

NEXT LEVEL INNOVATION IN ROBOTICS AND AUTONOMY

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Title: External non-contact multi-agent intelligent condition monitoring system for buried oil and gas pipelines

Around the world, many oil and gas facilities are still using at least decade-old infrastructure of metallic pipes, carrying expensive and explosive fluids, but unfortunately, there is no availability of inspection solution, which can do non-contact external detection of various kind of defects creeping into such highly vulnerable aging pipes. These pipes are subjected to extreme weather conditions and have not been inspected for a long time leading to unexpected failure many times causing massive loss of revenue and environmental pollution. Whereas, currently used manual inspection procedures for pipes are not only hazardous and expensive but also inefficient for the risks at stake. A new alternative automated non-contact external inspection method for the pipeline was investigated, to complement and overcome the shortcomings of the conventional inspection by the ILI (In-Line Inspection) tools of the buried pipelines. Current research work proposes smart multi-agent inspection mechanism, where autonomous ground and unmanned aerial vehicles (AGV and UAV) are used in coordination for the purpose of multi-level inspection. Inspection mechanism has two main component categories, the first category is of the non-contact inspection and navigation sensors and the second is of the mobile platforms carrying these sensors. The complete inspection is also performed in two stages, at first quick inspection by the UAV equipped with light-weight sensors and in the second stage, the detailed inspection is performed by AGV equipped with heavy and non-aerodynamic inspection sensors. Automated inspection by the mobile platform is achieved by following the three-level strategy in sequence at first detection of the pipeline, then navigation along the pipeline and then finally inspection of the pipeline. This integrated mechanism can autonomously perform the non-contact external inspection of the transportation pipelines 24x7 freed from all human limitations. Successful development of such a complex mechanism requires the solution of many critical challenges like teleoperation, system and supervisory controls, trajectory tracking, autonomous navigation, machine vision, sensor data fusion, and data analysis.