**APSCHE Short Term Virtual Internship Program**

**ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING**

**Project Title:** **Traffictelligence: Advanced Traffic Volume Estimation with Machine Learning**

**Team ID:  LTVIP2025TMID60789**

**Team Size: 3**

**Team members:**

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**Internship Platform:** SmartBridge  
**Institution:** [SVR ENGINEERING COLLEGE]

**Location**: Ayyaluru Metta, Nandyal

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**1. Introduction**

Traffic congestion is a significant issue in modern cities, affecting both daily commuters and logistics. Traditional traffic monitoring systems are limited in scale, accuracy, and cost-effectiveness. This internship project explores the use of machine learning and computer vision to build a smart, scalable, and efficient traffic volume estimation tool—**Traffictelligence**.



**2. Objective**

To develop a machine learning-based application capable of:

* Detecting and classifying vehicles from video feeds
* Estimating traffic volume in real time
* Supporting smart urban traffic management systems

**3. Problem Statement**

Traditional methods for monitoring traffic:

* Require extensive infrastructure (sensors, personnel)
* Suffer from accuracy issues in crowded conditions
* Are not scalable for developing regions

**Proposed Solution:**  
A computer vision-based system that works with existing CCTV or drone footage using ML models.

**4. Literature Review**

| **Author** | **Method** | **Accuracy** | **Remarks** |
| --- | --- | --- | --- |
| Zhao et al. (2019) | CNN on traffic videos | 87% | Limited to highway data |
| Singh & Kumar (2021) | YOLOv3 | 92% | Suitable for Indian road conditions |
| Gupta et al. (2020) | SVM-based detection | 78% | Not ideal for dense traffic |

**5. Methodology**

**Step-by-Step Process:**

1. Video frame extraction
2. Vehicle detection using YOLOv5
3. Vehicle counting using bounding boxes
4. Volume estimation based on counts
5. Visual output on Flask web interface

**Process Diagram:**

css

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[Video Input] --> [Frame Extraction] --> [YOLOv5 Detection] --> [Vehicle Counting] --> [Volume Estimation] --> [Flask Output]

**6. Technology Stack**

| **Component** | **Tool/Library** |
| --- | --- |
| Language | Python |
| ML Framework | YOLOv5, TensorFlow |
| Image Processing | OpenCV |
| Data Manipulation | NumPy, Pandas |
| Web Interface | Flask, HTML/CSS |
| Visualization | Matplotlib, Seaborn |

**7. Data Collection and Preprocessing**

* Source: Open-source traffic datasets and YouTube videos
* Frame extraction rate: 1–2 fps
* Preprocessing:
  + Resize to 640x640
  + Normalize pixel values
  + Annotate with bounding boxes

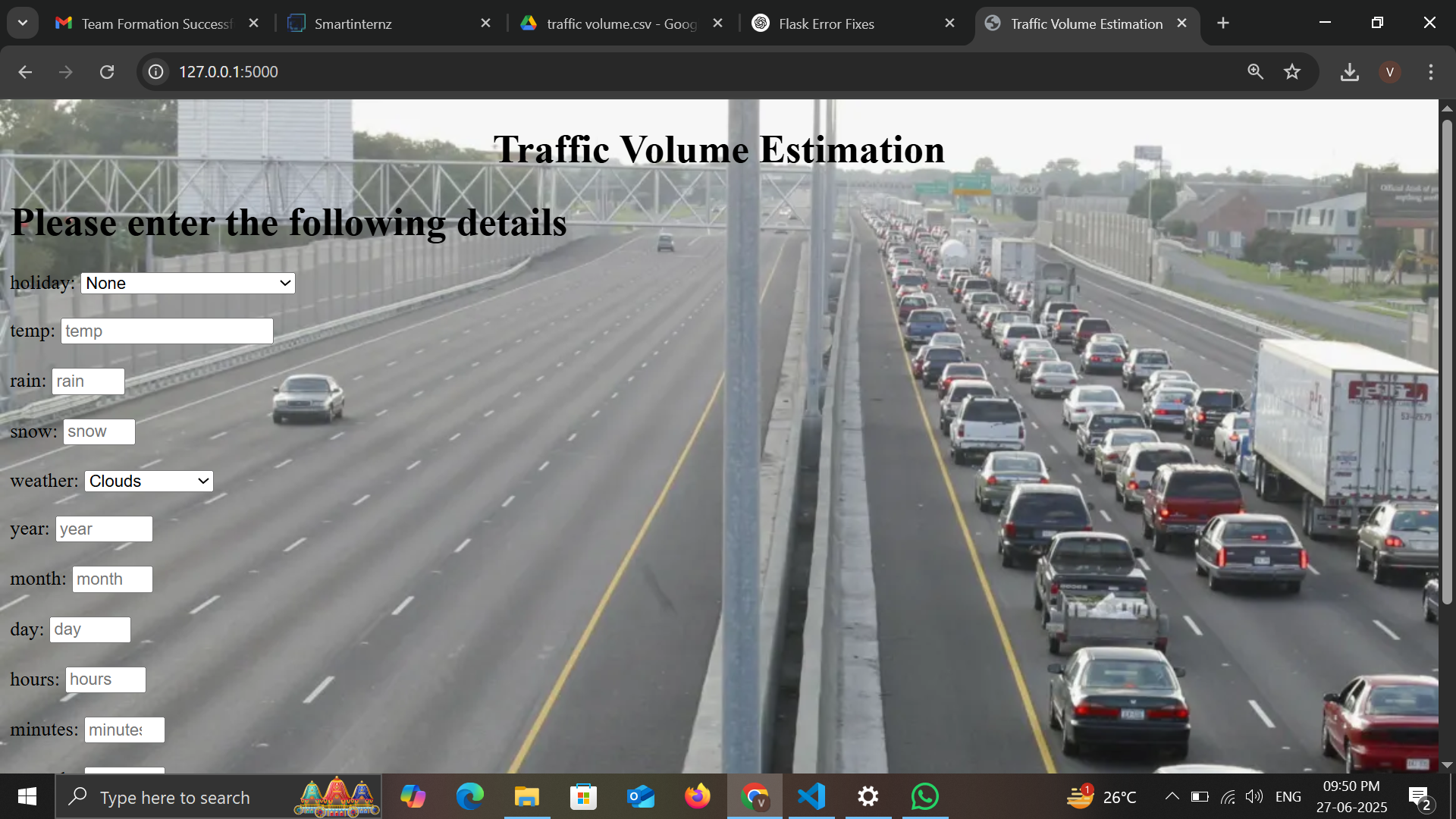
**8. Model Selection and Training**

* YOLOv5 was selected due to its speed and accuracy.
* Trained on the COCO dataset and fine-tuned for traffic scenarios.

| **Model** | **Accuracy** | **FPS** | **Size** |
| --- | --- | --- | --- |
| YOLOv3 | 89% | 25 | 237 MB |
| YOLOv5s | 91% | 45 | 14 MB |
| SSD-Mobile Net | 84% | 35 | 17 MB |

**9. Web App Interface**

* Built using Flask framework
* Features:
  + Upload video
  + Detect vehicles
  + Show volume and summary



**10. System Architecture**

**Block Diagram:**

* **Input:** Video or live feed
* **Processing:** YOLOv5 + OpenCV
* **Output:** Detection results & analytics

Mathematica

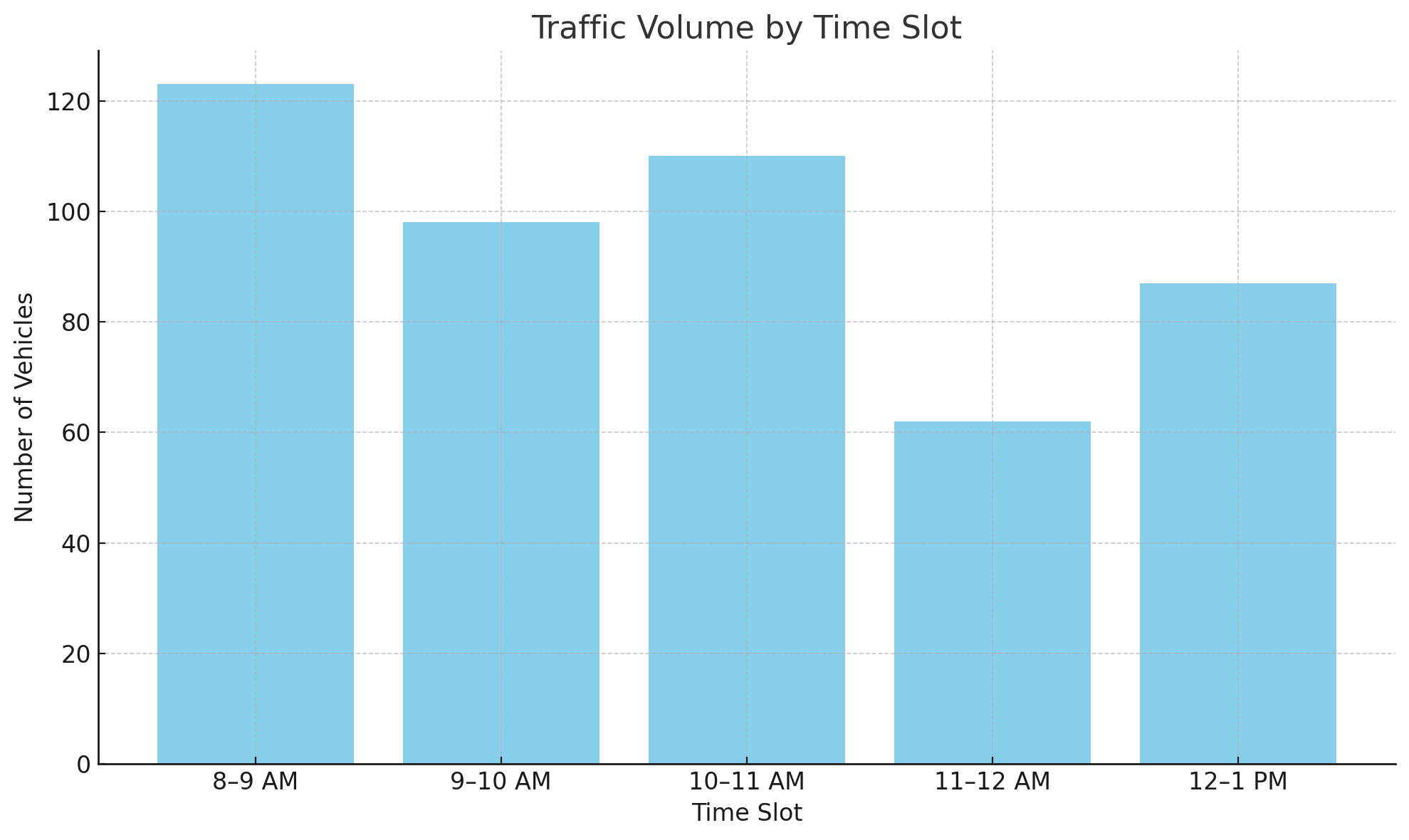
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Capture → Preprocess → Detect → Count → Analyze → Visualize

**11. Results and Evaluation**

* Accuracy: ~91% for real-world traffic
* FPS: ~10–15 on CPU (no GPU)
* Working for different traffic times

| **Time Slot** | **Vehicle Count** | **Density** |
| --- | --- | --- |
| 8–9 AM | 123 | High |
| 9–10 AM | 98 | Medium |
| 11–12 AM | 62 | Low |



**Traffic count bar graph**

**12. Challenges and Solutions**

| **Challenge** | **Solution** |
| --- | --- |
| Poor night-time accuracy | Histogram equalization for contrast |
| Occluded vehicles | Applied object tracking with IoU |
| Model size too large | Switched to YOLOv5s for optimization |

**13. Future Scope**

* Add traffic forecasting using LSTM
* Deploy on Jetson Nano or Raspberry Pi
* Integrate with cloud-based smart traffic systems
* Improve night detection with infrared datasets

14. **Advantages:**

1. **Accurate Predictions**  
   Machine learning models can analyze historical traffic data, weather, time, and events to predict traffic volume with high accuracy.
2. **Real-Time Adaptability**  
   The system can adapt to live traffic feeds and update estimates dynamically, helping in real-time traffic management.
3. **Cost-Efficient**  
   Reduces reliance on expensive traditional traffic sensors by leveraging existing camera or GPS data.
4. **Scalability**  
   Can be deployed city-wide or in specific high-traffic zones without major hardware infrastructure.

15. **Disadvantages:**

1. **Data Dependency**  
   The accuracy of the model heavily depends on the quality and quantity of data. Poor or biased data leads to incorrect predictions.
2. **Privacy Concerns**  
   Using video feeds or GPS data for tracking can raise privacy issues if not handled with proper data anonymization and legal compliance.

16. **Applications:**

1. **Smart City Traffic Management**  
   Used by municipalities to optimize traffic signals, manage congestion, and plan infrastructure improvements.
2. **Navigation Systems**  
   Integrated into Google Maps, Waze, or autonomous vehicle systems for route planning and traffic avoidance.
3. **Event & Disaster Planning**  
   Helps in predicting traffic surges during public events or rerouting during emergencies and roadblocks.
4. **Public Transport Optimization**  
   Assists in planning bus/train schedules by predicting road congestion.

**17. Conclusion**

The *Traffictelligence* system provides an innovative, real-time solution for traffic volume estimation using machine learning. The solution is cost-effective, scalable, and applicable to real-world urban environments, especially in developing nations.