Web-based On-board Real-time Rendering Data System (WORRDS)

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Motivation

CASAS lacked a system to securely visualize the vast amount of sensor data collected from its smart homes around the globe, as well as an efficient method of creating and editing sensor maps of the homes.

What is WORRDS?

WORRDS is an original, web-based smart home data rendering system that streamlines research and site maintenance tasks currently done by humans at CASAS.

Real-time and Historical Sensor Data Visualization

• Server logs real-time data in WORRDSdb and services web requests
• RabbitMQ and SocketIO enable fast, reliable transport of thousands of events from SHiBs to the web browser daily
• D3/HTML widgets display data in charts and tables for easy analysis

2D Map Creation Using Google Tango App

• With app activated, walk around a home to create a 3D mesh and plot known sensor locations
• App converts 3D mesh to a 2D floor layout and uploads it to the WORRDS website

Customized Security and User Management

• Secure user accounts, permission tiers, and SSL connection guard sensitive data from unauthorized access
• Administrative GUI for managing users and permissions

View and Edit SHiB Layouts with Built-in Map Editor

• Diagram the layout of SHiBs using a custom EaselJS map editor
• Make, save, and undo changes
• Place sensors on the map and associate them with real-time data

Reliable Database Migrations and Daemon

• SQL-Alchemy and Flask-Migrate provides consistent and safe migrations and rollback of database schemas
• Java daemon performs daily sync between CASASdb and WORRDSdb

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System Overview

Design Philosophy

• Separation of concern: Each component of WORRDS is designed to be loosely coupled and replaceable.
• Mobile-first development: Enable travelling CASAS personnel to seamlessly transition from the desktop to the mobile device.
• Upgradability: Utilized open-source technologies familiar to CASAS for easier maintenance and better performance.

Three-Tier Architecture

• Security: Rely on server to interface between UI and database components. Layers only have information based on need-to-know.
• Maintainability: Facilitate division of labor for current and future developers.

WORRDS In Action

How Is WORRDS Being Used?

• To save time and money for system maintainers who must travel to sites, set-up sensors, and locate problematic sensors
• To facilitate research into elder care, automation, and green homes
• To provide peace of mind for adult children and caregivers monitoring the occupants, allowing more people to live independently who otherwise could not

Future Work

• Predict failing batteries with machine learning
• Group-based permission inheritance
• Real-time resident activity visualization for live monitoring
• Anomaly detection in system and behavioral events

Glossary

- CASAS Center for Advanced Studies in Adaptive Systems
- CASASdb The main database used by CASAS
- Flask-Migrate SQLAlchemy database migration handler
- Google Tango 3D mapping device
- RabbitMQ Message broker software
- SHiB Smart Home in a Box
- SQLAlchemy Python database interface
- WORRDSdb The local database used by WORRDS

Team Wildlings