Experiment #8

Forest Fires Robot [BoldRobotics]

Overview and Objectives

BoldRobotics, based in Coimbra, Portugal, is a pioneering company dedicated to the development and research in robotics and UAVs, with strong focus on emergency services. For this third-party experiment, project partner ONE had the opportunity to integrate BoldRobotics' advanced robot within the 5G-EPICENTRE platform, and more specifically the *VS4: Network Applications and Services for internet of Things (IoT) for improving first responders' situational awareness and safety* (Mobitrust platform.

BoldRobotics has developed the forest robot depicted (Figure 1) over the past few years, incorporating cutting-edge technology to enhance remote control and assisted navigation through multiple cameras and sensors. This innovation significantly improves forest management, by making it faster, more efficient, and more profitable, while minimizing risks and hazards for workers. The robot is designed to perform intelligent biomass management, tailored to the specific characteristics of each location, thereby maximizing the benefits and value derived from natural resources. Additionally, it optimizes labour efficiency by utilizing advanced technological tools instead of increasing the human workforce.

Figure 1: BoldRobotics Forest Robot

Before the integration with the 5G-EPICENTRE project, the robot was only managed by its RF radio, and without any capability to transmit the cameras and sensors through mobile networks. In this experiment, the robot was integrated with a OneSource 5G modem and sensors (Figure 2), enabling real-time streaming of high-definition and infrared camera feeds to the Mobitrust platform. This capability is further enhanced by the ability to capture a 3D LiDAR feed, and collect real-time data on temperature and gases, leveraging the 5G-EPICENTRE platform from the Altice Labs facility.

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The integration of BoldRobotics' robot with the Mobitrust platform (Figure 3) aims to elevate forest management capabilities by leveraging 5G technology. The real-time streaming and data collection features provide comprehensive situational awareness and environmental monitoring, enabling more informed decision-making and efficient resource management. This synergy between BoldRobotics' innovative robotics and the 5G-EPICENTRE project sets a new standard in technological advancements for forest management.

Figure 2: Robot control unit

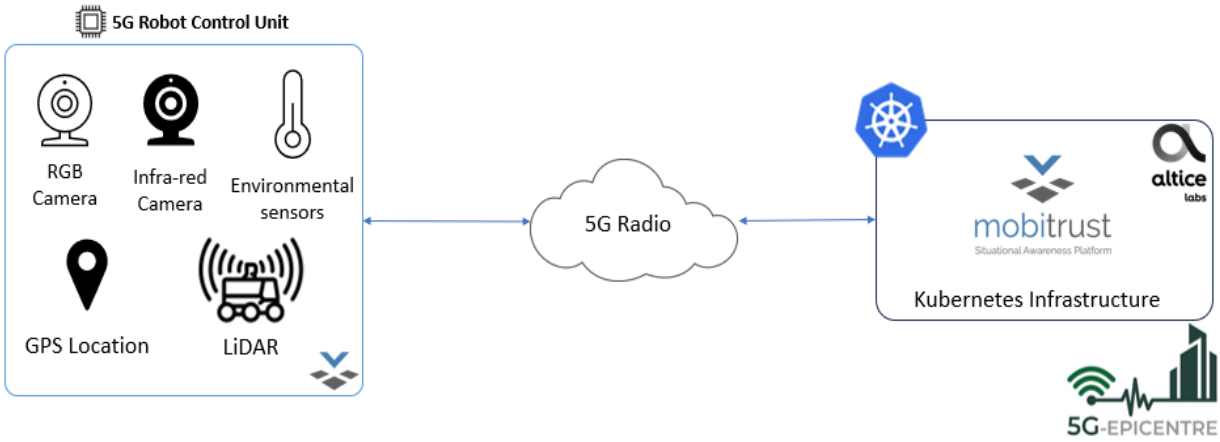

Figure 3: Robot integration with 5G-EPICENTRE

Testbed Readiness

For the integration with BoldRobotics, a dedicated deployment of the Mobitrust application was achieved at the Altice Labs testbed, through the 5G-EPICENTRE Portal, as shown in Figure 4. This new Mobitrust platform deployment includes new features and communication capabilities, to interact with the robot and exploit the new data sources. Due to the logistics associated with moving the BoldRobotics' robot, namely due to its prototype status and weight (nearly a ton), the integration efforts were all done at BoldRobotics premises, while the integration was achieved using ALTICE 5G network with access to the 5G-EPICENTRE testbed in Aveiro.

Experiment Execution and Results

To carry out this experiment and analyse the results, the integration team collaborated with the BoldRobotics team at BoldRobotic laboratories in Coimbra. After several integration and development activities, a final testing was performed in the field (nearby BoldRobotics laboratories), as shown in Figure 5. The testing focused on validating the integration by demonstrating the various components of the Forest robot, including cameras, GPS, and LiDAR in a remote location leveraging the Mobitrust dashboards.

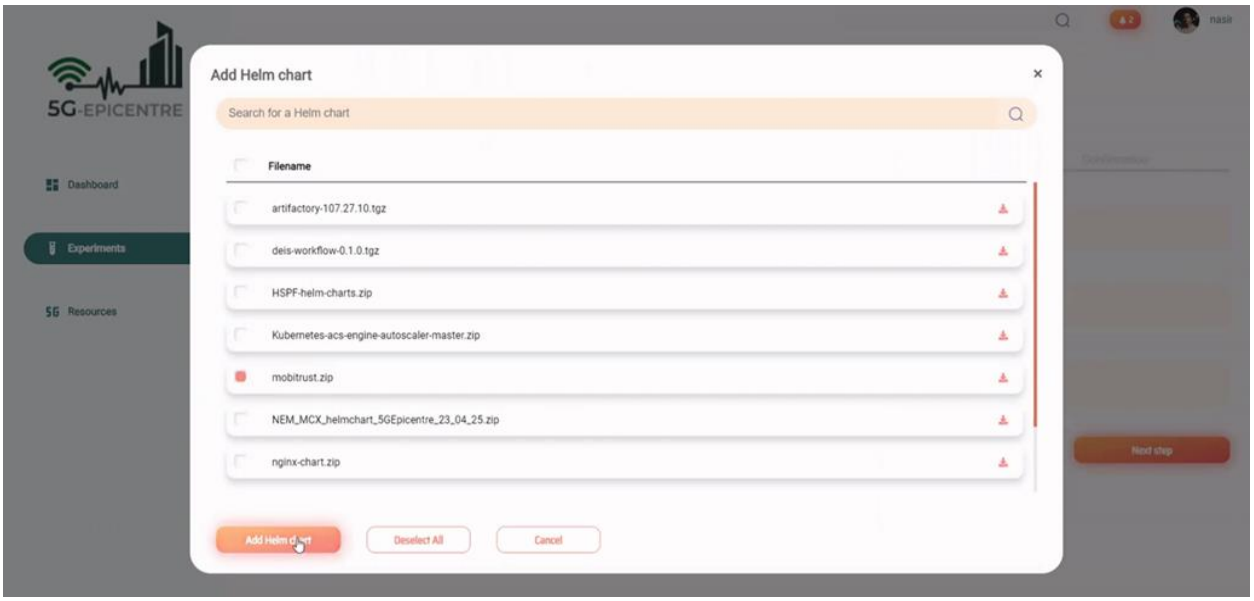

Figure 4: BoldRobotics: Mobitrust deployment

Figure 5: Experimentation of the forest robot in the field

Regarding the cameras on the Forest robot, an RGB camera and a thermal camera were integrated into the Mobitrust platform, with their video feeds simultaneously transmitted to the Mobitrust CCC (Figure 6). The robot's GPS, present in Figure 7, was also integrated into the Mobitrust platform, allowing the robot's exact location to be displayed on the map available in the Mobitrust CCC dashboard. Additionally, a LiDAR sensor (Figure 7) was incorporated into the Mobitrust platform. This sensor provided real-time 3D mapping, which was also transmitted to the Mobitrust CCC, Figure 8.

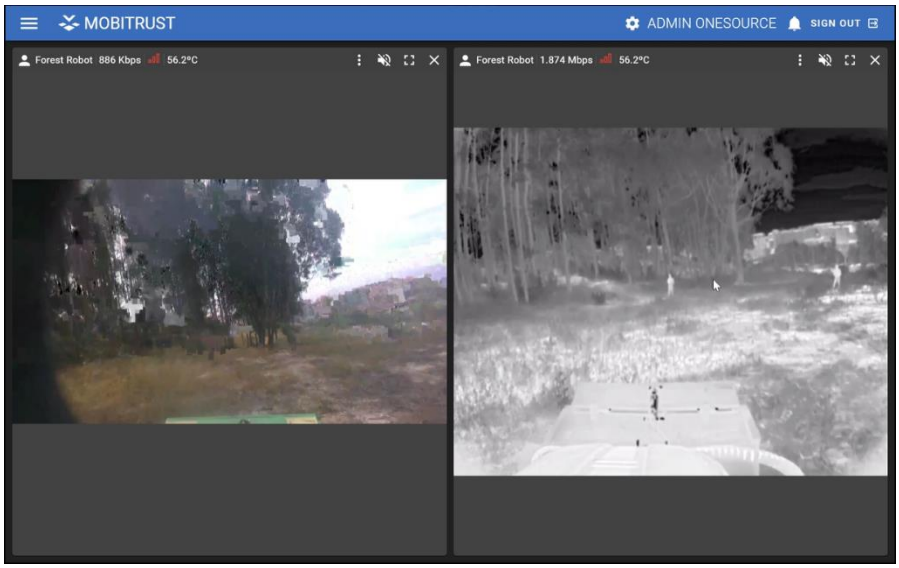

Figure 6: Video transmission from the robot's cameras

Figure 7: LiDAR and GPS from the forest robot

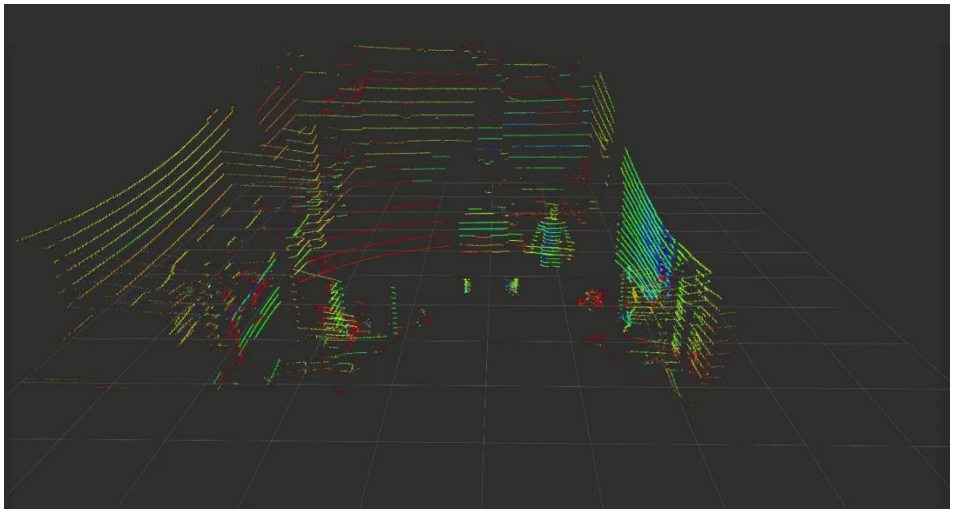

Figure 8: 3D LiDAR Feed

Overall evaluation

The integration of BoldRobotics' advanced robot with the Mobitrust platform network applications has been a resounding success. This collaboration has validated the interest of the Portuguese SME in the capabilities of the 5G mobile network, the 5G-EPICENTRE platform, the ALB testbed, the Mobitrust platform, and the project-developed, vertical-specific network application integration elements.

Through this experiment, the 5G-EPICENTRE partners have showcased the seamless integration of 5G technology, through an easy, cloud-based 5G-EPICENTRE platform deployment, to enable real-time streaming and data collection from the robot's high-definition and infrared cameras, 3D LiDAR, and various environmental sensors.

Results of this integration for BoldRobotics were also positive, demonstrating that the 5G-EPICENTRE platform and the UC4 integration enhanced the robot capabilities, bringing novel services to firefighters in fighting forest fires. Leveraging 5G communications, a comprehensive managing platform, and the Mobitrust dashboards, BoldRobotics can provide new services and advanced features to its customers (who were not initially in their roadmap).

The collaboration between BoldRobotics and 5G-EPICENTRE promises to pave the way for further innovations that will continue to enhance operational efficiency and environmental sustainability. Both BoldRobotics and OneSource plan to continue their collaboration and evolve together the BoldRobotics product together.