

Development of a Data Model for traffic infrastructure on motorways

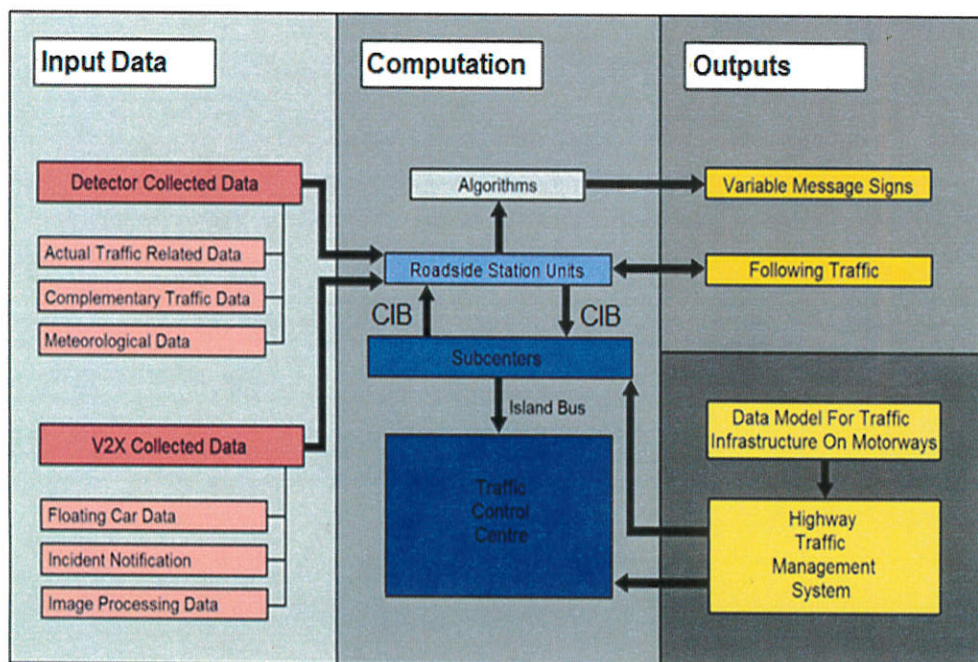
Master's Thesis of Georgios Papatzikas

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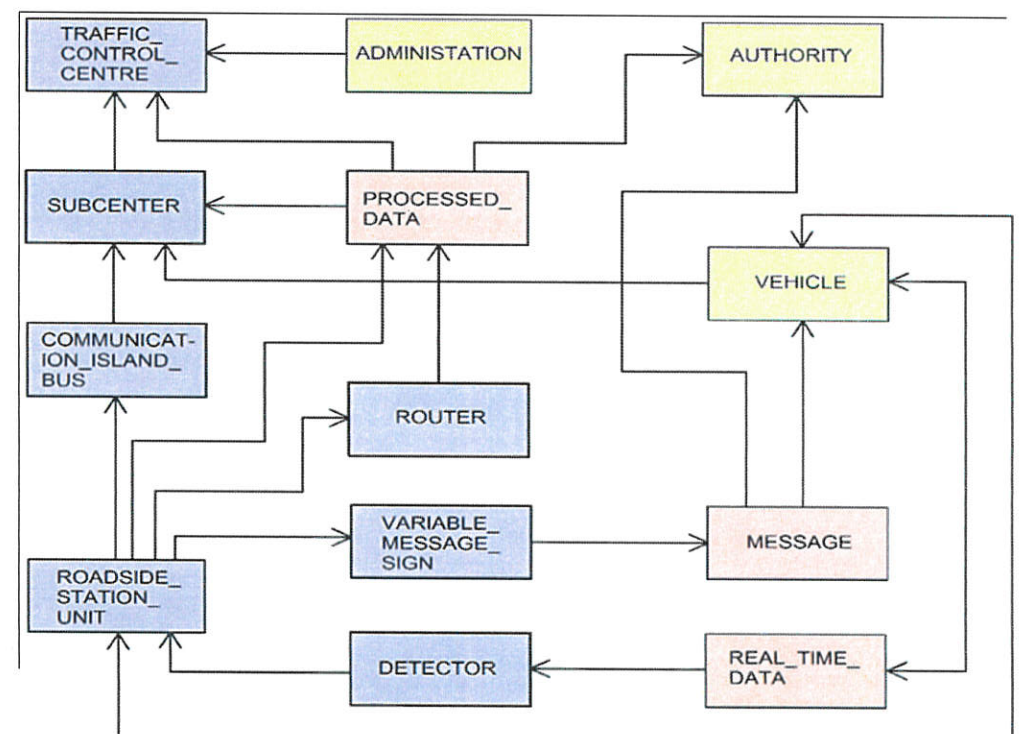
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During requirement analysis, the initial preliminary study was conducted, oriented in detection of essential data inputs, according to current sources of data collection associated with future potentials generated by Vehicle2X communication technologies. After examination of various forms of data-modeling, based on the actual needs of this research, the ideal modeling approach was promoted. An Entity-Relationship model was selected for that cause. Building procedure followed a typical three-step modeling formation, commencing from conceptual design, where relative objects of interest were identified. Logical design followed afterwards where interrelations between objects that were identified in the initial step were determined in precision. Consequently, population of objects and relationships with certain characteristics was carried out. When every aspect was considered, the physical formation of the model was actuated. Final model was represented by a close-up diagrammatic scheme, supplemented by a detailed documentation of all its compounds. Finally the product of this research was also converted into a relational schema, evaluated, and analyzed in contrast with an existing relational model that was previously developed for that cause, but due to its narrow enclosure could not meet challenging expectations that constantly arise.

Relationship	Degree	Entities Involved	Cardinality	Existence Occurrence
1.	Collection	Real_Time_Data, Detector, Vehicle	1-N	Mandatory
2.	Transmission_RSU	Vehicle, Roadside_Station_Unit, Detector	1-N	Mandatory
3.	Transmission_SC	Subcenter, Vehicle	1-N	Optional
4.	Process	Roadside_Station_Unit, Processed_Data	1-N	Mandatory
5.	Control_Router	Router, Roadside_Station	1-1	Mandatory
6.	Transmission_Router	Subcenter, Router, Processed_Data	1-N	Mandatory
7.	Control_VMS	Roadside_Station_Unit, Variable_Message_Sign	1-N	Mandatory
8.	Transmission_VMS	Variable_Message_Sign, Processed_Data	1-N	Mandatory
9.	Display	Variable_Message_Sign, Message	1-N	Optional
10.	Detection	Message, Authority, Vehicle	M-N	Mandatory
11.	Control_SC	Subcenter, Communication_Island_Bus	1-1	Mandatory
12.	Control_RSU	Communication_Island_Bus, Roadside_Station_Unit	1-N	Mandatory
13.	Monitor	Subcenter, Traffic_Control_Center	1-N	Mandatory
14.	Store	Traffic_Control_Center, Processed_Data	1-N	Mandatory
15.	Data_Share	Authority, Processed_Data	M-N	Mandatory
16.	Management	Administration, Traffic_Control_Center	1-1	Mandatory

During last years, technological capabilities of individual means of transport are constantly improving. According to numerous conducted research, implementation of new technologies transform road and especially motorway infrastructure into a relatively innovative environment. Integrated and reliable management of motorway operations, is fundamental for safe, convenient, and cost-efficient traveling. Aim of this master thesis was the provision of the preliminary study, based on a data modeling tool, that leads to the development of such an instrument. However, since each motorway network is marked by uniqueness, every system oriented to this objective should meet the certain actual needs of every individual instance. Considering different peculiarities, main technical aspects of the south Bavarian motorway network were defined. Apart from common mobility aspects, a database that delineates the singularity and onward the feasibility of every system, is hinged on these individual parameters. The actual outcome of this research was a modeling tool following the principles of object-oriented database modeling, where all relevant objects and sources of information were comprehended.



Modelling outcome was addressed by a distinct building step formation, consisting of comprehensive inputs with explicit detail and legible visual outputs. Two significant upsides, update flexibility and reverse conversion applicability, are an earmark for follow-up investigation and future potentials. Current research conducted to significant findings related to identification, ordering and design of a modern database. Database formation, apart from being a time demanding procedure, requiring a manifold approach, must remain simple, well-structured, and intuitive. Additionally, a data management system should carry flexible and user friendly capabilities, like object and data georeferenced bearing, that will resolve problematic operation functionality. Finally, access into processed traffic data from stakeholders is a necessity for further elaboration. Therefore, new aspects considering parameters that are frequently updated were examined. Configuration of the integrated modeling tool that was developed in this paper, must be frequently updated as well, so to overcome technical difficulties that arise, providing promising and versatile potentials.