EXTENDED REALITY AND HUMANOID ROBOTICS: NEXTGEN ASSETS FOR REMOTE CB RESPONSE AND OPERATION

Using Virtual Reality To Explore Operational Utility, Virtual And Digital Twins For Cbrn Situational Awareness

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Because of the limited ability to test or train in an actual chemical- or biological-contested environment, we rely on a combination of (both real and simulated) science and modeling technologies to improve the warfighter's readiness posture. Through the strategic combination of virtual reality (VR) and digital twins (DTs), the warfighters (and science and technology (S&T) analysts) are empowered to conduct risk-free explorations and make informed decisions. VR provides an immersive (repeatable) experience of a virtual environment that can be used for training and mission planning. However, the virtual environment is detached from our physical existence. This is where the role of digital twins is becoming increasingly important to mirroring the physical world more closely. For this talk, we will examine the CB Training and Assessment in Simulation Conditions (CB TASC) VR environment and injection of virtual replicas of phenomenology and physical objects/assets.

The CB TASC prototype brought together chemical and biological (CB) transport and dispersion (T&D), health and human effects (HHE), and epidemiological prediction models (e.g., infectious disease models) with sensor performance models into the VR variant of Tactical Assault Kit (TAK). The software leverages the rendering technology of Unreal Engine 5 (UE5), which can be either desktop-based or full VR. CB TASC includes both a Lagrangian puff model, using Gaussian puffs, and a Computational Fluid Dynamics (CFD) Large Eddy Simulation (LES) model. The T&D data is voxelized and rendered using UE5's Volumetric Fog and Particle systems, if visible to the human eye. An instructor can render the plume visible for review or for after action replay (AAR). Terrain capabilities include the Army's One World Terrain (OWT), displaying buildings and synthetic terrain in 3D at run time. Human effect emulations are a result of exposure to real-time, time-varying concentration data captured as user avatars contact the threat(s). Signs and symptoms of exposure such as blurred vision, nausea, headache, and pain are included via visual screen effects. Emulators exercise the message flow of integrated sensor architecture information.

Further development is required to demonstrate the utility across the full breadth of CBRN preparedness and response activities. Non-player characters (NPCs) are an essential element of the 3D and virtual reality experiences. NPCs can be generated based on troop formation data from wargaming tools such as the Mission Impacts of Nuclear, Chemical, and Biological (NCB) Events Software (MINES). Ongoing efforts are working to create more realistic digital twins for core CBD capabilities and interactions. Core capabilities include sensors, protective equipment, and medical countermeasures (MCMs). In addition to atmospheric (outdoor) T&D, we are coupling advanced indoor/outdoor T&D with 3D models of the building(s), terrain environments, weather forecast data, and entities. Key interactions include deposition of agent (potential contact hazard), and secondary evaporation over time. Individual task requirements include self-aid and buddy care (SABC) treatments. Virtual replicates of sensors will be physics-based and consider 3D object interactions. Time-scaling will allow the user to modify the speed at which the simulation runs in real time. Both post- and between-scenario time skipping will be supported.

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