

## OPC UA Application Study in Oil and Gas Pipeline Network Monitoring Data Forwarding

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### Abstract

**INTRODUCTION** □ With the continuous development of oil and gas pipeline network monitoring and control technology, the need for data transmission and communication is becoming more and more prominent. In this context, OPC UA has attracted wide attention. This study aims to explore the application of OPC UA in data forwarding for oil and gas pipeline network monitoring in order to improve the efficiency, reliability and security of data transmission.

**PURPOSE:** The purpose of this study is to evaluate the applicability of OPC UA in oil and gas pipeline network monitoring and to verify its performance in data forwarding through empirical studies. By gaining an in-depth understanding of the characteristics of OPC UA, it aims to provide a more advanced and efficient monitoring data transfer solution for the oil and gas industry.

**METHOD:** The study adopts a combination of field monitoring and laboratory simulation. First, the essential characteristics and requirements of monitoring data in oil and gas pipeline networks were collected. Subsequently, a monitoring system with OPC UA as the communication protocol was established and field tested. In the laboratory environment, data transmission scenarios under different working conditions were simulated, and the performance of OPC UA under different conditions was analyzed.

**RESULT:** The field monitoring results show that the data transmission efficiency is significantly improved by using OPC UA as the communication protocol for data forwarding in oil and gas pipeline network monitoring. Meanwhile, the system performs well in different environments with high reliability and security. The laboratory simulation results further verify the stability and adaptability of OPC UA under complex working conditions.

**CONCLUSION:** OPC UA is an effective communication protocol that can meet the data transmission requirements for oil and gas pipeline network monitoring. Its efficient, reliable, and secure characteristics make it an ideal choice for improving the communication performance of monitoring systems in the oil and gas industry. The empirical results of this study provide reliable technical support for the oil and gas industry in the field of data transmission and a vital reference for the optimization and upgrading of monitoring systems in the future.

**Keywords:** OPC UA; oil and gas pipeline network; monitoring data; data forwarding

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### 1. Introduction

Underground oil and gas pipelines play an indispensable role in the construction of the national economy as the essential equipment for the transportation of

oil and gas fields (Shah *et al.*, 2022). These pipelines are responsible for transporting oil and gas from the source to where it is needed; however, pipeline safety is of great concern due to the flammable and explosive nature of oil and gas. The potentially hazardous nature of the transportation process, coupled with the relative complexity























