Literature Survey

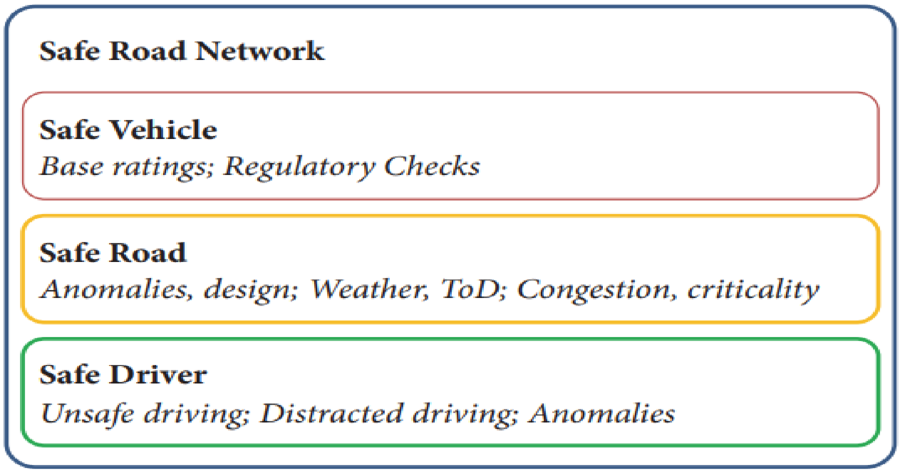
An IoT Architecture for Assessing Road Safety in Smart Cities (2018)

The Safe System (SS) approach to road safety emphasizes safety-by-design through ensuring safe vehicles, road networks, and road users. With a strong motivation from the World Health Organization (WHO), this approach is increasingly adopted worldwide. Considerations in SS, however, are made for the medium-to-long term. Our interest in this work is to complement the approach with a short-to-medium term dynamic assessment of road safety. Toward this end, we introduce a novel, cost-elective Internet of Things (IoT) architecture that facilitates the realization of a robust and dynamic computational core in assessing the safety of a road network and its elements. In doing so, we introduce a new, meaningful, and scalable metric for assessing road safety. We also showcase the use of machine learning in the design of the metric computation core through a novel application of Hidden Markov Models (HMMs). Finally, the impact of the proposed architecture is demonstrated through an application to safety-based route planning.

An IoT Architecture for Assessing the Safety of a Dynamic Road Transport System

Assessment Elements. The way the SS approach comprises the three elements of safe vehicle, safe road, and safe driver facilitates a hierarchical safety assessment approach whereby the safety of the individual elements can provide a collective indicator of safety for the road network, as illustrated in Figure 3. In turn, this indicator can be concatenated from the assessment of individual road segments, to routes, to the road network.

It is possible to consider a meaningful safety metric based on the live (or real-time) status of the road. For example, the safety level of a certain segment/road depends on the aggregate safety of vehicles currently traversing it, combined with the number of potholes and/or the wetness or how slippery is the road, in addition to safety/alertness of the drivers on the road



In designing our architecture, we exploit three important dependencies. The first is between the SS elements, e.g., how well a car can handle a certain road, or how some drivers exhibit safer behavior in instances of higher visibility. The second dependency is in between consecutive segment/roads, especially in terms of traversing vehicles and drivers. The third dependency is like the second but is established in time. Abrupt changes in safety levels can thus be viewed as an anomaly (outlier) or inferred as indicator to a substantial change in the road context.

Safety-Based Route Planning

Route planning has become widely used in both personal and commercial use, resulting in an increasing dependence on its reliability. Various applications employ efficient algorithms for route planning [43]. Trip time and cost, e.g., for tolls, have been the typical metrics for route planning applications, but other metrics, however, have been utilized, e.g., for fuel emission/consumption or energy requirements of electric vehicles.

Reference:

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