UPDATED PROPOSAL

PERFACE

ORIGAINL PLAN: Optimize the energy usage in a HVAC system

METHODOLOGY:

* Machine learning with a year-long dataset( time interval: 1hr)
* Dataset -> 80% training, 20% testing

PROBLEM:

* Result model can only be validated by the given data set
  + Absent of a true model to examine the result
* The control logic is predefined.
  + Predefined logic limited the choice of AI
  + A supervised AI chess player would only play as well as a human
  + An unsupervised AI could ‘think’ out of the human thought
* A robust model of the system is required for unsupervised learning

NEW APPROACH

Three-stage:

1. Create a real physics model
2. Create a virtual system characteristic model from real model
3. Energy optimization with Neural Network

A real model:

* Design a small and simple room with cooling system
* Replace a compressor with thermal electric generator
  + COP of TEG is much lower than the compressor
  + The best only way to do it (Compressor is expensive and too large)
* A heater acting as a heat load

Components:

* Two pumps for evaporator and condenser
* Thermal Electric cooler (TEC)
* Heat exchanger
* Pipe
* ROOM (To be designed)

A virtual mode

* Log data (system characteristic)
* Train predictive model
  + Power consumption (P=VI)
  + Temperatures of heat exchanger (Regression)
  + Temperature of indoor (Regression/ NN)
    - Without load
    - With load
* Measure error, refine model

Optimal control

* Create a Reinforced Neural Network for optimal control
  + Output: TEC ON/OFF
  + Reward
    - Low energy consumption
    - Reach target set point
* Feed the Result to real model for validation

TIMETABLE

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| September 1st week | Proposal |
| September 3rd week | Data review |
| October 1st week | Try regression model on cooling load |learn python ML library| Modify topic and method |
| October 3rd week | Buy essential | build model |
| November 1st week | Start recording data | debug |
| November 3rd week | Debug | Refine |
| December 1st week | Debug | Refine |
| December 3rd week | Feed data to virtual model | Term report |
| January 1st week | Debug | Refine |
| January 3rd week | Debug | Refine |
| February 1st week | Debug | Refine |
| February 3rd week | Debug | Refine |
| March 1st week | Try optimal control model |
| March 3rd week | Validate | Debug | Refine |
| April 1st week | Validate | Debug | Refine |
| April 3rd week | Summarize | Presentation prep |
| Final presentation week | Presentation |