The Titan Power Distribution Unit (Titan PDU) is a breakthrough product intended to facilitate RXL’s expansion into the power distribution market. This new product line, custom designed to integrate with the server racks RXL is currently known for, is specifically created with data centers in mind, and each unit can reliably power up to 12 servers at a time with single phase 120VAC. To make monitoring and controlling individual servers easy and efficient, our design boasts both in person and remote user interfaces. Both our in person LCD interface and our website interface allow users to monitor system vitals including temperature, humidity, voltage, as well as outlet-specific current and power. Outlets can also be turned on and off individually from either user interface, allowing precise, individual control of each server connected to the system. The remote user interface supports multiple PDUs per user, an essential feature for server house applications.

Software Overview

- Firmware on PDU communicates with networked server.
- PDU communicates with internet router via wired Ethernet.
- Data and commands are transferred to and from outlets via I2C.
- Temperature and humidity sensing performed onboard PDU.
- Delta ADCs at a rate of 1.8 kHz.
- Pre-outlet data sent in a 2 KB buffer to master MPU for SMS calculations.
- Toggle commands are sent asynchronously.

Sensing and Communication

- PCs communicate via I2C for data transfer and outlet control.
- Outlet current and voltage data are collected by 24-bit Sigma Delta ADCs at a rate of 1.8 kHz.
- Pre-outlet data sent in a 2 KB buffer to master MPU for SMS calculations.
- Toggle commands are sent asynchronously.

Communications and Server

- PDU communicates with client PCs on a local area network (LAN).
- PDU plugs directly into router via Ethernet.
- Website hosted on local server in vicinity of PDU.
- SQLite database
- Detached PDU synchronization

Product Summary

- The Titan Power Distribution Unit (Titan PDU) is a breakthrough product intended to facilitate RXL’s expansion into the power distribution market.

Team Positively, Definitely, Ultimately

Emily DiTommaso, Karston Christensen, Joseph Dunbar, Tristan Santiago, Madison Chodikov, Zach Wilson

User Interfaces

Remote UI:
- LAN
- Supports registration of multiple PDUs per user
- Displays PDU vitals
  - Temperature
  - Humidity
  - Voltage, current, and power measurements
  - Input voltage
  - Per outlet
  - Current
  - Power (apparent)
  - Outlet Status and Control
    - Indicated on LED and in LCD menu
    - Outlet on/off control

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In Person UI
- Use buttons for navigation and performing actions
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Outlet Control and Measure

Outlet control and measurement is split into two separate PCBs, one which houses the digital logic (outlet control board), and the other handles all high current devices (relay board).

Relay Board
- Voltage and current sampling with MSP430j4404 onboard 24-bit Sigma Delta ADCs
- Relay drivers for outlet control
- Outlet status detection and indication (LED front panel indicators)
- I2C for data transactions

Driver Board
- LCD parallel interface
- Displays telemetry data on LCD and system state
- Button GPIO interface
- Necessary for work in non-networked environments
- Outlet Control
- Turning individual outlets on/off
- Serial interface to outlet controllers (I2C)
- Necessary for power management and security
- Meteorology
- Handles temperature, humidity measurement
- Receiving information about current, voltage sensing

Power Delivery Board
- AC to DC Conversion with 4 Outputs
  - 3.3V for Driver Board
  - 3V for LCD
- 4A to control relays on outlet board
- Ground line

Acknowledgements

Thank you to Professor Femrite and our TA Jake Perez for working with us throughout the project. We would also like to thank Eddie Garcia, Jackson Chong, Kelvin Lee, and Angel Garcia from AIGM, Steve Dunbar from Texas Instruments, Zachary Lefin from Horizons, and Sean McKee from CET for all of the help throughout the project.

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