Mobile robot based inspection of large scale infrastructure in extreme conditions - a mining industry case study

Radosław Zimroz[1][0000-0003-4781-9972]
[1]Faculty of Geoengineering, Mining and Geology, Wroclaw University of Science and Technology, Na Grobli 15, 50-421, Wroclaw, Poland

Abstract. Mobile robotics is enjoying a significant increase in popularity. A drone, legged robot or wheeled robot equipped with an appropriate set of sensors for recording of noise, temperature, image, distance, etc. can provide the objective data necessary for diagnosing infrastructure components.
In the case of extremely difficult, dangerous environment (steel mills, underground mines, drilling platforms, etc.) or when a mass (large scale) inspection is required (conveyor belts, pipelines, electrical infrastructure, tracks, etc. which means many objects scattered over a wide area) using mobile robotics seems to be reasonable solutions in comparison to human-assisted inspection or multiple monitoring systems. In considered situations the diagnostic procedures can be based on contactless measurements. Within these limitations the robot can utilize most common sensors such as microphone, RGB/IR cameras, and Lidar. Thanks to these sensors one may localise diagnosed object, measure its geometry (potential deformation), surface properties (e.g., color), oil and grease leaks, operational conditions (speed), and emitted noise and heat. Unfortunately, inspection robot in extreme conditions (as underground deep mines) faces significant challenges due to the lack of GPS, extreme dust, high humidity, and various hazardous conditions. Therefore, robots require autonomy and a powerful processing unit for data analysis. All of the above-mentioned non-contact measurements require appropriate processing and interpretation. Often, fusion of information from different sensors can yield additional insights. To provide effective solutions, certain legal aspects must also be considered (leading to changes in some regulations). Despite all the unresolved issues, inspection robotics remains a fascinating field of research in diagnostics. This article will discuss examples of inspection robot applications in the mining industry.
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