Military Robotics Applications for Ground Battle Operations Q-GUV

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Abstract

Ground Military robots come in different shapes and sizes depending on the requirement, and they may be remotely controlled or semi and fully v. Robots consist of different types of payloads depending on the application. Depending on the application requirements, sensors, detectors, weapons, programmed software, and other payloads can be equipped on robots used in the military[1].

The military has been developing various new robot technologies that can assist armies in case of war with various applications for decades. DARPA, for instance, is funding a robotic submarine system that could be used for detecting underwater mines, conducting anti-submarine operations, and protecting ships in harbors[2]. The Strategic Computing Initiative (SCI) was launched by DARPA in 1983 with the sole goal of advancing artificial intelligence and robots integrated plans to promote computer chip design, computer architecture, and artificial intelligence software[3].

Military Ground Robotics

As a result of these benefits, militaries worldwide are increasingly employing robots for military purposes. According to market analysis, the military robot's industry is expected to reach USD 30.83 billion by 2022, growing at a CAGR of 12.92%. Different types of ground operations robotics units have been developed by the military for a variety of military applications as follows. It has been reported that 30% of the military forces in the US are now robotic[4].

Unmanned Ground Vehicles (UGV) Robots

Unmanned Ground Vehicles (UGV) are autonomous or semi-autonomous robotics with various applications as mentioned as follows:

Military Transportation Robots

Transport roles are performed by these robotic soldiers. These vehicles can transport bombs, artillery, military supplies, soldiers, and other materials for the soldiers. While most of these military robots have wheels, some have legs to enable them to move over rough terrain. Using military robots for transportation increases logistics efficiency and assists soldiers in their movements as well. Materials are carried to the battlefield by them. They also assist in picking up casualties from the battlefield and help soldiers to avoid life threatening combat situations. For instance, an Autonomous Platform Demonstrator (APD) is an Army Tank-Automotive Research vehicle commonly used for transport[5].

Search And Rescue Military Robots

The use of robot search and rescue soldiers can also be useful during natural disasters like tsunamis, earthquakes, and artificial disasters like Chernobyl or 9/11. Search and rescue missions are carried out by military robots of this type. Rescue missions on land or in the water can save lives and reach places where a normal human cannot. They are also useful in times of floods, wildfires, earthquakes, wrecks, and other disasters[6].

Fire Fighting Military Robots

Robots of this type are used to put out fires and save lives. Unlike humans, they are able to withstand elements that humans cannot.

Mine Clearance Military Robots

The use of this type of battle robot is useful in warzones and areas where mines, bombs, and other explosive items may cause harm to humans.

Surveillance and Reconnaissance Military Robots

There are many military robots that can be used in surveillance and investigation missions. As a result of these robot soldiers, the enemy can be spied on with greater accuracy

Armed Military Robots

The robots in this type are armed with weapons and can shoot live ordinances and protect soldiers and defend military resources.

Unmanned Aerial Vehicle (UAV) Robots

These robots are also known as Drones and raptors capable of flying by remote control or autonomously to deliver ordinances to targets or serve some military function.

Unmanned Underwater Vehicle (UUV) Robots

These robots can maneuver and operate underwater autonomously

As a result of all these different types of robotics, Quadrupedal Unmanned Ground Vehicles (Q-UGV), also known as a robotic dog are currently considered to be one of the most advanced robot applications being developed with more advanced artificial intelligence systems and autonomous capabilities. There are a wide range of applications for the Q-UGV, including surveillance, transport, armed security, rescue, surveillance, and mine clearance, as well as the extermination of strategic military targets. Currently companies like DARPA, Boston Dynamics , and Ghost Robotics have working military applications using Q-UGV[7].

The Portland Air National Guard Base became the first Air National Guard base in 2021 to implement Q-UGV A.K.A (autonomous defenders) for its armed security patrol units at the base. Since then many other military installations have adopted the technology for military security. This robot can operate in unknown environments and return to position regardless of the failure of the vision sensors or the slippage of the robot. Ghost V60 quadrupeds are expected

to enhance ground-based forces' situational awareness. Additionally, it will act as the eyes and ears of frontline soldiers. Four-legged robots can traverse different terrains, including rocks, sand, hills, and stairs. Complex environments can be navigated by walking, running, crawling, climbing, and swimming. Sensors can be equipped with RGB and time-of-flight (TOF) sensors for surround-sensing, as well as thermal/infrared (IR) sensors. Moreover, it can be equipped with CBRN and specialty sensors. As a result of the integration of light detection and ranging (LIDAR) imaging systems, users can obtain 3D imaging of the surrounding environment in order to assess potential threats. A 360-degree camera offers 360-degree views, which enhances situational awareness, which is important for planning effective strategies. There are currently trials of 5G connectivity on the V60, which also has Wi-Fi and dual sim 4G/LTE connectivity[8].

Typically Quadrupedal Unmanned Ground Vehicles are built with 4 frames and 12 to 15 degrees of freedom. With 3 degrees of freedom in each leg and other DOF for additional drivetrains. They use onboard electrical systems and lithium ion batteries. Voltage regulators can help adjust the voltage depending on the requirements of the motors, sensors, and the onboard CPU with multiple navigation systems and logic operators that are controlled by smart AI models. With MCS AI models, DARPA seeks to construct computational models that mimic the core domains of child cognition for objects (intuitive physics), agents (intentional actors), and places (spatial navigation)[9].

Retrospectively, the applications and advancements that Q-GUV robotics can accomplish or implement barely scratch the surface of the technology. We will see great strides in Q-GUV advancements with the advancement of AI, sensors, and industry in the near future.

Resources

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