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Development and improvement of technology in emergency response

Ionel NUȚĂ^{* a} Octavian ORBAN^b Lucian GRIGORE^c^a Rm. Valcea, County Valcea, Postal Code 240292, Romania.^b Bucharest, Postal code 22187, Romania.^c Bucharest, Postal code 22187, Romania.

Abstract: The last time we witness extreme natural phenomena, plus technological accidents, weather situations, global warming, asymmetric non-classical actions of unknown nature, with influences immediate or direct or indirect, over the life of each human individual and the human society as a whole. All of these are causes emergency generators that produce large numbers of casualties and material damage scale. Prevention and emergency management is increasingly becoming an integral part of policy and strategy development, security and stability at all levels and in all areas of interest. In both fields the primary role plays the man who has to travel on site, analyse, and make decisions of life and death for solving emergencies. Unfortunately, no matter how well prepared it has its limits. The key to solving this problem lies in intelligent action coordinated between man and machine. Thus, there is need to undertake a technological bridge between people, machines and methods of intervention in emergencies. Therefore, research efforts in recent years have been focused mainly on the satisfaction of human needs replacement staff for the execution of high-risk missions in difficult environments with controlled accelerated progress in the field of mechatronics, optoelectronics, electronics computing power and allowed the market providing specialized technologies required to achieve this goal. One solution is the development of families of robots specialized for prevention and intervention, capable of movement in critical areas before the emergency to be unleashed and out of control, to save life and property or to obtain a detailed view transmitting data and information necessary human an effective response.

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1. The need to design and implement a robotic platform for emergency response.

For prevention and emergency management, assurance and coordination mechanisms, improved management, human resources, material, financial and otherwise, necessary for the defence of life and health, the environment, material and cultural values important during the production of emergency and

* Corresponding author. Tel.:
E-mail address: nuta_ionel2014@yahoo.com

restoration of normality, in 2014, he established the Emergency Department.

National coordination of all organizations involved in emergency management in accordance with international regulations, is made by the General Inspectorate for Emergency Situations under the Ministry of Interior.

Engineering intervention in the endowment of the General Inspectorate for Emergency Situations and intervention units consists usually of high capacity vehicles propelled by internal combustion engines, mainly specialized fire.

Due to the highly diversified field of fire with a great magnitude on a random front wind direction and speed over 40 km / h, capacity is severely limited intervention of special vehicles.

Approaching the outbreak or even reduce the fire area subjected to intervention system stability and the period of intervention. In this regard, although mobility features play a role, the literature provides few references that address these issues thoroughly.

In assessing the work of the Department for Emergency Situations held in March 2014, its coordinator, the Secretary of State in May, dr. Raed Arafat, said the following:

"50% of the intervention equipment IGSU are older than 20 years (Figure 1). Here is one of the things that we focus. Funding source is the Structural Funds 2014-2020 and may be other sources that will be allocated, so to create a multi replacement of equipment and machines. "

To fulfill their responsibilities, as the members of international bodies to participate in the intervention (fire, natural disasters, etc.) in collaboration with similar bodies in any part of the world where there is need for emergency interventions are required looking for solutions as diverse and autonomous choice for the development and improvement of current intervention technique, its gradual replacement by new technique, specializing in risk types of emergency generators and replace the human factor by robotic systems.

The latter is considered the highest priority for intervention in emergency situations.

2. Current status of research.

Robotic technologies have developed greatly in the last 10 years, robotic systems are widely used in many civil and military applications. There are so many types of robots, androids, static, mobile tele-mobile, autonomous or semi-autonomous, use the various services and applications, as an enumeration of all these types would be almost impossible.

And civilian applications have been developed, primarily in the areas of:

- medicine, being able to move along the vessels and tubes of the human body for the purpose of investigations, surgery, dosing and distribution of drugs, etc. (Figure 2);
- industry, as represented by AGV's (Automated Guided Vehicles-) wheeled vehicles, automatic guided, carrying and handling parts as an alternative flexible mounting bands;
- agriculture, being represented by unmanned tractors and agricultural machines, capable of performing only work surfaces which were scheduled;
- Forest, where mobile robots can climb tall trees and perform transport operations and primary processing;



Figure 2. Surgical Da Vinci Robot.



Figure 1. Fire truck with water and foam.

- transport and services.

Military applications have been developed, primarily in the areas of :

- reducing the risk of human losses in battle by replacing soldiers with robots combatants;
- development and modernization of existing technology by using the latest technologies and robotic systems.

The most representative military robots using or developing world are:

- Crusher unmanned ground vehicle (UGV), 6.5 ton, armored and armed, able to navigate the terrain extremely difficult to access;

- Battlefield Extraction-Assist Robot (URS), a UGV that can pick up and retrieve injured persons from danger area (Figure 3);

- Big Dog quadruped robot that can move and traverse terrain inaccessible. It is made in two versions: Little Dog (Boston Dynamics 2010a) and PETMAN biped or humanoid version (Boston Dynamics 2010b);

- Pack Bot, robot family including famous models that have saved thousands of soldiers and civilians by detecting and defusing improvised explosive devices (IED);

- Dragon Runner, a surveillance robot designed for urban environments, particularly operating in buildings;

- Reaper aerial robot navigation and overflight long distances at high altitude UAV surveillance and warfare, the armed anti-armor Hellfire missiles used in Iraq, Afghanistan, Pakistan;

- Hummingbird, a small robot or "nano-UAVs", DE10 grams or the weight of two nickels, which is highly maneuverable and can be used for surveillance in urban areas (AeroVironment 2009);

- Seahorse, an unmanned underwater vehicle (UUV), launched from torpedo tubes systems oceanographic surveying and mapping down;

- Seafox, unmanned surface vehicle (USV) that can be used to patrol the waterways to detect mines, saving sailors or pilots;

- Phalanx Close-In Weapons System (CIWS), a mobile robot or fixed mounted aboard a fully automatic, identify, track and shoot down missiles launched by the enemy. It is similar to Counter Rocket and Mortar robots (C-RAM);

- Chemical Robot (Chem Bot), a robot soft, flexible, and amorphous called "blob-bot" that can be stretched and twisted and inserted through small openings for then to return to its previous size and shape.

US Army uses two major types of autonomous and semi-autonomous vehicles land: large vehicles such as tanks, trucks and Humm and small vehicles that can be carried by a soldier in a backpack like PackBot®. PackBot® is equipped with cameras and communications equipment and may include manipulators (arms) .is designed to find and detonate improvised explosive devices, reducing civilian casualties and



Figure 3. Battlefield Extraction-Assist Robot



Figure 4. Talon SWORDS.

military, and to perform reconnaissance operations. Its small size allows it to enter buildings to transmit data on potential occupiers, and trigger various traps.

Other typical vehicles are Talon SWORDS (Reconnaissance Detection System) (Figure 4.), made by Foster-Miller, which can be equipped with machine guns, grenade launchers or anti-tank rocket launchers, cameras and sensors and vehicles MAARS (Modular Advanced Robotic System later). Newer vehicles MAARS are able to navigate autonomously from specific objectives, through its global positioning system (GPS), but the percussion system is driven by a soldier located at a safe distance. It weighs about 350 kg and was modified in order to replace the firearm with a manipulator capable of lifting 100 kg.

Were also developed autonomous ground vehicles, Grand Challenge. to traverse portions of the Mojave Desert in California. The vehicles were equipped with GPS coordinates for compliance points along the route, especially on land completely unknown to the designers.

Other nations have used robots guard to guard borders, for example, Israel and South Korea. These robots can legitimize people facing and if the person is not on the default list can open fire.

Some of the most representative military robots used or have experience developing contrubuit streamline military actions, actions which in some cases have contributed, along with global warming, climate change major. Impact of climate schimbărilor average temperature increase is reflected in significant variations in global water scarcity population, reducing the volume of ice caps and rising sea levels, changing hydrological cycle, increasing arid areas, changes in the course of the seasons, increased frequency and intensity of phenomena extreme climate (Figure 5), reducing biodiversity and aims at the increasing complexity and frequency of emergencies.



Figure 5. Natural disaster Fukushima.

In this context, to reduce the risk of human and material losses, we witness a re-program research and development of robotic systems, land, air and naval existing civil and military applications, leading ultimately to a new generation technique for prevention and intervention in emergency situations, based on the interaction between human, robot and environment or even replace humans by robots, aiming at increasing the performance of mobility and autonomy both as command / control as well as source energy. These robotic systems are designed as a mobile platform able to travel, including off-road and transport superstructures (modules) specialist.

Mobile platform is a key element in a family of robots accomplish a modular and flexible design, so that the same platform can work with many types of special superstructur.

Advantages implementation and development are related to increased performance over conventional systems with wheels and / or tracks, especially on uneven support surfaces, strewn with obstacles and critical areas as follows:

- reducing the number of casualties and material goods;
- reducing intervention time;
- intervention in different parts of the environment in which they work, resulting in a considerable increase workspace and recognition streamline operations, observation and inspection, analysis, decision making and implementation device intervention intervention;
- avoiding or overcoming obstacles on the supporting surface, moving stairs and other artificial surfaces and navigation around or over major bumps it independently;
- eliminate placement of sensors or devices in close proximity to sources of emergency generators, which are already implemented on the robot;
- proximity to a fire can be very dangerous considering that ignition sources (elements with hydropower) are unknown or do not know which is their situation in terms of the temperatures reached, draft, etc.

- no matter how careful operator intervention is to fire there is always the possibility that they trigger explosions the effect of which can not be predicted;
- elimination of potential risk scenarios and creating the possibility of fatal firefighter to focus on operations that have to be done to neutralize the fire and no immediate dangers to safety;
- even if a robot can not neutralize a fire he is able to change the position of the base relative to a fixed reference system considered linked to the supporting surface and can provide crucial information for management;

Main features of the robot are established, so that they can operate in various conditions, environments, locations, and at any time of day (night / day) as follows:

- be autonomous in terms of energy;
- allow remote command and control;
- to explore the environment, to locate victims and to detect hazardous substances emitted in the critical area;
- to submit data and information necessary for the prevention, decision making, intervention and rescue of biodiversity;
- to actively work with staff intervention;
- be able to change position independently to avoid damage the equipment;
- be able to handle and carry accessories required intervention;
- allow rapid adaptation and change modules and accessories depending on whether you need to perform;
- lightweight mobile components of the robot so that the payload (tank fire substances) or equipment related to renewable substances fire at a considerable distance from the fire and can provide high throughput for a duration sufficient large effect on the fire is sensitive;
- service and easy maintenance and low cost;

Researchers are working to create robots (Figure 6) înlocuiească to people in emergency situations, such as nuclear disasters, natural disasters.

So researchers at the Massachusetts Institute of Technology (MIT) in Cambridge developing a robot that can carry out dangerous places hostile to human life, such as Fukushima. This is referred to as "Atlas", 185 cm high and weigh approximately 160 kg,. In the world there are only seven robots of this type. The machine is hydraulic driven and is very strong, which enables it to be able to easily lift heavy objects can move very quickly in the affected area. Now, with minimum guidance, Atlas can move, to keep the balance and lift things - tasks that can be crucial in situations rescue people caught by debris.

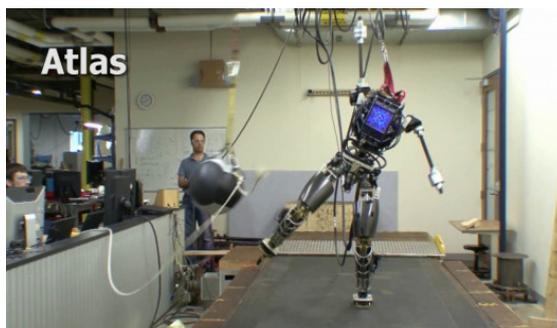


Figure 6. Robot ATLAS

The robot platform used fire Thermites range are produced by Howe and Howe Technologies Inc.



Figure 7. Robot Thermites

Thermites are designed for use in extreme risk areas such as aircraft fires, refineries, chemical plants or nuclear reactors. They have been used successfully to nuclear disaster in Fukushima, for reconnaissance operations, observation, assessment, search and rescue survivors. These modules are equipped with robotic arms, or a recognition cameras, or may be configured as a bulldozer.

Thermites is made of steel aircraft aluminum, it is high, a length of 74 inches (187.96 cm)

wide by 35 inches (88.9 cm), height of 55 inches (139.7 cm), weight of 743.89 kg, has 25 hp diesel engine (18.64 kW), can carry a load of up to 576 kg in rugged terrain,

The main tool Firefighting is a discharge pipe with a multi-directional nozzle that is fed by a pump discharge flow rate of 600 gallons per minute (2271.25 l / min) (Figure 7). It is remote controlled and can operate at a distance of a quarter mile (400 m) away and is able to pass through doors and surf indoors. Also, being small, it is easy to carry in city traffic a Bulldog truck firefighting, which is designed to carry a pair of Thermites or robots of similar size.

Also, Naval Research Laboratory, in collaboration with Virginia Tech and other universities in the USA, has developed a humanoid robot, Saffir (Figure 8), capable of autonomously detect and extinguish fires on board shoulder to shoulder with human firefighters using advanced sensors. Fire fighting robot can withstand temperatures up to 500 degrees Celsius, is equipped with advanced navigation multimodal sensor technology to overcome obstacles and remain upright under pitching or rolling sea conditions and with a vision to search for survivors. The board may execute and classical transport operations, lifting, stretching fire hoses and water discharge heat. The robot can respond to gestures and commands and sensor package includes camera sensors, gas detection and temperature IR and UV, to see through smoke and detect the source of excess heat.

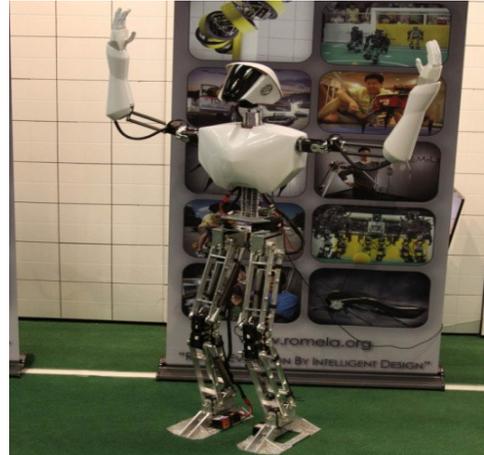


Figure 8. Robots Saffir.

Another concern is palm robot, called Guardians and Viewfinders that will be used to conduct reconnaissance inside buildings on fire, locating small outbreaks, but smoke generating, evaluating buildings in terms of structural strength and to identify substances toxic chemicals and other hazards before the rescue plan and the Stig.

This is a risky task, occupying valuable time in an emergency situation.

This will help save people, marking the direction of propagation of fire or moving victims, and, equally important, to establish a safe route exhaust to the outside.

The Guards will work in teams to convey information about potential obstacles and dangers in each of their routes back to the fire, while Viewfinders chemical sensors and video will be used to identify safe locations for intervention crews.

It is hoped that the two projects will play a key role in increasing the effectiveness of future missions of rescue, especially when emergency services face extremely hazardous or dangerous missions to rescue in hazardous environments.

British researchers-developed and perfected, military robots, using the fronts in Iraq and



Figura 9. Robotul Black Max

Afghanistan, to replace the fire in fulfillment of the most dangerous missions, especially the fire danger of explosion. The robots are equipped with different sensors specialized and can fulfill different but complementary operations remotely. Talon robot perform reconnaissance operations (you can slip easily into hard to reach places, can climb stairs), carrying quipment and rescue victims. Robot Black Max is specialized firefighting operations, the water discharge devices (Figure 9). Brokk robot is equipped with a

giant pair of pliers, with which may leave dangerous objects at the fire. The vehicles are designed to address the specific issue of fire near the tracks British problem that has been growing in the last period of time causing great economic damage.

3 . Conclusion.

The research mentioned are of particular importance and joins global effort to combat climate change and limiting its impact reduction globally to meet the needs of present, future and maintaining the earth's capacity to support life in all its diversity.

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