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 provide consistent and safe migrations and rollbacks of database schemas
- Java daemon performs daily sync between CASASdb and WORRDSdb

CASAS Database PostgreSQL

System Overview

- SHiBs send sensor events over the Internet to RabbitMQ server
- WORRDS server consumes events from RabbitMQ server and WORRDSdb
- Daemon syncs CASASdb and WORRDSdb
- End users view events on website
- Google Tango app uploads maps to WORRDS

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

- Google Tango App
  - Only 3D. UI
- Database Daemon
  - Java
- User Interface
  - JavaScript, HTML, CSS, K pne
- WORRDSdb
  - MySQL
- WORRDS Server
  - Python

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

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