Final publishable summary report

This report covers the work carried out during last year of the European Commission Framework 7 project 'Firerob' Autonomous Fire-fighting Robotic Vehicle. The main body of this report is a précised overview.

In recent years, there have been number of serious accidents, including fires and explosions that have occurred at industrial establishments and dangerous areas. We have been witnesses of major fire and leakage accidents worldwide at facilities handling hazardous substances like nuclear power plants, chemical facilities with inflammable and noxious materials, oil refineries and petroleum and gas tanks. Large-scale fire at industrial establishment, once started, can result in a serious, fatal accident, and would take tremendous time and effort to put out. Further, nobody can deny that it causes a huge amount of damage to corporate assets, threaten people's lives in the surrounding neighbourhood, and has a significant impact on society and ecology.

Due to the fact, access to regular fire fighting vehicles with crew inside is not possible. That is why the overall objective of project was to develop the prototype of the autonomous unmanned fire fighting vehicle that would be able to fight efficiently against fires in hazardous environments, particularly where men and firemen are highly jeopardized.

The "FIREROB" is able to enter into the heart of fires, operate and navigate reliable and recognize different objects, fight fire and remove flammable or dangerous materials. To overcome mentioned barriers and reach targeted performances, selected R&D institutions from Croatia and Scotland helped with the research and development activities in order to create the final product marketable in EU and worldwide.

The idea was to develop effective fire protection multilayered shield which will be used for vehicle body protection in order to ensure longer fire and temperature explosion, while still retaining some mechanical strength and having characteristics of heat reflector.

After rigorous testing and investigations, R&D Institute "Scot-ATRI" found the best solution which showed outstanding results during tests. Coating prevented the steel from reaching the critical temperature of 250C when subjected to temperature of 830 C and thermal radiation of 23kW/m2 for a period of 30 minutes. The coating was applied on Hardox 450 steel which is used on the fire fighting vehicle.

Croatian "Brodarski Institute" developed remote control system that is capable to control the vehicle in the 2 km range in the reduced conditions of visibility. It is combined with the dynamic positioning system that is capable to position vehicle within the range of +/- 50 cm. Overcoming limitation was done by implementation of the Integral navigation system using Khalman and GPS-INS algorithms that recently reached performances and price acceptable levels for such application. System was developed, customized and integrated for purposes of fire fighting vehicle.

Vehicle was also equipped with video imaging system with the aim to support operator to remotely guide the vehicle. The system has two cameras, visible spectrum camera and infrared spectrum camera, and image analysis subsystem. Wireless video link is used to transmit video signal to the remote station. The vehicle can operate in conditions of extreme

temperatures, in short time periods up to 350°C of ambient temperature. Under these the video imaging system has to be able to operate as well. Video imaging system enables vehicle navigation in the conditions of reduced visibility like smoke or dark conditions.
Image analysis and pattern recognition system extracts additional data that assists the operator in remote navigation of the vehicle and firefighting procedures. Functions of this system include:

- indication of areas consumed by fire
- indication of surrounding areas which could be obstacles to vehicle movement
- indication of humans in the area consumed by fire
- visibility enhancement in the fire and dark conditions

List of all beneficiaries:

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