Detection of defects in Oil-Pipes using Autonomous Robots through Image Analysis

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Abstract:

In oil and gas industry, pipes are used for many purposes. Transporting the fluid on surface and subsurface. There are also different types of fluid transported in pipes like water, oil and gas. Pipes are the primary transportation method for water usage across cities. There are networks of pipelines that needs to be inspected regularly to prevent leakage, oil spill and even explosion for gas. To maintain the serviceability of the pipes, problems occurring inside the pipe should be detected in a timely and periodic manner, and the most importantly problems that we focus on in our project are corrosion and leaks. To complete the corrosion and leaks detection task, we will use a method based on image processing. We will research and compile a dataset of image samples and use them to train and test the model. Moreover, In our project, we will be focusing on the automatic digital visual inspection system to detect corrosion and leaks inside the pipe. The design is mainly focusing to report the issues inside the pipe. We will use magnetic robots, so it can stick on the inner surface of the pipe. The robot supported with 5 cameras and 5 powerful LED's in order to take a clear view of inside the pipe from all sides. We will program the robot and put some function to control where it should go, which side and when it should stop. The frame of the images will be transmitted to the PC outside (on the ground). In order to replicate the data between underground and on the ground, we will use a wireless underground sensor network. LORA sensors are suitable to do this job by building number of nodes depending on the net we have in the project. LORA will be connected to the Raspberry pi computing device. Also, we will use Python software to do the coding part utilizing R-CNN machine learning method. This method will detect the corrosion, erosion, cracks and objects stuck inside the pipe. When the issue is detected, R-CNN will segment and classify which type of the different faults found. As a result, this technique will report the type of issue and provide the location through GPS.