# Project 4: Measure Energy Consumption

## PHASE-2 PROJECT SUBMISSION

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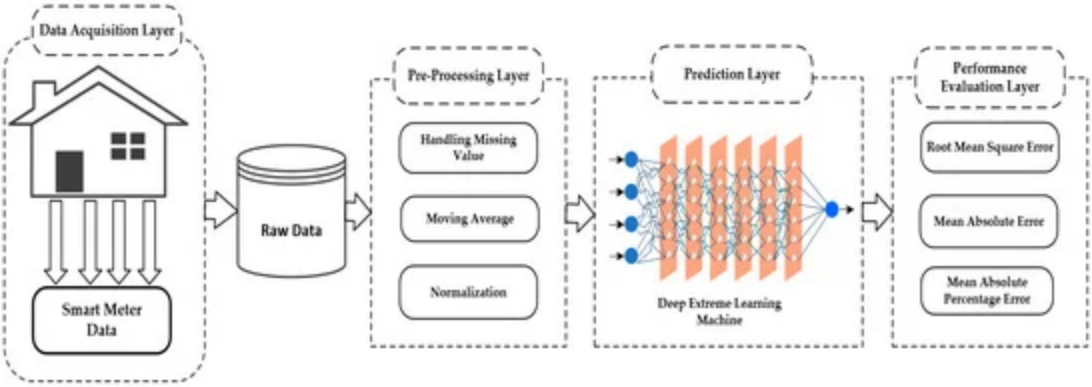
**Objective:**

The objective of this project is to create an automated system that measures energy consumption, analyzes the data, and provides visualizations for informed decision-making. This solution aims to enhance efficiency, accuracy, and ease of understanding in managing energy consumption across various sectors.

We have discussed about the data preprocessing steps in the previous phase(phase 1)

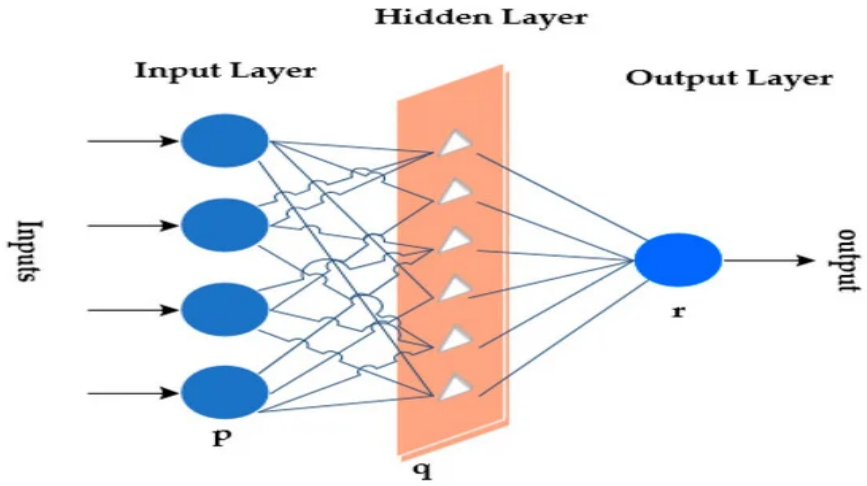
**Proposed Energy Consumption Prediction Methodology**

Energy consumption prediction in residential building is extremely important; it assists the manager to preserve energy and to avoid wastage. we have proposed a methodology based on a deep extreme learning machine (DELM) for energy consumption prediction in residential buildings. We have divided the proposed method into four main layers, namely data acquisition, preprocessing, prediction, and performance evaluation. In the data acquisition layer, we have discussed the detailed data used in the experimental work. In the preprocessing layer, the moving average has been used to remove abnormalities from the data. In the prediction layer, the deep extreme learning machine (DELM) has been proposed to enhance the accuracy of energy consumption results. In the performance evaluation layer, MAE, RMSE, and MAPE performance measures have been used to measure the performance of prediction algorithms.Below fig shows the detailed structure of the diagram of the proposed method.




**Deep Extreme Learning Machine (DELM)**

The extreme learning machine (ELM) technique is a very famous technique and it has been used in different fields for energy consumption prediction. The conventional artificial neural network based algorithm requires more training samples, slower learning times, and may lead to the over-fitting of a learning model . The idea of ELM was first specified by Reference . The ELM is used widely in various areas for classification and regression purposes because an ELM learns very quickly and it is computationally efficient. The ELM model comprises the input layer, a single hidden layer, and an output layer. The structural model of an ELM is shown below, where p represents input layer nodes, q represents hidden layer nodes, and r indicates output layer nodes.




**Automation**

Automation in measuring energy consumption using AI involves leveraging artificial intelligence techniques to streamline and enhance the process of collecting, analyzing, and

optimizing energy usage data. AI-driven automation can provide more accurate insights, predictive capabilities, and adaptive control over energy consumption. Here's how AI can be applied to automate energy measurement. Our model development is based on machine learning algorithms like linear regression, random forest regression, gradient boosting regression.

**Conclusion**

These statistical measures values indicate that the performance of proposed DELM is far better as compared to other counterpart algorithms. These initial results give us confidence, and we are currently exploring various alternatives and collecting data to extend this work in directions above.