

CMSC451 - CS 24-330 Fault detection and diagnostics Automation using 5-minute building automation system data II

Project Proposal

The Current State:

The current state involves the continuation of a project initiated in the previous year. It involves a detailed data engineering process to detect faults and identify their root causes using data collected since January 2022. The project is a collaboration with VCU Facilities Operations and Engineering and Utilities (E&U) staff.

Problem Statement:

The "Fault Detection and Diagnostics Automation using Building Automation System Data" project, undertaken in collaboration with VCU Facilities Operations and Engineering and Utilities (E&U) staff, seeks to optimize facility maintenance and service delivery. Building upon the previous year's success, which involved a detailed data engineering process to detect faults and uncover their root causes in data collected since January 2022, this year's project extends its scope to include data from an additional nine buildings (Biotech, College of Engineering/East, College of Engineering/West, Kontos, Massey Goodwin, Molecular Medicine, Oliver Hall/Monroe Campus, Robert Smith/MCV Campus, Sanger/MCV Campus).

The objectives for Part Two encompass various stages, from allowing for additional data from different buildings and expanding upon previous constraints to implementing predictive and time-series analysis. Additionally, the project emphasizes feature engineering for fault detection, conducting in-depth root cause analyses.

Results will be communicated through detailed reports, fostering a feedback loop with E&U staff for validation and further insights.

Comprehensive documentation and an organized codebase will be maintained for future reference, and a presentation will be prepared to showcase detected faults, their causes, and recommendations for improvement.

Ultimately, these endeavors aim to support maintenance operations' efficiency, aligning with VCU's commitment to delivering cost-effective, high-quality facilities support.

Social Benefit:

In addition to its technical objectives, this project holds significant social value. Enhancing the efficiency and effectiveness of facility maintenance operations directly contributes to creating a safer, more comfortable, and sustainable environment for the entire VCU community. Timely fault detection and diagnostics reduce downtime and potential hazards and minimize energy wastage, contributing to a more sustainable campus. This initiative improves the overall quality of campus life for students, faculty, and staff, exemplifying VCU's dedication to fostering a conducive learning and working environment.

Business and Functional Requirements:

1- Automate Data Standardization

Objective: Implement automated data conversion using Python to ensure consistency in naming conventions across all nine additional buildings' data points. This streamlines analysis for the E&U team.

2- Detect Drifts and Identify Causes

Objective: Develop methods to detect data drifts and determine their underlying causes using standardized data, enabling proactive maintenance and troubleshooting.

3- Dashboard for Data Analysis (Recommended)

Objective: Build a user-friendly dashboard, allowing the client to upload and analyze the newly standardized data with Python effortlessly.

These requirements aim to extend the successes of Part One to the additional nine buildings, focusing on automated data standardization, drift detection, and enhanced data analysis capabilities.

Priorities	
Must have	Last year's files modified to incorporate new data from the nine buildings.
Should have	The system should be usable at the command line and take and convert data in real time.
Could have	User Interface
Won't have	All VCU buildings. It is only limited to these nine buildings.

Constraints:

- The system should be usable at the command line and take and convert data in real time.
- It is limited to the nine specified buildings and doesn't cover all VCU buildings.

Solution (Deliverables):

We will use Python and SQL languages for this project.

- We will use GitHub and Google Docs to collaborate and store our documents.
- We will hold Zoom/Discord meetings to discuss the following steps.
- We will meet with Professor John Leonard and our client, Michael Risley, weekly or bi-weekly whenever we have questions.
- We will review last year's project, read many internet resources, and watch YouTube videos to understand complex concepts.
- Final deliverables will be a command line interface where raw data can be converted in real time, as well as a user-friendly dashboard with data analysis.

Stakeholder:

- **VCU Facilities:** This includes the Facilities Operations and Engineering and Utilities (E&U) staff. They are directly involved in the project and are the end-users of the system.
- **Students, Faculty, and Staff of VCU:** They indirectly benefit from the project as it aims to create a safer, more comfortable, and sustainable environment on campus.

Resources:

- **Languages:** Python and SQL
- **Collaboration Tools:** GitHub, Google Docs
- **Communication Tools:** Zoom/Discord for meetings
- **Skills:** Linux, Python, Command-Line Interface, SQL.

Project Team	Major	Role
Fatma Saafan	Computer Science	Project Manager
Aiman Hanif	Computer Science	Systems & Manufacturing Engineer
Nathan Goehring	Computer Science	Testing Engineer
Feyza Sakin	Computer Science	Logistics

Conclusion
• We will use Python and SQL languages for this project. • We will use GitHub and Google Docs to collaborate and store our documents. • We will hold Zoom/Discord meetings to discuss the following steps. • We will meet with Professor John Leonard and our client, Michael Risley, weekly or bi-weekly whenever we have questions. • We will review last year's project, read many internet resources, and watch YouTube videos to understand complex concepts.