Military Robots in 2025

DENIS MAINGI MUTUNGA

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Abstract

This study analyzes the evolving role of military robots in modern warfare. Using peer-reviewed articles, we examine different military robots and what roles they play in combat and support operations. The results show a notable increase in the success rate of military operations with a decrease in the number of human casualties. These findings suggest that military robots will have a bigger role to play in modern warfare, influencing the conduct of military operations and broader perception of war.

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1 Introduction

Technology has proven to be a solution to problems facing many sectors. The military has been quick to involve technology in its programs and routines to

increase its efficiency. The most eye-catching development has been military robots. This development aims to close the military capability gap. In many battlefield spaces, namely air, water, land and cyberspace, military robots are increasingly being used.

In the early phases of development, the military robots were mostly mechanical and controlled by humans. Now most of the military robots are either semi-autonomous or fully autonomous while for the future military robots the goal is greater autonomy (Agarwala 2023). Furthermore, military robots are being used in all arms of the military and they can be cross-deployed as special operations are inherent in them (Agarwala 2023).

2 The evolution of military robots

In war, there are many dangerous and hazardous activities that can lead to loss of life. Robots can be used to perform or handle dangerous activities shielding military personnel from death. In 2025, the military robots are more advanced. Below is the journey of the military robots (Rahman et al. 2023).

In the 1940s, during the world war 2, spy robots were introduced. The main goal of these robots was to reduce the number of victims of the war (Rahman et al. 2023). Collecting information from the enemies was very difficult. It was almost impossible for a person to enter the enemy territory. The Spy robot was the solution but it had major flaws. They were not wireless and for the robot to store the video streamings it required a large amount of disk storage (Rahman et al. 2023).

In 1970, Unmanned Ground Vehicles (UGV) were introduced (Rahman et al. 2023). The Unmanned Ground Vehicle (UGV) made major advancements (Rahman et al. 2023). It featured wireless control capabilities. The downside was that it was controllable over a small distance range 50-100 m. For video transmission, the flaw was still the same, a large amount of disk storage was required. Another major flaw was that there needed to be a clear line of sight with the robot to be effectively controlled (Rahman et al. 2023).

In the early 2000s, modern Unmanned Ground Vehicles were invented (Rahman et al. 2023). The new Unmanned Ground Vehicle had live video streaming, eliminating the need for large amounts of disk storage (Rahman et al. 2023). It was now possible to control the robot from a long range of hundreds of meters. However, they were still controlled manually using joysticks and targeting the felon manually by viewing the target on the screen (Rahman et al. 2023).

Later, the control features were improved from wire transmission to radio frequency (Rahman et al. 2023). Wi-fi control features have also been in use, over which graphical features are used to control the robots (Rahman et al. 2023).

3 Limited military days

Military personnel perform extensive physical actions, such as lifting objects, changing directions at high speeds while wearing heavy military equipment, and patient repositioning. Due to repetitive movement and overuse of the limb, they are susceptible to musculoskeletal (MSK) injuries (Cooper et al. 2024).

In 2017, it was reported that there were more than 2 million clinic visits related to MSK (Cooper et al. 2024). Compared to the general population, the incidences of MSK among military personnel are higher by ten times (Cooper et al. 2024). This makes it the number one reason for limiting military readiness (Cooper et al. 2024).

Likewise, in 2020, the Healthcare and Social Assistance Sector (HCSA) had more than 806,200 cases of injury and illness in the private sector (Cooper et al. 2024). For nursing assistants, registered nurses, and licensed practical and vocational physicians they have perform more physical activities - manual patient handling including moving, lifting, and repositioning. This led to a notable increase in the number of days off work (Cooper et al. 2024). In addition, MSK injuries can lead to chronic disability and high medical expenses (Cooper et al. 2024).

3.1 Wearable Robots

The wearable robot is a technological advancement that helps people perform physical activities using less energy. They also prevent work-related injuries (Cooper et al. 2024). This technological advancement is attached to the body to help in motor functions. With its help, individuals can perform tasks with reduced physical strain, increased efficiency and prolonged task and mission endurance (Cooper et al. 2024). For the injured, the wearable robot can help in facilitating a better recovery (Cooper et al. 2024).

Figure 1: Military personnel using wearable robots

4 Military land operation robots

In the military, ground robots are used to perform hazardous duties. Various types of robots have been developed for specific purposes, such as bomb detection, reconnaissance, and other specialized tasks, which are discussed below.

4.1 Robot Scouts

When the military is preparing for a mission, they need to gather information about the area of attack. To make this process more efficient, the Robotics Institute at Carnegie Mellon University, has developed small unmanned robots called 'throwbots' (Voth 2004). Their main task is to scout buildings and relay information back to soldiers before they enter a certain building. With a weight of 15 pounds, the robot is light enough to be tossed through windows (Voth, 2004). Apart from scouting, the robot can be used as a listening device as it has motion sensors and sound alerts. Its night vision capability enables it to scout even in the dark (Voth 2004).

Figure 2: Soldiers using a robot scout

4.2 Bomb Detection

Mines, a defensive mechanism that can be used to protect land, can be deadly when activated. The development of the Talon, a water-proof vehicle that is used for bomb detection in land operations (Voth 2004). Attached to the talon is a 64 inch pincer arm that is used for explosives disposal. The talon weighs 60 pounds and can move at a speed of 5.2 miles per hour (Voth 2004). Furthermore, the talon is able to carry a 200-pound payload relieving soldiers from carrying extra weight (Voth 2004).

Figure 3: A Talon carrying an explosive

4.3 Medical Aides

Robots can help medics recover soldiers in the field (Voth 2004). Applied Perception Inc. is developing marsupial robots that can follow or lead medics around the battlefield and find and remove wounded soldiers(Voth 2004).

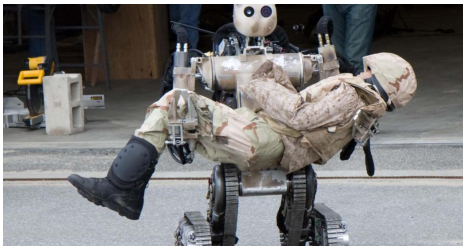

Figure 4: A medical aide carrying a soldier

5 Main challenge facing military robots

Lethal Autonomous Weapon Systems (LAWS) are military robots capable of identifying, selecting and engaging targets all on their own with minimal human interaction (Limata 2023). The challenge facing these robots are discussed below.

The human-specified goal of Lethal Autonomous Weapon Systems (LAWS) is to engage and attack targets autonomously. They should be able to distinguish combatants and noncombatants (Limata 2023). Firstly, LAWS has sensors such as infrared cameras or sonars that are not able to distinguish between military targets and non-military targets (Limata 2023).

In this process of trying to distinguish between the targets and non-targets the robots can get biased (Limata 2023). The robots are created using data algorithms by humans (Limata 2023). During this process the robots can end-up with incomplete knowledge about relevant information such as legal and moral rules. This can lead to the death of innocent people (Limata 2023).

6 Conclusion

Military robots are increasingly being integrated into military operations. They are able to conduct reconnaissance, help the medics and detect bombs and mines (Voth 2004). Compared to the human soldiers, they are less vulnerable to chemical and biological weapons. However, they are not without weakness. Flaws in the Lethal Automated Weapons (LAWS) can lead death of innocent people (Limata 2023).

The developments discussed are those that are on the visible spectrum of the military. Other areas that are invincible are considered critical in the functioning of the military (Agarwala 2023). This includes threat perception, target acquisition, medicine, finance, to name a few (Agarwala 2023).

In recent years, we have seen great advancements in the military robots facilitated by the ever-growing Artificial Intelligence and Machine Learning (Agarwala 2023). However, there is still a long road of development ahead before the military robots can operate on their own without human intervention. Though this is inevitably going to happen, we must prepare ourselves to transition as this will change the perception and conduct of war fighting (Agarwala 2023).

7 Refrences

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