SMART INDIA HACKATHON 2024

SIGHT-O-SYNC

- **Problem Statement ID** –1607
- **Problem Statement Title-A** smart AI based solution for traffic management on routes with heavy traffic from different directions, with real-time monitoring and adaptation of traffic light timings
- **Theme**-Smart Automation
- **PS Category-** Software
- **Team ID**-35617
- **Team Name** :Team SAS Squad

Team SAS Squad

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Proposed Solution:

Implement a state-of-the-art AI-driven traffic management system utilizing panoptic segmentation to optimize traffic flow, enhance safety, and improve overall efficiency.

- **Dynamic Signal Timings**: Adjust traffic signal timings dynamically based on real-time traffic conditions and predictions.
- **Priority Management:** Adaptively prioritize traffic flow in critical directions during peak times and manage turn lanes efficiently.

Link to our GitHub Repository :

https://github.com/bhanushashi6/Team_SAS_SQUAD

Benefits:

- **Accurate Traffic Management& Reduced Congestion**: Improved detection and segmentation lead to more precise traffic signal adjustments.
- **Enhanced Safety**: Better monitoring of traffic and pedestrian movements reduces the likelihood of accidents.

Unique Value Proposition (UVP) for Using Panoptic Segmentation

- Comprehensive Scene Understanding
- Enhanced Precision
- Efficient in Cluttered & Dense Environment
- Performs well on Real Time Indian Traffic data

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TECHNICAL APPROACH

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Technology Stack:
Python, C, HTML, CSS, JavaScript, Cloud Storage, TensorFlow, PyTorch, Annotation tools ,Edge devices, Web interfaces for management, monitoring and secure access.

Hardware:

Loop Cameras:

Purpose: To capture high-resolution visual data at intersections and monitor traffic flow**.**

Data Aggregation Unit:

Purpose: To collect Junction wise data from loop cameras and perform preprocessing

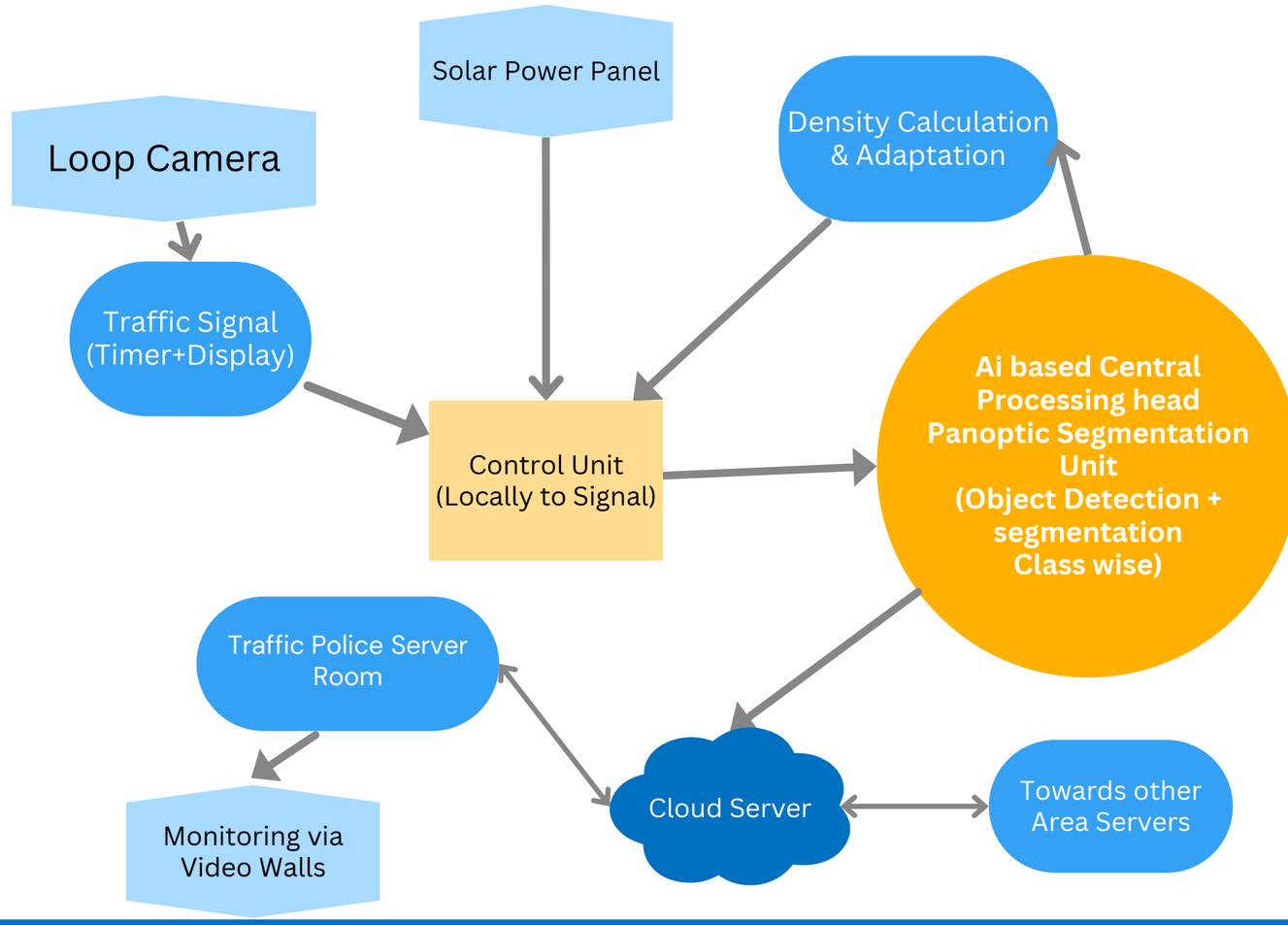
Data Transmission Unit:

Purpose: To send aggregated data to central servers for Panoptic Segmentation

Data Processing and Analysis:

Purpose: Using powerful Processors & GPU perform analytics on data and provide inference

Proposed Architecture



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FEASIBILITY AND VIABILITY

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Feasibility Analysis:

- **Market:** High demand in congested urban areas; targets are upcoming cities ,city planners and traffic authorities.
- **Technical**: Real-time data integration through multiple input devices.
- **Financial**: Initial costs for hardware/software are significant due to non existence of similar technology.
- **Potential savings** in fuel consumption of vehicles due to reduced travel & wait time, Reduced accident.
- **Operational**: Implementation of the project can be executed in Phased Manner .

Potential Challenges & Risks:

- **Technical**: Accuracy of the System is necessary and Probable system delays must be handled carefully.
- **Financial**: Input Costs for developing Scalable Infrastructure.
- **Operational**: System downtime should be promptly Resolved

Strategies for Overcoming Challenges:

- **Pilot Testing:** Test in controlled environments.
- **Deployment**: Phased rollout in key areas.
- **Monitoring:** Evaluation based adjustments and performance monitoring.
- **Scaling**: Expansion based on feedback
- **Market:** Market stakeholders can be key contributors to new technology's development and implementation.
- **Technical:** Modular design for easy setup & Installation.
- **Financial:** Controlling costs is Key, exploring diverse revenue models and probable partnerships with Tech giants for Data Processing Centers.

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IMPACT AND BENEFITS

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Impacts:

- **Behavior Analysis**: By analyzing the interactions between different traffic elements, the system can offer insights into driver and pedestrian behavior, which can be used to improve road design and traffic policies.
- **Reduced Emissions**: Can contribute to lower vehicle emissions and fuel consumption.
- **Efficient Resource Use**: Better use of road infrastructure, potentially reducing the need for extensive new road construction and maintenance.
- **Cost Savings**: Can lead to significant cost savings by reducing travel times and fuel consumption.
- **Enhanced Productivity**: Can lead to shorter commutes and faster delivery times, which can boost overall productivity and economic efficiency.

Benefits:

- **Reduced congestion:** Optimizes traffic signal control, reducing congestion.
- **Data-driven decision-making**: Provides valuable insights for urban planning, transportation infrastructure development, and policy-making.
- **Predictive analytics**: Uses data to predict traffic patterns, allowing for proactive traffic management.
- **Improved quality of life**: Enhances overall quality of life by reducing travel times, improving air quality, and promoting sustainable transportation.

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RESEARCH AND REFERENCES

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Link to a explanatory video of our beta model :

https://drive.google.com/drive/folders/1KzabwiFRUf1yjdPg8QI42Kt5hrpJrnVu?usp=sharing

References:

- Girshick, R., Donahue, J., Darrell, T., & Malik, J. (2015). Region-based convolutional networks for accurate object detection and segmentation. *IEEE transactions on pattern analysis and machine intelligence*, *38*(1), 142-158.
- Feng, D., Haase-Schütz, C., Rosenbaum, L., Hertlein, H., Glaeser, C., Timm, F., ... & Dietmayer, K. (2020). Deep multi-modal object detection and semantic segmentation for autonomous driving: Datasets, methods, and challenges. *IEEE Transactions on Intelligent Transportation Systems*, *22*(3), 1341-1360.
- Kirillov, Alexander, Ross Girshick, Kaiming He, and Piotr Dollár. "Panoptic feature pyramid networks." In *Proceedings of the IEEE/CVF conference on computer vision and pattern recognition*, pp. 6399-6408. 2019.