

Out of the Frying Pan and into the Fire, or ...

... the Quickest Way to Your Destination

Keeping an Overview in the Event of Road Incidents
Thanks to DELPHI and ARGOS

Overnight, strong autumn rain has badly affected the small but steep slope. The roots of trees have so far kept the soil firmly in place. However, the water keeps washing the soil away. In the early hours of the morning, the roots finally lose their grip. The normally picturesque stretch of the parkway suddenly turns into a perilous area as the washed down soil turns the road into a slippery slide. In the end, one of the trees loses hold and crashes onto the busy road. The morning rush hour traffic quickly jams all the way back to the nearby highway. The radio soon broadcasts the traffic warning dreaded by all drivers "Drivers who are familiar with the area are advised to avoid the vicinity!" The control offices are working frantically. How will the recovery vehicle get to the incident site as quickly as possible? What is the situation on other sections of the road? Can the bridge across the river still be used? Can traffic be diverted to the other riverbank given the bad weather conditions which can also cause road closures on that bank if there is flooding? In such a case, decision-makers are faced with a double problem: They only have an incomplete picture of the current traffic situation and they are under time pressure. In its projects DELPHI and ARGOS, DLR is developing solutions that can support relief units in making their decisions.



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Major emergency incidents as well as large-scale events place high demands on traffic managers and emergency services. They need to make decisions immediately and manage the organization of the respective event both safely and efficiently. In such situations, there is a danger that "critical infrastructure" such as roads, public transport, and emergency services can no longer fulfill its functions. In the worst-case scenario, public life comes to a standstill.

Over the past years, the Cologne police and DLR have cooperated on several projects, for example, during the World Youth Day 2005 and the FIFA Soccer World Cup 2006. In the course of this cooperation, a monitoring system for large-scale events was developed. It utilizes data from several different sources to depict and forecast the traffic situation.

Section of an aerial image taken from an altitude of 2 kilometers with DLR's own 3K camera system: Highway A96 with the exit north of the DLR branch in Oberpfaffenhofen



Closing information gaps

This system is now being further developed in the projects DELPHI and ARGOS. The DELPHI project is aimed at creating a decision support portal for traffic and crisis managers. Emergency services, such as the police or the fire department, instigate measures that influence the traffic situation. Traffic managers carry out measures which in turn affect emergency service activities. The DELPHI portal will allow these measures to be coordinated in future. It effectively provides (the presently missing or insufficient) information on the current traffic situation, which can then be used to develop a traffic forecast, as well as information about the effects of particular measures on traffic.

A typical problem is, for example, the lack of up-to-date data for a specific incident area. The ARGOS project therefore aims to create an airborne monitoring system. It transmits pictures of the situation and traffic parameters from a particular target area to a ground station without delays. In the case of an incident, this system can be immediately deployed. At night-time or during poor visual conditions, an active radar sensor (SAR) is utilized. The capability of the ARGOS and DELPHI system will be demonstrated in the regions

of Cologne and Munich. Currently, researchers at the Institute of Traffic Control and Vehicle Guidance are surveying the requirements of the users. For this purpose, a user group comprised of emergency service staff was formed to define and assess requirements and to evaluate the capabilities of the system.

A first prototype of the DELPHI portal, which integrates situational functions and forecasting functions, is currently being developed. Traffic analysis and transport management functions will be subsequently developed. The DELPHI portal depicts the traffic situation in an integrated and holistic manner. Alternative approaches have so far only concentrated on partial networks such as the Federal highway system. Traffic flows, however, do not stop at the end of one sphere of responsibility or at a particular road type. Staff at the traffic computer centers can use the portal to take into account, e.g., the traffic situation in the city, when they divert traffic or provide detour recommendations. The public can thus be better informed, which reduces the danger of consequential traffic jams.

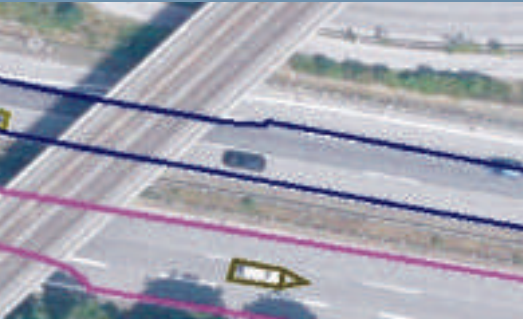
To this end, the portal integrates different data sources for a comprehensive and uniform depiction and aggregates the data for a common analysis. Data from local sensors of

Federal highways and city roads is integrated and combined with Floating Car Data (so-called FCD) and traffic parameters provided by aerial images from ARGOS. Sensors carried by the plane provide images of highly sensitive road sections or roadway systems with a resolution of up to 15 centimeters. They fill up the data gaps for routes without other detectors, for example, by collecting traffic-relevant parameters such as the number, location and speed of vehicles. Based on these high resolution images, emergency services receive an overview of the current road situation and the area surrounding an incident in the DELPHI portal. This enables decision-makers to better manage operations.

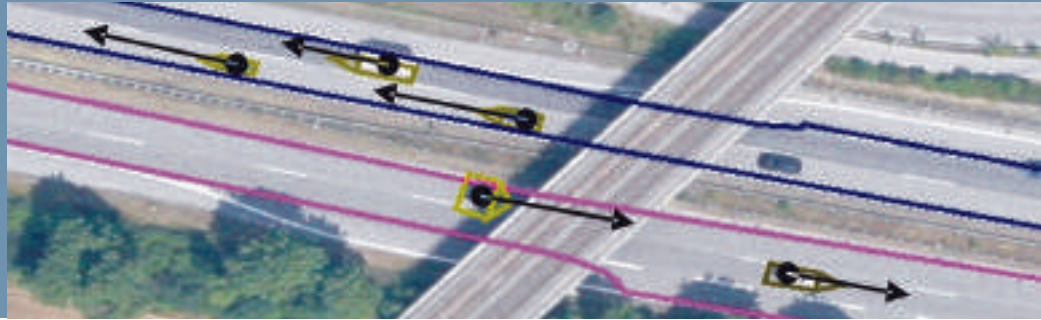


DELPHI combines traffic and crisis management. A web portal supports networked decision-making between the various responsible parties.

Image details with automatically detected lane boundaries and vehicles



Detected vehicles with speed vectors, which are automatically derived from the serial images. The time interval between the images is 1/3 second



The automatic detection of vehicles and their speeds from a sequence of images is one of the challenges in the ARGOS project. Two consecutive images have a time interval here of less than a second. Only this frame rate enables vehicles to be automatically tracked. If a vehicle moves, it will be captured at two different positions on two consecutive images. The speed of the vehicle is calculated from the difference in location and the respective time difference of the images.

These calculations are highly complicated in particular for larger road networks since they must be performed very often and in a very short time span.

The associated system processes, such as image processing, must be extremely high performance. If decision-makers are confronted with questions such as: "Where is the traffic jamming up?" "Where is the nearest usable bridge?" "Which areas are flooded?" "Where shall we send drivers so that they will not end up in a traffic jam?" – the answers can be found in this image data.

This way, traffic controllers can prevent road users from jumping from the proverbial frying pan into the fire while trying to find a way through the traffic.

Transparency of depiction

The current traffic situation depiction is supported by details about the quality of the data. In conventional traffic situation depictions, missing or implausible information is usually replaced without the user having the facility to recognize whether the presented traffic situation is based on historic data or on current data. The depiction on the DELPHI portal carries out this task more transparently. If, for example, in a major incident situation the police are interested in the traffic situation along a particular route, which is to be used by particularly endangered persons, DELPHI can provide details about the usual traveling time or the current traveling time along the intended route. The transparent presentation of the data quality depiction provides planning certainty and can avert dangerous situations or even prevent them entirely.

Apart from providing a depiction of the current situation, the DELPHI portal can also develop a traffic forecast while taking into account the effects of planned measures. This improves the basis for decision-making in the pre-planning stage and when making ad-hoc decisions. Additionally, alternative modes of action can be evaluated with the help of the quan-

titative data provided, thus enabling the selection of more effective measures. The resulting disruptions for the public can consequently be minimized. DELPHI thus enables a directly citizen-oriented work approach to traffic.

The two projects DELPHI and ARGOS contribute in this way towards traffic safety in the event of an incident. They support decision-making for traffic managers and managers of emergency services. If measures are simulated in real time and if up-to-date aerial images are provided, emergency services operations can be optimized – and the consequences for other road users will be minimized.

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