WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Affordable Mobile Application Camera System To Monitor Residential Societies Vehicle Activity

K C Dhanush Reddy[1], Vikram P[2], Abhishek Sairam A[3], Mohith Kumar A[4], Mohammed Isaq[5], Ms. IMPA B H[6]

[1] Dept of CSE(AI/ML) Presidency University Bangalore, India DHANUSH.20211CEI0109@presidencyuniversity.in
[2] Dept of CSE(AI/ML) Presidency University Bangalore, India VIKRAM.20211CEI0107@presidencyuniversity.in
[3] Dept of CSE(AI/ML) Presidency University Bangalore, India ABHISHEK.20211CEI0102@presidencyuniversity.in
[4] Dept of CSE(AI/ML) Presidency University Bangalore, India MOHITH.20211CEI0096@presidencyuniversity.in
[5] Dept of CSE(AI/ML) Presidency University Bangalore, India Mohammed.20211CEI0101@presidencyuniversity.in
[6] Associate Professor Dept of CSE Presidency University Bangalore, India

ABSTRACT-

Residents of the community are faced with increasing challenges in managing traffic operations, ensuring safety, parking and improving traffic flow. Traditional methods, mostly manual or relying on expensive monitoring equipment, have difficulty meeting these needs. This study investigates investments in the use of video surveillance systems designed to monitor activities in residential areas, providing high-quality, efficient and cost-effective results. Integrated vehicle data using technology certification license.

Provides residents and community management with a mobile application interface that provides remote access to live video, detailed traffic information and instant notifications about entry, illegal or unusual activities. The system eliminates the need for physical infrastructure by utilizing cloud- based storage, providing scalability and secure data management. Automatic entry simplifies long management and reduces manual errors for efficient operation.

Keywords- Traffic operations management, video surveillance systems, residential traffic monitoring, cloud-based storage, traffic flow optimization, remote access application, vehicle performance data, automated entry systems, real-time notifications, scalable traffic management, smart parking solutions, technology certification license, paperless operations.

INTRODUCTION :

This project proposes an action-oriented video surveillance system designed to monitor vehicle operations in residential areas, addressing critical security and traffic management challenges. With rising urban living standards, ensuring the safety of residents and their vehicles has become increasingly important. The system leverages a network of cost-effective cameras strategically distributed throughout the community, integrated with a mobile application for real-time monitoring and efficient time management. By utilizing existing technology and affordable camera solutions, the project aims to establish a secure vehicle monitoring system, enhance community management, and improve the overall safety of residents. This initiative not only meets the demands of modern urban living but also contributes to creating a healthier and safer environment.

RESEARCH GAP OR EXISTING METHODS :

1. **High Installation :**

CCTV systems require significant upfront investment for camera hardware, installation, and setup, which can be prohibitive for many residential communities.

2. **Limited Access and Flexibility:**

Accessing video feeds often requires being physically present at the monitoring location or using a desktop application. This limits real-time monitoring capabilities for residents.

3. **Static Coverage:**

Fixed cameras have a limited field of view. If a vehicle moves outside the camera's range, it won't be captured, potentially missing critical events.

4. **Storage Challenges:**

Storing large amounts of video footage can be costly. Many systems require additional storage solutions, leading to increased maintenance and management efforts.

5. **No Real-Time Alerts:**

Traditional systems typically lack real-time alerting features. Residents may only discover unauthorized vehicle entries after reviewing recorded footage.

6. **Vulnerability to Tampering:**

CCTV cameras can be tampered with or vandalized, rendering them ineffective. This raises concerns about overall security reliability.

7. **Complexity of Management:**

Managing a CCTV system can be complicated, often requiring dedicated personnel for monitoring, maintenance, and troubleshooting.

8. **Limited Integration:**

Many traditional systems do not integrate well with modern technologies, such as mobile applications or IoT devices, limiting their functionality and user engagement.

9. **Privacy Concerns:**

Continuous recording can raise privacy issues among residents. Concerns about who can access the footage may deter acceptance of such systems.

TECHNOLOGIES USED :

1. Device System Architecture

Aim: Create a mobile application integrated with a camera system to monitor vehicle activities in residential societies.

Project Overview:

- *Structure of the System:* Design a device architecture that includes key components and functions.
- *UI Design Requirements:*
  - *User Authentication:* Provide a secure login or signup screen.
  - *Dashboard:* Display a dashboard with real-time updates.
  - *Alerts and Notifications:* Design notifications to alert users about events.
  - *User Permissions:* Implement a role-based access control system to manage user permissions effectively.
- *Technical Integration:* Utilize APIs for model invocation and employ a web server using Ngrok for secure and dynamic application access.

2. Integration of YOLO

Objective: Integrate YOLO (You Only Look Once) object detection capabilities into a mobile application camera system for monitoring vehicle activities in residential societies.

Tasks:

- *YOLO Version Selection:* Choose an appropriate YOLO implementation (YOLOv3, YOLOv4, or YOLOv10) for the project.
- *Model Training:* Train the model using a labelled dataset.
- *Integration:*
  - Incorporate YOLO into the mobile application.
  - Capture frames from the camera feed and process them using the YOLO model to identify and detect vehicles and their number plates.
- *UI Display:* Present the YOLO object detection results on the application interface.

3. ML for Number Plate Recognition

Goal: Enhance the accuracy and applicability of the number plate recognition system using machine learning models.

Tasks:

- *Model Selection:* Use the Stanford Cars Dataset, which includes labelled images, for training the model.
- *Training Details:*
  - Provide details about the dataset, including its labelled images.
  - Explain the training methods and validation techniques used.
  - Describe any fine-tuning done to optimize the model.

4. User Interaction Flow

Objective: Ensure an intuitive and user-friendly interaction experience.

Key Features:

1. *Security Authentication:* Implement secure login and access control mechanisms.

2. *Dashboard:* Provide a central hub for real-time updates and data visualization.
3. *Alerts and Notifications:* Deliver timely notifications about detected events.
4. *User Feedback:* Include a feature to collect and manage user feedback.
5. *Logout:* Provide an easy and secure logout option.

5. Privacy Measures and Ethical Considerations

Key Measures:

- Ensure the privacy of user data through robust encryption and secure data handling.
- Adhere to ethical practices by limiting data usage to project objectives and avoiding misuse.
- Comply with relevant regulations and standards for data protection and surveillance.

PROPOSED METHODOLOGY :

Vehicle Image Capture and License Plate Recognition Process

Vehicle Image Capture The first step involves capturing an image using an electronic device such as a digital camera or webcam. The captured image is stored in JPEG format and subsequently converted into a grayscale image for further processing.

Pre-Processing Preprocessing is essential to prepare the image for high-performance recognition. Key steps include:

- *Binarization:* Converting the image into black-and-white format to isolate the characters.
- *Noise Elimination:* Removing unwanted noise to enhance the quality of the input image.

Gray Conversion

- The input is a colour image of the car, clearly showing its license plate.
- The RGB image is converted into a 256-level grayscale image using a mathematical formula.
- *Binarization:* Reduces each pixel value to either 0 or 255, ensuring simplicity in processing.
- This step flattens tonal variations between the red, green, and blue channels, producing a single hue grayscale image.

4. Median Filtering

- Median filtering is applied to eliminate noise, such as "salt and pepper" artifacts, commonly found in license plate images.
- This method not only removes noise but also enhances the concentration of high-frequency image details.
- Improved clarity aids in accurate edge detection and feature extraction.

5. Feature Extraction

- This step involves studying and extracting useful information from the filtered image.
- Extracted features may include grey shades, textures, shapes, or other contextual details of the image.
- These features simplify subsequent image processing and recognition tasks.

6. Character Segmentation

- This stage isolates individual characters on the license plate for further analysis.
- Challenges include handling:
    - Image noise
    - Plate frames and rivets
    - Rotation and illumination variances
- *Image Segmentation:* Divides the image into regions or pixel groups based on similar textures or colours, making it easier to process each character separately.

7. Character Recognition

- Two common methods for recognizing characters are:
    - *Template Matching*
    - *Neural Network Method* (used in this project)
- Using a neural network, individual characters and numbers on the license plate are identified.
- The network is trained on a dataset of 36 characters, accounting for positional variations.
- A program is designed to extract, resize, and process each character, outputting the final sequence.

8. Optimal Character Recognition

- Optical Character Recognition (OCR) converts the identified characters from images into machine-readable text.
- This step ensures accurate reading of handwritten or typewritten license plate characters, enabling seamless integration into digital systems.

OBJECTIVES :

The objective of this project is to develop a comprehensive and user-friendly mobile application system to enhance security and safety in residential communities. The specific aims are:

1. **Develop an Accessible Monitoring Solution:**

Create a mobile application that enables residents to monitor vehicle activity in real time using their smartphones, ensuring convenience and accessibility.

2. **Enhance Community Safety:**

Implement features that allow residents to detect and report unauthorized vehicle activity promptly, reducing the risks of theft, vandalism, and other security threats.

3. **Utilize Cost-Effective Technology:**

Leverage existing smartphone cameras and cloud-based processing to minimize installation and maintenance costs, making the system affordable and viable for residential societies of all sizes.

4. **Enable Data-Driven Insights:**

Incorporate analytics to track vehicle patterns, providing valuable insights to residents and community administrators for improved planning and security measures.

5. **Ensure User Privacy and Data Security:**

Establish robust privacy protocols to protect user data while ensuring compliance with legal and ethical standards for surveillance.

6. **Promote Community Engagement:**

Foster a sense of collaboration by encouraging residents to actively participate in the monitoring process, building a community-focused environment dedicated to safety and security.

SYSTEM DESIGN AND IMPLEMENTATION :

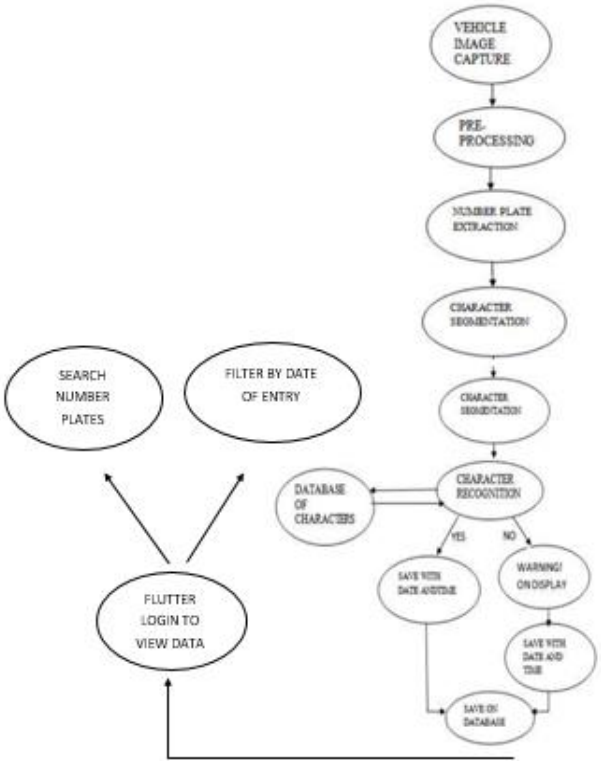

Fig: Vehicle Monitoring and Recognition Workflow Diagram

This diagram outlines the workflow for a vehicle monitoring system that captures and processes vehicle data for residential societies. It represents the key stages and interactions within the system.

OUTCOMES :

1. Enhanced Security

- *Real-Time Monitoring:* A camera system integrated with a mobile application enables live monitoring of vehicles entering and exiting the residential society.
- *Improved Incident Response:* Alerts for unauthorized vehicles or suspicious activities ensure swift action by security personnel or residents.
- *Evidence Collection:* Video footage serves as crucial evidence in cases of theft, vandalism, or other security incidents.

2. Efficient Access Control

- *Automated Entry/Exit Logs:* The system automatically logs details such as vehicle license plates, timestamps, and owner information, minimizing manual errors.
- *Pre-Approved Entry:* Residents can pre-register vehicles, enabling streamlined and efficient access without delays at entry points.

3. Transparency and Accountability

- *Audit Trails:* Complete records of vehicle movement ensure transparency and accountability in society security management.
- *Shared Access:* Both residents and management can access logs, fostering trust and collaboration within the community.

4. Cost-Effectiveness

- *Affordable Technology:* Leveraging a mobile app-based system significantly reduces hardware costs compared to traditional surveillance setups.
- *Low Maintenance:* Regular updates to the application and the use of cloud-based storage minimize maintenance and infrastructure costs, ensuring long-term financial viability.

CONCLUSION :

I. This affordable camera system offers an innovative and effective solution for monitoring vehicles operating in urban areas, addressing security, operational, and management challenges. The system enhances security by reducing unauthorized access and vehicle theft through real-time tracking, automatic vehicle locking, and timely alerts. It provides greater convenience to residents and managers by offering uninterrupted access to pre-approved vehicles while eliminating inefficiencies associated with manual logbooks through digital data management.

II. Its cloud-based design minimizes installation and maintenance costs, and digital features such as encrypted records and remote smartphone access boost citizen confidence by ensuring transparency and accountability. Additionally, analysing data from vehicle activity patterns can aid in improving parking and traffic management within the community.

III. While initial challenges such as user education and privacy concerns need to be addressed, these can be mitigated with proper training and robust encryption measures. This system strengthens community governance by delivering reliable, sustainable solutions to modern security and operational needs, making it an essential tool for building safer, smarter societies.

IX. REFERENCES :

1. Chandankar, B. R., Choudhari, R. S., Nagrale, S. M., Morey, P. D., Nikhade, P. G., & Nagrale, Prof. V. (2019, December). Affordable mobile application to monitor parking lots in residential areas. *IOSR Engineering Journal (IOSRJEN)*, Chandrapur.
2. Sahay, R., Waghela, M., Mulgaonkar, A., Tiwari, V., & Shinde, A. P. (2022). QR Code Generator using Python. *International Journal of Advanced Research in Computer and Communication Engineering*, 11(4).
3. Chinaechetam, N., Njoku, J., Lee, J. M., & Kim, D. S. (2022). Use Pyzbar to instantly scan a vehicle's QR code to find its license plate.
4. Priyanka, Hussain, I., & Khalique, A. (2019). Random number generators and their applications: A review. *International Journal of Science and Research (IJSR)*, 7, 1777–1781.
5. Wade, M., Sharma, M., Patil, M., Sheetal, B., Bewoor, M., Mrunal, P., Pawar, M., Avinash, K., Kadam, M., Amol, P., & Patil, S. (2023). License plate number detection using YoloV8 and EasyOCR. *International Journal of Science and Research (IJSR)*, 6(7), 2112–2115. https://doi.org/10.21275/art20175527
6. Real-time object detection and text extraction. (2019, October 11). *International Journal of Innovative Technology and Exploring Engineering*, 8(11S), 33–37. https://doi.org/10.35940/ijitee.k1007.09811s19
7. Sharma, U., Goel, T., & Singh, J. (2023, February 11). Real-time image processing using deep learning in OpenCV and Python.