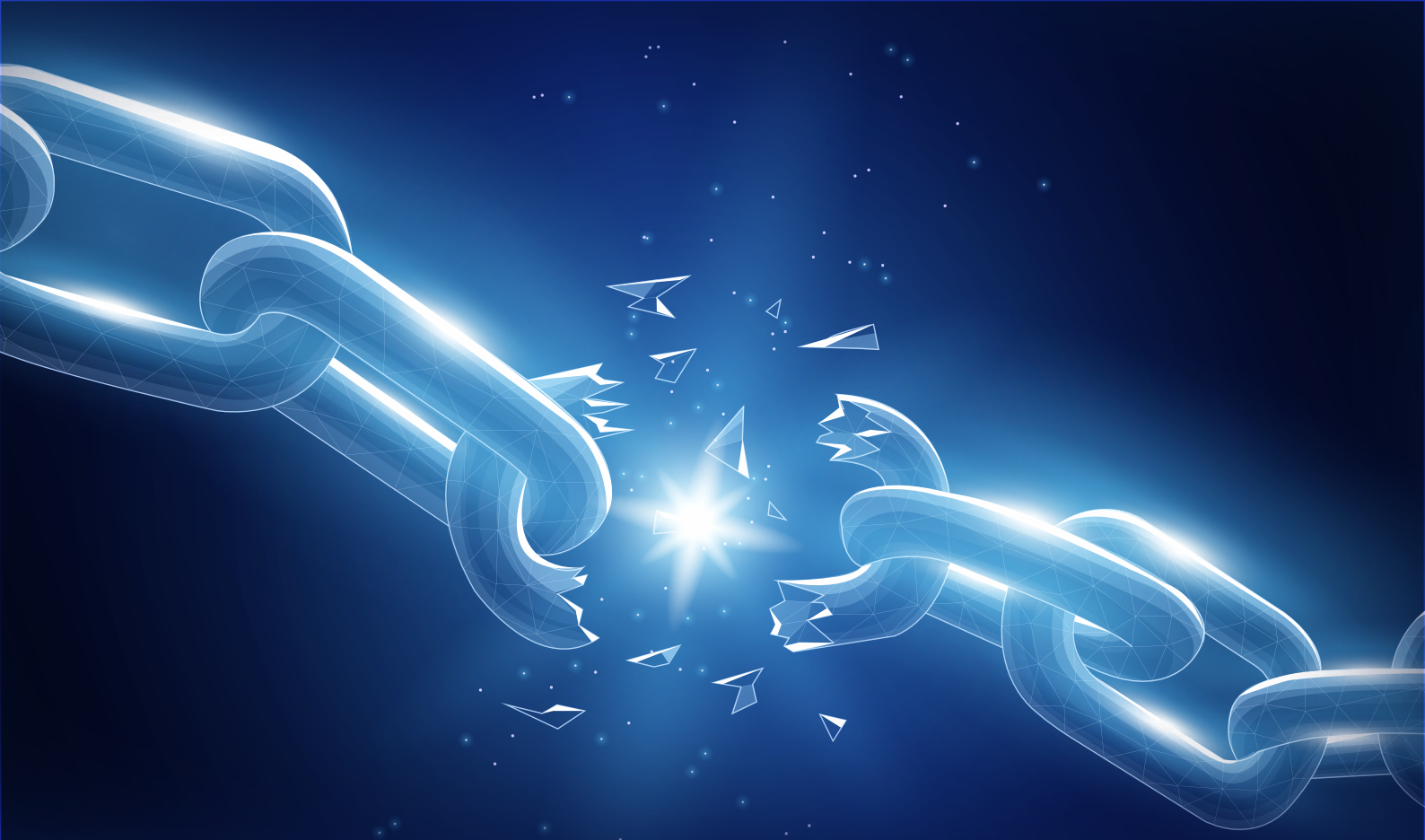

Unleash the Power of IoT

TandemG presents a Customizable and Flexible Platform for Your Needs

The Internet of Things (IoT) is reshaping industries, paving the way for automation, data-driven decision-making, and enhanced productivity. Yet, crafting and overseeing an IoT solution can be intricate, demanding specific skills and resources.

Enter **TandemG's** dynamic IoT platform, featured in this whitepaper. Tailored to empower businesses, it's a customizable tool designed to create solutions that effortlessly tackle the unique demands and hurdles of IoT.

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Introduction

The rise of IoT devices brings forth a mix of possibilities and hurdles for businesses in every sector. As companies aim to harness IoT advancements to spur innovation, boost efficiency, and elevate customer interactions, the demand for customizable and flexible IoT platforms becomes increasingly critical.

Key Challenges of Traditional IoT Solutions

Limited Customization: Many IoT platforms follow a rigid, one-size-fits-all model, failing to adapt to your specific needs.

Integration Complexity: Connecting your many devices and sensors can be challenging, requiring custom integrations and expertise.

Scalability Limitations: As your IoT solution grows, the platform may struggle to handle the increased data volume and complexity.

Security Concerns: Safeguarding your critical and sensitive IoT data requires robust security features and ongoing vigilance against potential threats.

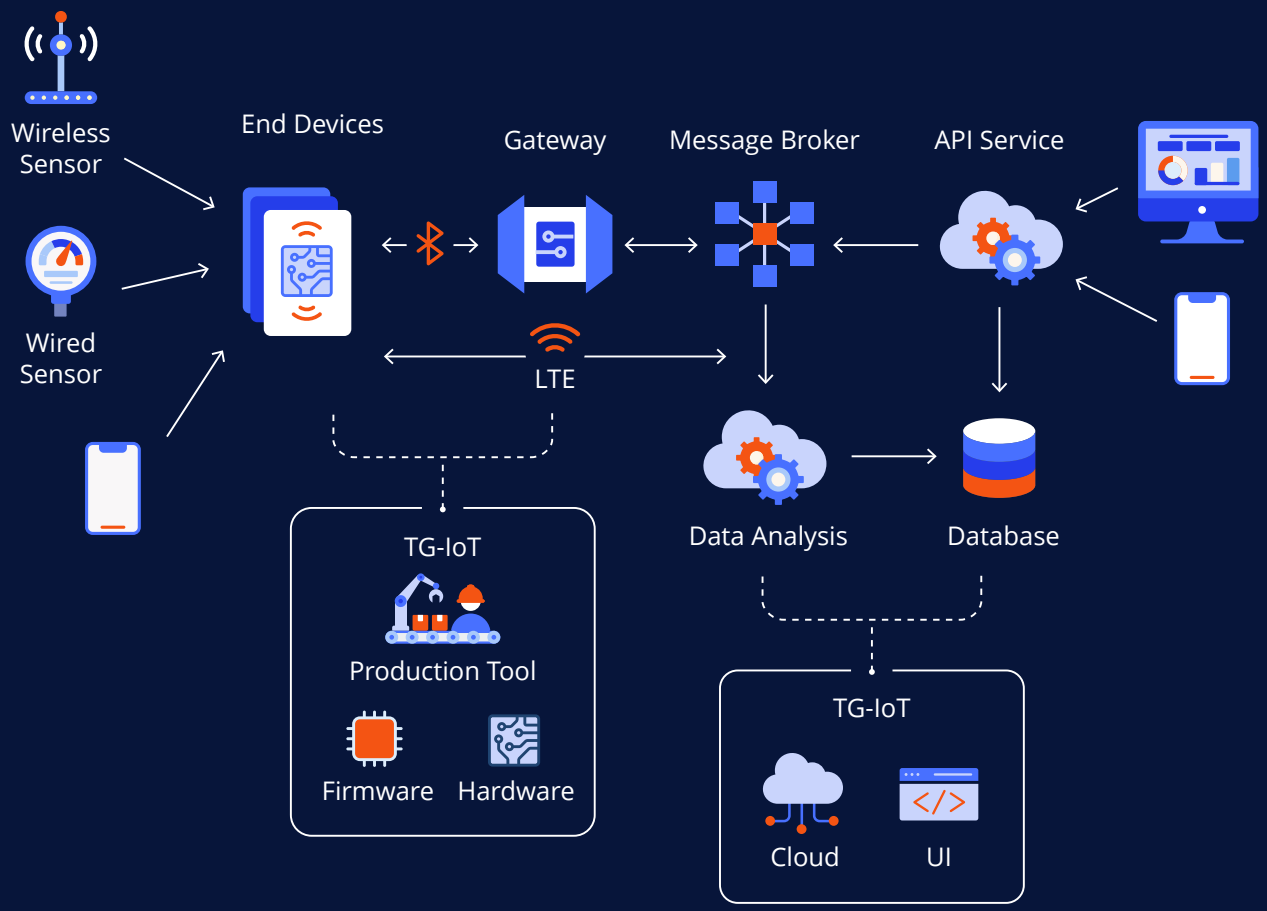
Conventional, uniform IoT platforms often fall short in catering to the varied demands of businesses across different industries and settings. Customization and flexibility enable businesses to personalize IoT solutions to meet their specific needs, seamlessly integrate with current systems, and adjust to changing business requirements and market conditions. On top of this, you will be aware of additional pain points concerning efficiency, cost reduction, and time-to-market.

Introducing a Powerful and Flexible Solution to make your IoT dream a reality

TandemG's customizable IoT platform addresses these challenges head-on, providing a comprehensive solution for building and managing your unique IoT applications. TandemG is a one-stop shop for your IoT dream – you will define what you need, and TandemG will customize, optimize, and connect swiftly, offering personalized functionality, top performance, and seamless integration.

The Product

TandemG offers a varied range of core items. Each of them could be used as a part of a complete TandemG solution or could be integrated with other technologies and products.



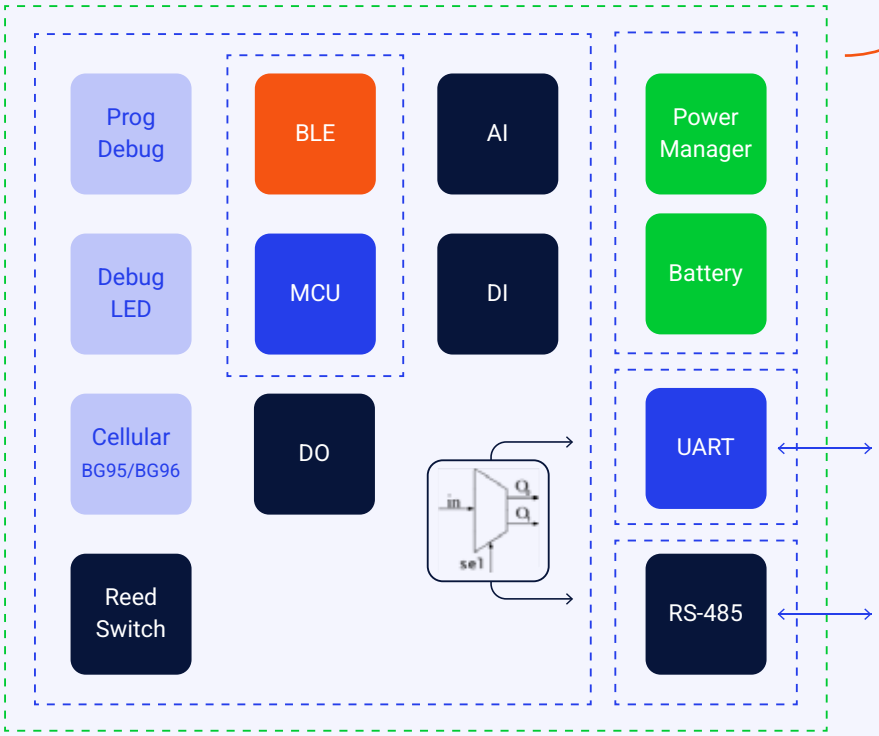
Are you curious about IoT products? Many well-known ones have TG technology inside.

The TandemG core offering contains:

IoT Devices

Standalone, End-device, Gateway and Sensors.

System Mail Block Diagram



According to the required configuration, the devices could be equipped with:

- Processing Unit
- Flash and RAM
- Cellular modem
- BLE chip
- UART
- USB
- RS485 (Modbus Master mode is a default/Slave is configurable by SW/FW)
- Peripherals:
  - 2x Digital Inputs
  - 3x Analog Inputs, 0-10V or 4-20mA (configurable by HW switch)
  - Note: 3xAnalog Inputs could be converted to 3xDigital Outputs
  - 3x Latch Solenoid Control
  - 1x Buzzer could be configured for alerts, etc.
  - 1x Button. The Button is not in use, and could be configured for any purpose
  - 1x LED for debugging
  - 1x Reed switch for Power On/Off device activation by a magnet
  - 1x Fuel Gauge for Battery level/ consumption measurement
  - JTAG

- **Connectors**:
  - SMA con for LTE antenna
  - Micro USB for DBUG
  - Sol/AI/DI/RS485
  - UART con
  - Micro SIM holder
  - Reed switch for Power On/Off device activation by a magnet
- **Sensors:** an extensive variety of sensors with a minimal integration required
- **Memory Extension**
- **Power supply source:**
  - Battery: Disposable 3x 1.5V Alkaline or Lithium 'AA' type
- **Enclosure:**
  - Dimensions: 110 x 90 x 55
  - Standard Compliance: IP65
  - Environment temp.: -10°C to +60°C
  - Humidity 100% (PCB has acrylic spray coating)
  - Storage temp. -200C to +600C
  - Maintenance/Access to battery holder, SIM card, Cellular Antenna
- **Standard Compliance:**
  - BT 5.3 Certified
  - FCC/CE
  - PTCRB/GCF

IoT Device Firmware

The firmware application can be customized to add more features and functions, giving users greater control over the device and its peripherals by incorporating specific settings and configurations based on their needs.
It's intended to support a wide range of functionalities listed below:

- Control hardware external peripherals
- Connectivity capabilities
- Communication with the Cloud
  - supports Azure IoT Device SDK in the firmware
  - uses Azure MQTT secured protocol channels
- Allow remote configuring, viewing, and controlling device behavior
  - Get/Set configuration parameters
  - Get and perform commands
  - Send measurements received from sensors/peripherals (current measurements and history logs)
  - Send statuses (Alert and system log messages)
- Control Firmware upgrade
  - Manage MCU wired/remote Over the Air firmware upgrade
  - Roll back MCU to the original version in case of errors
  - Support Modem firmware upgrade
- Optimize power usage
- Support the logging, recording and storage of data for future reference or analysis

Cloud-based platform

Backend (server-side) and Frontend (client-side)

TandemG IoT Backend offers the essential framework and resources to facilitate connectivity, administration, and data analysis from IoT devices.

- **Cloud:** Running on an Azure cloud setup, it includes serverless apps, NoSQL databases, Time-series databases, analytics services, an IoT Hub service, and other components.
- **Integration:** The backend provides a wide range of REST API endpoints, following the common standard for HTTP protocol APIs. This enables easy integration with 3rd party solutions.
- **Scalability**: The backend cloud environment can be adjusted to accommodate a high volume of devices and users in a flexible and efficient manner, capable of managing numerous requests concurrently.
- **Security**: User authorization is conducted through an external Azure service adhering to Microsoft's security protocols.
  - The authentication is based on OpenID and OAuth2 protocols.
  - The connection between the cloud and the device is secured by the mTLS protocol and requires an x509 dedicated certificate to authenticate the device.
- TandemG backend solution is generally responsible for:
  - Handling and enriching messages from devices
  - Controlling device configurations
  - Handling data requests from clients
  - User management
  - Notifying real-time device messages back to clients
  - Storing data
  - Automatic and configurable deployment
  - Triggers conditional trigger and distributing notifications to users

The **TandemG IoT Frontend** interacts with the **TandemG IoT Backend** to manage devices, display the data, manage users and roles, software versions, and more, delivering an exceptional User Experience:

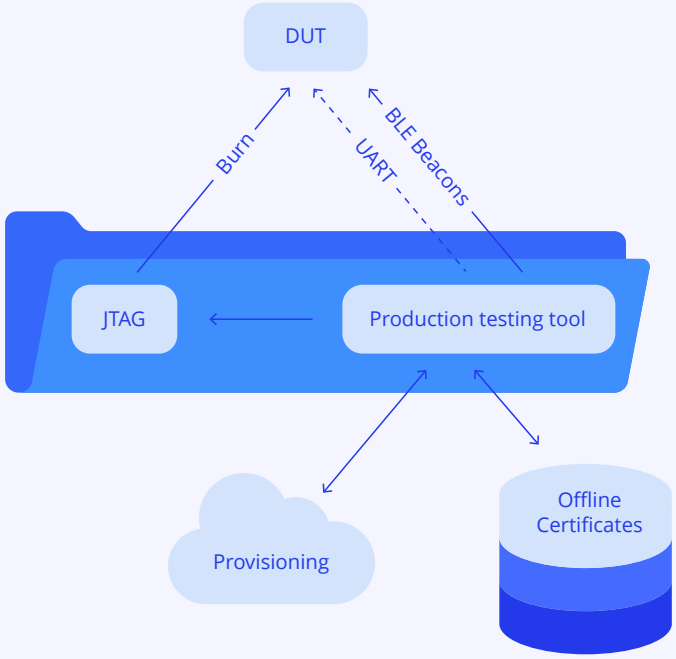
- Intuitive Interface: User-friendly for Administrators and Developers
- Customization Options: Configurable Dashboards, Workflows

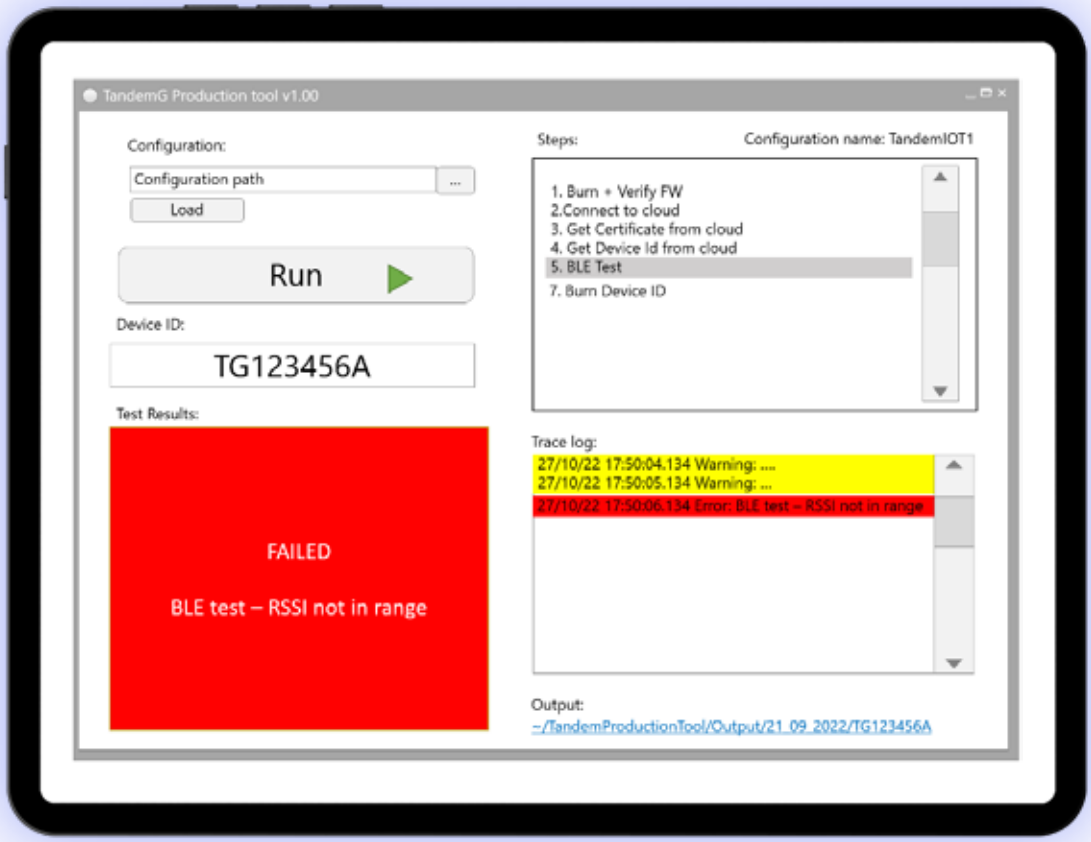
Production Tool

The Production Tool is a Python application designed to program the firmware and a serial number while verifying the absence of hardware issues in the manufacturing process. Featuring a user-friendly GUI, the Production Tool installation validates permissions, setup, availability of the serial number and firmware image. The certificate and serial number need to be taken from the cloud for authentication.

The production tool:

- Could run on Linux and Windows
- Supports connection to the hardware device via USB or UART either way, the application is connected via COM port
- Obtains Burning FW + Certificate by JTAG
- Uses a YAML-based configuration
- Supports UART commands in ASCII format
- Supports CLI Commands





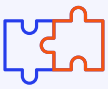
Key Features

Modular Architecture

With a Modular Architecture, you can handpick and integrate essential components and features, streamlining operations and maximizing resource efficiency.

Open APIs

Open APIs provide the flexibility to extend and customize the platform, integrate with third-party systems, and build tailored applications.



Wide Range of Device Integrations

Comprehensive Connectivity & Interoperability

The platform supports a wide range of protocols and standards to facilitate seamless integration with many different systems and devices. Provide built-in connectors and APIs to simplify the process of connecting your devices and accessing data from various sources.

Low Power

Both Hardware and Firmware Architecture support low power consumption, which is crucial for so many industries and applications.

Scalable Architecture

The platform effortlessly grows with your increasing needs, operating smoothly and cleanly as your IoT solution expands. It can also support growing numbers of devices and users.

Remote Device Management

Enjoy Remote Device Management to oversee connected devices from anywhere, enhancing efficiency and control.

Edge Computing Capabilities

Edge Computing Capabilities enable real-time data processing and analysis at the edge of the network, reducing latency, conserving bandwidth, and boosting reliability.

Enterprise-Grade Security

Benefit from robust security features, including data encryption, access control, and ongoing security updates.

Reliability and Uptime

Emphasize the reliability and uptime of your platform, highlighting features such as redundancy, failover mechanisms, and service level agreements (SLAs).
Position your platform as a trusted partner that customers can rely on for mission-critical applications.

Benefits for your Business

By using TandemG's flexible IoT platform, you can:

Create tailor-made solutions: You can design and deploy IoT solutions that precisely meet your unique needs and requirements, maximizing value and ROI.

Reduce development time and costs: The modular structure and open APIs speed up solution creation and implementation, leading to quicker market entry and enhanced competitiveness.

Future-proof your business: The scalable platform adjusts to your evolving IoT strategies, keeping you ahead of the game amidst changing market dynamics and technological advancements in the expansive IoT realm.

Increase operational efficiency: You can streamline processes, allocate resources effectively, enhance product development, mitigate risks, and strengthen overall business strategies.

Develop ecosystem partnerships: Collaboration with silicon suppliers and manufacturing plants to expand your reach.

Uses and applications

TandemG platform's versatility caters to a broad range of industries, including:

Smart Cities (Manage traffic flow, optimize energy usage, and boost public safety)

Medical devices (Monitor patients remotely, track medication adherence, and improve asset management. Some of TandemG solutions are already FDA-ready.

Retail (Enhance customer experience, streamline inventory management, and gain valuable consumer insights)

Agriculture (Implement precision agriculture for increased crop yield, manage resource efficiency, and environmental sustainability)

Industry 4.0 (monitor equipment health, and improve predictive maintenance)

And many more!

Case Studies

We present case studies demonstrating successful implementations of our IoT platform across different industries and applications, showcasing the tangible benefits experienced by our clients.

Test case I:

One such instance involved an IoT system for monitoring trees and plants. This system utilized battery-powered devices equipped with off-the-shelf sensors for on-site deployment, remote configuration, power management adjustments, continuous sensor data reporting, and device status monitoring.

These devices supported remote software updates without disrupting functionality or configurations. All device management was centralized through TandemG's backend server and accessed through a customized web browser. Users could easily control and monitor devices using intuitive search features, logical grouping, and customizable views.

In this scenario, TandemG's platform was integrated with the client's existing backend server that keeps the sensor data processing, allowing seamless integration with all existing systems.

Test case II:

A second example saw the platform's use in the water infrastructure sector

Complete usage of end-to-end system using TandemG IoT solution – HW ,FW ,backend ,front end and mobile application to deploy ,control and manage several types of devices that monitor and regulate pressure and other measured parameters.

Using the same platform ,different types of devices were managed ,and for each device numerous types of sensors were supported .The system allowed the definition of new sensors, the way to measure them, and dynamically built alerts and a monitoring system on top of those new types of sensors.

All devices were remotely upgradeable and periodically self-tested themselves.

The system allowed maintaining one deployment, with a clear hierarchy where each client only had access to its own devices, and even then, access and privileges were enforced by roles, which can be modified by the client.

All devices were deployed and monitored with a mobile application that maintained same access privileges, and merged data collected from the cloud to data collected from devices, when technicians are near the device.

TandemG's front end web server was completely customized to the preferences of the client, so all views and capabilities were adjusted to comply with the customer needs.

Getting Started with TandemG's IoT Platform

For proof of concept please contact us.

TandemG offers a range of resources to help you get started with our platform, including:

Comprehensive documentation: Detailed Access Guides, tutorials, and API references to facilitate development.

Professional Services: Our experienced and highly skilled team is available to listen to and understand your requirements, execute, and deliver. We are here to answer your specific questions and guide you through the development, integration, and deployment process.

Conclusion

TandemG's customizable IoT platform empowers you to unlock the full potential of the Internet of Things.

Take action now and contact us

to discover how together we can tailor our solutions to meet the unique requirements of your business, propelling it towards greater efficiency, innovation and success!