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Article

An Integrated Home Monitoring System with a Scalable IoT Architecture Using UDP and TCP Connections

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Abstract: The advancement of the Internet of Things (IoT) provides a set of new possibilities and challenges within the Industrial and Manufacturing environments, as well as into the Private Sector and the user daily life in our houses. In this context it is important to design and provide an IoT integrated system with a scalable architecture while maintaining a set of competitive costs and performance. This paper presents the development of low cost IoT-based Smart Home Temperature and Humidity Monitoring System. The proposed architecture aims to demonstrate core IoT principles such as real-time data collection, remote device control, and scalable architecture using low cost technologies, such as Arduino Uno R4 Wi-Fi and ESP32 microcontrollers. The system successfully simulated appliance control - e.g., radiators, extractor fans - via LEDs and basic actuators, combined with a mobile application providing real-time environmental data - e.g., temperature, humidity, Carbon Monoxide (CO) levels - and remote-control functionality. Thanks to the proposed design the architecture is also inherently scalable, customizable and expandable, combining a modular approach with a customized mobile app and an user friendly interaction. Challenges included hardware compatibility, power management, and software integration, with further work on security features (i.e., cryptography algorithms) and cloud integration.

Keywords: Smart Home; Building Management System (BMS); Internet of Things (IoT); Low-Cost IoT; Integrated IoT

1. Introduction

The advancement of the Internet of Things (IoT) has transformed various industries, including home automation. Smart homes leverage IoT technologies to enhance convenience, energy efficiency, and safety by integrating real-time monitoring and automated control of appliances [1]. One of the critical applications of IoT in smart homes is environmental monitoring, which ensures optimal temperature and humidity monitoring and control for users [2]. In this context, the purpose of this paper and the project laid out in this paper was to develop an IoT-based Smart Home Temperature and Humidity system. The central aim was to create a system enabling users to remotely monitor and control various home appliances through a mobile application. This involved creating a physical, fully functional model that could demonstrate these capabilities wirelessly. The system would integrate an Arduino as a central hub with ESP32 microcontrollers for sensor management and device control. Accordingly, the proposed design focuses on the development of a home environment-monitoring system that measures the temperature and humidity of a given room. What was conceived was the Sweet Spot, a system that goes beyond the most basic application by way of only monitoring the environment. Instead, Sweet Spot aims to automate the management of the home, office space, or other areas through the distribution of the data collected from the main hub to other connected smart devices, ensuring optimal indoor conditions. The true value of this system lies not only in its convenience but also in its potential benefits to health and well-being.

Unregulated indoor climates can contribute to a range of health concerns, from respiratory issues caused by excessive humidity [3] and mould growth [4] to discomfort and poor sleep quality due to fluctuating temperatures [5]. By actively maintaining a stable indoor environment, Sweet Spot reduces these risks, helping to prevent conditions such as asthma flare-ups, allergies, and even dehydration caused by overly dry air [4]. Therefore the proposed design focused on the development of an Internet of Things based smart home temperature and humidity system. The aim was to develop a centralised system that allows users to monitor and control various home appliances remotely via a mobile application. In practice, the system integrates an Arduino module as the central hub, with ESP32 microcontrollers managing DHT-11 sensors for temperature and humidity monitoring and MQ-7 sensors for Carbon Monoxide (CO) detection. The mobile application provides users with real-time access to sensor data while also offering functionalities such as remote monitoring, automation, and system alerts. An overview of the overall system set-up is reported in **Figure 1**. The mobile application receives data from the main monitoring unit (central hub) and has temporary data persistence displaying all 3 devices in their individual sections with live visualisation.

The rest of the paper is organised as follows: section 2 presents the materials and methods, section 3 details the prototyping and manufacturing of the system, then section 4 and 5 focus on a critical analysis and real life applications, respectively. Section 6 reports the main challenges encountered. Then section 7 reports the results with a discussion. Finally, sections 8 present the conclusions with a perspective on future works.

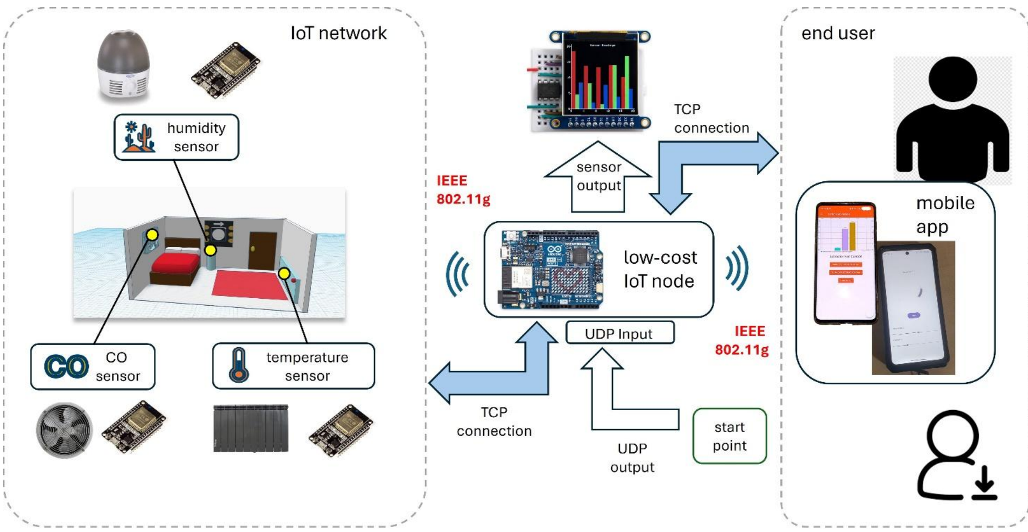

Figure 1. Set-up of the proposed system with the IoT network, the central hub and the end-user interface.

2. Materials and Methods

The following section presents the main system architecture and components of the proposed system.

The development of the smart home temperature and humidity monitoring system utilized a combination of microcontroller units, sensors, and software tools.

For environmental sensing, DHT-11 sensors were integrated to measure temperature and humidity, while MQ-7 sensors were employed for CO detection. The user interface and remote control functionalities were realised through a custom mobile application developed in Android Studio using Java. The initial system design and prototyping were facilitated by TinkerCAD for creating models and circuit simulations before physical implementation.

Communication protocols established were UDP for initial device discovery and TCP for subsequent data transmission between the Arduino hub and the mobile application. Power was supplied through various methods during development, including battery packs and direct AC/USB power, with a hybrid approach for the final model. A 4.57cm TFT display was also incorporated for local real-time data visualisation attached to the main monitoring unit giving the user the option to view current data with the use of the app.

a. Design

A number of different aspects of development were explored such as data simulation, component research and acquisitions, component integration, 3D modelling, TFT programming, networking, app development, testing, and final integration. **Figure 2** shows the initial proposal of the system design on the end-user side.

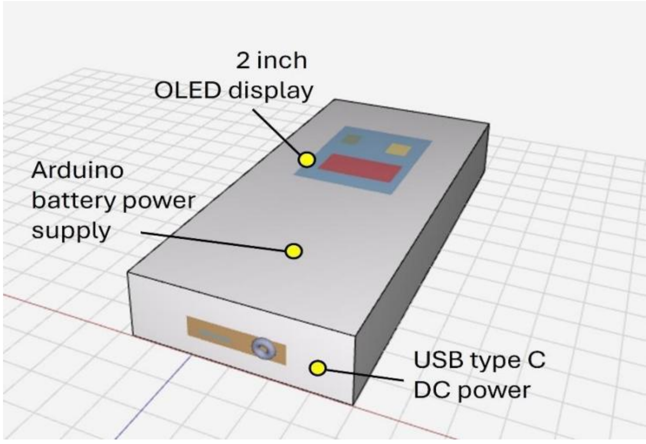

Figure 2. The conceptual design with the 4.57cm TFT display reporting temperature, humidity and Carbon Monoxide (CO) readings, the bottom ports with the USB Type C connector for DC power. Within the box an Arduino low-cost embedded board and a battery power supply were to be integrated.

b. Process Implementation

The following process of implementation was followed in order to design the system:

Research and Planning - Research and Planning were approached according to the following stages: (a) initial brainstorming within the team, researching IoT communication protocols such as MQTT and UDP/TCP, and studying existing smart-home solutions; (b) a list of required components was created, and sources for procurement were identified; (c) research was conducted to determine the best microcontrollers and sensors for the project; (d) low-cost embedded-computing identification: the Arduino board was identified, researched and chosen because it is easy and – at the same time - enough flexible even for expert users; (d) considered making an enclosure for the components to be encased in for durability and aesthetics.

Design and Prototyping - Following the Research and Planning, the following steps were established in order to set up the main design, namely (a) model of the IoT system was created using TinkerCAD and other prototyping tools (see also the **Supplementary Materials** section); (b) the implementation of a 4.57cm TFT was considered and, in particular, how its display might look; (c) an enclosure for the components was conceived; (d) the mobile application was drafted to display data and provide user control options; (e) physical representation in the form of a doll house room model was eventually designed to simulate and portray a smart home environment.

Hardware Development - Finally, a proper selection of the hardware was performed as follows. **Table 1** summarises the selection of the main hardware components. The system is also integrated with a set of power sources and a TFT LCD Display for a better user-interaction experience.

Table 1. Hardware components of the modular design of the system.

Hardware Component	Specifications & Role in Project
Arduino Uno R4 Wi-Fi	Acts as the central hub, managing UDP/TCP associations/connections between embedded devices and the mobile app; parses inputs and forwards messages.
ESP32 Modules	Small, power-efficient microcontrollers with Wi-Fi capabilities embedded in appliances for smart functionality and communication with the hub.
Sensors (DHT-11 & MQ-7)	The system uses sensors for environmental monitoring; for instance, it detects CO levels to trigger automated responses like a fan.
TFT LCD Display	Incorporated into the "Smart Monitor" unit to provide a real-time visual interface for temperature, humidity, and CO levels.
Power Sources	The main hub uses a lithium battery (backup/portability) and USB Type C (primary); ESP32s use USB power.

The Arduino acted as the central hub for controlling the functionality of the system. A 1.8-inch TFT display was used to visualise real-time sensor data. Various sensors, DHT-11 for temperature and humidity and MQ-7 for CO detection, were integrated. Testing of different power sources was conducted to ensure efficient energy management. A 3D-printed case was designed for the smart home system to enhance durability and aesthetic appeal. A modular approach was adopted in order to reduce costs and provide scalability as well (**Figure 1** and **Figure 3**).

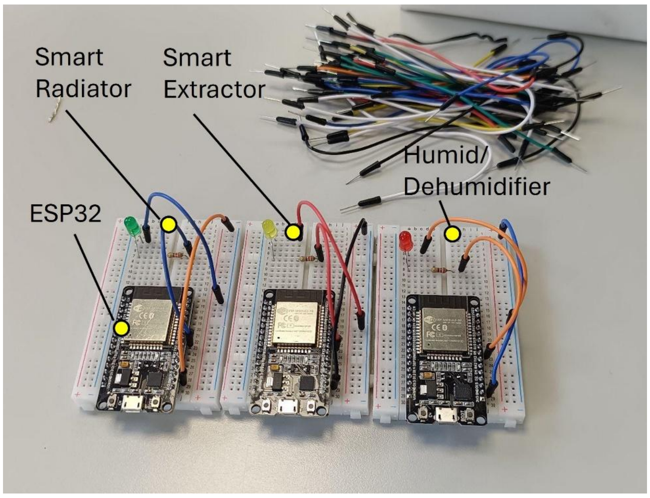

Figure 3. The modular approach is based on the ESP32 board providing both low cost and scalability of the proposed system.

Software Development - A proper selection of the software was then performed as well:

(a) the Arduino board was coded to act as the central hub of the system. (b) the ESP32 modules were programmed to send data over Wi-Fi; (c) the Arduino board was set up as a server using UDP packets for initial discovery and TCP for data transmission. Wi-Fi communication protocol was adopted, namely IEEE 802.11g. **Figure 4** shows the initial design and integration of the wireless communication protocol. (d) the mobile app was developed in Android Studio with Java, implementing UDP and TCP communication protocols. (e) A display for the user was created using a 4.57cm TFT connected to the Arduino. (f) the user interface was refined to ensure intuitive navigation and smooth performance.

Figure 4. Design and integration of the mobile app with wireless communication.

Preliminary Testing and Refinement - In order to refine the design, a set of preliminary checks and testing was performed:(a) the connectivity between ESP32 modules, the Arduino, and the mobile application was tested. (b) the efficiency of power sources was evaluated, including using 8 AA batteries and wall adapters. (c) the user interface and how the user interacts with the mobile application were refined for better usability. (d) further testing and subsequent improvement of the enclosure for the system would have produced a more polished final product.

3. Prototyping and Manufacturing

Before selecting the actual components, an initial testing of some investigated solutions was performed; the testing involved simulating random environmental data and having the Arduino interact with LEDs based on the current simulated values. It was this simulation that represents the future functionality of the system in which the data values result in a smart device such as a radiator being turned on if the temperature is deemed to be too low. Furthermore, it was brought up to take this further and include data associated with CO levels. In order to proceed with the additional datapoint, an additional LED was also added to the simulation.

a. Components

While these initial simulations were taking place, research was being conducted with regard to the additional components needed for such a system, and because of the initial prototype it was agreed that the top-of-the-line sensors were not required at this stage. As a result of this, the DHT-11 Temperature and Humidity Sensor was selected for its cost and two-in-one nature, and while for example the DHT-22 is more accurate, there is less than a single percent between their accuracy values 'at 98.15% and 97.19%' [6] and thus the DHT-11 was deemed more than acceptable for prototyping. Additionally, the MQ-7 CO sensor was selected once again for its cheap and easy-to-implement nature. Issues, however, relating to the recommendations that the MQ-7s should be kept away from water condensation were noted, as in a home-environment monitoring system, recommendations such as this would mean that the implementation of such a device in a kitchen environment would not be applicable [7]. Consequently, this device would need to be changed after the development of the first functional prototype.

With the sensors selected, now it was time to tackle the data visualisation requirements set within the specification, and it was decided that a two-pronged approach would best fit users' needs. The approach 1 was to implement a 4.57cm TFT display into the system for their low power consumption, power efficiency, and cost advantages over more traditional devices such as LCD displays [8]. Approach 2 concerns developing a downloadable app that would connect to the same system and through which the user would be able to view real-time environmental data, set their environmental preferences, and change the modes by which their connected smart devices work. This dual approach ensures that a user has instant access to their environmental data be they away from the monitor, or without their phone.

b. Networking

Beyond the initial choices, discussions, and actions taken up to this point, it was time for the development and testing of different networking configurations. Firstly, the device chosen for each embedded system was the ESP32. A device that was selected not only for its Wi-Fi capabilities but also for its small form factor and 'powerful and cost-effective' nature compared to other internet-based boards such as the other commercial platform, namely the Arduino or the Raspberry Pi [9]. The chosen platform was thus determined to be perfect for the development of systems embedded within real-world smart devices such as a humidity controller.

Initial network implementations used an HTTP web-server approach in which each ESP32 associated with an individual smart device hosted a dedicated web server with activation functions. Issues became apparent quickly in this iteration relating to the latency of such a network design and it was directly a result of the inclusion of web protocols that caused this latency [10]. From here, a decision was made to investigate other network and IoT-related protocols. MQTT was seen as a potential option but with the additional complexity of setting up a local or cloud-based broker it was deemed unnecessary for a system designed to exist on a closed network with a focus on minimal traffic. While MQTT is designed to be lightweight and efficient for resource-constrained devices, factors like complex message structures, frequent connection/disconnection cycles, and lack of optimization can make it difficult to get a connection via Android Studio leading to halts in development progress.

This conclusion led to the decision to interact directly with the transport layer and its associated protocols being made because the sole use of TCP is more efficient when transmitting data using port 12345. UDP offers packets void of unnecessary header information for initial device discovery on the network using port 8888 pulsing the message "SensorBoard" across its connected network from the application and awaiting the message "ACK" to begin TCP communication[11]. IP addresses are used for both device discovery and data/control communication. It broadcasts UDP messages to 255.255.255.255 to find the smart monitor's IP address, then uses that discovered IP to establish a TCP connection for real-time data exchange and sending commands to home appliances.

c. Smart Home Monitor Modelling

This physical Sweet Spot portal is designed to house the Arduino hub and its associated components, including a battery pack for a dedicated power supply [12,13]. A key feature is its TFT display with a resolution of 126 X 160 pixels, which not only shows real-time values for temperature, humidity, and *CO* levels but also incorporates 3 visual bars [12–14] (**Figure 5**). These bars correspond to each data point and change color based on how far the current readings deviate from a predefined optimal range—for instance, the CO level bar might shift from green to yellow, and then to red as concentrations increase. Envisioned as a clean white box, the unit aims for a modern aesthetic, allowing it to blend seamlessly into various living spaces without drawing undue attention. Therefore this physical prototype collects, displays, and distributes data and commands within the smart home system as initially shown within **Figure 1**.

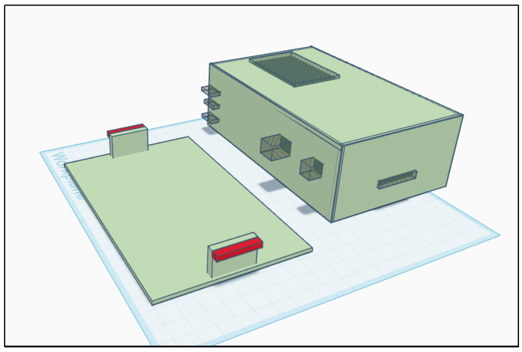

Figure 5. Smart home monitor print.

d. Mobile Integration and Customised App

The mobile application is a key component of the Sweet Spot smart home system, enabling users to monitor and control their home environment [15]. Developed using Android Studio, the app provides real-time access to sensor data, including temperature, humidity, and CO levels [16,17]. Users can remotely activate or deactivate connected smart appliances like radiators or fans, and also set them to an "AUTO" mode, which allows the devices to manage the environment of the room automatically based on sensor readings and user-defined preferences [18]. The application features a user-friendly interface designed for ease of use, presenting data in a clear and understandable format. It communicates with the central Arduino hub initially via UDP for device discovery, then switches to TCP for reliable data transfer and command execution [19,20]. The system is designed to be scalable, allowing the app to control multiple devices across different rooms, and with port forwarding, users can access the system of their home from anywhere globally. **Figure 6** provides an overview of the mobile app appearance [21,22].

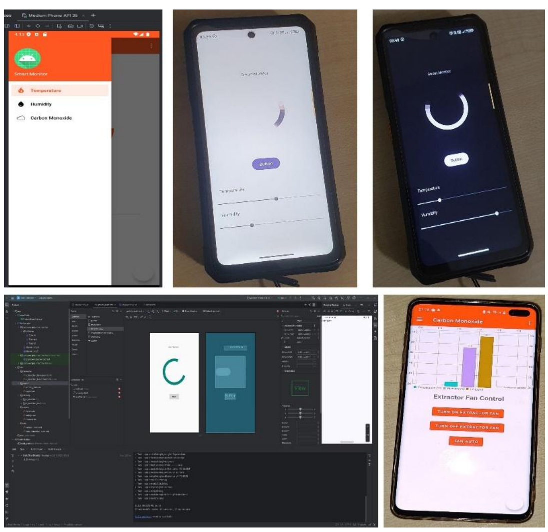

Figure 6. Smart home monitor app: final outline of the end-user interface.

4. Critical Analysis

According to the proposed design and integration, it is worth making a short analysis concerning the main contributions of the proposed system.

The prototypial system has successfully demonstrated the potential integration of IoT and smart devices into home or similar environments to enhance individual health and comfort. By leveraging advanced sensing and networking technologies, the system ensures that all devices remain informed of real-time environmental conditions and can respond accordingly. Throughout the process, challenges were addressed through collaborative problem-solving, and areas for improvement in individual components were identified. Moreover, the proposed design serves as a foundational proof of concept for intelligent environmental control using interconnected devices. However, the research does not end here. As AI technologies continue to evolve, future developments should explore the integration of machine learning to enable predictive device activation and optimize resource usage - such as identifying the most cost-effective way to heat a room based on current environmental data.

Security is another key consideration moving forward, with the potential adoption of cryptography algorithms to safeguard system integrity. These algorithms are fundamental to ensuring data confidentiality, integrity, and authenticity, directly protecting against unauthorized access, manipulation, and spoofing. Their implementations can provide the foundational security measures necessary for robust digital operations and trustworthy data handling. Primary examples of common cryptography algorithms include AES for symmetric data encryption. RSA and ECC facilitate public-key operations like secure exchange and digital signatures. Hash functions such as SHA-2 and SHA-3 are fundamental for data integrity, collectively securing modern digital environments.

Overall, this project contributes to the expanding global field of IoT, offering a compelling step forward in the intelligent management of domestic environments.

5. Real-Life Applications

According to the aforementioned considerations, we oversee a set of real-life applications and use cases. The smart home automation system we developed offers a range of benefits, starting with the ability to remotely control the heating and humidity, allowing users to maintain an optimal living environment. This contributes to energy efficiency, as automated power management can reduce energy consumption and save money. Additionally, the system enhances home safety and security by monitoring hazardous gas levels and automatically activating fans or ventilation when thresholds are exceeded, ensuring a safer living space.

The system's scalability is another significant advantage, as it can be expanded to accommodate larger households, integrating with multiple rooms and appliances to manage energy and security on a broader scale. In other words, we have designed a prototype to demonstrate the potential of smart home automation in real-life applications. This prototype was featured in our presentation to highlight how the system can seamlessly integrate with existing household setups, providing clear and in-depth tracking for better insight into system performance. By showcasing its scalability, we aimed to illustrate how such a system can grow with the needs of a home while ensuring both efficiency and safety. The system is designed to be scalable from the ground up, meaning it can accommodate more devices connected wirelessly anywhere in the house, provided the home's Wi-Fi connection reaches them. This implies that the system would still work even if sensors were physically spaced out beyond 10 cm.

This implementation serves as a concrete example of how smart home technology can transform everyday living, offering convenience, savings, and peace of mind.

6. Challenges Encountered

The following implementation challenges were raised, and solutions were adopted in order to solve or mitigate these limitations and challenges:

Hardware Compatibility: Ensuring smooth communication between Arduino, ESP32 modules, and various sensors required significant troubleshooting. Compatibility issues were resolved by refining the circuit design and using appropriate libraries.

Power Management: The initial battery-based power supply was insufficient, necessitating additional research into alternative power solutions. Eventually, a hybrid power system was implemented, allowing both battery and direct AC power options [19].

Software Integration: Establishing stable UDP and TCP connections between the mobile app and Arduino was complex due to protocol differences. Implementing proper packet handling and optimizing request-response times helped resolve these issues.

Security Concerns: The implementation of cryptography algorithms was an aim of the group and would have secured data transmission and enhanced system integrity. Furthermore, it could be used to prevent potential cybersecurity threats. Cryptography algorithms are capable of 'ensuring the confidentiality, integrity, and authenticity of data transmitted over networks'. After initial trouble trying to introduce security into our system, due to limiting factors of the project such as the allocated time to complete the project, we decided to prioritise other aspects of the project.

Mobile App Development: Implementing features such as real-time data updates and interactive controls while ensuring responsiveness posed challenges. Iterative testing and debugging helped create a seamless user experience.

3D-Printed Enclosure: Designing and 3D-printing an enclosure for the hardware to be enclosed in provided some difficulty, due to time constraints and an error with the initial print of the enclosure. Furthermore, accurate measurements were required to be taken to ensure that the wires were still able to be connected and the display was still readable. It was difficult to ensure that the measurements were not only accurate but would align with hardware components in the correct position of the enclosure. **Figure 7** displays the design of the room mock-up with a possible setup of the different smart units and sensor components, according to the initial design proposed in **Figure 1**.

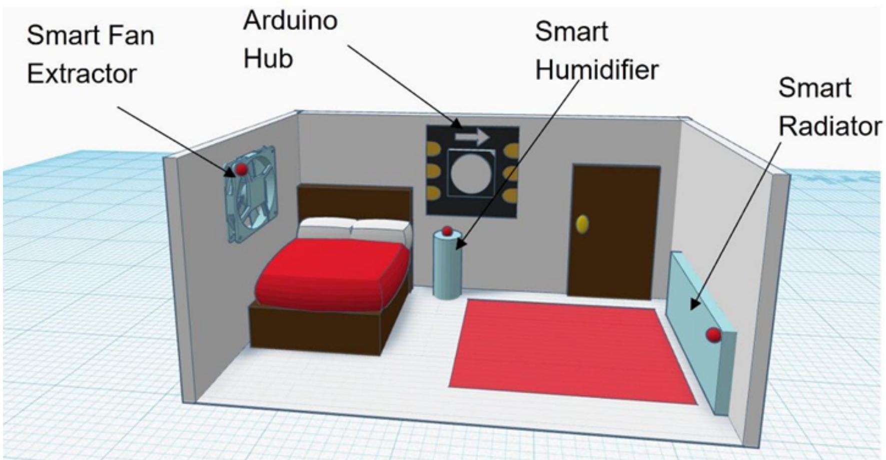

Figure 7. Design of the room mock-up.

7. Results and Discussion

To improve the overall performance and user experience of the system, several enhancements can be made. First, integrating rechargeable lithium-ion batteries or a direct AC adapter would significantly extend the operational duration and improve power efficiency. Additionally, implementing robust security measures, such as a cryptography algorithm encryption, would enhance the safety and protection of the system, ensuring that user data and communications remain secure. Another key improvement would be the incorporation of cloud-based data storage like initially planned: Arduino Cloud. By integrating cloud services, data logging and remote access could be facilitated beyond local Wi-Fi networks, providing greater flexibility and scalability for users.

In terms of user experience, refining the mobile application is crucial. Currently, the focus has been more on backend development, but a more intuitive and streamlined interface would improve navigation and overall usability. Furthermore, leveraging Artificial Intelligence could take the system to the next level by optimising appliance control based on user behavior and environmental conditions. Finally, improving the quality of the 3D-printed enclosure would be beneficial. With more time dedicated to ensuring a higher-quality print, the enclosure could be better integrated with sensors and the display, resulting in a more polished and functional product. These improvements would enhance both the technical capabilities and user experience of the system.

a. Testing

While the networking side of development was taking place, the mobile app (see also the **Supplementary Materials** section) was being constructed by other members in the group and the time eventually came to see how both components worked together. Initial tests were positive as each command and data request message sent between the devices was defined as pre-development. Minor issues in how the two systems communicated did occur however but these were fixed through inspecting code on both sides and implementing more debugging methods to see where the communication broke down (**Figure 8**).

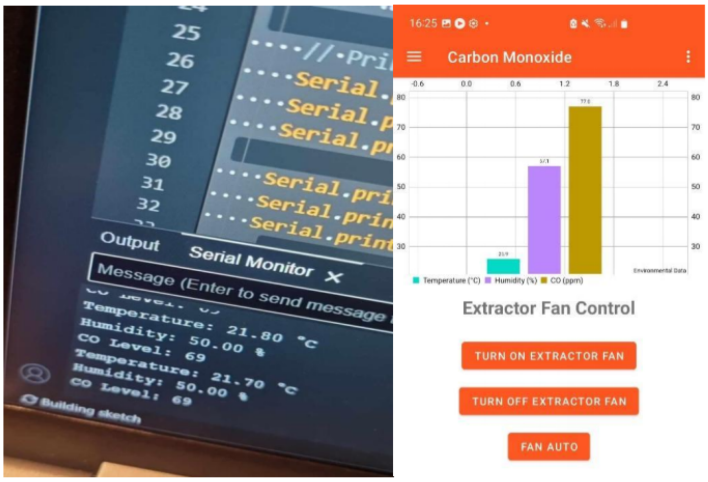

Figure 8. DHT-11 and CO modules output on the development system and as it appears on the end-user mobile app (left and right panels, respectively).

b. Demonstration

With a complete and working system now in hand, the three ESPs were connected to a 3D-printed model of a real room with LEDs connected to an extractor fan, a radiator, and a humidity controller (**Figure 9**). This working model displays the real-world functionality of such a system while using real data and the communication network previously set up in development with data messages being sent automatically between devices and manually from a user sending requests and commands via the app.

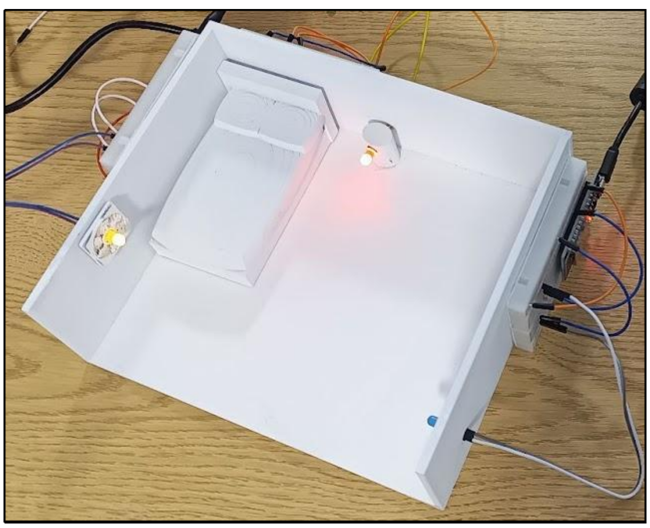

Figure 9. Doll house room model with integrated system.

8. Conclusions

With development completed, this project has successfully demonstrated the potential integration of IoT and smart devices into home or similar environments to enhance individual health and comfort. By leveraging advanced sensing and networking technologies, the system ensures that all devices remain informed of real-time environmental conditions and can respond accordingly [23]. Throughout the process, challenges were addressed through collaborative problem-solving, and areas for improvement in individual components were identified. This work serves as a foundational proof of concept for intelligent environmental control using interconnected devices which could be expanded together with other similar applications [24,25].

However, the research does not end here. As AI technologies continue to evolve, future developments should explore the integration of machine learning to enable predictive device activation and optimise resource usage — such as identifying the most cost-effective way to heat a room based on current environmental data. Security is another key consideration moving forward, with the potential adoption of cryptography algorithms to safeguard system integrity. Overall, this project contributes to the expanding global field of IoT, offering a step forward in the intelligent management of domestic environments.

Finally, the development of the IoT-based smart home temperature and humidity monitoring system successfully demonstrated the core principles of the Internet of Things, including real-time data collection, remote monitoring, and appliance control. The integration of Arduino and ESP32 microcontrollers provided a solid foundation for environmental monitoring through sensors like the DHT-11 and MQ-7. Despite facing challenges in hardware compatibility, power management, and software integration, the system achieved its key objectives, offering a functional mobile application with remote-control capabilities. Although advanced features such as cryptography algorithms and cloud integration were not implemented due to limiting factors, overall the project exhibited a functional IoT-based smart-home system with real-time monitoring and remote-control capabilities.

In terms of future development, it is worth considering integrating other communication protocols to reach a higher Technology Readiness Level (TRL) of the proposed system. A more appropriate set of communication protocols will be a benefit to validate the system in real-life scenarios and not just in laboratory conditions. In this context, there are various opportunities to further enhance the system by leveraging emerging standards and protocols, such as the MATTER connectivity protocol by Connectivity Standard Alliance (CSA), which is quickly becoming the industry standard for smart home devices. By adopting Matter, the system could ensure compatibility across different platforms, making it easier for users to integrate with other IoT devices regardless of manufacturer. Given the modular design and communication flexibility of our system to be able to have more devices connected with their own private ip addresses, switching to a different protocol or upgrading to support newer technologies would be relatively straightforward [26]. This adaptability would enable the system to remain relevant as new standards emerge, ensuring long-term scalability and integration potential. Matter integration involves adapting the Arduino hub to function as a Matter bridge, enabling existing UDP/TCP-connected sensors and actuators to communicate via the Matter protocol. This process is facilitated by the existing ESP32 hardware's compatibility and robust Matter SDK support, simplifying the translation of current communication into Matter's standardized data models. This standardization, coupled with the availability of development tools, contributes to a relatively straightforward integration for secure system discovery and interaction by a Matter-enabled mobile application.

Another relevant aspect which is worth exploring in order to provide vs new features and developments concerns the costs and the intuitiveness of the end-user interaction and experience vs the use of the system [26,27]. This is of particular importance especially considering the ageing of the population and the fact that elderly users can largely benefit from the ease of access and use of these interfaces.

Supplementary Materials

The source algorithm of the developed system can be found at the following links on GitHub

- https://github.com/20000625/SmartMonitor3-working-bar-charts
- https://github.com/20000625/Smart-Home-Monitor-Arduino-ESP32-Code-

The links of the .stl files are

- TinkerCAD. (2025). 3D design Smart Home Monitor Print - TinkerCAD. [online] Available at: https://www.tinkercad.com/things/eoYLhWCo6WN-smart-home-monitor-print?sharecode=ESavPfd8lp8NiMjMbC200LSVmqqxAA9Zs7r_7twTPKM [Accessed on 20 May 2025]
- TinkerCAD. (2025). 3D design Doll House Model - TinkerCAD. [online] Available at: https://www.tinkercad.com/things/6gGgH6oEdWa-doll-house-model?sharecode=rqBIC41eOJDeX-CRRbJHLI_cUYE0Nuy8vMpsrcKJGR4 [Accessed on 20 May 2025]

Author Contributions

Conceptualization, M.D., T.G., N.J.; methodology, M.D., T.G., N.J.; software, M.D.; validation, M.D.; writing—original draft preparation, M.D., E.L.S.; writing—review and editing, O.A., E.L.S.; supervision, O.A. All authors have read and agreed to the published version of the manuscript.

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Data Availability Statement

Not applicable.

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Conflicts of Interest

The authors declare no conflict of interest.

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