

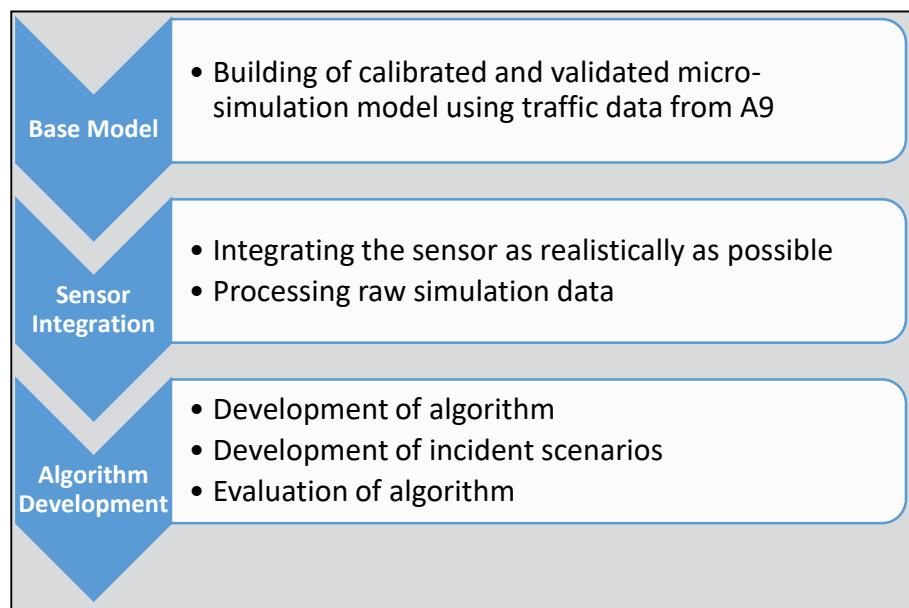
Integration of a new type of side radar sensors in a Vissim Simulation and development of a trajectory based incident detection on motorways

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Problem Statement

Approximately one-third of all congestion in developed countries is caused by traffic incidents. Researchers have been working since several decades to come up with intelligent solutions for the timely and automatic detection of incidents. A lot of the existing methods suffer – for a variety of reasons which include sensor type and spacing – from either a low detection rate or a very high false alarm rate forcing traffic management centers to discontinue the use of such methods.

Research objectives

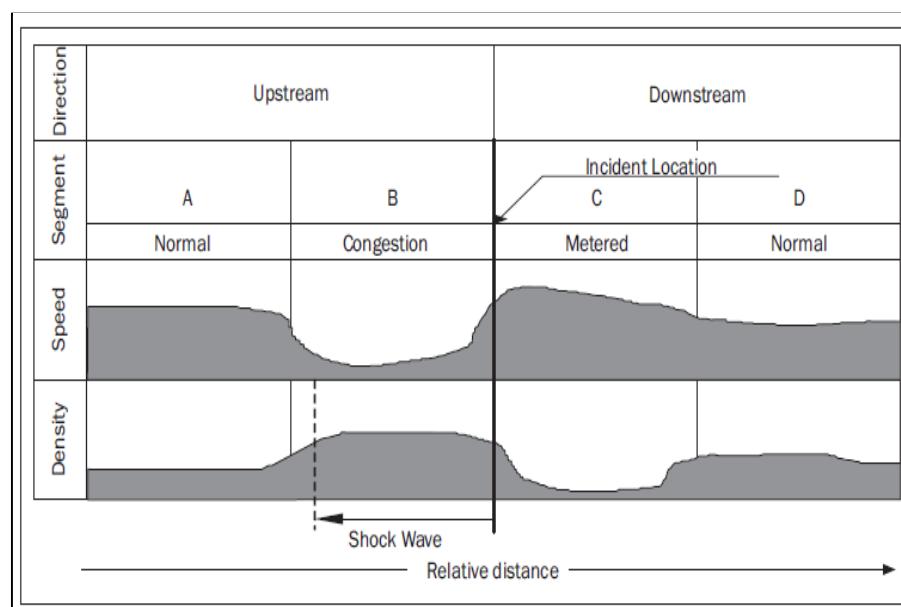
This thesis aims to integrate a new type of radar sensor – that is being developed as part of the KoRA 9 research project – in a Vissim simulation, develop an incident detection system and subsequently evaluate the developed incident detection system.

Working Principle of Algorithm

A pattern based algorithm was developed which detects incidents based on differences in speed and density over the course of two steps carried out in two subsequent minutes. It uses the principle that there is a speed drop upstream of an incident while critical high speeds occur downstream of an incident. Errors that may occur from heterogeneous traffic or errors in the data are prevented by comparing the current minute with the moving average of the previous five minutes.

Evaluation

The algorithm was evaluated by modeling incidents on the right and left most lanes at different times of the day, hence different traffic volumes. The performance measures used to evaluate the algorithm were detection rate (DR), false alarm rate (FAR) and time to detect (TTD)



Scenario	DR (%)	FAR (%)	TTD (min)
5min_rt_0607	100.00	0.00	2.00
5min_lt_0607	90.91	0.00	2.00
5min_rt_1011	100.00	0.00	2.00
5min_lt_1011	100.00	4.55	2.45
5min_2rt_1011	95.45	4.55	2.09
5min_rt_1516	100.00	4.55	2.27
5min_lt_1516	81.82	27.27	3.67
5min_rt_1920	100.00	0.00	2.18
5min_lt_1920	90.91	0.00	2.40

Results

The radar sensors were successfully integrated in Vissim. All significant parameters that are expected to be detected by these detectors in real life were obtained as simulation output in Vissim.

The extensive evaluation of the algorithm shows that it performs very well against all measures of performance. The scenarios modeled for evaluation purposes varied in terms of traffic volume and location of the incident. The results show that the algorithm performed well under different traffic loads including periods of low traffic volume (5min_rt_0607 and 5min_lt_0607) where incident detection algorithms often struggle.

Finally, it bears mentioning that the algorithm not only detects an incident but also provides the location information which includes the relevant section as well as the lane in which the incident has taken place.