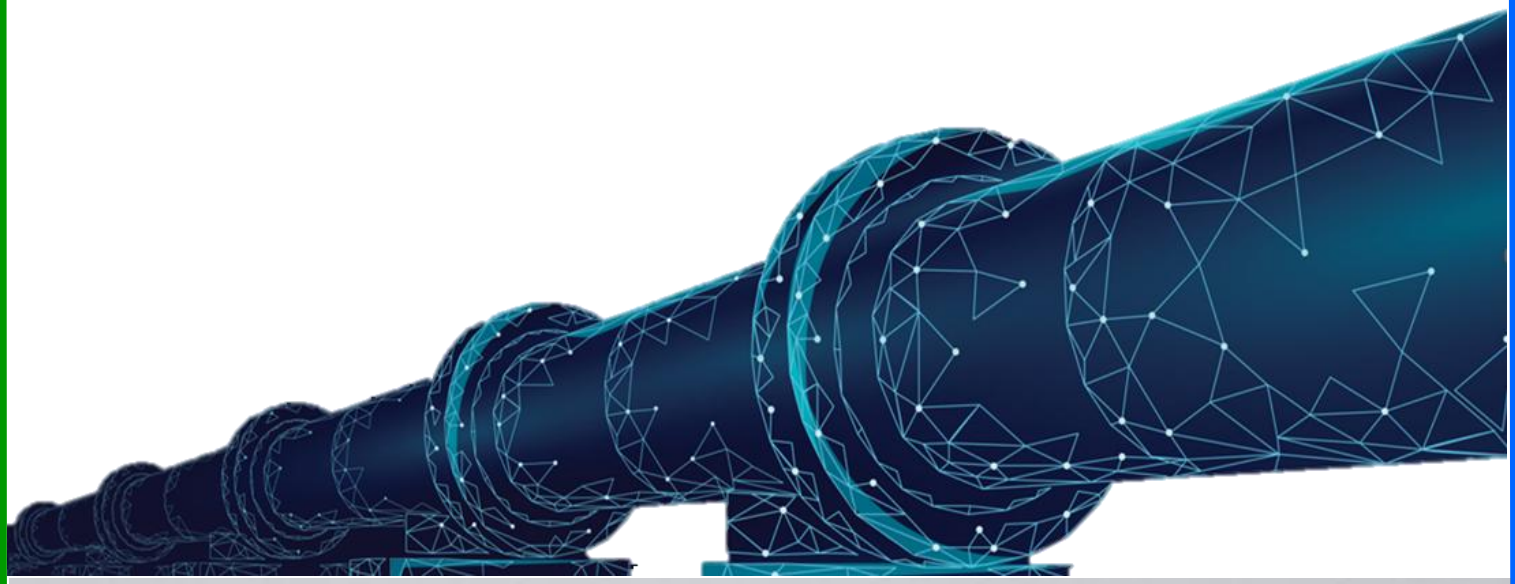
Value Added is Our mission

SUSTECH
INTEGRATED TECHNOLOGIES

UTILITIES NETWORKS MONITORING SYSTEM



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Introduction:

The Utilities Network Monitoring System project at KAUST aims to leverage the existing LoRaWAN network to enhance the monitoring and management of various utility networks across the campus. This initiative focuses on integrating new field instrumentation, including flowmeters, pressure transmitters, and temperature sensors, with a centralized monitoring system. By utilizing the advanced capabilities of the LoRaWAN network, the project seeks to ensure real-time data collection, transmission, and analysis, thereby improving the efficiency, reliability, and responsiveness of KAUST's utility management processes.

This project will address the monitoring needs of multiple utility systems, including chilled water, potable water, raw seawater, pumps left station of sanitary sewer, stormwater, TSE irrigation, golf course irrigation, treated water, and Electrical Networks Monitoring Connection to Power Monitoring System (PMS) for Remote monitoring of Package Substations, Backup Generators, and Lift station electrical system; connect the existing NEXUS meter to the PMS system.The integration of these systems into a unified monitoring platform will facilitate better resource management, quicker response to issues, and overall enhanced operational performance. Special emphasis will be placed on electrical network monitoring, which will include the remote monitoring of package substations, backup generators, and lift station electrical systems through the LoRaWAN network.

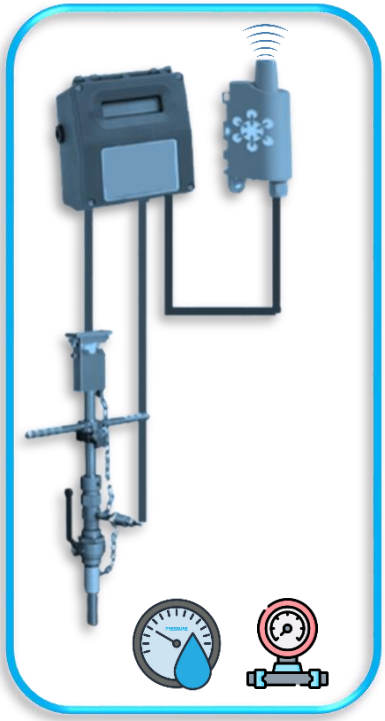
KAUST is committed to utilizing cutting-edge technologies to maintain and enhance its infrastructure. By adopting LoRaWAN technology and integrating it with the Kaust Cloud LNS Thing Park, KAUST will achieve a seamless flow of data from various field devices to the centralized monitoring system. This project will also include the installation of solar power supply units for remote field devices, ensuring uninterrupted operation even in locations without permanent power sources.

This proposal outlines the scope of work, the methodology for implementation, and the benefits that KAUST will derive from this project. We are confident that the

development of the Utilities Network Monitoring System will significantly contribute to the university's infrastructure management capabilities and align with its vision of innovation and excellence.

Our solution

This deployment showcases a smart pressure and flow monitoring solution for a potable water distribution network using IIoT technology. An insertion flowmeter and pressure transmitter are installed on the main pipeline to measure real-time hydraulic data. Both instruments are connected to a local converter which transmits the data via Modbus protocol to a LoRa-enabled communication device. The system operates on solar power, enabling reliable, off-grid performance even in remote areas.



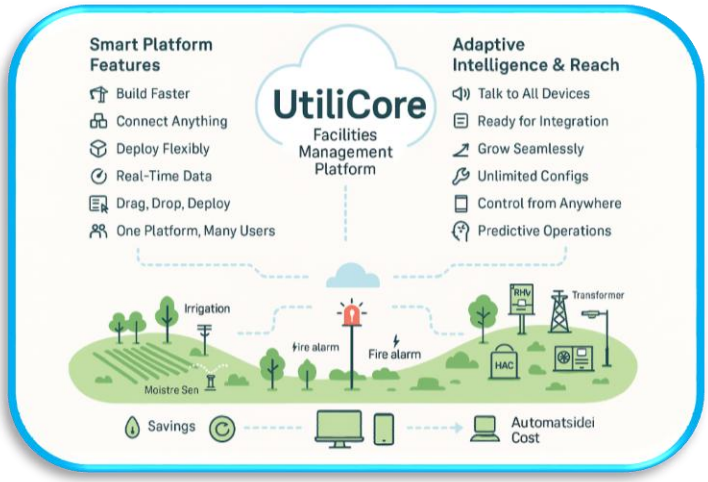
The collected data is transmitted to a centralized web SCADA platform where it is visualized for operators through a GIS-integrated dashboard. This solution enables early detection of leaks, abnormal pressure drops, and unauthorized consumption. Key advantages include energy efficiency, minimal excavation or retrofitting, and long-range wireless communication. The system greatly reduces operational costs by minimizing site visits, enhances water conservation efforts, and improves decision-making through actionable analytics. It addresses key utility challenges such as non-revenue water, aging infrastructure, and inefficient manual monitoring.

Modbus-to-LoRaWAN converter

Externally powered 24VDC continuous, it serves as Modbus interface for the flowmeter and at same time controls and monitors power to it. This connects to the controller MV145 via RS485 taking all the Modbus parameters and transmit / receive (bidirectional) to a LoRaWAN gateway.

Query, write and read all registers on the Modbus flowmeter.

Utilicore IIOT platform cloud based



UtiliCore is a unified SaaS platform for intelligent utilities and facilities management, designed with full alignment to **ISA/IEC 62443** cybersecurity standards. It enables secure, real-time monitoring and control of critical systems like HVAC, irrigation, fire alarms, and electrical networks. UtiliCore's multi-tenant architecture ensures data isolation and encrypted communication across all endpoints. Role-based access control (RBAC), secure device onboarding, and audit trails protect operational integrity. With UtiliCore, you get scalability, interoperability, and **cyber-resilience by design**, meeting the toughest industry compliance requirements.

SOLAR PANEL SYSTEM WITH BATTERY BACKUP

With Solar PVs, this system generates energy from the sun and uses this to charge a bank of battery backups for solar panels. During the day, the solar energy is used to power the end devices. At night or during cloudy days, the end devices will be powered from the battery backup.

Main Components of Solar Panel System:

- Solar Panel (also known as Photovoltaic cell)
- Charger
- Controller
- Batteries

Sizing Calculation for the Solar Power (Standalone continuous operation) as shown:

Load Analysis:

- Modbus to LoRaWAN device consumes 500mA @24V (12W)
- Flow meter + pressure transmitter powered by converter with 4W

Load Daily Consumption:

Description	Qty	Power Consumption (W)	Hours Used (H)	Per Day Consumption (WH)
Modbus to LoRaWAN device	1	12	24	288
Flow meter + pressure transmitter via	1	4	24	96
		Total Power Consumption per Day (WH)		**384**

Sizing of PV Panels

PV Power	=	Total Daily Consumption / Sun Peak Hrs	x	Losses Constant
	=	384 / 9	x	1.3
	=	55.5 W		
Note:	(1)	Losses constant / Voltage drop in the system	=	130%
	(2)	Sun peak hours / Average Peak Sunlight Hrs per day in KSA	=	9 hours
No. of PV Panels	=	PV Power / Rating of PV		
	=	55.5 W / 200 W		
	=	0.27 (1 No. of PV panel)		

Hence it is recommended to use 1 No. of 200W Monocrystalline Solar Panel

Battery Capacity	=	Total Daily Consumption / (DOD x System Efficiency x System Voltage
	=	384 WH / (80% x 90% x 24)
	=	22.22 (32Ah minimum capacity of Nickel Cadmium batteries available in the market)

Hence it is recommended to use 2 No. of 12V, 32Ah Nickel Cadmium batteries connected in Series to generate the required 24V System voltage.

LoRaWAN Gateways

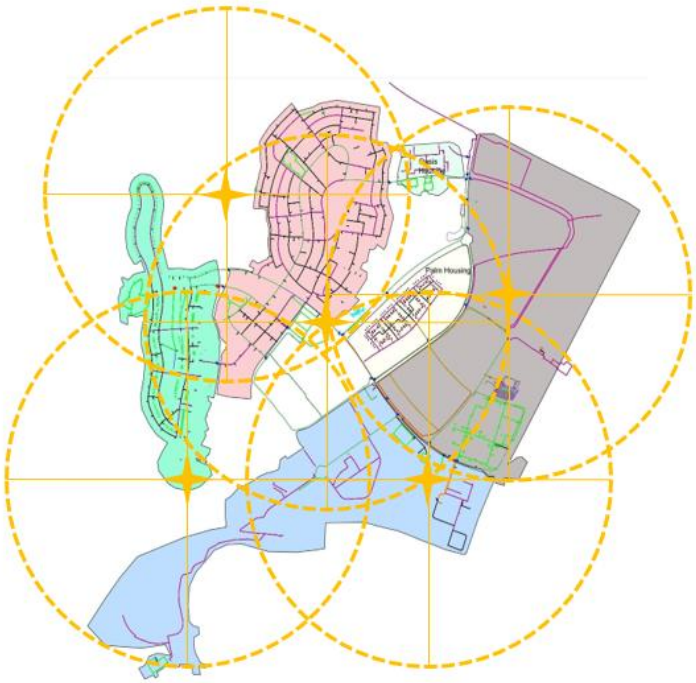
Receive messages from end devices and forward them to the Network Server.

Here gateways form the bridge between Flowmeter/Modbus-to-LoraWAN slave device and The Things Network. Low power devices connect to the Gateway via LoRaWAN, while the Gateway uses high bandwidth networks like WiFi, Ethernet or Cellular to connect to The Things Network.

SUSTECH considered The Gateway, Conduit IP67 Base Station for Outdoor; it is designed for easy deployment and includes a Gateway Conduit with a LoRa Gateway mCard, LoRa antenna to improve outdoor range and 4G/LTE backhaul. It should be mounted on a roof at approximately 2-m high.

Main Features: ISM band scanning for optimum LoRa performance, Listen Before Talk operating protocol, GNSS for location coordinate information, with improved design enhancing thermal performance and easy external port access to SIM and USB connectors.

SITE LAYOUT WITH ESTIMATED LOCATION OF GATEWAYS



5 Nos of. LoRaWAN Gateways

LoRaWAN Network Server

The Things Stack is a robust yet flexible LoRaWAN Network Server that caters to the needs of demanding LoRaWAN deployments, from covering the essentials to advanced security configurations and device life cycle management.

The Network Server manages gateways, end-devices, applications, and users in the entire LoRaWAN network, and typically has the following features.

THE THINGS NETWORK

- Establishing secure 128-bit AES connections for the transport of messages between end-devices and the Application Server (end-to-end security).
- Validating the authenticity of end devices and integrity of messages.
- Deduplicating uplink messages.
- Selecting the best gateway for routing downlink messages.
- Sending ADR commands to optimize the data rate of devices.
- Device address checking.
- Providing acknowledgements of confirmed uplink data messages.
- Forwarding uplink application payloads to the appropriate application servers
- Routing uplink application payloads to the appropriate Application Server.
- Forwarding Join-request and Join-accept messages between the devices and the join server.
- Responding to all MAC layer commands.

the Gateways send the data to LNS server , and each GW communicate with multiple a LoRaWAN Modbus Concentrator. A Network Server forwards packets received by one or more Gateways to the LNS Servers and vice versa.

From LNS Server, we link our the Data management system , or integrate with main **Utilicore IIOT platform** Cloud based.

All functionalities are exposed via MQTT to integrate LoRaWAN information to various applications Utilicore IIOT platform and existing SCADA at site if needed and send SMS/Email notification.

SUSTECH provide END -To-END LoRaWAN solution .

From selecting the instruments to LoRa connectivity to LoRaWAN gateway to LNS LoRa network server to IIOT platform

Refer below System Architecture.