INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH IN ENGINEERING AND MANAGEMENT (IJSREM)
VOLUME: 08 ISSUE: 05 | MAY - 2024 SJIF RATING: 8.448 ISSN: 2582-3930

Smart Temperature and Humidity Tracker

Vibha J
Dept of Inforamation science and Engineering
Atria Institute of technology
Bangalore, India
vibhaj671@gmail.com

Vidya J
Dept of Inforamtion Science and Engineering
Atria Institute of Technology
Bangalore, India
vidyaj671@gmail.com

Preksha N
Dept of Information Science and Engineering
Atria Institute of technology
Bangalore, India
prekshan085@gmail.com

Prof. Malini R
Dept of Information Science and Engineering
Atria Institute of technology
Bangalore, India
malini@atria.edu

***Abstract*—The HC-05 Bluetooth module for data transmission, the things of network (IoT) smart temperature and humidity tracker presents an economical and effective Wireless Bluetooth Temperature and Humidity Monitoring System. Real-time temperature is offered by the system in a variety of situations, including homes, workplaces, warehouses, and agricultural settings. A dependable communication link between the monitoring devices and a central monitoring station—usually a computer or smartphone—is supplied by the HC-05 Bluetooth communication. The particulars for monitoring system's creation and implementation are covered in detail, with an emphasis on how the HC-05 Bluetooth modules are integrated with temperature and humidity sensors. The system design makes sure that data is acquired, processed, and transmitted in order for users to obtain accurate and timely environmental data from a distance. Important aspects of the system. The Wireless Bluetooth Temperature and moisture sensing system, in conjunction with Network of Things (IOT)-based smart temperature and humidity tracker, essentially ushers in a new era of environmental monitoring. By combining hardware and software components in a seamless manner and adding strong security measures, the system gives users practical information about temperature dynamics, which in turn promotes a more sustainable and healthy living and working environment.**

Keywords*—*HC-05 Bluetooth, NodeMCU ESP8266, DHT11 sensor, Temperature monitoring, Thingspeak.

I. INTRODUCTION

The increasing demand for real-time data, efficiency, and sustainability across multiple industries has led to a notable surge in the significance of smart temperature and humidity monitoring in recent times[1]. Smart monitoring systems offer a proactive way to comprehend and reduce the effects of the changing climate, where severe weather occurrences and changing environmental patterns are becoming more common[2].

The field of environmental monitoring has seen a transformation thanks to the incorporation of things of network (IoT) technology, with wireless data transmission emerging as a critical component for real-time insights and control[2]. The HC-05 Bluetooth module is used in this project's things of network (IoT) wireless temperature and humidity monitoring system to provide seamless communication. The HC-05 wirelessly transmits the measured ambient the levels from the sensors in the system. The method is made up of sensors to evaluate an ambient temperature and humidity, which are subsequently sent wirelessly via the HC-05 Bluetooth module to a central monitoring station. Real-time data visualization is made easier by an intuitive user interface, allowing stakeholders to monitor environmental conditions remotely.

This project presents a Network of things (IoT)-based wireless system to keep an eye on humidity and temperature that utilizes the HC-05 Bluetooth module for seamless communication. With the help of HC-05 modules, IoT-based wireless Bluetooth value monitors have progressed from a specialized field to a popular solution used in many industries. Thanks to the convergence of sensor technologies, cloud computing, and Bluetooth communication, monitoring systems that improve comfort, safety, and efficiency across an array of environments have grown more accessible, scalable, and user-friendly[4].

To ensure prompt interventions, the system includes alert mechanisms that warn users of any deviations from predefined thresholds. additionally, to improving monitoring effectiveness, this integration of Bluetooth and IoT technologies opens the door for intelligent applications in a number of industries, including infrastructure management, healthcare, and agriculture[7]. The primary objective has been to produce a practical and effective method for tracking temperature and humidity levels indoors[9]. This is mostly used in information centres and other sensitive sectors where temperature is important[11].

II. LITERATURE SURVEY

We reviewed at the current surveys that are available on temperature and humidity monitoring systems and selected a few of the publications. Literary works employ a range of techniques to generate summaries for a range of situations and document types.

The Study analyses a transportable sensor system for interior temperature and humidity monitoring. A temperature sensor, a communication module, a battery, a charger circuit, and a microcontroller make up the system. For monitoring and control, the framework is linked to a user interface that runs on a smartphone. The data protocol determines how the message is delivered between the host and sensor node. Users may monitor the condition of their home from anywhere at any time with ease because to the system's practical and comfortable design. A portable sensing system for interior temperature and humidity monitoring is examined[1].

Temperature sensor, microcontroller, rechargeable battery, charger circuit, and communication module make up the system. For monitoring and control, the system is linked to a user interface that runs on a smartphone. The data protocol specifies the message transmission method between the host and the sensor node [2].

Study discusses the creation of a tracking system based on IoT for storage areas in several sectors. The system gathers and stores temperature and relative humidity data via an assortment of access protocols, including Ethernet, GPRS, and Wi-Fi. The system's goal was to ensure the durability and high quality of the goods kept in the rooms. The application's structure, employed technologies, gateway system architecture, and software design are all covered in this article [3].

Technical article describes how to produce a wireless method for communication that can remotely and in real-time gather temperature and humidity data. A dot-matrix LCD display, a wireless transceiver module, a temperature and humidity sensor, and a microcontroller are all utilized in the system [4].

An overview the use of ZigBee technology in a wireless temperature monitoring system may be found in the literature review in the material named "Wireless temperature sensing apparatus based on the wi-fi connectivity". It goes into ZigBee's technical specs, network topology architectures, and potential applications. The survey suggests a ZigBee-based wireless temperature sensing system that consists of temperature sensors, RFD nodes, and coordinator nodes. The system's 18B20 temperature sensor from MAXIM Company and the CC2430 chip from Chipcon Company are also mentioned in the content. The accuracy and stability of the systems for measuring temperature are by the experimental findings that are presented. The survey's overall findings demonstrate ZigBee technologies [5].

Several references pertaining to the research issue is included in the literature survey of the paper titled "Humidity and Indoor Environment Temperature Sensor." A few of the publications cited are “devices with networked bodies on the Web in Smart Homes: A Live Demonstration" and "Design Prototyping for IR Remote Controller Usage in Smart Houses" Both during 2016 and 2017, these papers were presented at conferences. Additional sources of information include papers on low-power Designing smartphone apps for smart homes, database and safe channel exchange protocols, and wireless protocol design. The research topic can be further understood and explored with the help of these references, which offer insightful information [6].The literature review of research "moisture and temperature control tracking the Indoor space" includes a number of sources relevant to the research question. Some books are "Live Show: Mind-Meshed and Internet Connected for Smart House devices" and " Smart Home IR Remote Controller Model Design." They were shown at meetings in 2016 and 2017. Other sources cover data and safe communication plans, wireless plan creation, and low-energy mobile app creation for smart homes. These sources give helpful details for studying and exploring the research topic of the work [7].

III. METHODOLOGY

The cleverly designed system smoothly integrates Things of network (IoT) modules and concepts by combining a variety of state-of-the-art technologies and approaches. Using modules like the HC-05 Bluetooth, Node MCU ESP8266, Arduino, and specialized humidity and temperature sensing modules are among the essential elements. This combination creates the framework for an all-encompassing system that improves user experience via exact control mechanisms, home automation, and an easy-to-use user-facing smartphone applications controls. In order to attain thorough environmental monitoring, specific modules for measuring temperature and moisture levels are positioned strategically throughout the system. These sensors are necessary for precisely and instantly gathering environmental data since they detect and measure temperature.

A. Sensor and MC connections

Integrating of Bluetooth modules, namely the HC-05, enables wireless connection by serving as a dependable communication interface for uninterrupted data transfer across the system. The monitoring procedure is more flexible and accessible because to its wireless feature. A Relay Module is incorporated into the framework to allow for automatic or remote operation of the fan. This part functions as a crucial control mechanism, enabling users to control and remotely manage the fan in accordance with the humidity and temperature readings that are being monitored.

As a dedicated monitoring device, the Node MCU ESP8266 is used in monitor the humidity and temperature. Its incorporation guarantees a strong and effective data collecting procedure, enhancing the general dependability and efficacy of the system.

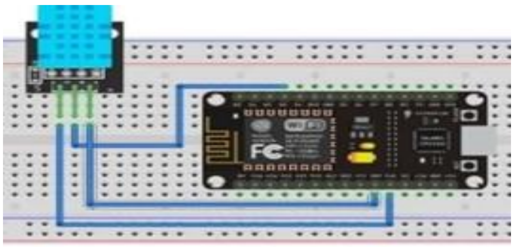


Figure 1 Sensor and MCU interface

As figure 1 shows the interfacing among the Sensor and Node MCU. Here we build a communication interface between the Sensor and the microcontroller to enable establish a seamless data transmission.

B. Hardware Design

The study presented the general the layout of the wireless temperature system based on a discussion and analysis of Bluetooth and similar technologies. As the Figure 2 displays the diagrammatic view of system's design.

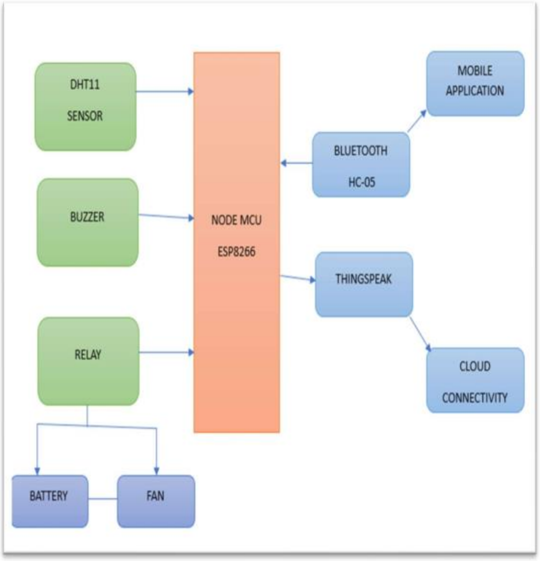


Figure 2 Diagrammatic view of hardware design

C. Design of components in the wireless model

Along the tiny architecture and an assortment of capabilities optimized for control and communication, NodeMCU ESP8266 is a potent platform made especially for Things of network (IoT) applications. ESP8266 Wi-Fi module: a vital element of the NodeMCU ESP8266, allows for smooth wireless communication—a must for Things of Network (IOT) installations. Its architecture is as per the ESP8266 chip, a low-cost Wi-Fi microcontroller that features integrated Wi-Fi with plenty of computing capability, making it a great option for Things of Network (IOT) applications that need interfaced to local networks or the web.

GPIO pins of the NodeMCU ESP8266 board enable interfaces with sensors, actuators, and other peripheral devices among its many input/output choices. Additionally, it offers flexibility and support for programming using the Lua scripting language, the Arduino IDE, and other development environments.

Figure 3 Node MCU ESP8266

Accurate temperature and humidity measurement is achieved by the comparatively simple execution of the DHT11 sensor, an integral component within the Internet of Things applications. A thermistor for temperature detection and a humidity-sensitive capacitor are included into its structure. Temperature changes cause changes in the thermistor's resistance, while changes in humidity cause changes in the capacitance of the humidity-sensitive capacitor. Utilizing a custom firmware algorithm built inside the sensor, these adjustments are translated into digital signals.

The DHT11 sensor is tiny and physically consists of an exposed electrode for sensing inside a plastic shell that surrounds a small chip. Because the design is geared towards low-cost mass production, it is suitable for variety of IoT applications and projects. Three pins are typically employed in electrical connections: data (OUT), ground (GND), and power (VCC).

Figure 4 Temperature sensor

D. Software Implementations

Using an assortment of software tools, like the Arduino IDE and IoT platforms, is necessary for designing a wireless temperature and humidity monitoring system.

Choosing the proper hardware parts, like sensors for measuring humidity and temperature, microcontrollers like Arduino boards, and wireless communication modules like Wi-Fi or Bluetooth, is usually the first step in the process. After selecting the hardware, the next stage is to develop the software that will operate on the microcontroller to gather sensor data and wirelessly send towards a primary monitoring system.

An Arduino code would contain instructions to initialize and setup the sensors, read data from them on a regular basis, and send the gathered data over a wireless connection in the background of a temperature and humidity monitoring system. To maximize system performance and energy efficiency, this code may additionally include error-handling techniques and power-management techniques.

E. Algorithmic Version Of code:

1. Set up the required constants and variables.
2. Establish a Wi-Fi connection.
3. Use the DHT sensor to read humidity and temperature.
4. Using the API key, send the data to ThingSpeak.
5. Verify whether the temperature has risen above the threshold.
6. Activate the buzzer and send an email notice if the temperature rises above the threshold.
7. Switch off the buzzer if the temperature is below the threshold.
8. Wait two seconds, then carry out step eight again.

TABLE I. THERSHOLD RANGES AND ACTIVITIES

Threshold Ranges(T)	**Activities done during the temperature monitoring**		
	ALERT MSG	***BUZZER***	***DC FAN***
T >= threshold	Send email	ON	ON
T < threshold	No email	OFF	OFF

Table 1 outlines that the ambient temperature monitoring cutoff ranges are as follows: when the temperature rises to or exceeds 29 degrees Celsius, the buzzer and DC fan are activated and an email alert is sent. On the next side, if the temperature drops below 29 degrees Celsius, the sound of a buzzer and the direct current fan stop working and no email notice is issued. This configuration guarantees that users receive timely notifications of high temperatures, eliciting both visible and auditory alerts. It also permits automated cooling procedures when required to preserve ideal environmental circumstances.

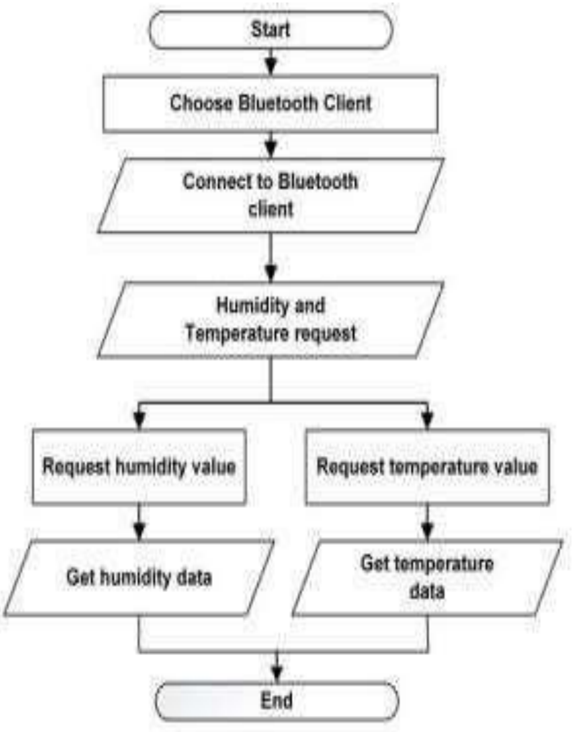


Figure 5 Flow Diagram of data transfer between the Bluetooth and app

IV. RESULTS AND DISCUSSION

The goal of the "Smart Temperature and Humidity Tracker" project is to use temperature and humidity sensors to create a wireless monitoring system. For real-time data display and control, the project makes use of a microcontroller board, a Bluetooth module, and a smartphone app. The hardware configuration and the cloud-based database were successfully implemented, according to the results. The IoT cloud platform stores and displays the observed values. Additional aspects of the project include remote device control, interaction with mobile apps, and alerts and notifications for predetermined criteria. The project's originality is emphasized in the discussion, which also cites relevant studies on wireless temperature and humidity monitoring systems. All things considered, the study shows how feasible and advantageous it may be to detect temperature and humidity using IoT technology.

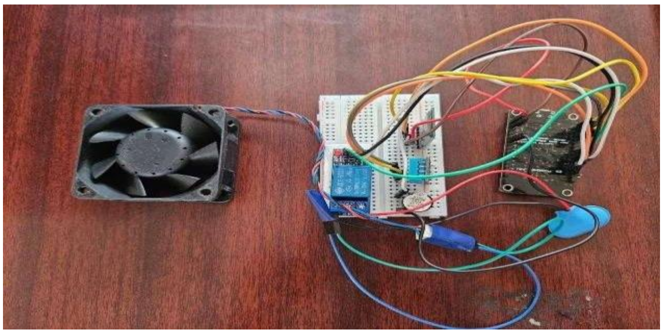


Figure 6 Overview of the model

As the figure 6 shows the overview of the model been setup using all components that are been mentioned in hardware design part.

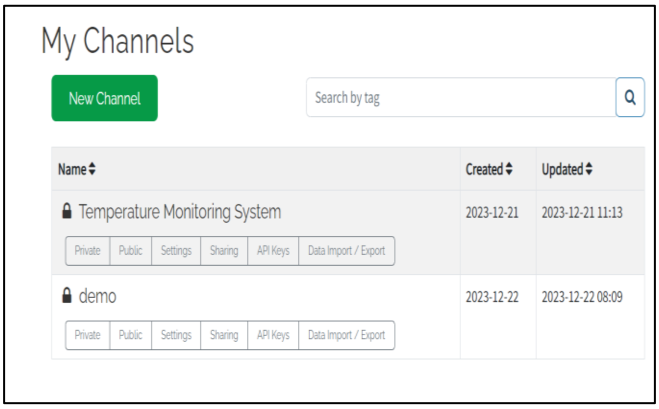
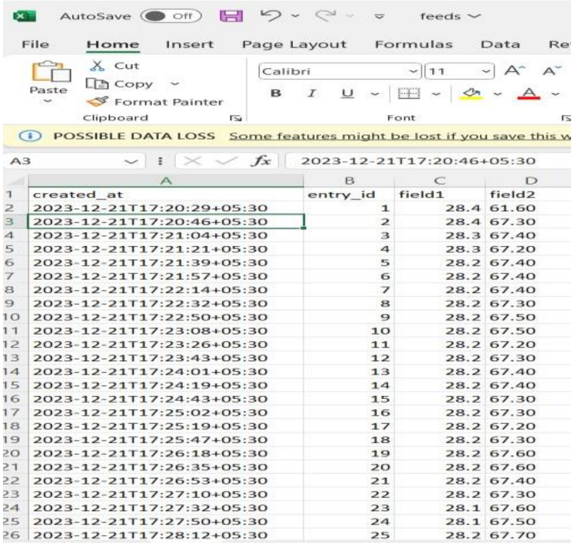


Figure 7 Channel created in the DB

Figure 8 Two field charts

There are two field charts created to show the monitored values where field one shows the temperature readings in a graph format where x-axis is date and y-axis is values.



	A	B	C	D
1	created_at	entry_id	field1	field2
2	2023-12-21T17:20:29+05:30	1	28.4	61.60
3	2023-12-21T17:20:46+05:30	2	28.4	67.30
4	2023-12-21T17:21:04+05:30	3	28.3	67.40
5	2023-12-21T17:21:21+05:30	4	28.3	67.20
6	2023-12-21T17:21:39+05:30	5	28.2	67.40
7	2023-12-21T17:21:57+05:30	6	28.2	67.40
8	2023-12-21T17:22:14+05:30	7	28.2	67.40
9	2023-12-21T17:22:32+05:30	8	28.2	67.30
10	2023-12-21T17:22:50+05:30	9	28.2	67.50
11	2023-12-21T17:23:08+05:30	10	28.2	67.50
12	2023-12-21T17:23:26+05:30	11	28.2	67.20
13	2023-12-21T17:23:43+05:30	12	28.2	67.30
14	2023-12-21T17:24:01+05:30	13	28.2	67.40
15	2023-12-21T17:24:19+05:30	14	28.2	67.40
16	2023-12-21T17:24:43+05:30	15	28.2	67.30
17	2023-12-21T17:25:02+05:30	16	28.2	67.30
18	2023-12-21T17:25:19+05:30	17	28.2	67.20
19	2023-12-21T17:25:47+05:30	18	28.2	67.30
20	2023-12-21T17:26:18+05:30	19	28.2	67.60
21	2023-12-21T17:26:35+05:30	20	28.2	67.60
22	2023-12-21T17:26:53+05:30	21	28.2	67.40
23	2023-12-21T17:27:10+05:30	22	28.2	67.30
24	2023-12-21T17:27:32+05:30	23	28.1	67.60
25	2023-12-21T17:27:50+05:30	24	28.1	67.50
26	2023-12-21T17:28:12+05:30	25	28.2	67.70

Figure 9 Once the values are been monitored, the values are been imported and exported in the format of CSV file.

Figure 11 The process flow of the Bluetooth connectivity and the readings Among the observed values.

As the figure 11 shows the process flow of the Bluetooth connectivity and the readings among the observed values.

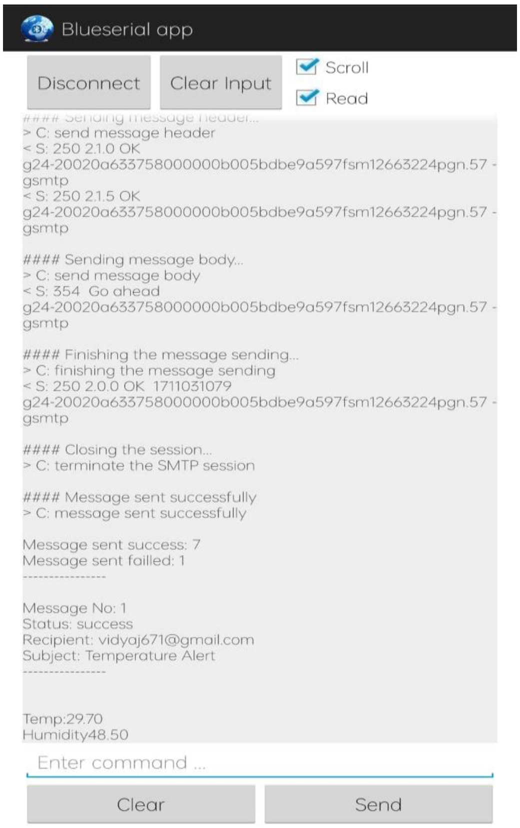


Figure 12 The process flow of the Bluetooth connectivity and the readings Among the observed values.

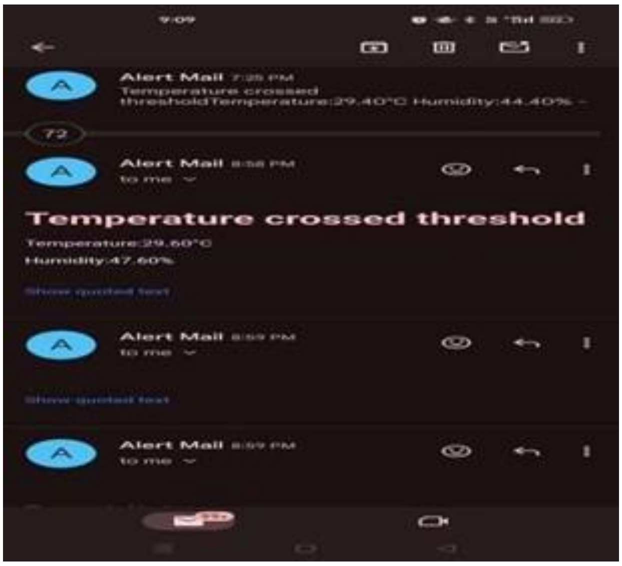


Figure 12 Once the temperature crosses the threshold then the user will be alerted with an email.

V. CONCLUSION

The project "Smart Weather Tracker" achieved success by making a wireless system that tracks humidity and temperature. It merged these trackers with a small computer and a Bluetooth tool, plus a phone app, to show and manage data right away. It used simple wires to connect the computer and device. The recorded values were then put on a cloud list called Thingspeak, so people could see and track them when they want. This project showed that tracking humidity and temperature through IoT (Web of Things) can work. By using IoT, the project makes new ways to get benefits like better tracking and easier data deals. Also, the project had more things like an app, far-off control, and alerts just when you need to know. These add-ons make the tool more useful and easier to use. the "Smart Temperature and Humidity Tracker" project shows how IoT tech can help track the world around us. It gives quick data and proves that IoT tools can make life smoother. With its strong traits and help, this project paves the way for more IoT tools for the world around us.

REFERENCES

[1] T. Adiono, M. Y. Fathany, S. Fuada, I. G. Purwanda and S. F. Anindya, "A portable node of humidity and temperature sensor for indoor environment monitoring," 2018 3rd International Conference on Intelligent Green Building and Smart Grid (IGBSG), Yilan, Taiwan, 2018, pp. 1-5, doi: 10.1109/IGBSG.2018.8393575.

[2] Z. Gao, Y. Jia, H. Zhang and X. Li, "A Design of Temperature and Humidity Remote Monitoring System Based on Wireless Sensor Network Technology," 2012 International Conference on Control Engineering and Communication Technology, Shenyang, China, 2012, pp. 896-899, doi: 10.1109/ICCECT.2012.223.

[3] A. Roy, P. Das and R. Das, "Temperature and humidity monitoring system for storage rooms of industries," 2017 International Conference on Computing and Communication Technologies for Smart Nation (IC3TSN), Gurgaon, India, 2017, pp. 99-103, doi: 10.1109/IC3TSN.2017.8284459.

[4] Y. Wang and Z. Chi, "System of Wireless Temperature and Humidity Monitoring Based on Arduino Uno Platform," 2016 Sixth International Conference on Instrumentation & Measurement, Computer, Communication and Control (IMCCC), Harbin, China, 2016, pp. 770-773, doi: 10.1109/IMCCC.2016.89.

[5] Li Pengfei, Li Jiakun and Jing Junfeng, "Wireless temperature monitoring system based on the ZigBee technology," *2010 2nd International Conference on Computer Engineering and Technology*, Chengdu, China, 2010, pp. V1-160-V1-163, doi: 10.1109/ICCET.2010.5486248.

[6] T. Adiono, M. Y. Fathany, S. Fuada, I. G. Purwanda and S. F. Anindya, "A portable node of humidity and temperature sensor for indoor environment monitoring," 2018 3rd International Conference on Intelligent Green Building and Smart Grid (IGBSG), Yilan, Taiwan, 2018, pp. 1-5, doi: 10.1109/IGBSG.2018.8393575.

[7] E. Senthilkumar, D. Pamela, 2013, Remote Temperature Monitoring and Recording Using Bluetooth Wireless Technology, INTERNATIONAL JOURNAL OF ENGINEERING RESEARCH & TECHNOLOGY (IJERT) Volume 02, Issue 11 (November 2013),

[8] Wang, Anhang. (2021). Bluetooth wireless temperature and humidity detection system based on STM32. E3S Web of Conferences. 284. 04006. 10.1051/e3sconf/202128404006.

[9] Mestria, Mário."Temperature Control System Using Mobile Application Interface." European Journal of Formal Sciences and Engineering 5.1 (2022): 1-15

[10] Vijayvrgiya, Ankit, et al. "Home Automation Using Smart Android Phone with Bluetooth Technology." International Journal of Advanced Engineering, Management and Science, vol. 2, no. 3, Mar. 2016.

[11] Bogati, Sabina et al. "Designing of the Wireless Digital Portable Temperature and Humidity Monitoring Device and Analyzing Data at Different Part of Kathmandu Valley." (2021).

[12] S. Bogati, M. Sharma, and R. Shrestha, "Designing of the Wireless Digital Portable Temperature and Humidity Monitoring Device and Analyzing Data at Different Part of Kathmandu Valley", semicond. sci. and inf. n.a., vol. 3, no. 1, pp. 41–48, Jun. 2021.