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Military Technology and It's Effectiveness in Future Wars Strategic Vision for Combat Robot Wars

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ABSTRACT: Mankind no longer merely has its advanced muscular or military capabilities, not even nuclear weapons, but has developed an advanced generation of highly destructive electronic machines to replace the human element in the management of bloody wars. But where will destructive technology take humanity's future? Will the fate of the state be controlled by robots after their brains are developed beyond human intelligence? Will humans be able to control the next technological challenge or that robots will control the fate of nations and peoples?
According to above questions, the hypothesis of the increased control of military technology of combat robots over the course of future wars has been formulated, resulting in the loss of human decisionmakers control over the course of political life.

INTRODUCTION

Technology has changed human relations significantly controlled the quality of human behavior and human relations, and has transformed unprecedented economic and industrial systems towards continuous development. Its intervention was not limited to changing the nature of human communications and interactions, rather the change included the military aspect, which changed the form and means of war until the means used by technology became more destructive and subversive of what human beings had accomplished earlier.
One of the most remarkable achievements of military technology is the high level guided combat robots that reduce destruction in wars in record time.
The research attempts to demonstrate the repercussions of the continued development of war technology that exacerbates the use of combat robotic weapons to such an extent that it is difficult to redirect human control over the course of the war. This may be because military robots can develop their brains beyond mankind's ability to keep pace with this evolution. This contributes to humankind's isolation from war management.
The research is based on the hypothesis that: The increasing control of military technology of combat robots over the future wars results in the loss of human decision makers control over the political life.
To thet validate hypotheses, the research covered historical military robotics, robot components, major types, future warfare, arms race, and potential risks in robot wars.

Historical Development of military robotics technology

The information revolution introduced developments in the military strategic field and witnessed the entry of sophisticated weapons, one of the most important entrances to military wars.[1] It may be clear that States' attempts to disburse funds on military technology are due to a change in the forms and consequences of war and thus to a total difference in defense and offensive strategies depending on the type of weapon used and the degree of its technical development. Information security theory reveals that the basic development of information entry into military systems was not used in combat as much as it was used in maintaining state security and funding its intelligence services with what is necessary to protect the armed forces from possible attacks from the opponent. However, information played a prominent role in direct war after artificial intelligence entered the field of military manufacturing, as countries began using information to modernize their military tools, which became more of a threat to the future of humanity. Therefore, to know about the evolution of States in their military information production, it is necessary to review the stages of temporal development, together with the type of information development that States have experienced, bearing in mind that the achievements of developed countries in this area are completely different from those of developing countries.
Weapons development led to the creation of military robots. The first, named George, emerged in 1913, designed by engineer Mercebiri. George, initially an aircraft autopilot, featured a magnetic compass, altitude reader, and gyroscope. This gyroscope

allowed human pilots to retain control, with George adjusting the plane's direction in response to changes. Inventor Elmer Sperry tested this autopilot by flying hands-free in the early 20th century.[2]

The period of World War II reached advanced stages by forming semi integrated parts of robots, especially when the tasks of each robot and the tasks performed by it began to be determined.

Among the most famous robots are robots that are beginning to show biological behavior similar to that of humans. The research of William Gray Walter - a neuroscientist and brain neuron - is considered one of the most famous studies of the mid twentieth century, especially with regard to his construction of some of the first independent electronic robots, as he wanted to prove that the rich connections between a small number of brain cells could lead to complex behaviors in the first place. The secret of how the brain works lies in how it is connected. His first robots, which were called (Elmer and Elsie), were built between 1948 and 1949. They were often described as turtles due to their shape and slow rate of movement, but it is adept at photo response, through which they can find their way to a recharging station when the battery runs out. [3]

One turtle was modified and some sensors suitable for single celled organisms were added to its brain, then two conditional reaction circuits through which they could be taught simple behaviors similar to Ivan Pavlov's dogs. This robotic turtle was called Cora.[4]

Later versions of Cora were shown at the 1951 Festival of Britain. Walter stressed the importance of using purely analog electronics to simulate brain processes at a time when his contemporaries such as Alan Turing and John von Neumann were all moving toward viewing mental processes in terms of digital computation. His work has inspired subsequent generations of robotics researchers, including Rodney Brooks, Hans Moravec, and Mark Tilden. Modern incarnations of Walter's Turtles can be found in the form of robots. [5]

In 1954, the first industrial robot, its inventor George, was designed by engineer George Devol, who was based on self learning and surveillance. The main task of this robot was to capture and move heavy objects from place to place and was later developed to do metal welding. [6]

In 1961 Devol remanufactured his robot and added to it some characteristics to be used in the industry.

In Japan, in 1963, a researcher in technological sciences, Fuji Yusuke Kogyo, designed the first robot in the form of a mobile platform, which transformed technological thought towards equipping factories and facilities with robotic machines capable of transporting people and goods from one place to another using a machine that does not require human management, which was inspiring in developing military means that are based on the same idea but perform purely combat missions, such as military tanks and drones. [7]

Robot parts

Robots consist of the following parts[8]:

First: Body or frame: The robot's body or frame can be in any shape and size. Initially, the main body or frame provides the robot structure.

Second: Control system: The robot's control system is equivalent to a person's central nervous system. It contains a large number of sensors (algorithms) to help the technology interact with the outside world and aims to coordinate the management of all elements of the robot. The sensors respond to the robot's interaction with the environment. The sensor's response is sent to the central processing unit, which uses a program to process the data and make decisions based on the logic. [9]

The control unit also contains a light and sound sensor that enables the robot to recognize light from objects and identify sound waves. This function can help to pass or get close to different objects. [10]

As it has a pressure sensor, some robots are equipped with pressure sensors that simulate touch. [11]

Third: Robot arm: To complete the task, most robots interact with the external environment and the surrounding environment. Sometimes it's needed to move objects in the environment without direct operator intervention. The processor is not an element of the basic design of the robot due to its structure, frame, or control system, that is, the robot can operate without the processor.

Fourth: Structure: Although some robots can perform tasks without changing their position, they usually require the robot to be able to move from one place to another. To complete this task, the robot needs a walking mechanism, the chassis is the driving means of movement. Humanoid robots are equipped with outriggers, and almost all other robotic structures are implemented using wheels.

The motor is the "muscle" of the robot. Currently, the most common motor is the electric motor, but other motors that use chemicals or compressed air are also used. It has included all the main options for robot engines. [12]

Developed robots can navigate Earth's terrain, select alternate routes, and handle weapons, ammunition, mine clearance, and escort tasks. Ongoing advancements aim to enhance their sensory capabilities, improving performance, speed, and overall functionality.

Some research focused on the robot's carrying out several tasks, including feeding the handicapped and picking up the phone on his behalf, receiving orders from a chin wrapping tape that turns commands into signals for the robot. There is also a robot capable of jumping and penetrating enemy locations and crossing walls and barriers 6 meters high. It stores hundreds of small robots and releases them into enemy areas by emitting a hypnotic gas, influencing breathing and sight, which is one of the modern means of warfare. The Swedish scientists developed a robot that was able to fly within three hours after they identified 20 bases and then ordered it to fly. [13]

Military robots are divided into three types according to the environmental field in which they operate: [14]

First type: Military ground robots: Many military science researchers call them intelligence robots because of their espionage impact on the enemy's ground capabilities the areas where his forces are located and their statistics. These types can carry out the following tasks:

1. Military Transport

These robotic soldiers perform transportation as they can help soldiers transport bombs, artillery, military supplies, and other materials. Although these military robots usually have wheels, some come with legs rather than performing on rugged terrain[15]. they can optimize the transportation system like Autonomous Platform Demonstrator or APD. APD is a military transport robot designed by the United States Army's Automotive and Tank Research Center. [16]

2. Search and rescue

The use of these types of military robots is dedicated to search and rescue missions and is also useful when floods, wildfires, and debris occur during an earthquake. Robotic soldiers can also assist in rescue missions during some incidents such as tsunamis, earthquakes, and man-made disasters such as Chornobyl. [17]

3. Demining

This battle robot is useful in dangerous situations that can cost human lives. There are many weapons of war robots used around the world today. They are usually remotely controlled. Also, the operator from a distance to ensure its safety.

4. Surveillance and reconnaissance

These robots are essential in spying on the enemy. Many military robots are useful in surveillance and investigation tasks. Future surveillance and investigation robots will have weapons as well. Among the most important examples of this type of robot are:

- iRobot 110 First Look robot

It is another type of reconnaissance robot group, as it weighs 2.5 kg, has tracks, and is controlled by a controller located in the operator on the wrist. The robot is equipped with four cameras and can overcome small obstacles, and other sensors can be installed on it: Thermal imaging devices, and biological, chemical, and radiological pollution indicators. [18]

- Dragon Runner Robot

It is another remotely controlled vehicle, that is actively used in armies to perform reconnaissance tasks. This robot is also equipped with a tracked metal structure, developed for the front combat line, where this robot is carried in the bag, and it can be thrown at any obstacles. [19]

- TALON Robot

The most massive robot, developed by Foster Miller, produced more than three thousand pieces. it is fond of the warrior soldiers; it was effective on the battlefields. This robot is ideal for reconnaissance and also for disarming explosive devices, and this robot has been actively used to reconnaissance caves where hiding is located. The robot was also modified, in which it was possible to install an automatic rifle, sniper, or (ATGW), as it is a robot with real sniper accuracy in shooting. The line between different sets of military robots is often weak: The automated system can conduct reconnaissance, detect mines, and participate directly in hostilities.
Second: Aerial military robots and their most important forms

- Scientists have developed a robot as a small soldier, who can crawl, jump, and fly over minefields, in the desert, and on beaches, to spy on the enemy, clear mines, and detect chemical weapons. A fly sized aerobic robot was produced, for which the Pentagon allocated $60 million for its development. It could carry photographers to monitor, catch and kill enemy soldiers by poking poison in their necks. A swarm of microrobots, armed with plastic explosives, could land on critical parts of a bridge, for example, and blow them up sequentially, destroying the entire thing with a small number of explosives, the same as a cruise missile. The US space agency NASA is developing a robot that operates on four wheels, and it was able to travel a distance of 125 km, on a journey through the Atacama Desert in Chile, crossing the snows of Antarctica to distinguish a place rich in fallen stones from outer space, west of an American base, at Macordo Station. [20]
- Unmanned aerial vehicles (UAVs): Unmanned aerial vehicles or drones are aircraft that are controlled automatically without a pilot on board. This term has faced a lot of criticism because the plane is controlled remotely by a ground pilot, who is responsible for preventing it from crashing. It is classified into three types:[21]

The first type: Is micro and mini, whose weight does not exceed 150 kg. Many types of first class drones are used in ISTAR operations, for example: Espionage, surveillance, target identification, and reconnaissance operations.
The second type is tactical drones: The weight of this type of drone ranges from 150-600 kg and is usually used in surveillance, warning, or guidance operations. The best of them is Watchkeeper, produced and developed by Thales. It is a drone used in ISTAR operations at all times and circumstances and is currently used in British forces, as well as the RQ-7B Shadow drone.
The third type: Is strategic drones. This type can be divided into three forms:[22]

a. Drones with (Medium Altitude Long Endurance, MALE). They are usually used in non dangerous areas or that do not pose a direct threat.

b. Drones with High Altitude Long Endurance UAVs, HALE.
c. Drones are used to locate the enemy or monitor displacement operations in the event of war, as well as the identification and monitoring of target lists.

Third: Marine military robots

The American website (Military), which specializes in military affairs, revealed that the leaders of the US Marine Corps (Marines) have developed a more detailed and realistic vision for the use of automated and robotic vehicles in future battles, following the "Rim of the Pacific" exercise that took place in the Pacific Ocean in 2022. The website explained that this vision includes the use of combat robots, unmanned platforms, and drones that are part of robot led supply lines in battles.

One of the most prominent types of marine military robots

- Unmanned underwater vehicles (UUV): Underwater drones are a type of vehicle capable of operating underwater without a human crew. These vehicles may be divided into two types: Remotely operated underwater vehicles (ROVs), which are operated by a remote human operator, and autonomous underwater vehicles (AUVs), which operate independently through direct human input.
- The Fish Robot: In 2014, the US Marine Corps unveiled its latest weapon, a new fish shaped robot for use in espionage operations. [23]
- The US Navy succeeded in manufacturing a spy robot in the shape of a shark and a tuna, and tested it in the state of Virginia, according to the German Spiegel Online website. The weight of the new robot reaches 45 kilograms, and it can dive to a depth of ninety meters. It can be directed either by remote control or with a 150 meter cable, and no weapons have yet been developed for use in the robot. [24]

Future warfare and arms race

The most important features of future robotic warfare can be determined by the following points:

1. The coming robotic wars are inspired by the bloody creativity of humans and their potential to invent new models of combat robots.
2. Increased support by various Governments of States - regardless of their economic potential - for individuals and companies producing war technology whose sales ratios are expected to increase according to their potential to create superior warfare robots.
3. The form of economic competition has changed, as companies producing robotic weapons are expected to occupy a superior position in the global economy, especially for countries capable of inventing new weapons with lower costs and greater destructive impact. Thus, the major industrialized countries will seek to research new areas rich in raw materials that they use to remanufacture these weapons, and it is expected that the countries of the African continent will provide them with this privilege.
4. Military cooperation between States in the technological exchange in the field of robotic weapons and the exchange of raw materials used in production, as well as the exchange of experts in this field, is expected to further achieve new military objectives.
5. New regional and international forces appeared that possess such weapons as a result of the proliferation of such weapons and the ability of many countries to develop them.

Recently, the United States has spent $6 billion annually on unmanned systems used in war. The Defense Advanced Research Projects Agency (DARPA) has developed military robots and funded projects such as the LS3 off road robot, created by the American company Boston Dynamics.

US policy documents include plans to increase the autonomy of weapons systems. In the Roadmap for Autonomous Integrated Systems [2011-2036], the Department of Defense wrote that "Envision nonhuman systems that operate quite seamlessly with manned systems, while gradually reducing the level of human control and decision making required by the non humanized portion of the force structure." [25]

It should be noted that, several years ago, there was a more autonomous self acting defense technology, such as the United States Navy's MK 15 Phalanx missile system, its terrestrial version, antimissile, artillery, and mortar system (C-RAM). [26]

Drones are also moving toward greater autonomy than existing drones. For example, the US Navy X-47B aircraft can take off from or land on an aircraft carrier and refuel using its power. While Britain unveiled the "Taranis" unmanned "independent and secret" aircraft. The two aircraft are said to have weapons magazines that can be removed and reassembled as needed.[27]

For Russia, Moscow's vision of the role of lethal robots and Russian efforts in their development could allow Russia to quickly keep pace and even outperform the United States, from drones to robotic tanks and submarines.[28]

This is helped by the fact that the Russian government and financial bureaucracy, especially the military industries, are considered advanced and flexible. Comparing Russia with the United States and the United Kingdom in key areas such as telecommunications equipment, microelectronics, high tech control systems, and other key technologies, Russia remains too late. In many respects of

self operating military systems, Russia may be at the forefront of its competitors at least in designing, testing, and conceptualizing a wide range of systems for future use.[29]

The enormous military force that Russia inherited from the Soviet Union was generally more obsolete and less technologically advanced than the United States arsenal, but it included a relatively recent squadron of unmanned reconnaissance aircraft such as the "Yakovlev Buchla" aircraft and the "Shamlam" aircraft, which were used in The Chechen wars in the nineties, the Syrian war today, and all the conflicts in which the Russian army fought. In the first decade of this century, Russia compensated for the lack of capacity to manufacture drones by importing aircraft such as the Forbost and Zastava drones from Israel. Today, the Eleron, Orlan, and Forpost drones are widely used by Russian forces, including in domestic and foreign military operations, along with a growing list of other models and platforms[30]. Russia has also benefited from its cyberwarfare capabilities; For example, the Orlan drones were integrated into the Lear-3 electronic warfare platform, surprising American and Western observers with their effectiveness in jamming cellular communications in operating theatres.

In August 2017, Russia launched the first domestically manufactured drone capable of flying for a long period at medium altitudes. Two famous Russian aircraft manufacturing companies also announced the production of drones with combat characteristics that entered service in 2020, and the Sukhoi design office is working on developing a line called "Ohotnik" (Hunter) of large combat drones that may resemble the X-47 aircraft manufactured by North Robe Grumman of the United States.[31]

The Russian army currently has self operative mine clearance systems on the battlefield and has been tested in Syria, such as "Oran 6 ′ ′," which is added to the situational awareness systems "Scarab" and "Safir". However, Russia's vision for the future includes medium to heavy autonomous ground vehicles with a variety of weapons. This stems from Russia's status as a major land force still planning to fight based on tank and armored formations supported by long range artillery batteries and air power. Currently, a range of autonomous ground vehicles has been developed to test this technology, including tank sized vehicles such as the Uran 9 and Vihr, along with medium range and smaller vehicles such as the Suratnik, Nirehta, "Platforma-M", "Argo" and "Nirhta", which were built to help develop artificial intelligence systems, while "Soratnik" is currently undergoing testing and evaluation.[32]

In the maritime domain, Russia is advancing autonomous ship tethered minisubs and deep sea robotic platforms. Although trailing behind the West, the prospect of Russian autonomous naval fleets, possibly artificial intelligence controlled, demands a reevaluation of the U.S. Navy's global control. About 50 nations, including Israel, Germany, China, Russia, and Iran, have acquired or developed guided reconnaissance aircraft in recent years, adding complexity to the evolving geopolitical landscape.

These aircraft have multiple economic advantages, which motivates many States to own them. For example, if the F-22 is priced at approximately $150 million, the cost of the piloted aircraft is only about 10 million dollars, and the cost of training the remote control crew is low compared to the training of fighter aircraft pilots.[33]

Risks of Rebellion by Combat Robots in Modern Warfare

Given the evolution of artificial intelligence techniques, the major nations, especially the United States of America, Russia, the Federal Republic of China, and China, have begun to develop multiple applications of artificial intelligence based military systems, because they have become among the new capabilities of forces and influence zones. This threatens the possibility of countries entering into an arms race, as is the case with the American Chinese arms race in developing squadrons of flying drones. This makes the situation more dangerous for international peace and security, as artificial intelligence can play an escalating role in conflict interactions between countries if it's take into consideration the difficulty of determining the identity of the party launching the attack, whether in real military operations (through drones) or in the cyber field. This may prompt one country to use it to create a crisis between two other countries. Among the risks anticipated as a result of the current competition are:

First: The integration of artificial intelligence into weapons increases the risk of war, per a report by the US National Security Center (CNAS). Drones, due to their small size and low cost, can unintentionally escalate conflicts, posing a threat to international peace and security. Countries have not established clear rules for autonomous systems in armed conflicts, creating uncertainty that could serve as a pretext for war. The potential ambiguity in the use of drones, such as China's autonomous Blowfish A2, raises concerns about accurate targeting and threatens global stability.[34]

Second: The rise in casualties and deaths attributed to the use of artificial intelligence techniques underscores the pressing need to address the risks associated with fully automated decision making in national security. The Defense One report specifically examines the potential dangers of AI weapons operating without human intervention.[35]

Third: Autonomous weapons, extending beyond armed drones, remove force from direct human control. Relying on software and sensors, they autonomously make life or death decisions, lacking human qualities like emotion and conscience that usually guide complex moral choices in soldiers.

Fourth: Autonomous weapons cannot be guaranteed to comply with international humanitarian law or human rights, as programmed robots may kill civilians due to incorrect interpretation of data. They also lack the human judgment necessary to assess the significance of an attack, distinguish between civilians and combatants, and adhere to other basic principles of the laws of war.

Fifth: Authorizing violence also has implications for accountability and responsibility. Who is responsible if a robot kills civilians? Was he the military commander who ordered its use? Or the programmer who designed it or set up the algorithms? Or developers of hardware or software? A machine cannot be confined to war crimes. Whom should face judgment and punishment?

CONCLUSIONS

1. The rapid spread of robotics technology horizontally is represented by the use of highly destructive military robots, especially since the visions of European countries have become public.
2. Multiple field experiments by countries in recent years with robots in their military arsenal to measure their survival and operational performance.
3. Autonomous or remotely controlled robots according to military applications such as transport, search, rescue, and attack. Due to the new developments, robots will have combat capability in warfare while programming to perform a different set of functions including the ability to classify the target as neutral or hostile.
4. Military robots can perform unsafe, mysterious, or repetitive military tasks and those that need muscular effort. They do not get tired, do not sleep, endure weather factors, do not waste time communicating with friends, and have no passion. They are programmed to perform tasks only.
5. Military robots, marked by advanced capabilities, face high costs. Research explores diverse tasks, from aiding the handicapped to receiving phone orders via chin wrapping tape. Some robots can leap, infiltrate enemy zones, and release smaller units emitting hypnotic gas for disruptive effects on breathing and vision.
6. The struggle of robots is represented by the attempt of each of the competing robots to disable one part of the corresponding robot which confirms the remote warfare management as the machines of competitors vary in design and in winning plans. The designs of these machines mostly contain a weapon to attack the opponent, such as axes, hammers, dumpers, rotors.

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