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Server Room Monitoring System using IOT

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Abstract— Temperature is one of the most monitored items in many industrial and commercial applications. Internets of Things (IoT) temperature sensors are commonly small, low power, and able to measure humidity as well. Obtaining timely, accurate temperature information is critical in an IoT system. This paper aims to evaluate an IoT temperature system's performance by comparing it with an industrial system. In this project, an IoT temperature monitoring system has been developed using a DHT22 temperature sensor and a Raspberry Pi to represent an IoT temperature monitoring system. The system is evaluated by comparing its temperature measurement with a Keithley 6517-TP industrial grade temperature probe connected to Keithley 2110 benchtop digital multimeter as the acquisition system. The IoT temperature monitoring system utilizing the DHT22 sensor provides accurate measurement up to 0.10C but a slower response in detecting temperature change. This finding would be able to provide a reference in developing an IoT system that requires temperature monitoring.
Keywords- temperature, IoT, humidity, raspberry pi, DHT22.

I. INTRODUCTION

Temperature is a common item that is monitored in an IoT application. Among the temperature monitoring applications in an IoT is poultry monitoring to prevent chickens from dying by maintaining the temperature between 18oC to 22 C An IoT system is also used to monitor greenhouse gases where the temperature is one of the items monitored Another example is that temperature and humidity are monitored in concrete structures.

DHT22 sensor and its similar type are mostly used in an IoT temperature monitoring system [8, 9]. However, there is limited information on validating the accuracy of the DHT22 sensor. This paper aims to evaluate the DHT22 temperature sensor in an IoT system by comparing it with an industrialgrade instrument. This paper's findings are expected to provide beneficial information as a guideline and benchmark for future research when using a similar temperature sensor in an IoT system.

The research project is carried out by first designing a generic platform for an IoT-based real-time environmental monitoring system that can be used for many purposes. The scope of the generic platform is to collect temperature data.

The temperature sensor selected is interfaced with a microcontroller or microcomputer. A program has been developed to enable the device to read, store and upload the data to the IoT cloud platform. The microcontroller board has been selected based on the ability to manage single General-Purpose Input/Output (GPIO) pin as only one sensor has been used in this experiment. The system has been integrated as an IoT cloud platform.

II. PROPOSED SYSTEM DESIGN

A real-time IoT temperature monitoring system has been developed. The IoT system used DHT22, a temperature and humidity sensor, and a Raspberry Pi (RPi) to integrate the sensor data with MySQL open-source database to log data and Grafana to display the system online. Initially, three commonly used temperature and humidity sensors in an IoT system were compared. DHT22, DHT11, and SHT71. Table I provides the comparison of the popular temperature sensors. The DHT22 has been selected because it has good accuracy, low price, and an acceptable range than the other two sensors. It also has low power consumption and provides a digital signal response.

Parameter	DHT22	DHT11	SHT71
Humidity Range	0 - 100%	20 - 80%	0 - 100%
Temperature Range	-40◦C- 80◦C	0◦C - 50◦C	40◦C - 123◦C
Accuracy	±0.5◦C	±2◦C	±3◦C

The DHT22 sensor was integrated with Raspberry Pi, as shown in Figure 1. The IoT system is divided into two parts, the first part is the sensing unit consist of the DHT22 sensor and Raspberry Pi, and the second part is the data display unit consist of MySQL and Grafana. In the sensing unit, the DHT22 sensor is turned on, and the serial communication is checked. If it is available, the data is read. If the serial communication is not available, the device is put into sleep mode. In the data display

unit, the data read from the sensing unit is sent to the MySQL database. The Grafana web application has been used to allow the user to fetch data from the database and display the data in real-time. The flowchart of data is shown in Fig 1.
performed to evaluate the DHT 22 IoT sensors in ambient room temperature environment, zero degree Celsius experiment, and boiling temperature experiments. The DHT22

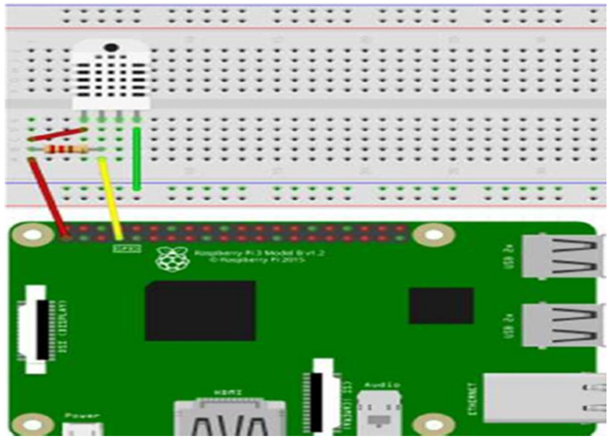

Fig .1 DHT22 Temperature and Rpi setup

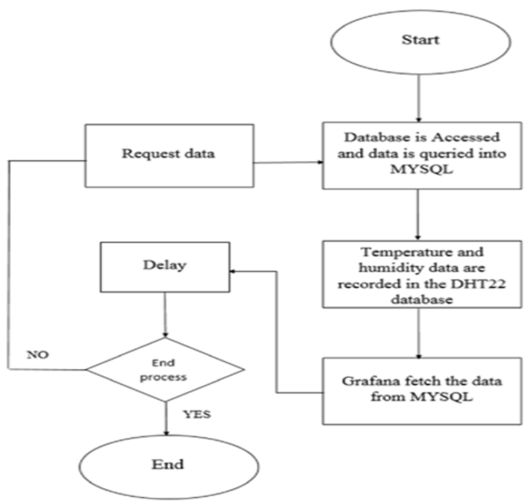

Fig .2 Flowchart of data in the IoT temperature system

The system is verified by allowing the system to run and collect the real temperature data. The measured temperature in each instance is stored in a MySQL database. Finally, the temperature data is displayed in real-time on the Grafana dashboard.

III. EXPERIMENTAL SETUP

The temperature experiment was performed in the Electronics laboratory in the Faculty of Engineering at International Islamic University Malaysia (IIUM). Three experiments were performed to evaluate the DHT 22 IoT sensors in ambient room temperature environment, zero degree Celsius experiment, and boiling temperature experiments. The DHT22 IoT sensor measurement is compared with Keithley 6517-TP industrial grade temperature probe readings. The
data acquisition of the 6517-TP probe is recorded through Keithley 2110 digital multimeter. The test setup is shown in Figure 3, Figure 5, and Figure 7 according to the experimental setup. The 6517-TP temperature probe is a type K thermocouple calibrated from 0oC to 1250oC. The 6517- TP Temperature probe was connected to the 2110 Keithley digital bench multimeter, and the reading was recorded and exported out to our computer using Keithley Instruments software tools. The DHT22 sensor was connected to the GPIO pin at Raspberry Pi, and data from the DHT22 sensor was collected in a CSV file. Both data were compared and analyzed in Microsoft Excel.
IoT sensor measurement is compared with Keithley 6517-TP industrial grade temperature probe readings. The data acquisition of the 6517-TP probe is recorded through Keithley 2110 digital multimeter. The test setup is shown in Figure 3, Figure 5, and

Figure 7 according to the experimental setup. The 6517-TP temperature probe is a type K thermocouple calibrated from 0oC to 1250oC. The 6517- TP Temperature probe was connected to the 2110 Keithley digital bench multimeter, and the reading was recorded and exported out to our computer using Keithley Instruments software tools. The DHT22 sensor was connected to the GPIO pin at Raspberry Pi, and data from the DHT22 sensor was collected in a CSV file. Both data were compared and analyzed in Microsoft Excel.

IV. RESULTS AND DISCUSSION

A. Room Temperature Measurements

The room temperature was set to 20oC by setting the air conditioner. Both measurements were taken by the DHT22 IoT sensor and Keithley 6517-TP industrial grade temperature probe simultaneously. The room temperature experimental setup is illustrated in Figure 3.

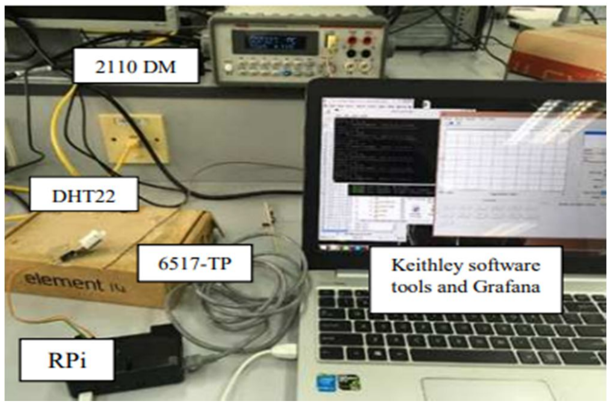

Fig .3 Room temperature measurement

The room temperature measurement by each sensor is shown in Figure 4. The readings from DHT22 IoT sensors show a constant value of 20.4oC, while the measurements from the Keithley 6517-TP thermocouple fluctuates between 20.7oC to 20.9oC. Nevertheless, both measurements provide an accurate measurement of ambient temperature. The 6517- TP probe is accurate to two decimal points, while the DHT22 sensors are accurate to a single decimal point giving a constant value.

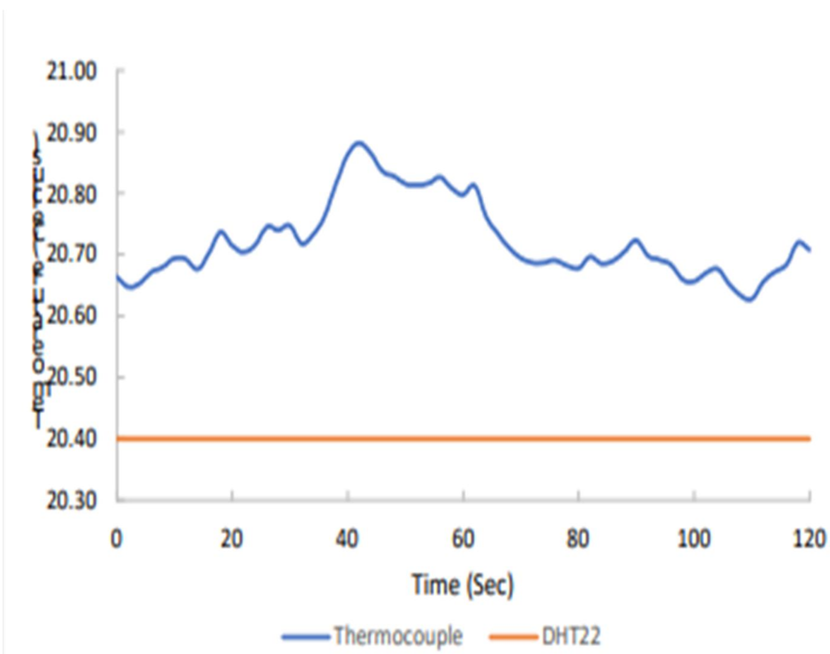

Fig. 4 Room temperature measurement result

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B. Zero degrees Celcius temperature

The experiment was conducted by putting both sensors in the ice bath together, as shown in Figure 5. Both temperature sensor is not waterproof, so it is cover with plastic to prevent it from damage. The 6517-TP probe immediately measures 0.5oC when it is dipped in the ice bath. The DHT22 sensor initially measures 9oC, and the reading takes 540 seconds (9 minutes) to reduce to 1oC. It is observed that both temperature measurements converge to 1oC after 540 seconds. In 9 minutes, the ice starts to melt, so it is not giving a 0oC celsius reading.

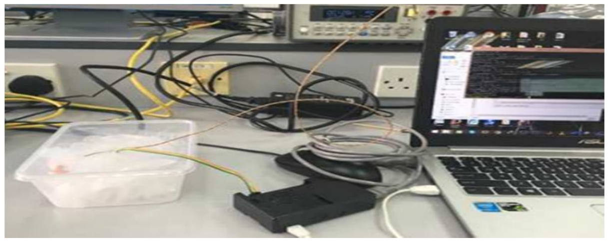


Fig .5 Zero degrees Celcius temperature measurement

The DHT22 sensors with the Raspberry Pi provide accurate measurement, but it takes time to measure temperature accurately when there is a large temperature change.

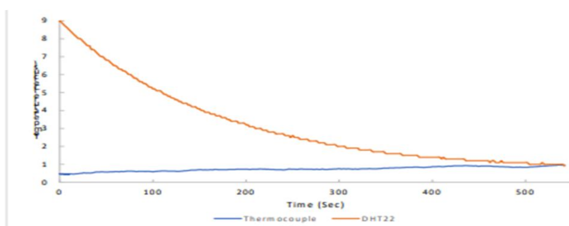


Fig .6 Zero degrees Celcius measurement results

C. Boiling Temperature Experiment

In this experiment, the aim is to measure at a hightemperature reading. A metal water kettle is used to increase the temperature by boiling the water. The sensor is not dipped into the boiling water because both sensors are not waterproof. The 6517-TP temperature probe is taped to the metal body of the water kettle. Similarly, the DHT22 sensor is also taped to the metal body of the kettle. Figure 7 shows the setup for boiling temperature measurement. The 6517-TP probe has an added advantage since its thin and tiny sensor can directly touch the water kettle's metal body. The data is recorded at boiling temperature. The experiment setup is similar to the experiment room temperature and zero degree Celsius, but both sensors were attached to the metal kettle body.

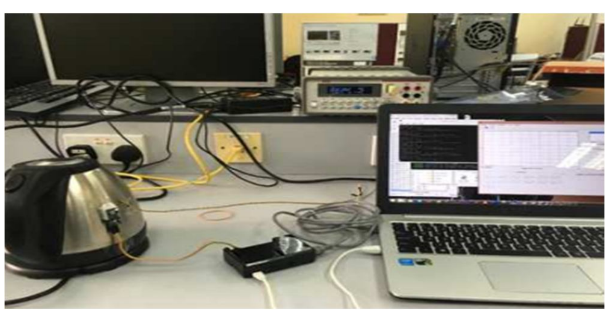


Fig .7 Boiling temperature measurement

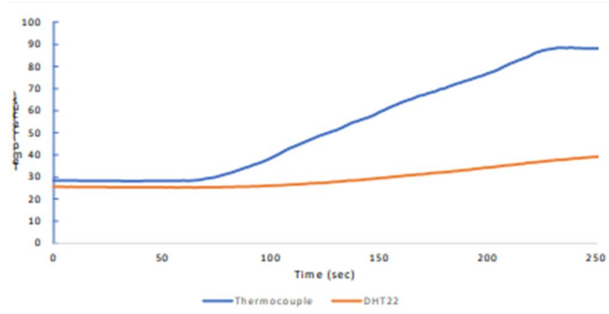


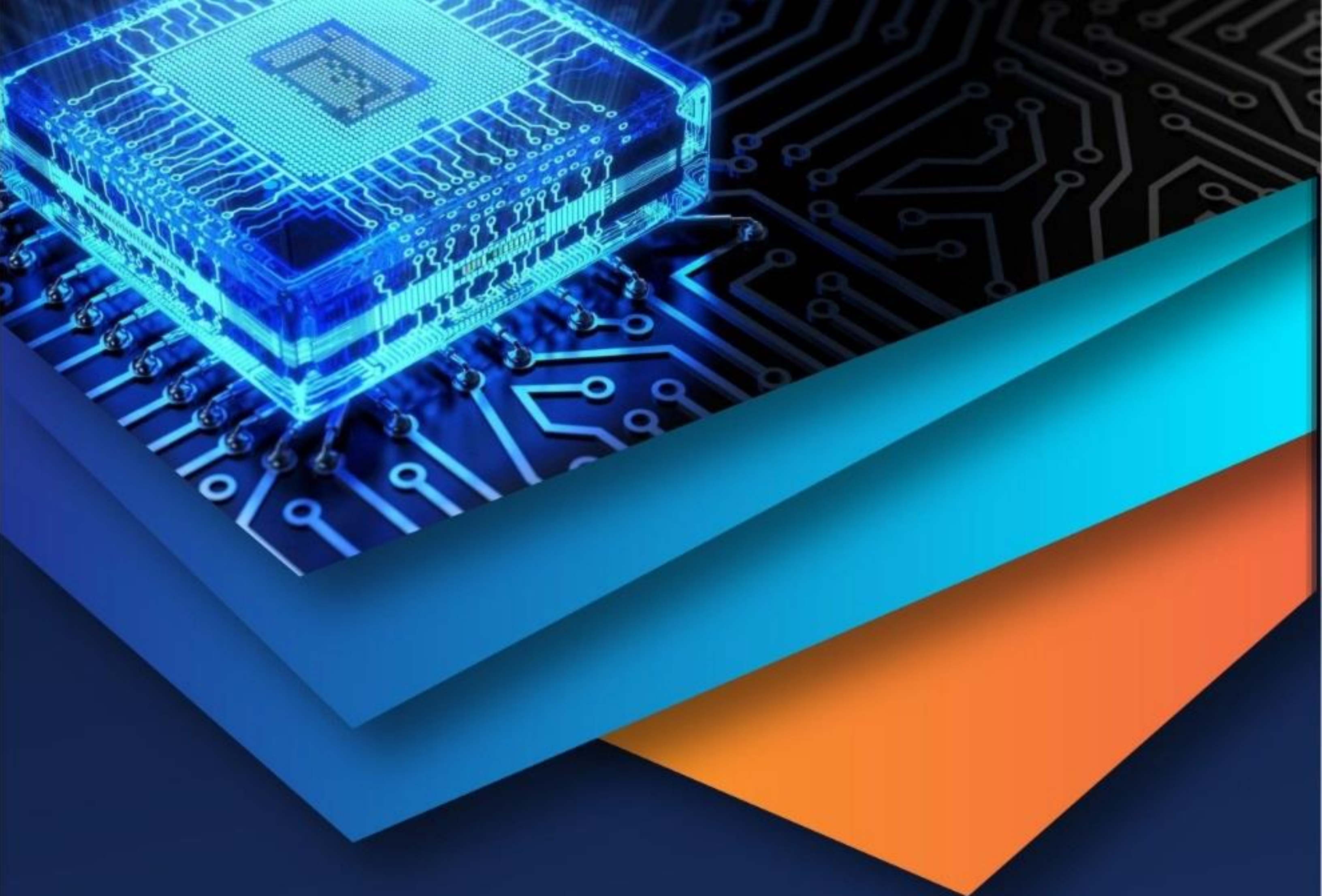
Fig . 8 Boiling temperature measurement

V. CONCLUSION

This research was conducted by first developing an IoT temperature monitoring system that emulates an IoT system that allows users to monitor real-time data through the internet using the DHT22 sensor, a common IoT temperature sensor interface with a Raspberry Pi board. The IoT temperature monitoring system is compared to an industrialgrade thermocouple. A Keithley multimeter was used to evaluate the data's sensitivity and accuracy. After conducting the experiment and obtaining the results, It is observed that the DHT22 sensor with Raspberry Pi configuration in an IoT configuration provides accurate temperature measurement up to 0.1 deg Celsius. However, it is slower in detecting the rate of temperature change. Therefore, the DHT22 and its type are not suitable in an application that requires the monitoring and feedback of rapid temperature changes. The DHT22 sensor in IoT configuration is more suitable for monitoring ambient temperature in an environment with gradual temperature changes. The advantage of the IoT temperature sensor is the low cost, allowing large-scale monitoring. Therefore, a developer of an IoT system must know how rapidly the temperature changes in an environment to be monitored, which would lead to selecting the right temperature sensor for an accurate and reliable result. This research's findings could provide insight into a good use case for IoT sensors in temperature monitoring applications. The system can send notifications on the telegram and setting temperature on air conditioner if temperature and humudity in server room exeeds the limit. The suggestion of this paper is that this system can also regulate the humidity in the server room and use one of the tools as sensors and actuators.

REFERENCES

[1] R. Rahim, " Humidity and Temperature Prototype for Education with Internet of Things", International Journal of Pure and Applied Mathematics, vol. 119, no. 16, pp. 2487-2491, 2021.
[2] S. Pallavi, "Internet of Things: Architectures, Protocols, and Applications," Journal of Electrical and Computer Engineering, pp. 1-26, 2021
[3] P. Narkhede, "Physical Conditions Monitoring in Server Rooms Internet of Things," International Journal of Electrical and Electronics Research, pp. 237-239, 2020.
[4] H. Nainggolan, "Rancang Bangun Sistem Kendali Temperatur Dan Kelembaban Relatif Pada Ruangan Dengan Menggunakan Motor Dc Berbasis Mikrokontroler Atmega8535," Jurnal Fisika Unand , Vol. 2, No. 3, P. 140, 2020.
[5] Relative Humidity, International Research Journal Of Engineering And Technology, 2020.
[6] J. P. SIPAN, "Temperature & Humidity Monitoring & Control System Based On Arduino And Sim900a Gsm Shield," International Journal Of Electrical, Electronics And Data Communication, Vol. 5, No. 11, P. 62, 20119.
[7] S. A. Nugroho, " Detektor Suhu Ruangan Dengan Tombol Pengatur Manual Berbasis Mikrokontroler AT89S51," Seminar Riset Unggulan Nasional Informatika Dan Komputer FTI UNSA, Vol. II, No. 2, Pp. 15-21, 2013.
[8] M. Ichwan, "Pembangunan Prototipe Sistem Pengendalian Peralatan Listrik Pada Platform Android," Jurnal Informatik, Vol. IV, No. 1, Pp. 13-25, 2013.
[9] G. P. Nugroho, "Sistem Pendeteksi Dini Banjir Menggunakan Sensor Kecepatan Air Dan Sensor Ketinggian Air Pada Mikrokontroler Arduino," Jurnal Teknik Pomits , Vol. II, No. 1, Pp. 1- 5, 2013
[10] Monicris, "Air Conditioning Web Controlled By Arduino," Instructables, [Online]. Available: Https://Www.Instructables.Com/Id/Air-Conditioning-Web-Controlled-By-Arduino/. [Accessed 10 8 2018].
[11] H. Mansor, A. N. Azlin, T. S. Gunawan, M. Md Kamal, and A. Z. Hashim, "Development of smart chicken poultry farm," Indonesian Journal of Electrical Engineering and Computer Science, vol. 10, no. 2, pp. 498-505, 2018



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