An In-house Energy Dashboard
(Challenges and Achievements from Oregon State University)
Demo

COMMITTED TO:
CARBON NEUTRALITY.

OSU Energy Dashboard

This Energy Dashboard has been developed by the Oregon State University Sustainability Office to enable members of the OSU community to access, view, and analyze energy consumption trends.
Building Your Dream Dashboard

- Defining Use Cases
- Gathering Resources
- Building Infrastructure
- Managing Development
- Long-Term Support
- Q&A

^ This is a moustache.
(That's actually an industry term.)
Defining Use Cases

(Software isn’t a tool; it’s an experience.)
Why Do You Need a Dashboard?

• Reach Institutional Goals
  – Carbon emissions reduction

• Cut Costs
  – Encourage OSU community members to reduce energy consumption through the dissemination of data

• Inspire Behavior Change
  – Show the results of collective action in real time
  – Integrate behavior change campaigns with social media
  – Compare effectiveness of campaigns year-to-year

• Eliminate Data Requests
  – Need 15-minute Real Power interval data for the Memorial Union? [Here's a link]
Crafting Use Cases

• From Broad to Specific
  – Use institutional goals to identify specific use cases.
• Who?
  – Who is your audience?
• What?
  – What is each user trying to accomplish?
• How?
  – How does the user achieve their goal?
• Example
  – An electrical engineer goes to the energy dashboard to download building energy data. They click the building on the map, select view full graph on the popup and then hit the download button to retrieve amperage data in fifteen minute intervals.
Design
(Perfection at its finest.)
Design is IMPORTANT!!

- Consider how your USERS will interact with the dashboard/software.
- How can you optimize each user’s journey?
  - **Consider how:**
    - Users will get from one page/view to another.
    - Users will search for buttons, data, or other important elements.
  - Keep design consistent.
  - **CONSISTENCY = INTUITIVITY!!!**
- Refer to your institution’s brand guidelines.
Bootstrap 4 “Dashboard” Template
Landing Page
Building Browser
Early Dashboard Draft
Perfection - Current

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Gathering Resources

(Your software grocery list.)
Hire Your Weaknesses

• Off-the-Shelf Solutions
• Students
  – Course Projects – Capstone Experience
  – Student Employees
• Contractors
  – Custom software development firms
  – Jim’s nephew’s friend Lance that graduated a year ago and still needs a job
    • Won’t work. Sorry Lance!
• IT Professionals
  – Currency vs. Proficiency
  – Start a conversation
Hiring Software Gurus

• Look For
  – Full Stack Web Development Experience
  – Knowledge of HTML/CSS/JavaScript
    • NodeJS
  – Familiarity with Git/GitHub
  – Experience with Databases & SQL

• Ask For
  – Link to a GitHub Profile/Portfolio
  – Personal projects (and their respective languages)

• Wish For
  – Familiarity with Universal Model Language and Entity Relationship Diagrams
  – Experience with Amazon Web Services, or similar

• Hope For
  – Everything to work out
What is Git/GitHub

- **Project Management Tool**
  - Organizations have repositories (or “repos”)
  - Collaborators can create “issues”
    - Issues have a title & description
    - Issues are assigned to developers

- **Collaborative tool**
  - Developers create “Branches”
    - Branches store unique copies of the main code
    - Branches are merged into the main project when features are done
  - Integrates with Slack and other team communication platforms

- **Source Code Version Control Tool**

- **Completely Free!**
Overview

Repositories 21  Projects 0  Stars 22  Followers 6  Following 7

- Assembly
- C

- Asteroids
  Asteroids
  Java

- CS381 Assignments
  All of the assignments I completed for CS 381 - Programming Language Fundamentals.
  Haskell

1,129 contributions in the last year

Contribution settings

Activity overview

- Contributed to
  OSU-Sustainability-Office/osu_car...
  OSU-Sustainability-Office/shared...
  jackwoods/CS344 Assignments
  and 5 other repositories
osu_carbon_calculator_update_project
Backup of the OSU Sustainability Office Carbon Calculator (Beginning with Version 1)

energy-dashboard
Oregon State University's energy dashboard.

shared-node-server
This server allows all of our web apps to access our databases through Ajax requests.
Senior Capstone Experience - Contributions

November 2017
January 2018
March 2018
May 2018

Finals Week Fall 2017
Development During Winter 2018
Bug Fixing, Testing and Support Spring 2018
Senior Capstone Experience - Contributions

Deleted their GitHub Account...
Building Infrastructure
(It’s a verb and a noun.)
Metering Hardware

- **Purchase Digital Meters with Modbus Output**
  - Examples: Veris E51C2, Siemens Centron Pac 3200

- **Data Acquisition Servers (DAS)**
  - AcquiSuites by Obvius – We’ve only worked with these, but they work well, and others use them too.

- **Installation can be expensive**
  - Location, Location, Location
  - Require communication and power connections
  - May need to change or add current transformers inside electrical gear
Costs of Hardware

• Devices
  – Meter: $400
  – Current Transformers: $600-2,000
  – Acquisuite: $800

• Installation
  – Require communication and power connections
  – Location is important
  – May need to change current transformers
  – $1,800

• Add to Building Design Standards
  – Cheaper for new buildings
    • Buildings may need to be shut down
  – Bonus: LEED Certification Credits for Measurement and Verification
Software Infrastructure

(It's all done by computer.)
Hosting

• Application Programming Interface (API) Hosting
  – An extra layer between frontend and database to keep the data secure
  – Options
    • AWS, Google Cloud, Heroku
    • On Campus Options
  – With AWS, we pay up to $8 per month.
    • Multiple Databases
    • Virtual Servers (Amazon Elastic Compute 2/EC2)
    • Multiple Databases (Amazon Relational Database Service/RDS and DynamoDB)
    • Continuous Integration Services
    • Take advantage of the “Free Tier”

• Frontend Hosting
  – Static site host that the user interacts with
  – Options
    • GitHub Pages, GoDaddy.com (or other web hosting services)
Data Flow Overview

Physical Hardware
- Veris E51C2 Electric Meter
- Red Lion PAX CDC Steam Totalizer
- Siemens Centron Pac 3200 Electric Meter
- Acquisuite A8812 Data Acquisition Server

Amazon Web Services (AWS)
- Secure Data Acquisition API (Application Programming Interface)
- Amazon RDS Database (Relational Database Service)
- Public API (Application Programming Interface)

GitHub Repo
- Brogan
- Jack

Dashboard User
- Dashboard Frontend (Hosted with GitHub Pages)
Managing Development
(This is fine.)
Workflow

• Define the Scope of Your Software
  – Desired Features -> Use Cases
  – Decide software frameworks to use
  – Establish a medium for rapid communication
    • Email, Texting, Slack/Instant Messaging, etc.

• Begin an iterative development process
  – Schedule (weekly) meetings
  – Assign a set of features to each developer
    • Consider a SCRUM board
  – Test newly-implemented features on a test-server

• Perform usability testing in-house
  – 3 groups of 5 users catch 90% of usability-related bugs

Source: [Nielsen Norman Group](https://www.nngroup.com)
Download and Install pending updates

Did you know that there are pending updates for this machine? Choose “Apply this fix” option below to start the update process in the background immediately.

→ Apply this fix

→ Skip this fix

Long-Term Support
(How to plague users with incessant updates.)
Planning for Maintenance

• **Documentation**
  – Describing our API/how to leverage our infrastructure
  – Providing documentation for use of future OSU Software Gurus™

• **Legacy Support**
  – Fixing bugs and addressing accessibility/usability concerns
  – Maintaining support for older hardware and software

• **Responding to Feature Requests**
  – Determining what features should be added
  – Maintaining project scope
    • What features should not be added?

• **Other Projects**
  – [OSU Carbon Calculator](#), Sustainability Kiosks, Interactive Digital Marketing Materials
  – Automated donut ordering & delivery software for staff meetings (Pending Approval).
Question & Answer
(Please submit a support ticket.)