Indoor Air Quality Predictions For Automation

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Abstract

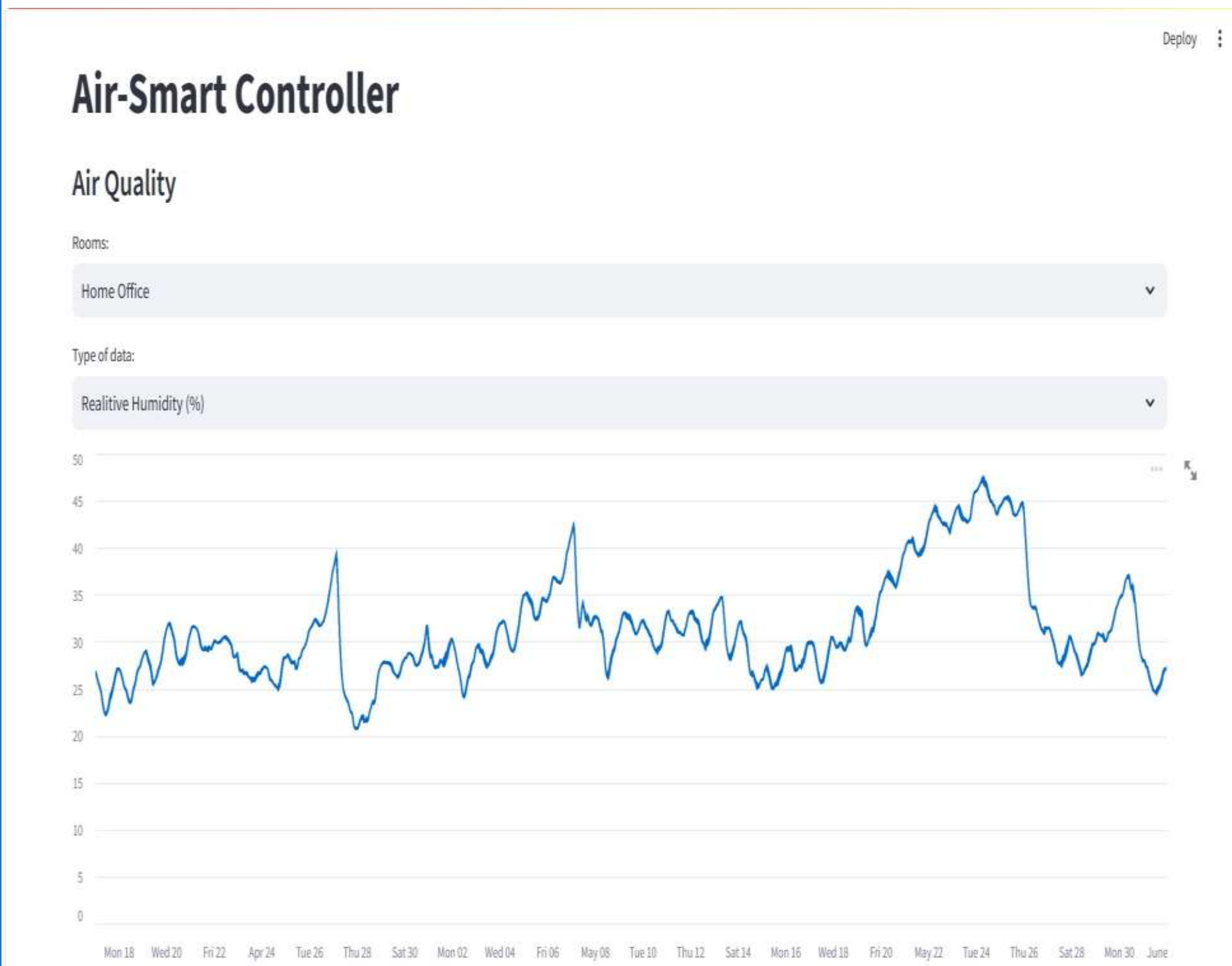
This study explores the application of home automation systems for indoor air quality prediction, leveraging real-time data on temperature, humidity, pressure, CO_2 levels, occupancy status, and window conditions. Despite potential challenges in data quality and responsiveness, the research employs deep learning techniques to predict air quality. Comparative analysis of GRU and LSTM models reveals GRU's superior performance across multiple metrics. The research highlights the potential of home automation systems in air quality management, introducing the Air-Smart Controller interface, allowing users to monitor predictions and control automation systems. Overall, this study contributes significantly to home automation and air quality management fields.

Introduction

Spending extended periods indoors can lead to significant health and comfort issues, particularly in light of the recent pandemic. Proper indoor air quality is crucial for maintaining health, reducing the risk of respiratory issues, and enhancing overall well-being. As smart home technologies advance, they provide innovative solutions to monitor and improve indoor environments automatically. By leveraging real-time data and deep learning techniques, this study aims to predict and manage indoor air quality effectively. Understanding and implementing these technologies can lead to healthier living spaces and contribute to the broader field of home automation and air quality management.

Methods and Methodologies

In this study, deep learning methods are employed for predicting indoor air quality. The primary models utilized are GRU and LSTM. These models predict indoor air quality using collected data. A comparative analysis of GRU and LSTM models was conducted, and their performances were evaluated using metrics such as MAE, MSE, and RMSE. Additionally, a web interface named Air-Smart Controller was developed using Python's Streamlit library. This interface displays prediction data and allows users to control automation systems. Users can view prediction data at ten-minute intervals and change the modes of automation systems through the interface. The interface is integrated with SCADA and MES systems, managing automation systems based on user demands.



Results and Discussion

The study revealed that GRU models generally outperform LSTM models. Low RMSE, MSE, and MAE values in predictions underscore the effectiveness of GRU models. However, it's crucial to consider all scenarios when selecting a model.

The aim of the study was to predict weather conditions, for which GRU models proved more suitable. Nevertheless, careful consideration of usage scenarios is essential in model selection.

The Air-Smart Controller interface enables users to monitor prediction data and control automation systems. This real-time application demonstrates how predictions can be practically utilized.

In conclusion, while GRU models may be an effective option for weather predictions, usage scenarios and system integration must be carefully evaluated. This study may lay the groundwork for future research and applications.

Referances

I would like to thank the Computer Engineering Department at Ankara University for their support in this study. I am also grateful to Gazi Erkan Bostancı.
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