Research on Intelligent Combat Robot System as a Game-Changer in Future Warfare

[1]Byung-Hyo Park, [2]Sang-Hyuk Park [*]

[1]Inspector General, Ground Operations Command, Korea
[2]professor, Dept. of Military, Woosuk Univ, Korea
plbas@Woosuk.ac.kr

Abstract

The Army has presented eight game-changers for future warfare through 'Army Vision 2050,' including Intelligent Combat Robots, Super Soldiers, Energy Weapons, Hypersonic Weapons, Non-lethal Weapons, Autonomous Mobile Equipment, Intelligent Command and Control Systems, and Energy Supply Systems. This study focuses on Intelligent Combat Robots, considering them as the most crucial element among the mentioned innovations. How will Intelligent Combat Robots be utilized on the future battlefield? The future battlefield is expected to take the form of combined human-robot warfare, where advancements in science and technology allow intelligent robots to replace certain human roles. Especially, tasks known as Dirty, Difficult, Dangerous, and Dull (4D) in warfare are expected to be assigned to robots. This study suggests three forms of Intelligent Robots: humanoid robots, biomimetic robots, and swarm drones.

1. INTRODUCTION

Robots, in conjunction with artificial intelligence, are fundamentally transforming the future of warfare. Intelligent robots have found widespread applications in various fields such as industry, healthcare, agriculture, and defense, leading to the replacement of numerous human jobs. Furthermore, the future of defense is focused on developing Intelligent Combat Robots that can either replace or collaborate with human combatants in performing military operations.

These intelligent combat robots can be categorized into humanoid robots that resemble humans, biomimetic robots that mimic the forms and movements of animals, and swarm drones that operate collectively. Ultimately,

designing the concept of operating combat robots in future battlefields and actively leveraging intelligent combat robots as game-changers will be crucial.

2. DISCUSSION ON INTELLIGENT COMBAT ROBOTS

To leap into a realm of advanced, highly connected, and super-intelligent military platforms that can dominate the battlefield, it is imperative to integrate Fourth Industrial Revolution (4IR) technologies into military strategies.

The utilization of Artificial Intelligence, Cyber, Biological, and Materials (AICBM) technologies, along with innovative concepts for weaponry and military organization, is essential. We currently reside in the era of digital transformation, transitioning from mechanization to informatization and entering an age of intelligence due to advancements in science and technology.

Figure 1. Future Super Soldier [1]

In this context, we find ourselves in a hybrid environment where analog and digital coexist, and technologies are blending high and low mixes. As we enter the intelligence era based on artificial intelligence, preparing for future wars involves harnessing the wave of 4IR technologies, including AICBM and the convergence of reality and virtuality, in a military context. Robotics stands out as a key technology driving the 4IR, with nations globally competitively developing robotic technologies.

Notably, the U.S. Defense Advanced Research Projects Agency (DARPA) is actively pursuing the development of quadruped robots and humanoid robots, engaging in challenges such as the Small Humanoid Robot Manipulation Program (SHRIMP) to advance key technologies in this domain.

Figure 2. Future AI Super Soldier [2]

Figure 3. Future AI Super Soldier [3]

3. ANALYSIS OF INTELLIGENT COMBAT ROBOT SYSTEM

Intelligent combat robots are poised to redefine the nature of warfare in future battlefields by engaging in combined manned-unmanned operations. The amalgamation of robotics and artificial intelligence, fueled by advancements in science and technology, enables intelligent robots to assume roles traditionally performed by humans. Particularly, tasks characterized by the 4D attributes—Dirty, Difficult, Dangerous, and Dull—commonly encountered in war scenarios will be delegated to robots.

Humanoid Robots will be utilized in three main forms, fundamentally following human commands to perform tasks. Firstly, they will operate autonomously, making independent judgments and taking actions in fully autonomous mission scenarios, collaborating with humans without direct control to function as a unified combatant. Secondly, they will take the form of semi-autonomous giant robots that communicate with and assist humans on board, enhancing human capabilities. Thirdly, there will be Avatar robots controlled through Brain-Machine Interface (BMI) technology, enabling the integration of robotic and human functions through control by human brainwaves.

Biomimetics Robots leverage characteristics found in living organisms, such as insects, birds, bees, ants, spiders, snakes, etc., to perform autonomous missions by incorporating artificial intelligence. They often take forms that are inconspicuous to the enemy, such as insects or birds, and discreetly infiltrate urban areas, buildings, or underground locations to carry out surveillance and detection missions.

Swarm Drones, on the other hand, are drone swarms that operate in a coordinated manner, similar to birds, bees, locusts, or fish. They can perform simultaneous and coordinated attacks on large numbers of specific targets. These drones communicate with each other, can dynamically adapt their swarm formation based on the environment, and return to base upon completing their mission. Swarm drones are typically mounted on vehicles or airborne mother drones and move to the target area through the platform during long-range operations.

The future army will advance new concepts of warfare using intelligent combat robots. In particular, humanoid robots and biomimetics robots will become key ground combat assets as their performance improves. Therefore, the army must prepare for future wars by modernizing combined manned and unmanned systems, effectively deploying manned and unmanned weapon systems and robots, and training personnel capable of utilizing these systems promptly in the future.

Figure 4. Swarm Drone[4]

4. CONCLUSION

Proposing strategic utilization of the three core capabilities of future intelligent combat robots in military operations, the following recommendations are presented. Firstly, humanoid robots, crafted in the form of humans, should be categorized based on the level of human control, distinguishing between strong, moderate, and weak. These robots, equipped with artificial intelligence, should be capable of autonomous combat missions, enabling them to independently operate at the same level as human combatants while collaborating with them. Secondly, semi-autonomous robots that communicate with humans on board should be developed. These robots act under the control or guidance of humans and are equipped with various weapon systems, forming robust robot systems with powerful firepower and protection capabilities. Thirdly, biomimetic robots, designed to mimic the forms of animals or plants, should be employed. These robots are seamlessly integrated into natural environments, allowing for discreet mission execution. Specifically, they should facilitate surveillance, reconnaissance, and targeted missions through camouflage, infrared laser utilization for enemy identification, and targeting within buildings. Furthermore, the use of swarm drones, inspired by various forms such as dragonflies, bees, or bird swarms, can significantly enhance lethality through simultaneous, coordinated attacks. Miniature smart dust particles can infiltrate enemy command centers and buildings, executing diverse tasks such as eavesdropping, guided firepower, self-destruction, and cyber-electronic warfare.

REFERENCES

[1] https://www.dtaq.re.kr/ko/index.jsp

[2] https://post.naver.com/viewer/postView.nhn?volumeNo=28402660&memberNo=3901450&vType=VERTICAL

[3] https://www.lockheedmartin.com/en-us/news.html

[4] https://blog.naver.com/stoppoint/223146395414