Crowd-AI Sensing Based Traffic Analysis for Ho Chi Minh City Planning Simulation

NSF Project ID: 2025234
Lead PI: Tam Nguyen, University of Dayton
ASEAN EAGER, FY2020

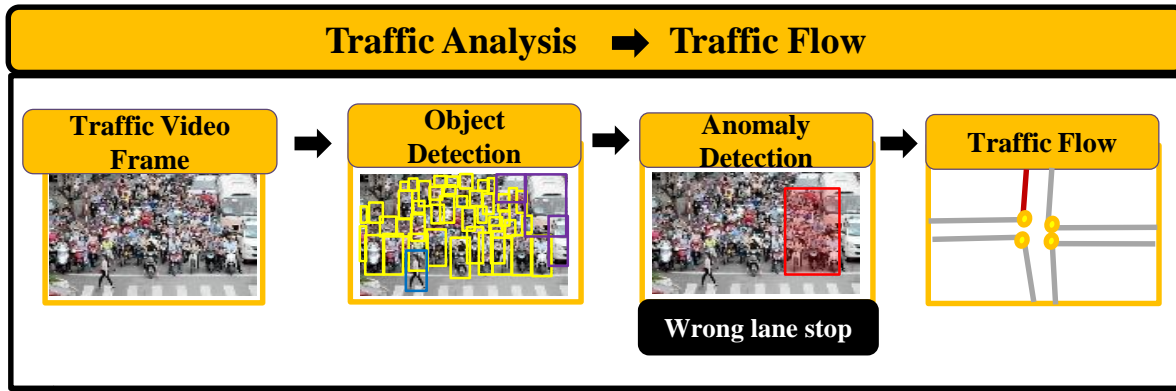| Principal Research Investigators	Community Partners
Tam Nguyen, University of Dayton **Phu Phung**, University of Dayton	**Minh-Triet Tran**, University of Science, Vietnam National University Ho Chi Minh City. **Khang Nguyen**, University of Information Technology, Vietnam National University Ho Chi Minh City. **Duy-Dinh Le**, University of Information Technology, Vietnam National University Ho Chi Minh City.

Project Overview

Traffic Analysis ➡ Traffic Flow

Traffic Video Frame → Object Detection → Anomaly Detection → Traffic Flow

Wrong lane stop

Camera → Traffic Analysis → Traffic Flow
Camera → Traffic Analysis → Traffic Flow
...
Camera → Traffic Analysis → Traffic Flow
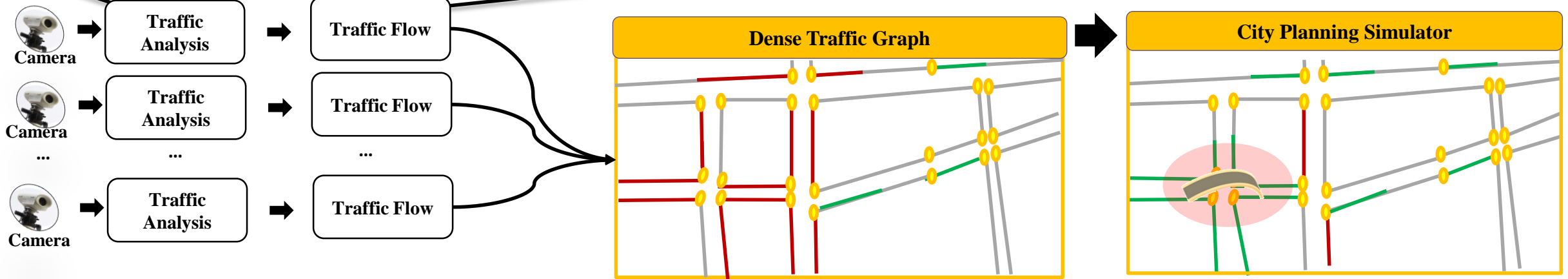
Dense Traffic Graph ➡ **City Planning Simulator**

* US Team:
Design and implement the traffic analysis component
Implement the city planning simulation.

* ASEAN Team:
Collect the traffic data
Support the project implementation
Showcase the project to the city leaders

Legend

Detected Object Bounding Boxes		
Anomaly Detection		
Camera Location		
Heavy Traffic / Normal Traffic		
Simulation Overpass		
Simulation Highlight		

* Project Vision:
- The development of the simulator will aid the city authorities in HCMC to seek drastic improvement to the existing infrastructure so as to ease the growing traffic volume in the process of urbanization.
- Integrate the traffic analysis and urban planning into a unified system.

Project Overview

Use-Inspired Research

- Large-scale urban development projects have exacerbated road conditions, making traffic congestion more severe, even in off-peak hours. Additionally, Ho Chi Minh City really needs resources to solve infrastructure problems.

- The monitoring staff watch traffic activities on multiple screens, whose data are collected from numerous monitoring cameras installed on streets in Ho Chi Minh City. There is a need of automatic traffic analysis.

Fundamental Research Contributions

- Develops and applies technical innovations in artificial intelligence (AI) to major societal problems, like urban congestion , traffic, and city planning.

- Advances AI research to address new and emerging technical challenges in a smart city.
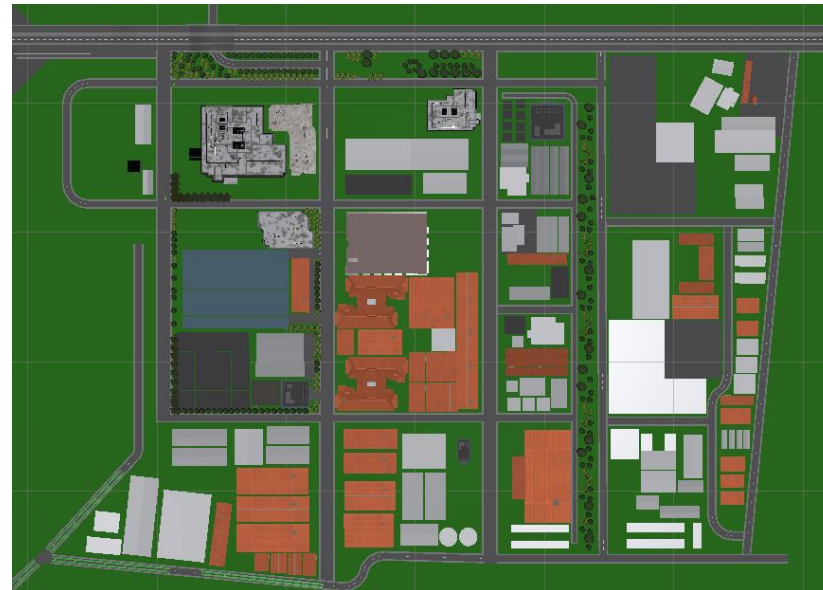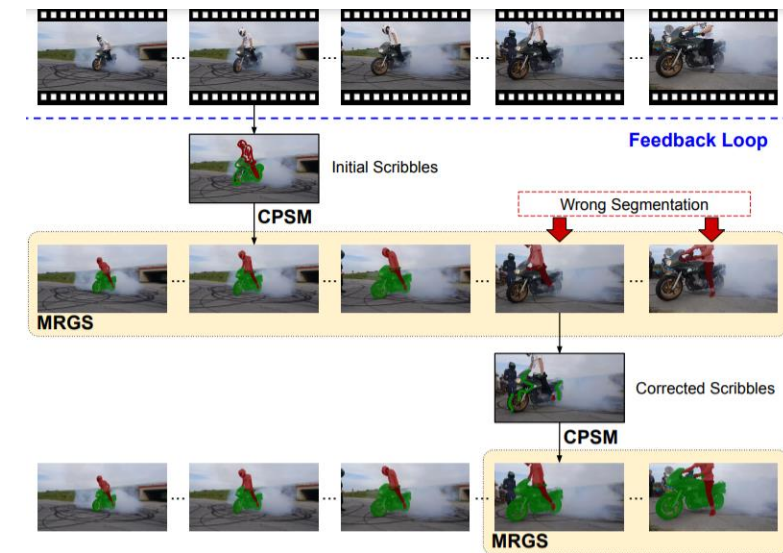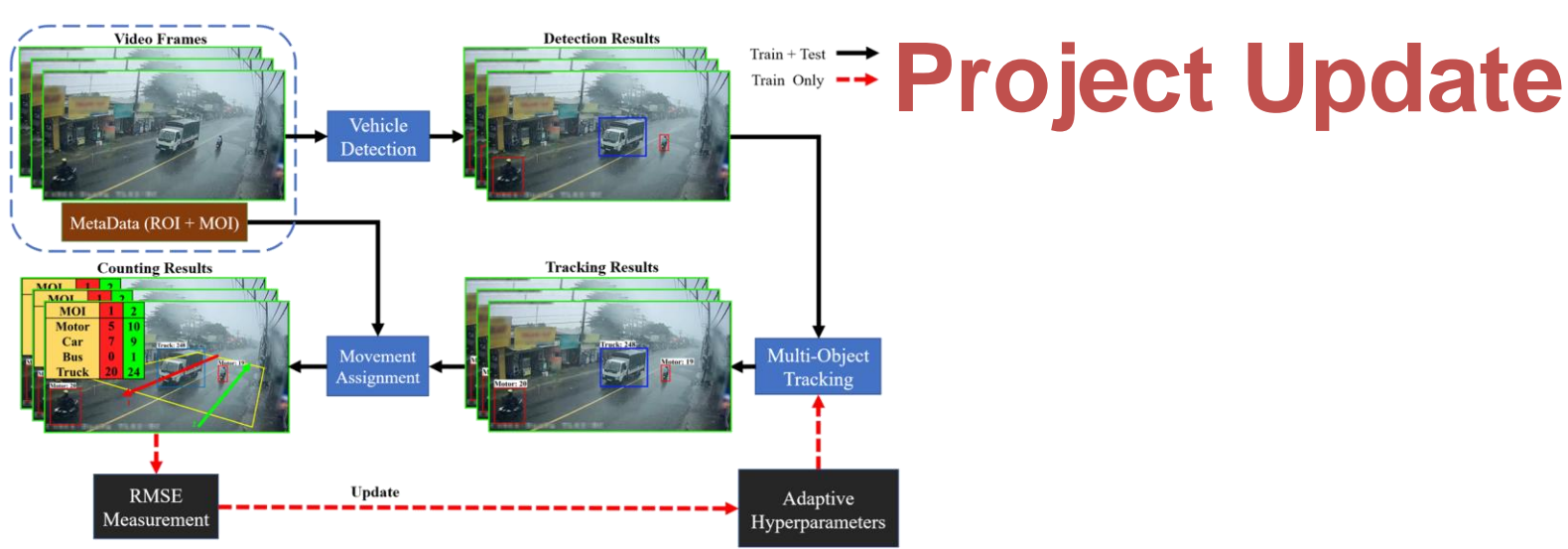
Project Update

Traffic Analysis
- Data Collection
- Data Annotation
- Traffic Analysis
  - Object Detection
  - Object Tracking

City Simulation
- Object Modeling
- Scene Modeling

Project Update

Publication

1. N. Le, T. Nguyen, C. Tran, L. Nguyen, H. Hoang, Q. Le, T. Tran. *Interactive Video Object Mask Annotation.* AAAI 2021 Conference

2. N. Le, V. Nguyen, C. Le, C. Nguyen, T. Tran, T. Nguyen. *CamouFinder: Finding Camouflaged Instances in Images.* AAAI 2021 Conference

3. T. Nguyen, S. Kamma, V. Adari, T. Lesthaeghe, T. Boehnlein, V. Kramb. *Mixed reality system for nondestructive evaluation training.* Journal of Virtual Reality

4. J. Yan, N. Le, K. Nguyen, T. Tran, T. Do, T. Nguyen. *MirrorNet: Bio-Inspired Camouflaged Object Segmentation.* IEEE Access

Under Review

1. X. Nguyen, A. Vu, T. Nguyen, N. Phan, B. Dinh, D. Nguyen, T. Nguyen, V. Nguyen, D. Le. *Adaptive Detection-Tracking-Counting Framework for Multi-Vehicle Motion Counting.*

2. N. Vo, K. Nguyen, T. Nguyen, K. Nguyen. *Data Augmentation Analysis of Vehicle Detection in Aerial Images.*

Project Evolution

We learned that the **camera data collection** *is very challenging. We need to have the access to the camera grid. In addition, the amount of collected traffic videos is very large (~20 GB per day for each camera). Therefore, we worked with our collaborators to collect a dataset of annotated vehicles. Then, we trained an AI model to analyze the traffic on the line. Thus, we only need to store the analyzed data instead of all traffic videos.*

We also learned that the city simulation requires **completely new 3D models** *since Vietnam scenes comprise of different 3D models from available art assets. In addition, the models should be in low-poly for the rendering speed. Thus, we collaborated with the team in Vietnam in creating low-poly 3D models.*

Anticipated outcomes & success measures for next year

Plan to accomplish over the next year

- Complete the traffic analysis component
- Construct the dense traffic graph from the analyzed data
- Integrate the dense traffic graph into the city simulation

Research Activities

- Leverage the object counting into the traffic analysis component
- Collect testing data and evaluate the performance of the traffic analysis component
- Model the dense traffic graph such as graph nodes and vertices
- Implement the graph algorithms on dense traffic graph to update the traffic flow in the simulation.
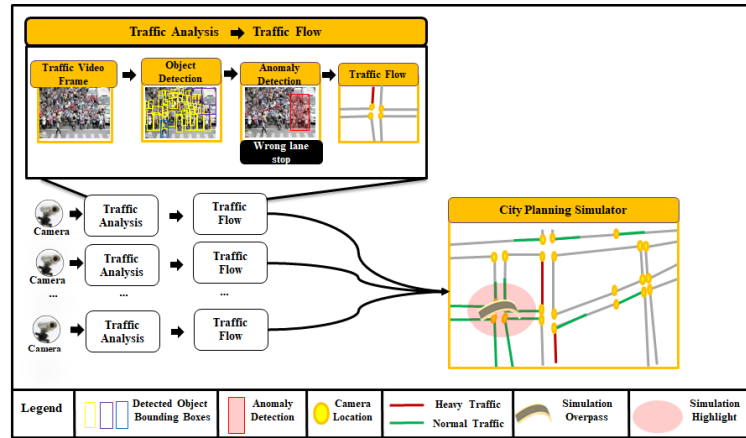
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Visual Schematic

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