every user to be informed about everything necessary in the company and in his projects but also protects him from unnecessary information.

Creativity is supported by a Brainwriting component and the Morphological Box. The Brainwriting component allows integrated synchronous and asynchronous creativity sessions, which can be restricted so only team members can deliver their input, but also be open for the whole enterprise to participate. This ‘open innovation’ part opens a much bigger pool of creative people what raises the probability to get real innovative ideas and pushes the technology leadership.

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EMRAgis – Analytical Risk Assessment Tool for Community Risk Reduction

Stephan Mann, Christoph Gurath, Sebastian Stahn, Richard Gülde

University of Applied Science Magdeburg-Stendal,
Otto-von-Guericke University Magdeburg
Safety and Hazard Defense

39106 Magdeburg
info@emragis.de

Abstract: EMRAgis is a modern risk assessment tool. It is developed as an innovative fire prevention strategy for "Community risk reduction" (CCR) in Germany. The primary objective is to deal the assessment of personnel and material requirements of the local fire services based on reproducible empirical mathematical algorithm. These algorithms quantify the risk in a municipal area of discretion and deriving the demand of fire services. Therefore empirical approaches and efficiency investigations describe necessary measures. Simulations with geo-information systems of the improved measure allow quantified evidences of their efficiency for the local fire protection value. This new level of risk assessment needs a wide data collection. For an effective data handling a flexible and high-performance web-application had to be developed.

1 Introduction

1.1 Need of new kind of risk assessment

In the next few years German cities and communities will have more difficulties to solve problems with their assigned tasks. The last published report about the capability of the common fire services shows that the quantity of volunteer members decreased in the last ten years about 14%. Furthermore 96% of all fire services in the state of Saxony-Anhalt are not ready for action on workdays [LSA13]. As the local fire prevention authorities they are obliged by law so set up and retain a functional and public fire service corresponding with the fire protection requirement plan [LSN12]. With the increasing scarcity of funds and the simultaneous demographic change it is an almost insoluble task to gain the socially required security level within the community. In the previous system for creating a fire protection requirement plan functionaries of the fire services were able to have some influence on the plan with their general knowledge and years of

experience. The purpose was to clarify the structural alignment of the fire defense to the political representatives. By the ongoing realignment within the municipal administration and the growing pressure for financial savings potential more and more fire services are confronted with the demand for profitability and a more functional deployment. Furthermore the delivery of engines for the fire services in different German states is based on a fire risk analysis. If the analysis would not be accepted of the administration no delivery is possible [LSA11].

In addition to volunteer fire services and those with full-time fire fighters are affected and professional fire services who are in regions with falling population and a lack of economic growth. For those cities and municipalities it is not just a problem to maintain the necessary infrastructure for firefighting but also to handle the apparently immoderate number of staff and connected with that the labor cost. Fire services see themselves now compulsorily to justify their plans and their deployment, which are hard to implement because of a lack of methodical rudiments while planning a fire protection requirements plan.

With the constraint for savings the municipality has to pay attention to the functionality of fire prevention measures. That raises the question, if fire services are the financial ruin of a municipality or if they are a chance for economic growth because of an existing security level demanded by society.

In this predicted financial area of tension between fire services and politics started 2010 the special service for fire brigades Pirna as a leading role for Saxony. Together with students with the major „Safety and Hazard Defense“ from the Otto-von-Guericke university Magdeburg and the University of Applied Science Magdeburg-Stendal arose a pilot scheme for developing a forward-looking method for fire protection requirement plans. In the 2 years duration of this scheme and cooperation with the Institute of Fire Services Saxony-Anhalt (IdF LSA) and the Fraunhofer Institute for traffic and infrastructure systems (IVI) was the model EMRAgis developed. The abbreviation EMRAgis stands for empirical mathematical risk analysis for cities and municipalities – geographic information system. Due to this empirical mathematical method in a community based risk analysis and a replicable logic it is possible to make a statement about the necessary demand for operational technology and personnel. Together with the density ratio of the risk within the municipality, that was ascertained based on analytical gathering, it is possible to optimize the vehicle deployment and the necessary personnel. Thus the best safety level in a municipality is achieved with the lowest cost.

Furthermore, there are important intercepts who allow a regional assistance of operational technology for bordering municipalities. As a result there is a regional capability of fire service appropriate plannable taking into account personnel and economic aspects. At the same time does the travel time analysis has the same importance as the systematic integration of the latest scientific perceptions in the field of fire prevention and demographic change.

1.2 Project group

The project group consists of four students, studying safety and hazard defense in the last bachelor term. The course of studies aims to train executive managers for the civil protection as well as safety engineers for industry. Thus, all members of the project group are active firefighters and research on the theme of risk assessment and fire prevention requirements since three years. During this time, a large network of collaborations has been created, for instance with the fire research center in the town of Heyrothsberge or with the Fraunhofer institute of traffic- and infrastructure systems in the town of Dresden.

2 Demands on the software support

2.1 Preliminary considerations

The new method for risk analysis, the so called EMRA model, was developed for the fire protection requirement plan Pirna (Saxony, district Saxon Switzerland-East Erzgebirge). With the ambition to raise the capability of fire protection in Pirna and the problem of unavailable personnel during weekdays or bad accessibility of certain districts within response time [PIR05]. Therefore the project group determined requirements for the new fire protection requirements plan.After a critical literature research the project group was certain that the risk analysis by Prof. R. Grabski from the Institute of Fire Services Saxony-Anhalt [GP07] fits best for determining the equipment for fire services in Pirna.

This risk analysis of the Institute of Fire Services Saxony-Anhalt is based on the classification of buildings. That means that all buildings have to be known by address and some additional information. The emerging amount of data sets was the first sign for the project group to use a software based acquisition.To solve the second problem of Pirna, the unavailability of personnel, was no usable model known. Therefore the project group developed her own personnel analysis. This asks personal data of the staff of fire services from Pirna. Among details about place of residence, job location and the fire service training was the query of availability for different times of day given priority to.With reference to a total strength of the fire department Pirna of 140 fire fighters was it unavailable to use a software based acquisition and evaluation as well. The following figure shows the necessity of a software assisted method for a risk analysis for Pirna.

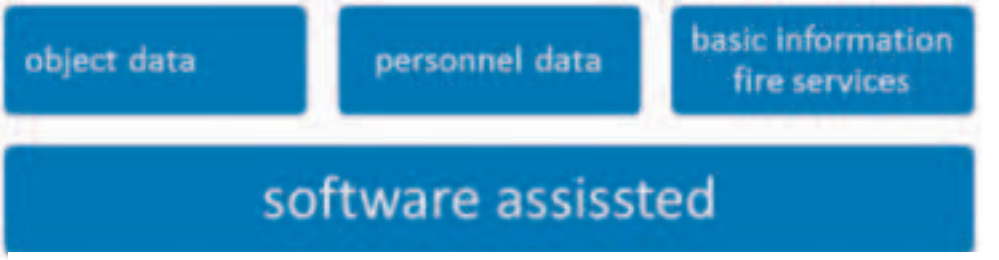

Figure 1: Necissity of software assistance

For an estimation of the amount of data were this assumption made:

- 42 information per staff member
- 15 information per object
- 5 basic data per fire department

With this estimation was certain, that not just a software assisted acquisition was needed but also a software assisted data evaluation.

2.2 Definition of requirements

The main demand at the data acquistion was the unlimited practicability of the data input by the personnel on site in Pirna. In other words the use by users without profound knowlegde in using computer and without knowlegde of databases. The data input had to be clear and lucid for the user. For the acquisition of the analysis was also a requirement that the underlying algorithm is allready carried out in the gathering of the programm in order to ensure the accuraccy of the analysis. Even a secure performance of the software was provided.

Finally a software for data processing had to be used. Either one that allready existed in the software pool of the fire department Pirna or one that could be used with the existing computersystems without additional costs.

The figure shows the requirements on the data- management- system.

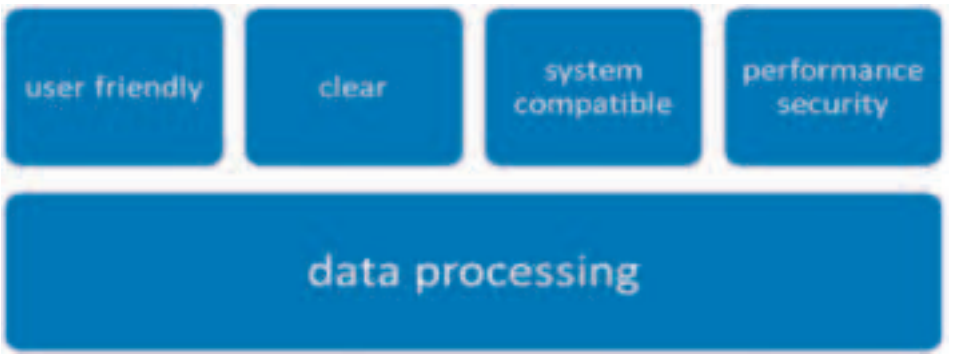

Figure 2: data management system

With the completion of the development of the EMRA model by the end of 2012 the requirements of the data acquisition and analysis had to be extended. The project group was able to verify the EMRA model with other municipalities in Saxony and discussed

improvements especially in data processing. In addition the working title EMRAgis arose.

Especially to perform data acquisition with tablet PCs or smartphones and also to examine the data while acquisition on site and to identify errors, new requirements arose, they are shown in figure 3:

- Functioning independent of operation system
- Functioning as a web application

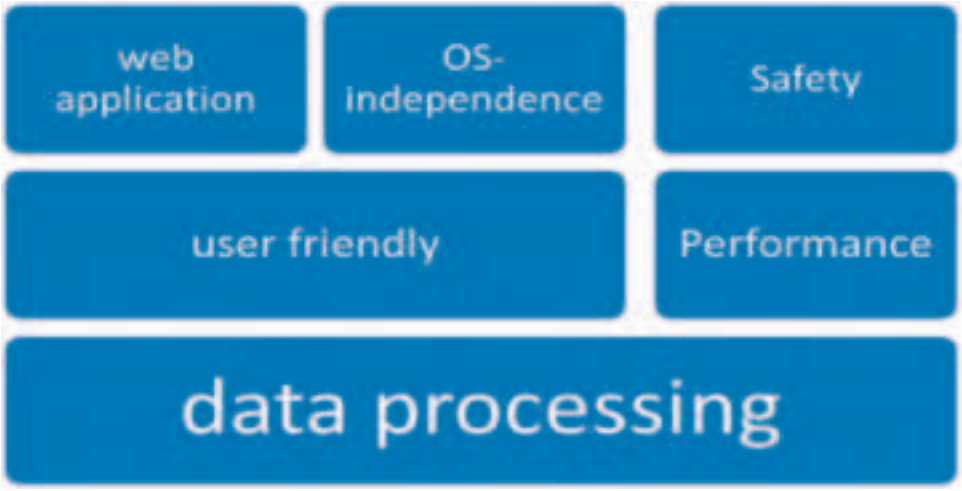

Figure 3: advanced repuirements on the data management system

It should be possible to perform data input with a large number of devices online and offline and there should always be the possebility that the project group can access the data. The requirements allready existing in figure 2 must apply. In summary figure 3 represents the increased demands on the software support for the EMRA model.

3. Implementation of the data processing software

3.1 First step: MS Access

The members of the project group EMRAgis have received a thorough and broad engineering education during their studies, but an in-depth training in computer science is not part of the studies. Thus it was clear to them that they need external help for the software implementation.

The first database application was implemented by a student from Pirna using the software MS Access. Both the personnel acquisition and the object acquisition have been implemented with the database management system. The personnel acquisition was a simple query of personal information without logic operation. The resulting query form included either a text or a yes/no decission.

For the form of the object acquisition was the use of different logic operations between the data input necessary to be able to perform calculations. Depending on the selection of the kind of object and the assignment of a risk level the database application calculates an object specific risk. The necessary data such as kind of object and the degree of danger were determinded by the Institute of Fire Services Saxony-Anhalt and can be imagined as a catalogue [GP07]. To this catalogue of objects will the building on site then be assigned.

The first step in the data base application with MS Acces made the implementation of the EMRA modul in Pirna possible and was a vital basis for the large acceptance of this method in the fire protection requirements plan. However the data analysis was not possible with this simple form and had to be carried out manually.

This major disadvantage and the lack of knowledge of the project group in working with MS Access were the reasons to find other database applications, especially with relation to the requirements in figure3.

3.2 Second step: Python-Tool django

With dedicated support of the Center of Digital Engineering (CDE) of the Otto-von-Guericke university Magdeburg the project group implemented their demands for a database since october 2011 with the Python web framework Django. Both the requirements for the database application (especially the possibility to use it online and the independence of an operations system) and the appropriate performance parameters (object-relational mapper, automatic-admin interface, DRY-principle...) from Django were decisive for this kind of implementation. Based on experience with MS Access it was important for the project group to learn and understand the programming itself (none of the project group members knew a relevant programming language).

The implementation of the personnel acquisition and the object acquisition could be realised with the in Django existing object-relational mapper. The production ready automatic admin interface allows an immediate representation and self-control of programming performance. The stringent realisation of the DRY-principle promotes a traceable source. The existing admin interface and the authentification system enabled the project group to concentrate on the permutation of the context from the beginning without having to create a user interface.After an intensive course in programming of Python, in auxilliary service by the CDE, was the project group able to realise the

personnel acquisition and the object acquisition in Django within one year and achieved the standard of the MS Access forms. In additon the evaluation of the object data could, corresponding with the algorithm of the Institue of Fire Services Saxony-Anhalt, be realised and parts of the personnel evaluation. Within a print ready template the results of the risk analysis from the EMRA model can now be displayed directly without manual evaluation.With the Python web framework the demands of the project group for a database application were fulfilled very well. Especially the operational system independence by the function of the frameworks in any internet browser and associated with that with tablet PCs and smartphones are very crucial for further developments for EMRAgis.

The aim of the project group to create an all-embracing software based application for fire protection requirements plans is possible with Django and in basic approaches realised. In the future the application will be provided online with Microsoft Azure (easy realisation with MS Visual Studio), to make the on site collected data immediately available for the project group. Thus and on site support for the user and a quality control of the gathering can be achieved. Furthermore a geographic information system will be integrated. For this Django provides ready modules.

To sum it up, the Python web framework implements the demand of the project group for a fire protection requirement plan very well and this is the reason for a large positive response to the EMRAgis model of expert groups from fire services and local and state administration.

4 Results

“Community risk reduction“ (CRR) as a fire prevention strategy has existed in Germany for a long time. But there´s one aspect of CRR that we continue to struggle with, and it affects all the other aspects of this strategy: Prospective we must be able to accurately identify what´s at risk before developing or purchasing prevention programs intended to mitigate that risk. These processes require suitable and forward-looking solutions, which consider economic trends and demographic changes. Past practices are characterized by qualitative evidences and subjective grades with justifiability statements in the face of politicians.

Performing a risk assessment tool like “EMRAgis” can be as simple as asking firefighters where they most frequently respond, because what we´ve faced in the past is what we´ll likely face in the future – and so we should be doing something proactive to prevent it. Based on calculus estimates, “EMRAgis” can objectively and conclusively differentiate between the risks in various places in your community. One area may respond frequently to assisted-living centers, while another may have industrial property to protect. Transferring this system in a web-based information system enables “EMRAgis” to safeguard fire prevention with respect to structurally weak areas. In this way the efficiency of fire prevention will be improved and with scientific statements

underpinned. Furthermore supply crunches can be identified and pointedly supported with necessary resources.

All in one EMRAgis allows us to better target the most at-risk citizens and reaching a high level of quality in CRR. In addition it helps to establish locational advantages for a seismic shift in fire prevention. That's why we should investigate EMRAgis further.

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Translation: Ulrike Arsand, student of safety and hazard defense