Pilot Demonstration of RF-based Localization and Monitoring in Offshore Platforms

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The OffshoreMuster technology enables localisation of personnel in high-risk environments, such as offshore platforms or oil-rigs. CSEM's ultra-low power communication and localisation system was successfully tested in real scale and target environment, showing commercialisation maturity.

Oil & Gas offshore platforms are industrial towns, ranked among the world's most hazardous work environments. Personnel safety may be endangered by fire, explosion, suffocation from toxic gases, fatigue, failure of structures or extreme weather conditions. Emergency situations are unpredictable, in the midst of time pressure, high risk, ambiguous information on incident escalation, lack of real-time people location information or rapidly changing conditions. With EU Horizon 2020 FTI project OffshoreMuster [1] (OSM), CSEM and its partners propose an innovative decision support system capable of real-time personnel localisation, situational awareness and advanced incident escalation monitoring in emergency response [2].

OSM adapts and extends the person localisation technology developed for safe evacuation of passengers and crew on large cruise ships (Lynceus2Market EU project). Connected, low-cost, ultra-low power mobile devices are worn by the personnel, periodically transmitting short radio-frequency signals that are captured by dedicated base stations (gateways). A data collection infrastructure (using the Publish/Subscribe paradigm and capitalizing on Apache Kafka), processing components and an interactive, rich-featured Graphic User Interface provide a holistic view of the situation on the platform in real time (Figure 1), showing people location, movement and alerts, Instant headcount etc. Localisation is based on Received Signal Strength Intensity (RSSI) and uses two algorithms (particle filtering and a simple, proximity-based one as a backup).

Figure 1: Monitoring display showing personnel in a meeting room.

Zakher Marine International offered to conduct pilot tests and a demonstration of the system in one of the company operations barge, the QMS PRIDE, at the port of Abu Dhabi (UAE). A total of 82 gateways were deployed in several areas on the barge, covering various space types (cabins, corridors, indoor and outdoor open spaces, engine room, galley, etc.). Their placement was based on know-how acquired from test deployments at CSEM premises and on RSSI signal measurement campaigns conducted beforehand. In addition, the deployment on QMS PRIDE was validated using localisation data obtained by placing mobile devices in various known positions, as shown in Figure 2.

Up to 21 OSM mobile devices participated in these pilots, a limit set by the constrained timeframe and the available personnel to run the test scenarios (the Lynceus pilots had involved over 500 crew members). The latter scenario covered manifest reporting and personnel localisation over normal, non-emergency conditions, mobile device re-assignment, mustering, missing people localization (including overboard localisation), alerting (using alert buttons on the mobile devices) and manifest reporting over emergency conditions. In addition, a few experimental features were tested, such as presence detection in a restricted area (e.g., in the engine room) or overboard fall detection (using gateways with directional antennas).

Figure 1: Gateways (in blue) and mobiles (in orange) on a few decks.

The system showed extremely good stability throughout testing and demonstration (for over a week). Mobile device connectivity (coverage by the gateways) was very stable overall, which is key to good performance, only experiencing slight perturbations in spaces with many metallic elements (e.g., engine room) or on outer outdoor spaces. The device positions were computed at the expected rate (every 5 seconds) with only occasional position misses. Localization has performed very well in indoor areas such as cabins, offices, recreation areas, corridors and isolated outdoor areas, with a precision below 5m. In the "known position" tests, the average precision per device varied from 1.8m to 13.9m. The larger errors occurred when the mobile device signals were detected by gateways on more than one deck, or when connectivity was at times deficient (device detected by less than three gateways, i.e., when the proximity algorithm was used). Latency (measured as time from beacon emission to position calculation output) was consistently around 10 seconds (with maximum values below 20s for most devices).

OffshoreMuster marks a step-change in worker safety offshore with a good perspective for commercialization.

[1] https://offshoremuster.com/

[2] I. Panaretou, *et al.*, "OffshoreMuster: An Integrated Real Time Localisation, Mustering And Evacuation Management System For Offshore Oil & Gas Health And Safety Operations", ADIPEC Technical Conference, Abu Dhabi, November 2021.