Atom OS™
Infrastructure Management Software Application

Features

- Distributed network architecture
- Simple, interactive GUI
- Automatic network configuration
- Remote management
- Multi-platform support, including mobile
- Dynamic coordination
- Real-time metering
- Secure communication
- User accounts with permissions
- Power management
- Power scheduling
- Simple networking over ethernet LAN
- Software and firmware updates LAN

Overview

Atom OS is the software user interface for the Atom Ecosystem. It is a web application with a client-server model hosted on the Atom Gateway Controller inside the Atom Panel, and is compatible with any device that can access the local network. The software has an HTML based frontend and a REST compliant backend. The data between the backend and frontend service is exchanged in JSON format, and Atom OS interfaces with the Atom Panel Gateway through HTTP request based communication both wired and wirelessly.
All Panels Overview

When the user first logs in to Atom OS, they are taken to the “All Panels” page, which is an overview of the Atom Panels on the network. Each Atom Panel appears here, as well as their connection to each other, similar to a one-line drawing. Users are able to select an individual panel form this view, to adjust its settings and view breakers located in the panel.

Multiple Users

In the bottom right corner of the screen, a collapsible window displays the signed in user on this machine, as well as a list of active users who are signed in elsewhere on the network.

Panel View

Once an individual panel has been selected from the “All Panels” page, the user is taken to the Panel view, where settings for the panel can be adjusted. From this page, users can set up the panel display, set up external relay settings, and configure demand management for electric vehicle charging.

External Relay Input

At the bottom of the Panel View page, the external relay input menu allows the user to assign Atom Switches in the panel to relays that have been connected to the Gateway Board. The assigned breakers can then be configured to switch on or off on relay input. Once relay input has been assigned, the breakers that have relay input active display a number corresponding to the relay which is active.
Demand Management

The Atom Panel can be set up as a demand management system for high density EV charging and other applications. From the Panel View, users can set limits on the maximum power usage of the panel, and the load shedding priority for each breaker. Real time utilization for the panel is displayed when demand management is engaged.

Switch View

After selecting an Atom Switch from the panel view page, the user is taken to the TCC page, which is the default switch view page. On all switch view pages, the currently selected Atom Switch is displayed, along with its associated real-time metering data. The breaker can be turned on or off, and renamed, by clicking different parts of the breaker image located on the left hand side.

TCC Settings

Trip settings are selected on this page, with the TCC plot displaying the trip curve in real-time as defined by the user settings. Users can select linear or logarithmic mode for the TCC plot, and can add the trip curves from other Atom Switches in the network to the graph.

Virtual Protective Relays

The Atom Switch has six software defined circuit protection relay functions: under voltage, over voltage, under current, under/over frequency, voltage balance, and current balance. These are set up and adjusted on this page.
Motor Soft-Starting

When motor soft-starting is enabled, the Atom Panel can act as a complete motor control center in one panel. Ramp start, kick start, ramp stop, overload trip class, and motor setup can be accessed from this page.

Extended Metering

Per phase metering data in terms of volts, amps, and power (KVA), as well as the temperature of the Atom Switch, can be obtained on this page. Historical metering data storage feature forthcoming.

Software Defined Transfer Switch

Atom OS provides software defined ATS functionality when the Atom Panel is connected in reverse, with two parallel sources feeding the panel through the breaker lugs. Users can then set up the transfer switch using the transfer switch menu, and select one of three transfer conditions: over voltage, under voltage, or short circuit.
User Management

User accounts are classified into four (4) tiers, each having a different set of permissions ranging from view only, to administrator. Only administrators (tier 1 users) can add or delete user accounts. Users can view the tier list and associated permissions for each user tier by clicking “Tier Guide” on the menu bar.

Event Logs

When a user opens or closes a circuit, adjusts breaker settings, or if there is a software error, it gets recorded in the event log. Users can view this page by selecting “Log” from the menu bar.

Breaker Scheduling

Atom Switches can be set to operate at a set time on either a one way or two way schedule. When set to a one way schedule, the breaker simply opens or closes at the set time, a two way schedule sets both the closing and opening time for the breaker. This can be set to repeat on a daily, weekly, monthly, or yearly basis.

Software Updating

Administrators can update Atom OS and the Atom Switch firmware by clicking “Update” on the top menu bar. On the Update Page, the user can check for a newer version of the software or breaker firmware. Before checking for updates, the Atom Panel must be connected to a router that has access to the internet.
Network Overview

Atom Switches send and receive information to/from the Gateway Controller through the CAN bus. The Gateway Controller processes the data and organizes it in a database through the Backend Service and hosts the data on the Atom OS. Conversely, the Atom OS also takes user inputs and the Frontend service sends this data to the Backend Service, and eventually to the Atom Switches over the CAN bus. The data is exchanged in the JSON format in between the services, and this exchange takes place only when the HTTP requests are authenticated with Tokens. The http protocol operates over TCP/IP in the underlying layers.

Gateway Controller
The Gateway runs a Linux-based OS. Hence, the default Linux firewall “iptables” is used for various tasks to address the OWASP Top Ten Security risks. Additionally, all the other accessible ports (ssh/mosh/telnet/VPN) on the gateway are blocked to restrict access only through the Atom OS. User passwords are encrypted before storing in the database.

Atom OS
The Atom OS additionally has username + password based authentication and 4 possible tiers of users that can be set by the Admin user. The http requests are not authenticated unless the credentials are correct, hence restricting any kind of communication from a malicious source.

Protocols Used
Application, Presentation, and Session Layer - HTTP
Transport Layer - TCP
Network Layer - IP
Physical & Data Link Layer - Ethernet and/or WiFi

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