International Academic Conference On Research In ENGINEERING and TECHNOLOGY

4th International Academic Conference on Research in Engineering and Technology

18 – 20 September 2025

Prague, Czech Republic

Integration of Smart Metering, IoT, and AI for Digital Transformation in Natural Gas Distribution Systems

Sinem Şenol[1] , Yeşim Övgü Durak[1] , Alper Vahaplar[2] , Berkay Koç[1]

İGDAŞ (Istanbul Gas Distribution Company)1, Turkey

NETAŞ2 , Turkey

ABSTRACT

The digitalization of natural gas distribution systems has become a key enabler of improved operational efficiency, reliability, and sustainability. Within this transformation, smart meters play a central role by delivering precise consumption data, supporting real-time monitoring, and minimizing both technical and non-technical losses. Among available technologies, ultrasonic smart meters are particularly advantageous due to their long-term measurement accuracy, durability under varying operating conditions, and minimal maintenance requirements. These characteristics make them well aligned with the evolving demands of modern gas networks.

In this project, an integrated smart metering framework has been developed, encompassing approximately 3000 smart water and gas meters. The system architecture incorporates a dedicated communication topology that ensures secure and reliable data transfer, while a centralized IoT platform enables interoperability and streamlined management of heterogeneous devices. Beyond the physical infrastructure, advanced data analytics form a critical component of the framework. Artificial intelligence–driven algorithms are employed to enhance billing accuracy, detect anomalies, and support fraud prevention. The analytics workflow begins with customer segmentation and proceeds through statistical modeling, anomaly detection, and load forecasting, thereby providing actionable insights for both operational optimization and long-term planning.

Keywords: data analytics; digitalization; efficiency; smart meters; IoT (internet of things)