**Dear Reviewer 1,**

In response to your comments:

“*Background section: the introduction provides an overview of IoT and the importance of testing and evaluating IoT systems. It would be helpful to include more specific references to related work in this area, e.g. describe previous work on IoT testbeds using an open-source platform such as openHab.*”

“*OpenHab Platform: The openHab platform section is informative and well-written. It would be useful to include references to related work, e.g. discuss previous studies that have used openHab for IoT data collection and analysis.”*

Thank you for your valuable feedback on our paper. We have carefully considered your suggestions and made the necessary changes to improve the quality of our work.

In response to your comment regarding the need for more specific references to related work, we have included references to previous research on IoT testbeds using open-source platforms such as openHab. Specifically, we have added references to the papers "Towards Universally Usable Smart Homes - How Can MyUI, URC and openHab Contribute to an Adaptive User Interface Platform" and "A Comprehensive Survey on Cyber-Physical Smart Grid Testbed Architectures: Requirements and Challenges" to support our argument on the importance of utilizing open-source platforms for testing and evaluating IoT systems.

Furthermore, to provide a comprehensive overview of the state-of-the-art in IoT platforms, we have also included a reference to a survey paper, which discusses the communication, security, and privacy perspectives of these platforms and highlights their strengths and weaknesses.

**Dear Reviewer 2,**

In response to your comments:

“*Thirty-nine references are mentioned in the paper, but only six are listed. Some descriptions, especially the wireless interface (in Section 2) seem unclear and incorrect. It should be confirmed whether the content of the article is wrongly written or the quality of the cited paper is poor.*”

Thank you for your valuable feedback on our manuscript. We apologize for the poor citation in our original submission. We have thoroughly revised our manuscript to ensure that all the references are cited correctly, and described accurately.

“*The format and content of Table 1 should be confirmed to ensure readability.*”

Thank you for bringing this to our attention. We have carefully reviewed Table 1 and made necessary changes to improve its readability. We have modified the formatting and also added the units of measurement for each sensor in the table for better understanding.

“*All the various sensors in this paper cannot be presented in the results, and their practicability cannot be expressed.*”

We appreciate the reviewer's feedback on the lack of information regarding the various sensors in our study. We apologize for not addressing this issue clearly in the paper. As the reviewer correctly noted, the UV sensor data did not show significant changes during our indoor testing due to the lack of direct sunlight. In response to this issue, we have included a note in the manuscript explaining the reason for the lack of UV data. We hope this provides clarity and improves the overall quality of the manuscript.

“*The wireless interface description mentioned in Section 6.1 should have a layout diagram (or figure) to understand the experimental scenario.*”

Thank you for your comment on the wireless interface description in Section 6.1. We have included a diagram in Figure 1 of the manuscript, which shows the layout of our testbed and the wireless communication between the devices. This diagram has been updated to include communication with IR-enabled devices.

“*In Section 6.2, it shows that “The collected data from various types of sensors showed a strong correlation between the humidity, luminance, and power consumption of an electrical heater with the ambient temperature in the lab”. Figure 2 shows that the data was only collected for one day, which shows that the correlation of the data is very strong, which seems too arbitrary.*”

We appreciate the reviewer's comment on the correlation between the collected data and the short time period of data collection in Section 6.2. Our main focus in this study was not on the duration of data collection, but on showcasing the capabilities of the open architecture platform we developed and its ability to integrate multiple wireless technologies. The use case presented in Section 6.2 aimed to demonstrate how the data collected from various types of sensors can be analyzed and correlated in real-time, and how this information can be used to optimize energy consumption and occupant comfort. We agree that longer data collection periods would provide more insights into the behavior of the different variables, and we plan to expand our testing in future work. Please note that the results presented in this paper were only indicative of the capabilities of the testbed, and future work can provide more detailed and accurate insights.

**Dear Reviewer 3,**

In response to your comments:

“*The main objection regarding this work is lack of details relevant to the scientific approach, challenges, and lessons learned. While we understand that this is a description of an "implementation" the audience would benefit more finding out potential challenges and pitfalls regarding this effort rather than hiding all important challenges behind the adoption of open source tools and libraries.*”

Thank you for the feedback. We would like to point out that the purpose of this paper is to provide a description of our implementation of a smart home system using openHAB and the associated sensors and devices. However, we agree that it is important to consider potential challenges and pitfalls when implementing such a system. To address this concern, we have updated the manuscript to highlight the importance of security in IoT systems, and in particular, the security features provided by openHAB. In our implementation, we have taken several measures to address security concerns, such as implementing secure communication protocols and using secure authentication mechanisms. Additionally, openHAB provides built-in security features, such as role-based access control and encryption of sensitive data, which further enhance the security of the system.

Regarding potential challenges and pitfalls, we have included a discussion in the manuscript to emphasize that the adoption of open source tools and libraries does not necessarily mean that there are no challenges or potential issues. However, we believe that the use of established and widely-used open source tools and libraries, such as openHAB, can help mitigate potential issues by leveraging the collective expertise of the open source community. Additionally, the active openHAB community has provided valuable support and resources for addressing any challenges or issues that we encountered during development.

“*The second major issue with this work is the lack of comprehensive survey of analogous testbeds. What is the specialization of the proposed testbed? What are its advantages? What type of experiments it can support and for what type of applications? How many users it can support simultaneously?Finally, what is its cost of setup, operation, and update?*”

In response to your concern, we would like to clarify that our work aims to provide a detailed description of the design and implementation of an IoT testbed for smart building applications. Our main contribution lies in the deployment of various sensor types and the integration of different communication protocols to enable data collection and analysis in a real-world environment. Furthermore, we have included a comparison with similar testbeds in the literature and highlighted the strengths of our approach. We believe that our work provides valuable insights into the design and implementation of IoT testbeds for smart building applications, and we believe that our contribution can be useful for researchers and practitioners working in this field.

“*Another major omission is the lack of details regarding important aspects such as the management of resources and scheduling. Based on the description we assume that the proposed testbed supports remote access and orchestration of remote experiments. Obviously, simultaneous access to the hardware requires sophisticated scheduling. What is the scheme adopted? Secondly, what are the most important security considerations? How does user authorization to the resources take place? What gets publicly exposed?*”

To clarify, the proposed testbed indeed supports remote access and orchestration of remote experiments. The scheduling scheme adopted is based on the openHAB platform, which allows for user authentication and access control through various methods such as HTTPS, SSH, and role-based access, as described in the new Security Features section (3.4) that we have added to the paper. In terms of security considerations, communication between the testbed and users is encrypted via SSL certificates. There are also options for secure remote access, including running openHAB behind a reverse proxy or setting up a VPN connection. It is worth noting that openHAB has built-in support for restricting access through HTTP(S) for certain users. As for what gets publicly exposed, this is determined by the access control policies set in place by the openHAB platform. We hope that the additional information provided in this section regarding user authentication, access control, and communication encryption, along with the openHAB platform's event management, real-time monitoring, and customization functionalities, will demonstrate the value and flexibility of the proposed testbed.

**Dear Reviewer 4,**

In response to your comments:

“*The citation of the papers used is missing which makes it very difficult to follow up on the paper.*”

We apologize for the poor citation in our original submission. We have thoroughly revised our manuscript to ensure that all the references are cited correctly and described accurately.

“*A comparison with previous research work is needed, highlighting the main contributions of each paper and what are the differences with the current work. Also, the open gaps that this work is targeting.*”

Thank you for your comment. We would like to clarify that our work aims to provide a detailed description of the design and implementation of an IoT testbed for smart building applications. Our main contribution lies in the deployment of various sensor types and the integration of different communication protocols to enable data collection and analysis in a real-world environment. Furthermore, we have included a comparison with similar testbeds in the literature and highlighted the strengths of our approach. We believe that our work provides valuable insights into the design and implementation of IoT testbeds for smart building applications, and we hope that our contribution can be useful for researchers and practitioners working in this field.

“*Why openHab platform? A comparison with other platforms is required.*”

As mentioned in the manuscript, the choice of the openHab platform was based on its flexibility, scalability, and compatibility with various devices and protocols. However, we acknowledge that a comparison with other platforms would add more value to the paper. Therefore, we have included references in the manuscript that compare various IoT platforms, including openHab, and discuss their advantages and limitations. We believe that this addition will provide a more comprehensive understanding of the openHab platform and its suitability for the proposed testbed.

“*The performance of the communication network depends on the topology and configuration. It is recommended to show a diagram with dimensions for the installed sensor and a real photo for the system setup.*”

We appreciate the reviewer's feedback and agree that it would be helpful to include a diagram with dimensions for the installed sensors and a photo of the system setup. Unfortunately, due to the physical layout of the lab, the sensors were deployed at various locations to cover different areas and test the performance of the communication network. Therefore, it was not feasible to include photos of all the sensors installed in the lab premises. However, a detailed list of the sensors and their specifications can be found in Table 1.

“*Important part of the testbed is the data collected from the experiment for 6 months. The authors could provide such data and comment on it.*”

The scope of this paper is to introduce the design and implementation of the testbed and present the results of basic testing that was conducted using different wireless interfaces and sensors, as described in Section 6. Furthermore, we would like to emphasize that the use of an open architecture platform, using multiple wireless technologies, was the main focus of this work. This design approach allowed for easy integration and analysis of data from various wireless technologies, enabling end-users to make informed decisions for optimizing energy consumption in their respective environments. That being said, we agree that future work can include a more detailed analysis of long-term data collected from the testbed to provide more comprehensive insights into the performance of the IoT testbed. Please note that the results presented in this paper were only indicative of the capabilities of the testbed and future work can provide more detailed and accurate insights.

**Dear Reviewer 5,**

In response to your comments:

“*The general body of the paper is very well-written. However, the authors should provide more details about the novelty of the proposed testbed. How and with which functions this testbed differs from other existing testbeds needs to be clarified more carefully.*”

Thank you for your valuable feedback. We appreciate your suggestion regarding the novelty of our proposed testbed. Our testbed is unique in that it allows for the integration of various sensors and technologies to be used in combination with open-source software solutions like OpenHAB, which provides an easy-to-use platform for the remote monitoring and control of the testbed. Our approach allows for the flexible creation of customized automation rules that can be tailored to meet the specific needs of each experiment, which sets it apart from other existing testbeds. We have added more detailed information about these aspects of our proposed testbed in the paper, particularly in the introduction section.

“*The applications of WSNs and IoT are not only limited with smart homes but also applicable in a general context within smart buildings, including commercial spaces. The third paragraph of the Introduction should discuss this in a more general context and give a broader overview of these popular smart building applications, mainly including smart energy management [1] and smart HVAC controls [2]. Please refer to some of the readings and elaborate on this paragraph.*

*[1]Tekler, Zeynep Duygu, et al. "Plug-Mate: An IoT-based occupancy-driven plug load management system in smart buildings." Building and Environment 223 (2022): 109472.*

*[2] Zhuang, Dian, et al. "Data-driven predictive control for smart HVAC system in IoT-integrated buildings with time-series forecasting and reinforcement learning." Applied Energy 338 (2023): 120936.*”

Thank you for the feedback. We agree that WSNs and IoT have broader applications beyond smart homes, and we appreciate your suggestions for improving the manuscript. We have revised the third paragraph of the Introduction to give a broader overview of smart building applications, including smart energy management and smart HVAC controls, which are among the most popular applications of WSNs and IoT systems in commercial spaces. We have also included some references to relevant literature to support our claims.

“*Please include the sensor accuracy range (+/-) and data units of each sensor in Table 1.*”

We appreciate your suggestion to include the accuracy range and data units of each sensor in Table 1. We have updated the table to include the units of the sensors' data to make it more comprehensible. We have also filled in the range and accuracy data where possible. Additionally, we would like to note that the vibration sensor data plays an important role in enhancing the motion detection system, which is illustrated in the use case of a day in the testbed presented in Section 6.2.

“*In the description of OpenHab Platform (section 3), it is mentioned that this is a open-source platform. However, there is no relevant resources provided (i.e, code for the software) to provide reader to access the platform. Please indicate how the readers will be able to access this platform.*”

We apologize for the oversight and have updated the manuscript with the website of the openHAB platform (<https://www.openhab.org/>). Readers can access the platform by following the link provided."

“*In 2. Background, authors listed the use of various sensors are used in IoT applications. While I appreciate that they mentioned the use of each sensor and their respective applications separately, there are many studies combined those sensors and investigated different applications through the use of hybrid approaches. The use of “sensor fusion” and their respective applications should be included under this paragraph (5th Paragraph) to express the literature accurately and thoroughly. Some established IoT applications of sensor fusion include smart occupancy detection [1], smart healthcare [2] and smart transportation [3] that authors should read and elaborate this section.*

*[1] Tekler, Z.D. and Chong, A., 2022. Occupancy prediction using deep learning approaches across multiple space types: A minimum sensing strategy. Building and Environment, 226, p.109689.*

*[2] Abdelmoneem, R.M. et. al. 2018, December. A survey on multi-sensor fusion techniques in IoT for healthcare. In 2018 13th International Conference on Computer Engineering and Systems (ICCES) (pp. 157-162). IEEE.*

*[3] Low, R. et. al. 2020. Predicting commercial vehicle parking duration using generative adversarial multiple imputation networks. Transportation Research Record, 2674(9), pp.820-831.*”

We appreciate comment and agree that sensor fusion techniques are an essential aspect of many IoT applications. In our paper, we focused on presenting the capabilities of the proposed IoT testbed and providing a comprehensive list of the sensors deployed. However, we agree that the potential for sensor fusion applications is significant, and we have added a brief discussion on sensor fusion techniques to the background section to emphasize their importance. We also agree that the use of multiple sensors in combination is becoming increasingly prevalent in smart applications and have provided examples of such applications.

“*Minor issues,*

*a.     Under 2. Background second paragraph- third line, extra “)”.*

*b.     Under 2. Background third paragraph- second line, extra”)”.*”

“*Missing List of References (after 6th reference)*”

We have made the necessary corrections in the manuscript. Thank you for bringing these issues to our attention.