UDC 528.93

USING LIDAR TECHNOLOGIES FOR TERRAIN MAPPING IN MODERN WARFARE

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Key words: LIDAR, remote sensing, terrain mapping, digital elevation models (DEM), tactical advance

Introdaction: In the realm of modern warfare, accurate and detailed terrain mapping provides a critical tactical advantage. Traditional methods of terrain analysis often lack the precision and speed necessary for rapidly evolving combat situations. LIDAR (Light Detection and Ranging) technology has emerged as a revolutionary tool, offering unprecedented capabilities for terrain mapping in military contexts. This technology offers high-resolution mapping, vegetation penetration, and the ability to generate detailed 3D terrain models.

Materials and Methods

- ✓ **LIDAR Systems:** Airborne, terrestrial, and mobile LIDAR systems are employed for military terrain mapping. Airborne systems provide broad coverage, terrestrial systems offer high-detail surveys, and mobile systems enable rapid data collection along routes.
- ✓ **Data Acquisition:** LIDAR data is collected based on the system used. Airborne systems utilize planned flight paths, terrestrial systems rely on strategic scanner positioning, and mobile systems gather data during movement.
- ✓ **Data Processing:** Raw LIDAR data undergoes point cloud filtering to separate ground points, followed by digital elevation model (DEM) generation. Features like buildings and infrastructure are then extracted algorithmically from the DEM.
- ✓ **Software:** Software like ArcGIS, QGIS, or specialized military platforms are used to process and analyze LIDAR data.

Results

LiDAR technology has been instrumental in transforming the landscape of modern warfare, with its applications yielding significant results in various military operations.

One of the primary applications of LiDAR in the military [1-3] is in the creation of 3D tactical maps of battlefield terrains. These high-resolution maps provide detailed information about the environment, including both urban and non-urban areas, which is crucial for mission planning. The ability to accurately determine the positions of enemy forces and installations has proven to be a

game-changer in strategic planning.

In addition to mapping, LiDAR technology has also been employed in driverless military vehicles, enhancing their navigation capabilities. The detailed terrain information provided by LiDAR allows for more precise route planning, thereby increasing the efficiency of these autonomous vehicles.

LiDAR has also shown promise [4] in the field of mine hunting. By providing a detailed view of the terrain, it aids in the detection and neutralization of mines, thereby enhancing the safety of military personnel.

Furthermore, experimental results have demonstrated the effectiveness of LiDAR and camera fusion in fulfilling real-time and reliable traversability mapping.

However, it's important to note that while LiDAR technology has proven to be highly effective, there are certain limitations. For instance, LiDAR measurements in complex terrains can be influenced by factors such as orographic complexity, measurement height, surface roughness, atmospheric stability, and half-cone opening angle. These factors can lead to errors in the data, which need to be accounted for to ensure the accuracy of the terrain maps.

Conclusions: The application of LiDAR technology in modern warfare has proven to be a game-changer, revolutionizing the way militaries understand and navigate the battlefield. The high-resolution 3D maps provided by LiDAR have significantly improved mission planning and execution, enabling militaries to operate with greater precision and efficiency.

In conclusion, LiDAR technology has made significant strides in modern warfare, but there is still much to explore and improve. As technology continues to evolve, it is anticipated that LiDAR will play an even more integral role in the future of defense operations.

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