RREES: SEADS Vault

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Abstract

When the power grid fails, the failure can be life threatening. The **Resilient Renewable Electric Energy Systems (RREES)** Lab aims to deliver power quality data fast enough to keep the failure from becoming an emergency, detailed enough to identify the failure, and comprehensive enough to locate the failure. While the **Smart Energy Analytic Disaggregation System (SEADS)** handles the collection of an overwhelming quantity of data (~5.5GB per day per device uncompressed), our team built the **SEADS Vault** to:

- identify important **events** in the SEADS data,
- **notify** homeowners of events,
- inform grid managers of event **locations**

Overview
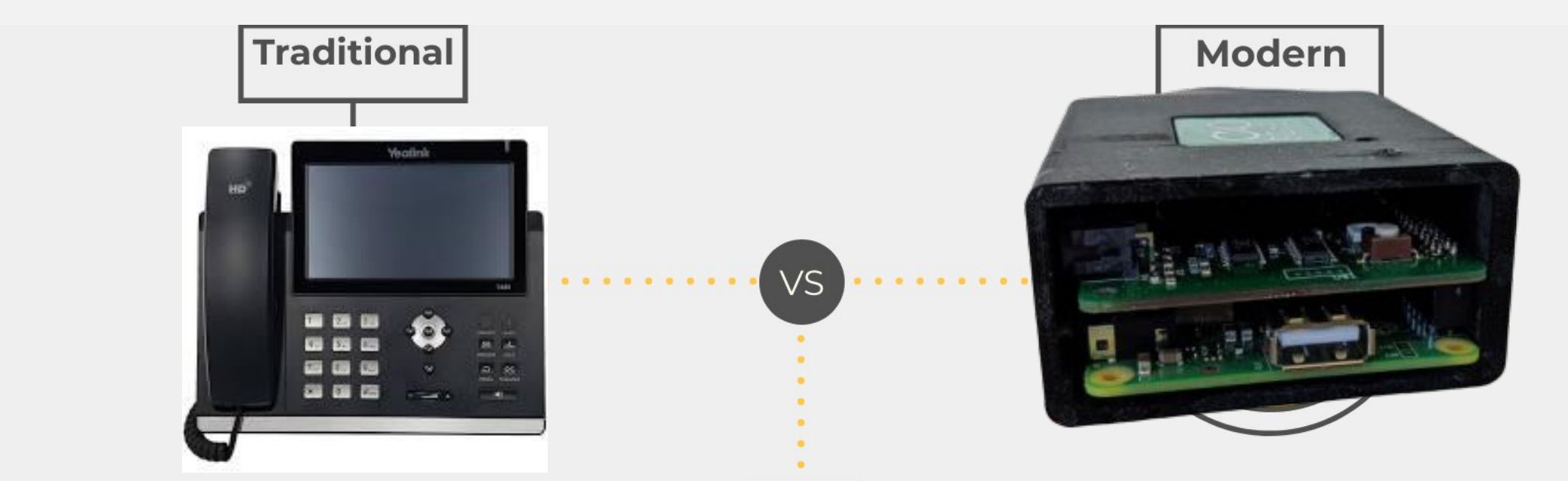
How Outages are traditionally handled
- A user calls their provider to manually report.
- Perform a scheduled/monthly maintenance.
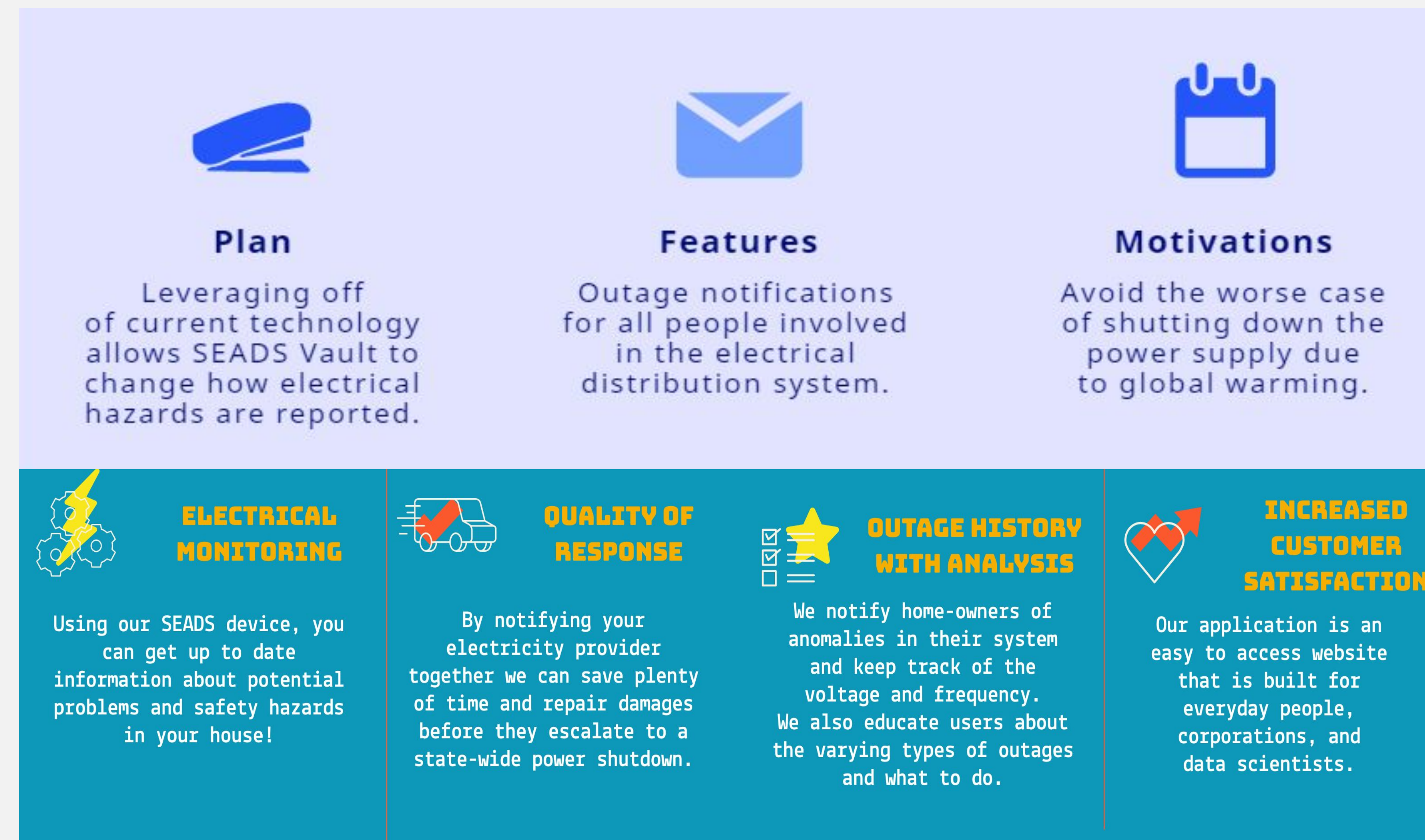- Voltage is measured at the substation

How we want to change it
- Automated Event Detection and notification
- Isolate problem areas and fix faulty equipment
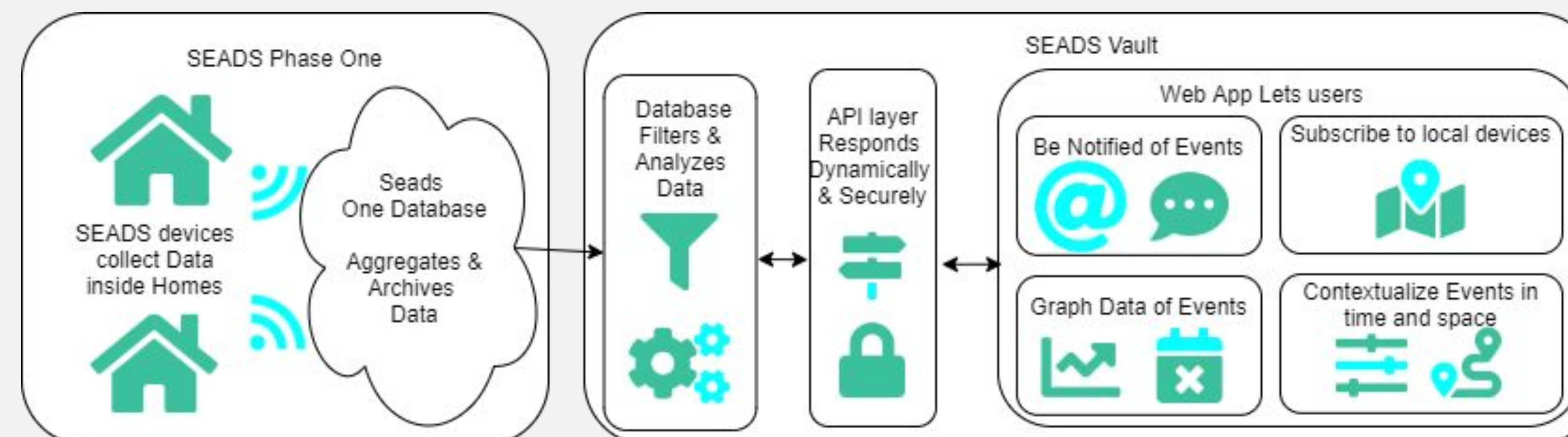- Voltage is monitored at the consumer's house

All these factors provide better system health
- Monitors on the Consumer level leads to higher accuracy and can be used to link common events to faulty equipment.

Approach

Plan
Leveraging off of current technology allows SEADS Vault to change how electrical hazards are reported.

Features
Outage notifications for all people involved in the electrical distribution system.

Motivations
Avoid the worse case of shutting down the power supply due to global warming.

ELECTRICAL MONITORING
Using our SEADS device, you can get up to date information about potential problems and safety hazards in your house!

QUALITY OF RESPONSE
By notifying your electricity provider together we can save plenty of time and repair damages before they escalate to a state-wide power shutdown.

OUTAGE HISTORY WITH ANALYSIS
We notify home-owners of anomalies in their system and keep track of the voltage and frequency. We also educate users about the varying types of outages and what to do.

INCREASED CUSTOMER SATISFACTION
Our application is an easy to access website that is built for everyday people, corporations, and data scientists.

Architecture Diagram

Technology used includes React, Flask, and PostgresSQL for development. We incorporated as third party services, such as Auth0, Mapbox, and Twilio; in order to handle account management, geolocation, and notifications. Finally, we used Skyhook for partitioning on each SEADS Device.

Acknowledgments

Issues

Downed power lines can cause safety issues like wildfires.

Here, a tree falls down in an rural area and is not detected for a long time.
This causes a power outage and a road obstruction (at intersection of Highway 35. and Hutchinson Rd).

SEADS Vault Features

1. Have an application deployed to the web.
2. Display real time live voltage to end user.
3. Notify consumers of potential outages in interested areas via email and text.
4. Flag defective equipment for repairs ASAP to improve safety and improve reporting.

Conclusion

We hope to establish a strong foundation for future innovators to build new features using SEADS and extend the user base outside of Santa Cruz. For instance, researchers and scientists could use the data to develop machine learning models.