TS – AI CAPSTONE PROJECT

PARKING LOT MONITORING SYSTEM

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OUTLINE

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Project Background

- **Inefficient use of parking space** is a common problem in busy urban areas.

- Parking lot users often **struggle to find available parking spots**, leading to congestion, frustration, and wasted time.

- Ensuring **compliance with parking regulations** is a challenge for both users as well as owners.

Project Background

- Therefore, there is a need for **a reliable and efficient** parking lot monitoring system that can help users find available parking spaces quickly and easily.

- It will also be great asset for **parking lot operators/owners; with real-time data** on parking usage and occupancy rates.

- Such a system can improve the overall parking experience for users, reduce traffic congestion, and **increase revenue for parking lot operators.**

Problem Statement

- This project addresses the problems such as **inefficient use of parking space, congestion in parking lot, time wastage in find parking space in a busy parking lot, and ensuring compliance with parking regulations.**

- We plan to solve these problems by **building a real-time parking lot monitoring system, which provides real-time data** on parking usage and occupancy rates, using a surveillance camera.

- Such a system can **improve the overall parking experience** for users, reduce traffic congestion, and increase revenue for parking lot operators.

Proposed solution

- The goal of the project **is to detect the number of available and occupied parking spaces using computer vision.**
- It **is impossible to manually track** the number of available spaces and occupied spaces in a parking lot.
- So to **automate the process**, we introduced our project **"Parking lot monitoring system"** where we will use some **Python** libraries like **OpenCV, Pickle, Numpy** for using **computer vision** to do the same.
- In this project we are using a video for analyzing the output.
- It can be used to monitor the parking lot in real-time, track parking space usage over time, and **generate reports on parking space occupancy.**

Project Audience

- **<u>Car owners –</u>**
  - To find the exact parking space which is available.

- **<u>Parking Lot Operators –</u>**
  - To easily guide the car owners to empty parking space.
  - Keep a track of available and occupied parking spaces.
  - Ensure there is no congestion and confusion about parking the cars.
  - Predict the upsurge in requirement using the data gathered daily by the system, to prevent any possible bottlenecks.

- **<u>Business owners and managers -</u>** who want to improve the efficiency and security of their parking lots. Track total revenue.

- **<u>Local authorities and traffic management agencies</u>** who want to monitor traffic flow, congestion, and compliance with parking regulations.

Project Execution Steps

- **System Design:** Define the requirements of the parking lot monitoring system, including the number of parking spots, the types of vehicles to be monitored, and the types of sensors to be used.

- **Sensor Installation:** Install sensors in each parking spot to monitor the status of the parking space. The sensors can be cameras, ultrasonic sensors, magnetic sensors, or any other type of sensor capable of detecting the presence of a vehicle.

- **Data Collection:** Collect data from the sensors about the status of each parking space.

- **Data Analysis:** Analyze the processed data to identify trends and patterns in the parking usage, which can be used to optimize parking lot usage, improve parking lot design, and increase revenue.

- **Alerting:** Set up alerts for parking violations or other anomalous events, such as a vehicle occupying a parking space for an extended period or parking in a reserved spot without authorization.

- **Maintenance:** Perform regular maintenance on the sensors and other hardware components to ensure that the system operates reliably and accurately.

- **Scale-up:** If the parking lot expands or additional sensors are added, the system can be scaled up to accommodate the changes.

…Project Execution Steps
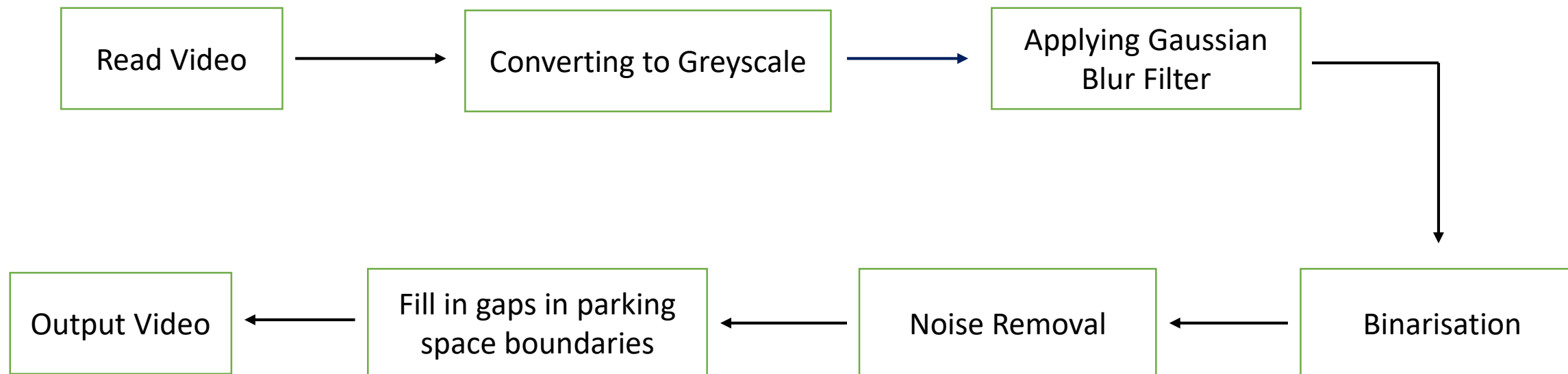
System Architecture

FUTURE SCOPE

The future scope of a parking lot monitoring system project in machine learning (ML) is quite promising.

As the technology is continually advancing, and there is a growing demand for smart parking solutions.

Here are some potential future directions for such a project such as -

- **Use of advanced sensors**
- **Integration with mobile payment**
- **Integration with smart city infrastructure**
- **Integration with autonomous vehicles**
- **Use of AI and machine learning**

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- ## Use of advanced sensors:

  - In addition to cameras and sensors, future parking lot monitoring systems may use more advanced technologies such as **LiDAR, radar, or acoustic sensors.**

  - These sensors can provide more detailed information on the location, speed, and direction of vehicles, and improve the accuracy of the ML models.

- ## Integration with mobile payment systems:

  - **UPIs** such as **BharatPay , Google Wallet** etc can enable parking lot users to pay for parking directly through the parking lot monitoring system, making the process more convenient and streamlined.

- **Integration with smart city infrastructure:**
  - Parking lot monitoring systems can be integrated with other smart city infrastructure, such as traffic management systems, public transportation networks, and electric vehicle charging stations.
  - This integration can help optimize the use of parking spaces, reduce congestion, and promote sustainable mobility.

- **<u>Integration with autonomous vehicles:</u>**
  - With the emergence of autonomous vehicles, parking lot monitoring systems could be integrated with these vehicles to enhance parking efficiency.
  - For instance, autonomous vehicles could communicate with the parking lot monitoring system to find available parking spots, reserve spots in advance, and navigate to the parking space automatically.

FUTURE SCOPE

- **<u>Use of AI and machine learning:</u>**
  - Advanced AI and machine learning algorithms can be employed to analyze parking data and provide more accurate and insightful information.
  - For instance, the system can predict parking demand and adjust pricing dynamically to optimize revenue.

CONCLUSION

- The services provided by the smart parking have become **the essence of the smart cities.**

- The proposed system has advantages those of **automated systems** as opposed to manual work, like detect parking spaces using computer vision.

- Overall, a parking lot monitoring system project in ML can be a **valuable investment** for businesses, city authorities, and researchers who are looking to improve the efficiency and sustainability of urban mobility.

- With the right methodology, tools, and skills, these projects can **deliver tangible results and contribute to the development of smarter and more livable cities**.

Thank You!