Architecture and Interfaces Management in Proteus System - Case Study

Proteus System

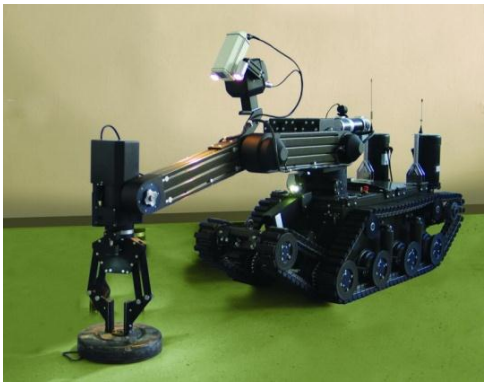
Terrorist actions, natural and industrial disasters are serious sources of threat to the security of European society. Only in the last few years, the inhabitants of Europe have experienced situations such as attacks on transport networks in London and Madrid, great foods in Poland and Germany, great fires in Spain, or earthquakes in Turkey. In all those cases, the technical measures used by the services responsible for public safety turned out to be insufficient for rapid and effective neutralization of the threat. Proteus Project has been developed in order to meet this challenge. Proteus System is a mobile solution integrating various technical measures in order to provide awareness of the situation and effective command within a few dozen square kilometers. The development of Proteus System is coordinated by Przemysłowy Instytut Automatyki i Pomiarów (*Industrial Research Institute for Automation and Measurements*).

Proteus system consists of:

- **Mobile Command Center** – the car carrying the servers and communication systems, which also constitutes BSL mobile airport, has the system analysts, may become the Communal Crisis Management Center
- **Unmanned Aerial Vehicle** – which provides reconnaissance within several kilometers from the command center thanks to the optoelectronic head,
- **Mobile Robotic Operations Center** – the car for the transport of robots, mobile sensors sets, increasing the range of communications systems
- **Set of 3 mobile robots** – they are the devices for reconnaissance and intervention under unfavorable conditions, weighing from a few dozen to several hundred kilograms
- **Mobile set of sensors** – allowing to configure the independent position of sensors, depending on the occurred situation
- **Wearable sets for the rescuers**

Proteus Project is funded by the European Union and national contribution. It is realized by the Consortium of leading Polish research and implementation centers.

Requirements analysis



Design and construction of such a complex system requires identification and management of a number of specific requirements. Close cooperation with the fire brigade and the police allowed to develop a set of functional and technical requirements for the system. A team of several experts spent about a year on the identification process and study of the possibilities to meet the requirements.

Understanding the set of requirements led the project team to the conclusion that the system's modularity at the hardware level, which will allow for flexibility of go, is one of the most desired features of the system.
Modularity allows the configuration of the system depending on the occurred situation. It is also a simple way to develop and modernize it.
At the software level, the system must be integrated and has to provide the user with the services allowing the visualization of a comprehensive picture of the situation based on multiple data sources and management of the resources available to them.

Requirements sources

The final set of requirements was created on the basis of the analysis of three main data sources: case studies of the conducted actions, formal requirements included in the internal services and the studies of trends.

Architecture and Interfaces Management in Proteus System - Case Study

Challenges

The aim of Proteus Project is to create a modern complex tool for the fire brigade and the police enabling a flexible reaction to crisis situations. The integration of many different technologies such as robotics, unnamed aerial vehicles, advanced data analysis, GIS, GPS, satellite telecommunication, sensor technologies and various communication systems into one coherent system will give a whole new quality of rescue actions in situations such as fires of large industrial facilities, natural disasters, surveillance of mass events or terrorist actions.

Systems integration

From the point of view of external systems, Proteus must maintain the possibility of cooperation and data exchange with:

- Fire Brigade Communication System
- Police Communication System
- Communal Crisis Management Center
- Any data source available on the Internet
- How to create reports with such a complex architecture?

Main IT functionalities

Proteus is a C4I class system – command, control, communication, computer for intelligence designed for civil use. The main IT functionalities include:

- Ensuring the communication and flow of data (including video transmission) throughout the system
- Ensuring the interpretation and visualization of the data saved by the system
- Data Archiving
- Managing resources and planning rescue tasks

Additional, non-standard functionalities realized by the system include:

- Monitoring and control of robots
- Monitoring and control of unnamed aerial vehicle
- Monitoring of sensors
- Application of the data collected by the system onto the GIS maps in real-time
- Ensuring the situational awareness of the main decision-makers of the action (Commune Authorities)
- Transmitting the data through the Satellite link
- Dynamic configuration of communication networks
- Managing the energy available for the operation of the whole system

Architecture and Interfaces Management in Proteus System - Case Study

Business – science cooperation

Cooperation between PIAP and Modesto is a model example of the relation between the world of science and economy. Modesto created a dedicated tool meeting the unusual needs of PIAP and supported its implementation. The Company has gained experience considerably exceeding current needs of the market. PIAP has gained the effective tools that support the Proteus system integrations based on the best industry standards.

Implementation challenges – interfaces supervision – solution's devices

The aforementioned complexity of the Proteus Project has made the team face a few fundamental questions:

- What techniques should be used to gather the requirements?
- How to map the requirements into the components of the project go?
- How to decompose the complexity at the hardware and software level?
- How and with the use of what tools to manage the large repository of the project, which may be used by few Consortium members – the project participants?
- How to create reports with such a complex architecture?

Additionally, CASE tools, which should not be too expensive but quite popular, play an important role.

Enterprise Architect from Sparx Company met the most features which were required by CASE application and became one of the tools for modeling and managing the requirements, architecture, as well as the interfaces in the system.

Enterprise Architect was used to build the uniform project repository. Proteus System was modeled to the level allowing the clear definition of interfaces between all Partners creating the Proteus Consortium.

Selection of CASE tool

UML language was used to model the system. Enterprise Architect from Sparx Systems Pty Ltd Company was selected as the CASE platform.

MODESTO Actions

Within the frameworks of entrusted tasks, MODESTO Company has provided a number of guidelines and good practices within software engineering. In combination with PIAP experience from the development of mobile robots and automation systems, it is possible to effectively manage the complexity of the PROTEUS project.

In order to supervise the interfaces, MODESTO Company has provided the TORMIGO tool, which is used to generate reports according to the given criteria. It enables quick supervision over the system configuration.

Architecture and Interfaces Management in Proteus System - Case Study

First use

The teledetective subsystem and GIS for the Proteus system developed at CBK PAN was already used in practice during the floods in May 2010. Thanks to the quick reaction of the scientific environment, the authorities engaged in the rescue action had detailed maps of the flooded areas and were able to cooperate with experts for every possible action. This spontaneous action may be proven by the fact that during the first 24 hours after beginning the information service, it was used by over 50 entities commanding the rescue actions at the level of communities and districts.

Project final

The project phase will last until the end of 2011. The System will be handed over for the end-users tests at the end of 2012.

Information about the entities involved

PIAP – Przemysłowy Instytut Automatyki i Pomiarów (Industrial Research Institute for Automation and Measurements) is the leading Polish research and implementation center involved in the problems of mobile and industrial robotics, security systems, satellite technology use and industrial automation systems. It occupies the first place in the G5 category (Electrical Engineering, Automation, Electronics and IT technologies) of the ranking of Polish scientific units. BPK PIAP – Biuro Projektów Kluczowych (Office of Key Projects) is a specialized unit dealing with the management and implementation of the most significant PIAP projects.

Modesto – is a company which supports its Customers through trainings, advising, consultations and outsourcing of the services within the scope of broadly understood software engineering. Modesto specializes in modeling business processes (also in enterprise architecture), as well as in designing IT systems (particularly web ones and SOA).
As enthusiasts of Enterprise Architect from Sparx Company, Modesto employees provide technical support and external devices supporting the work of the Enterprise Architect.

Proteus Consortium consists of the leading research and implementation centers; for the needs of the project, the following centers have provided their competence in the following areas:

- CBK PAN – GIS, satellite images, satellite communication, satellite navigation
- CNBOP – procedures for crisis management, gathering requirements
- ITME – innovative sensor technologies
- Politechnika Poznańska (Poznan University of Technology) – command center, unnamed aerial vehicle, IT systems
- Politechnika Warszawska (Warsaw University of Technology) – communications technologies, simulators, and materials engineering
- WAT – special sensors, optoelectronics
- PIAP – system engineering, robotics, electronics, IT systems

Jana Pawła II 10 Street
05-500 Piaseczno ▪ Poland
modesto@modesto.pl
en.modesto.pl (EN) ▪ www.modesto.pl (PL)