



Federal Ministry
of Education
and Research

Research for Civil Security

Rescue and Protection of People



HIGH-TECH STRATEGY

Igniting ideas!

Imprint

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Federal Ministry
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Research for Civil Security

Rescue and Protection of People

Forewords

The success of our export-oriented economy would not be feasible without the free movement of information, persons and goods. Secure energy and transport networks, Internet and telecommunications, food and healthcare provision are vital nerves of our highly networked society. However, due to its high population density and sophisticated technological infrastructure, Germany is constantly exposed to new threats. The security risks have changed. Despite robust technologies, our supply networks are vulnerable to even just small disruptions: Global mobility facilitates the spread of danger and makes it difficult to combat. Natural disasters and technological accidents, but also terrorism, crime and sabotage can cause serious damage in a closer-knit world.

In the period up to 2010 the Federal Ministry of Education and Research (BMBF) will be investing approximately 123 million euros in security research under its Research Programme for Civil Security, which is part of the High-Tech Strategy for Germany. The aim is to develop innovations which will provide more security without at the same time encroaching on Germany's culture of freedom. It is the task of the stakeholders in the research projects to take up the best ideas from science and research and integrate them in innovative security solutions. It is decisive to involve the entire innovation chain from research to industry and end users in public authorities and private industry.



Innovation in this context does not only mean new technological processes, but also includes innovative organisational concepts and action strategies. Interdisciplinary projects involving the humanities and the social sciences, the transfer of knowledge to the public, accompanying research on critical issues and transparency are important preconditions for the success of security research.

The single projects in the programme will be presented within the framework of a series of publications. The present brochure gives an overview of research work into the development of security solutions and concepts for the rescue and protection of people. Besides the handling of incidents through the timely and effective initiation of rescue and security measures as well as effective emergency care on site, this in particular includes the prevention of crises. The results of this research form the basis for improving security standards in our country for the benefit of our people.

A handwritten signature in black ink that reads "Annette Schavan". The signature is written in a cursive, flowing style.

Prof. Dr. Annette Schavan, MP
Federal Minister of Education and Research



Crowds assembled in public spaces, whether at concerts, trade fairs and football matches, or in everyday situations such as commuter traffic, present special challenges to security and rescue forces in the event of terrorist attacks, major accidents and natural disasters. Large numbers of people can be endangered from one instant to the next. What counts then is to rapidly assess the situation on site while also taking into account the often unpredictable behaviour of the people involved.

It is all the more urgent to be able to achieve early recognition of disturbances and dangerous moments, in order to initiate timely and efficient rescue and evacuation measures and to ensure effective emergency medical care on site in case of a crisis. To this end, innovative technologies, new action strategies adapted to the specific situation and networked organisation forms are exceptionally well-suited either to help prevent possible catastrophic consequences already beforehand or at least to hold them to a minimum.

The Scientific Programme Board welcomes the focus on protection and rescue solutions that forms a specific part of the Security Research Programme. In this context, complex scenarios from a broad range of perspectives are examined – scenarios used to study, among other things, the control of major public events and the tremendous challenges they present for rescue services and disaster management. By taking the technologies, action strategies and organisation forms into consideration all together, the collaboration projects can develop holistic solutions that emphasize the protection of the individual – from the victims right through to members of the emergency team.

Central research topics include the creation of intelligent communication and information systems for rescue forces, the required development of modern evacuation concepts and the preparation of enhanced measures for the rescue and care of the injured.

The Scientific Programme Board places great hope in the “Rescue and Protection of People” innovation platform, which will accompany the research focus. It offers a forum for all of the actors involved to participate in the formulation of future research needs and to sound out processes for successfully and rapidly implementing the results in practise.

A handwritten signature in blue ink, appearing to read 'Karsten Michael', written in a cursive style.

Dr. Karsten Michael
German Federal Office of Civil Protection and
Disaster Assistance (BBK) / Head of Research,
Engineering, Protection of Public Health
Member of the Scientific Programme Board
Security Research

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FOREWORDS

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Innovations for Civil Security: Rescue and Protection of People



Large-scale emergencies may have many different causes – terrorist attacks, natural disasters, accidents – but one thing always takes top priority: protecting and rescuing the people affected. Germany has a comprehensive network of security and rescue forces. These include authorities and institutions on the federal, state and local level (such as the German Federal Agency for Technical Relief (THW), police and fire brigades) as well as private organisations (among others the German Red Cross). Their roles cover a broad spectrum ranging from security concept design and crowd control for major public events to the rescue of disaster victims. Their work saves lives and is essential for maintaining or re-establishing public safety. Civil security research supports the development of innovative strategies and concepts for both preventive and reactive disaster management as well as for the optimisation of collaboration among the individual organisations.

Significance of the research topic

Against the background of terrorist threats and increasingly extreme weather, disaster scenarios are attracting greater public interest. The neuralgic points for specifically targeted attacks include transport infrastructures and the settings of major public events. In terms of technical operations, disasters of this type present tremendous challenges for security and rescue forces. Along with early warning systems and the development of preventive measures, the preparation of innovative crisis management strategies is of crucial importance. Among other things, they deal with the generation and optimisation of contingency plans and training concepts for command and control centres and rescue forces, with innovative communication strategies as well as with research into human behaviour. What happens, for example, when mass panic sets in? Which steps have to be initiated by whom? Because irrespective of whether large-scale operations are undertaken in response to a terrorist attack, a natural catastrophe or a major accident, they

invariably involve a fabric of complex procedures requiring the cooperation of different operational forces and authorities. With this in mind new technologies to improve the operational readiness and networking of participating organisations must also be developed alongside comprehensive rescue strategies within the context of an integrated crisis management system.

The brochure “Research for Civil Security – Rescue and Protection of People” presents 17 projects along with the players involved which receive 49 million euros of funding. By sponsoring these projects, the German Federal Ministry of Education and Research (BMBF) aims to promote innovative security solutions in the field of protection and rescue. This will enable both better early warning systems and optimised coordination of crisis management strategies.



Rescue and Protection of People within the “Research for Civil Security” programme

The “Research for Civil Security” programme that the federal government adopted on 24 January 2007 as an element of the High-Tech Strategy for Germany focuses on improving the protection of its citizens. The aim is to counteract threats to society posed by terrorism, organised crime, natural disasters or major technical accidents.

The programme typically involves application-oriented work within the projects by incorporating the entire innovation chain, from research to industry to end users. In the research field of protection and rescue, these include not only governmental authorities and organisations but also for example event location operators, fire brigades, hospitals and the German Red Cross. Their experience is in demand for the innovations sought after.

Security cannot solely be achieved by the development and use of technologies, however. A holistic approach to all ethical, legal and data privacy questions is absolutely essential for the development of



successful solutions, especially within the context of developing successful protection and rescue solutions. Research into these societal issues also encompasses the verification of training requirements for rescue and security forces along with the preparation of decision-making aids for authorities and relief units. Further aspects here consider questions of security communication and of prioritisation during large-scale emergencies.

The funding of innovative protection and rescue solutions opens up opportunities for German companies to improve their competitiveness and participate in a growing market. According to a study commissioned by the Federal Ministry of Economics and Technology, the market volume of products and services related to security technology in Germany was around 20 billion euros alone in 2008. Annual growth rates are high – according to the OECD, worldwide they run about seven percent per year.

An integral part of the “Rescue and Protection of People” funding priority includes the establishment of an innovation platform offering a common forum for all end users and relevant groups of actors involved in the research consortia of the individual

collaborative projects. Innovation platforms represent a new instrument in research funding within the German Federal Government’s High-Tech Strategy. The establishment of innovation platforms within the Security Research Programme is being promoted in order to develop an overall perspective on the innovation process. The aim is to facilitate the continuous dialogue between the various social actors and to create a network of all participants. Under the guiding principle “Anticipating through research”, the forum enables the actors to participate in the formulation of future research needs and to sound out processes for successfully and rapidly implementing the results into practise.

Research topics relevant to the protection and rescue of people

The measures used to protect and rescue people during large-scale emergencies depend on a wide range of circumstantial factors. The action plans and technical solutions available for use by both decision-makers and emergency forces on site are often a key factor. The interaction options available to the various authorities and organisations responsible for rescue activities are also of crucial importance. The projects presented in this brochure are concerned with optimising the effectiveness of preventive and reactive rescue and evacuation measures and with the associated legal and psychological aspects.

Some of the research topics involved are summarised below:

Crisis management strategies

Large-scale emergencies present a huge challenge – not only for the emergency teams on site but also for the operation managers “behind the scenes” in the command and control centres. Decision-makers in the government agencies and organisations involved and at the site of the operations are directly confronted with tasks that extend well beyond their daily routine. To support their work, the strategies and processes they resort to during emergencies have to be developed further and also adapted to heretofore unknown dangers. This includes contingency plans as well as electronic communication and information systems or a proactive communication management. In addition, the use of new technologies and processes and the rescue measures that derive from them require new, interactive training methods, both for those in charge and for the rescue personnel.

Overarching strategies take on special significance here, as emergencies know no boundaries. Rather, disaster operations require the interaction and close coordination of different authorities and organisations – also beyond the borders of individual German Federal States. For this reason, along with the development of strategies to formulate priorities in rescue actions, concepts to optimise coordination and cooperation among the various functions at the national level will also be worked out in order to make future operations more effective. In so doing, the legal standards relative to the implementation of the rescue actions will also be examined.

In an emergency, communication means more than merely issuing alarms and providing information to the emergency forces involved. The general public must also be informed in the event of a crisis situation, in order to avoid panic reactions among the populace and – in today’s media age, where events are reported immediately – to control the flow of information proactively.

Information and communication platforms

For the implementation of the strategies and concepts – particularly in view of the collaboration among the various organisations and extending beyond the boundaries of local responsibility – the research field of information and communication platforms primarily aims to study IT-supported solutions for an integrated crisis management system. Data-based information and communication systems are already in use, of course, but most are tailored to the respective organisation and their needs: the aim here is to transform these IT solutions, which are used “adjacent” to one another, into a system that acts in concert. An overarching network has to be created, in order to support the continuous information flow and exchange between the rescue forces and between the responsible operational and command levels.

Today, each organisation uses its own specific management tools. The spectrum ranges from paper-based work practices – handwritten notes on the condition of the victims, for example – to



IT-based support systems. Integrated IT solutions do not yet exist. For this reason, coordination and data exchange between the individual organisations still occurs primarily via personal consultations or the analogous official radio transmission. Resource-efficient cooperation among the emergency forces on site, the command and control centres and the institutions providing follow-up medical care such as hospitals, requires the development of electronic

crisis management aids. These have to be able to communicate all data and information to all persons involved on a timely basis. To this end, concepts for the creation of a modular, interoperable and service-oriented architecture will be developed. The information collected could contribute significantly to the generation of standardised situation reports. This will accelerate and simplify the coordination of action strategies among the organisations involved in a given operation.

Care of the injured

The primary focus here is not on the medical care of injured persons, but rather on the possible means of optimising organisational aspects for response to a hypothetical mass casualty incident. Today, the injured are still classified manually. A so-called triage tag is used to record the handwritten personal data about a patient along with their injuries. The development of an electronic casualty registration system using RFID chips to identify patients who have been examined would significantly increase the chances of survival for severely injured people. In the event of a large-scale emergency, entering patient data of relevance for this emergency into an electronic information pool could help make rescue measures more effective. Because evaluating the information stored could not only serve to enable the command and control centre to gain a rapid overview of the injury situation, but it would also guarantee optimal medical care of the patients through the synchronisation of capacity data from hospitals and rescue services.

Moreover, these projects will develop innovative learning and teaching methods in the form of e learning platforms to adequately prepare doctors and rescue forces to the challenges of disasters.

Evacuation

One of the main rescue measures employed after major accidents or attacks is the evacuation of crowds from buildings – from stadiums following football matches with some 40,000 spectators, for example. The growing size and complexity of public buildings, such as football stadiums or major train



stations, pose a tremendous challenge for rescue forces during a disaster. Rescue forces also have to be able to respond to natural catastrophes, such as thunderstorms or flooding, of a magnitude heretofore unknown in these regions.

For this reason these research projects will investigate how the facilities management system data on smoke and heat development, fire extinguishers or emergency exits can be integrated into the evacuation process, for example. The aim here is to link these data to automated people counting systems, in order to permit faster and easier identification of useful escape routes, thereby increasing the effectiveness of rescue measures. In the course of developing decision-supporting emergency response plans and action strategies – in particular also for cross-functional cooperation among multiple government agencies and rescue organisations – it is also essential to examine extended escape routes, i.e. regional traffic infrastructures.

All of the various rescue and evacuation scenarios share one factor that has a very significant impact on the success of the actions taken: the human factor. For this reason, besides the formulation and implementation of new training concepts for rescue forces on the one hand, the social dynamics of people must also be studied – mainly based on simulations and modelling. What affects escape behaviour? What leads to non-cooperative behaviour at so-called bottlenecks? What conditions favour

the outbreak of mass panic? The results, i.e. the answers to research questions such as these, are the basis for the development of innovative procedures for directing the flow of people in the event of an emergency. In addition, the use of communication systems as protection and rescue tools (using mobile telephones to distribute relevant information to the general population, for example) might yield new, more effective crisis communication methods. The systems and action strategies for security and rescue forces developed on this basis will enable the intelligent control of an escape route guidance system.



Major public events

Meetings of many people in one place carry a high risk potential. Under such circumstances, even small and unintended disturbances can have catastrophic results. Moreover, large crowds such as the Love Parade or public viewing sessions during World Cup football matches are considered potential targets of terrorist attacks. Nevertheless, the popularity of such major public events continues to increase. More and more often, entire cities find themselves in a “state of emergency”. For this reason, there is

a need to develop more comprehensive concepts to help those responsible take security aspects into account already in the planning of such events and carry out those plans as smoothly as possible with the aid of security and rescue forces.

At the same time, major public events are also extremely well-suited as research scenarios. Time and location are known and the planning is facilitated – linked to that, the testing of new concepts strategies. Here the focal points of the research presented earlier will be combined: the innovations – IT solutions for inter-institutional cooperation, handling of uncontrolled crowds, evacuation by means of new guidance systems – will thus be translated into an overall concept.

Sources:

Research for Civil Security – Programme of the Federal Government; Federal Ministry for Education and Research; Public Relations Division, 2007

Announcement of the Federal Ministry for Education and Research on guidelines governing the funding of the range of topics “Rescue and Protection of People” within the framework of the Security Research Programme of the Federal Government (<http://www.bmbf.bund.de/foerderungen/10660.php>)

Market potential of safety technologies and security services; VDI/VDE Innovation + Technik GmbH, Arbeitsgemeinschaft für Sicherheit der Wirtschaft e. V., 2008

OECD (<http://www.oecd.org>)

Collaborative projects and players at a glance



The research projects presented here are focused on scenarios in which attacks, for example, or natural disasters injure or endanger a large number of people. In so doing, they also examine everyday circumstances like major public events, where the onset of disasters makes it necessary to handle complex crisis situations and take decisions quickly:

- What preparations have to be made in an evacuation?
- What systems, technologies and emergency forces can be used to support operations?



In addition to early identification of incidences and effective crisis prevention, the requirements concentrate primarily on crisis management through the timely and efficient initiation of rescue and security measures along with effective emer-

gency medical care on site. Within the collaborative projects, comprehensive concepts for protecting and rescuing people will be developed with embedded technologies, action strategies and organisation forms.

On the following pages all players involved present short profiles describing their motivation, research priorities, goals and the potential for applications of the innovations developed under the collaborative projects.



ALARM

Telemedical concepts and innovative IT solutions to support emergency workers and services during responses to large-scale emergencies



They are among the first to arrive at the operation site and have to form an overall perspective on the situation: in the case of a disaster, the closely meshed coordination of all rescue forces is a decisive factor. IT-supported communication systems will be used to support this task (source: Berlin Fire Brigade)

Motivation

During large-scale emergencies with mass casualties, resource shortages and the lack of timely and precise information often impede the provision of supplies. The medical and logistical processes receive inadequate support in terms of communication and information technology during the course of operations: rescue workers have insufficient information about the situation, decision processes are barely documented. As events unfold, the quality of medical care for the injured depends on a large number of factors and cannot be evaluated. This delays individual medical care and increases the risk of panic spreading within the context of such scenarios.

Scenario

An accident occurs and initial reports are converging at police and fire brigade command centres. The emergency response procedures begin: Rescue forces on the scene gather information about the situation and feed this back to the command centres by phone. Emergency doctors arriving on the scene classify the injured according to treatment priorities (triage). The results are recorded manually by filling out casualty tags.

Possible risks in current emergency response systems are lack of information flow and problems with patient care. Much of the information may not reach the hospital that eventually treats the patient, thereby making it more difficult to assess the injuries. If an injured person's condition deteriorates after triage, for example, this might go unnoticed at first. If more resources are needed, locally established operational command centres request them. Those local command centres do not necessarily know whether the additional resources will be made available – and if so, when. The process documentation is often incomplete which severely restricts the ability to learn from decisions and procedures later on.

Project description and goals

The project ALARM targets the development of an integrated ALARM service platform that ensures and accelerates communication and the flow of information and data between those involved, including rescue workers on location, staff and command centres, hospitals and associated aid and rescue services. With its modular structure, this platform will be designed to meet requirements ranging from seamless electronic documentation and identification and the dynamic resource manage-

ment of rescue materials and equipment to direct telemedical care of patients. Platform operations will be backed up by redundant configuration of the platform components across a local and strategic management system and through the use of intelligent network technologies – even after critical infrastructure damage.

The second basic objective of the project is the development of suitable emergency medical quality indicators. These indicators will provide a means of measuring and comparing the effects of IT supported triage, telemedical intervention and modified workflows.

Evaluation of the usability of technical and medical systems in stress and panic situations represents the third research focus. Throughout the project simulations and exercises will be used to test the technical components of the new system and the concepts developed. Finally, the new system and the concepts will be demonstrated and evaluated within the framework of a major exercise.

Innovations and applications

The comprehensive concept for data acquisition and exploitation grants local rescue and aid forces, central command structures and other organisational units involved, immediate and reliable access to all information needed. For the initial review of the situation and examination of the casualties, the project partners will assess the value of using an electronic mobile triage system.

Furthermore, the project scope calls for research into the feasibility of IT-supported registration of injured persons, permanent electronic/digital linkage of the patient with his data, and the telemedical monitoring of vitals signs, also during large-scale emergencies. This would make it possible to provide individual medical care already in the preclinical management. Via input from digital identification systems, such as the electronic healthcare card, further relevant data can be collected, which can be useful during subsequent hospital treatment or in the personal information system. In case of a communications networks breakdown a local management platform will be established, allowing the rescue forces on site access to relevant information at all times.

Project title

Adaptive solution platform for active technical support when saving human lives (ALARM)

Duration

1 February 2009 – 31 January 2012

Project partners

- Charité – Universitätsmedizin Berlin
 - Telemedicine Centre Charité (TMCC)
 - Department of Anesthesiology and Operative Intensive Care Medicine
- Condat AG, Berlin
- DAI Laboratory of Berlin Technical University, Berlin
- Berlin Fire Department
- PRIVAT-NERVEN-KLINIK Dr. med. Kurt Fontheim GmbH & Co. KG, Liebenburg
- Telematic Solutions International GmbH, Berlin
- HiSolution AG, Berlin

Associated partner

- Der Polizeipräsident in Berlin

Collaboration coordinator

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e-Triage

Electronic registration of disaster victims

Motivation

In heavily populated areas, during major public events, in connection with the use of mass transit systems and in densely occupied public spaces of all kinds, accidents require effective crisis management. In such cases, the rescue resources normally used suddenly no longer suffice and emergency forces have to draw on resources held in reserve. To begin with, the operational command centre and rescue forces need information as quickly as possible on the type and number of injuries. In addition, the path taken by those affected along the various stations within the rescue chain also has to be clearly traceable.



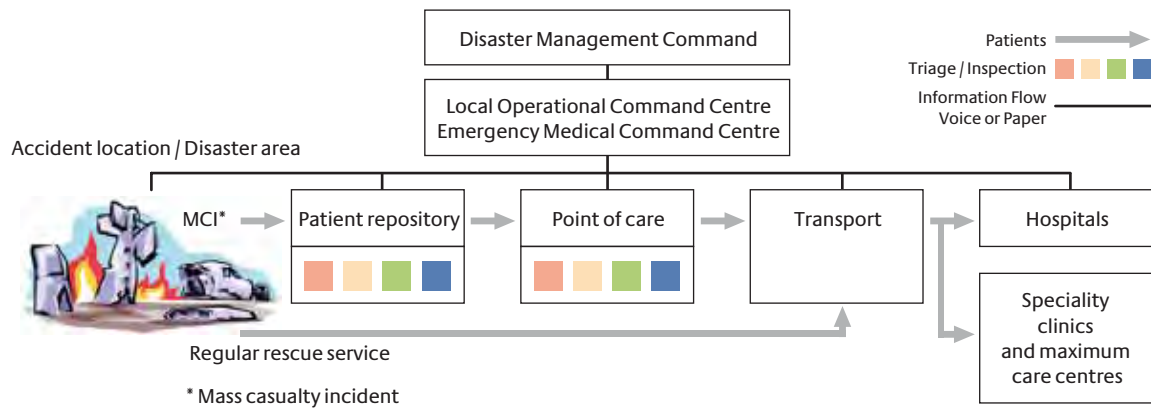
Operational command centre during a disaster management exercise. The inspection categories represented by different colours and the paper-based lists are clearly visible here; these will be replaced by the e-Triage system (source: e-Triage)

Scenario

For this reason, a timely overview of the situation in a mass casualty incident (MCI) is of crucial importance for the effective use of rescue personnel, vehicles and receiving hospitals. According to the usual procedure, inspection teams first classify the injured at the site (triage), recording the results on triage tags, which they attach to the victims. Rescue forces subsequently use those inspection results to prioritise the treatment and transport of those affected. The inspection and registration of the victims, which necessarily takes place on a decentralised basis, considerably impedes disaster management, as the information needed by the operational command centre remains attached to the patients. Duplicating these data in paper form is a laborious and time-consuming manual process. Another danger in this context is the risk of simultaneous failure or overloading of communication infrastructures. This can result in the loss of important data.

Project description and goals

The main objective of the project is the design and demonstration of a system for the electronic registration of affected persons. This system is particularly applicable to large-scale disasters but can also be used in individual emergencies. The goal is to provide a communication and database system for everyone involved in the rescue, transport and placement of victims in hospitals and temporary lodgings. These processes must be coordinated quickly, reliably and efficiently, and they must be documented automatically to permit analysis of operations at a later time. This e-Triage system comprises a satellite-based communication system with radio cells that can be installed locally, matching end devices with application software for the registration of victims and a distributed, self-synchronising database system.



Schematic diagram of the sequence previously used in individual emergencies and mass casualty incidents (source: e-Triage)

Innovations and applications

This research project will convert the previous paper-based victim registration system into a consistent overall concept for the first time. The data are recorded electronically using state-of-the-art communication networks and database systems. Apart from technical aspects, the degree to which emergency forces accept the e-Triage system will depend primarily on psychological factors. These factors will be investigated as an integral part of the research project and made comprehensible through accompanying psychological research. In particular, this work will study the pre-emptive design of the technology, which accommodates the reduced cognitive abilities of emergency personnel operating under extreme stress. Because the system ultimately focuses on people who are either active as rescue forces or receive medical care as injured victims. Both must have confidence in the tools applied.

Project title

Electronic registration of disaster victims (e-Triage)

Duration

1 June 2009 – 31 May 2012

Project partners

- German Aerospace Center (DLR), Weßling
- Euro-DMS Ltd., Olching
- Ludwig Maximilian University of Munich, Psychology Department, Munich
- TriaGnoSys GmbH, Weßling
- Bavarian Red Cross (Bayerisches Rotes Kreuz), Kreisverband Starnberg
- Trauma Center Murnau
- Starnberg district office, Department traffic systems, fire safety and disaster control, Starnberg

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EVA

Risks associated with major public events – Planning, assessment, EVAcuation and rescue concepts

Motivation

Major public events have become very popular. They attract more and more visitors who want to share occasions such as concerts or football matches. As a consequence, many people gather in close quarters during such events. Without information on the expected number of visitors and possible visitor behaviour, it is virtually impossible to develop accurate estimates of the rescue forces needed – which in turn also makes it extremely difficult to plan successfully for such events. For an event with 100,000 visitors, it is generally estimated that about 300 people will need medical attention, 70 of whom will have to be transported. Whenever more than 200 people are injured, experts normally speak of the disaster threshold. The accuracy of these assumptions and the possible effects of a so called compounding load – fire, attack, etc – cannot be determined.

Scenario

As the Love Parade in Dortmund demonstrated in 2008, even simple measures – like a ban on glass beverage containers – can have a significant impact on the presumed number of injured persons. However, the factors that have an influence on the safety and security of visitors at major public events vary considerably. Planning limits – such as the maximum number of people that an event location can tolerate – are unknown or developed from a store of experience with no scientifically justified basis. Clearly 200,000 visitors in a medium-size town like Münster have to be assessed differently from 1,000,000 visitors in Essen. What, then, constitutes a critical major public event?



Major public events are popular but a challenge for all involved at the same time, from organisers via security force through to fire brigade and police (source: Mbdort-mund@commons.wikimedia.org)

Project description and goals

The protection of people at major public events requires thorough planning fundamentals for the task forces. To this end, relevant parameters will be determined and analysed – parameters such as the likely impact of the event's location, traffic



Determination of crowd densities at major public events (source: Dortmund Fire Brigade)

infrastructure or target group. Based on these parameters, an interdisciplinary approach will be used to develop concepts for planning, assessment, evacuation and rescue operations, and to validate them by means of simulations. In addition, historical reports and other documentation (video, photo) on the behaviour of people will be used to adapt the simulation models to actual modes of behaviour. The ultimate aim is to develop a catalogue of factors that affect critical major events, on the basis of which planners can use irrefutable safety engineering considerations to determine whether an event of size X can be carried out in a given town.

Innovations and applications

Using risk assessments, simulation tools and databases, this project will develop crisis management concepts to support the timely initiation of rescue operations and countermeasures. This includes not only the integration of different technical equipment but also the incorporation of a wide variety of

informational and communicative forms of interaction. Finally, new training concepts for rescue forces will be drafted.

Further information:

<http://www.vfdb.de>

Project title

Risks associated with major public events – Planning, assessment, EVAcuation and rescue concepts (EVA)

Duration

1 March 2009 – 28 February 2012

Project partners

- German Fire Protection Association (GFPA / vfdb e. V.), Altenberge
- Universität Paderborn, Computer Application and Integration in Design and Planning (C.I.K.), Paderborn
- Fraunhofer ICT, Pfinztal
- Institute for Firefighting and Rescue Technology of the City of Dortmund
- I.S.T. Integrierte Sicherheits-Technik GmbH, Frankfurt
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EvaSim

Combined traffic and hydraulics simulation for controlling traffic in evacuation measures

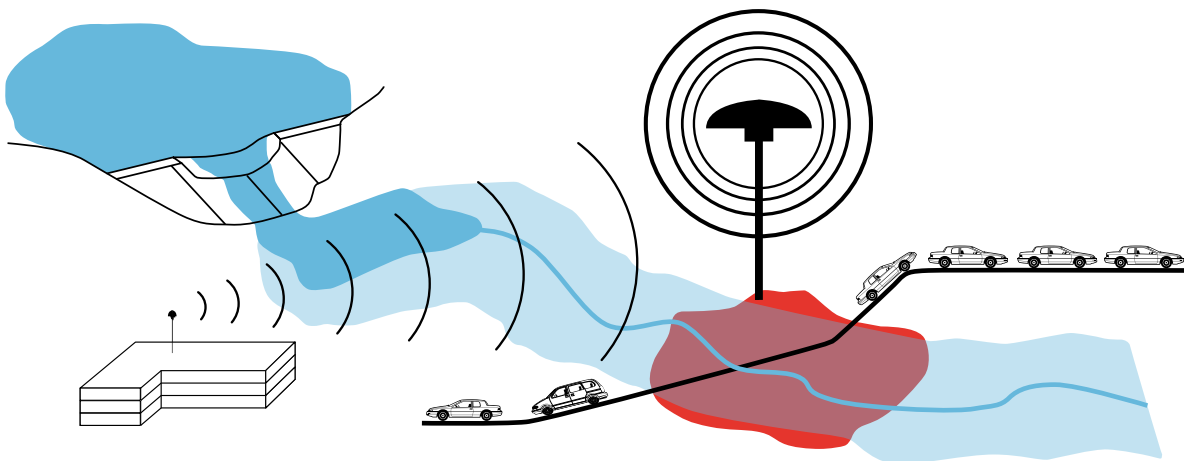
Motivation

Heavy rainfall can not only cause streams overflow, raise the water levels of major rivers or break dams. Residential areas located at some distance from rivers, and especially streets and access roads, can also be affected by flooding due to heavy rainfall. From a traffic engineering standpoint, possible measures designed to minimise the effects of potential flood events downstream of reservoirs or in communities and on traffic routes must be established in advance. The planning of future residential areas and traffic routes must be adapted to handle such events. Additionally, suitably located roads can create alternative escape routes for existing communities. The development of a crisis management system based on evacuation scenarios has to be viewed as a complementary function. This approach enables residents and the emergency forces to be better prepared for an emergency situation.

How can we minimise the risk of catastrophic flooding in existing developed areas where only appropriate planning or expanded road networks can reduce the potential risk significantly? This collaborative project addresses precisely this issue by developing suitable strategies and planning tools to optimise evacuation.

Scenario

As a starting point, the simulation investigates different scenarios involving catastrophic flooding of residential areas, such as extreme high water level, dam failure or (partial) dam break. A dam situated upstream of a town is selected as an initial pilot area. In exceptional cases, i.e. under extremely unusual weather conditions, in case of technical failure, or when the dam is intentionally damaged, uncontrollable flow conditions might develop. An uncontrolled amount of water could be discharged from the reservoir as a result. As to the geometry of the valley, a flood wave with tremendous destructive potential is likely to form. The second pilot area is relatively small, but has a pronounced Alpine character. Here, extremely heavy precipitation can lead to a very rapid rise in the water levels and to high flow rates. This reduces advanced warning times to less than one hour in some cases.



Use of combined traffic and hydraulic simulations to optimise evacuation measures in cases of extreme flooding (source: Hydraulic Engineering Institute, Stuttgart University)

Project description and goals

Inasmuch as there are few technical options that can prevent extreme flood waves today, the primary means of protecting the population remains an optimised evacuation. The aim of this research project is to combine the simulation of high water and/or flood wave propagation with the simulation and optimisation of traffic patterns and to contribute to improved crisis management during extreme events while taking disaster sociology into account. Upon completion of the project, the researchers will present a simulation system for the optimisation of crisis communication that takes social dynamics into consideration. It will incorporate the findings on mobility restrictions due to flooding, the variations in traffic route availability over time, the diversion of traffic for optimised use of remaining available roads, the escape and panic behaviour of the population and the optimally adapted operational strategy of disaster control forces.

Innovations and applications

When initiating suitable evacuation and rescue measures, time is of the essence. The more advanced warning, the more effectively measures can be implemented. As a consequence, improving the ability to predict extreme events accurately assumes a key role in the process. In the future, the latest methods for detecting and predicting precipitation will also be available for decision-makers in small areas in order to extend their latitude of action during evacuations. The use of traffic flow simulations that consider the effects of flooding on vehicles and roads will make it possible to optimise coordination of both evacuation and emergency forces in the future. New, innovative disaster control plans for flooding events will guarantee the targeted and effective use of disaster control forces.

Project title

Combined traffic and hydraulics simulation for controlling traffic in evacuation measures (EvaSim)

Duration

1 June 2009 – 31 May 2012

Project partners

- Stuttgart University
 - Chair for Hydraulic Engineering and Water Quantity Management, Hydraulic Engineering Institute
 - Chair for Hydrology and Hydrogeology, Hydraulic Engineering Institute
 - Chair for Traffic Planning and Traffic Control Technology, Institute for Road and Traffic Systems
 - Chair for Technical and Environmental Sociology, Social Sciences Institute
- DHI WASY GmbH, Berlin
- AquaSoli Ingenieur GmbH, Traunstein
- Regional Government Office, Karlsruhe
- Calw district office
- Municipality of Altensteig

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GenoPlan

Generic emergency plan and adaptive process model to protect local government in the event of a pandemic



Treatment of highly infectious patients (source: Dortmund Fire Brigade)

Motivation

In 2001, a group of experts at the Robert Koch Institute (German federal institute under the administration of the German Federal Ministry of Health) began working to develop a response to a future influenza pandemic. This work led to the preparation of the federal and state governments' pandemic response plans. In order to implement these plans as needed at the local level, each municipality is once again required to issue its own specific plan. For the most part, this function has to be performed by the local health authorities and currently places a particularly strong emphasis on the medical infrastructure. The problem of maintaining the local government's ability to function during a pandemic is almost completely left out of consideration in this context.

Scenario

Experts are convinced that a worldwide influenza pandemic is very likely to occur within the next several years. Influenza pandemics occurred several times in the past century, including three major outbreaks in 1918, 1957 and 1968. The most devastating of these was the so-called "Spanish flu" of 1918-1919, an influenza outbreak that eventually claimed the lives of 20 to 50 million people worldwide. Mathematical models indicate that in a future pandemic, 100,000 people could die from influenza in Germany alone within a few weeks.

Under such circumstances, a far higher number of people would contract the disease and public life would come to a virtual standstill in some respects.

Project description and goals

This research project considers local government as a critical infrastructure. During a pandemic, the ability of that infrastructure to function has to be safeguarded so it can provide protection and

countermeasures for the entire population. To this end, the project will develop the so-called generic emergency plan, which will present the necessary actions that can be taken during the disaster. Available options and suitable actions will be developed using the example of a concrete scenario in which the city of Dortmund and its population of nearly 600,000 people are affected by the different phases of a pandemic.

This project will identify how, and to what degree, the functional and service areas of local government can and must be maintained during a pandemic. It will also develop complementary solutions to address these questions.

Innovations and applications

Three building blocks will be developed within the framework of this project. The generic emergency plan (GEP) for local government will document all of the required measures that have to be initiated and taken to protect a local government in the event of a pandemic. Owing to its modular structure, this

emergency plan can be continuously adapted to the constantly changing conditions of a pandemic. This approach will ensure the local government's ability to carry out its functions throughout every phase of the pandemic. As an adjunct to the GEP, an adaptive process model (APM) that simulates the service processes of a local government will be created. Subject to available resources and the specific level of the emergency, these processes must be provided during a pandemic, in order to respond to the emergency effectively. A third, science-based and event-oriented system will help the staff take complex decisions. It will form the link between process model, ICT and infrastructure control.



Dortmund Fire Brigade's ambulance for transporting patients with infectious diseases (source: Dortmund Fire Brigade)

Project title

Generic emergency plan and adaptive process model to protect local government in the event of a pandemic (GenoPlan)

Duration

1 May 2009 – 30 April 2012

Project partners

- IBM Deutschland GmbH, Bonn
- IDS Scheer AG, Saarbrücken
- Robert Koch Institute, Berlin
- Universität Paderborn, Computer Application and Integration in Design and Planning (C.I.K.), Paderborn
- Ulm University Hospital, Clinic for Psychiatry and Psychotherapy II, Günzburg District Hospital
- City of Dortmund / Dortmund Fire Brigade
- Psychology and Safety Research Hofinger, Remseck

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Hermes

Study for an evacuation assistant for use in emergencies during large-scale public events

Motivation

The trend toward large, multi-functional building structures in combination with a wide range of large-scale public events presents new challenges for the quality of security concepts. In an emergency, everyone present must be able to leave the danger zone quickly. As a general rule, this is ensured through the application of construction and planning regulations. In the event of overcrowding or the loss of specific rescue routes, however, dangerously high crowd densities and lengthy bottlenecks can occur. For this reason, ensuring the safety of people requires the development of new strategies and tools that are capable of both recording the number of people present and supporting the optimal evacuation of a danger zone.

Scenario

The multi-functional arena in Düsseldorf has a capacity of up to 66,000 spectators. Such arenas are used not only for football matches and concerts, but also for meetings, seminars and workshops. This multi-functional arena will be used as an example to show how – taking the specific danger into account – crowds can be effectively managed during large-scale public events in order to permit optimal use of rescue routes.

Project description and goals

The Hermes collaborative project aims to improve personal safety during emergencies through the use of an evacuation assistant. This assistant predicts bottlenecks in advance in order to help decision-makers (operators, security services, police and firefighters) correctly assess conditions, thereby enabling the optimal use of security personnel and rescue forces. In addition, it offers the ability to analyse potentially dangerous situations prior to the events. The preparation of appropriate emergency plans or the specifically targeted training of security forces can help to meet the challenges that such situations present.

The evacuation assistant system will be tested in the arena in Düsseldorf in 2011.



Concert in a multi-functional arena (source: ESPRIT arena)

Innovations and applications

Coupling the simulation core to the fire alarm system and counting people by means of automated image processing will make it possible to obtain simulation results pertaining to actual danger conditions for the first time. Using the available data on the distribution of people and the availability of rescue routes, a parallel computer will generate a faster-than-real-time simulation to predict the movement of all people present during the next 15 minutes and update it at one-minute intervals, thereby providing immediate simulation results for crowd management. A communication module will provide necessary and up-to-date information to the emergency teams on site.

In order to optimise the underlying models of pedestrian dynamics, researchers will conduct comprehensive field studies and laboratory trials that will make it possible to validate the construction and planning regulations, which are currently somewhat contradictory. In addition, the research project will be complemented by a fundamental investigation of user requirements and by the accompanying social scientific research.

Further information:

<http://www.fz-juelich.de/jsc/hermes>



Principle diagram of the evacuation assistant (source: Hermes)

Project title

Study for an evacuation assistant for use in emergencies during large-scale public events (Hermes)

Duration

1 November 2008 – 30 October 2011

Project partners

- Forschungszentrum Jülich GmbH, Jülich Supercomputing Centre (JSC), Jülich
- University of Wuppertal, Civil Engineering Department, Chair for Construction Materials Technology and Fire Protection, Wuppertal
- Imtech Deutschland GmbH & Co. KG, Hamburg
- Multifunktionsarena Immobiliengesellschaft mbH & Co. KG, Düsseldorf
- PTV Planung Transport Verkehr AG, Karlsruhe
- TraffGO HT GmbH, Duisburg
- University of Bonn, Geographic Institute, Bonn
- Cologne University, Institute for Theoretical Physics, Cologne
- Vitracom AG, Karlsruhe

Associated partners

- Düsseldorf Fire Brigade
- North Rhine-Westphalia State Office for Central Police Services and Düsseldorf Police Headquarters

Collaboration coordinator

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LAGE

Integration of existing information systems for joint crisis management

Motivation

During large-scale incidences, different public safety authorities and organisations (German acronym: BOS) have to cooperate over extended periods of time. As consistent IT solutions are not available in this type of situation, information must be exchanged via liaison officers of the respective organisations. Up until now, this has been the only possible means of closely meshed interaction. Within public safety authorities and organisations, many different operational command systems have already been introduced in support of command and decision-making functions during large-scale operations. Due to the wide variety of such systems, near-term harmonisation and standardisation are unlikely to occur in this area.

Scenario

A large-scale disaster at the central train station of a major city has been selected as the principle scenario. Within the critical infrastructure 'train station', events involving normal operations have to be considered along with other singular events such as an accident or an explosion. Different parameters – e.g. the event itself, the location and the time –

affect the course of the scenario, thereby generating a large number of alternative operation sequences. In effect, a primary action and various secondary actions have to be taken into account.

The scenario involves a large variety of organisations and highly complex spatial conditions, and the event gives rise to a highly dynamic situation that is also drawn-out over a long period. In this case the group of players comprises authorities and officials, the fire brigade, emergency rescue services, the German Federal Agency for Technical Relief (THW), the German Federal Office of Civil Protection and Disaster Assistance (BBK), the German federal police (railway-police duties), the police and the German rail service, Deutsche Bahn AG.

Project description and goals

This collaborative project aims to use a standardised exchange of data among the public safety authorities and organisations involved to achieve a shared perspective of the events, structures and processes in the operation, thereby generating a common situation report. This will make it possible to coordinate actions and avoid conflicts. The project serves to prepare such standards for the exchange of reports. Due to the current heterogeneous structure



Operation command centre with liaison officer on site (source: Dortmund Fire Brigade photographic service)

of available information systems, the system will use a “report turnstile” – which means using mediation (rule-based data transformation) to convert all available information to unambiguously interpretable data, which is then added to a situation database. This information pool and the integrated processes, taking all connected systems into account, then generates an overall situation report, which will facilitate a networked operation command structure.

On the part of communication technology, networking will be facilitated by a secure broadband ad-hoc network. This ensures a rapid and flexible restoration of communication, even if – as it is often the case in large-scale emergencies – the necessary infrastructures have been damaged severely. Information on the capacity and position of currently available communication resources is entered dynamically into the situation database and thus can be used for an efficient crisis and disaster management.

Existing information systems for an overall crisis and disaster management system will be incorporated and the common situation report that is generated will be evaluated. In so doing, new applications will not be created, but rather the exchange of information between existing information systems will be used to support the “networked operation command” of the public safety authorities and organisations.

Innovations and applications

The project will use innovative approaches to meet the challenge of establishing inter-operability among the players’ technical systems.

Based on existing standards and through the establishment of a new generic data model, the basis for a standard “xHelp” will be defined together with the group of players.

The interlinking of decentralised situational information is facilitated via a mobile ad-hoc network. Its network information in turn is available in the form of situational information.

The realisation of an innovative, event-controlled, collaborative system that public safety authorities and organisations can use to generate a situation report for higher order decision-making will be illustrated by means of a demonstrator.



Coordination work of different organisations (source: Dortmund Fire Brigade photographic service)

Project title

Integration of existing information systems for joint crisis management (LAGE)

Duration

1 June 2009 – 31 May 2012

Project partners

- PSI Transcom GmbH, Berlin
- Industrieanlagen-Betriebsgesellschaft mbH (IABG), Ottobrunn
- Unternehmensberatung H & D GmbH, Munich
- Universität Paderborn, Computer Application and Integration in Design and Planning (C.I.K.), Paderborn
- Institute for Firefighting and Rescue Technology (IFR), Dortmund
- Psychology and Safety Research Hofinger, Remseck

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MANET

Disaster Management using Autonomous Sensor Networks

Motivation

Against the background of terrorist threats, increasingly extreme weather and inevitable technical accidents, society is turning its attention to possible disasters and their effects. The ability to handle such major events – also because they occur so rarely – represents a huge challenge for emergency rescue services and disaster management. Up until now, most technical aids that provide logistical support in such cases are rudimentary at best. Situational information such as the number and triage classification of casualties, which the command centre needs in order to plan and organise rescue operations with available resources, becomes available only after considerable delay. Moreover, casualties are sometimes scattered over a large operations area. The lack of operations documentation also makes it difficult to learn from exercises or previous events or to compare various procedural models. This project investigates how rescue processes can be supported through autonomous networked sensors.



An electronic support of the situation and operation planning could improve the effectiveness of rescue operations considerably (source: Benedikt Weber / Cologne University of Applied Sciences)



Fast and reliable support in information acquisition is required, but the technology is not currently available (source: Benedikt Weber / Cologne University of Applied Sciences)

Scenario

The scenarios under consideration within the context of the research project are damage events in which a large number of people are injured, become ill or are otherwise directly affected. Such events are generally classified as mass casualty incident (MCI). Five key elements are always required in order to handle an MCI: first aid, treatment, support, care and transport. In order to maintain and assure these functions, leaders require a continuous exchange and flow of information.

In an MCI, the optimal, timely and effective distribution of all resources, including both manpower and material, is of crucial importance. This can only be facilitated when an assessment of the following aspects can be made at all times: how many patients having which degree of illness or injury must be treated where in the operations location? In order to accomplish this, it is important and necessary to have seamless, up-to-date and validated documentation without diminishing the role of medical care.

Project description and goals

The aim of this project is to develop solutions for the support of logistics for MCI operations. In so doing, it will concentrate on the use of sensor networks. Autonomous sensor networks are easily scalable and self-configuration mechanisms make it possible to use them with a minimum of cost and effort in unfamiliar environments without infrastructure. The sensor network can be used to process information acquired during the operation and provide it as a support for the command of the operation or division. Rescue forces can provide assistance more effectively, thereby significantly shortening the elapsed time between alarm and transport and treatment of patients with life-threatening conditions. At the same time, such networks will support reliable automatic documentation of the operations which represents an important basis for the evaluation of actual operations and exercises. This will ensure the comparability and improvement of models and strategies for handling large-scale emergencies.

Innovations and applications

In lieu of the standard patient triage tags used today, a patient node will be used as an electronic triage tag. The sensor network can be used to provide information on the processing of mass casualty cases or on patients (movement status, vital signs). Important information is stored in the node and can also be called up without a network (in the hospital, for example). In so doing, the emergency forces use mobile rescue equipment to interface with the patient node, input process information and support sub-processes and tasks (such as transport planning, documentation, etc). To support the command staff, a central information system for data aggregation, analysis and visualisation of situational information will be installed. This system will process all of the information available via the sensor network in real time and store it for documentation purposes. A decentralised, self configuring sensor network will enable a reliable exchange of distributed situational information and the localisation of radio nodes in real time.

Project title

Disaster Management using Autonomous Sensor Networks (MANET)

Note: This project is funded within the framework of the ICT 2020 research programme.

Duration

1 October 2007 – 30 September 2010

Project partners

- Kontron Embedded Computer GmbH, Eching/Munich
- Amber Wireless GmbH, Cologne
- Cologne University of Applied Sciences, Specialty Area, Cologne
- Vomatec International GmbH, Bad Kreuznach
- FZI Research Center for Information Technology, Karlsruhe

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Pri-Kats

Coordination, steering and standardisation in the German disaster management system under large-scale emergency conditions

Motivation

Previously considered in highly compartmentalised terms, the homeland security system mainly comprises police, intelligence services and – with increasing importance since the 1990s – the private security sector. With the new and publicly recognised risks of terrorism in the wake of September 11th and also as a result of climate change and the associated threat of natural disasters heretofore unimaginable in Central Europe, the complex disaster management network in the German Federal Republic is attracting more and more public interest. There is a growing consensus to regard it as an integral part of homeland security. The discussion on how to design such modified and integrated security architecture is still in its infancy.

Scenario

The current scenarios for terrorist attacks, serious accidents and natural disasters present huge challenges for German security forces and disaster managers. Terrorist attacks such as those in the USA, Spain and the UK clearly demonstrate that the targets, forms and typical perpetrators of the attacks have changed. At the same time, such events also reveal the vulnerability of modern society. The number of natural disasters with mass casualties continues to rise. The frequency of tornados with a significant degree of damage is increasing in Germany, for example. The project concept is based on cascading damage scenarios. From a social scientific point of view, these carry a heightened potential to impair society's security, its critical infrastructure and therefore ultimately the life and health of people.



First responders during a large-scale emergency (source: German Federal Agency for Technical Relief (THW))



Resource management during LÜKEX (designation for a series of exercises in the field of national crisis management in Germany / source: German Federal Office of Civil Protection and Disaster Assistance (BBK))

Project description and goals

The planned project entitled “Priority setting for rescue measures” will focus on two principal elements: In terms of administrative and organisational analysis, the aim is to support the collaboration, cooperation and steering of the various authorities and organisations of Germany’s federal, state and local governments during large-scale disasters involving more than one German federal state. The main tasks are to identify weaknesses, to contribute to and draw on the experience, positions and priorities of the players involved, and to develop possible solutions. The second, legal objective is to examine the different legal standards. This involves reviewing them to see where they may conflict with the principles and provisions of constitutional law and procedures. In particular, this work will attempt to determine which procedures and standards should be used to define and implement corresponding priorities for carrying out rescue measures.

Innovations and applications

From a thematic perspective, the project considers questions of security architecture: how does disaster management develop within an integrated concept for internal security? The basis for this will be provided by comprehensive organisational analyses of the authorities and organisations operating in this field. The project focuses on questions that concern security cultures: Which value structures and standards currently exist in the disaster management system? How are these managed and coordinated, especially under the conditions of large-scale disasters? Overall, therefore, the project will help identify deficits and the resulting dangers for civil security concepts. In so doing, it will support practical applications and develop suitable structures, decision-making processes and substantive strategies, thereby enhancing the ability to deal with potential disasters preventively.

Project title

Priority setting for rescue measures (Pri-Kats)

Duration

1 April 2009 – 31 March 2012

Project partners

- Witten/Herdecke University, Faculty for Humanities and Arts, Chair for Political Science, Security Research and Security Management, Witten
- Bielefeld University, Faculty of Law, Institute for Public Law, Political Science and Constitutional History

Associated partners

- German Red Cross (DRK), General Secretariat Berlin
- Free Hanseatic City of Hamburg, Office of the Interior
- Ministry of the Interior of the German Federal State of Saxony-Anhalt
- City of Frankfurt am Main, Fire Direction

Collaboration coordinator

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REPKA

Regional evacuation: planning, control and adaptation



The west end stands: Fan section of the 1st FCK football team
(source: C. Maurer)

Motivation

One of the basic rescue measures in the case of attacks, attack threats, large-scale accidents and natural disasters is the evacuation of the affected buildings and regions. In this context, the overarching goal is to evacuate affected persons as fast and reliably as possible. That means they have to be taken away from the danger area and brought to safety. Several tragic scenarios are already known from the past, such as the disaster in Hillsborough Stadium in April 1989: due to the overfilling of a pen, spectators were crushed against a fence at the edge of the pitch or trampled by the panicked crowd. The accident resulted in the deaths of 96 people, and 766 were injured.

Scenario

This project is primarily concerned with regional evacuation. In particular, it will examine the situation that occurs when a large crowd has already left a building and must then be brought further away to safety. A similar situation now occurs every week after each professional soccer match in Germany, when up to 75,000 visitors crowd into trains and parking places at some stadiums. The potential danger is also aggravated when rival groups of violence-prone fans encounter each other. This becomes evident in view of, among other things, the massive array of forces of public safety authorities and organisations (German acronym: BOS), especially police, fire brigades and emergency rescue services. And when the site of a match has to be evacuated, the fact that many visitors are strangers to the area makes matters that much worse. In a real emergency, therefore, leaving the stadium via emergency exits does not suffice. A reliable guidance system must also be in place to direct the people to safe locations as rapidly as possible after leaving the stadium.

Project description and goals

Mathematical optimisation and simulation will be used to develop methods, by means of which practical evacuation plans can be drafted for an entire region before a disaster actually occurs. These plans can be monitored in the actual escape situation and adapted to continuously changing conditions during an evacuation. A robust localisation technology for mobile end devices, i.e. one that is protected against outages and overloads, will make it possible to transmit a guidance system to mobile phones via WLAN in the event of an emergency. In crisis situations, this will minimise the risk for all concerned. Previously developed methods will be tested and analysed in a large-scale evacuation exercise. Upon completion, a software library will be available, which public safety authorities and organisations can use to plan and practise their operations in advance for many possible scenarios.

Innovations and applications

The research hinges on the results of the building evacuation, thereby bridging an important security gap. In contrast with a building evacuation, a regional evacuation must adapt to continuously changing topology. Particularly as a result of the emergency forces who generally make their way toward the stadium against the flow of the crowd, the environment changes constantly. The crowds are localised through the use of existing WLAN



Fritz Walter Stadium in Kaiserslautern (source: C. Maurer)

networks. Personal mobile phones can serve as an individual escape guidance system. Along with this, the comprehensibility and acceptance of the technical innovations will be verified and a social scientifically oriented study focussed on panic and fear will be conducted. The key characteristic of this project is the holistic perspective that takes into account all of the people involved. The result is no individual solution, but rather a comprehensive system innovation.

Further information:

<http://optimierung.mathematik.uni-kl.de/repka>

Project title

Regional evacuation: Planning, control and adaptation (REPKA)

Duration

1 February 2009 – 31 January 2012

Project partners

- University of Kaiserslautern
 - Optimisation working group, Department of Mathematics
 - Urban sociology working group, Department of Architecture, Spatial Planning and Civil Engineering
 - Emergency management and disaster response working group, City of Kaiserslautern
- Siemens Corporate Technology, Department PP 2, Munich
- Communications Network Department, Fraunhofer Institute for Integrated Circuits (IIS), Nuremberg
- IT2media GmbH & Co. KG, Nuremberg
- TU München, Department Civil Engineering and Surveying, Computation in Engineering, Munich

Collaboration coordinator

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SECURITY2People

Secure IT-Based Disaster Management System to Protect and Rescue People

Motivation

The number of large-scale emergencies affecting one or several German federal states (Länder) at the same time has continuously increased in recent years. Effective crisis management can only be achieved by close collaboration of all involved emergency operations and crisis management centres of public and private organisations throughout all phases of a crisis and at all decision-making levels. The ability to protect and rescue people depends on the crisis management capabilities of these institutions. For better preparedness and higher efficiency a flexible and comprehensive system is required. This system has to provide information and decision support to the crisis management teams in a way that is timely and appropriate for the respective level. Furthermore, this system should support pre-planning and training in the preparation phase for a crisis.

Scenario

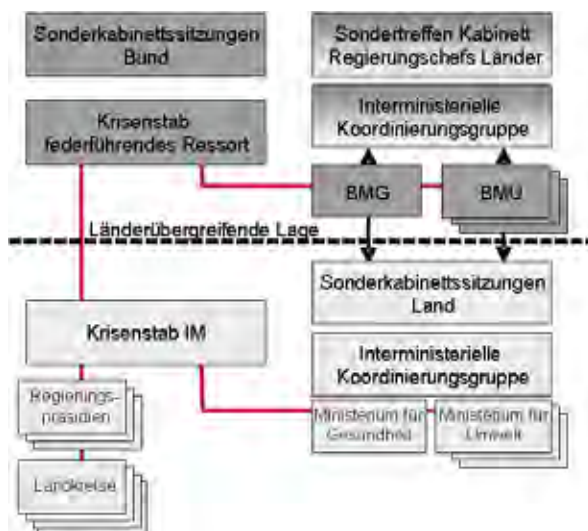
Based on a catastrophic storm event as an illustrative example, possible threats to the population (e.g. damage by heavy winds) will be simulated in different areas and for different critical infrastructures. Serious technical incidents at an overcrowded major airport and a trade fair will be hypothesized, which will necessitate, among others, large-scale measures on medical care and rescue activities for injured people. These and other catastrophic incidents will build up a complex crisis scenario which will incorporate operational and crisis commands at all official levels, including municipal, district and federal authorities, etc., as well as the rescue organisations and operators of critical infrastructures.



Crisis management exercise involving multiple German federal states (source: German Federal Office of Civil Protection and Disaster Assistance (BBK))

Project description and objectives

The objective of the project is to study, understand, and create the foundation for an integrated IT- and simulation-based crisis management system to support the abovementioned operational and crisis command structures with the following core capabilities: Role-oriented information provision, cross-level decision support and integration of simulation capabilities for training, exercises, and evaluation of command and communication processes, and finally for the representation of possible consequences of decisions and actions taken. The system is intended to support all phases of an emergency, ranging from preparedness to the management of real crisis situations. In order to accomplish this goal, the system will incorporate new technologies and integrate existing solutions at all levels.



Example of a crisis management structure in the public sector (source: SECURITY2People)

Innovations and applications

This approach of a fully integrated system covers all aspects of crisis management (levels, structures, processes, etc.), thereby achieving transferability to all crisis situations. An iterative strategy will be applied for system analysis, design, and development integrating a continuous evaluation process during the project. A large number of associated end users will contribute their expertise in workshops and user forums followed by participation in tests and experiments.

Project title

Secure IT-Based Disaster Management System to Protect and Rescue People (SECURITY2People)

Duration

1 June 2009 – 31 May 2012

Project partners

- CAE Elektronik GmbH, Stolberg
- PRO DV Software AG, Dortmund
- Karlsruhe University, Institute for Technology and Management in Construction, CEDIM, Karlsruhe
- Karlsruhe University, Institute for Nuclear and Energy Technologies, CEDIM, Karlsruhe
- German Federal Office of Civil Protection and Disaster Assistance (BBK), Bonn
- DIALOGIK – gemeinnützige Gesellschaft für Kommunikations- und Kooperationsforschung mbH, Stuttgart

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SiKomm

Emergency Communication for Security: Preventive, proactive and reactive strategies for communications support in security and rescue operations



Rescue workers after an operation (source: www.digitalstock.de)

Motivation

Crises and disaster situations require more than the management of technical or organisational measures to protect and rescue people. Adequate communication processes must also be used to prepare, initiate, coordinate, guide and post-process these actions. For this reason, communication today is generally considered to have a direct impact on safety in the context of catastrophes. The key requirement of communication for security is for robust and reliable communication to occur across all levels.

Scenario

In crises and disasters, communication is essential for protection and rescue operations. For that reason, this research project is studying communication processes of and with those involved, within and among rescue and aid services, emergency

management and includes emergency policy and reporting in the media. In so doing it focuses on the scenarios “Infrastructure breakdowns” (e.g. power outage, road closures, failure of telecommunication networks), “Natural disasters” and “Terrorist acts” (retrospectively in each case) and analyses communications processes in crisis exercises and possibly in actual crises. The findings from this work will be used to implement future communication measures in crises and catastrophes by raising people’s awareness to security topics and enabling players to adapt to, and prepare better for these unexpected, complex and often counterintuitive situational contexts and the different communication requirements, conditions and options associated with them. When protecting and rescuing people, this can ultimately result in decisive time savings.

Project description and goals

Safety-related communications processes are identified on a cross-scenario basis and studied relative to generally applicable communication and media strategies. Building on this foundation, robust communication and media intervention options will be developed and tested using system dynamics crises and disaster models. This also includes analyses of media reporting on the selected scenarios. The secondary analysis of communication documents from crises and disasters will be used to actively observe communication processes and to study those processes with time-geographic methods. In order to support emergency communication also through ICT (information and communication technology) solutions, existing holistically applicable crisis communication and crisis management systems will be tested. Aspects involving communication ethics, which have gone largely unexamined in the past, will also be studied extensively. In order to ensure ongoing consideration for communication for security issues, teaching and training modules will be developed along with comprehensive information offerings.

Innovations and applications

Crisis, disaster or risk communication concepts will be adapted to the idea of communication for security, which covers communication processes ranging from psycho-social aspects of crisis intervention to political and mass communication. In so doing, the security communication itself will be understood as protection and rescue tool. Furthermore, security communication is well-suited to proactively strengthen self-organisation and restructuring processes and to promote civil stability in the face of a crisis. The development of dynamic crisis models and anticipatory intervention strategies ultimately represents a basic foundation of preventive, proactive and reactive communication measures to protect and rescue people.

Project title

Communication for Security: Preventive, proactive and reactive strategies for communications support in security and rescue operations (SiKomm)

Duration

1 February 2009 – 31 January 2012

Project management

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Communication between emergency forces (source: private)

SOGRO

Immediate rescue in a large-scale accident with mass casualties

Motivation

In a mass casualty incident (MCI), the medical condition of each patient is still recorded on a so called triage tag, which remains attached to the injured person. These data are often incomplete,



Aerial view: Frankfurt airport as scene of SOGRO (source: Fraport AG)

and the number of victims – classified according to their injury category (red, yellow, green) – is always based on estimates. This impairs the accuracy and speed with which hospitals and rescue resources are pre-warned during large-scale emergencies: the emergency forces involved lag behind the ongoing course of events.

From an emergency medical care perspective, only part of the information on the tags is actually necessary for treating the patients. Transmitting the required basic information to those involved – including the command and control centre, rescue services and hospitals – immediately after the event, would significantly improve patient care.

Scenario

The Frankfurt airport is the setting for the scenario: an airplane crash with 500 casualties. In accordance with the alarm plans, an MCI 500 is declared. An emergency of this magnitude involves teams from outside the immediate region and units from throughout the German state of Hessen are called in. The airport's own rescue service will be the first to arrive on the scene to assess the situation. The first responders already start performing triage. This exercise no longer uses triage tags, but rather the new system (PDAs and coloured wristbands equipped with a chip-RFID tag). While additional rescue units arrive from Frankfurt and the surrounding area, the fire brigade starts to set up a technical command and control center at the accident site. This is where the number of injured, their status etc. are collected via the new form of data transmission. Above all, this information now helps emergency personnel provide faster medical care to the most seriously injured.



Example of electronic triage for rapid registration of victims during a mass casualty incident (source: SOGRO)

Project description and goals

The project aims to optimise the initial medical care of accident victims and to establish cross functional information networks among the organisations involved. This means ensuring the collection and processing of comprehensive situational and operational information for the command and control centres. How can this be achieved? The example scenario is the basis for developing a modified procedural model for rescue forces during mass casualty incidents (MCIs).

Triage tags will be replaced by coloured wristbands – which are in use already today by some emergency personnel. The special feature of these armbands is that they contain a recordable RFID chip. A special PDA is used to document the condition of the patient, including all treatment performed on the patient and along with the means of transport. All data are recorded on the chip and immediately forwarded to the responsible parties involved (command and control centres etc). A photo (face of patients) taken with the PDA is also used for later identification. This way, the system forms a seamless information chain that forwards all existing RFID information ranging from the start of triage right through to the patient's admission to the hospital. Information on current conditions at the site (bird's eye views) will be transmitted by so called drones (UAVs) as camera platforms.

Innovations and applications

Researchers expect to optimise initial medical care of accident victims primarily through the use of IT to register casualties and record their medical care electronically and through the use of transportation systems with traceability right through to hospital admission.

The automated medical information chain from accident site right through to the admitting hospital with minimal need for interaction by rescue forces will ensure faster, more timely medical care and logistics. The accompanying social scientific research regarding questions of acceptance, interfaces and legal issues such as data privacy, will help ensure the acceptance of the new technologies among patients and rescue forces.

Project title

Immediate rescue in a large-scale accident with mass casualties (SOGRO)

Duration

1 February 2009 – 31 January 2012

Project partners

- German Red Cross (DRK), Frankfurt/Main
- Siemens AG, Paderborn
- Andres Industries AG, Berlin
- Freiburg University, Freiburg im Breisgau
 - Institute for Sociology
 - Institute for Public Law
 - Institute for Economic Development Research
- Paderborn University, Computer Science and Mathematics, SIS C-Lab, Paderborn
- Stuttgart University, Institute for Aircraft Construction (IFB), Stuttgart
- Fraport AG, Frankfurt

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SoKNOS

Disaster management for the future

Motivation

Today's modern and open society is extremely complex and fragile. It must be protected against the consequences of natural disasters or accidents, for example. As such, the SoKNOS (Service-oriented architectures supporting public security networks) research project is aiming to use information technology to provide better support to emergency response organizations. The project focuses on large-scale emergencies or disasters, which generally require the operation of a command structure encompassing the fire department, police, or German Federal Agency for Technical Relief (THW). Precisely for such scenarios, SoKNOS is developing a platform that allows command structures to quickly communicate across organisations, effectively coordinate their actions, and anticipate changes.

Scenario

Through the combined efforts of users, research institutes, and industry, SoKNOS is addressing large-scale emergency scenarios that require the interaction of a wide range of information from the "Internet of Services". The project demonstrates how a disaster management command staff can use a digital map to maintain a fast and comprehensive overview of the situation in case of a flood (on the Rhine, for example). The digital system will be able to display damage reports, partial and total lists of resources, and command and communication structures.

Project description and goals

The service-oriented architectures being developed will be used, above all, during large-scale emergencies, such as massive floods, earthquakes, or forest fires. Catastrophes of this type require the deployment of command staffs to orchestrate the various actions of different rescue organisations. This



SoKNOS at CeBIT 2009: Networked operations – taking effective action to protect and rescue people (source: SAP AG)

project is using an innovative approach to integrate opportunities offered by today's information technology.

The SoKNOS platform can be used to call up different information and processing services via the Internet. These include, for example, digital maps, satellite images, and water levels, or information about public buildings and installations. In this way, the system will make it possible to collect and combine up-to-date information from different sources and systems. This will put command staffs in a position to efficiently form an accurate assessment of the situation, thereby reducing the time required for making decisions. This not only decreases response times but also increases the safety and success of the actions undertaken. At the same time, the system is being designed to simplify inter-organisational cooperation among those response teams involved. In this way, it can make a key contribution to public safety in Germany and has, in the long term, the potential to be applied globally.

Innovations and applications

The initial phase of a disaster is often marked by a flood of data, out of which the command staffs must identify the essential information and pass it along quickly to the specialists and decision-makers. Today this process is carried out largely by means of telephone, fax, and email. The aim here is to use semantic technologies to accelerate the classification and distribution of information and, with a reduction in the users' stress levels, to decrease the rate of error. Along with efficient information processing technologies, innovative application interfaces that are customisable to the specific organisation and user task are being developed. In this process, interactive methods for collaborative work on high-resolution and touch-sensitive wall displays are also being tested.

Further information:
<http://www.soknos.de>

Project title

Service-oriented architectures supporting public security networks (SoKNOS)

Note: This project is funded within the framework of the ICT 2020 research program.

Duration

1 June 2007 – 31 December 2009

Project partners

- B2M Software AG, Karlsruhe
- Berlin Fire Department
- Cologne Fire Department
- German Research Center for Artificial Intelligence, Saarbruecken
- DHI-WASY GmbH, Berlin
- ESRI Deutschland GmbH, Bonn
- Fraunhofer IESE, Kaiserslautern
- German Police University, Muenster
- itelligence AG, Bielefeld
- ontoprise GmbH, Karlsruhe
- SAP AG, SAP Research, Walldorf
- Fraunhofer IGD, Darmstadt
- Rutgers University (CIMIC), Newark / USA
- Technische Universitaet Darmstadt (KOM, TK)
- Technische Universitaet Dresden (GIS)
- Westfaelische Wilhelms-Universitaet Muenster (IfGI)

Associated partner

- German Federal Agency for Technical Relief (THW), Bonn

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SpeedUp

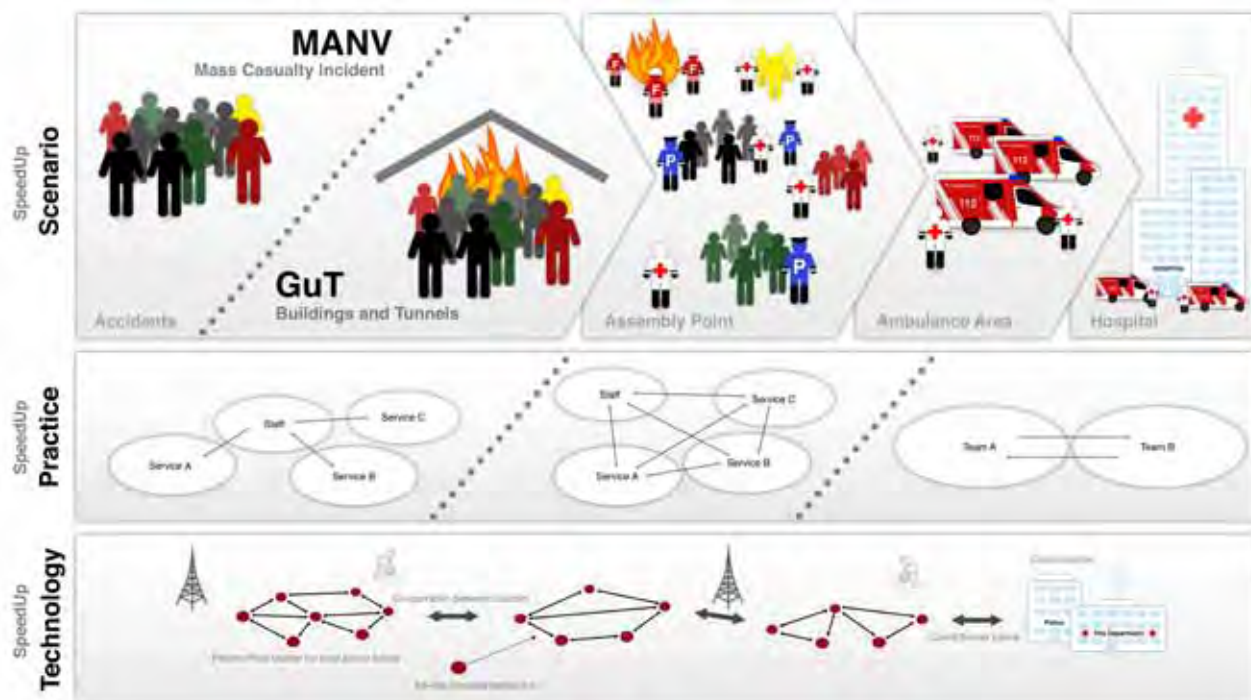
Investigation of mobile and self-organising communication and data platforms and of strategies for organisation and action in complex, large-scale situations

Motivation

In a variety of normally safe facets of everyday life (such as large-scale public events or the use of private or public transportation) or in situations with high risk potential – for example in civil engineering, underground construction and tunnel management, i.e. underground infrastructure – unpredictable events that endanger all concerned occur time and again. In such situations, law enforcement and emergency services are faced with an abundance of challenges. Emergency services focus on the rapid rescue and medical care of all persons involved in the accident. Simultaneously other authorities need to collect data to prevent additional risks and assure potential criminal proceedings.

Scenario

For the security forces and rescue workers engaged in a major operation, no integrative information and communication tool is available up until now. Today such coordination is carried out by personal consultation at the site, via official radio channels or by means of paper-based documentation. In the case of scenarios such as mass casualty incidents, however, personal consultations or the procurement and dispatch of documents are virtually impossible to manage. Processes are inefficient and precious time is lost as a result: factors that, in the worst case, raise the number of victims.



Combination and coordination of SpeedUp Scenario, SpeedUp Practice and SpeedUp Technology (source: Friedrich Schiller University Jena)

Project description and goals

The project combines two different access channels, which have also been divided into two separate work segments within the project: SpeedUp Practice and SpeedUp Technology. SpeedUp Practice focuses on the development of interaction and communication models for the emergency forces and on methods for structuring and describing the situation. This can then serve as a basis for assessing the situation and options and their impacts. At the same time, the results serve as specifications and a benchmark for the future technical implementation, the SpeedUp Technology. SpeedUp Technology as IT solution will be designed to support rescue workers in all required actions through additional information, processed sensor data and flexible communication structures. This will enable faster and higher quality action in a disaster and make it possible to save more lives.

Innovations and applications

The coordination of the emergency forces in large-scale operations will be supported by a mobile and largely self-organising technical system (IT framework). To this end, a communication and data platform for the coordination and networking of all emergency forces will be developed. The design of this software solution will enable it to integrate mobile platforms and local sensors as standard and within its architecture permit – on command – different communication and organisation structures to be set up and operated stably on a largely self-organising basis.

Project title

Investigation of mobile and self-organising communication and data platforms and of strategies for organisation and action in complex, large-scale situations (SpeedUp)

Duration

1 May 2009 – 30 April 2012

Project partners

- synchronity GmbH, Jena
- Rittal GmbH & Co. KG, Herborn
- Navimatix GmbH, Jena
- the agent factory GmbH, Jena
- Technische Universität München
 - Chair for Computer Aided Medical Procedures & Augmented Reality (Institut für Informatik)
 - Feuerwehr TUM
- Friedrich Schiller University Jena, Institute of Computer Science, Jena
 - Chair for Software Engineering
 - Heinz-Nixdorf Endowed Chair of Practical Computer Science
 - Artificial Intelligence Work Group
- Friedrich Schiller University Jena, School of Philosophy, Intercultural business communication, Jena

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SPIDER

Security-System for Public Institutions in Disastrous Emergency scenaRios



Cooperation between emergency rescue services and the fire brigade in the context of a large-scale emergency (source: German Red Cross / DRK-LV Berliner Rotes Kreuz e. V.)

Motivation

Coordination by government authorities of all aid and rescue measures in connection with a large-scale emergency represents a serious challenge whenever several hundred injured persons have to be given medical and psychological care. At the same time, the many organisations involved receive a huge amount of information that must also be managed. There are organisation-specific information systems, but the performance of the various institutions' systems together as a network is only marginal at best. Existing information systems from the field of facility management are also rarely available for use by emergency forces.

Scenario

A large-scale emergency in the context of a trade show is considered as a hypothetical scenario. An explosion has severely damaged part of a hall. At the time of the accident, approximately 2000 people are in the danger zone. In emergencies like this, a mass exodus is very likely to begin. Those involved will identify different escape routes, which will be used to varying degrees. The resulting imbalance in the use of the various escape routes can cause additional injuries that could have been avoided.

The static escape route guidance systems available in buildings today do not give sufficient consideration to the actual risk situation at the moment. The broad variety of information received by the organisations involved makes it even more difficult to assess the emergency situation, thereby slowing overarching decision-making processes.

Project description and goals

SPIDER aims to create a comprehensive emergency process management system that supports emergency forces before, during and after the rescue mission. The focus here is on the study of integration and federation concepts designed to fuse the individual systems of the organisations involved together with building automation within the context of technical facility management. Federating the individual systems implies that they can continue to operate alongside each other and that the information from the associated systems is displayed in a transparent manner in the users' "own" systems. This creates synergies above all with regard to dispatching the rescue resources and handling the emergency management process. Moreover, the aggregation of the data will also generate additional information that will make the individual systems far more useful.

Innovations and applications

The project focuses on the design and development of a new Protection and Rescue Markup Language (PRML), which will form the interface core of the federating middleware. This platform will enable all connected users to access a wide range of the partners' data and services via a standard interface. The special challenge in this context is to guarantee the privacy of data automatically when they are accessed. This can be accomplished by accumulation or anonymisation of the data, which are processes that do not restrict the content for the emergency forces to any significant degree. Moreover, a high reliability, high availability mobile communication network will be provided at the location. Real-time simulations will be added to the existing building intelligence systems, so that escapees can be offered escape routes that optimise safety and distance. Furthermore, emergency psychological care will also be incorporated as a sub-process in the scenario and considered in the overall concept.

Further information:

<http://www.spider-federation.org>

Project title

Security-System for Public Institutions in Disastrous Emergency scenarios (SPIDER)

Duration

1 March 2009 – 28 February 2012

Project partners

- German Red Cross (DRK), Headquarters, Berlin
- Dortmund Technical University:
 - Chair for Communication Networks
 - Institute for Psychology
- Duisburg-Essen University, Chair Physics of Transport and Traffic
- IMS Gesellschaft fuer Informations- und Managementsysteme mbH, Dinslaken
- PRO DV Software AG, Dortmund
- CKS Systeme GmbH & Co.KG – a Tyco International Company, Meppen
- North Rhine-Westphalia State Police, State Office for Central Police Services, Duisburg
- Gelsenkirchen Professional Fire Brigade
- Katholisches Klinikum Bochum gGmbH
- koelnmesse GmbH, Cologne

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VoTeKK

Preparation for terrorist attacks, crises and disasters: Web-based interdisciplinary information and training platform to prepare security and rescue forces, medical personnel and the general population for large-scale emergencies

Motivation

The demands placed on systems and organisations that protect the general population are constantly growing. The reasons for this include, among other things, circumstances altered by the threat of international terrorism and the increasing frequency and magnitude of mass public events and natural catastrophes. Crisis situations such as these present unique, often completely unprecedented challenges to those affected and to all actors with responsibility for crisis management and the protection and rescue of people.

With regard to effective interdisciplinary crisis management, both Germany's security and rescue forces and its general population suffer from widely acknowledged and scientifically proven deficits. Instruction and advanced training of all of the players concerned together with efficient interdisciplinary transfer of knowledge are essential for effective crisis management. For that reason, these topics are the focus of this project.

Scenario

This function begins with the identification of possible threats by terrorist attacks, crises and disasters and their impact on people and the society. In this context, all natural and man-made threats will be considered ("all hazards approach"). E-learning and virtual reality modules based on these scenarios will be offered to target groups via the Internet on an individualised basis.

Project description and goals

The aim of this project is to develop a platform to prepare security and rescue forces, doctors, caregivers and the general population for terrorist attacks, crises and disasters.

An online platform with a modular structure (employing teaching methods such as e learning, blended learning etc) will offer innovative and specialised instruction and advanced training to all



Mass casualty incident following a bus accident (source: German Red Cross / DRK Rettungsdienst Rhein-Sieg gGmbH)

users. In so doing, a broad spectrum of web-based learning forms will be developed as models and tested for illustrative purposes in a wide range of target groups, where their effectiveness and acceptance will be evaluated. At the same time, a variety of production processes used to generate e-learning modules will also be tested.



Inter-regional mass casualty incident scenario (source: German Red Cross / DRK Rettungsdienst Rhein-Sieg gGmbH)

Innovations and applications

Experts agree that the modern teaching methods and computer-based simulations mentioned here (such as virtual reality methods) are excellent tools to help train people efficiently to respond to events that cannot be planned, such as terrorist attacks and other catastrophes.

The use of these innovative methods and completely novel, user-friendly, web-based instruction and information modules is designed to address – to a heretofore unprecedented degree – all security and rescue forces concerned as well as the general population in particular. Ultimately this will significantly improve security and rescue operations in the event of terrorist attacks, crises and disasters.

Project title

Preparation for terrorist attacks, crises and disasters (VoTeKK)

Duration

1 June 2009 – 31 May 2012

Project partners

- Bonn University Hospital, Clinic for Orthopaedics and Trauma Surgery, Bonn
- die medialen GmbH, Bonn
- T-Systems Multimedia Solutions GmbH (MMS), Dresden
- University of Göttingen, Occupational and Social Medicine Department, Göttingen
- Robert Koch Institute (RKI), Berlin
- German Institute for Disaster Medicine, Stuttgart

Associated partners

- German Federal Office of Civil Protection and Disaster Assistance (BBK), Bonn
- Deutsche Gesellschaft für Unfallchirurgie e. V. (DGU), Berlin
- Bundesarbeitsgemeinschaft Notärzte in Deutschland e. V. (BAND), Berlin
- Arbeitsgemeinschaft in Nordrheinwestfalen arbeitender Notärzte e. V. (AGNNW), Gütersloh
- European Society for Trauma and Emergency Surgery (ESTES)
- Deutsche Gesellschaft für Katastrophenmedizin e. V. (DGKM), Kirchseeon
- German Interdisciplinary Federation for Intensive and Emergency Medicine (DIVI), Homburg/Saar

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GLOSSARY

Blended learning	Form of learning in which the methods of e-learning are combined with conventional live events.
e-learning (electronic learning)	Form of learning in which digital media are used to support communication.
Evacuation	The evacuation of people from transportation systems, buildings, locations or entire regions during an emergency or accident.
Large-scale emergency	An emergency that threatens or impairs the life and health of a large number of people, considerable material assets or infrastructure that is vital for the general population. Such large-scale emergencies can occur after events such as earthquakes, floods, fires or mass transportation accidents and usually result in a mass casualty incident (MCI).
LÜKEX	Acronym for <i>Länder-Übergreifende Krisenmanagement-Übung / EXercise</i> (German for 'crisis management exercise involving multiple German federal states'). This is the designation for a series of exercises in the area of national crisis management in Germany.
Markup language	Such a markup language serves to describe the data and, to some degree, the procedure required to process those data. In the present case, the conception and development of a novel markup language will lead to the networking of all systems involved.
Middleware	IT term that refers to application-neutral programmes which intercede between applications, thereby masking their complexity and their infrastructure. Middleware can also be understood as a distribution platform. In contrast to lower-level network services that handle simple communication between computers, middleware supports communication between processes.
Pandemic	The spreading of a disease (e.g. flu) across national borders and multiple continents. By contrast, an epidemic is restricted to a limited area.
RFID	Radio Frequency Identification, or RFID, is a wireless-based electronic process for marking and identifying goods, objects and people. An RFID system comprises the data carriers – these are the so-called RFID tags – an antenna and the reading device. These tags are small transponders that can be applied to objects and the data they contain can be read without physical or visual contact. Tags are used in materials management systems and in logistics, as well as in the field of personnel applications for access control or non-contact ticketing, for animal identification or in motor vehicles as an engine immobiliser system or for toll collection.
Topology	Surroundings and/or conditions surrounding buildings, towns or entire regions. During an evacuation, rescue forces must be able to adjust to constantly changing surrounding conditions – as a result of crowds, for example.

Triage / sorting

Decision on further treatment and/or treatment priority for injured people when personnel and material resources are scarce and a large number of people are injured or become ill all at once (major accident, large-scale emergency).

Virtual reality

Interactive environment generated by computers in real time, which offers a representation of physical reality. Virtual reality is increasingly used as a substitute for complex and particularly expensive test installations and simulations. The best-known application area for virtual reality is pilot training in flight simulators.

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