



# POWER EDGE



## **Company**

Sensordrops Networks Pvt. Ltd.: A newfangled company dedicated to address basic societal needs by utilizing advanced Internet of Things (IoT)-based solutions. With IIT Kharagpur professionals and a team of bright and dedicated researchers at the reins, we design and deploy contemporary solutions to overcome domain-specific challenges using economical and sustainable means. The team has already won several awards including the recent Gandhian Young Technological Innovation Award for the system of Battery-less IoT sensing from the president of India in March 2018.

## **Objectives**

- a. To monitor the temperature and humidity of the surroundings inside the bus-bar, panel box, distribution pillar box and in between the metallic plates of a distribution transformer.
- b. To detect the presence of partial discharge from high voltage installations using ultrasonic sensors with frequency response centered around 40 kHz.
- c. To enhance the sensitivity of ultrasound-based PD detection.
- d. To localize the occurrence of partial discharge in cables using HFCT-based PD monitoring.
- e. To power the sensor nodes from the monitoring infrastructure itself (bus-bar, panel box, distribution pillar box, etc.), and incorporate auxiliary power backup in the system in case of power failures.
- f. Devise alert generation mechanisms, either on-site and web-based and/or cellular message-based alerts.

## **Motivation**

There is a long-standing and urgent need in the power sector for monitoring of partial discharge attributed to the temperature and humidity conditions inside electrical junction boxes, bus-bar panels, and bus-bars themselves. The need for monitoring of temperature of the line termination junctions for transmission lines, and switch-gear mechanism in switching stations and substations of power distribution companies, which have to face the brunt of India's seasonal variations in temperature and water-logging every year is imminent as rising operating temperatures and waterlogging may lead to system failures, fires, and even electrocution. The solutions have to be affordable and economically viable enough so that mass deployment in rugged and high-voltage operating conditions can be carried out for extended durations of time.

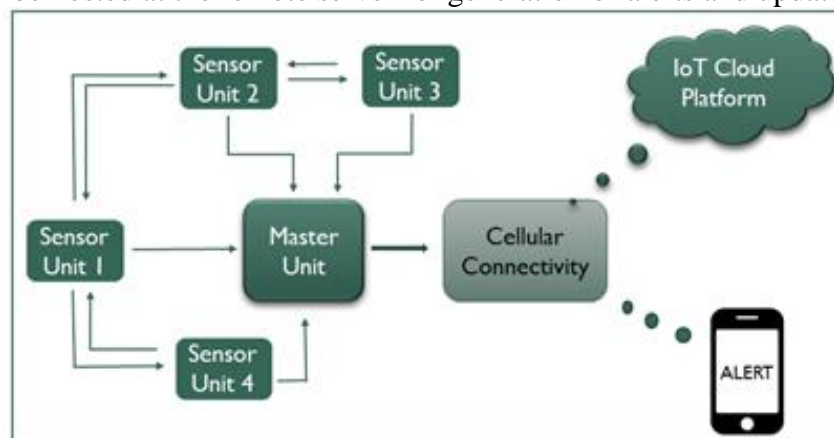
The major manufacturers of power sector equipment, which are used in substations, transmission lines, and switching-houses are ABB, Emerson Electric, General Electric, Itron, Schneider Electric, and Siemens. However, the systems provided by a majority of these corporations do not include India-centric problems of rapidly fluctuating temperature and humidity conditions. Some of the recent systems by ABB Corp. and others do include system health monitoring but the use of those in existing installations would mean the replacement of already existing multi-million dollar equipment, an exercise no operational company is willing to undertake. Additionally, the newer systems cost a lot more than the systems already in place, which are operational and healthy. In light of these facts, we plan to develop minuscule IoT-based add-on technologies for monitoring of equipment (high voltage switching and distribution) in the electric generation and supply industry.

### Market Scenario:

As per statistics sourced from Reuters, research analysts forecast the global power utility monitoring system market to grow at a CAGR of 6.24 % during the period 2018-2022. According to another market survey by Coherent Marketing Insights, among communication technology in this market segment, the wireless technology segment held the largest market share in 2016. The segment includes cellular, wireless LAN, and Zigbee among others. The wired communication technology are easily susceptible to corruption, as they are more difficult to maintain than wireless technology. Therefore, the demand for wireless technology is increasing and is thus expected to fuel the growth of the market over the forecast period (2017-2025). The Asia Pacific is expected to witness the highest growth in the substation monitoring system market over the forecast period. India, China, Japan, Australia, and South Korea are major growth engines in the substation monitoring system market in the Asia Pacific. Owing to an increase in the Transmission and Distribution (T&D) losses, governments in these countries are undertaking initiatives to introduce measures to reduce the T&D losses. For instance, the Government of India is focusing on reducing the transmission and distribution losses of power from 21% in 2018 to 15% by 2019. The government is spending US\$ 26.92 for improving the power infrastructure across the country.

### What is PowerEdge?

The PowerEdge is an IoT-based Monitoring System consists of different off-the-shelf sensors for the purpose of sensing and monitoring of ambient conditions in industrial control systems, small to medium scale industrial setups. The incorporation of PD detection and localization will have to be undertaken in parallel to the regular monitoring system for temperature and humidity. The complete unit consisting of sensing mechanisms for temperature, humidity, PD detection, and PD monitoring will have to be packaged as a single unit with proper communication mechanisms for enabling IoT. These sensor units/nodes might be connected in a mesh network where all the sensor nodes can communicate with each other. A master unit/node will act as a GSM-based gateway, responsible for uploading the data received from the mesh network to a remote server at the monitoring station. Additionally, light-weight local processing, as well as advanced learning techniques, can be hosted at the remote server for generation of alerts and updates.



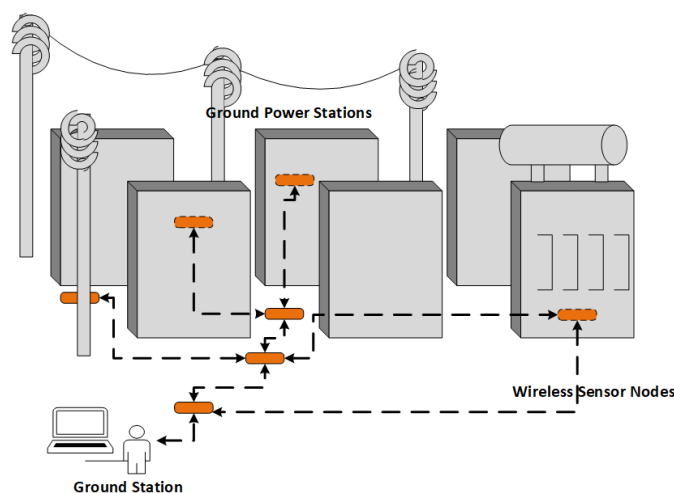
## Why PowerEdge?

The major advantage of our proposed system as compared to the existing market leaders and other competition is the pick-and-place nature of our system. In addition to being highly economical, our pick-and-place system would not need major additional changes to existing infrastructure to integrate with the operational machinery and systems (such as provisions for powering of nodes, provisions for enabling connectivity, and others). As this feature would reduce the operational downtime of systems in a power-house, the resulting economic benefits for the concerned industries is significant. The placement of these sensing solutions would also reduce the need for additional trained manpower for periodic manual checks of these systems.

## Socio-Economical Impact of PowerEdge:

Upgrading existing electrical infrastructure and deploying newer systems cost a lot more than the systems already in place, which are operational and healthy. The major advantage of our system as compared to the existing market leaders and other competition is the pick-and-place nature of our system. In addition to being highly economical, our proposed pick-and-place IoT-based monitoring system would not need additional changes to existing infrastructure to integrate with the operational machinery and systems (such as provisions for powering of nodes, provisions for enabling connectivity, and others). The integration of partial discharge (PD) monitoring -- both ultrasonic-based (for detection of PD) and high-frequency current transformer (HFCT) based (for localization of PD) -- with the proposed IoT-based monitoring nodes would further enhance the functionalities of the proposed system. The in-place collection of data for temperature, humidity, occurrence of PD and its localization would enable for robust studies of interdependencies among these conditions in the future.

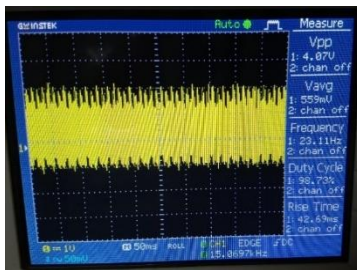
As this system will be an add-on for existing systems, it would avoid the need for complete shut-down of units and systems in a power-house for integration. The resulting economic benefits for the concerned industries is projected to be significant. The placement of these sensing solutions would also reduce the need for additional trained manpower for periodic manual checks of the systems in place.



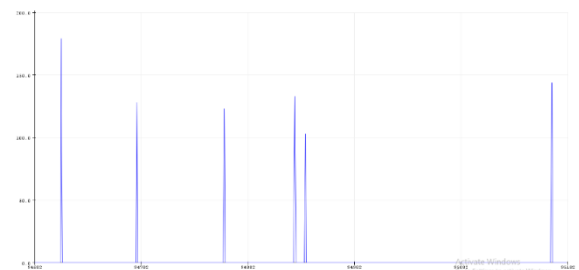
## PowerEdge

### Product Overview and Features:

- Detect PD in power cables and
- Detect ultrasonic-based PD and HFCT-based PD
- Monitor temperature and humidity of the surrounding
- Remote monitoring and historical data access
- Generate and send alerts for abnormal detections by sensor nodes
- Mesh network-enabled sensor nodes with inter-sensor node communication for reliable data delivery
- Portable system, easy to carry pick-and-place device to outdoor inspection sites
- Low-cost partial discharge detection system in the market



HFCT-based PD detection



Ultrasonic PD detection