Preliminary Study on Measuring Indoor Light Intensity, Temperature, and Humidity Using DHT11 and BH1750 Sensors

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Abstract

Indoor light intensity, temperature, and humidity are physical parameters that can affect indoor air quality as regulated in the Indonesian Minister of Health Regulation No. 2 of 2023. This study conducted an initial study of a light intensity measurement system based on the BH1750 sensor and temperature measurement based on the DHT11 sensor. This research aims to evaluate the performance of the sensor-based measurement system and analyze indoor air quality based on these three parameters. The research method used was research and development with a waterfall model. Data collection was conducted in a 340 cm x 340 cm room. The results showed that the sensor-based measurement system could work well and had an accuracy of 90.13% with an error rate of 9.87%.

Keywords: *Air Quality Index, Light Intensity, Temperature, Humidity, DHT11 sensor, BH1750 sensor*

1. Introduction

Indoor air quality has become a significant concern due to its impact on human health. The requirements for indoor air quality encompass three aspects: physical, chemical, and biological quality. Physical quality refers to physical parameters, including Particulate Matter (PM 2.5 and PM 10), temperature, humidity, light intensity, and airflow [1]. The Indonesian Minister of Health Regulation Number 2 of 2023 has underscored the importance of maintaining good indoor air quality [2]. Lighting is a crucial environmental factor in the workplace as it affects the visual neural system in the brain. Light intensity in indoor environments, especially workplaces, must meet standards to avoid risks to workers [3]. Accurate measurement of these physical parameters is a crucial first step in improving indoor air quality.

Previous studies have extensively measured physical parameters in indoor environments, but they have been limited to specific settings and used different types of sensors [4-6]. This study aims to evaluate the performance of the BH1750 sensor for measuring light intensity and the DHT11 sensor for measuring temperature and humidity indoors. The results of this study are expected to serve as a basis for developing a more comprehensive indoor air quality monitoring system. This monitoring system can be used to monitor indoor air conditions in real time and provide early warnings of significant changes.

2. Method

This research employed a research and development (R&D) methodology. The R&D research method is utilized to produce a specific product and evaluate its effectiveness. The block diagram of the research is presented in Figure 1 and the hardware system circuit diagram is presented in Figure 2.

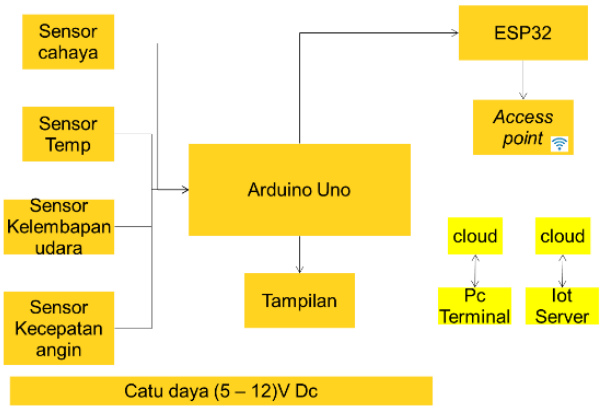

Figure 1. Block Diagram

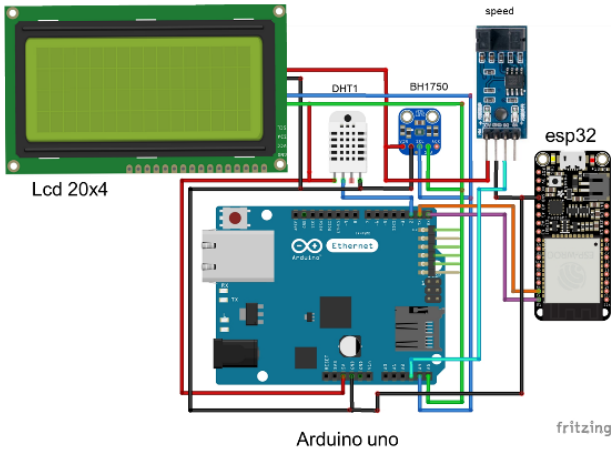

Figure 2. Schematic Simulation Circuit Diagram

3. Result and Discussion

3.1 Experimental Setup

The experimental setup was designed within a 340 cm x 340 cm laboratory room. Data was acquired at five specific locations, denoted as points A, B, C, D, and E, as illustrated in Figure 3. For the light intensity measurements, a lamp was mounted at a height of 375 cm above the floor, centered at point E. Data was acquired at five distinct points within the experimental space, labeled A, B, C, D, and E.

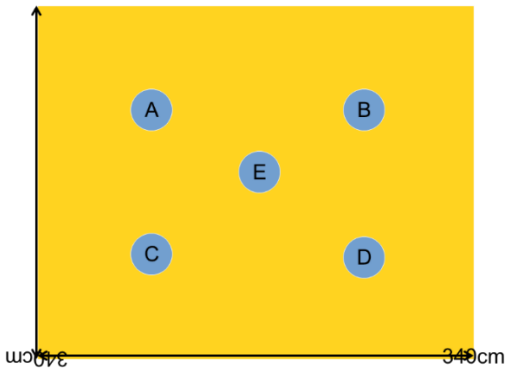

Figure 3. Sampling Point Layout

3.2 Data Evaluation

The ambient temperature and humidity at the data acquisition site were determined to be 28.2°C and 70%, respectively. The corresponding light intensity measurements are presented in Figure 4.

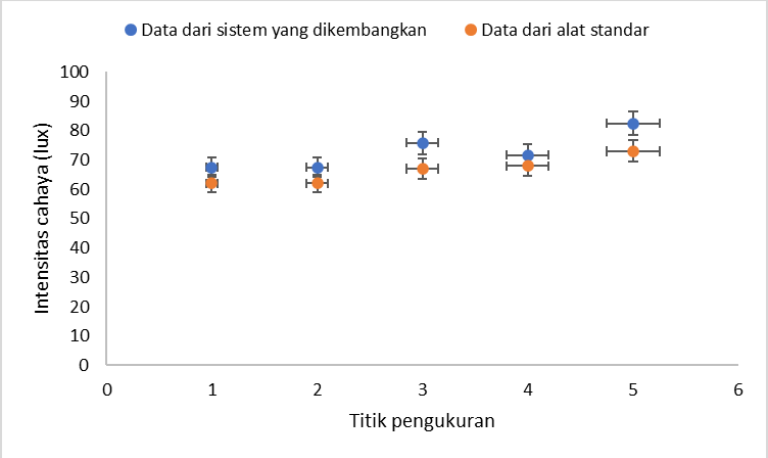

Figure 4. Measured indoor light intensity.

The developed instrumentation system is capable of measuring room temperature, humidity, and light intensity. To assess the system's accuracy, error values were calculated as shown in Table 1.

Table 1. Percentage Error and Accuracy of System Measurements

Trial Point	System Data	Standart Data	% Error	% Accuracy
A	67,5	62	8,87	91,13
B	67,5	62	8,87	91,13
C	75,83	67	13,18	86,82
D	71,67	68	5,40	94,60
E	82,5	73	13,01	86,99
	Average		9,87	90,13

As shown in Table 1, the average percentage error of the measurement system is 9.87%. This implies that the system exhibits a high level of accuracy, with a mean accuracy of 90.13%.

4. Conclusion

This research successfully developed a room environment monitoring system based on DHT11 and BH1750 sensors to measure light intensity, temperature, and humidity. The results of the experiments demonstrated that the system is capable of operating with a reasonably high level of accuracy, specifically 90.13%. This indicates that the data generated by the system is reliable for further analysis.

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