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3D Adaptive Coverage Planning for Confined Space Inspection Robots

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The manual inspection of confined spaces, such as ballast tanks, for corrosion is a hazardous, time consuming, expensive, and subjective process. Robotic inspection techniques are being considered as they promise greater objectivity and comprehensive coverage as well as repeatability, reduced risk, and shorter maintenance downtime. To enable a robot to comprehensively inspect all surfaces within the tank, it needs a route-plan. Although coverage path-planner algorithms can be used to automatically generate optimal plans, complex environments and robot kinematics can make the problem challenging. Most existing coverage algorithms can only produce offline plans that cannot cope with unforeseen obstacles and would consequently fail. Such problems present the need for adaptive coverage-planning algorithms that can replan routes autonomously. To date, the focus of our research has been to evolve the offline Redundant-Roadmap algorithm into an enhanced algorithm capable of adapting its plan online. The online solution utilises LIDAR scan updates to rectify compromised paths through region-based replanning, allowing localised replanning around identified areas of change without recalculating the whole tour from scratch. Preliminary results reveal that the online planner is capable of replanning multiple regions concurrently, faster, and with minimal path degradation compared to its offline counterpart.

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