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MACHINE LEARNING IS USED TO PREDICT THE ENERGY USAGE OF ELECTRIC APPLIANCES

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ABSTRACT_ The energy use of residential buildings has increased recently as a result of the growth in residential construction and the ongoing urbanization of areas. An increase in the buying of household appliances is a result of the citizens' rising economic status. According to the survey, home appliances like computers, televisions, washing machines, refrigerators, rice cookers, and electric water heaters account for 57% of the energy used in residential structures.The kind and number of home appliances have a significant impact on the indoor environment, including temperature, humidity, and light, which in turn affects how much electricity a home uses.

Hence, by developing appropriate models and utilising various environmental data and electricity consumption data, it is possible to anticipate the energy consumption of household appliances.Intelligent forecasting algorithms are a fundamental component of smart grids and a powerful tool for reducing uncertainty in order to make more cost- and energy-efficient decisions about generation scheduling, system reliability and power optimization, and profitable smart grid operations. Yet, since many crucial tasks of power operators, such load dispatch, rely on the short-term forecast, prediction accuracy in forecasting algorithms is highly desired.

1.INTRODUCTION

A new type of power generation grid called the "smart grid" has emerged, and its main goal is to control and manage electricity in a way that is more prudent, dependable, and intelligent. The most efficient and reliable smart grids are those that include specific automation devices, protective equipment, communication protocols, and most importantly, customer feedback. By reducing the energy gap between supply and demand, these architectures and technologies enable the production and distribution of electricity in a sustainable manner. A difficult task is creating an intelligent and smart system for managing home energy systems, in addition to the opportunities provided by smart grid. The adoption of smart grid technologies has received positive feedback from customers because it enables more effective and sustainable energy management. The need for seamless integration with current infrastructure and consumer behaviour patterns presents a challenge in the development of an intelligent home energy system.

The integration of renewable energy sources is made possible by smart grid technologies, which also have the potential to lower energy costs and increase reliability. However, utilities, regulators, and customers must work together and make sizable investments in order to implement these technologies. Additionally, the intelligent home energy system can deliver up-to-the-minute information on energy production and consumption, enabling homeowners to make wise choices about their energy use and possibly reduce their costs. Additionally, the use of this technology could lower carbon emissions and advance sustainability.

In addition, these technologies must be designed, installed, and maintained by a skilled workforce. To ensure that there are enough qualified professionals to support the growth of these industries, it is crucial to invest in education and training programs. By investing in education and training programs, we can equip individuals with the necessary skills to meet the demands of these emerging industries. This will not only support the growth of sustainable technologies but also create job opportunities and contribute to economic development.

30% to 40% of all the electrical energy used worldwide, worldwide, is consumed by the residential sector. The population and residential area are both steadily growing, which is causing this consumption to increase quickly. In order to plan the power system effectively and guarantee optimal energy management and a reliable supply of electrical energy from generation to consumer, it is essential to forecast consumer demand. Especially for small-scale micro grid operations, accurate and timely forecasting of consumer demand may aid in effectively controlling the non-urgent need for electrical energy in order to achieve a better balance between production and consumption. One of the most crucial components of power sources is electrical energy, which is also regarded as a fundamental requirement for basic life

2.LITERATURE SURVEY

2.1 Luis M. Candace∗, VéroniqueFeldheim, Dominique Alderamin, "Data driven prediction models of energy use of appliances in a low-energy house," Energy and Buildings 140(2017).

This study has demonstrated one thing in common: how much energy is used by appliances in a home or office depends on a variety of factors, including the number of occupants, the interior and exterior environments of the building, its architecture, and its geographic location. It is impossible to estimate the appliance energy use in a home or office without taking these factors into account. In order to comprehend the internal and external environments of the building, we have used environmental wireless sensor data from this study, such as humidity, temperature, wind speed, dew points, and visibility, along with energy use data from smart electric meters. The experimental dataset is a secondary dataset that was takenfrom the UCI machine learning repository in accordance with the copyright guidelines for research purposes. The dataset was created by Luis M. Candace.

2.2 A prediction system for home appliance usage

Numerous studies have looked into household appliance energy consumption prediction models. Using different machine learning (ML) algorithms, such as the decision tree (DT) algorithm, the decision table classifier (DTC), and the Bayesian network, Basu et al. [10]proposed a model for predicting the next-hour and next 24-hour energy consumption of household appliances (BN).In their suggested method, they look for a suitable data structure for the regression as well as a way to formalize expert knowledge on energy consumption. They also demonstrated that choosing the right regression model for a particular dataset is notan easy task.The study also emphasizes how crucial it is to take into account expert knowledge when predicting energy consumption precisely and effectively. The results of this study can be used to create household energy management systems that are more efficient. Therefore, the development of accurate regression models requires the integration of both statistical analysis and domain-specific knowledge. By incorporating expert knowledge, energy consumption can be predicted more accurately, leading to the creation of more efficient household energy management systems.

2.3 Accuracy of different machine learning algorithms and added-value of predicting aggregated-level energy performance of commercial buildings

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In order to predict the overall energy consumption of buildings, Chaos ET Al. [15] reviewed several models based on artificial neural networks (Ans) and support vector machines(SVMs). They came to the conclusion that it is challenging to choose the best model without weighing them all against one another for the same set of conditions. In order to enable fair comparisons, the authors recommended that future research concentrate on evaluating the effectiveness of various models using a standardized dataset and standard evaluation metrics. This would make it easier to determine which energy consumption prediction model for buildings is the most accurate and trustworthy. Moreover, it would also help in identifying thestrengths and weaknesses of each model and provide insights for further improvement. This approach can lead to more reliable and consistent results in predicting energy consumption in buildings.

3.PROPOSED SYSTEM

- The adaptability of random forest is one of its main benefits. It may be used for classification and regression issues and makes it simple to see the relative weights it gives the input attributes.
- The bagging algorithm is the foundation of the ensemble learning method Random Forest. The output of all the trees is blended once as many trees as possible have been created on the subset of data.
- This decreases the issue of overfitting in decision trees, as well as lowering variance and raising accuracy. In order to solve classification and regression issues, Random Forest may be employed.
- Efficacious Random Forest applications may be made for both continuous and categorical data. Missing data processing is automated in Random Forest.

3.1 IMPLEMENTATION

3.1.1 Random Forest

Popular machine learning algorithm Random Forest is a part of the supervised learning methodology. It can be applied to ML problems involving both classification and regression. It is based on the idea of ensemble learning, which is a method of combining various classifiers to address complex issues and enhance model performance.

3.1.2 Bagging in Machine Learning

Bagging, also known as Bootstrap aggregating, is an ensemble learning technique that helps to improve the performance and accuracy of machine learning algorithms. It is used to deal with bias-variance trade-offs and reduces the

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variance of a prediction model. Bagging avoids overfitting of data and is used for both regression and classification models, specifically for decision tree algorithms.

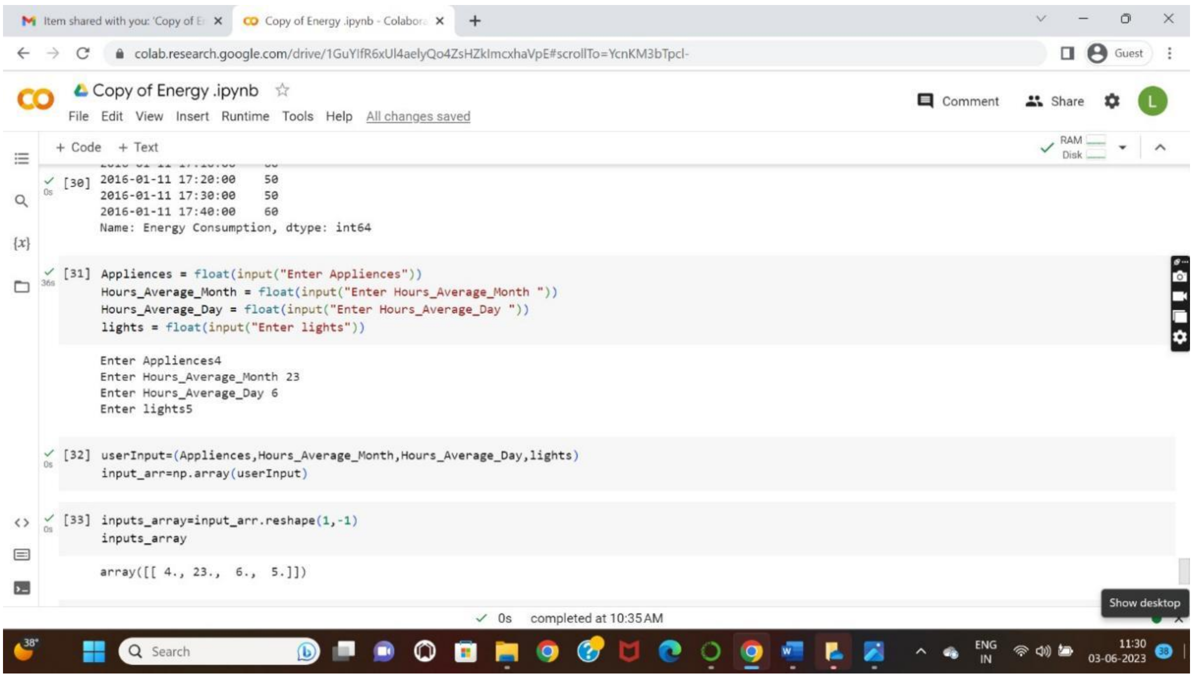
Advantages of Proposed system:

- Greater training effectiveness and speed.
- Use less memory.
- Greater accuracy.
- Support for GPU learning in parallel.
- Able to manage large amounts of data.

ENSEMBLE LEARNING

Ensemble learning is a widely-used and preferred machine learning technique in which multiple individual models, often called base models, are combined to produce an effective optimal prediction model. The Random Forest algorithm is an example of ensemble learning. Bagging, also known as Bootstrap aggregating, is an ensemble learning technique that helps to improve the performance and accuracy of machine learning algorithms. It is used to deal with bias-variance trade-offs and reduces the variance of a prediction model.

4.RESULTS AND DISCUSSION



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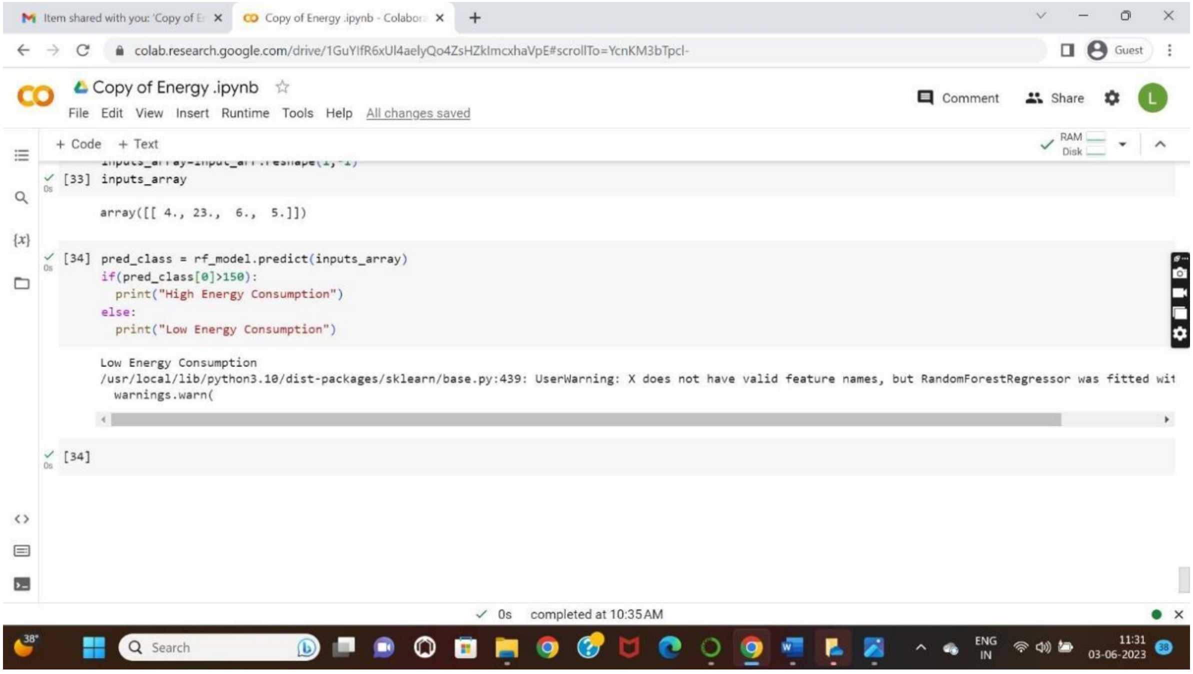

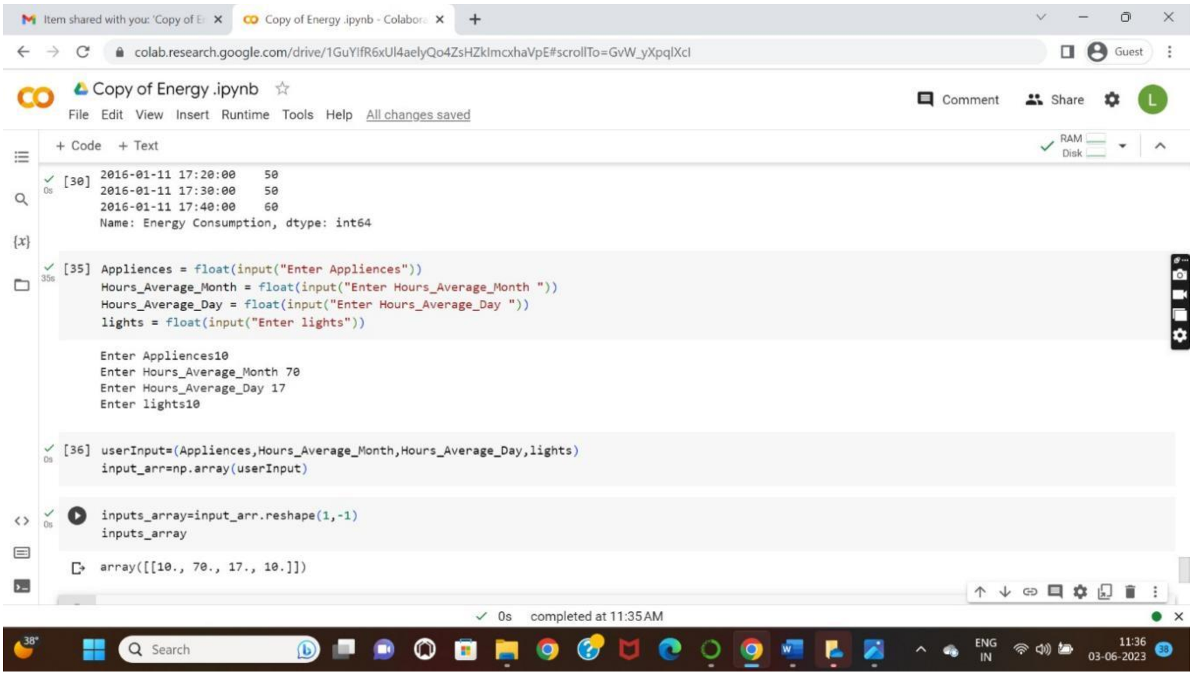

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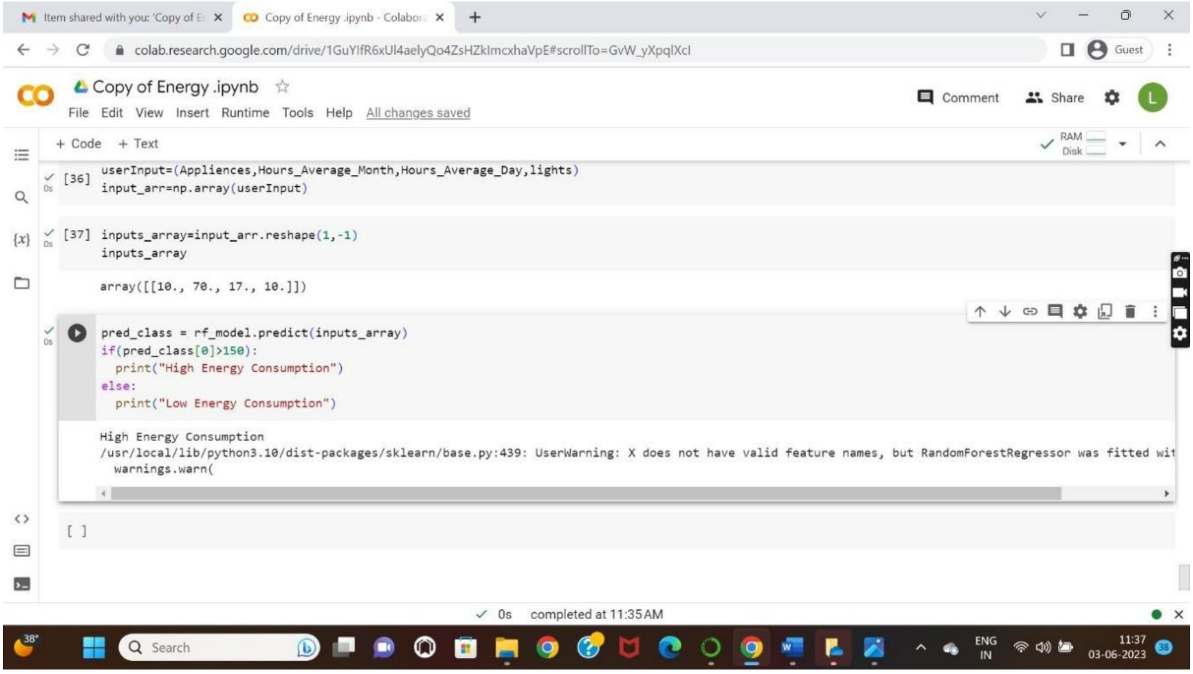

The outcome of the machine learning model is the output. It is a classification or prediction made using the input data the model was trained on. The output's accuracy is a function of the model's complexity, performance, and the quality and quantity of the training data. It is crucial to remember that the caliber of the data used to train the machine learning model affects the output's accuracy and dependability. To ensure the model performs at its best over time, ongoing monitoring and updates might also be required.

A well-trained RF model, data cleaning, and preprocessing combined to produce this result. The fact that the RF model could confidently and accurately predict the target variable shows that it is a trustworthy tool for further analysis. These findings highlight the significance of meticulous data preparation and model selection for making precise predictions.

Result

It predicts the energy consumption whether it is low or high.

5.CONCLUSION

With an accuracy of 100% and an average error rate of 0.00002 degrees, our project effectively forecasted each and every use of the electric appliances. The model's high degree of accuracy and low error rate demonstrate how effectively it anticipates energy consumption, which can result in

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significant cost savings and energy conservation. It is critical to constantly tracking and developing the model to ensure its continued correctness throughout time. Regular monitoring and updating of the model can assist in identifying changes in energy consumption trends and adjusting the model accordingly, ensuring the model's continuous accuracy and efficacy in predicting energy usage. Incorporating new data sources and factors into the model can help increase its accuracy and provide more insights into energy consumption

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