Cue Environmental Control App

Machine Learning Engine

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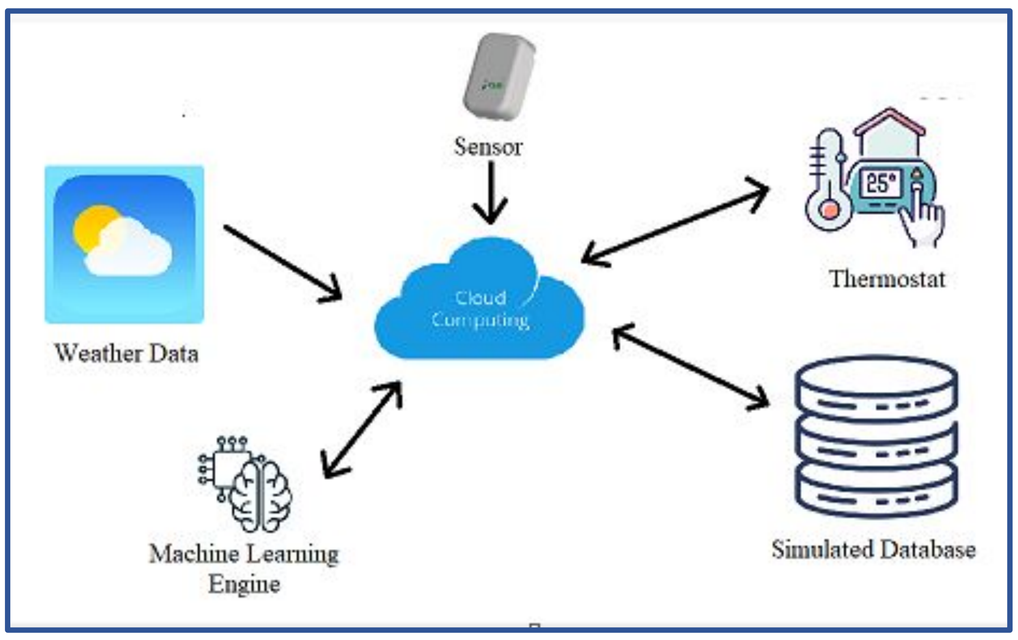
Abstract

Propose, develop, document, and test machine learning algorithms for the home's HVAC system that will optimize energy usage and comfort.

Factors such as types of training data, preprocessing data, optimization of algorithms, time/storage complexities, and infrastructure setup had to be considered when designing and programming our machine learning algorithm.

Keywords: Machine Learning, Cloud Service, RESTful API

Architecture



Impact

Minimize energy usage for consumers, which will result in the consumer paying less, and less energy being used.

Performance Metrics

- Successfully output HVAC controls for user comfort and energy efficiency
- Research ML algorithms/techniques to find best fit
- Determine necessary inputs for algorithm and output

Limitations

One of the significant limitations of our project was the lack of real-world data. The system the machine learning algorithm was designed for is new and proprietary, therefore lacking historical data. This is an issue because no matter how good a machine learning algorithm is, it needs quality and preferably numerous amounts of data for training. We accommodated this by simulating as much data as possible close to real-world conditions. Although there will be situations we can't account for, it created a basis for us to develop the machine learning algorithm. Another limitation we experienced is the connection to infrastructure. The interface connection to the backend database has been specified and outlined but is not fully functional. Therefore we have a local implementation as a placeholder. Once we have access to a continuously updating database, our algorithm will get smarter with more new data.

Future Direction

Our current machine learning algorithm exists in an isolated space using simulated data and outputs. This will eventually be moved to a real-world environment and then to consumer households. This will involve connecting to a continuously updating database with actual data, preprocessing the data to remove noise and improve efficiency, and getting a model to predict the optimal state of the HVAC system for each household.

Summary

Our machine learning algorithm was developed and tested in an isolated system, where weather data and thermostat information were simulated. When training the model, we had to consider what were the most crucial data points and how to format them. This was done after careful investigation of various ML techniques and optimizations.

The programs and documentation prioritized making a foundation for future development when real-world data is collected and can be integrated into the backend infrastructure.