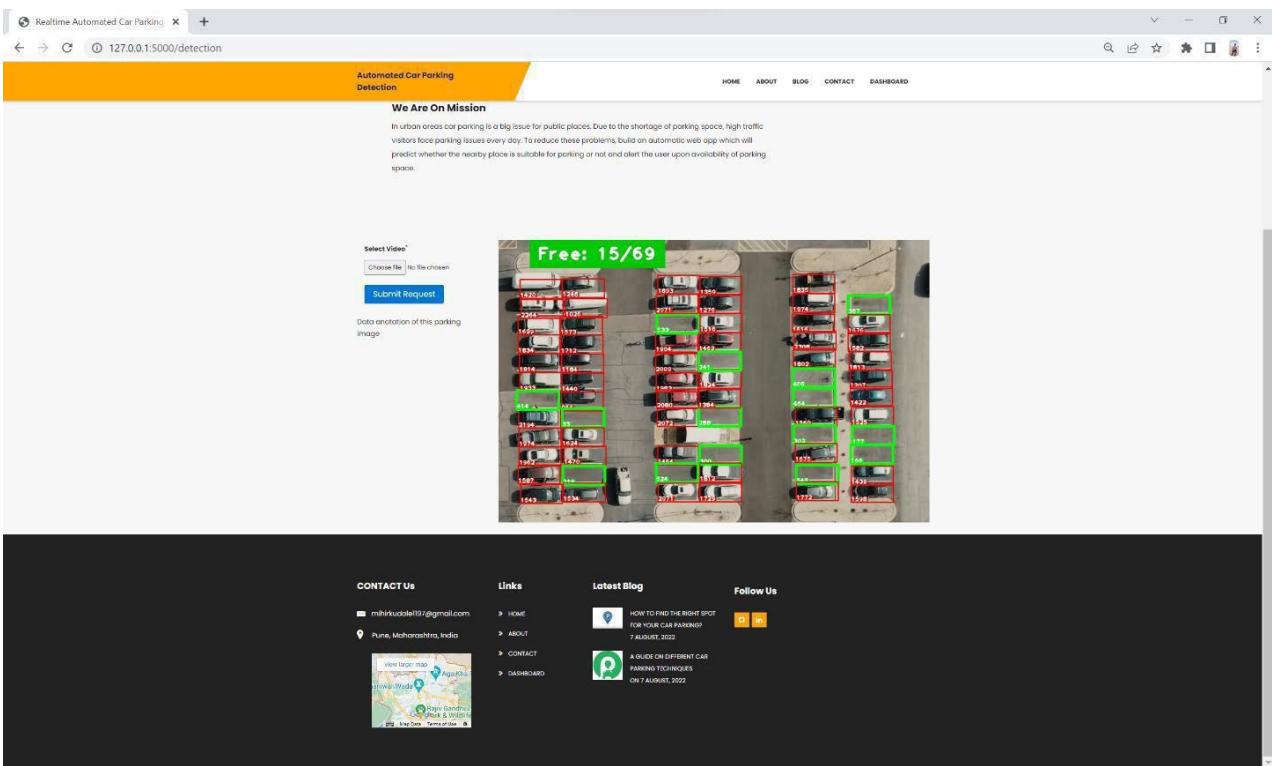
HOW TO FIND THE RIGHT SPOT FOR YOUR CAR PARKING?
7 AUGUST, 2022

A GUIDE ON DIFFERENT CAR PARKING TECHNIQUES
ON 7 AUGUST, 2022

Follow Us

Detection Page





Alert received on phone



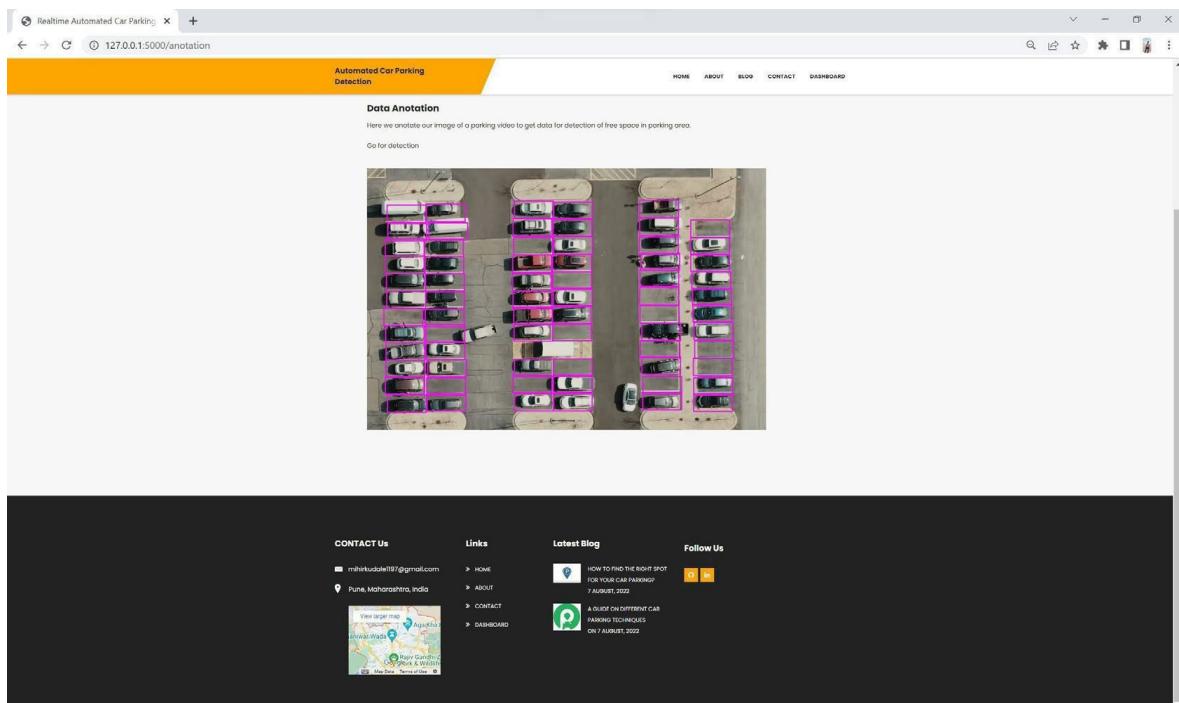
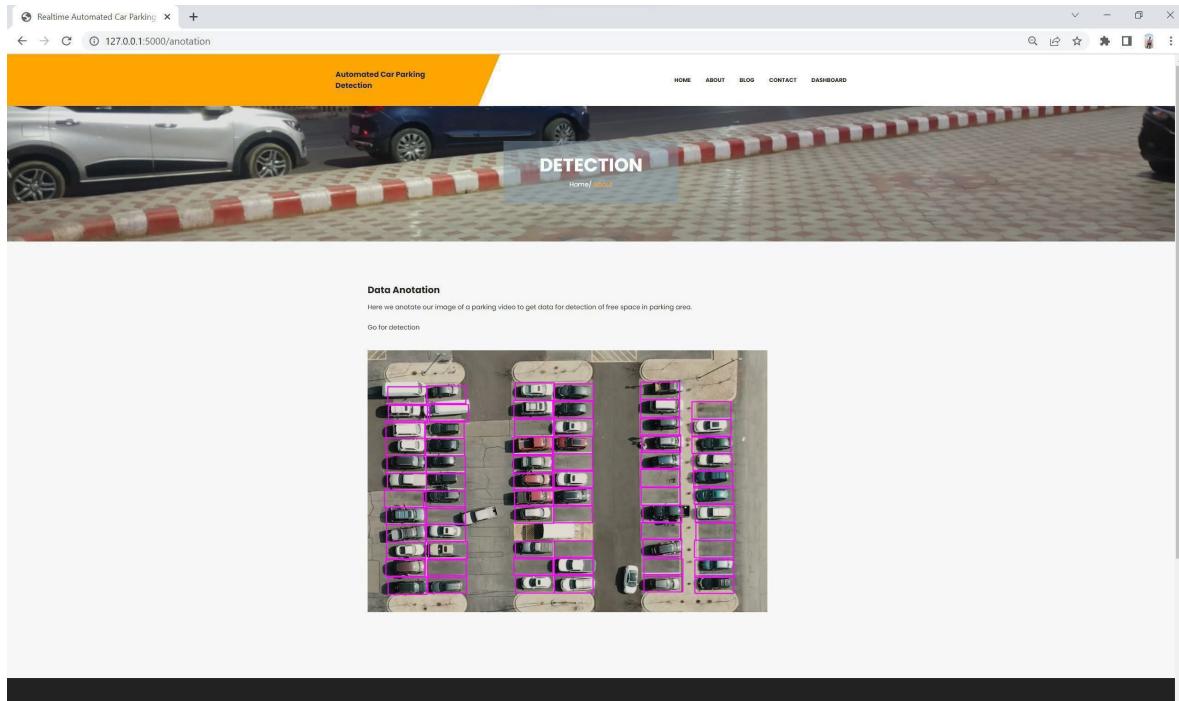
10:48

Sent from your Twilio trial account - 15 Parking space available!!! You can Go

aval

Text message

Anotation Page



CHAPTER 4

CODING

4.1 Algorithms

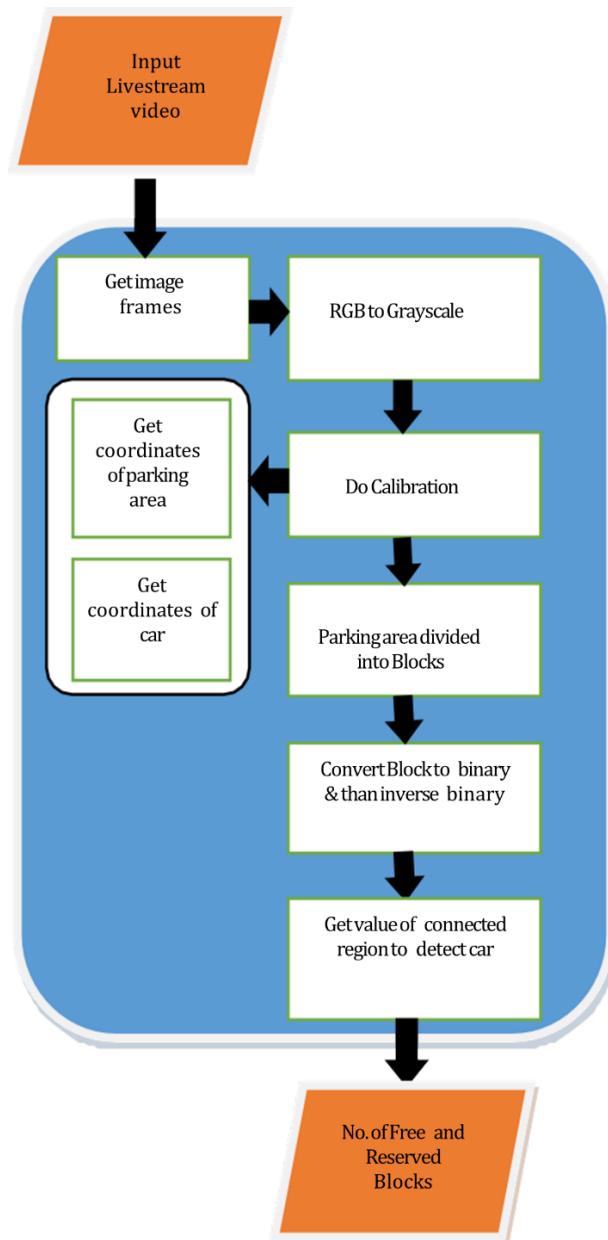


Figure 1: Algorithm of proposed system

The main steps of the proposed algorithm for parking space detection are shown in Fig.

1. System will get Livestream video of the parking lot from camera.
2. Images are captured when a car enters or leaves the parking lot.
3. RGB Images are converted to grayscale images.
4. Do calibration
 - First select the coordinates of the parking lot. This will crop the extra space other than parking lot from the image.
 - Secondly select the coordinates of the single parking slot. This will divide the parking lot into equal size slots.
5. Each block is converted from grayscale to binary and then inverse binary to get the car in white color and parking area into black colour.
6. Threshold value is calculated in every block to detect whether that block contain car or not.
7. If value is less than threshold value than that block is free and available for parking car and if value is greater than block is occupied.

The main flow of framework is shown in Figure 2. Videos were acquired from the top view of parking arena, from ten feet heighted camera. To strengthen the recognition capacity of system video data was captured at different environmental conditions and temporal shifts. Video is segmented into frames. Then from each segment a key frame is extracted and further processing is applied

on this key frame, to reduce computational complexity. When car enter or leave the parking lot from parking area, motion of car is estimated by key frame subtraction.

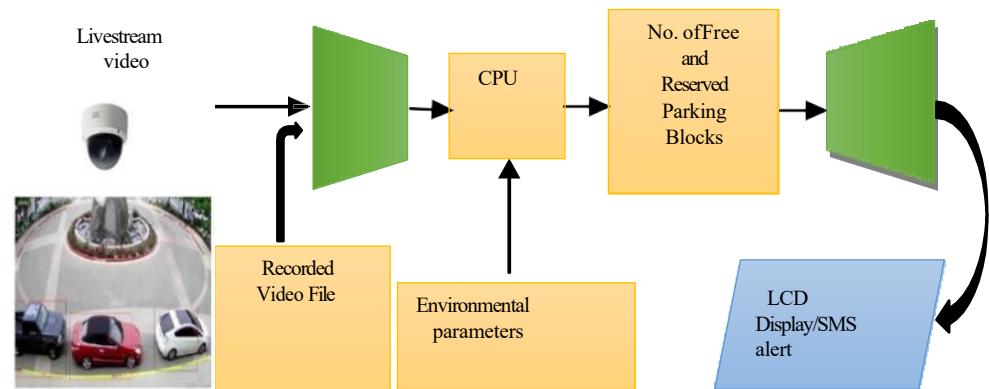


Figure 2: Block diagram of proposed system

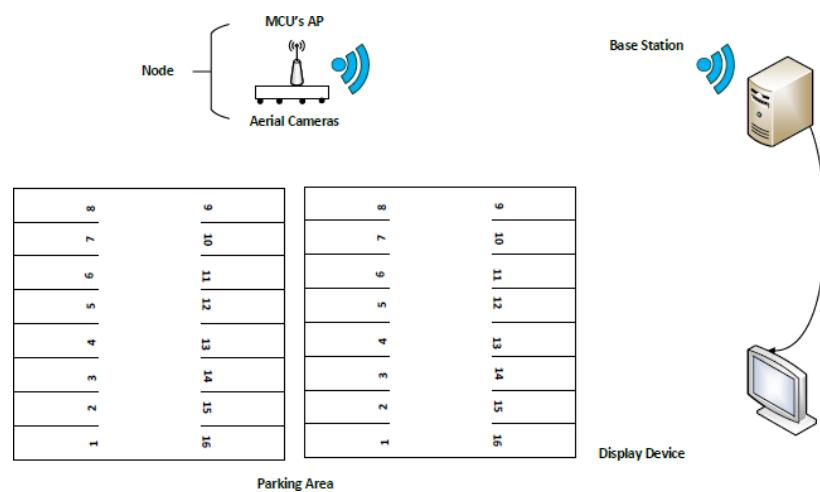


Figure 3: System Architecture

Initially, the parking arena have no parking lines. User will manually input the coordinates of parking area and vehicle intended to be parked. The system automatically generates virtual parking lines keeping in view the size of vehicle. The maximum capacity of parking slots in our training model is sixty-nine. A unique numeric label is assigned to each parking lot from 1-69. After the parking arena is divided in the virtual blocks, our system will check the existence of car in each block. Binary filter is applied on image and then inverse binary to extract car as region of interest ROI. Computing the value of connected region in ROI and setting the threshold value greater then eighty as reserved parking slot. The number of the free blocks will be indicated to the drivers in green and the reserved blocks will be indicated in red colour.

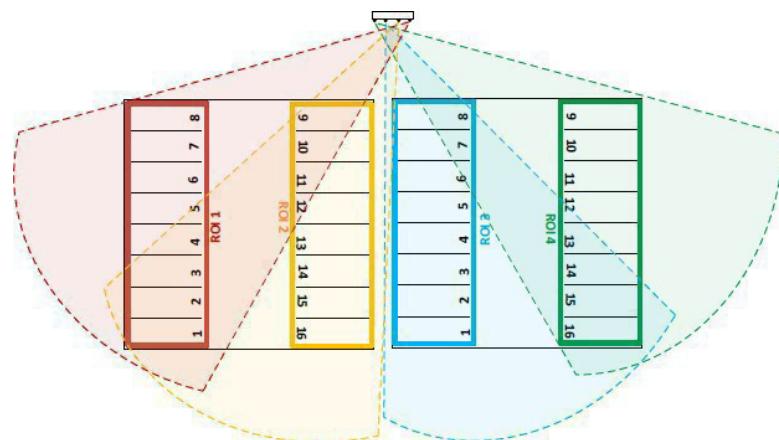


Figure4: Camera focusing on region of interest (ROI)

The online system is getting images from the camera while offline system is getting images from a video file. The result of the online system shows that the proposed algorithms has efficiently detected the available parking slots and notify the drivers. The proposed algorithm is implemented on the model parking lot having space for 69 cars. The Slots having no car are shown as free while the Slots having car in it are shown as reserved to drivers as shown in Fig. 6.

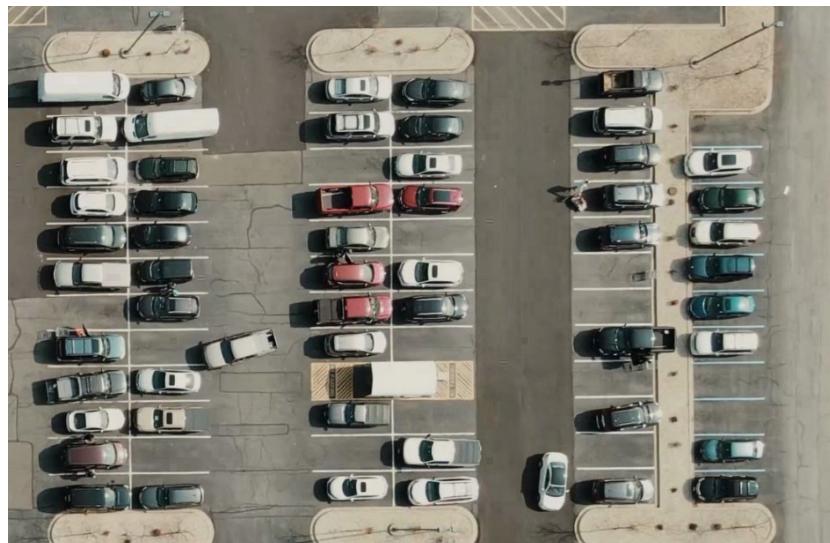


Figure 5: Car parking lot

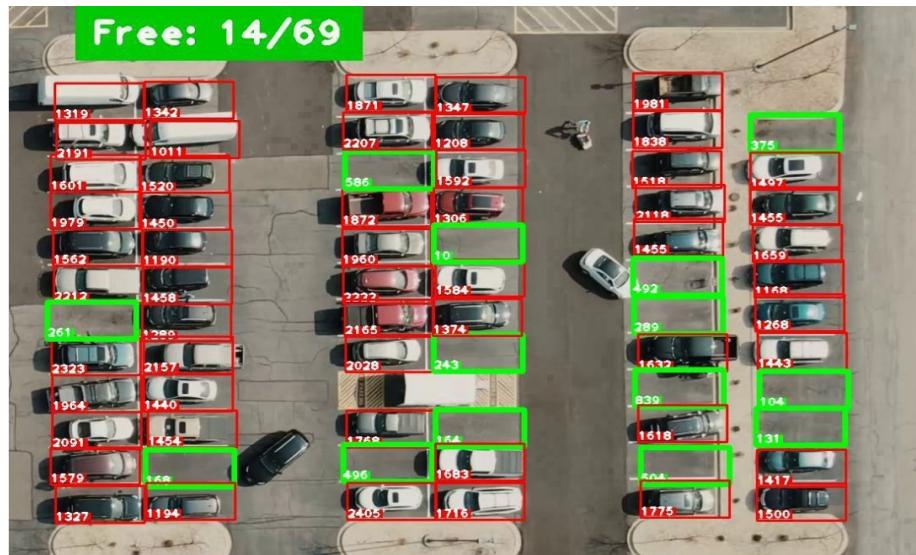


Figure 6: Car parking lot showing free and empty slots after actual detection.

To test the performance of our proposed algorithm, the accuracy of the system is measured with images taken at different time intervals. The performance is calculated by comparing the results of occupancy to the ground truth after every 5 sec. The performance of the proposed system is measured by the using the equation (1)

TPS = Total Parking slots

ANC =Actual Number of Cars

PNC=Predicted Number of Cars

$$\text{Performance} = 1 - (| \text{ANC} - \text{PNC} |) / \text{TPS} * 100 \quad (1)$$

The percentage of error in the proposed system will be find by using the equation (2)

$$\text{Percentage Error} = (| \text{ANC} - \text{PNC} |) / \text{TPS} * 100 \quad (2)$$



Figure 7: Free slots detection.

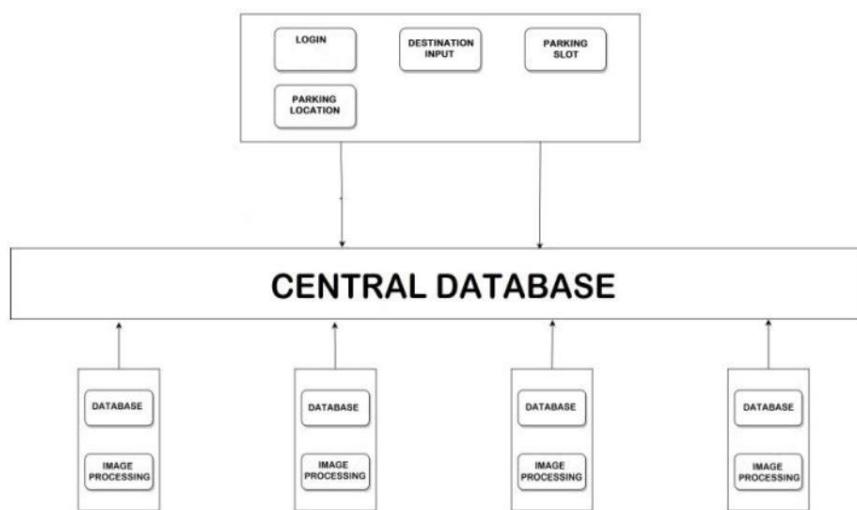


Figure 8: System and Database Interaction Architecture

4.2 Code snippets

```
from flask import Flask, render_template, Response, request,
redirect, url_for, session
from flask_mail import Mail
from flask_sqlalchemy import SQLAlchemy
from ParkingSpacePicker import parkingspacepicker
from main import generate_frame
import json
import os
from datetime import datetime

with open('config.json', 'r') as c:
    params = json.load(c)["params"]

local_server = True
app = Flask(__name__)
app.secret_key = 'super-secret-key'
app.config.update(
    MAIL_SERVER='smtp.gmail.com',
    MAIL_PORT='465',
    MAIL_USE_SSL=True,
    MAIL_USERNAME=params['gmail-user'],
    MAIL_PASSWORD=params['gmail-password']
)
mail = Mail(app)
if (local_server):
    app.config['SQLALCHEMY_DATABASE_URI'] =
params['local_uri']
else:
    app.config['SQLALCHEMY_DATABASE_URI'] =
params['prod_uri']

db = SQLAlchemy(app)

class Contacts(db.Model):
    sno = db.Column(db.Integer, primary_key=True)
    name = db.Column(db.String(80), nullable=False)
    email = db.Column(db.String(20), nullable=False)
    date = db.Column(db.String(12), nullable=True)
    phone_num = db.Column(db.String(12), nullable=False)
    msg = db.Column(db.String(120), nullable=False)
```

```

@app.route('/')
def index():
    return render_template('index.html')

@app.route('/contact', methods=['GET', 'POST'])
def contact():
    if request.method == 'POST':
        name = request.form.get('name')
        email = request.form.get('email')
        phone = request.form.get('phone')
        message = request.form.get('message')
        entry = Contacts(name=name, phone_num=phone,
msg=message, date=datetime.now(), email=email)
        db.session.add(entry)
        db.session.commit()
        mail.send_message('New message from ' + name,
                           sender=email,
                           recipients=[params['gmail-user']],
                           body=message + "\n" + email + "\n" + phone)

    return render_template('contact.html', params=params)

```

```

@app.route('/about')
def about():
    return render_template('about.html')

@app.route('/dashboard', methods=['GET', 'POST'])
def dashboard():
    error = None
    if request.method == 'POST':
        if request.form['uname'] != 'mihir' or request.form['pass'] != 'mihir123':
            error = 'Invalid Credentials. Please try again.'
        else:
            return redirect(url_for('detection'))
    return render_template('dashboard.html', error=error)

```

```

@app.route('/detection', methods=['GET', 'POST'])
def detection():
    if request.method == "POST":
        if 'upload' not in request.files:
            print("no file part")
            return redirect("/")
        file = request.files['upload']

```

```

if file.filename == "":
    print('No image selected for uploading')
    return redirect(request.url)
else:
    # base_path = os.path.abspath(os.path.dirname(file))
    # print(base_path)
    # upload_path = os.path.join(base_path, "video")
    # print(upload_path)
    # f.save(os.path.join(upload_path,
    secure_filename(f.filename)))
    # filename = secure_filename(file.filename)
    filename = "output.mp4"
    print(filename)
    file.save(os.path.join("output video", filename))
    # print('upload_video filename: ' + filename)
    print("successful")
    # flash('Video successfully uploaded and displayed
below')
    return render_template('detection.html',
filename=filename)
    return render_template('detection.html')

```

```

@app.route('/anotation')
def anotation():
    # display = 0
    return render_template('anotation.html')

```

```

@app.route('/video/<filename>')
def video(filename):
    print('display_video filename: ' + filename)
    display = filename
    return Response(generate_frame(display),
mimetype='multipart/x-mixed-replace; boundary=frame')

```

```

@app.route('/videocam')
def videocam():
    display = 0
    return Response(parkingspacepicker(),
mimetype='multipart/x-mixed-replace; boundary=frame')

```

```
app.run(debug=True)
```

CHAPTER 5

TESTING

5.1 Test Strategy

Software testing is a critical element of software quality assurance & represents the ultimate review of specification, design and code generation. It is the process of executing a program with a primary objective of finding errors. Testing gives the guarantee that the software does not fail and runs according to its specification and in the way the end user expects. This can be done by various software testing techniques which provide a systematic guidance for designing tests that exercise the internal logic of software components, and exercise the input and output domains of the program to uncover errors in programming functions, behavior and performance. Testing is the exposure of system to trial input to see whether it produces correct output. Testing is the process of detecting presence of faults. Once the source code has been generated, software must be tested to uncover as many errors as possible before delivery to your customer. Our goal is to design a series of test cases that have likelihood of finding errors. That's where software testing techniques enter into the picture. A set of test cases designed to exercise both internal login and external requirements is designed and documented, expected results are defined and actual results are recorded.

Testing Objectives:

Testing is an activity to verify that a correct system is being built and is performed with the intent of finding faults in the system. However not restricted to being performed after the development phase is complete but this is too carried out in parallel specification. Testing results, once gathered and evaluated, provide qualitative indication of software quality and reliability and serve as a basis for design modification if required a project is set to be incomplete without proper testing.

System testing is process of checking whether the development System is working according to the original objectives and requirements. The System should be tested experimentally with test data so as to ensure that the System works according to the required specification. When the system is found working, test it with actual data and check performance.

Software testing is a critical element of software quality assurance and represents the ultimate review of specification, design and coding. The increasing visibility of software as a system element and the attendant “cost” associated with a software failure is motivating forces for a well-planned, through testing.

Testing Principles:

All tests should be traceable to customer requirements. This focus of testing will shift progressively from programs. Exhaustive testing is not possible. To be more effective, testing should be one, which has probability of finding errors.

The following are the attributes of good test:

- ⊕ A good test has a high probability of finding an error.
- ⊕ A good test is not redundant.
- ⊕ A good test should be “best of breed”
- ⊕ A good test should neither too simple nor too complex.

Levels Of Testing

The details of the software functionality tests are given below. The testing procedure that has been used is as follows:

1. Unit Testing
2. Integration Testing
3. Validation Testing
4. Output Testing
5. User Acceptance System
6. Performance Testing

1. Unit Testing

The first level of testing is called as Unit testing. Here the different modules are tested and the specifications produced during design for the modules. Unit testing is essential for verification of the goal and to test the internal logic of the modules. Unit testing was conducted to the different modules of the project. Errors were noted down and corrected down immediately and the program clarity as increased.

The testing was carried out during the programming stage itself. In this step each module is found to be working satisfactory as regard to the expected output from the module.

2. Integration Testing

The second level of testing includes integration testing. It is a systematic testing of constructing structure. At the same time tests are conducted to uncover errors associated with the interface. It need not be the case, that software whose modules when run individually and showing perfect results will also perfect results when run as a whole. The individual modules are tested again and the results are verified.

The goal is to see if the modules can be integrated between modules. Poor interfacing may result in data being lost across an interface causing serious problems. This testing activity can be considered as testing the design and emphasizes on testing modules interactions.

3. Validation Testing

The next level of testing is validation testing. Here the entire software is tested. The reference document for this process is his requirement and the goal is to see if the software meets its requirements.

The requirement document reflects and determines whether the software functions the user expected. At the culmination of the integration testing, software is completely assembled as a package, interfacing and corrected and a final series of software test and validation test begins. The proposed system under construction has been tested by Using validation testing and found to be working satisfactory.

4. Output Testing

The output of the software should be acceptable to the system user. The output requirements are defined during the system analysis. Testing of the software system is done against the output requirements and the output testing was completed with success.

5. User Acceptance System

An acceptance test has the objective of selling the user on the validity and reliability of the system. It verifies that the systems procedures operate to system specification and make the integrity of vital data is maintained.

6. Performance Testing

This project is a system-based project, and the modules are interdependent with the other modules, so the testing cannot be done module by module. So, the unit testing is not possible in the case of this driver. So, this system is checked only with their performance to check their quality. In case of the Unit testing the initialization, module is first tested. Since read module and the write module is interdependent the performance testing is done only after the final phase of coding.

IMPLEMENTATION

Implementation is the stage in the project where the theoretical design is turned into a working system. The most crucial stage is achieving a successful new system & giving the user confidence in that the system will work efficiently & effectively.

5.2 Test Case / Test Script

Test Case ID	Scenario to Test	Steps to Perform	Expected Result	Actual Result	Pass / Fail
TCL1	Login into application as Admin/User	<p>1. Open the loginpage of the application.</p> <p>2. Enter the valid username.</p> <p>3. Enter valid password.</p> <p>4. Click on Login button.</p>	Application should accept valid user name and password entered by user and should redirect to respective dashboard.	Login into the application is successful.	Pass

TCL1.1	Login into application.	<p>1. Open the login page of the application.</p> <p>2. Enter invalid username.</p> <p>3. Enter valid password.</p> <p>4. Click on login button</p>	<p>Application should not accept invalid username.</p> <p>Application should throw “Invalid Username or Password” error</p>	Login denied with proper message	Pass
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TCL1.2	Login into application	<p>1. Open the login page of the application.</p> <p>2. Enter empty username.</p> <p>3. Enter empty password.</p> <p>4. Click on Login button.</p>	<p>Application should not accept empty values username.</p> <p>Application should display Fill Form message</p>	Login denied with proper message.	Pass
--------	------------------------	--	---	-----------------------------------	------

TCL1.3	Upload Video	<p>. Open the detection page of the application.</p> <p>2. Click on upload video button.</p> <p>3. Upload Video</p> <p>4. Click on submit response.</p>	<p>Application should accept the file if its video file e.g. .mp4 format.</p>	<p>Display mane of upload ed file.</p>	Pass
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TCL1.4	Sending Message to company via Contact Us	<p>1. Open the contact page of the application.</p> <p>2. Enter empty name</p> <p>3. Enter empty email address</p> <p>4. Enter empty phone number.</p> <p>5. Enter empty message</p>	<p>Application should not accept empty values.</p> <p>Application should display fill Form message</p>	<p>Send message denied with message</p>	Pass
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TCL1.5	Sending Message to company via Contact Us	<ol style="list-style-type: none"> 1. Open the contact page of the application. 2. Enter name 3. Enter email address 4. Enter phone number. 5. Enter message 	Application should accept valid values. Application should display message sent.	Send message successfully	Pass
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CHAPTER 6

LIMITATIONS OF PROPOSED SYSTEM

Our System has few limitations which are to be overcome in near future. Some of them are given below:

1. Regular maintenance

The system is automated; however, it still requires several regular maintenances from the company. This is to ensure that the system is working perfectly and that nothing has gone wrong. The maintenance could be once in months.

2. Operation

A lot of people are not used to the parking detection system. As a result, it may be difficult for them to make use of, thereby causing further complications during parking.

3. Breakdown

As a machine, the system could inevitably breakdown at some point.

CHAPTER 7

PROPOSED ENHACEMENTS

In the near future the project can be further enhanced to include a multitude of features. This extension could be incorporated in the project to improve the overall performance. We can include enhancements such as:

- All the operations done by Admin and Guest User can be kept in log.
- Platform for automatic number plate recognition and car parking ticket issue as well as payment as per usage per hour can be added.

Can be further enhanced for high level establishment

CHAPTER 8

CONCLUSION

Working on project was good experience. I could understand the importance of Planning and designing as a part of software development. But it's very difficult to complete the program for single person. Developing the project has helped us some experience on real time development procedure. The system is able to achieve the objective and provide the unlimited result called "Customer Satisfaction"

- The main contribution of this study is to optimize the identification of available parking slots to possibly reduce the congestion in parking arena. Due to advancement in machine learning and vision base technology cost effective automatic parking systems facilitate the drivers to locate available spaces at parking arena. Future researchers can focus on allocation specific location to customers already registered from online parking management system.
- The vision of project is a step towards the greater mission. This module ensures those flexibility and efficiency of the all services on line.

The project is also designed as user friendly as it is easy to use the user interfaces.

CHAPTER 9

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CHAPTER 10

USER MANUAL

- User Manual:**

For any system to be successful it is important that the intended user find the system easy to operate. The purpose of the user manual is to make user acquainted with the system and help user understand the system and operate it conveniently. The User Manual is prepared reflexively because it is an item that must accompany every system.

The manual contains several screenshots that describes how to use the entire system. This manual helps user to navigate efficiently through the system and help user to solve issues whenever they occur.

Information about the system.

The system contains following users:

Admin

User

Admin: can login by clicking on login button and he will be able to see the detection page in his dashboard, there he can upload the car parking video by clicking on choose file, once the file is selected he can annotate the data for detection by clicking on go for annotation and click on submit request button to send data for detection. after detection, system will send sms to car drivers mobile.

View and manage public notice/blogs: admin can see public notices/blogs at the top on home page and also can scroll down from all pages in order to view public notices/blogs.

View Contacted Users: Admin will be able to view contacted users and also receive email about contacted users.

User: View public notice/blogs: User can see public notices/blogs at the top on home page and also can scroll down from all pages in order to view public notices/blogs.

Contact: to contact the car parking company click on contact us button given on home page and user will see details for contacting company.

About: By clicking on about us button user can see details about car parking company.