Humidity Analysis Using 808H5V5 by Mean Formula

Wisnu Kartika*, Muhammad Geraldo, Kholid Al Sulaimi, Kuat Supriyadi
Department of Medical Electronics Technology, [Universitas Muhammadiyah Yogyakarta], Indonesia
Email: *wisnu2007@umy.ac.id

Abstract. Humidity and noise in the baby incubator are parameters that must be maintained according to the BPFK (Health Facility Security Center) standard, which is fifty to sixty percent for humidity. Moisture needs to be maintained to keep the stability of the baby's body temperature. Therefore, the authors intend to make a calibration tool for baby incubators (incubator analyzers) with moisture parameters. To measure the moisture content, the 808H5V5 sensor was used, while the minimum system used was Arduino Uno. The test method used to see the performance of this tool were to compare the values in the humidity of the TA module, the incubator analyzer with a comparison (Temperature Humidity Meter). At the humidity reading, the error value was below two percent, where the biggest error in the measurement value of 37 Celcius degree is 1.56 percent. The tool is functioning properly as incubator analyzer because it has an error below tolerance of approximately five percent.

1. Introduction
Early pregnancy and lack of nutrients can cause birth and premature birth problems. Therefore, these babies need an incubator as a heating device with a standard temperature between 32-37 °C [1] to help babies survive and be able to adapt to outside temperature [2]. Baby incubator is one of medical device that is used to keep the body temperature of a premature baby stable at 37 °C. The body temperature of a premature baby must be kept constant, because if it is too high or too low it can cause damage to the babies’ organs [1]. The humidity condition of the incubator must be maintained between 50% RH - 60% RH. If it exceeds the recommended range, it can make premature babies uncomfortable. The parameters in the baby incubator often change due to long usage, so once a year calibration must be done [3]. Calibration is the activity of checking to determine the accuracy of a measuring instrument or measuring material. To calibrate the baby incubator, an analyzer incubator is needed. This tool uses a humidity sensor [4] [5]. An incubator analyzer is a device designed to calibrate the environmental conditions of a baby incubator that can record parameters such as air flow, noise, temperature (with five individual measurement modes), and relative humidity. The baby incubator uses a sound level meter to measure noise inside the incubator. In the medical field, to do this, a tool [6] is used to look after babies called baby incubators in the field of biomedical engineering systems [7][8]. Therefore, all parameters in the baby incubator are in accordance with the standards set by the BPFK (Health Facility Safeguard Center). If the parameters in the incubator are not in accordance with the standards set by the BPFK (Health Facility Security Center), it can be fatal for babies, especially in humidity and noise [9] [10] [11].

2. Literature Review
The baby incubators use efficient power [12]. The workings of the humidity sensor [13] [14] [15][16] only differ a few degrees above room temperature [17]. Temperature sensor [18] [19] and humidity
sensor can be used to measure and to monitor [20] a room. The latest technology of humidity sensors is the optical humidity sensor [21][22][23] and high speed humidity sensors [24].

3. Methodology
The method used in this study consisted of several stages, that were hardware design, software design, tool testing, and data retrieval.

A. Hardware Design
The hardware design on the TA module used several circuit modules including the minimum system of AT Mega 328P microcontroller [25]–[33], while the software used was Arduino programming software as a data processor in the device. The sensor used in this device was 808H5V5 sensors.

![Figure 1. Block Diagram](image)

When the power button is pressed, the power supply voltage will supply the overall voltage of the circuit so that the Humidity sensor will be active. After the power button is pressed, the sensor will start reading the area around it. The data from the reading of the humidity sensor will go to the ADC port on the Arduino IC [34]–[40]. Then the data received will be obtained by Arduino and will get the results (output) that will be displayed on one LCD simultaneously, if you want to make measurements again then press the reset button and press the start button again.

B. Software Design
The software on the device processing signals [41]–[52] obtained from the sensor uses the Arduino microcontroller as a data processor. The transmitter system flowchart can be seen in Figure 2.2 as follows:

![Figure 2. Humidity Measurement Flowchart](image)
When the start button is pressed, the sensor will initialize. After that, it will start reading the ADC on the humidity sensor. Then the data from the sensor will be converted into digital data. After that, the program will convert the digital data to % RH units and be displayed to the LCD display. Then the End is to end the program.

4. Result and Discussion
In this Final Project research, the authors conducted a TA module test with two methods of testing, namely test point testing and comparison of TA module with comparison. The first test point test was as follows

4.1 Humidity Test Point Testing

| Temperature | Display (%RH) | Test Point (V) |
|-------------|--------------|--------------|
| 32 °C       | 62.939       | 2.1863       |
| 33 °C       | 60.671       | 2.1307       |
| 34 °C       | 59.524       | 2.0909       |
| 35 °C       | 57.572       | 2.038        |
| 36 °C       | 55.654       | 1.9784       |
| 37 °C       | 53.728       | 1.919        |

From the data collection above, it is to determine the voltage changes to humidity. From the results of the measurement of the humidity of the baby incubator in Figure 3.1, the voltage changes at the output of the close humidity sensor are obtained. In table 3.1 the higher the air temperature so the moisture and the output voltage on the sensor decreases, conversely the lower the air temperature, the humidity and output voltage on the sensor increases.

![Figure 3. Mean Value on Each Temperature Setting Measurement](image)

4.2 Testing of Humidity for Calibrators.

| Temperature | Display Modul (%RH) | Calibrator Display (%RH) |
|-------------|---------------------|--------------------------|
| 32 °C       | 63.029              | 62.25                    |
| 33 °C       | 60.945              | 60.17                    |
| 34 °C       | 59.549              | 59.05                    |
| 35 °C       | 57.241              | 56.53                    |
| 36 °C       | 55.754              | 55.34                    |
| 37 °C       | 53.76               | 52.93                    |
From the data from the TA Module measurement with Comparator shows that the measurement error in all measured humidity has an error value below 2% and is still within the tolerance limit of ± 5%, where the biggest error is 37 °C i.e. 1.56% and the smallest error in measurement 36 °C which is 0.74%. From the above measurements the error is caused by several factors, among others: differences in the location of the humidity sensor with a comparator in the baby incubator, setting the temperature that is no longer suitable for the baby incubator, poor air circulation in the baby incubator and tolerance on the 808H5V5 sensor which is ± 3.5% to ± 4%, so the module that the author makes can already be used in calibration activities and learning activities.

![Comparison Graph between Module and Comparator](image)

### 5. Conclusion
The incubator analyzer works properly after measurement using comparative equipment. From the results of the trial by comparing the values produced by the TA module with a comparison tool, the results were quite significant. At humidity the error value was below 2% and was still on the tolerance threshold ± 5%, where the biggest error in the measurement value was 37 °C which was 1.56% and the smallest error at the measurement of 35 °C is 0.75%.

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