Digitally optimised route planning for security companies

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Improved route planning for armoured vehicles and security companies with mathematic and heuristic methods. Credit: Oberthur Cash Protection

Security and temporal efficiency of security personnel are the focus of a current Austrian Science Fund FWF research project. And here, the journey is the reward: improved route planning for armoured vehicles and security companies. In particular, the project is aimed at reducing travel times while simultaneously avoiding predictable driving routes. A key component in the project is a novel analysis method for modelling such routes: it combines mathematic and heuristic methods to achieve optimum results. This decision-supporting tool will offer security companies not only cost savings, but also improved protection for the transport of valuable goods and VIPs, as well as for staff.

Protecting important people and valuable goods is a sensitive domain and a big business. In 2016 alone, several billion dollars will flow into the services of private security firms, and the trend is increasing. Employees tasked with transporting valuable goods and protecting people are expected to use routes that criminals can't predict, and at the same time, to follow the shortest paths to ensure the greatest efficiency in terms of time and cost. This makes route planning for security services a logistical challenge. A recently launched FWF-sponsored project now aims to create a computer-based system to master this challenge in the best way possible.

A "matheuristic" powerhouse

The project team working with Prof. Karl Dörner at the Department of Business Administration of the University of Vienna is developing an innovative analysis procedure for modelling complex route planning problems on a digital drawing board. This procedure uses heuristic methods that can quickly calculate good solutions with limited information, and that can be combined with exact algorithms for the final optimising touch: "Our hybrid approach, SANSERO, first combines a special calculation method – set partitioning – with a metasearch method. Afterwards, this approach is combined with what is

known as path relinking to solve multi-objective problems. Further calculations then make it possible to compare and evaluate the results", says Prof. Dörner.

Routes without routines

In a computer-based system, this hybrid approach can be used to produce minimal driving times and, simultaneously, the most heterogeneous routes possible. These are defined by the avoidance of predictable patterns. In this way, certain routes are not repeated at all, if possible, or a discernible periodicity of the repetitions is avoided. These are important criteria, particularly for applications in the field of security: "For example, different buildings must be checked at periodic intervals, and the check times and routes must always be different in order to reduce the risk of an incident", says Prof. Dörner. Tasks involving so-called mobile routing components, where the security personnel and/or the objects or individuals to be guarded are mobile, are particularly complex to model. The SANSERO approach now makes it possible to model precisely these problem situations. A cash transporter, for instance, can avoid predictable routes and routines without forgoing the shortest possible route, thus reducing the risk of a robbery. This protects both the transported goods and the transport staff, saves personnel and fleet costs, and safeguards the environment by reducing fuel consumption and traffic volume.

To further improve the practical suitability of the system, there are also plans to create possibilities to incorporate calculations for additional ad hoc personnel requirements, for instance due to unforeseen events. Real-time data and the hands-on know-how of industry partner ÖWD Österreichischer Wachdienst security GmbH & Co KG constitute further important input for the planned test runs.

This practise-oriented basic research at the University of Vienna, with

the support of the Austrian Science Fund FWF, will allow this system to be developed into a comprehensive decision-supporting planning tool for the security industry. The acquired data will thus also pave the way for exploiting their potential for commercial applications. In this way, scientific achievements will soon contribute to optimising not only business costs, but also the safety of individuals in security professions.

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