SMEV: Digital Optimisation of Smart Emergency Vehicles in smart cities, explained by **Wolf Peter Zeplin**

In case of emergency, break with tradition

It is undeniable that the on-going deployment of the so-called Cyber-Physical Systems in all levels of our society requires new stabilising structures based on Internet 4.0/augmented or mixed reality.

Nowadays, traffic represents a key element in a well-functioning society. Therefore, an efficient interfacing of traffic telematics has become an absolute priority. New traffic categories will play a leading role in the society of the future.

This assumption will force city administrations to keep traffic flowing and to be equipped with software programmes that enable, on the one hand, traffic light programming via smart devices while on the other hand allow the interfacing with a full traffic management system as one crucial element for traffic flow in big cities. That is what a Cyber-Physical System stands for, i.e. a system with high complexity and physical and (cyber) virtual components.

As a matter of fact, the above will become the most important challenge for city administrations that have to guarantee that traffic control centre systems (TCCs) handle such tasks with adequate software programmes.

THE PROBLEM (FOR EMERGENCY VEHICLES, EVS)

Today, traffic volume in our cities is growing rapidly and continuously. Consequently, emergency vehicles (EVs) and special mission vehicles are limited in their mobility. Rescue crews are suffering from situations of extreme stress during missions when they have to drive from their base to mission locations through overburdened and congested roads.

This increases the potential for accidents on road crossings, junctions, roundabouts, etc., even with sirens blaring and blue lights flashing. This occurs when the normal traffic does not evacuate the route in time and the crossing and incoming traffic with the green light does not react accordingly.

In that regard, self-driving autonomous vehicles represent an additional risk for EVs, because they are still unable to recognise approaching EVs, identifying their routing and 'giving way' to them in time. This represents a potential risk and danger for the overall security and an obstacle to free routing of the emergency vehicles. Thus, the central control, monitoring and communication of the EVs with autonomous

▲ **Congested roads make the already stressful job of emergency vehicle crews even more taxing**

and/or semi-autonomous cars becomes an issue of growing importance.

During emergency missions, EVs need to be guided via priority monitoring of obstacle-free traffic lights on each and every route selected. At the same time, autonomous cars need to be detected, informed and guided in order to be warned about the approaching EV in exactly the same way as human drivers.

Without such predominant real-time detection and temporarily overruling influence on route and direction, autonomous cars hinder EVs in their attempt to reduce: i) mission times to reach the location of an incident; ii) the risk of having an accident, and iii) drivers' level of stress.

It is therefore necessary for TCCs to not only monitor the traffic lights to give priority to EVs, but also to monitor the exact position of such autonomous cars and inform them about the approaching EVs on a real-time basis. This anonymous information system has to be put at the disposal of the autonomous cars, whose drivers need to communicate their position to the TCC and to the EV in order to trigger the correct actions to be undertaken.

"According to some international research, based on data from Belgium, Germany and the UK, more than 4000 casualties and accidents connected to EV missions are registered every year"

The SMEV system creates the cyber-physical requirements for such continuous communication, detection and acknowledgement of the cars' position. This detection is continuously carried out on a real-time basis and within the same action radius as for the traffic lights temporary monitoring that controls prioritisation rules to EVs. Then, the TCC is informed and can monitor the traffic lights accordingly.

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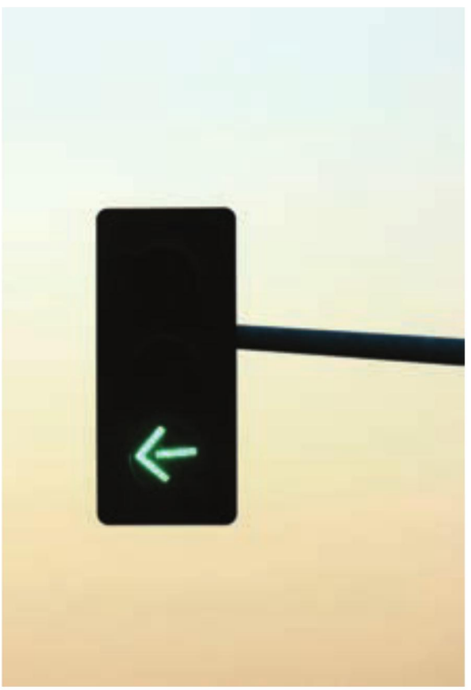

▲ **Does green-wave right of way for emergency vehicles actually increase the risk of accidents?**

research, based on data from Belgium, Germany and the UK, more than 4000 casualties and accidents connected to EV missions are registered every year.

In Germany, every 19 seconds dangerous driving manoeuvres occur during EV missions, almost every time resulting in an accident. Some 43 per cent of all accidents occur at junctions. The risk of life threatening injuries is eight times higher compared to normal traffic accidents.

Also in Germany, approximately 3500 accidents occur per year, costing more than €40m in repair, total loss and collateral damages. These costs burden society as taxpayers, since they are not coverable by insurance policies.

Research studies have shown that, in a region with about 10 million inhabitants, reducing emergency calls for ambulance, fire brigade or police vehicle missions by only one minute can save about €70m.

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The daily experience of rescue crews confirms that the execution of a mission based on a siren and blue light is not a sufficient guarantee to avoid accidents. In order to provide immediate action in case of emergency calls, a TCC that guarantees the status of absolute priority for the EVs is mandatory. The normal practice to give 'Right of Way' to EVs increases the risks for accidents and results in a considerable slowdown of the mission time.

In addition, empiric research by several international institutes and organisations have identified the following issues:

1. Court decisions usually attribute a partial responsibility to the driver in case of an accident, even if they are on a mission with siren and blue light. This leads to internal disciplinary proceedings for the involved driver and to a certain demotivation for young professionals who are interested in joining the rescue services.
2. In Germany, the mission time limit, i.e. time duration from an incoming call to the arrival at the location of the accident, is between five to eight minutes. However, this limit is never achieved; it is actually exceeded by up to five times. More rescue bases should be installed in order to reduce the distances and the time limit accordingly. This would burden the community with an extra cost of almost €40m per year to the already uncovered repair cost of accidents.

THE SMEV SOLUTION

SMEV (German Patent Nr. 10.216.105.58.1) is an intelligent system, which solves the problem of mission delays in emergency cases. SMEV enables emergency vehicles to reach the location of an emergency without any delay, interruption or disturbance

SMEV's advantages

1) An upgrade of existing traffic control systems

The above is achieved by optimising the existing technical and digital resources, guaranteeing that all relevant traffic lights along the route are always switched to green for the emergency vehicles in advance anytime during the execution of a mission. A central controlled traffic control unit in cooperation with the individually synchronised monitoring of the traffic lights (Green Cloud Patent) provides the fastest and shortest route to the mission location.

2) The implementation of a versatile system for City Councils

This enables the unrestricted use of the already installed system following minor investment and adaptation costs (ROI of less than 12 months).

3) An improvement of the existing citizens' services

Citizens will enjoy improved services for better safety and emergency solutions.

4) Reduction of up to 100 per cent of accidents during missions

The system provides free corridors and routes for the SMEV anytime during mission without any risk of unexpected accident situations.

5) Reduction of up to 75 per cent of general repair and maintenance costs

Only about 25 per cent of these costs remain for the normal and general maintenance activities.

6) Reduction of disciplinary proceedings against the driver of the EV due to overruling of traffic regulations with siren and blue light during missions. SMEV enables the full respect and attention of all existing traffic regulations at any time.

7) Reduction of CO_2 emissions by means of EV route optimisation.

8) Silent Missions (mission without siren, just blue light)

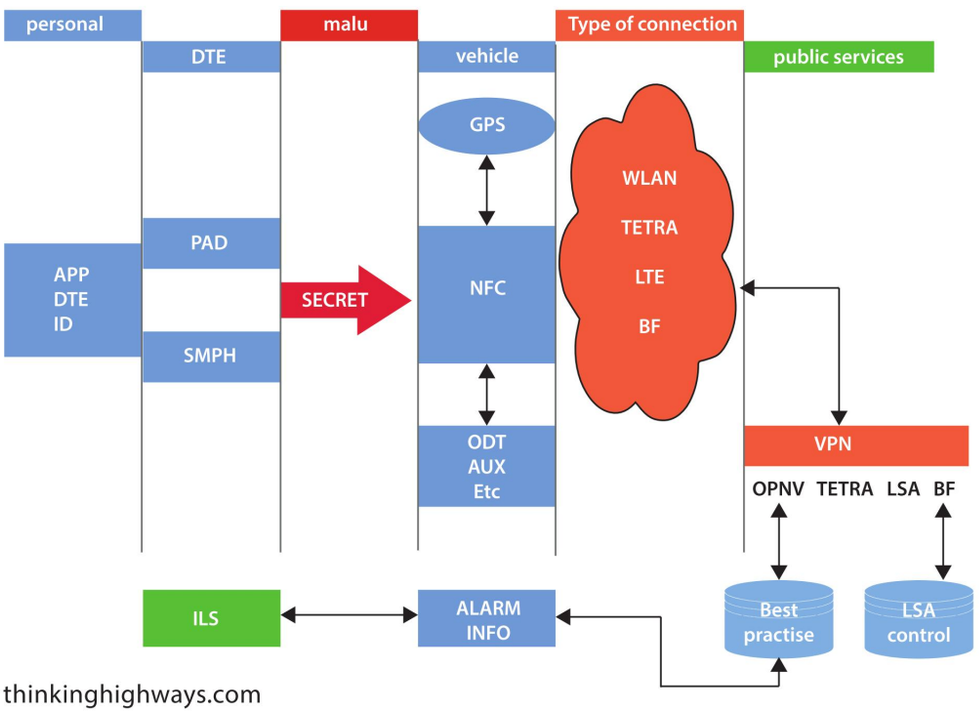
This applies in case of terrorist attacks, suicide situations, bank robberies, kidnappings, night missions, etc.

9) Budgetary savings ('Value for Money' technology)

For a city administration, accident reduction can result in savings of up to 75 per cent for repair and other related costs. These savings may be allocated to other budget items.

10) Reduction of cost for insurance companies

There is no need for a compensation of collateral damages caused by accidents involving emergency vehicles. This may lead to a reduction in policy premiums.



by undertaking a real-time traffic evacuation of: i) all critical traffic areas such as crossings, junctions and roundabouts, etc, and ii) the desired routes, through a reorganisation and control of the traffic situation that guarantees the EV has a clear run.

Interface with self-driving (autonomous/semi-autonomous) vehicles

To enable self-driving vehicles to receive the information about SMEV, the system includes a VPN signal with encrypted IP address that will be sent to these vehicles in the area of the 'Green Cloud' via the automotive industry's server system. With this information, the self-driving vehicle will be able to seek the next possible parking area and give way to the SMEV vehicle immediately.

The system guarantees an exclusive free corridor and preferential routes and enables the SMEV mobility digital optimisation so that emergency vehicles in smart cities can:

- Change the route immediately in case of unforeseen obstacles;
- Avoid such unforeseen obstacles by avoiding this location;
- Inform the TCC in order to monitor the traffic lights along the new route;
- Follow a temporary new free corridor.

The implementation of the SMEV system reduces the mission time limit by 25-35 per cent. The average period of 12 minutes is reduced to less than 8 minutes. SMEV uses and adapts the existing traffic control system as used in the cities and the installed traffic control server.

The fully functional SMEV System utilise the latest state-of-the-art protocols and analyses the following details:

a) Reduction of accident risks;
b) Reduced stress situations for the rescue crews;
c) Faster intervention times;
d) Analysis of legal, juridical, traffic-related and reliability-related incidents with the real situation to avoid juridical and liability problems.

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