

APPLICATION OF SERVICE ROBOTS FOR DEFENSIVE PURPOSES

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ABSTRACT

Intelligent machines and systems with a different level of complexity are used today for performing the various processes in the industry and also everyday life. Applications of service robots in everyday life are practically unlimited. Service robots will change our daily lives sooner or later as: assistants, servants, supporters, friends, surgeons assistants in medical operations, interventions in hazardous environments like search or rescue, in agriculture and forestry, cleaning, excavating, transport constrictions and demolitions. Probably the greatest achievement of robotics is cooperation between robots and humans. Serving robots besides application for daily tasks also are applied for military actions apropos defense. These kinds of the service robots should decrease number of humans in military defense which affects at number of military casualties. Most used service robots for military defense are unmanned ground vehicles. This type of robot is generally capable of operating outdoors and over a wide variety of terrain, functioning in place of humans. Unmanned robotics is actively being developed for both civilian and military use to perform dull, dirty, and dangerous activities. There are two classes of unmanned ground vehicles Remote-Operated and Autonomous. The greatest part of service robot application is for the military defense. In this paper are presented some applications of service robots in military defense.

Keywords: robot, service robot, military forces, unmanned ground vehicles.

1. INTRODUCTION

The idea of world leaders is to lead the future wars with decreased number of human units. For these purposes service robots or robotic systems will be used. Service robots in the defense should reduce the involvement of the humans with purpose to reduce the number of victims in military actions. The most used service robots for military defense are unmanned ground vehicles (UGV). This type of robot is generally capable of operating outdoors and over a wide variety of terrain, functioning in place of humans. Unmanned robotics is actively being developed for both civilian and military use to perform dull, dirty, and dangerous activities. There are two classes of unmanned ground vehicles Remote-Operated and Autonomous. The greatest part of service robot application is for the military defense.

Autonomous service robots have following characteristic:

- Information acquisition from surroundings,
- Prolonged operation without human intervention,
- Moving from point A to point B without human assistance,
- Avoiding hazardous situation,
- Self recovery,
- Awareness to critical objects as humans and vehicles.

2. DISTRIBUTION OF SERVICE ROBOTS IN DEFENSE PURPOSES

Source of data are International Federation of Robotics (IFR) [1,2,3], United Nations Economic Commission for Europe (UNECE) and Organisation for Economic Co-operation and Development (OECD). UNECE and IFR adopted system for classification of service defense robots by categories and types. Service robots for defense are classified: demining robots, unmanned aerial vehicles, unmanned ground based vehicles, and other undefined defense robots.

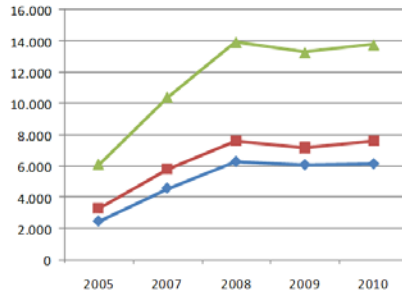


Figure 1. Trend of service robots implementation in defense in period 2005 - 2010

Figure 1. shows increasing trend in implementation of service robots in defense. Service robots in defense 2005 takes share of 42,5% of total number of service robots, unlike 2010 where service robots in defense participated with 45%. It can be seen that service robots supply were increased in last three years in defense purposes.

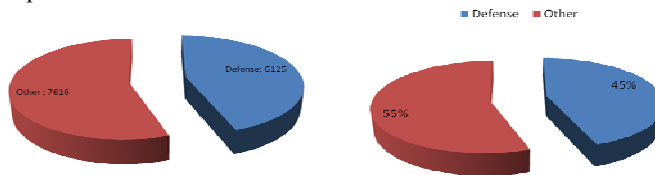


Figure 2. Yearly supply of service robots in defense in 2010

The highest relevant factors are: high quality of performance and productivity, manual work reduction, safety increase therefore risk avoid, operative capacity increase, flexibility, new available contents, stages etc. Following table presents estimation of factor relevance for different types of service robots in defense.

Table 2. Relevance factors for different types of service robots in defense

48-51	Defense	Manual work reduction	Increase of safety, risk avoid
48	Demining robots	•	•
49	Unmanned aerial vehicles		••
50	Unmanned ground based vehicles	•	••

Table shows estimation of factor relevance for types of service robots: relevance factor-no dote (not relevant), relevance factor to two dots (very relevant) [1].

3. SERVICE ROBOT APPLICATION IN DEFENCE

American, English and companies from other countries have been developing new modulate robotic platforms that can operate in undefined areas and conditions. These platforms have to deal with different types of terrain and fulfil given tasks no matter day or night. The most common robots currently in use by the military are small, flat robots mounted on miniature tank treads. These robots are tough, able to tackle almost any terrain and usually have a variety of sensors built in, including

audio and video surveillance and chemical detection. These robots are versatile, with different sensor or weapon packages available that mount to the main chassis. Virtually all of them are man-portable. The TALON is a man-portable robot operating on small treads. It weighs less than 45 kg in its base configuration. TALON robots can be configured with M240 or M249 machine guns or Barrett 50-caliber rifles. MAARS robot has upgrading characteristic comparing to TALON robots mostly in possibility of rapid transforming. METAL-STORM is powerful robotized vehicle, already tested by USA ministry of defense. This robot has 40 mm grenade launcher, controlled from distant position by advanced optical systems. Feature of these listed defense robot are presented in Figure 3.

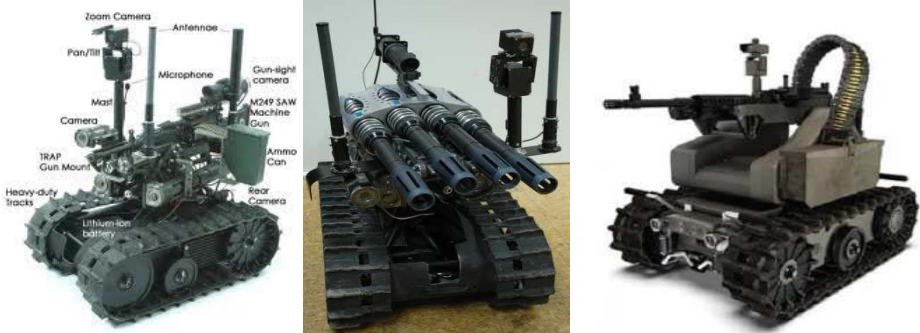


Figure 3. Service defense robots TALON, METAL-STORM, MAARS

SWORDS (The Special Weapons Observation Remote Direct-Action System) represents a new technological concept currently in the developmental stage by American company Foster-Miller. American army has used the robots for surveillance and peacekeeping/guard operations. This robot has a cameras (colour, black white, infrared, thermo vision and zero light), double robotic arm, gripping manipulator, communication equipment, NBC (nuclear, biologic, chemical) sensors. The robot is armed with Squad Automatic Weapon (SAW), M249 Light Machine Gun, fired 750 shots at minute, calibre 5,56 and has not yet been used with this weapon in combat.



Figure 4. Service robots for remote military action SWORDS

Overall objective is to create robot-warrior with purpose to decline human victims in war situation. For some scientist armed robot or robot warrior would present threat to the humanity. Examples of SWORDS robots is given at figure 4.

Robotic Armored Assault System (RAAS) was developed by American army. These robots weights about 5 to 6 tones and can carry almost 1 tone. RASS incorporates a turret system capable of launching missiles such as the Common Missile or Hellfire and operating a medium calibre gun system such as the 30mm Mk 44 Chain Gun. They were designed to unload military airplanes. In the future this vehicle should carry almost 2 tones such as munitions, equipment, people etc. [11].

ARV (Armed Robot Vehicle - Assault) is military model of robot based on MULE (Multi-function Utility/Logistics and Equipment). This robot is used for transportation of weights in order to unburden the soldier. MULE is manipulated manually or by remote control but in some cases MULE can operate autonomously. Robot follows the soldiers and carries all necessary equipment and food needed in possible fight [13]. ARV-A is version of combat/logistic vehicle armed with long-lunch missiles, automatic gun and cannon. List of mentions arms makes ARV-A one of the most effective robotic platforms. ARV-A is still in developing phase [13].



Figure 5. Robotic armored vehicles RAAS and ARV-A

4. CONCLUSION

Service robots are designed to perform daily tasks needed to help humans or for military purposes, respectively defense. Service robots in the defense should reduce the involvement of the humans with purpose to reduce the number of victims in military actions. Most used service robots for military defense are unmanned ground vehicles. This type of robot is generally capable of operating outdoors and over a wide variety of terrain, functioning in place of humans. Investigation shows increasing trend in implementation of service robots in defense. Service robots in defense 2005 takes share of 42,5% of total number of service robots, unlike 2010 where service robots in defense participated with 45%. It can be seen that service robots supply were increased in last three years in defense purposes. From total number of service robot installed units 13.741 in 2010 on defense go 6.125 units. Development in service robotic is going to use robots in every part of human lives in daily bases and application for different tasks. Prediction for the future is increasing trend of service robot application in every field of live and also in defense.

5. REFERENCES

- [1] World Robotics Service Robots 2010, United Nations, New York and Geneva, 2010.
- [2] World Robotics Service Robots 2008, United Nations, New York and Geneva, 2008.
- [3] World Robotics Service Robots 2006, United Nations, New York and Geneva, 2006.
- [4] Doleček V, Karabegović I. Robotika, Tehnički fakultet Bihać, Bihać, 2002.
- [5] Doleček V, Karabegović I. Roboti u industriji, Tehnički fakultet Bihać, Bihać, 2008.
- [6] Karabegović, I., Hodžić D., (2010), Application scenario of robot industry, CENT,M2- Br.2.(ISSN 1986-5201), pp.31-40.
- [7] Karabegović I., V.Doleček (2003), Primjena robota u 21. stoljeću, 4th International Scientific Conference on Production Engineering RIM 2003, Bihać BiH, September 25th-27th 2003, (ISBN 9958-624-16-8), pp. 3-22.
- [8] Karabegović, I., Karabegović, E., Husak,E., (2010), Ergonomic integration of service robots with human body, 4th International ergonomics conference, Stubičke Toplice, june 30 till july 3, (ISBN 978-953-98741-5-3), pp. 249-254.
- [9] Karabegović, I., Begić, Š., Hodžić,D., (2009), Primjena servisnih robota u različitim područjima, 18. Međunarodni Elektroinžinjski simpozij- EIS 2009, Šibenik Hrvatska, 3-6. maj , 2009, S8, pp.12-16.
- [10] <http://www.ai.rug.nl/robocupathome>
- [11] <http://www.worldrobotics.org/modules.php?name=News&file=article&sid=3>