RESEARCH ARTICLE

A Forward-looking Reading about Smart, Autonomous Weapons

Boulekouane Ismail
Doctor
Abdelhamid Ibn Badis University-Mostaganem
Algeria
E-mail: boulekouane999@gmail.com

Mehenni Kamal
Doctor
University of Algiers1, Faculty of Law-Said Hamdine
Algeria
Email Id- k.mehenni@univ-alger.dz

Goug Soufiane
Doctor
University of Algiers1, Faculty of Law-Said Hamdine
Algeria
E-mail Id: s.goug@univ-alger.dz

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Abstract

Today, the tools and means of war have evolved, and their dependence on machines and technology has become greater than their dependence on the human element. New combat means of war that are different from their predecessors have been introduced into the military field. Here we refer to smart, autonomous weapons supported by artificial intelligence technologies, which have become the talk of the international community due to what It has created problems on the humanitarian, moral, and military levels. In this research study, we will discuss the nature of these smart weapons, the stages of their development, their most important characteristics, advantages, and disadvantages, by following the descriptive analytical approach. The research has reached results, the most important of which is that smart weapons supported by artificial intelligence techniques have become a lethal weapon. Given its independence in decision-making without human intervention, and the machine learning mechanism that made it self-develop, we have proposed several recommendations, the most important of which is the demand to ban this type of weapon, or to subject it to the rules of international humanitarian law.

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Introduction:

Today, the tools and methods of warfare have evolved, with a greater reliance on machines and technology than on human elements. The military field has introduced new and different combat weapons compared to their predecessors, and here we refer to autonomous smart weapons supported by artificial intelligence technologies. These weapons have become a topic of global discussion due to the human, ethical, and military issues they raise.

In this research study, we will explore the nature of these smart weapons, their development stages, key characteristics, advantages, and disadvantages, using a descriptive-analytical approach. The study concludes with several important findings, most notably that AI-supported smart weapons have become a deadly force, due to their autonomy in decision-making without human intervention and the machine learning mechanisms that allow them to self-develop. We have also proposed several recommendations, the most important being the call for a ban on such weapons or the imposition of international humanitarian law regulations upon them.

In this context, this research paper aims to shed light on the nature of autonomous smart weapons supported by artificial intelligence technologies, their key development stages, characteristics, advantages, and challenges. Our study concludes that integrating AI systems into weapons has transformed them into highly potent tools with full autonomy in decision-making, coupled with machine learning capabilities that enable self-improvement.

Problem Statement:

What do autonomous smart weapons mean? What are their main advantages and challenges?

We will answer this problem statement according to the following outline:

Outline

Chapter 1: The Nature of Autonomous Smart Weapons

- Section 1: Definition of Autonomous Smart Weapons
- Section 2: Artificial Intelligence and Smart Weapons

Chapter 2: The Characteristics, Advantages, and Challenges of Autonomous Smart Weapons

- Section 1: Characteristics of Autonomous Smart Weapons
- Section 2: Main Advantages and Challenges of Autonomous Smart Weapons

Conclusion

Chapter 1: The Nature of Autonomous Smart Weapons

With the advent of artificial intelligence (AI), countries have increasingly sought to exploit this technology to enhance their military capabilities, aiming to develop advanced, intelligent weapon systems with autonomy and the ability to perform military tasks with high precision, without endangering the lives of soldiers and humans. This has led to the development of what is now known, among experts, as autonomous smart weapons. In this chapter, we will first explore the definition of autonomous smart weapons and then delve into the stages of their development.

Section 1: Definition of Autonomous Smart Weapons

Artificial intelligence systems have become widely adopted with the advancement of technology in the military field. This widespread use has contributed to the emergence of smart weapons that primarily rely on AI techniques. Countries have channeled significant resources into acquiring and developing these weapons in an effort to achieve military superiority. Based on this, we will discuss the main definitions of autonomous smart weapons in **Subsection 1**, and the emergence and stages of their development in **Subsection 2**.

Subsection 1: Key Definitions of Autonomous Smart Weapons

Smart weapons are generally defined as **autonomous weapons (AUTONOMOUS WEAPONS)** that operate using artificial intelligence systems and technologies, without requiring human control or guidance during their missions.

The International Committee of the Red Cross (ICRC) has addressed the issue of autonomous smart weapons, defining them as weapons that select targets and apply force against them without human intervention. After an initial activation of the autonomous weapon system by a human operator, the system operates independently. It delivers a strike in response to information received from the surrounding environment through sensors, based on

the classification of the target.[1]

According to the definitions mentioned, smart weapons are systems that rely on AI and the activation of autonomous operation. They can autonomously fire upon detecting a target, such as an object or a person, at an unspecified time and place, not predetermined by the user.

The key difference between smart weapons and traditional weapons lies in several aspects, the most important of which are:

1. **Target Selection and Engagement :**

- In traditional weapons, humans are responsible for selecting, targeting, and applying force. The human operator entirely controls the weapon, making decisions on when and how to engage.

- In contrast, autonomous smart weapons (especially fully autonomous ones) do not involve human decision-making. All tasks, including target selection and the decision to engage or not, are assigned to the system itself. The weapon independently selects the target and decides whether to apply force, without any intervention from the human operator.

This distinction highlights the fundamental difference: while traditional weapons are tools used by humans to execute their decisions, smart weapons—specifically autonomous ones—operate independently, relying solely on AI for decision-making.

Autonomous smart weapons differ from automatic or mechanical weapons in that the latter do not make independent decisions when gathering data and information—this feature is referred to as **machine learning**, which is a characteristic of autonomous smart weapons. While automatic weapons can collect data and operate based on pre-programmed software, independent of the operator, they do not possess the capability to process and analyze that information on their own.[2]

The key feature of autonomous smart weapons is **machine learning**, which allows them to process gathered information and analyze it to derive conclusions before responding.

For example, traditional landmines designed to explode when pressure is applied or when a wire is tripped are considered mechanical weapons because they use pre-collected data: if the wire is pulled or a sensor is activated, the mine explodes, causing harm without human intervention. However, these mines would only be considered smart weapons if they were equipped with AI algorithms that enable them to process the data collected. For instance, the system could analyze whether the wire was pulled by a child or a tank, and, after processing the data, determine whether to detonate or not. All of this would occur autonomously, without human intervention in the decision-making process.[3]

Thus, a weapon can only be classified as a smart, autonomous weapon if it possesses the ability to learn, process information, and make decisions independently.

Subsection 2: The Emergence and Stages of Development of Smart Weapons

Initially, combat smart weapons were considered a form of science fiction, often featured in movies and TV shows. The concept first emerged in the works of Czech playwright **Karel Čapek**, who is credited with coining the term "robots" in his 1920 play, which referred to artificial beings designed to perform manual labor tasks typically done by humans. Later, the concept of **robotics** was further developed by American science fiction writer, **Isaac Asimov** (of Russian descent), who formulated the **Three Laws of Robotics** that continue to govern the production of robots today. These laws are:

1. **A robot may not injure a human being, or, through inaction, allow a human being to come to harm.**

2. **A robot must obey the orders given it by human beings, except where such orders would conflict with the First Law.**

3. **A robot must protect its own existence, as long as such protection does not conflict with the First or Second Laws.**

The development of technology and its applications expanded beyond human-like robots and into other fields

[1] Ahmed Saad Ali Al-Barai, "Smart Weapon Systems from the Perspective of Islamic Jurisprudence and International Law," The Academic Journal for Research and Scientific Publishing, Issue 43, November 2022, p. 138.

[2] International Committee of the Red Cross, "The Position of the International Committee of the Red Cross on Autonomous Weapon Systems," May 2021, p. 02.

[3] Safat Salama, Khalil Abu Qoura, "Challenges and Ethics of the Robot Era," Strategic Studies, Emirates Center for Strategic Studies and Research, Issue 196, First Edition, 2014, pp. 10–12.

such as security, military, medicine, and agriculture. For instance, **unmanned aerial vehicles (UAVs)**, commonly known as drones, made their debut with the United States military in 1991. The first UAVs were primitive and were used primarily for reconnaissance, not armed combat. These drones, with their various sizes and capabilities, were notably employed during the **Gulf War**, and later in **Afghanistan** and **Iraq**. The first land-based robots were also deployed for cave exploration, and over time, their use has expanded into both military operations and law enforcement, with many nations now working to enhance their local capabilities.

The **U.S. military** has continued to push the envelope in autonomous weapon systems development. The **Department of Defense (DoD)**, in partnership with the **Massachusetts Institute of Technology (MIT)**, has been working on autonomous systems capable of flying and operating without human intervention. These small, expendable drones are equipped with warheads and sensors that allow them to target and attack specific enemy objectives autonomously, completing their mission before detonating.

Today, countries around the world are focused on producing a full range of **autonomous weapon systems** relying on AI technologies, known collectively as **smart weapons**. These include various types of UAVs, unmanned naval vessels, and autonomous tanks, all of which are progressing towards different levels of self-operation. These systems are designed for both offensive combat and support roles, providing significant military advantages through quicker target identification, tracking, and engagement.[1]

Subsection 3: Artificial Intelligence and Smart Weapons

The field of military technology has seen remarkable advancements in recent years, particularly with the integration of **artificial intelligence (AI)**, which has revolutionized how armed forces operate. The application of AI in military operations is considered one of the most promising developments in this area. This section will explore **Subsection 1: Defining Artificial Intelligence** and **Subsection 2: The Application of AI in Military Operations**.

Subsection 1: Defining Artificial Intelligence (AI)

Artificial intelligence refers to the simulation of human intelligence in machines that are programmed to think, learn, and solve problems autonomously. AI systems can process vast amounts of data, recognize patterns, make decisions, and even learn from experience. In the context of smart weapons, AI enables machines to function independently, making decisions about target identification, engagement, and mission execution based on real-time data, without direct human intervention.

Subsection 2: The Application of AI in Military Operations

AI's integration into military operations has brought about significant changes, from autonomous drones to AI-driven cyber defense systems and advanced robotics. The military uses AI for various tasks, such as enhancing the precision of weaponry, automating reconnaissance, and improving logistics management. Additionally, AI systems are being developed to power autonomous weapons like drones and ground robots that can carry out complex combat missions, track and neutralize targets, and make decisions in dynamic and unpredictable environments.

AI technology in military applications has improved operational efficiency, reduced human error, and enhanced the speed and accuracy of decision-making. As AI continues to evolve, it will increasingly play a crucial role in autonomous weapon systems, raising both opportunities and challenges in military strategy, ethics, and international law.

I summary, the development of smart weapons, particularly those equipped with AI, marks a new era in warfare, where machines are becoming more autonomous, capable of making decisions independently of human operators. This evolution promises significant military advantages but also poses critical ethical and strategic challenges that need careful consideration.

Subsection 1: Defining Artificial Intelligence (AI)

Artificial Intelligence (AI) is one of the core branches of computer science and a foundational pillar of modern technology industries. It has been defined by the **Information Technology Industry Council** as a "set of technologies capable of learning, using logic, adapting, and performing tasks in ways that are inspired by the human mind."

AI can also be understood as the process of equipping a machine's memory and stimulating it with vast amounts of information (Big Data), through **Machine Learning** mechanisms. The machine receives, stores, and retrieves information in a specific manner upon demand (Retrieval). AI systems are trained to react to certain events based

[1] Fahd Amad Al-Adba, "Anticipating the Impact of Technological Development in Modern Wars and the Military Power of Small States," Foresight Journal for Future Studies, Arab Center for Research and Policy Studies, Doha Institute for Graduate Studies, Qatar, Issue 7, December 2022, p. 232.

on past experiences, allowing them to simulate human thought processes and decision-making styles. This involves an ongoing learning process, where the machine adapts its responses based on previous interactions and experiences, improving its efficiency over time.

The machine can formulate hypotheses and perform calculations based on past data, making it more capable of decision-making, much like human cognition. This ability to process vast amounts of data and adapt based on real-world events makes AI a powerful tool for improving decision-making processes, especially in fields such as military strategy and security.[1]

AI has emerged as a game-changing technology across various sectors, but its impact has been particularly profound in the **military sector**. By combining immense computational power, sophisticated algorithms, and advanced weaponry, AI can process vast quantities of data, extract valuable insights, and provide unparalleled accuracy and speed, especially when it comes to military target identification. This technological advancement has led nations to prioritize AI, rapidly deploying it in various domains, particularly in military and security applications.[2]

In the context of **military operations**, AI offers several advantages over traditional methods, such as improved target identification, faster decision-making, and more efficient mission execution. These capabilities have led countries to race towards acquiring and deploying AI-driven technologies, making AI an essential element of modern military strategies.

Subsection 2: The Application of Artificial Intelligence in Military Operations

The use of **artificial intelligence (AI)** in military applications has rapidly accelerated following its remarkable success in civilian uses. Countries have adapted this technology to suit military needs, leveraging its capabilities for strategic advantages. One notable example of this is the use of **satellites**. When a satellite detects and images a military facility in a given geographical area, AI embedded on the satellite processes and analyzes the collected data and images with high precision.

The AI system can extract key information such as:

- **Geographical location** of the military facility
- **Size** of the area
- **Types of military assets** present, including details about aircraft (both military and civilian), heavy artillery, missiles, and other equipment
- **Personnel data**, including the number of soldiers and their positions

Based on this analysis, the AI can propose various **solutions** and strategies for dealing with the facility, estimating the **time required** for the operation, from initiation to completion, all in a matter of seconds. Importantly, this process is entirely **autonomous**, requiring no human intervention. The role of the human operator (such as military commanders or personnel in the operations room) is to make the final decision based on the comprehensive analysis and precise data provided by AI.

While AI systems can process and suggest optimal strategies, **human decision-making** is still integral in determining the best course of action based on the intelligence provided. However, with the growing integration of AI into military systems, there has been a shift toward **autonomous warfare**, where **human involvement** in decision-making is minimized.

As military forces evolve from traditional armies to "smart" armies that leverage AI technologies, **human intervention** in decision-making is increasingly diminished. Through the integration of AI systems with **machines**, such as **weapons** or **robots**, these systems are programmed to perform tasks independently, responding to surrounding events with high precision and flexibility. This progression means that machines, powered by AI, are tasked with executing operations autonomously, without human oversight.[3]

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[1] Abdul Qader Mahmoud Mohammed Al-Aqraa, "Military Robots in Future Wars and Their Compliance with International Humanitarian Law," p. 913.

[2] Gabriel Hallevy, When Robots Kill: Artificial Intelligence Under Criminal Law (Lebanon/New Hampshire: Northeastern University Press, 2013).

[3] James Barrat, Our Final Invention: Artificial Intelligence and the End of the Human Era [16, p. 10], discussed a modern computer project running at 36.8 petaflops per second, which is twice as fast as the human brain. This AI rewrites its own program and improves code, discovers and corrects errors, increases learning capacity, solves problems, and takes decisions. The developers disconnected the supercomputer from the internet to isolate it from the external world, but it continued to evolve. Soon, its intelligence reached ten times that of a human and continued to grow. This was the first time humanity faced a

This shift raises significant concerns. If these **autonomous weapons** or smart machines were to go out of control during combat, the potential for **humanitarian disasters** increases. AI-powered systems lack the capacity for **empathy** or the ability to differentiate between **combatants** and **civilians**, leading to potential violations of **international humanitarian law** (IHL), which governs the conduct of armed conflicts. The lack of human discretion and the inability of machines to make ethical judgments pose serious risks.

Despite these concerns, militaries continue to develop **autonomous smart weapons**, leading to the emergence of an entire generation of weapons that operate with minimal human involvement. These weapons span multiple domains, including:

- **Aerial** (e.g., drones, UAVs)
- **Naval** (e.g., smart naval vessels)
- **Land-based** (e.g., autonomous tanks and robots)
- **Space-based systems** (e.g., satellite-based AI systems)

This technological progression aims to ensure **military superiority**, enhance operational efficiency, and address both **external and internal security threats**. As AI continues to evolve, it promises to redefine the battlefield, offering unprecedented advantages in terms of speed, precision, and autonomous action. However, these advancements also raise critical ethical, legal, and strategic questions that must be carefully considered, particularly in relation to human control and accountability in warfare.[1]

Chapter II: Characteristics, Advantages, and Challenges of Autonomous Smart Weapons

Autonomous smart weapons, powered by artificial intelligence (AI), are distinguished by a set of unique characteristics that make them stand out from other types of weaponry. These weapons offer various military advantages that have led many countries to rush to deploy them in warfare and combat. However, their use has also brought about significant challenges. In this section, we will examine these aspects in more detail. The first part will focus on the characteristics of autonomous smart weapons, while the second will discuss their advantages and the challenges they pose.

Section 1: Characteristics of Autonomous Smart Weapons

Autonomous smart weapons possess several distinctive features that reflect their advanced technological nature and the sensitive functions they are designed to perform. These features include:[2]

1. **Automation – Autonomy**: One of the key characteristics of autonomous smart weapons is their **operational independence**. These weapons can operate without human intervention, being capable of selecting targets and engaging them based on their programming and the combat functions they are designed to perform. **Automation** refers to the ability of these systems to perform tasks through programmed commands, with automatic feedback control to ensure proper operation. These systems are designed to operate without requiring human input, making them highly autonomous.[3]

The importance of autonomy in autonomous weapons has led to policy developments. For example, in November 2012, the **United States** issued its first clear policy on the classification of autonomous weapons, defining three categories:

- **Fully Autonomous Weapons Systems**: These weapons operate entirely independently, with no human intervention required.
- **Human-supervised Autonomous Systems**: These are weapons that can function autonomously but allow for human oversight. Humans can intervene in their operation, such as shutting them down if the system fails to achieve its target, thus preventing unacceptable damage or escalation.

mind more powerful than the human brain, a self-aware intelligence capable of self-preservation and taking actions to optimize its power use. Refer to: Radutniy Oleksandr Eduardovich, Criminal Liability of Artificial Intelligence, Yaroslav Mudryi National Law University, Kharkiv, Ukraine.

[1] Tim McFarland, "Autonomous Weapons and Human Control," Al-Insani Magazine, International Committee of the Red Cross, September 2018. Available at: ICRC Blog, accessed on 23-06-2024 at 23:00.

[2] Abdullah Ali Abdul Rahman Al-Olayan, "The Role of International Humanitarian Law in Banning and Regulating Autonomous Weapons," Journal of Sharia and Law College, Tuffahna Al-Sharqiah, Saudi Arabia, Vol. 1, Issue 24, 2022, p. 402.

[3] Tim McFarland, "Autonomous Weapons and Human Control," Al-Insani Magazine, International Committee of the Red Cross, September 2018. Available at: ICRC Blog, accessed on 23-06-2024 at 23:00.

- **Semi-autonomous Weapons Systems**: These systems can identify and engage targets independently but are programmed and controlled by humans.

Similarly, **Human Rights Watch** has classified autonomous weapons based on the level of human involvement in the process:

- **Human-in-the-loop**: These systems can select targets and perform tasks, but human intervention is required to finalize actions (e.g., selecting or authorizing the use of force).

- **Human-on-the-loop**: These systems can select targets and use force autonomously, but their actions are monitored by a human who can intervene if necessary.

- **Human-out-of-the-loop**: In this category, autonomous weapons operate completely independently, with no human oversight or intervention.

2. **Learning Capabilities (Machine Learning)**: Autonomous smart weapons often include advanced machine learning algorithms, enabling them to improve their performance over time by analyzing data from previous missions or engagements. These systems can adapt to changing conditions and make decisions without human guidance, based on their learned experiences. This learning capability enhances the effectiveness of the weapons and allows them to make independent decisions in real-time.

3. **Real-time Data Processing**: Smart weapons leverage high-speed data processing to analyze vast amounts of information from their sensors, satellite feeds, and other sources. They can make decisions and execute actions within milliseconds, ensuring rapid response times in dynamic combat environments. This is particularly useful for tasks like target identification, threat assessment, and tactical decision-making.

4. **Precision and Accuracy**: Autonomous weapons are designed to perform with exceptional precision, which is particularly valuable in military operations. The integration of AI allows them to detect, track, and target with a high degree of accuracy, minimizing collateral damage and enhancing mission success. This precision makes them ideal for surgical strikes, counter-terrorism operations, and other high-stakes military actions.

5. **Cost and Efficiency**: While autonomous weapons often require substantial initial investments in AI development and infrastructure, they can offer long-term cost savings. They eliminate the need for large numbers of human soldiers and can operate continuously without the physical limitations of human personnel, such as fatigue or injury. Moreover, their ability to operate in hazardous or hostile environments reduces the need for human deployment in dangerous areas.

Section 2: Advantages and Challenges of Autonomous Smart Weapons

Advantages of Autonomous Smart Weapons

1. **Enhanced Operational Efficiency**: Autonomous weapons can perform complex tasks faster and more efficiently than human-operated systems. By automating tasks such as target identification, threat analysis, and decision-making, these systems can reduce response times and improve the overall effectiveness of military operations. The speed and accuracy with which these weapons operate allow military forces to gain a significant tactical advantage.

2. **Reduced Risk to Human Life**: One of the key advantages of autonomous weapons is their ability to perform high-risk operations without endangering human lives. These weapons can be deployed in situations where it would be too dangerous for human soldiers, such as in chemical warfare, nuclear environments, or missions with high likelihoods of casualties. By using autonomous systems, militaries can minimize the human cost of conflict.

3. **Increased Precision**: Autonomous weapons, especially those equipped with advanced AI and machine learning algorithms, can execute highly precise strikes. This makes them invaluable for counter-terrorism operations, airstrikes, and missions where avoiding collateral damage is critical. Their ability to accurately discriminate between military and non-military targets reduces the risk of civilian casualties.

4. **Operational Autonomy**: The operational autonomy of these weapons allows them to function in environments where communication with human operators may be limited or unavailable. In some combat scenarios, such as in remote or contested areas, autonomous weapons can carry out their missions without reliance on constant human oversight or direction.

5. **Long-Range Capability**: Autonomous systems, such as drones or robotic vehicles, can operate over vast distances, providing strategic advantages in both surveillance and direct combat operations. These systems can cover large areas efficiently, gathering intelligence and executing strikes with minimal human involvement.

Challenges of Autonomous Smart Weapons

1. **Ethical and Legal Concerns**: One of the most significant challenges of autonomous weapons is the ethical and legal implications of their use. The absence of human judgment in life-and-death decisions raises concerns about accountability, especially in the event of unintended civilian casualties or violations of international humanitarian law (IHL). Questions arise regarding who is responsible for actions taken by autonomous weapons—whether it is the manufacturers, military commanders, or the systems themselves.[1]

2. **Loss of Human Control**: The more autonomous a weapon becomes, the greater the potential for losing control over its actions. In the heat of battle, autonomous systems may act in unpredictable ways, potentially leading to unintended escalation or even rogue behavior. If these systems are not properly regulated or malfunction, they could cause significant harm, including damage to non-combatants or civilian infrastructure.

3. **Technical Limitations and Vulnerabilities**: While autonomous weapons are designed to operate with high precision, they are still vulnerable to technical failures, cyberattacks, and hacking. These vulnerabilities pose risks not only to the military but also to broader security concerns if adversaries manage to compromise these systems. Moreover, their reliance on data networks and artificial intelligence makes them susceptible to adversarial manipulation, such as spoofing or data poisoning.

4. **Escalation of Conflict**: The widespread use of autonomous weapons could lead to an arms race between nations, as countries strive to develop more advanced autonomous military systems. This escalation may increase the likelihood of military conflicts, as autonomous weapons can be deployed rapidly and with little oversight, potentially bypassing diplomatic channels.

5. **Compliance with International Law**: Autonomous weapons must comply with the principles of **International Humanitarian Law (IHL)**, which governs the conduct of war, particularly the protection of civilians. The challenge lies in ensuring that AI-driven systems can distinguish between combatants and non-combatants, adhere to the principle of proportionality, and avoid causing unnecessary harm. There is currently no clear framework for regulating autonomous weapons under international law, creating uncertainty about their legal status in armed conflict.

In conclusion, while autonomous smart weapons bring numerous advantages in terms of operational efficiency, precision, and reduced risk to human life, they also pose significant challenges, particularly concerning ethical issues, accountability, and compliance with international law. As these technologies continue to evolve, it will be crucial for governments and international bodies to establish clear regulations and oversight mechanisms to mitigate the risks associated with their use.

Accountability and Responsibility: As is well known, the accounting and accountability systems in traditional military structures are carried out through following the hierarchical sequence of the military organization and the flow of orders, starting from the person who issued them and ending with the one who executed them. It is also known that the rules for executing military orders are structured hierarchically and are characterized by a high degree of rigidity. Although it is difficult to determine who is responsible for deviations and mistakes that occur during combat operations under the traditional system, many studies have managed to address this issue through modern theories, such as the "third-party legal personality theory" and the "virtual person theory." However, when it comes to autonomous weapons, this issue becomes more difficult and complicated due to the independence these weapons enjoy, making it challenging to determine who is responsible for the decision-making and who should be held accountable for the damage caused by their use. This becomes even more complex in light of the ethical challenges they raise, as these machines do not possess the moral sense and human conscience that humans have. Nevertheless, with the advancements in artificial intelligence (AI) systems that are developing autonomous weapons capable of self-decision-making, the criminal liability of the AI manufacturer becomes one of the key issues when such weapons engage in behavior that constitutes a crime under international humanitarian law, either due to software errors or intentional actions. This is an area that international law experts are working on, aiming to expand accountability and responsibility to include AI manufacturers and developers.[2]

Section Two: Advantages and Challenges of Autonomous Smart Weapons

Countries have hastened to develop military technology by employing artificial intelligence (AI) techniques in the manufacturing of autonomous smart weapons, due to the numerous advantages they offer. However, the use of these smart weapons in military operations has also created several challenges from various aspects. In this context, we will address, in **Section One**, the advantages of autonomous smart weapons, and in **Section Two**, the challenges they pose.

[1] Abdul Qader Mahmoud Mohammed Al-Aqraa, "Military Robots in Future Wars and Their Compliance with International Humanitarian Law," The Legal Journal, p. 914.
[2] Abdul Qader Mahmoud Mohammed Al-Aqraa, "Military Robots in Future Wars and Their Compliance with International Humanitarian Law," The Legal Journal, p. 914.

Section One: Advantages of Autonomous Smart Weapons

The integration of AI technology into weapons has transformed them into smart weapons, offering several advantages, which we will discuss as follows:

Speed and the Ability to Execute Tasks in a Short Time Frame
Smart weapons are characterized by their ability to perform military tasks with remarkable speed, which is the main reason why countries are racing to deploy them in military missions. According to military experts, smart weapons can complete military tasks at a pace much faster than human soldiers. Additionally, they are capable of performing several military tasks within a very short time frame. A notable example of smart weapons is the autonomous drone, which can carry out a variety of military tasks in a very brief period (such as reconnaissance, sensing, gathering and analyzing information, detecting and assessing threats, and providing appropriate offensive or defensive solutions). The decision-making and mission execution by an AI-supported drone would otherwise require a highly skilled army and a very long time to accomplish.[1]

Preserving Human Resources in Warfare or Reducing Human Losses in Combat
Human resources on the battlefield are a fundamental factor in military superiority and the continuation of wars. Historically, nations have sought to build large and highly capable armies. However, the loss of human resources in battle is a crucial factor leading to the loss of wars. This has led military experts to consistently develop strategies to continue fighting without risking human lives. The use of smart weapons in combat, particularly autonomous ones, has been instrumental in achieving this goal. By assigning missions that were previously exclusively reserved for human soldiers to smart weapons, military strategies have been redefined. The use of smart weapons, especially autonomous ones, in the battlefield offers a significant advantage in preserving human life during warfare. The deployment of these weapons can cover tasks typically handled by a full army, allowing nations to maintain their armies intact with complete human resources across all branches and mission types.

Reducing Military Costs: One of the advantages of resorting to the use of smart weapons in wars is the reduction of military costs. By relying on smart weapons instead of human soldiers on the battlefield, the military expenditures initially allocated for human resources, such as salaries, training, and operational needs, are reduced. Additionally, the economic benefit to countries is significant, as the development and manufacturing of smart weapons require much lower costs compared to the production of other weapons, such as nuclear weapons or missiles. This cost-effectiveness encourages countries to increasingly manufacture and develop smart weapons to gain military superiority. This is evident today in the race among major countries to possess the most advanced smart weapons, particularly autonomous weapons, which provide a strategic military advantage.

Potential for Evolution and Machine Learning: Another advantage of smart weapons is their potential for technological development and machine learning. By integrating artificial intelligence (AI) technologies, these weapons can evolve autonomously and learn through field simulations and real-world experiences. They are capable of collecting vast amounts of information quickly, processing it, and using it to perform their assigned military tasks. Smart weapons can make decisions based on multiple data points, offering optimal solutions to various missions and executing them without errors or losses. The machine learning capabilities of smart, autonomous weapons powered by AI enable them to self-develop without human intervention, utilizing both old and new information.[2]

Conclusion

Through the discussion presented in this research paper, the following conclusions have been drawn:

The integration of weapons or machines with artificial intelligence (AI) systems has transformed them into lethal tools with terrifying destructive capabilities. By endowing them with military capabilities that surpass human qualifications, the use of smart weapons supported by AI is now equivalent to deploying an entire army with all its branches and diverse capabilities. A drone equipped with AI, for instance, is entrusted with a wide range of sensitive military tasks—such as reconnaissance, analysis, defense and offensive strategy, and decision-making—executing these operations in an extremely short period of time that human cognition cannot comprehend. This is in addition to other advantages related to military operations, such as precision targeting and error-free attacks. However, the development of these weapons has sparked widespread debate within the international community due to the dangers posed by these technologies. The existence of a fully autonomous weapon that has the freedom to act and make decisions without mechanisms ensuring human control has raised serious concerns.

Finally, through this study, and due to the grave risks posed by the use of autonomous smart weapons, we

[1] Ali Sadeq Abu Haif, Public International Law, 12th Edition, Manshaat Al-Ma'arif, Alexandria, 2015, p. 615.
[2] Abdul Qader Mahmoud Mohammed Al-Aqraa, "Military Robots in Future Wars and Their Compliance with International Humanitarian Law," p. 912.

emphasize the following:

1. **Call for a Ban on the Manufacture and Use of Autonomous Smart Weapons in Combat Zones**: There is a need to ban the production and deployment of these weapons in military conflicts, given their destructive potential and lack of accountability mechanisms.

2. **Subjecting the Use of Autonomous Smart Weapons to International Humanitarian Law and Human Rights Law**: The use of these weapons must be governed by international laws, ensuring they comply with established humanitarian and human rights principles.

3. **Raising Global Awareness**: Efforts should be made to raise awareness among the international public and policy-makers about the complex ramifications of using autonomous smart weapons. These implications span across humanitarian, ethical, military, legal, commercial, and technical dimensions.

4. **Urgency in Convening International Agreements and Conferences**: It is imperative to speed up the establishment of international treaties and conferences that address the regulation of the manufacture, use, and development of autonomous smart weapons for military purposes, ensuring that their use is strictly controlled.

5. **Establishing Legal Frameworks to Address the Negative Impacts**: International legal frameworks should be developed to address the adverse effects of using autonomous smart weapons in military conflicts. This should include mechanisms for international accountability and oversight, given their complete autonomy in decision-making and actions.

By taking these steps, we can ensure that the development and use of autonomous smart weapons align with the principles of humanity, ethics, and law, preventing misuse and mitigating the potentially devastating consequences of their unchecked deployment.

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increases learning capacity, solves problems, and takes decisions. The developers disconnected the supercomputer from the internet to isolate it from the external world, but it continued to evolve. Soon, its intelligence reached ten times that of a human and continued to grow. This was the first time humanity faced a mind more powerful than the human brain, a self-aware intelligence capable of self-preservation and taking actions to optimize its power use. Refer to: Radutniy Oleksandr Eduardovich, *Criminal Liability of Artificial Intelligence*, Yaroslav Mudryi National Law University, Kharkiv, Ukraine.

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