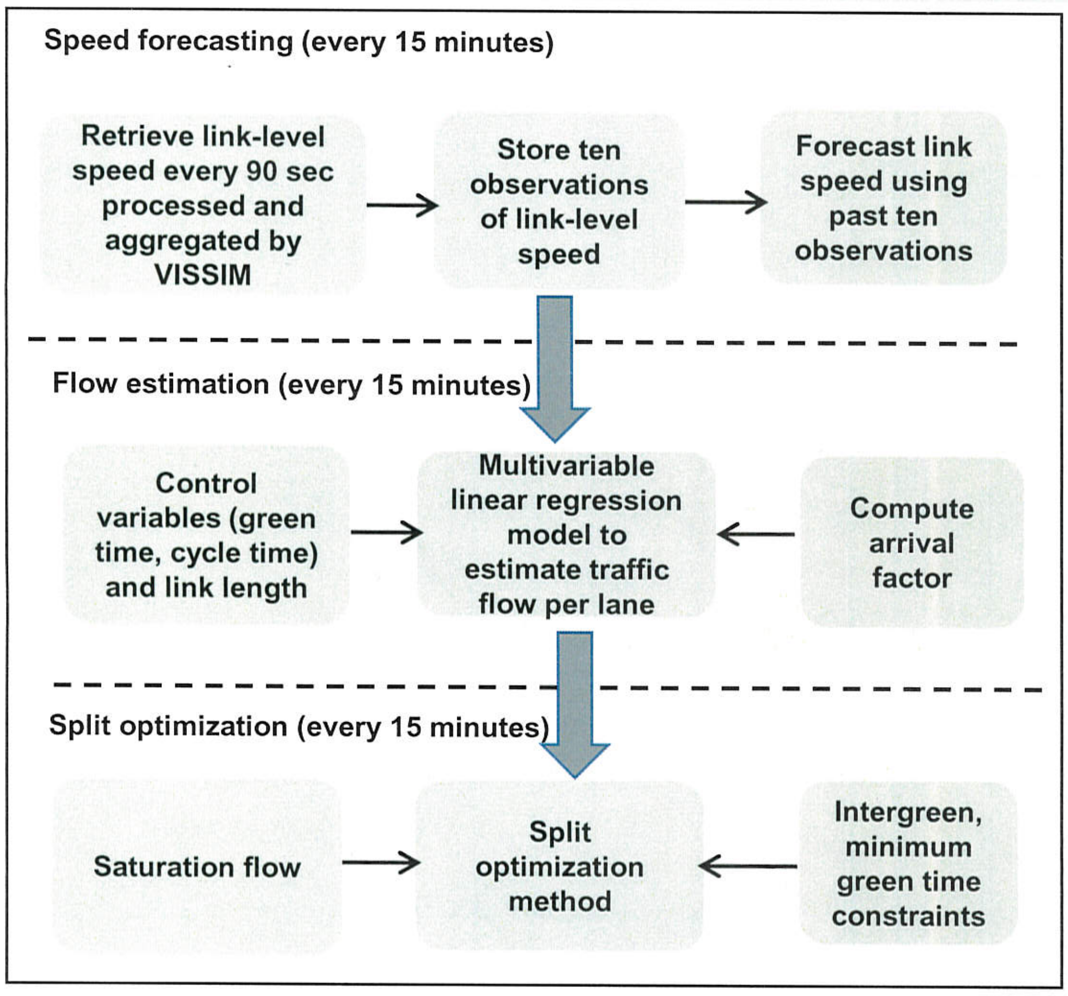
Traffic Signal Re-timing Strategy using Floating Car Data

Master's Thesis of Salil Sharma

Mentoring:

Dr. Jaehyun (Jason) So (TUM)

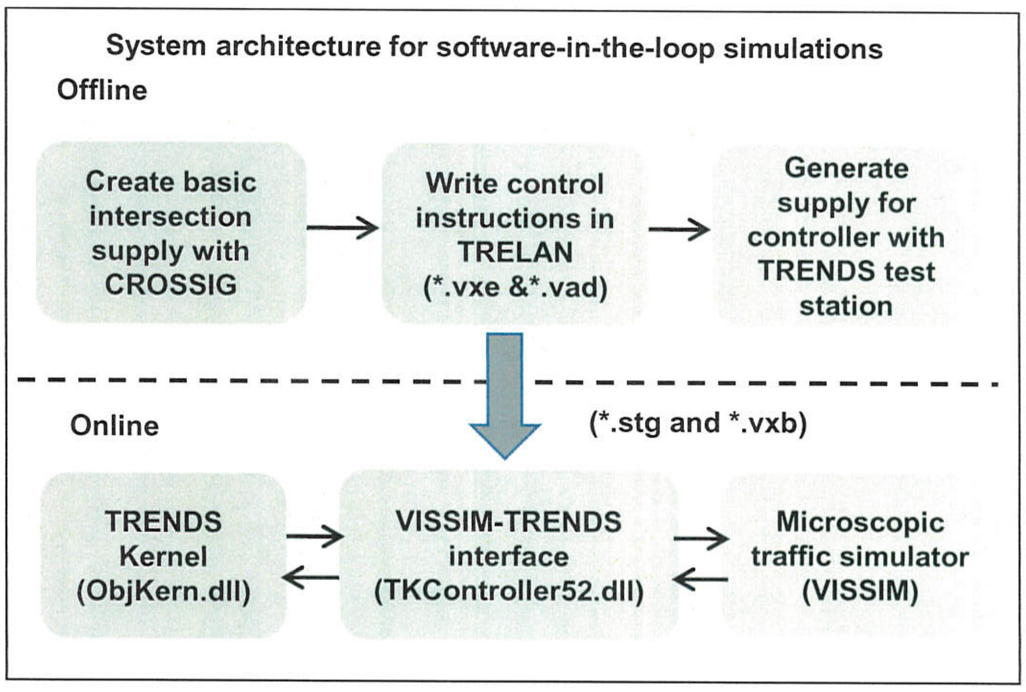
Dr.-Ing. Jonas Lüßmann (GEVAS software GmbH)

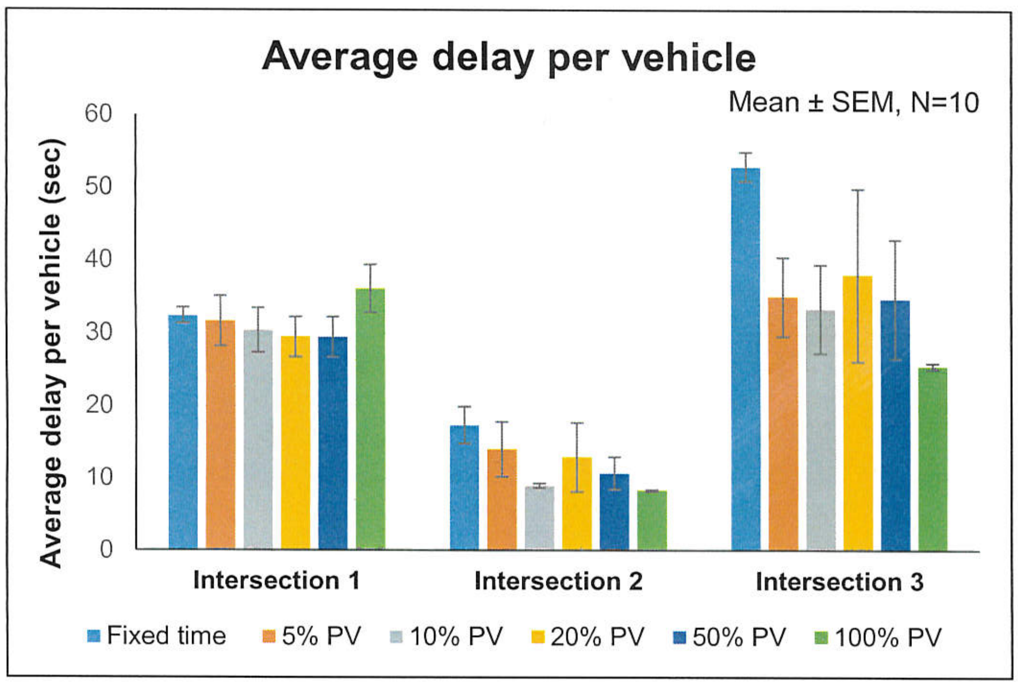


The aim of this thesis is to develop a local-intersection level signal control optimization method by utilizing the floating car data. A three-fold traffic signal re-timing strategy is proposed as shown in the figure on the left side. Instead of using raw floating car data, the method incorporates data processed by external agent which is traffic simulator VISSIM in this case.

First, the link-level speed data, processed and aggregated by VISSIM, is retrieved every cycle length of the signal program. Then, a modified form of exponential smoothing technique is used to forecast link-level speed which could also make use of intermittent data. Second, a multivariable regression model is developed to estimate traffic flow per lane for an approach. Lastly, split optimization uses the flow estimates of various approaches and generates new splits in the ratio of traffic flow to saturation flow. The strategy is of reactive in nature and it updates splits after every 15 minutes. The proposed strategy could qualify as rule-based traffic control method and it is suitable for the tactical level of traffic control.

The proposed strategy is tested on three neighboring intersections located in Starnberg. For this, the traffic control logic is interfaced with traffic simulator VISSIM through software-in-the-loop simulations as presented in the figure on the right side. Signalized intersection is planned with CROSSIG. TRELAN is used to generate the source-code for the strategy shown in figure placed above. Afterwards, controller's supply is generated with TRENDS test station. In the online mode, floating car data is sent from VISSIM to TRENDS kernel which then determines the splits and sends the information back to VISSIM over VISSIM-TRENDS interface.





Traffic demand scenarios is constructed for two hours. The traffic demand is varied over main directions every 15 minutes; however, the demand for minor directions is kept more or less same.

The figure on the left side presents the findings. The results indicate that the proposed strategy is able to improve the performance aspects of the signalized intersection. Compared to fixed-time controls, the strategy produces encouraging results as it could significantly reduce the average delay per vehicle even at the low level market penetration of probe vehicles such as 5 % and 10 %. The best outcomes, nonetheless, are reported for the case when the market penetration of probe vehicles is 100 % as this scenario could produce better estimates of traffic flow. The probe vehicles, however, in reality are not so prevalent at the moment; yet there is a growing interest in floating car data to improve the traffic situations. The work presented in this thesis is an important step in this direction.