



WHITE PAPER

Innovation in Severe Weather and Wildfire Alerting



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Overview

Transmission Operators make critical decisions in real time every day. These decisions can have a cascading effect throughout the company and service territory. Environmental conditions are a major factor which impact these decisions. Lightning, high winds, wildfires and other natural hazards can pose safety risks for crews, cause faults or downed lines and disrupt maintenance and repairs. Many utility and gas transmission companies have lines in remote areas. The remoteness of these areas provides little opportunity to observe what is happening, making decisions in these areas even more challenging.

Utilities not only need quality data when severe thunderstorms challenge their electric grids, or a wildfire erupts and changes direction toward gas valves and electrical assets, they need asset specific alerts, regarding

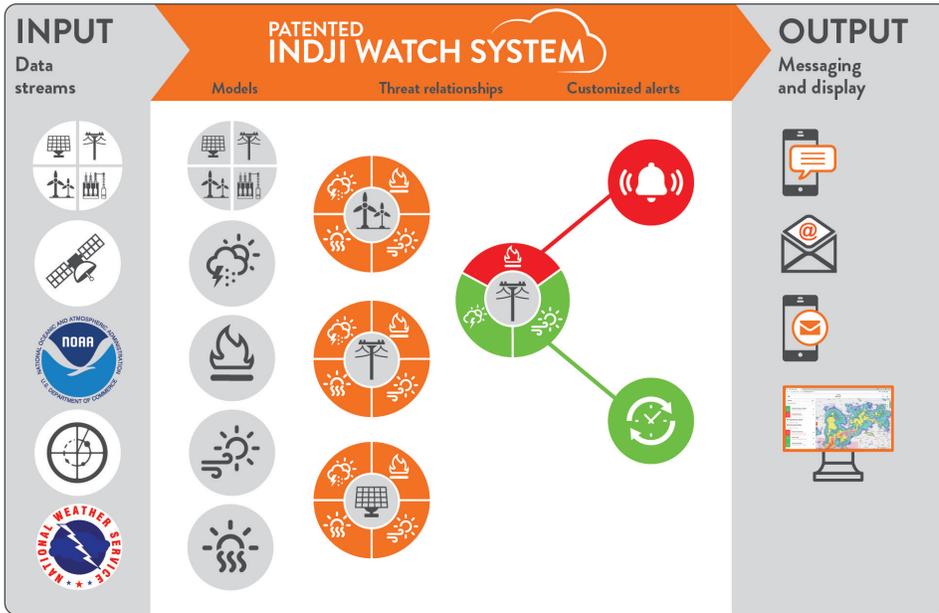
specific threats, to quickly make informed decisions. Decisions that will allow them to maintain grid stability, minimize downtime, reduce costs, and aid in reducing equipment loss. Utility control centers, emergency response teams, and field service personnel don't have the time or resources to find and view data from every fire or weather source to make informed operating decisions. A tool consisting of trusted data from reliable sources in one easy-to-understand view provides the ability to focus only on assets under threat and make quick decisions on cost saving actions.

Traditional weather monitoring solutions plot a point and inform about natural hazards within a 25, 50 or 100 mile radius. This 'one size fits all' approach doesn't work. Utilities need automated alert notifications when approaching threats are within their selected defined thresholds, giving electric grid operators advance notice

of threats directly impacting the grid, enabling loads on lines to be adjusted to avoid outages, and keep energy costs low.

A Patented Solution

Indji Watch Utility Edition from Indji Systems offers utility operators a solution that monitors natural hazards and sends alerts based on their user defined parameters, allowing them to make informed decisions. The technology designed by Indji Systems is an innovative cloud-based monitoring tool that enables electric grid operators, reliability coordinators, performance engineers and electric and high pressure gas control system managers to increase their level of preparedness and react more proactively to all natural weather hazards currently or potentially impacting their assets. Knowing what natural hazards are in the general area is surpassed by knowing exactly which of the assets are actually under threat.



Real-time Data

Maintaining grid stability is critical to utilities. Knowing exactly which assets are under threat with high quality weather-related data allows grid operators to make informed timely decisions. These decisions are critical for maintaining grid balance, preventing equipment damage, ensuring the availability of scheduled generation and also help ensure safety to the field crews. The unique Indji Watch threat dashboard allows users to quickly check all lines and substations at-a-glance for any wildfires and weather hazards that could interrupt normal operations and increase costs.

The patent covers the core technologies used in the Indji Watch cloud service including the dynamic modeling of assets and hazards from sensor networks, the ability to define complex rules for threat relationships between them and the real-time monitoring of threats to raise automated alerts for customers.

The patented technologies can be applied to all types of hazards. They are used to create models for a multitude of different weather-based hazards such as lightning, high winds, flooding, earthquakes and wildfires, drawing from multiple different sources. These technologies enable Indji Watch the distinction of being the only cloud-based service able to offer multi-source integrated wildfire alerting.

Customer assets are similarly modeled in sufficient detail to precisely identify threats posed to complete utility networks, including power lines and sub-stations. This is in contrast to

modeling a single point or a utility network with a handful of points. Indji's detailed hazard and asset models enable powerful multi-parameter rules to be defined that exactly identify threats. Further, patented technologies enable precise alerts to be raised to stakeholders, delivered with timely efficiency, noise reduced and clarity emphasized.

This real-time modeling is at the core of the Indji Systems patent. For example, each cloud to ground lightning event within proximity to the utility's modeled grid assets is identified as a threat, and will generate alerts, rather than alerting simply because lightning is within an arbitrary 100 mile radius of the utility service territory.

Asset Type	Asset Name	Threat Type	Threat Name	Distance [mi]	Last Updated (GMT-07:00)
Forecast Locations	Odessa	High Wind Forecast		0	5/13/2020 2:11 PM
Forecast Locations	Amarillo	High Wind Forecast		0	5/13/2020 2:11 PM
Forecast Locations	Fluvanna	High Wind Forecast		0	5/13/2020 2:11 PM
Forecast Locations	Lubbock Downtown	High Wind Forecast		0	5/13/2020 2:11 PM
Feeders	Tap-Odessa EHV	Lightning	5/13/2020 10:03:52 PM	138	5/13/2020 3:04 PM
Feeders	Tap-Crosby County	Lightning	5/13/2020 9:38:47 PM	203	5/13/2020 2:38 PM
Feeders	New Home-Wilson	Lightning	5/13/2020 9:43:35 PM	209	5/13/2020 2:43 PM
Feeders	Permian Basin-Royalty	Lightning	5/13/2020 9:51:19 PM	274	5/13/2020 2:51 PM
Feeders	Jones Station-Tucco	Lightning	5/13/2020 9:50:07 PM	287	5/13/2020 2:50 PM
Feeders	Ward SS-Royalty	Lightning	5/13/2020 9:42:31 PM	332	5/13/2020 2:42 PM
Feeders	General Rubber-Judkins	Lightning	5/13/2020 9:48:13 PM	392	5/13/2020 2:48 PM
Feeders	Odessa EHV-Moss SS	Lightning	5/13/2020 9:53:05 PM	454	5/13/2020 2:53 PM
Feeders	Permian Basin-Royalty	Lightning	5/13/2020 9:48:30 PM	534	5/13/2020 2:48 PM
Feeders	Ward SS-Barnsley	Lightning	5/13/2020 9:40:52 PM	586	5/13/2020 2:41 PM
Feeders	16th Street-Fort Stockton	Lightning	5/13/2020 9:43:32 PM	735	5/13/2020 2:43 PM
Feeders	Ward SS-Barnsley	Lightning	5/13/2020 9:54:33 PM	857	5/13/2020 2:54 PM
Feeders	General Rubber-Judkins	Lightning	5/13/2020 9:53:05 PM	2527	5/13/2020 2:53 PM
Feeders	Monahans Sw-Ward SS	Lightning	5/13/2020 9:52:08 PM	3609	5/13/2020 2:52 PM
Feeders	Tap-Sandhills	Lightning	5/13/2020 9:58:16 PM	4020	5/13/2020 2:58 PM

Indji Watch Asset Threat Window



Forecast Alerting

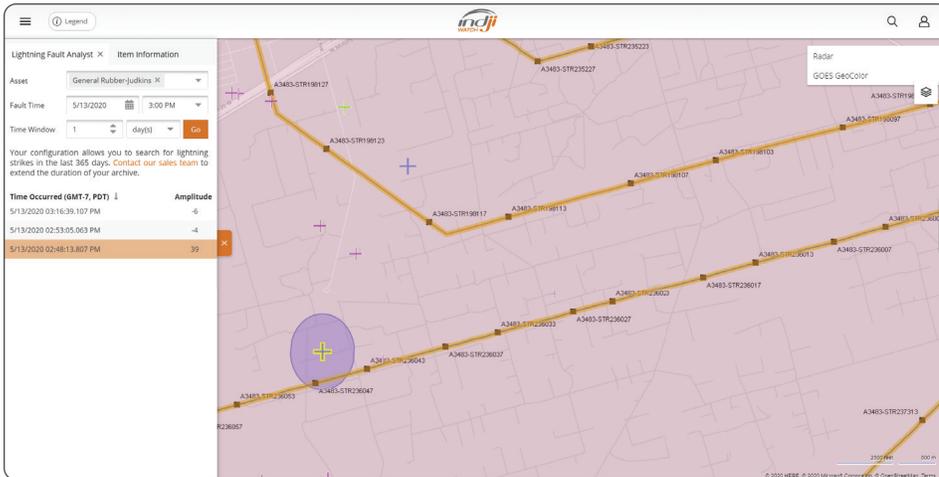
The Forecast Summary will provide users with an hourly updated seven-day forecast of multiple weather parameters including temperature, precipitation, wind gusts and ice accumulation among others. This can be viewed daily or hourly for the seven-day time period. The weather forecast is updated hourly using the latest weather observations, radar data and model information so maintenance and repairs can be scheduled with confidence. But the Indji Watch monitoring method takes this one step further by providing the utility with dynamic alerts from 48 to 72 hours in advance based on certain weather parameter thresholds being met which are considered as threats to specific grid assets or planned utility construction and maintenance activities near those threats.

The Indji Watch solution partners with and collects data from the most trusted and highly reliable sources to

provide users with accurate weather and wildfire forecast alerting. With Indji Watch, users receive threat alerts based on thresholds they have chosen for specific asset locations. The highly detailed maps show current threats in relation to each asset, not just weather on a map, and the Asset Threat Window provides a single view of each of the threatened assets, the type of threat and distance to the asset. Users choose the hazard warnings they want to see that are critical to their business. The threat window is easily sortable, allowing users to focus on a specific asset or threat type, helping to quickly identify threats to grid stability and avoid outages. Upcoming threats can also be viewed in the Asset Threat Window. Users can choose to receive threat alerts via email or text so both internal team members and those in the field have the right information to make informed decisions and stay safe. Users receive only the asset threat alerts that are important to them based on customized monitoring rules that they define.

Indji Watch Forecasting can help with:

- **OPERATIONS AND MAINTENANCE PLANNING**
See potential weather-related threats hours or days in advance allowing users to safely schedule maintenance
- **GRID DECISIONS**
Understanding when a line that has tripped can easily be reclosed, or if current wildfire location and wind conditions should lead to proactive de-energizing of particular lines
- **CREW SAFETY**
Early threat detection allows crews to decide if they should shelter in vehicles or at least discontinue the use of cranes or bucket trucks at the job site before lightning or extreme winds approach



Indji Watch Lightning Fault Analyst

Post Storm Analysis

Indji Watch is the only solution on the market that can not only tell users if there was lightning near specific utility lines, sub-stations or structures, but can also tell users the distance between where the strike occurred and the asset. The Indji Watch Lightning Fault Analyst makes it easy to quickly correlate if lightning occurred near a sub-station or power line at the time a fault was identified, so grid operators or managers can save time directing maintenance crews to a specific location, instead of manually searching for the strike location along miles of potentially remote lines.

The Lightning Fault Analyst allows users to choose a specific asset or area, time or approximate time of the fault and a time window in minutes, hours or days, allowing them to see lightning data in relation to the asset that occurred in that Time Window prior to the Fault Time. The figure above shows the lightning strikes are displayed as a table under the chosen parameters, giving the user the exact time the strike occurred, and the strike amplitude in kA. The lightning strikes are also displayed in blue on the right of the screen in relationship to the assets that were chosen.

Conclusion

Utility companies don't have the time or resources to find and view data from every fire and weather source to make informed operating decisions. Instead, grid operators throughout North America realize that a tool consisting of trusted data from reliable sources in one easy-to-understand view provides the ability to focus only on assets under threat and make quick decisions on cost saving actions.

The Indji Watch Utilities Edition arms users with real-time alerts specific to their grid assets, forecasts alerts with user selected thresholds and forensic data to make informed decisions regarding wildfire and significant weather threats.