Robotics in Environmental Site Assessment

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Background/Objectives. Robotics have potential wide-ranging uses in environmental assessment and remediation due to the hazardous and prescriptive nature of the work. Robots can be used as a proxy to protect workers from hazardous atmospheres, contamination, radiation, and confined or hard to enter spaces. In addition, robots are shown to be a viable and cost-effective tool in environmental site assessment. This presentation will explore different ways robots may be used to improve and safely implement environmental site assessments.

Approach/Activities. This presentation evaluates two environmental site assessment approaches that tested robots. The first used autonomous and controlled robots to collect soil samples from a land treatment unit (LTU). The LTU was previously used for biological and chemical treatment of oily sludges generated during petroleum refining operations at a former refinery in the Midwestern United States. The robot was equipped with a portable x-ray fluorescent (XRF) analyzer to measure the concentration of lead in surface soil. Sample locations were determined by a dynamic algorithm that responded to real-time measurements and focused on delineating hot spots. This approach is compared to traditional hot spot delineation and removal at an adjacent property. The second study used robots to keep workers out of potentially unsafe soil excavations and away from stockpiles. Excavation monitoring and sampling is routinely conducted at a former petroleum refinery along the central coast of California. At this site, workers are unable to enter excavations and historically could only provide visual monitoring and analytical sampling from a distance. Remote guided robots were tested for entering the excavation and monitoring and sample soils directly. This presentation compares both traditional and robot assisted techniques for excavation monitoring.

Results/Lessons Learned. In the first study, robots were found to effectively delineate areas with elevated lead content. The technology may be helpful for other environmental site assessments requiring real-time and efficient characterization of certain contaminants in surface soil. In the second study, robots were able to visually monitor and retrieve soil samples from the excavation and stockpile areas. This allowed workers to stay a safe distance away, while still effectively monitoring the excavations. From both these studies, it is evident that advancements of robotics in environmental site assessment may help reduce labor and laboratory costs, while also keeping workers out of unsafe work environments.