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Abstract

Unmanned Ground Vehicles (UGVs) are becoming increasingly common in security and combat operations. The introduction of Ukraine's Lyut tank is a clear example of how automation is revolutionising armed combat. UGVs are currently capable of operating in a semi-autonomous manner but not in the use of lethal force. This paper will analyse the ways in which fully autonomous UGVS are being developed and introduced on the battlefield as well as the role that they may play in the future of security operations. As artificial intelligence (AI) is becoming omnipresent, it is necessary to understand the debate surrounding these systems in armed conflict.

I. Controlled UGVs

Unmanned Ground Vehicles (UGVs) have become increasingly relied upon by States to perform tasks that were previously undertaken by soldiers and security personnel. Land-based mobile robotics have a long history of safeguarding borders. One notable example is the "Guardium". In use since 2009, it is a robotic vehicle which has been deployed by Israeli Forces to secure the borders of the Gaza Strip. The Guardium can operate in rough terrains continually for days while patrolling, escorting convoys, conducting reconnaissance and providing protection (FOP SHVACHKO 2013).

Their endurance provides a significant advantage compared to traditional border security forces in these same operations. Guardiums are generally considered "semi-autonomous" due to the fact they can be controlled remotely (FOP SHVACHKO 2013). However, advanced models of the UGV are capable of full autonomy. For instance, the Guardium MK III is capable of operating fully autonomously and is equipped with both less lethal and lethal weapons, enabling the UGV to engage in "complex combat missions" (FOP SHVACHKO 2013). According to the developer, the Guardium is not only "designed to perform routine missions, such as programmed patrols along border routes, but also to autonomously react to unscheduled events, in line with a set of guidelines specifically programmed for the site characteristics and security doctrine" (European Parliament 2013, p. 13). In practice, the Guardium has primarily been used to complement rather than entirely replace human efforts in guarding the Isreal-Gaza border. In many instances Guardium UGVs accompany human soldiers and border security forces as they patrol the border. This setup enables soldiers to identify potential threats from greater distances, reducing the danger to human lives during these operations (IDF 2012, para. 3).

A more recent illustration of the introduction of UGVs is Ukraine's Lyut, a miniature tank designed to execute "high intensity operations" (Saballa 2024, para. 1). The Lyut is fitted with a PKT 7.62-millimeter machine gun, allowing it to function as a mobile turret in combat (Saballa 2024, para. 2). It is used both as a diversionary tool and to identify enemy battlefield positions (Saballa 2024, para. 3). It is remotely controlled and capable of maintaining effective communication from 700 meters away (Saballa 2024, para. 8). This provides a significant tactical advantage for the Ukrainian army as these UGVs can replace the need for costlier, human-operated tanks, to carry out high-intensity operations.

Both the Guardium and Lyut UGVs are cheaper than human-operated counterparts, making them more cost-effective in operations in which they are likely to be damaged or destroyed. Furthermore, and more importantly, by circumventing the need for human operators, the IDF and Ukrainian army may save soldiers' lives. In a global context, this technology holds potential to enhance specific aspects of humanitarian missions. UGVs could be employed to supply resources to civilian populations, such as medicine, food and water, in operations which were previously deemed too dangerous for human soldiers. They may also assist in other high-risk tasks including bomb disposal and house clearing (Colonel Dynal 2017).

II. Autonomous UGVs

Both the Guardium and Lyut UGV systems are controlled remotely by human operatives. While some functions of the Guardium can run autonomously, there are restrictions on the vehicle's independent use of lethal force. With the development of more UGVs geared words intense combat, including the Lyut, it is worth exploring whether these vehicles will also incorporate autonomous capabilities. The Guardium system has benefitted from some autonomous functions, yet these are not explicitly related to combat and lethal force. It is worth analysing the legal, moral and practical challenges that a combat-focused system like the Lyut may face when introducing automation.

Autonomous UGVs would have many functions, making their operation in combat superior to controlled UGVs and human soldiers. A list of the systems that may become autonomous includes optimal path planning, collision avoidance, target identification, threat evaluation, engagement decision, weapons deployment, abort decision making and task scheduling (Quintina 2008, p.5). In armed conflicts, there is an enormous importance attached to making each of these calculations quickly and accurately. Decisions of this nature must also be made while calculating multiple factors simultaneously. In 2013, the United States (US) Air Force estimated that by 2047, advancements in computing speeds and capacity will have reduced the decision-making processes of drones to "micro or nanoseconds" (European Parliament 2013, p. 9). These advances enable drones "to make combat decisions and act within legal and policy constraints without necessarily requiring human input" (European Parliament 2013, p. 9). In this capacity, autonomous systems potentially hold a significant advantage over controlled UGVs and human soldiers.

Predicting the precise extent of the impact of autonomous UGVs might have on the future of armed conflict is challenging. Nevertheless, it is undeniable that countries will seek to gain any accessible available advantage for their militaries. However, this progress could be further complicated by legal, ethical and practical debates concerning their utilisation.

III. Legal Concerns

Within the Geneva Conventions and other sources of International Humanitarian Law, there is little precedent regarding the use of controlled or autonomous drone systems. Article 35 (2) of Additional Protocol 1 of the 1977 Geneva Conventions outlines rules on new weapons, stating that they cannot be of an "indiscriminate nature" or cause "superfluous harm or unnecessary suffering". This source is widely recognised as an international legal convention and has been relied upon in national case law (ICRC 2024). As this is an established source of international law, it would be essential for these UGV systems to be compliant with international humanitarian and human rights legal standards. Concerning the Additional Protocol, there is no evident rationale suggesting that autonomous UGVs would be likely to cause more superfluous harm or unnecessary suffering than other types of weapons deployed in armed conflict. It is highly unlikely that an autonomous UGV system with an "indiscriminate nature" would be deployed.

Indeed, target identification is one of the critical areas in which autonomous systems may outperform human decision-making (Quintina 2008, p.5; European Parliament 2013, p. 9). Naturally, there remain obstacles which need to be overcome to guarantee compliance with International Humanitarian Law (Quintina 2008, p. 18). Nonetheless, should these standards be upheld, there exists little or no legal precedent preventing their employment in armed conflict (Quintina 2008, p. 18).

IV. Ethical Concerns

One of the primary debates surrounding the use of Artificial Intelligence (AI) in both civil and military domains is whether this technology can comply with ethical and moral standards. As discussed in the previous chapter, the primary legal contention concerning autonomous systems pertains to the application of lethal force. What remains inadequately addressed in International Law is the question of whether a machine should ever possess the authority to terminate human life (Colonel Dynal 2017). In Colonel Dynal's opinion, there is something inherently wrong about a machine killing a human being, as this undermines the value of life (Colonel Dynal 2017). This question generates controversy both in the security industry as well as amongst the public (House of Lords 2023, para. 4). As it relies on moral judgement, there is no definitive answer. The adoption of AI drone systems such as autonomous UGVs may require a heightened level of public confidence in the development of these weapons (House of Lords 2023, para. 4).

V. Practical Concerns

For AI drone systems to earn public trust, they must demonstrate their commitment to being "safe and responsible" (House of Lords 2023, para. 3). As discussed, one of the primary challenges for these systems is their ability to adhere to International Humanitarian Law and acknowledge human rights.

From a practical perspective, AI drone systems may make superior decisions compared to humans in combat. Arguably, introducing systems such as autonomous UGVs may reduce the number of violations of humanitarian and human rights laws in stressful combat situations.

It is challenging to dissociate human behaviour from emotional instincts, potentially hindering soldiers from making impartial decisions on the battlefield (Quintina 2008, p.12). A study conducted by the US Surgeon General's Office in 2006 revealed that 47% of US Soldiers and 38% of Marines agreed that non-combatants should be treated with dignity and respect (Quintina 2008, p.12). Over a third of soldiers asked reported that torture should be allowed, whether to save the life of a fellow soldier or to obtain important information (Quintina 2008, p.12). Finally, 45% of soldiers and 60% of Marines did not agree that they would report a fellow soldier/marine if he has injured or killed an innocent non-combatant (Quintina 2008, p.12).

Autonomous drones can process more incoming sensory information than human soldiers or human-controlled UGVs and could, therefore, make more informed decisions in stressful environments (Colonel Dynal 2017). Indeed, Dr Arkin of the Georgia Institute of Technology argued that autonomous systems would lead to more ethical behaviour in combat (Quintina 2008, p.12). As they do not experience fear or rage, it could reduce the risk of war crimes that soldiers may have otherwise committed (Colonel Dynal 2017). Furthermore, these systems would not be affected by "scenario fulfilment" (Quintina 2008, p.12). This phenomenon distorts or neglects contradictory information in stressful situations where humans use new incoming information in ways that fit their pre-existing belief patterns (Quintina 2008, p.12). As automated systems are not affected by pre-existing belief patterns, they are more likely to make unbiased decisions in stressful situations. Of course, this would need to be guaranteed before they were introduced in combat situations. In turn, this may lead to more moral and ethical decision-making in combat scenarios. Certainly, the application of this technology in the types of conflicts dicussed has yet to seen on any significant scale, and there remains the possibility that it may never be comprehensively deployed in such scenarios. However, it undermines many pre-existing concerns surrounding the implementation of these systems.

Conclusion

The development and implementation of UGVs are becoming increasingly relevant to armed conflict. Controlled UGVs are already revolutionising the battlefield by separating soldiers from some of the most high-risk environments. This paper has found that there are currently no significant challenges to the implementation of this technology in international law. While automated UGV systems are far from being produced and deployed in international conflicts, they present substantial potential advantages in both armed conflict and supporting military operations. It seems likely that controlled UGV systems may implement a degree of autonomy in their operation, while maintaining human oversight as has been seen with the Guardium.

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