Hitachi Digital Services

Solution Profile

Intelligent Infrastructure Monitoring for Utility Substations

Secure and Monitor Your Facility's Critical Infrastructure While Increasing the Efficiency and Effectiveness of Inspections

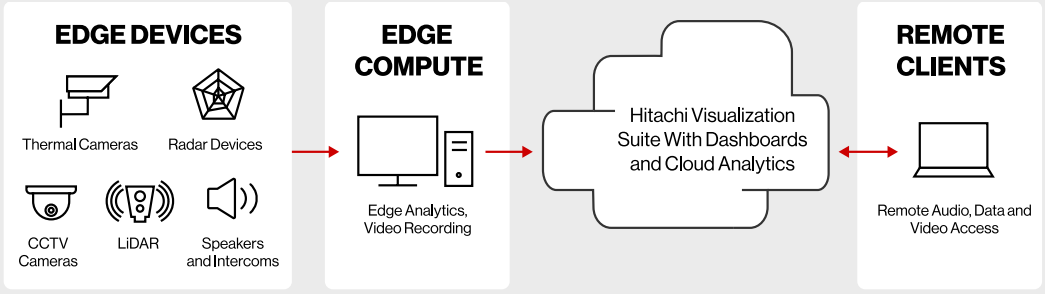
From roads, highways, and bridges to electric utility substations, today's infrastructure requires large investments, including capital and labor, to provide the upkeep required to maintain operations. The U.S. government has issued new trillion-dollar policies to not only continue maintaining these critical assets but also build and renew more to serve population growth and ensure that critical infrastructure remains secure and operationally sound. Pressures to improve infrastructure are becoming increasingly magnified, especially in the electrical power generation, transmission, and distribution sectors. In a world that is quickly embracing the electrification of everything, electricity must continue to flow 24/7, uninterrupted.

Prominent challenges electrical utilities face include:

- Ensuring that aging infrastructure continues to function and remains secure at all times.
- Working with a flat-to-declining supply of skilled labor to enable ongoing upkeep and on-site manual inspections.
- Accommodating changing rules about on-site activities with evolving rules around health and safety standards.

Compounding these challenges further, energy utilities are faced with the dichotomy that energy utilities are consistently challenged by high fixed costs to keep their infrastructure functional and secure. They have to balance regulatory restrictions and budgetary issues, causing them to be very careful when it comes to prioritizing modernization efforts.

These growing challenges may need to be addressed manually if automated response is not yet in play. Similarly, if monitoring and predictive strategies are not yet a given, the current challenge playbook may require reacting to incidents as they occur. Utilities must maintain a delicate balance between increasing operational costs of system downtime, accident prevention, pressures on system upkeep because of climate change, security demands (including from cyberattacks) and more, all while finding new sources of revenue growth and enhancing customer satisfaction.



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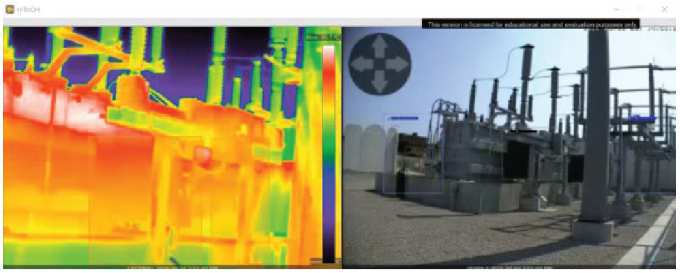
Improve Substation Safety, Security and Operational Excellence

To improve their operations and enhance safety and security measures, utilities require newer and more efficient methods of collecting data, resulting in faster and better insights into these challenges. This is possible thanks to the ubiquitous power and nature of IoT and the host of sensors used, including videospecific sensors (both visible spectrum and thermal). Efficient monitoring should be remote-capable and enable the required processes to start capturing and utilizing data via various types of feeds, including video streams, and perform analytics to provide insights, alerts, and targeted reporting.



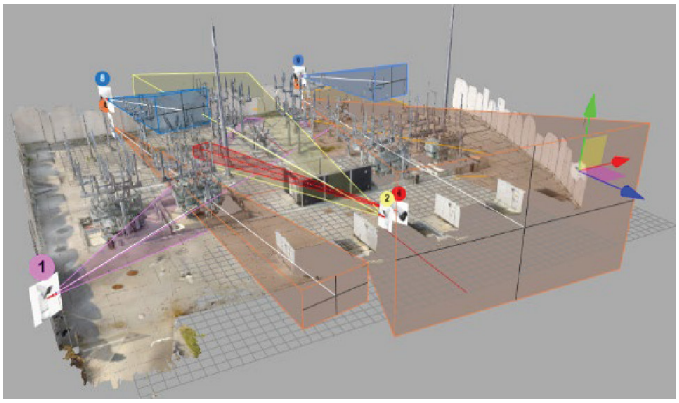
Thermal data and visual image capturing

Comprehensive, End-to-End Solution for The Modern Substation

Hitachi Smart Spaces and Lumada Video Insights provide realtime information that operations officials need to build a safer, more predictive, remote-friendly, and efficient operations and maintenance strategy.

This end-to-end solution allows for remote inspection and monitoring of critical infrastructure of electrical substations. It includes visual spectrum and the use of thermal video cameras, ruggedized PCs, edge, and cloud applications, and AI-powered data analytics software to support remote monitoring and inspection for increased autonomous operations.

Hitachi utilizes the latest technologies to design solutions that provide the best value by maximizing the sensors' functionality and coverage.

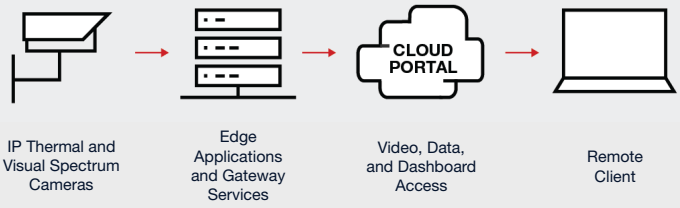


Position cameras to achieve best line of sight

Intelligent Infrastructure Monitoring for Utility Substations

Remote Monitoring

Remote monitoring is achieved as a base concept by utilizing network video and thermal equipment along with cloud-hosted applications that allow remote connection to the different sites and viewing live, playback, export and control video, and thermal cameras.



Benefits

- Increase the frequency of needed inspections at multiple sites as often as required.
- Obtain real-time views of critical infrastructure components from anywhere, at any time.

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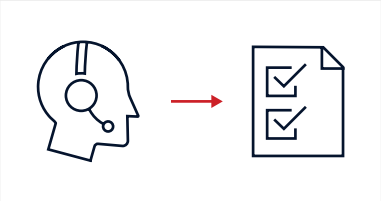
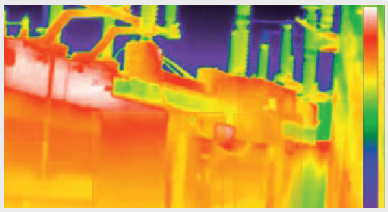
Remote Inspection

Remote inspections are enabled using pan-tilt-zoom (PTZ) presets in the installed cameras that show the components and items under inspection in great detail.



Follow inspection checklist and control cameras to remotely view and use thermal sensors for each item in the list.

Visual-spectrum CCTV cameras with pan-tilt-zoom functionality, including PTZ presets.



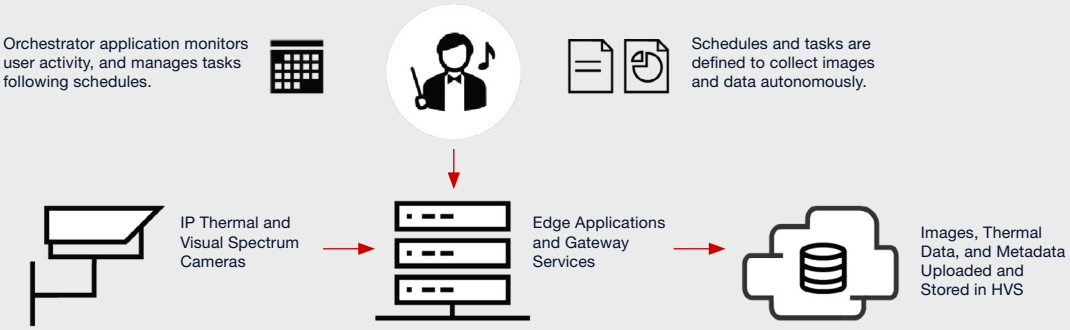
Thermal sensor cameras with pan and tilt functionality, including PTZ presets.

Benefits

- Utilizing remote inspection of critical infrastructure, operations teams can drastically reduce travel time and system downtime.
- Perform on-the-spot monitoring at will.
- Optimize resource usage.

Autonomous Data Collection

Using predefined camera presets and tasks, an orchestrator application runs schedules and monitors user input activity, enabling the cameras to collect data autonomously. All collected data is stored in the Hitachi Visualization Suite (HVS) software, which is available via a web user interface, mobile application, or through other applications via an API (Application Programming Interface) with authorized access to the data.



The Role of AI

The goal of the autonomous data collection is to gather enough information for AI models to be built. Typically, AI models require annotated samples for each use case, with tens to hundreds of images: The more images, the more accurate the prediction will be. These images should represent the possible visual conditions, like day and night, sun or shade, dry or wet conditions, and any other combination, including snow or debris. The AI model goes through continuous training to detect what a normal state looks like, and eventually any state that shows a decrement of confidence gets highlighted as an alert or event for an operator to review and respond to. Once enough information is available to identify specific defects or equipment states, they will be added to the list of events that can be detected.

Benefits

- Collect real-time and historical data allows you to better understand your assets' overall health in that moment.
- Receive real time alerts and notifications when a reading from a particular piece of equipment is out of its normal operating range.

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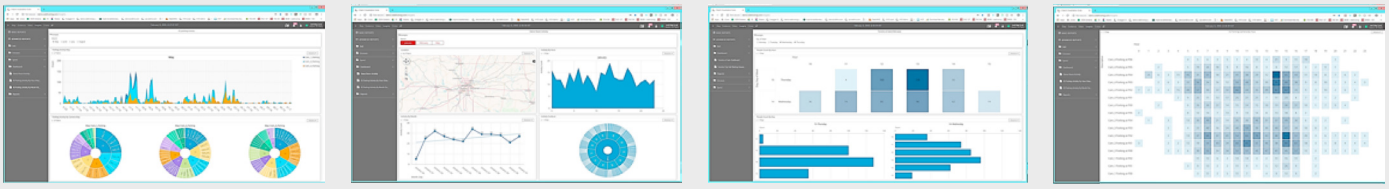
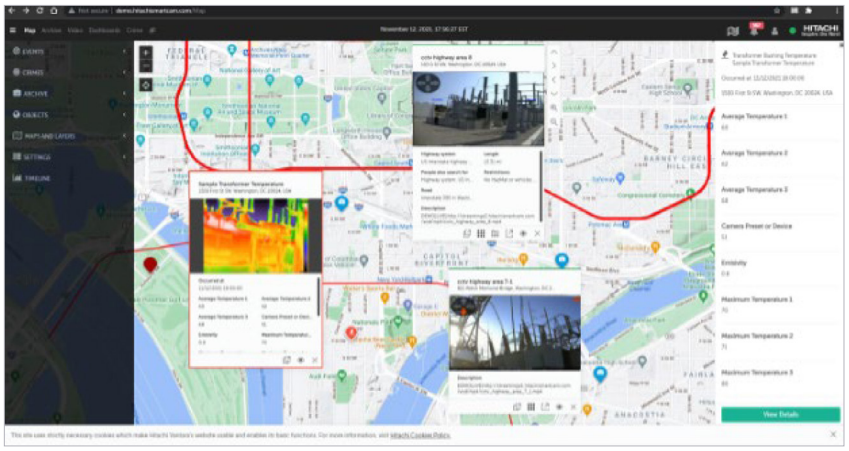
Autonomous Substation Monitoring

Autonomous substation monitoring is achieved once the AI models are built, processed, trained, and are considered robust or ongoing successful analysis. The system performs image validation, updates the KPIs, and identifies trends defined in visualization dashboards.

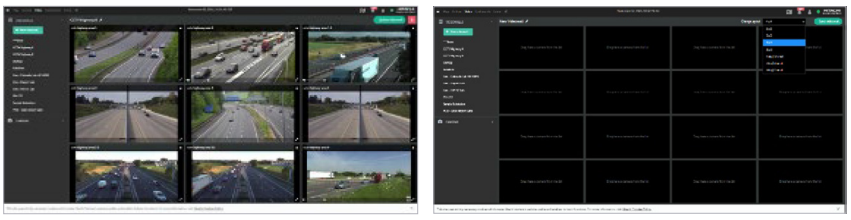
These dashboards can be composed from a variety of shapes and trends, and they can be customized using the C-Tools component of the application. Some examples are below:



Hitachi Visualization Suite allows you to view individual events as they are displayed in the map. You can see the associated images, thermal data and metadata pushed by the autonomous data collection applications, as well as live, playback, export and pan-tilt-zoom control.



HVS also has video wall capabilities, so a variety of configurations, from 2x2 to 8x8, can be stored, each with the applicable cameras per use case, site or as desired by the operators.



Operators simply drag and drop cameras from the camera list menu and save the video walls. These can be recalled at any time, on demand. Additional HVS functionality like email notifications and incident management allows real-time notification outside the platform, and it provides a tool to manage conditions outside the of the normal operation of the substation.

Benefits

Have all insights collected with real-time updated trends and key performance indicators (KPIs) based on data collected combined with learning from the AI and ML engine.

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Optimize Your Utility Substations While Improving Safety, Security and Operations

At Hitachi, we view the modern substation as a critical hub that requires consistent attention maintain consistent power delivery to its surrounding communities. Hitachi brings together people and technology through the power of data intelligence to achieve three basic goals:

- **Enhance safety** – not just for utility workers, but also for thirdparty vendors and unauthorized personnel.
- **Increase resiliency** – enabling utilities to understand weak points in their facility infrastructure from both a security posture and a maintenance perspective, to allow for a more proactive and predictive actions towards maintenance and operations.
- **Operational efficiency** – optimizing facilities team efforts, allowing them to prioritize their workloads and understand where they are needed right now to maintain maximum uptime for end users.

Next Steps

Enabling efficiencies, harnessing data and maintaining an extensive asset ecosystem require a partner like Hitachi to support your organization with an integrated, automated solution that can scale as your needs change.

- Learn about video intelligence solutions through Lumada Video Insights.
- Explore new ways to streamline operations with workflow personnel management through Lumada Field Service Management.
- Read about the disruptions affecting your industry and how Hitachi's Energy and Utilities experts can help.

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