**ParkEasy**

## A PROJECT

*Submitted By*

**Harshit Kumar Singh (E23CSEU1832)**

**Rutuja Godse (E23CSEU1858)**

**Drishti Singhal (E23CSEU1850)**

*In partial fulfilment for the award of the degree of*

BACHELOR OF TECHNOLOGY

in

Computer Science & Engineering Under the supervision of

**Dr Nitin Arvind Shelke**

Assistant Professor

School of Computer Science Engineering and Technology



SCHOOL OF COMPUTER SCIENCE ENGINEERING AND TECHNOLOGY

BENNETT UNIVERSITY, GREATER NOIDA

APRIL 26th, 2025

## TABLE OF CONTENTS

[DECLARATION](#_bookmark0) i

[CERTIFICATE ii](#_TOC_250033)

[ACKNOWLEDGEMENT iii](#_TOC_250032)

1. Introduction

Problem Statement

Objectives

Literature Review

2. Proposed Methodology

3. Technologies Used

4. Related Work

4. Conclusions and Future Work

#### DECLARATION

We hereby declare that the project work entitled “ParkEasy” submitted to Bennett University, Greater Noida is a record of an original work done by us under the guidance of Mr. Nitin Arvind Shelke and this research is being submitted to fulfil the requirements for the award of degree of Bachelor of Technology in School of Computer Science Engineering and Technology.

The results embodied in this research work have not been submitted to any other university or institution for the award of any degree or diploma.

Place: Greater Noida Signature of the Student

Date: April 26th , 2025 Harshit Kumar Singh

Rutuja Godse

Drishti Singhal

## CERTIFICATE

This is to certify that the report entitled **“ParkEasy”** submitted by Harshit Kumar Singh, Rutuja Godse and Drishti Singhal to Bennett University, towards the fulfilment of requirements of the degree of **Bachelor of Technology** is record of Bonafide Second year Project work carried out by them in the School of Computer Science Engineering and Technology, Bennett University The results/findings contained in this Project have not been submitted in part or full to any other University/Institute for award of any other Degree/Diploma.

Signature of Supervisor Name: Dr Nitin A. Shelke

Designation: Assistant Professor (SCSET)

Place: Bennett University Date: April 26th, 2025

## ACKNOWLEDGEMENT

A major project is a golden opportunity for learning and self-development. We consider our self very lucky and honored to have so many wonderful people lead us through in completion of this project.

Our grateful thanks to Dr Nitin Arvind Shelke for his guidance in our project work. He took time out to hear, guide and keep us on the correct path.

School of Computer Science Engineering and Technology monitored our progress and arranged all facilities to make life easier. We choose this moment to acknowledge their contribution gratefully.

Signature of Students

**Harshit Kumar Singh  
Rutuja Godse  
Drishti Singhal**

**INTRODUCTION**

**Problem Statement:**

Managing parking spaces efficiently has become a major challenge due to the rapid growth in vehicle numbers. Manual monitoring methods are slow, error-prone, and lack real-time updates, leading to congestion, wasted time, and user frustration. There is a strong need for an automated system that can accurately detect available parking spaces and track vehicle movements without heavy infrastructure costs.

**Objectives:**

* Automate the detection of vacant and occupied parking spaces using a YOLOv8 deep learning model.
* Track vehicle entry and exit to update parking availability in real time.
* Integrate a database to store and manage parking status dynamically.
* Reduce human intervention and improve parking efficiency.
* Visualize results for easy monitoring and administrative use.

**Literature Review:**

Early parking systems relied on manual checks or basic sensors, which were expensive and less accurate under varying conditions.  
The use of computer vision brought improvements but struggled with environmental changes like lighting and occlusion.  
Deep learning models, especially CNN-based detectors like YOLO, provided robust real-time detection capabilities. YOLOv8, in particular, balances speed and accuracy, making it ideal for real-world parking applications.  
Existing solutions often require costly hardware installations; a camera-based, AI-driven system offers a more scalable and cost-effective alternative.

**Proposed Methodology**

**Dataset Preparation:**

* Parking lot images are collected and manually labeled for two classes: empty and occupied spaces.
* Images are split into training, validation, and test sets.
* A data.yaml file is configured to define dataset paths and class names.

**Model Selection and Training**

* **YOLOv8** (You Only Look Once, version 8) is selected due to its balance between accuracy and speed.
* Training configuration:
  + **Epochs:** 10
  + **Image size:** 512 × 512 pixels
  + **Batch size:** 8
* A pretrained YOLOv8n model (yolov8n.pt) is fine-tuned on the parking dataset.

**Vehicle Entry and Exit Monitoring**

* Separate object detection modules are created to detect vehicles crossing entry and exit points.
* Each detection updates the number of cars inside the parking area dynamically.

**Parking Space Detection**

* The trained YOLOv8 model is used to detect and classify parking slots as **empty** or **occupied** in input images.
* Predictions are filtered based on a **confidence score** threshold (e.g., 0.5) to reduce false detections.

**Database Integration**

* A MySQL database is used to store:
  + Current available spaces
  + Total capacity
  + Timestamped images of parking lots
  + Location-based parking data
* db\_helper.py handles all database update operations securely.

**Visualization and Result Storage**

* Bounding boxes are drawn on detected parking spaces:
  + Green for empty slots
  + Red for occupied slots
* Processed images are saved to a designated folder for web access or admin verification.

**Logging and Error Handling**

* The system maintains logs (parking\_detection.log) for:
  + Training progress
  + Detection events
  + Database updates
  + Unexpected errors
* Helps ensure transparency and easier debugging during deployment.

**Technologies Used**

|  |  |  |
| --- | --- | --- |
| **Category** | **Technology** | **Purpose** |
| Programming Language | Python | Primary language for implementing the system. |
| Deep Learning Framework | YOLOv8 | Object detection model for parking space detection. |
| Computer Vision Library | OpenCV | Image processing and result visualization. |
| Database | MySQL | Stores parking space data, occupancy, and image paths. |
| Web Framework | Flask | Backend framework for handling APIs and server-side logic. |
| Version Control | GitHub | Version control for code management and collaboration. |

**Related Work**

**Harshit:** Deep Learning and Parking Detection Model

Harshit researched and implemented the YOLOv8 deep learning model for real-time parking space detection. He worked extensively on training the model with a customized dataset, optimizing it using techniques like batch processing, and setting the right confidence thresholds for better accuracy. Harshit also handled the integration of the detection module with the entry and exit systems, ensuring that parking availability is updated accurately in the database.

**Drishti:** System Integration and Database Management

Drishti focused on the backend integration of the project, connecting the model outputs to a MySQL database. She designed the structure for recording available and occupied spaces, along with image logging for each detection instance. Drishti ensured that the entry, exit, and detection modules were properly synchronized with the database, maintaining system consistency.

**Rutuja:** Testing and Result Validation

Rutuja handled the testing of the entire system. She validated the accuracy of parking space detection, tested different confidence thresholds, and analyzed the system's behavior with various image qualities and angles. Rutuja also helped in documenting the result analysis and identified any gaps between predicted and actual parking space counts for final fine-tuning.

**CONCLUSIONS AND FUTURE WORK**

**Conclusions:**

ParkEasy successfully developed a YOLOv8-based system for parking space detection. The system efficiently identifies available and occupied parking spaces, offering monitoring and updating of parking status. By leveraging deep learning for object detection, it provides an accurate and scalable solution for parking lot management. The integration with a database ensures seamless data logging and access through a user-friendly interface.

**Future Work:**

**Model Optimization**: Fine-tuning the YOLOv8 model for better accuracy, especially in complex environments.

**Real-time Processing**: Improving inference speed for faster detection.

**IoT Integration**: Combining with IoT sensors for enhanced accuracy and real-time data.

**UI Improvements**: Developing a mobile app for real-time parking updates.

**Scalability**: Scaling the system for larger or urban-wide parking areas.