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A Study on Defense Robot Combat Concepts Using Fourth Industrial Revolution Technologies

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Abstract

The ultimate purpose of this study is as follows: The current primary concern in the defense sector revolves around how to strategically utilize Fourth Industrial Revolution technologies in combat. The Fourth Industrial Revolution denotes a shift towards an environment where automation and connectivity are maximized, driven by technologies such as artificial intelligence. Coined by Klaus Schwab in the 2015 Davos Forum, this term highlights the significant role of machine learning and artificial intelligence. Particularly, the military application of Fourth Industrial Revolution technologies is expected to be actively researched and implemented. Combat involves military actions between units, typically conducted as part of a larger war, with units striving to achieve one or more objectives. The concept of combat refers to the fundamental ideas of how units should engage with the enemy, both presently and in future scenarios, to achieve assigned objectives.

Keywords: *Combat Concepts, Fourth Industrial Revolution, Non-linear Simultaneous Operations, System Destruction Operations, Non-contact Stealth Operations*

1. INTRODUCTION

Robots, Advanced military powers consider defense robots as game changers in the future battlefield, aiming for military innovation. The United States, through programs like Squad X, utilizes combined sensors for both manned and unmanned systems, focusing on enemy identification and small-scale precision strike capabilities. Israel, with its Digital Army Program (DAP), is developing and employing unmanned tactical vehicles, robotic mules, armored vehicles, and more. Similarly, the United Kingdom and France also leverage Fourth Industrial Revolution technologies to use cutting-edge defense robots as game changers in future warfare. From this perspective, the South Korean military should advance the concept of defense robot combat to perform integrated operations across various domains simultaneously.

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2. DISCUSSION ON THE COMBAT SYSTEM OF DEFENSE ROBOTS

The future concept of warfare involves the simultaneous integration of combat assets to conduct multi-domain operations, piercing through the adversary's vulnerabilities. The term "simultaneous integration" specifically refers to the fusion and complexity of time, space, location, and unit-specific levels. The operational concepts for different combat systems are as follows: The foresight system aims to grasp the enemy's intentions and rapidly process target information. To achieve this, it requires blocking surveillance gaps through the use of artificial satellites and drones, ensuring 24-hour surveillance and reconnaissance (energy harvest), and enhancing the survivability of information assets through stealth technologies.

The unity system achieves integration through information sharing among combat units and personnel, serving as a space that visualizes and predicts the battlefield comprehensively. The preemptive strike system automates firepower control through the fusion of sensors and shooters, enabling precise strikes with various means. The protection system actively defends against distances and temporal differences, allowing effective interception. The support system overcomes time and information constraints, providing on-site support and utilizing artificial intelligence-based IoT for 3D printing and predictive supply.

3. ANALYSIS OF DEFENSE ROBOT COMBAT OPERATIONS

The future South Korean military needs to advance the concept of multi-domain operations and redesign battlefield organization and weapon operations, taking into account the geographical characteristics of the Korean Peninsula. Moreover, it is essential to identify and destroy enemy-centric targets, including enemy air defense weapons, nuclear facilities, command centers, etc. The combat operational concept of defense robots, the game-changer in future warfare, targeting such vulnerabilities is presented in the following <Table 3-1>.

Table1. Concept of Combat Performance Using Defense Robots

Category	Objective	Concept
Non-linear Simultaneous Operations	Completely break away from linear concepts and ensure war victory by simultaneously attacking and defending	Protection against enemy threats, simultaneous approach using robots at different enemy levels.
Non-contact Stealth Operations	Enemy attacks are countered with non-contact protection, achieving minimal damage through stealth offensives.	Ensuring freedom of action by keeping the enemy out of sight of our allies and out of sight of our allies themselves
System Destruction Operations	Destroy enemy core systems, achieve maximum effectiveness	Paralyzing the enemy's core node system using advanced, high-power robots

In the future battlefield, various defense robots are essential for implementing the concept of simultaneous integration operations of electronic assets, leading to multi-domain operations piercing through the enemy's vulnerabilities. The term "Conversion" implies the integration of time, space, location, unit level, and means.

Figure 1. Future Super Soldier [1]

In the case of the 'Pre-emptive system', it involves first understanding the enemy's intentions and prioritizing the processing of target information. To block surveillance gaps, robots capable of multi-domain threat detection are needed, including satellite-based drone bots and biomimetic robots. Integration of core technologies for communication, batteries, and adaptive camouflage techniques to the surrounding environment and terrain is necessary. For the 'Pre-decision system', the ability to make decisions and take actions faster than the enemy is crucial.

Figure 2. Switch Blades [2]

Figure 3. Switch Blades 300 [3]

This requires leveraging artificial intelligence to process battlefield data swiftly and enhance the visualization and prediction of the battlefield by sharing real-time information with combatants. the 'Pre-action system' involves precision striking through the fusion of sensors and shooters. Drone bots, whether carried by humans or deployed through drone carriers, can penetrate enemy lines and attack their vulnerabilities,

incapacitating the enemy's focus. In the 'Defense system', an active protection system capable of intercepting attacks with distance and time differentials must be established. Nano-technology-integrated combat suits and gas masks are necessary, along with counter-drone systems and cluster drones forming a barrage against anti-aircraft missiles to protect critical facilities. the 'Support system' can utilize 3D printers for on-site maintenance and employ AI and IoT technologies for predictive supply.

Figure 3. Unmanned Military Vehicle [4]

Figure 5. Rescue Robot [5]

4. CONCLUSION

In the future battlefield, domination can only be achieved when leaping into an advanced, highly connected, and highly intelligent military based on cutting-edge platforms. Therefore, our military should develop defense robots that align with the characteristics of each combat system and actively utilize them in military operations. Additionally, we need to advance the concept of combat performance to protect the core capabilities and centers of our forces from enemy cyber, electronic warfare, space attacks, etc. Furthermore, the "Pre-emptive, Pre-decision, Pre-action, Defense, Support system" should interact, integrating rapidly through 4th industrial revolution technologies for faster reporting, decision-making, and simultaneous protection of Asia's center while maintaining operational sustainability through predictive supply.

To employ multi-domain simultaneous integration operations, concepts of combat performance utilizing defense robots, such as non-linear simultaneous operations, non-contact covert operations, and system destruction operations, need to be further refined. As military capabilities alone have limitations, collaboration in information exchange and technology between civil, military, industry, academia, and research institutions is essential. By harnessing collective intelligence, developing and deploying defense robots as a game-changer on the future battlefield will enhance the nation's core security capabilities.

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