Background/Purpose

Our goal is to reduce wasteful energy consumption on plug loads through predictive modelling and provide an actionable user experience for residents to better manage their energy consumption. We will:

1) Model user daily energy usage patterns via Long Short Term Memory Recurrent Neural Networks (LSTM RNN) which is useful for studying trends with relatively long histories to consider [1].

2) Nudge the users to be more thoughtful about their energy usage, giving them the option to turn off devices when the model predicts wasteful energy usage (including standby loads and poor device utilization [2]).

Our solution provides an automated solution to the manual energy saving methods suggested by Pigg [3].

Materials

- IoT energy, movement, and temperature sensors
- Wi-Fi Network and cloud compute service
- Server for hosting website
- Multi-state power appliances

Design

- Use sensors to collect data and feed it to our neural network.
- LSTM neural network will refine the model and make predictions regarding wasteful energy usage.
- Through the API, system will send notification through Slackbot to advise users and make actions base on the prediction.
- We designed our protocol to allow our service to be modularized and reusable.

Timeline and Results

Week 3-5: Data and Design

- Gather energy data from previous studies and SimHome so that we can preprocess it
- Design LSTM model on Google Colab Notebook
- Design API for notification system between prediction service and user interface/Slack bot

Week 6-8: Implementation

- Implement LSTM on sample energy usage data
- Implement API for notification system and Slack bot

Week 9-10: Verification

- Test system on SimHome sensors and verify that we get notifications when we waste energy

Results

- Built backend notification system with LSTM and energy tracking using a Slack bot as our client side
- For future work, we are going to increase accuracy our LSTM and create a web & app interface

References


Background/Purpose

Our goal is to reduce wasteful energy consumption on plug loads through predictive modeling and provide an actionable user experience for residents to better manage their energy consumption. We will:

1) Model user daily energy usage patterns via Long Short Term Memory Recurrent Neural Networks (LSTM RNN) which is useful for studying trends with relatively long histories to consider [1].

2) Nudge the users to be more thoughtful about their energy usage, giving them the option to turn off devices when the model predicts wasteful energy usage (including standby loads and poor device utilization [2]).

Our solution provides an automated solution to the manual energy saving methods suggested by Pigg [3].

Materials

- IoT energy, movement, and temperature sensors
- Wi-Fi Network and cloud compute service
- Server for hosting website
- Multi-state power appliances

Design

- Using sensors to collect data and feed it to our neural network.
- LSTM neural network will refine the model and make predictions regarding wasteful energy usage.
- Through the API, system will send notification through Slackbot to advise users and make actions base on the prediction.
- We designed the protocol to allow our service to be modularized and reusable.

References

Background

Long Short Term Memory Recurrent Neural Networks are useful when studying trends that take into account the history of a model. We want to use this to learn trends in energy usage and then provide suggestions to reduce wasteful or standby energy usage. As the energy crisis gets worse, it is important to have a system that can easily detect, notify, and log wasteful energy usage.

Design

The backbone of our system will be an energy collecting service that will take data and feed it to our neural network. This neural network will then be used in our back end data service which will make predictions about energy and provide data to our user interface. The most important thing our data service will do is use the predictions to send notifications to our user interface. The services will talk to each other using the protocol we designed. The protocol allows our service to be modularized and reusable.

Purpose

To reduce wasteful energy consumption through predictive means by software. Our main goal is to create a user interface that will nudge the users to be more thoughtful about their energy usage.

Materials

- IoT energy, movement, and temperature sensors
- Wi-Fi Network and cloud compute service
- Server for hosting website
- Multi-state power appliances

Timeline

Week 3-5
- Gather energy data from data sources and SimHome
- Design our LSTM Recurrent Neural Network to give a prediction on the probability of reducing energy usage of an appliance will save energy
- Verify that the neural network provides the right suggestions to reduce wasteful energy usage

Week 6-8
- Design protocol for notification system between prediction service and user interface
- Design user interface for webapp

Week 9-10
- Implement the protocol through a prediction service that will implement a websocket and GraphQL API
- Test it on SimHome sensors and verify that we get notifications when we waste energy

References