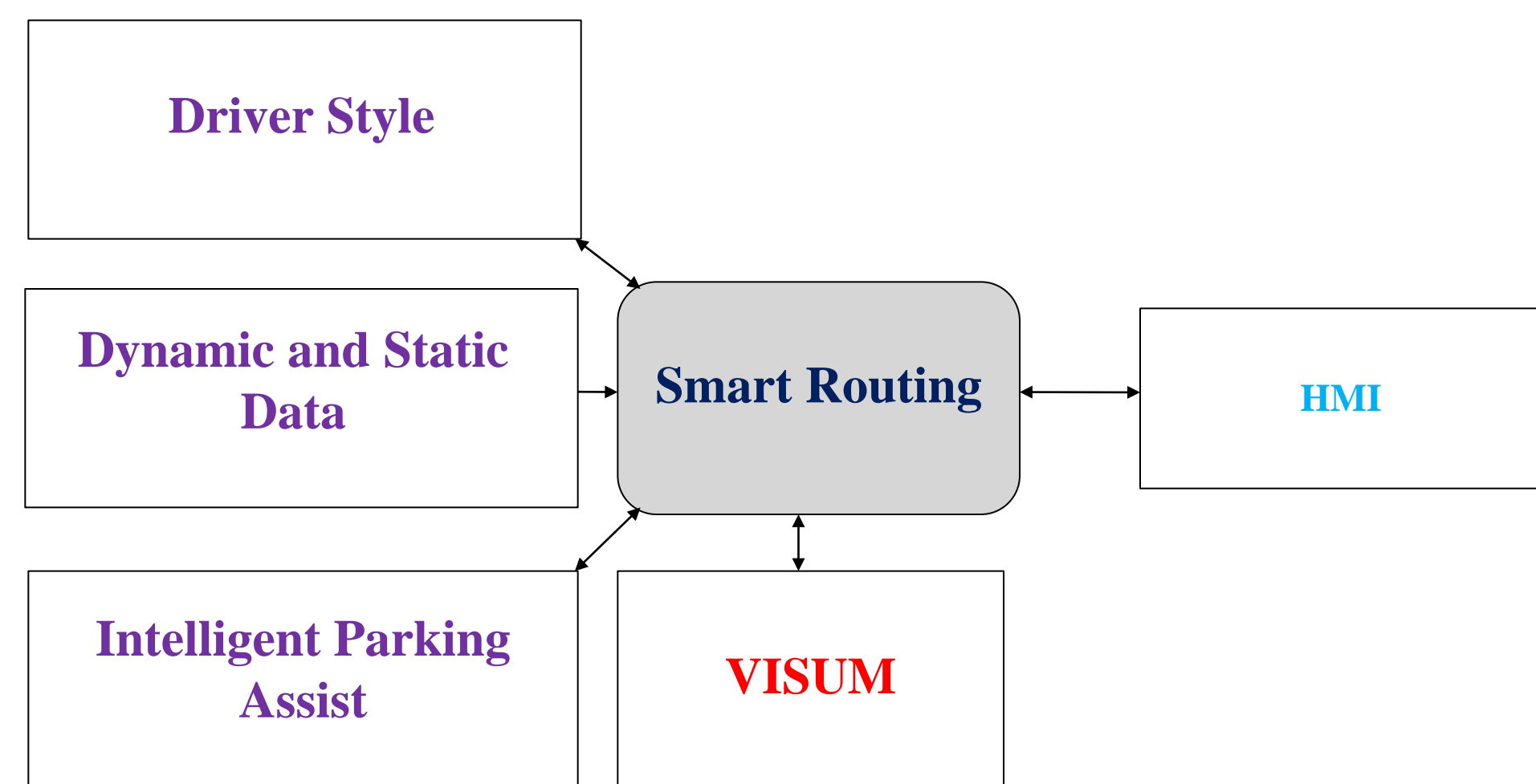


Smart Routing Characteristics

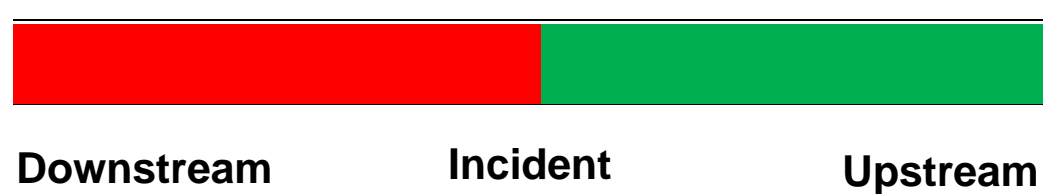


- Estimate real-time flow for all links (traffic data not available for all links)
- Incident detection
- Predict link flows in case of events
- Driver style
- Driver preferences

Structure of the System

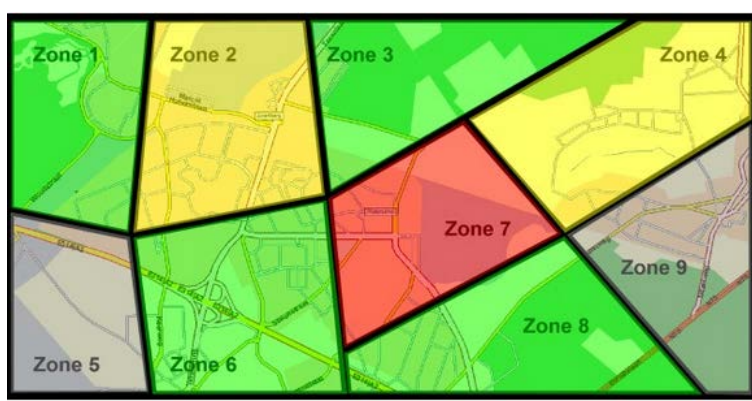


Incident Detection



Measurements:

- Speed
- Flow
- Occupancy



Events

On-Road events:

- Accident
- Road closure
- Construction



Off-Road events:

- Sport events
- Concerts



Extreme events:

- Natural disasters
- Terrorist Attack



Driver Style



Driver style has impact on the travel time estimation and classified into three categories:

- Fast
- Moderate
- Slow

Flow Generation Methodology

Initial Estimation

Four-Stage model



Trip Generation

Production of zone i

$$p(i) = \sum_{s \in S} \beta_s(i) p_s$$

Attraction of zone j

$$A(j) = \sum_{s \in S} \gamma(j) A_s$$

Trip Distribution

$$V_{ij} = \alpha(i, j) p(i) A(j) f(d_{ij})$$

Modal Split

- Car
- Bus
- Truck

Traffic Assignment

- Incremental assignment

Off-Line Estimation

Off-Line estimation is based on the historical data as well as the results from initial estimation.

$$\text{minimize } g(v) = \alpha_1 \sum_{l \in L} [\bar{v}_l - \rho_{s,r}^l v_{s,r}]^2 + \alpha_2 \sum_{s \in S} \sum_{r \in \theta} c_{s,r} v_{s,r}$$

subject to $v_{s,r} \geq 0$

\bar{v}_l : Average link flow l

$v_{s,r}$: Volume of route r connecting OD s

$c_{s,r}$: Cost of route r connecting OD s

$\rho_{s,r}^l$: Decision variable

$$0 \leq \alpha_2 \leq \alpha_1$$

On-Line Estimation

On-Line estimation is based on the off-line estimation and real-time flow.

$$\text{minimize } f(v) = \beta_1 \sum_{l \in L} [v_{l,r} - \hat{v}_l]^2 + \beta_2 \sum_{l \in L} [v_{l,h} - \hat{v}_l]^2$$

$v_{l,r}$: Real-time volume of link l

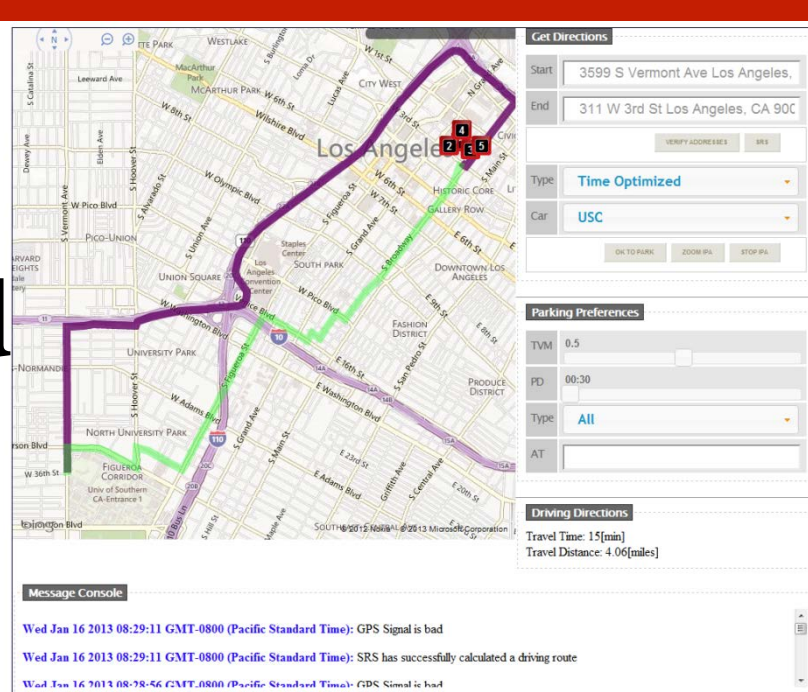
$v_{l,h}$: Historical volume of link l

\hat{v}_l : Estimated link flow

$$0 \leq \beta_2 \leq \beta_1$$

Interfaces

Web-Based



Car Interface



Smart Phone Apps

