Towards an informative simulation-based application for energy saving in large passenger and cruise ships

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Outline

❑ Introduction: Prediction of Energy Consumption in Large Cruise Ships

❑ Related Work

❑ Our Approach

❑ Experiments

❑ Summary

❑ Future Work

Prediction of Energy Consumption in Large Cruise Ships

❑ Energy Consumption in large cruise ships is a complex and challenging issue.

❑ The equivalent of energy consumption in cruise ships is energy consumption in giant buildings like skyscrapers or small villages.

❑ Energy consumption in cruise ships can be divided into two large theoretical segments:

  ❑ Energy spent for ship's movement
  ❑ Energy spent for customers and crew's services provision

Related Work

Simulation For Energy Consumption

- ❑ T. Zhang, P.-O. Siebers, and U. Aickelin, "Modelling office energy consumption: An agent based approach," 09 2010.

- ❑ Y. Chebotarova, A. Perekrest, and V. Ogar, "Comparative analysis of efficiency energy saving solutions implemented in the buildings," in 2019 IEEE International Conference on Modern Electrical and Energy Systems (MEES), Sep. 2019, pp. 434–437.

- ❑ S. Guzhov and A. Krolin, "Use of big data technologies for the implementation of energy-saving measures and renewable energy sources in buildings," in 2018 Renewable Energies, Power Systems Green Inclusive Economy (REPS-GIE), April 2018, pp. 1–5.

- ❑ S. Seyedzadeh, F. P. Rahimian, I. Glesk, and M. Roper, "Machine learning for estimation of building energy consumption and performance: a review," Visualization in Engineering, vol. 6, no. 1, p. 5, Oct 2018. [Online]. Available: https://doi.org/10.1186/s40327-018- 064-7

- ❑ A. Javed, H. Larijani, and A. Wixted, "Improving energy consumption of a commercial building with iot and machine learning," IT Professional, vol. 20, no. 5, pp. 30–38, Sep. 2018.

- ❑ R. G. Rajasekaran, S. Manikandaraj, and R. Kamaleshwar, "Implementation of machine learning algorithm for predicting user behavior and smart energy management," in 2017 International Conference on Data Management, Analytics and Innovation (ICDMAI), Feb 2017, pp. 24–30.

- ❑ M. Kaddari, M. El Mouden, A. Hajjaji, and A. Semlali, "Reducing energy consumption by energy management and energy audits in the pumping stations," in 2018 Renewable Energies, Power Systems Green Inclusive Economy (REPS-GIE), April 2018, pp. 1–6.

Our Approach

Our goals

- ❏ Prediction of energy demands at various ship's cites

Our assumptions

- ❏ Energy demands at ship's cites is being affected by the number of passengers are gathered at these cites at a given time .
- ❏ Energy Consumption at crowded cites such as Disco Room and Casino is determined by passengers' personal choices for entertainment during their voyage.
- ❏ These personal choices can be considered as peculiarity of the age group they are categorized to.
- ❏ The Energy demands for each cite of the ship, can be expressed by unique energy thresholds

Our Approach

Our Data

❑ Real Data
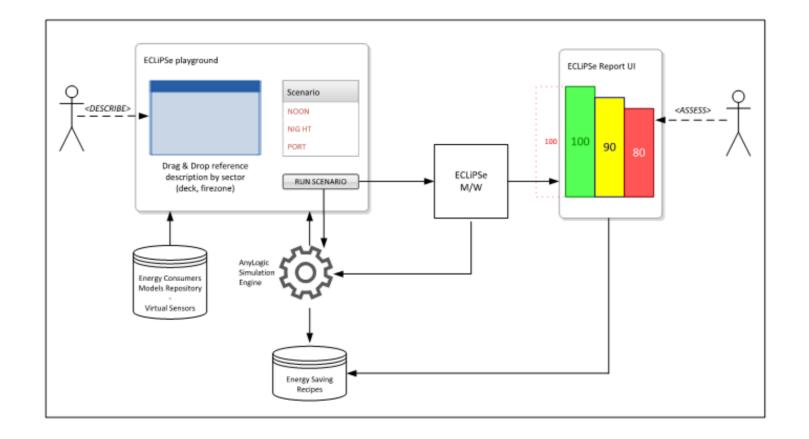 ❑ Spatial Data: Layout of each ship's Deck.

❑ Virtual Data
  ❑ Based on a series of meetings with shipping companies we created realistic compositions of passengers, categorized by age groups.

Simulation of passengers' movement

❑ With the use of AnyLogic software, we run different experiments to replicate passengers' movement from their cabins to different facilities of entertainment.
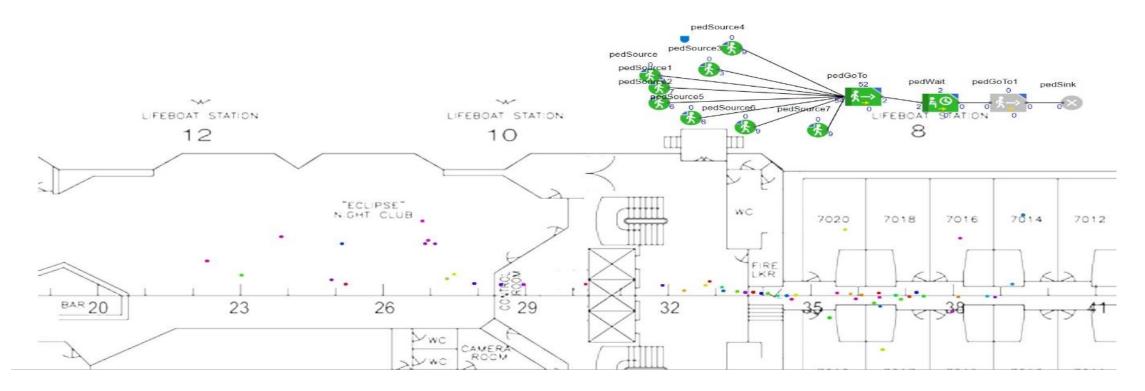
❑ We estimated the passengers' gatherings at given cite for each period of time.
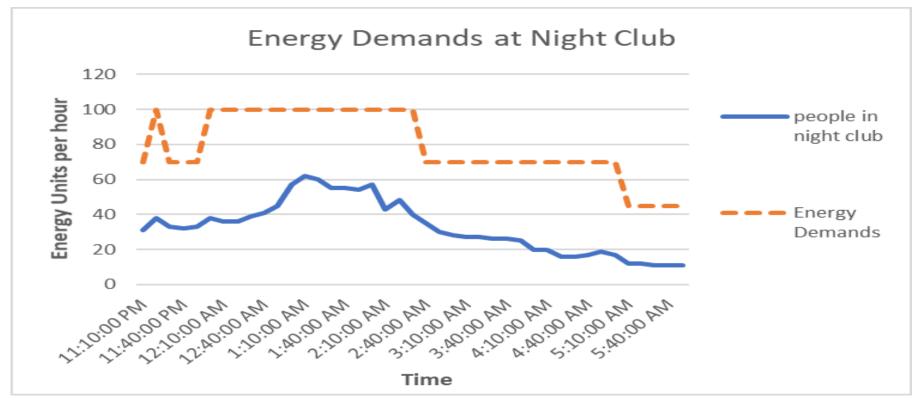
System Architecture

System Architecture

Experiments
Agent-Based Simulation

An instance of a simulated energy consumption scenario in the nightclub

Experiments
Estimating Energy demands at ship's Night Club

Energy demands corresponding to passengers' concentration in the nightclub

Summary

❑ Agent-Based simulation can be further exploited to predict energy demands in large passenger and cruise ships.

❑ Agent-Based simulation produce data such as passengers' gatherings in a way that no other method can.

❑ Modeling of passengers' behavior produce a series of recommendations towards better energy management.

Future Work

❑ Run similarly experiments for more than 4 cites.

❑ Find and utilize more real data into our models.

❑ Engage machine learning algorithms.

Any Questions?

Thank you!

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