COLLEGE PARKING SYSTEM

[1]Mrs.D.ShanthI,[2]K. Poojitha,[3]B. Pravallika,[4]V.Venkata trisha,[5]T. Vaishnavi
[1]*Associate Professor, Department of IT (Information Technology),*
[2,3,4,5]*B.Tech 4th Year Students, Department of IT (Information Technology), Vignan's Institute of Management and Technology for Women,*
Hyderabad, Telangana - 501301, India
[1]Drshanthicse@gmail.com,[2]kurapatipoojitha5@gmail.com,[3]bheemaganipravalika78@gmail.com,
[4]venkatatrisha984@gmail.com,[5]vaishnavitadukamadla@gmail.com

ABSTRACT

Finding a parking spot on a busy college campus is a constant struggle that often leads to wasted time and unnecessary traffic jams. To tackle this, the **Smart College Parking System** introduces an automated way to track and manage parking spaces using computer vision. Instead of relying on expensive, high-maintenance physical sensors, this project uses existing camera setups combined with machine learning to monitor the lot. The core of the system is a **YOLOv8-based model** that analyzes live video feeds to instantly identify which slots are occupied and which are free. This real-time data is fed directly into a web dashboard, where students and staff can quickly check availability or even book a spot before they arrive. By shifting hardware-heavy sensors to a smarter software-driven approach, the system provides a budget-friendly and scalable solution for modern campuses. Ultimately, this setup makes parking much less of a headache, cuts down on campus congestion, and creates a more organized environment for everyone.

Keywords: Smart Parking System, Image Processing, Machine Learning, Computer Vision, YOLOv8, Real-Time Monitoring, Slot Booking, Smart Campus Infrastructure.

1.INTRODUCTION:

With more students and staff bringing vehicles to campus every day, finding a parking spot has become a major daily headache. Most universities still rely on a "first-come, first-served" approach with zero real-time updates, leaving drivers to circle lots aimlessly. This isn't just frustrating—it creates unnecessary traffic jams, wastes fuel, and increases pollution within the campus.

The **Smart College Parking System** fixes this by replacing manual searching with an automated, tech-driven experience. The goal is to give drivers instant, accurate data so they can head straight to an open spot. By using **computer vision** and **machine learning**, the project avoids the need for expensive physical sensors that are difficult to maintain. Instead, it uses standard camera feeds to monitor parking zones. These live images are processed to instantly identify which slots are "Occupied" or "Available" with high precision.

Through a simple web portal, students and faculty can log in to view a live digital map of the lot. The system even allows for advance booking, so a spot is guaranteed upon arrival. For administrators, a dedicated dashboard helps track occupancy trends and manage the layout. Ultimately, this system turns a chaotic parking process into a streamlined, eco-friendly, and stress-free part of campus life.

2.LITERATURE SURVEY:

Traditional smart parking setups often rely on ultrasonic or infrared sensors installed at every single parking stall. While these provide accurate real-time data, they are incredibly expensive to set up and maintain, making them unrealistic for most college budgets. Other methods use IoT-based entry and exit counters, but these only tell you if a lot is full—they can't guide you to a specific open spot. This leaves drivers "blind searching" once they get inside, which does little to solve the actual traffic problem.

Early computer vision attempts tried to use basic image processing to spot changes in a lot, but they were notoriously unreliable. Changes in lighting, shadows, or even a heavy rainstorm could easily trigger false alerts. Our system moves past these hurdles by using a **YOLOv8-based deep learning architecture**. Instead of fragile physical sensors, we use software-driven intelligence to monitor spaces with high precision, even in tricky weather. By focusing on a "software-first" approach, we eliminate the need for costly hardware at every slot. Plus, by adding a real-time web portal with a booking feature, we bridge the gap between just knowing a spot is there and actually securing it, creating a much smoother experience than previous systems ever could.

Smart parking technology has come a long way, moving from basic manual tracking to high-tech sensor environments. Many early systems relied on ultrasonic or infrared sensors installed at every single parking spot. While these are accurate, the cost of installing and maintaining a sensor for every stall is just too high for most college budgets. Other researchers tried using IoT

counters at entry and exit gates, but these only give a general count of cars. They can't tell a driver exactly where an open spot is, which leads to people driving in circles once they're inside the lot—completely defeating the purpose of reducing campus traffic.

The **Smart College Parking System** solves these issues by using a robust **YOLOv8 machine learning architecture**. By moving the intelligence from expensive hardware into smart software, the system can accurately detect vehicles even when lighting or weather conditions aren't perfect. Unlike previous versions, this project includes a calibration phase to keep the detection flexible and integrates a web portal for pre-booking. This means students and staff aren't just seeing that a spot exists—they're securing it in advance, making campus parking much more organized and predictable.

3.PROBLEM STATEMENT:

The increasing number of vehicles in college campuses has led to parking congestion and inefficient space utilization. Students and staff often spend excessive time searching for available parking slots, causing delays and traffic buildups. Traditional parking management systems lack real-time monitoring and automation. Therefore, there is a need for an intelligent system that can detect parking availability accurately and provide real-time updates to users.

4.PROPOSED SYSTEM

To overcome the limitations of existing parking systems, we propose a Smart College Parking System based on computer vision and machine learning. The system uses cameras installed in the parking area to continuously capture images of parking slots. These images are processed to automatically detect whether a slot is occupied or vacant. The parking status is updated in real time and displayed through a web-based application. Students and staff can check available slots before entering the parking area, reducing unnecessary searching. The system eliminates the need for manual supervision and reduces human errors. It is more cost-effective compared to sensor-based systems since it does not require individual hardware for each slot. By providing accurate and real-time information, the proposed system improves parking efficiency and reduces traffic congestion within the campus. Overall, it offers a smarter and more reliable approach to parking management.

5.METHODOLOGY:

Methodology Overview

The **Smart College Parking System** works through a continuous cycle of gathering data, analyzing it with AI, and pushing live updates to the user. By ditching expensive hardware sensors for a software-first approach, the system stays budget-friendly without losing accuracy.

Data Acquisition and Setup

- **Live Video Streaming:** High-definition cameras are positioned to overlook the parking lots. These cameras feed a live stream into the system, which then chops the footage into individual frames so the AI can analyze them one by one.
- **Manual Slot Calibration:** During the initial setup, an admin uses a custom tool to "draw" and save the exact coordinates for every parking space. This tells the AI exactly where to look, helping it ignore background distractions like swaying trees or people walking by.

Core AI Processing

- **YOLOv8 Detection:** The captured frames are sent through the **YOLOv8** engine. This model is incredibly fast and can spot multiple vehicles at once, even in tough conditions like deep shadows or when cars are partially overlapping.
- **Occupancy Logic:** The backend compares the "bounding box" of every detected car against those pre-set slot coordinates. If a car is sitting inside a slot's boundaries, the system flags it as **Occupied**; if not, it stays **Available**. This entire process is handled by **Python** using the **OpenCV** library.

Database and Backend Management

- **Centralized Storage:** All the real-time info is kept in a **SQLite** database. Think of this as the "brain" of the project—it tracks everything from live occupancy and user accounts to advance booking logs.
- **Flask API Integration:** The **Flask** framework acts as the bridge between the database and the user. It manages requests from the web portal, grabbing the latest numbers and processing new reservations on the fly.

User Interface and Interaction

- **Real-Time Dashboard:** Students and staff access a web portal built with **HTML, CSS, and JavaScript**. It features a live map of the lot so they can check for free spots before they even put the car in gear.
- **Asynchronous Updates:** To keep things smooth, the dashboard uses AJAX to refresh the UI automatically whenever a car enters or leaves. This means the data is always fresh without the user having to manually hit the refresh button.

6. ALGORITHM:

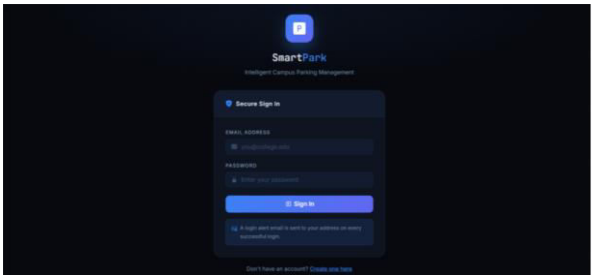
The **Smart College Parking System** is an automated way to handle the daily chaos of campus parking using tech like cameras and real-time databases. Instead of drivers circling lots, the system keeps a constant eye on every spot, giving students and staff instant updates on where they can actually park. When a car pulls in, the system identifies it and can even suggest the best available space based on how close it is to the entrance. By tracking exactly when vehicles enter and leave, the database stays current, reducing traffic jams and making the whole process a lot more organized.

6.1 Step-by-Step Logic

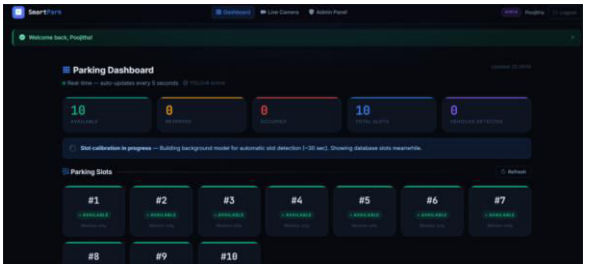
The system starts by firing up the database, where all the parking slots and user info are stored, and sets every spot to "Available" as a clean slate. As soon as a vehicle arrives, the system uses a camera or QR scanner to log the vehicle's details and the exact time it entered.

From there, the software queries the database to find the next open spot. While the car is parked, the system's vision logic or sensors continuously monitor that specific slot. If the vehicle moves, the status instantly flips back to "Available" in the system. When it's time to leave, the vehicle is scanned again to mark the exit time. The system then calculates the total duration, clears the slot for the next person, and saves the entire session in the transaction history for the admin to review.

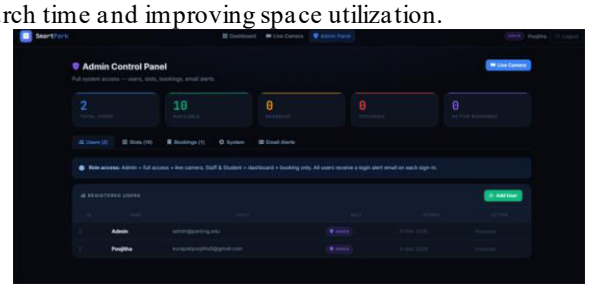
7.RESULTS:



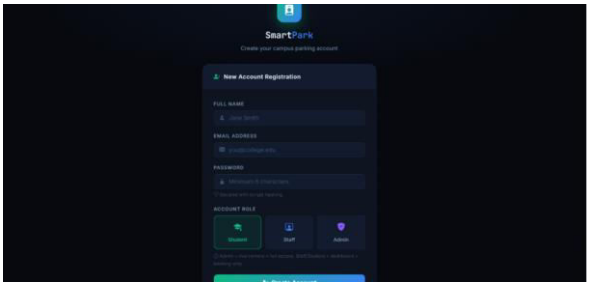
The **Smart College Parking System** provides a secure login interface to authenticate users before accessing parking services. It ensures that only authorized users can view and manage parking slots. This enhances system security and enables personalized parking management features.



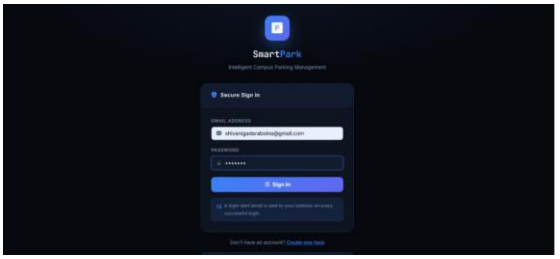
The **Smart College Parking System** dashboard provides real-time monitoring of parking slots using automated detection (e.g., YOLO-based vision). It displays available, occupied, and reserved slots while dynamically updating data to ensure efficient parking management. The system enhances user convenience by reducing search time and improving space utilization.



This image shows an **Admin Control Panel of a Smart Parking System (SmartPark)** used to monitor and manage parking operations.It provides real-time data on users, available slots, bookings, and occupancy while allowing admins to control users and system settings.The dashboard ensures efficient parking management with features like live camera access, role-based access, and email alerts



This image shows the **user registration interface of the SmartPark system**, where new users can create an account.It collects essential details like name, email, password, and role (student, staff, or admin) with secure authentication. The system ensures role-based access control for efficient and secure parking management.



This UI represents a secure login interface for the SmartPark system, designed to authenticate users before granting access to

parking management features. It includes input fields for email and password, along with a sign-in button to validate credentials. The design emphasizes security and user experience by providing login alerts and an option to create a new account.

8. CONCULSION:

The **Smart College Parking System** successfully tackles the daily struggle of finding a spot on campus. By automating the tracking and booking of spaces, the project cuts down on the traffic jams and wasted time that usually plague university lots. It's a practical example of how combining simple software with AI can solve real-world frustrations, making life easier for both students and faculty.

Throughout the build, the goal was to keep the data fast and accurate. The system monitors slot availability in real-time, ensuring users are guided to open spots without aimless driving. This doesn't just make parking less of a headache; it actually helps the environment by reducing fuel consumption and idling. With features like automatic entry/exit logging and a secure central database, the system runs smoothly with almost no manual effort.

9. FUTURE SCOPE:

Looking ahead, there's plenty of room to grow. A **mobile app** could allow users to check availability or reserve spots before they even leave home. Adding **cashless payments** via UPI or mobile wallets would speed up exits, while **CCTV security integration** could help track unauthorized vehicles. We could also add **EV-specific spots** to encourage sustainable transport or move everything to the **cloud** to analyze peak hours and parking trends. These updates would make the campus even smarter and more organized.

10.REFERENCES:

[1] Er.Prm Chandra Roy, Arjun Bhandari Thapa, Kumar Shrestha, Prasanna Karmacharya, Rajan Karna. Vehicle Number Plate Recognition and Parking System. ISSN (online): 2581-3048 Volume 2, Issue 10, pp 18-23, December-2018.

[2] Shweta Pardeshi, Pranali Pawar, Nikhil Raj. Real-Time Object Measurement. ISSN 2321 3361 © 2021 IJESC.

[3] Nashwan Adnan OTHM, Mehmet Umut SALUR, Mehmet KARAKOSE, Ilhan AYDIN an Embedded Real-Time Object Detection and Measurement of its Size. International Conference on Artificial Intelligence and Data Processing (IDAP) 2018 At Turkey

[4] Nashwan Adnan OTHM, Mehmet Umut SALUR, Mehmet KARAKOSE, Ilhan AYDIN an Embedded Real-Time Object Detection and Measurement of its Size. International Conference on Artificial Intelligence and Data Processing (IDAP) 2018 At Turkey

[5] Shally Gupta, Rajesh Singh, H.L. Mandoria. A Review Paper on License Plate Recognition System International Journal of Innovative Research in Computer Science and Communication Engineering 2020 Vol.5 No.1.4

[6] Nashwan Adnan Othman, Mehmet UmutSalur, Mehmet Karakose. An Embedded Real-Time Object Detection and Measurement of its Size,Publisher: IEEE. September 2018.

[7] Dr. Bhavesh R. Patel, 2Sachin A. Goswami, 3Preyash S. KaPatel, 4Yash M. Dhakad. Realtime Object's Size Measurement from Distance using OpenCV and LiDAR. April 2021Turkish Journal of Computer and Mathematics Education (TURCOMAT) 12(4):1044-1047

[8] Tommaso Tocci, Lorenzo Capponi and Gianluca Rossi. ArUco marker-based displacement measurement technique: uncertainty analysis.2021 IOP Publishing Ltd. Published 30 August 2021

[9] Shweta Pardeshi, Pranali Pawar, Nikhil Raj. Real Time Object Measurement. Volume 11 Issue No. 02. ISSN 2321 3361 © 2021 IJESC

[10] Salma, Maham Saeed, Rauf ur Rahim, Muhammad GufranKhan , Adil Zulfiqar and Muhammad Tahir Bhatti, Development of ANPR Framework for Pakistani Vehicle Number Plates Using Object Detection and OCR, Publisher: Wiley , 19 October 2021