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Intelligent TriCity The role of the Gdansk Science and Technology Park (Poland) in the creation of technologies that influence the development of cities

PARALLEL 1
Parks and cities - Intelligent systems and infrastructures

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Intelligent Cities

"The role of the Gdansk Science and Technology Park (Poland) in the creation of technologies that influence the development of cities"

IASP 2013 - Brazil

Poland is a country of modernity and innovation. By building Science and Technology Parks and developing cooperation within the "golden triangle" (i.e. business, science and local government) we are able to make breakthroughs in agglomeration management and safety technologies. The Gdansk Science and Technology Park provides patronage over several crucial system projects which will soon support the economy.

Intelligent cities

A key factor in the development of intelligent cities is a well-planned and implemented development strategy of cities and regions. A well-developed and consistently implemented plan contributes to economic development of cities and directly determines the fulfillment of the material foundations of the residents' lives. A modern and dynamic economy and enterprising residents are a basis for building the potential of urban agglomerations.

The city of Gdansk, where the Gdansk Science and Technology Park is located, with its 1,000 years of history, its coastal location, and its potential, is an important European city in the Baltic Sea region. Since the 1990's, Gdansk and its regions have experienced dynamic economic growth. In the Pomeranian Province there are over 225,000 companies, to include about 60,000 in Gdansk. For years, Gdansk has been one of the most attractive provincial capitals in Poland for investments and the leading city in rankings of labor market quality thanks to the high level of education of its residents. There are 21 higher education institutions in Gdansk, with nearly 64 thousand students.

In its strategy until 2015, Gdansk puts a major accent on supporting the development of an advanced economy by stimulating the growth of small and medium-sized companies, supporting the development of advanced technologies, and promoting innovation that enables the growth of knowledge-based economy. In the implementation of the strategy, Gdansk is assisted by the Marshall's Office of the Pomeranian Province, the Pomerania Development Agency, the Gdansk University of Technology, the Gdansk University, the Medical University of Gdansk, as well as the Pomeranian Special Economic Zone which is the owner of the Gdansk Science and Technology Park.

The strategy leads to an increase of the importance of the city as a partner in the development of advanced technologies.

The main objective in the creation of the Professor Hilary Koprowski Gdansk Science and Technology Park (GSTP) was to provide opportunities for development of creative ideas and revenue-bringing projects performed to the advantage of such beneficiaries as cities. We are a center that supports entrepreneurship, activity, development, and creativity. The GSTP's facilities include special biotechnological, pharmaceutical, and medical laboratories, office and technology buildings, a data center server room, a conference and training center, an educational park (EduPark), and an

educational kindergarten (EduPrzedszkole). The GSTP's building are systematically upgraded and comprehensively furnished. The GSTP offers modern technological and manufacturing as well as technological and office premises equipped with ICT systems.

Our work has resulted in the formation of 89 companies, which employ about 800 persons at the Park and work on projects that encompass, among others, construction of Intelligent Cities.

The present article presents three technologies developed in cooperation with the Gdansk Science and Technology Park and related to modern and safe cities:

1. **Tristar** - an intelligent traffic control system that may revolutionize the way people move in urban agglomerations. The core of the system is a central computer connected to control centers that will control traffic lights and the movement of public transport vehicles.
2. **SMARTLAMP** - an intelligent electronic ignition system intended for high-pressure sodium and metal-halide discharge lamps that saves even as much as 50% of consumed energy, significantly lowers the cost of maintenance of lighting infrastructure, and enables its flexible management.
3. **Crisis response simulation system for the police -** a state-of-the art system for training commanders of police operations related to security of various mass events (concerts, football games, etc.), demonstrations, gatherings, and other extraordinary situations taking place in particular in large urban agglomerations. The simulation system can be adopted to meet the needs of other agencies responsible for security of residents and public order (fire brigade, medical services, urban crisis management centers).

TRISTAR – ITS for the TRI-CITY agglomeration in Poland

Gdynia, Sopot, and Gdańsk are three Polish cities located very close to one another at the Baltic Sea coast. They form an agglomeration referred to as Tri-City with the total surface area of 415 km^2 and a population of 750,000 inhabitants. The Tri-City has nearly 1,400 km of roads, 300 signalized intersections and over 2,000 daytime public transport lines (buses, trams, trolleybuses, and trains). The Tri-City faces transport-related problems that are typical for large agglomerations. Public transport mode share has decreased in the recent years and the share of cars has increased. Currently, the modal split in non-pedestrian travel is 50%/50% and the car ownership rate is approx. 500 cars/1,000 inhabitants. Each city has its own administration, to include road management administration and, therefore, cooperation in such a complex area as traffic management is a real challenge.

The road system of the Tri-City is characterized by the insufficient number of roads connecting the cities of the agglomeration, which is due to the topography of the area. Gdańsk, Sopot, and Gdynia are connected with the Diametral Route (most often with a 2x2 cross-section) running through the centers of the cities and with the bypass, situated at distance the outskirts of urban areas, namely the S6 expressway. An additional load on the road network are trucks– which service the large sea ports located in Gdańsk and Gdynia.

Diagram of the Tri-City's road system. The S6 expressway is shown in yellow.

The fast increase in the number of vehicles in cities cannot be accompanied by an equally fast development of the road network. Consequently, an increase in the number of traffic interferences, occurring at peak hours and randomly (traffic incidents, breakdowns), is inevitable. In order to prevent or at least mitigate these negative phenomena, many cities worldwide have been introducing Intelligent Transport Systems (ITS), especially traffic management systems.

At present, the Tri-City does not have any means or mechanisms for real time traffic management. Traffic management is effected by appropriate city agencies and the Police within their authority and by way of administrative actions. All those factors have lead to the fact that the need to implement ITS in the Tri-City has been evident for a long time.

The conceptual work on the architecture of the TRISTAR integrated traffic management system (TRISTAR is an acronym meaning Tri-City Intelligent Agglomeration Transport System) started in 2002 at the Gdańsk University of Technology. Since then, concepts of an integrated system, encompassing the Tri-City Bypass and the three cities: Gdynia, Sopot, and Gdańsk, have been developed. In 2006, the presidents of Gdynia, Sopot, and Gdańsk signed an agreement concerning joint efforts to prepare an application for financing of the system from European Union funds. Based on this understanding, in 2007, a document entitled "Concept of an Integrated Traffic Management System in Gdańsk, Gdynia, and Sopot" was prepared. Its authors were experts from the Gdańsk

University of Technology and the Civil Engineering Development Foundation, including the authors of the present article.

In the same year, a demo project was implemented in Gdynia along Morska Street, over the distance of 3.6 km which included 9 signalized intersections. As a part of the project, the SCATS system[1] and the RAPID[2] system were installed; these systems are the initial elements of a priority system for public transport vehicles.

The results of the demo project were encouraging because implementation of the SCATS system improved the traffic conditions on the Morska Street despite a small increase in traffic. Improvement was noticed in travel time both by car (a reduction by 12%) and, to a greater extent, by public transport (a reduction by 18.5%). In the 4 years prior to the demo project, the share of public transport travel in non-pedestrian travel decreased by 4.3%. Despite this downward trend, after the system was implemented, the number of passengers in the demo project area increased by 6%.

The results enabled to define realistic objectives for the construction of the TRISTAR traffic management project in the Tri-City. The objectives are: to improve the traffic conditions by providing traffic management tools and increasing the share of travel by public transport by improving its competitiveness thanks to the use of ITS technologies.

The TRISTAR system will support the Traffic Authority and the Public Transport Authority in achieving optimum use of road infrastructure, improved traffic safety, and reduced negative environmental impact of traffic.

Due to jurisdiction constraints, it was also decided that actually that actually two parts of the system will be created: one for Gdynia and one for Gdańsk and Sopot, based on the same architecture and technology (software and hardware) with the maximum number of shared elements. The shared elements include the GIS map, a website with information on traffic conditions and public transport, with a journey planner functionality, and a traffic data mart. As part of the ongoing investment , two Traffic Management Centers (first in Gdansk, second in Gdynia) have been put into operation. In case of failure of one of the Traffic Management Centers, the second one will be able to take over the task of traffic management in the area of the Tri-City..

The preparations to announce the tender for the construction of the TRISTAR system were accompanied by very important activities aimed to obtain financing of the system from the European Union Regional Development Fund and preparations of the building documentation. Availability of European funds was one of the key factors in the decision to build the system, as it would enable reimbursement of 85% of the qualified costs. The financing will be available provided that the assumed results are achieved. After the TRISTAR system is started, the overall travel time for all vehicles is to be reduced by 5.5% and the overall travel time for public transport is to be reduced by 6.5%.

Poland's biggest cities are currently implementing many complex ITS systems with extensive functionalities which budgets often exceed 20 million euro. They are encouraged to implement such projects by the very attractive financing from EU funds and the lack of such comprehensive systems in Polish cities.

Ii is s also worth mentioning that experts are now arguing over rapid versus gradual (in a series of tenders) introduction of ITS systems. An analysis of systems built in Poland leads to the conclusion that all cities, with the exception of Kraków, have decided to take one large first step. So far, no advantages of Kraków over other cities have been observed. Currently, no Polish city has a professional ITS architecture. Also, there is no nation-wide ITS architecture.

In the case of the TRISTAR system, a unique method was selected: the works would be divided into two parts, namely construction works and other works (IT and ITS), and performed

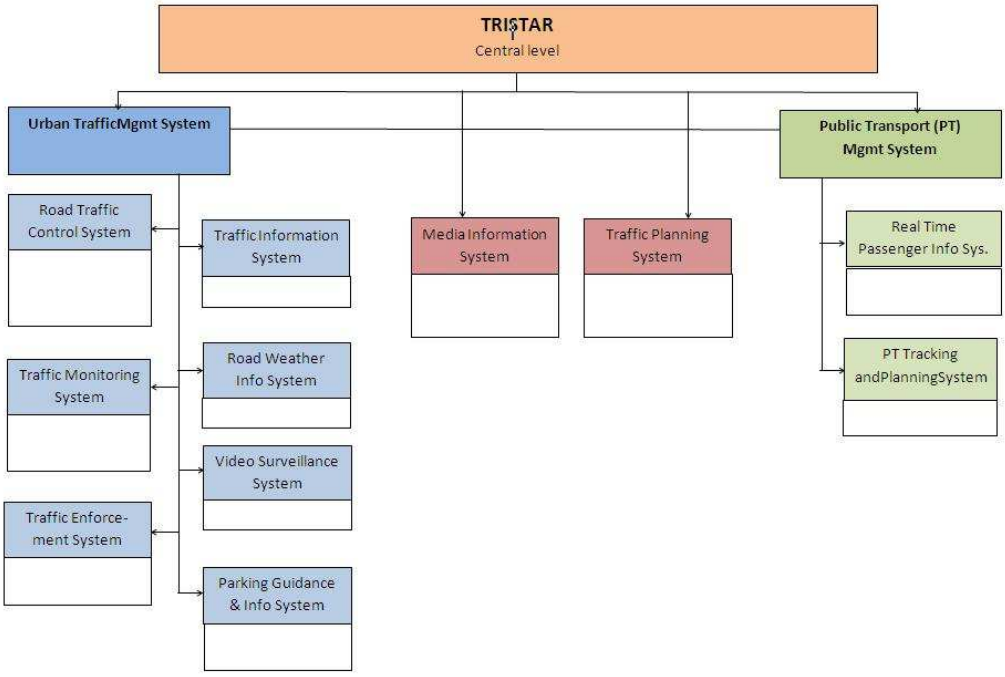
[1] The SCATS is a traffic management system delivered by Roads and Maritime Services from Australia.
[2] The RAPID is a public transport management system delivered by Sigtec from Australia.

under different types of contracts. The construction part would be performed under a "design-bid-build" contract and the IT and ITS part - under a "design and build" contract."

Building designs would be prepared for such works as construction of intersection infrastructure, ITC duct systems, and power supply systems. The building permit procedure takes several months and requires prior preparation of a design containing all the relevant decisions, opinionsand approvals. Finished building designs enabled a detailed pricing of the scope of works covered by the TRISTAR tender procedure. The design documentation is very extensive: it comprises over 9,200 single designs and its volume is nearly 20 m^3. Work on the documentation started in the second half of 2009 and ended in 2010. In August 2011 an unlimited tender was announced for the implementation of the TRISTAR Integrated Traffic Management System. Participants in the tender procedure had to meet the requirement to have adequate ITS experience. Price was the only criterion for evaluation of the bids.

A separate tender was conducted to select the Owner's Representative; the winner was the Polish branch of the Dutch company GRONTMIJ.

The terms of reference used in the tender contained a description of the structure of the TRISTAR system. It was shown in a diagram together with the infrastructure.



The bidders submitted nearly 500 questions concerning the tender documentation. The bids were submitted by 7 companies, mostly Polish ones. The cheapest bid, with the bid price of 134 million zlotys (approx. 30 million euro) was submitted by QUMAK S.A., a Polish ICT integrator. In February 2012, the authorities of Gdańsk, Sopot, and Gdynia, represented by the Gdynia Municipal Office, signed a contract for the implementation of the TRISTAR system with QUMAK S.A. The works are to be completed by mid-2014. This is the largest ever joint project of the three cities and currently the largest ITS system ever built in Poland.

QUMAK had had no experience in ITS but in the last 20 years has built various ICT systems, both comprising construction components, and could use the knowledge of its subcontractors.

Soon after the contract was signed, the managers of QUMAK decided to open a branch in Gdańsk and selected the Gdańsk Science and Technology Park for its location. At present, the branch employs about 30 experts in different fields. The largest group are designers, including traffic engineering designers. The Gdańsk branch is supported by QUMAK's experts working in other branches of the company. QUMAK has several key subcontractors. These are: GEVAS (Germany), GMV (Spain), Bosch (Germany), MSR Traffic (a leading Polish manufacturer of traffic lights controllers and software for such controllers), ELDO and ZUIR, local companies performing construction and erection works.

One of the requirements defined in the tender for the first time in Poland, was that the contractor prepares planning traffic signal systems and a traffic microsimulation using special software, that is also included in the scope of the contract. QUMAK decided to supply the Crossig (GEVAS) and VISSIM (PTV) software. The software package for traffic microsimulation and traffic modeling is VISUM (PTV).

GEVAS is the supplier of traffic management software and not a controller manufacturer. Consequently, the company does not compete with manufacturers of traffic lights controllers. As a result, the process of implementation of the GEVAS software in controllers is simple and takes about 2 weeks. The implementation consists of moving into the controller operating system environment the so-called TRENDS Kernel. This guarantees that a potential future expansion of the TRISTAR system by adding new controllers will be possible using a competitive tender procedure.

The TRENDS Kernel enables embedding in the controller a local *Entire Priority Intersection Control System* (EPICS). The EPICS system collects traffic data from inductive loops at intersections. On the other hand, the *Balancing Adaptive Network Control Method* (BALANCE) system ensures optimum operation of controllers in groups (control areas). The BALANCE system uses a traffic model, e.g. from the VISUM software, or the integrated DRIVERS and optimizing algorithms. It is possible to change the target functions in the optimization performed by the BALANCE system. The following factors can be considered: the vehicle waiting time/the number of vehicle stops/the length of vehicle lines waiting for the green light. Different weights can be assigned to particular factors. The BALANCE system communicates with the traffic lights controllers through a control module. The BALANCE, as a network system, assumes the task of overriding coordination of traffic control. The EPICS system is responsible for local optimization of traffic at intersections, including handling the public transport priorities. This way, regardless of the traffic intensity, the control functions are implemented within seconds and the system can quickly respond to changes in the traffic conditions.

The TRISTAR system will be based in most cases on existing traffic lights controllers with special additional equipment enabling their use in the system and implementation of the public transport vehicles' priority.

The communication protocol between the controller and the central system working at the Traffic Management Center is the OTS2[3]. Another communication protocol that can be used is the OCIT[4].

The GMS is a supplier of public transport management software. All public transport vehicles will be provided with on-board units (OBU), each with a GPS receiver, a GSM/GPRS modem, and a short range radio for direct communication with traffic lights controllers. The public transport schedules are imported from the BUSMAN software, which is popular in Poland[5]. In the past, Gdańsk purchased from the GMV a public transport management system with vehicle tracking and route planning support functionalities. In the TRISTAR system project, the GMV software will be updated

[3] http://www.opentrafficsystems.org/
[4] http://www.ocit.org/
[5] The BUSMAN software is developed by a Polish company, AGC.

and its functionalities will be expanded. Also, there will be more electronic displays at stops, which will provide information on estimated departure time.

Bosch is the supplier of PTZ cameras and operator's consoles for cameras, as well as equipment for video storage.

The computer system needed for performance of the various tasks is built using the Blade technology. The TRISTAR system's servers are ten CPU's of high processing capacity, installed symmetrically in two Blade chassis. The reliability of the information technology system is ensured by using redundant equipment and mechanisms that guarantee high availability. The database systems (Oracle and MS SQL) have their own high-availability mechanisms. All other applications use virtual mechanisms based on VMware vSphere that ensure correct operation of the system in the event of shutdown of one Blade module. The use of a virtualization platform that enables starting practically any number of virtual machines facilitates integration of systems provided by different vendors by rendering a virtual machine for each system.

The TRISTAR system is currently in the implementation phase. So far, the Traffic Management Centers in Gdańsk and Gdynia have been commissioned; they are equipped with servers, video walls, furniture, and other elements. The traffic control system now covers over 20 signalized intersections. Works on the pipeline network for fiber optics and local network nodes are in progress.

Operation room in the Traffic Management Center in Gdańsk

Traffic signal controller cabinet and network equipment cabinet with proper supply section are typical elements of the system installed at each intersection covered by the TRISTAR system.

As originally assumed, the municipalities adjacent to the Tri-City, i.e. Wejherowo, Puck, Pruszcz Gdański, Rumia, and Reda, with a total population of over 100,000 inhabitants, may be interested in an enlargement of the TRISTAR system. The decision regarding an enlargement of the system will be positively influenced by achievement of the objectives set for the system in the Tri-City and availability of European funds in the years 2014-2020 to cover a majority of the cost.

SMART LAMP

When we think about topics that is very often discussed in the public sector, state-owned and private companies, the mass media, and by the general public, the one that comes to mind is energy efficiency. This matter must be regarded with proper attention because nowadays the need to improve the energy efficiency is more than just a catchy slogan: it is a real requirement that is legally sanctioned, for example in European Union directives that impose the duty to demonstrate a reduced electrical energy consumption.

Solutions aimed to achieve this objective require significant financial outlays. From the economic point of view, the best solutions are those that guarantee the highest return on investment. A solution that, in addition to this advantage, has others, such as use of state-of-the art technologies and technical parameters that are better than those of other products, can be considered as perfect.

Development strategies of individual countries, and often even provinces and municipalities, clearly indicate where actions aimed at achieving improved energy efficiency, which translate into savings and cost optimization, are to be taken. One of such areas is upgrade of street lighting systems or their replacement and installation of energy-saving solutions.

Economists have for a long time agreed that the factors that enable long-term economic progress are innovation and creativity. In Poland there are more and more companies that introduce unconventional solutions and products and are becoming leaders in their fields in Europe if not

worldwide. They all are operated by people for whom work is a passion, who are not afraid to take challenges, and who consistently follow the direction they have chosen.

Engineers from the AZO Digital company from the Tricity have surprised everyone by designing an ignition system for street lamps. The brightest and best paid engineers in the lighting industry, with access to excellent laboratory facilities, have worked in vain to develop an igniter like this for years.

The way lamps work has not changed for almost half a century, while LED technologies, strongly supported by marketing campaigns, are still far from perfect. Meanwhile, most lighting infrastructure does not require replacing all their components but rather modernizing some of them. This involves significantly lower costs needed to implement solutions that enable meeting the legally imposed standards and achieving measurable operating savings.

All that is needed is to install a single small device in an existing lighting fixture...

What is SMARTlamp?

SMARTlamp is an intelligent electronic ignition system intended for high-pressure sodium and metal-halide discharge lamps that saves even as much as 50% of consumed energy, significantly lowers the cost of maintenance of lighting infrastructure, and enables its flexible management.

SMARTlamp is a single-element electronic stabilization and ignition system for high-pressure lamps with a microprocessor controller, light source power consumption control functionality, an automatic behavioral calendar, and a connection that enables creating intelligent lighting control systems with duplex communication.

Why is SMARTlamp a revolutionary solution?

A classical ignition system is supplied with 50 Hz sinusoidal voltage which causes the discharge arc to be heated and cooled 100 times a second, which leads to faster degradation of the electrodes and instantaneous uneven light intensity (stroboscopic effect).

A classic system is stabilized by an electromagnetic ballast which has about 10% of own heat loss. A classic system is extremely sensitive to voltage fluctuations: even a 10% instability may result in much shorter service life of a lamp. Also, electromagnetic ballasts cause high losses of passive power. Also, despite stabilized operating parameters of the lamp, the electronic igniters available in the market, which work with frequencies below 1 kHz, are very sensitive to variable behavior of hot plasma in discharge lamp and are not so effective because of the high complexity of the electronic system.

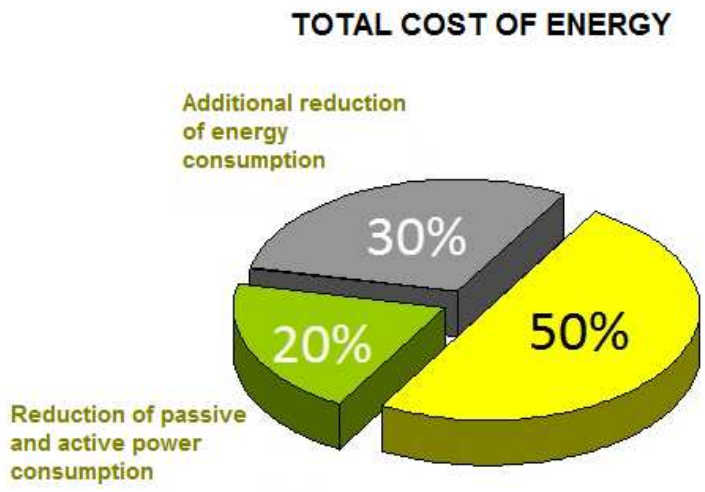
SMARTlamp is a new generation system that uses a patented method of avoidance of acoustic resonance which enables the use of high-frequency square-wave voltage (100 kHz). This makes it possible to maintain an even temperature of the light-emitting plasma and a significant reduction of the wear of the electrodes and of other disadvantageous phenomena present in other technologies. This control system leads to energy savings on the level of 15% and the active system of passive

power correlation enables saving another 5% of consumed energy. The stabilization system enables using a very broad range of input voltage (90-280 VAC).

SMARTlamp has a microprocessor system that enables multi-step reduction of consumed power, down to 50%, without any danger to the lamp. The system can work autonomously based on a behavioral astronomic calendar that reduces the power consumption at night. SMARTlamp can also be controlled from the outside by other control systems.

The use of a SMARTlamp significantly extends the service life of light sources, which significantly reduces the operating costs of lighting systems. Consequently:

- the energy consumption is 50% lower compared to traditional electromagnetic ballasts (which translates into a reduction in CO_2 emissions);
- the service life of lamps is up to 50% longer, which translates into big savings on maintenance;
- the power of the lamp is controlled autonomously – it is switched on and its energy consumption is reduced at appropriate times;
- the quality and safety of the light is improved by eliminating the stroboscopic effect (flicker).



Completed projects:

Jeronimo Martins Polska - the owner of the largest Polish retail chain, currently comprising over 2,000 stores. In December 2009, a program aimed to upgrade the outdoor lighting systems of existing stores and to install new lighting fixtures at new stores started. The SMARTlamp ignition systems were included as a requirement in the construction specifications of all new stores. Additional energy savings and illumination control functionality are achieved by using SMARTclock control clocks.

Municipal Sports and Recreation Center - Gdańsk

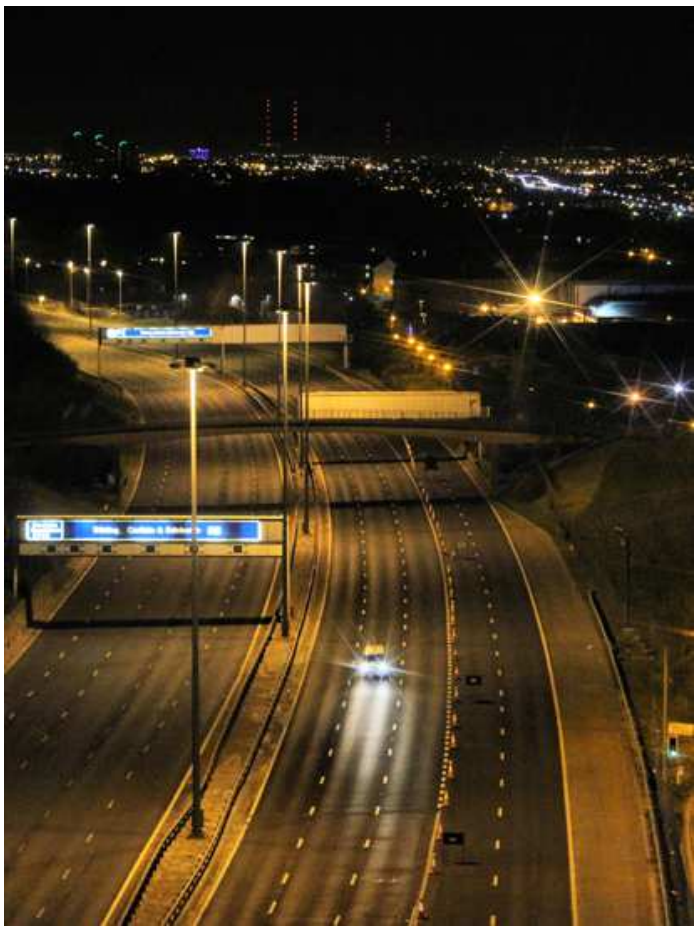
Based on the tests of illumination effectiveness and the achieved electric energy savings (on the level of 40.5%) at the pier in Gdańsk Brzeźno, a decision was made to use the SMARTlamp system to upgrade the lighting systems in a majority of facilities managed by the Center. The actual power consumption of the 70 W lamps was 84 W. By replacing the electromagnetic ignition systems with the SMARTlamp systems, with a planned energy consumption reduction profile, it was possible to reduce the power consumption of each lamp to 54 W without any noticeable impact on the quality of illumination and on compliance with the applicable standards.

Redbridge Borough, London, UK

In order to introduce an electrical product into the British market a unique system in the EXELON coding system must be obtained. The notification body is the National Weights and Measures Laboratory. The SMARTlamp electronic ignition system has received the code for all types of devices. The next step was a test installation of the devices in lamps in the London Borough of Redbridge which are administered by the Redbridge Borough Street Lighting. The energy consumption and photometric tests confirmed that the offered solution was effective and led to savings on the level of 42.67%. The lighting infrastructure was upgraded without the need to change the lighting fixtures in the entire borough.

M8 motorway (Scotland)

The M8 motorway in Scotland is one of the roads of this category with the highest traffic intensity in the United Kingdom. It connects the two largest Scottish cities, Glasgow and Edinburgh, and is 97 km (60 miles) long. The lighting infrastructure of the M8 uses 400 W road fixtures with high-pressure sodium lights (HPS). The requirement to use different light intensity at such locations as intersections and exits was fulfilled thanks to the functionalities of the SMARTlamp ignition system.



YAS Marina Circuit – Abu Dhabi

The unique Middle Eastern market has turned out to be very open to innovative energy technologies such as the SMARTlamp igniters. In order to demonstrate the actual capacity of the device, it was installed in the lighting system of one of the most modern and prestigious places in the world, the YAS MARINA CIRCUIT race track in Abu Dhabi in the United Arab Emirates.

From September 2011 until January 2012, electric energy consumption was measured and tested. The SMARTlamp system was highly evaluated and approved by the prospective customers thanks to the impressive energy savings and its immunity to extreme weather conditions.

The positive response of the facility owners, to include the UAE government, to the effects achieved thanks to the Polish product has resulted in the opening of an AZO Digital branch in Abu Dhabi with the aim to provide the best services to the customers in this region.

A CRISIS RESPONSE SIMULATION SYSTEM

This state-of-the-art system for training the commanders of large police operations during crises is a kind of a virtual multimedia decision-making game on a tactical and strategic level. The product elaborated on the project has received very good evaluations of European police officers who periodically improve their skills using the simulator in special premises at the Police Academy in Szczytno, Poland. The training improves the effectiveness of the selection of commanders for police operations who are charged with our security and enables eliminating any random decisions from the process and performing a thorough analysis of the leadership process in police operations. Due to the high interest in the system and the capacity for its development, there are plans to improve the simulation system and to modify it to make it suitable for use by other agencies responsible for the security of the state and its citizens, such as the Border Guard, the Fire Brigade, the Police, central and local government crisis management entities, and medical services.

Use of the simulation system in crisis situations

The simulation system uses a virtual reality that is more extensive than ever. The technology used to develop the system enabled implementation of thousands of virtual objects that act completely autonomously. This is of particular importance for creation of crowds of different levels of aggression where every single object acts independently. Of note is the fact that the behavior of the crowd involved in a given scenario is very realistic and based on observations and experience from similar events that have taken place in the past. When the crowd comprises tens of thousands of people, high efficiency of the system is essential. The simulation system is most of all a tool that enables improving leadership skills, the so-called drive for perfection. It consists of five work rooms integrated into the system. The individual work rooms in the prototype system are used for different, although related, purposes and supplement each other in the whole system. The work rooms are: a decision-making process design and analysis room, a police operation commander's and deputy commander's room, a police sub-operation commander's room, an operation commander's staff's room, and an instructor/operator/administrator's room. The work rooms are equipped with such functional workstations as the instructor's workstation, the administrator's workstation, the operators' workstations, the monitoring workstation, the operation commander's workstation, the deputy operation commander's workstation, the sub-operation commanders' workstations, and the workstation for recording images from cameras or maps. The system consists of computers connected in a network. Also, each workstation is provided with properly connected and configured printer/scanner combos. Besides controlling the weather conditions (fog, rain, wind, clouds, and time), the system enables adding and giving access to forces and means as well as defined scenario changes such as unexpected events, explosions, VIP motorcades, air or building crushes, etc. What is also important is that the trainees are able to move on foot, by car, or by helicopter. The simulation system also enables conducting training exercises in areas that match the real maps of urban agglomerations in Poland. The users can also enter into the system the current city plans, including the weather conditions (it is possible to use plans for any cities in the world). All the distances between objects seen on the map are the true distances. Currently the simulation system is used to train commanders for police operations in Poland's capital, Warsaw; however, the current works on the system are aimed, among others, to make it suitable for use by other agencies, with accent on universal application of the new solution.

Use/operation of the simulation system

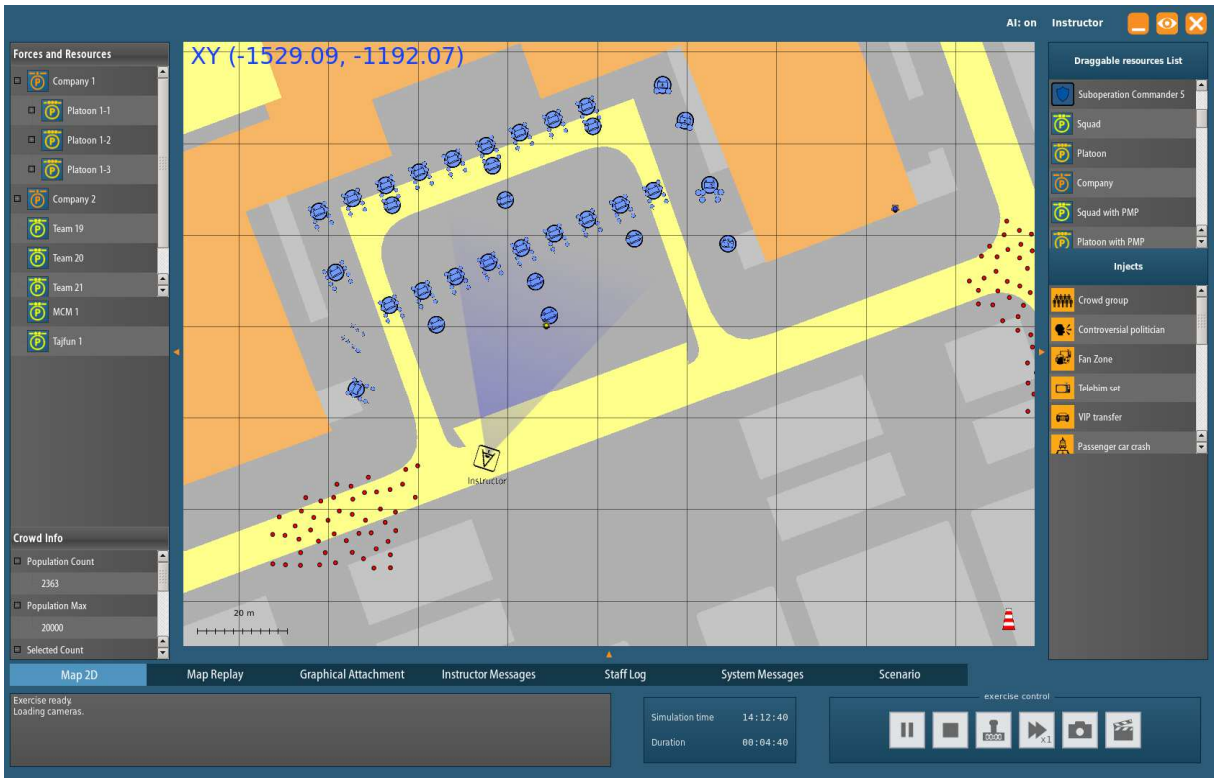
The system enables training in situations that closely approximate real ones and provides immediate evaluation of the commanders' actions through the response of the virtual environment to the decisions made. The users can evaluate a number of crisis scenarios taking into account real behavior of the virtual crowd, can anticipate the changes in the situation in real time and, consequently, can make decisions knowing their likely consequences. The standard sets of scenarios and scenario changes are supervised by an instructor who conducts the training. The instructor can also modify the scenario and generate additional events. This makes it possible to create different decision-making situations based on a single scenario. Also, thanks to the possibility to modify the entire environment, the instructor can make changes to the weather conditions. Both the crowd and the Police act different when it rains and during sunny weather. The scenarios must be connected and modified in real time, which enables full scaling of the difficulty level of the task being

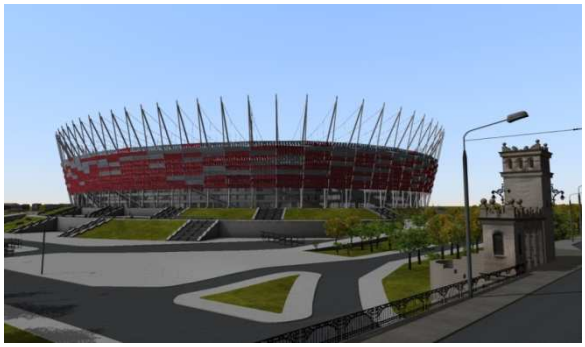
performed. During the preliminary briefing, the trainees are given the available sources of information and appropriate resources (forces and means). The decisions made by the trainees are based on information that is more or less complete, depending on the scenario and on the orders given. The system can simulate city and industrial monitoring networks, mobile monitoring centers, and other information sources. In pre-defined situations, the trainee who makes decisions can use the system to go to the location of an even in the virtual environment in order to lead the operation directly from there. The abilities to use information sources are different, depending on many factors (the weather, simulated technical failures, disasters), which are changed by the instructor.

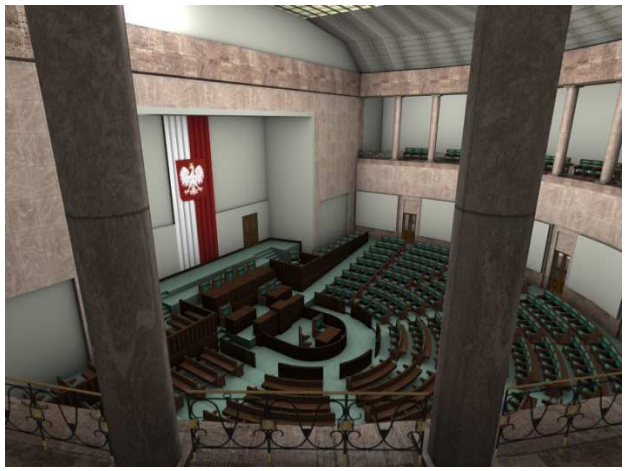
One of the advantages of the crisis response simulation system is its relative ease of use. When elaborating the system, its authors had in mind the possibility to train any potential user. The system can be installed on any computer commonly used by any agency, which also makes it very universal. Mobility is another advantage of the system. The authors of the system also want the system to be suitable for use by officers of different agencies working in the field during their daily work, performing their regular duties.

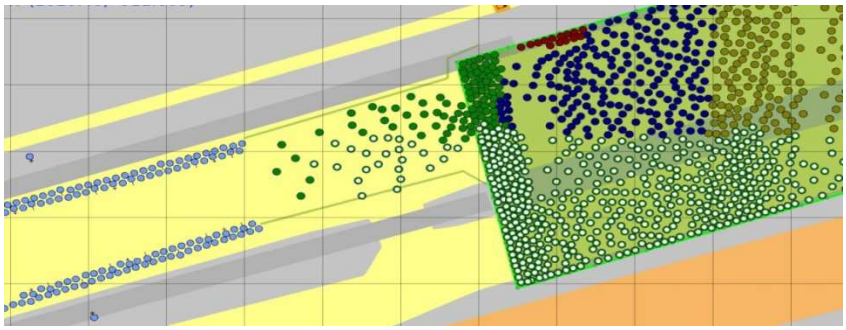
Simulator control by voice

Having in mind that the main task of the simulator is to improve and develop command skills in critical conditions, it is essential that the conditions of working with the simulator are as close to the real conditions as possible. Therefore, it is possible to equip a system with an additional functionality – voice control mode based on the high-tech speech recognition also developed by Polish research units. As it is known, technologies of this type are used in various spheres of life and they possess a wide range of application.
Voice control systems are assumed to replace device operation through the standard mouse or keyboard with the efficient and innovative approach making use of language and speech processing.
Owing to the faster and non-contact operation based on commands and voice orders made by the user, the use of this kind of applications in the simulator may turn out to be a very helpful and supportive solution also for the effective command and strategic decisions taking in critical conditions.


AI: on
Instructor
Forces and Resources
Company 1
Platoon 1-1
Platoon 1-2
Platoon 1-3
Company 2
Team 19
Team 20
Team 21
MCM 1
Tajfun 1
XY (-1529.09, -1192.07)
Instructor
20 m
Crowd Info
Population Count
2363
Population Max
20000
Selected Count
Draggable resources List
Suboperation Commander S
Squad
Platoon
Company
Squad with PMP
Platoon with PMP
Injects
Crowd group
Controversial politician
Fan Zone
VIP transfer
Passenger car crash
Map 2D
Map Replay
Graphical Attachment
Instructor Messages
Staff Log
System Messages
Scenario
Exercise ready.
Loading cameras.
Simulation time 14:12:40
Duration 00:04:40
exercise control







Current use of the simulation system

As of today, the crisis response simulation system is used by the Police to train police operation commanders at the Police Academy in Szczytno. Police officers use the system in official circumstances. A big event during which the simulation system was used as a security supporting tool was the EURO2012 football tournament. The plan of Warsaw, which was the area in the scenario used during the EURO2012 covered, among others, the National Stadium with the nearby bridges and the adjacent area. The National Stadium's surroundings were modeled in accordance with the state planned for 2012. The National Stadium was modeled on the outside and the inside in great detail and according to the architectural plans. All this enabled police officers to prepare several scenarios to be implemented in the actual structure and in its surroundings in the event of a crisis, taking into account the technical resources and the staff available at the site. The officers' opinions based on their experience with it during such a large and demanding event, were very positive.

Use of the simulation system in Brazil's conditions

The possibility to use plans of different urban centers makes the crisis response simulation system suitable for use in countries other than Poland. Once virtual maps are created based on up-to-date cartographic materials, the system can be used by Brazilian security agencies to train operations in various cities of that country. Two large events, namely the World Football Cup planned for 2014 and the Olympic Games and Paraolympic Games planned for 2016, certainly constitute a big challenge to the Brazilian agencies. The crisis response simulation system could support officers of the Brazilian Police and of other agencies in their work and enhance the internal security and law and order in large cities where the aforementioned sports events will take place. The simulation system would enable Brazilian police operation commanders to elaborate a number of possible

scenarios to be implemented in the event of a crisis. Officers of security agencies must make their decisions in an error-free and effective manner, which they can learn to do by using the crisis response simulation system. One of the effects of further works on the system is integration of several geographic areas covered by the system, i.e. several urban centers. It is quite possible that this function will be useful for organization and coordination of operations during the upcoming events.

Planned work on the simulator

The current version is used in practice and fulfills its purpose, but the authors, with the view to the new needs of the potential users of the system and the large group of entities that express their interest in using the system, as well as the constantly developing technologies, want to improve the current version of the simulation system. The plan is to:

- Equip the simulation system with a laser pointer that the user will use to control the system, to replace such devices as the mouse, the touch pad, and the touchscreen. This solution will in the future constitute an element of the 3D versions of the crisis response simulator system;
- Integrate the simulation system with the so-called expanded technology and, eventually, to create a virtual scenario technology platform to use expanded reality;
- Create an integrated crisis management platform in order to enable managing operations in crisis conditions not only in a specific urban center but also country-wide. This involves introduction into the simulation system's database of a number of plans of urban centers in order to create a network of connections based on real cartographic materials;
- Provide the simulation system with new functions in order to adapt it to the needs of other agencies than the police (medical services, fire brigade, border guard, and crisis management centers). This includes implementation of new commands, new equipment, new algorithms to pattern the behavior of officers of a given service, i.e. creation of a few models corresponding to the unique characteristics/methods used by the different agencies.

The role of science and technology parks

Cooperation with science and technology parks that specialize in technology transfers may turn out to be very useful in the process of transfer of the simulation system to the different agencies and, in the future, to commercial users. Their experience in popularization, their qualified staff, and their legal resources may become very useful when transferring successive new versions of the crisis response simulation system. It is also possible, that a new solution based on the simulation system's technology will be developed and then commercialized in collaboration with science and technology parks.

Why is using the simulation system a good idea?

Nowadays it is not possible to ensure full public security without the support of highly advanced technologies and IT systems. As a very innovative system, the crisis response simulation system is aimed to improve public security and order and conforms to the above statement. The system works in practice, as demonstrated by its use during the EURO2012 tournament, as well as by its use to train the current and future Polish Police commanders. Its current users have very good opinions about its usefulness, ease of use, and, most importantly, its extensive capabilities. They also see the potential it has. There are more and more systems and devices in the global market that are aimed to enhance security; however, they still fail to meet all the requirements. On the other hand, to the best knowledge of the authors of the project in question, there are no solutions that enable implementation of many thousand objects with the highest level of detail. Hence the great interest in the prototype system in scientific centers and institutions charged with security. This was evident, among others, during the system's presentation during the world modeling, simulation, and trading conference, I/ITSEC 2011, held in Orlando, Florida (28 November - 1 December 2011), during the Meeting of the European Police Chiefs Task Force in Warsaw (8-10 November 2011), and the Security Research Conference organized by the country holding the European presidency: Poland (19-21 September 2011).

The added value of the simulation system

When discussing the crisis response simulation system, one must also point at the added value that results from the use of the application. Of key importance is the enhancement of internal security that accompanies efforts to maintain public order. New technologies that support officers of different agencies in their work are an inevitable element of crime suppression and effective crisis management. Common use of the simulator and the resulting positive impact on internal security may also stimulate the economic growth of countries. This is because secure regions and countries are more attractive to investors who are more inclined to bring their money to places where their security is guaranteed.

CONCLUSION

The three areas - science, business, and administration - require an effective dialogue, closer ties, and an effective model of cooperation. This is the only way that an impulse for creation and implementation of innovative solutions can be achieved. This is where Science and Technology Parks, which for years have been present and active in the social and economical life of regions and cities, play a significant role These institutions, thanks to the financial support from the European Union, have an excellent infrastructure, high-class research and development facilities, and employ experts in the field of science and business.

The European Union's 2014-2020 programming period increases competitiveness of regions by supporting the formation of various areas of cooperation. The European Union Program Horizon 2020 challenges universities, research institutes, technology parks, and business incubators to develop an effective and durable cooperation with businesses. The financial mechanisms provided for in the Horizon 2020 program will reward joint research and development projects as they contribute not only to the development of contemporary knowledge but also to the creation of new technologies and business mechanisms and their implementation, thus helping to build the optimum conditions for the economic development of the country based on intelligent specialization.

What appears to be necessary is continued discussion on the possibility to exchange opinions on the creation of an innovation system that should be based on transparency, focus on continuous learning, and acceptance of high risk, which is an inevitable element of the most innovative processes.

The aforementioned examples demonstrate that the Gdansk Science and Technology Park is both a place where innovative ideas are born and where mature projects are implemented in large areas. This warrants the conclusion that the Park contributes to the image of the region and participates in the process of construction of safe and intelligent cities.