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# The Implementation of The Internet of Things in The Duck Egg Incubator Monitoring System

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**ABSTRACT**

Internet of Things (IoT) is a technology that creates modernization and makes it easier for humans to carry out their activities. IoT can be used in various fields, especially in monitoring stand-alone devices. This technology can communicate with other devices by utilizing radio waves and data transmission formats. This study aims to apply IoT to the duck egg incubator monitoring system. The method was an experimental method of designing a temperature and humidity monitoring system by implementing IoT. NodeMCU ESP8266 was used as the microcontroller and the DHT22 sensor was used as the temperature and humidity sensor. This study successfully implemented an IoT system in a duck egg incubator. The test results showed that temperature and humidity data can be read on the blynk application on a smartphone. Temperature and humidity in the incubator can be monitored in real time so that the process of monitoring the performance of the duck egg incubator becomes easier and more practical. This is very useful in increasing the efficiency and effectiveness of the device's performance.

**Keywords**: Humidity; Incubator; Internet of Things; Smartphone; Temperature

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## 1. INTRODUCTION

Technological developments are very beneficial in various sectors. In the livestock sector, technology can be applied to the use of egg incubators. Important elements in the process of hatching eggs include humidity and temperature. An egg incubator can work well if it is equipped with constant temperature and humidity settings [1,2,3,4]. The mechanism of this incubator is to warm the eggs as they were incubated by the their mother so that the eggs can hatch [5]. Egg incubator requires a temperature of around 36°C-39°C for the egg hatching process to be successful [6]. Egg incubators are usually used by duck breeders since ducks do not incubate their own eggs. Duck eggs are left anywhere after the mother duck takes out her eggs.

The busyness and high mobility of humans causes limited time to monitor the situation and condition of the egg incubator. A temperature and humidity monitoring system is needed in incubator development so that breeders can check the temperature and humidity of the incubator anytime and anywhere. The need to monitor these situations and conditions encourages people to create tools that can monitor in real time anywhere and anytime. Monitoring egg incubators can use Atmega8 as a microcontroller and SHT11 sensors as temperature and humidity sensors [7], microcontroller–PIC 16F877A and LM35 temperature sensor [8],Raspberry Pi with DHT11 sensor [9] and AT89S51 Microcontroller [10].

Internet of Things (IoT) technology can be applied to designing an incubator temperature and humidity monitoring system so that it can be monitored remotely using an internet-connected smartphone [11]. IoT technology has been applied to baby incubators [12,13]. This study aims to apply IoT technology to a duck egg incubator monitoring system using the NodeMCU ESP8266 as a microcontroller and a DHT22 sensor as a temperature and humidity sensor. All monitoring activities based on IoT technology with monitoring media using the blynk application on smartphones are expected to be able to monitor temperature and humidity in real time so that the process of hatching duck eggs through the incubator becomes more efficient.

## 2. RESEARCH METHOD

### 2.1 System Design

The system design stage is divided into two, namely hardware and software design. The hardware consists of a duck egg incubator, NodeMCU ESP8266 as a microcontroller, a DHT22 sensor, which is used to detect temperature and humidity in the incubator, two 5 watt lamps as heaters, one channel relay and a smartphone as a display of temperature and humidity information. The block diagram of the duck egg incubator monitoring component is shown in Figure 1 and the mechanical design of the egg incubator can be seen in Figure 2. The software consists of the Arduino IDE software and the blynk application. Making the program algorithm is done with the Arduino IDE software. In this section, programming is carried out to determine the maximum temperature and humidity percentage in the incubator. The NodeMCU Program Flowchart is shown in Figure 3. Testing of the duck egg incubator was carried out in two stages, namely direct observation through the information on the LCD and through notifications sent by the system to the blynk application on the smartphone.

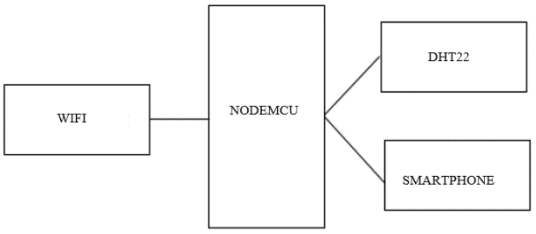


Figure 1. Block Diagram of Duck Egg Incubator Monitoring Components

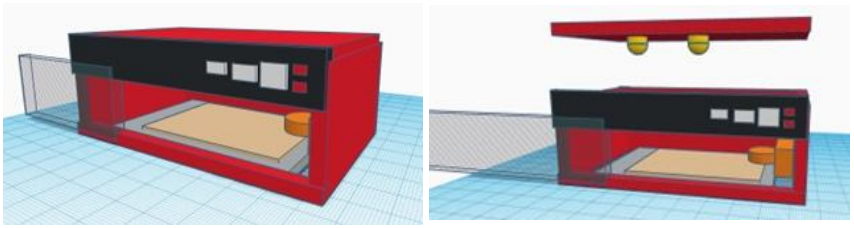

Figure 2. Duck Egg Incubator Design

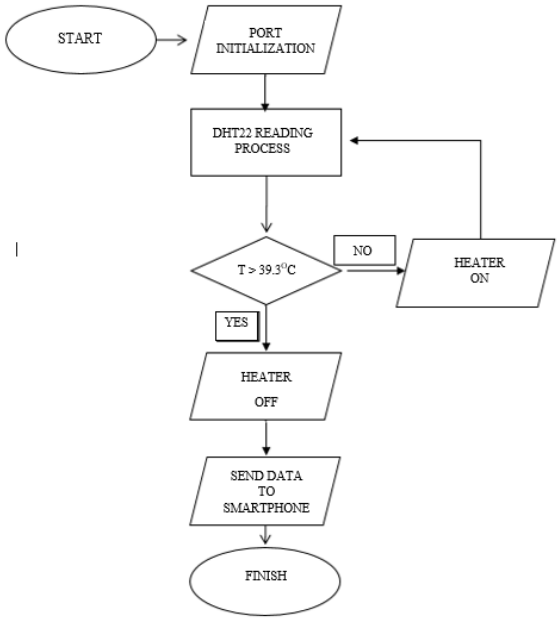

Figure 3. NodeMCU Program Flowchart

## 3. RESULT AND DISCUSSION

### 3.1 Interface System Implementation

The Internet of Things (IoT) based duck egg incubator uses the NodeMCU ESP8266 as a microcontroller and sends sensor data to the blynk application on an internet-connected smartphone. The DHT22 sensor is used as a temperature and humidity reader in the incubator and a one channel relay is used to control the lights. The configuration script for this system program can be seen in program code 1.

Program Code 1.
Library Declaration

```
#define BLYNK_PRINT Serial
#define BLYNK_AUTH_TOKEN
#include <LiquidCrystal_I2C.h>

LiquidCrystal_I2C lcd(0x27,16,2);
#include <SPI.h>
#include <ESP8266WiFi.h>
#include <BlynkSimpleEsp8266.h>
#include <DHT.h>
```

Program code 1 explains the library declaration contained in the Arduino IDE with the NodeMCU ESP8266, namely include which means input or input to the program code, here there are various kinds of input, the first of which is the DHT22 sensor, the blynk application and the wifi source library.

Program Code 2.
Pin Initiation

```
#define DHTPIN 2          // D4 pin
#define RELAY D5

#define DHTTYPE DHT22   // DHT 22, AM2302, AM2321
DHT dht(DHTPIN, DHTTYPE);
BlynkTimer timer;
```

Program code 2 describes the pin initiation connected to the NodeMCU ESP8266 microcontroller, the relay1 pin is connected to gpio 14 and the DHT22 sensor data pin is connected to gpio 2.

Program Code 3.
Internet and Blynk Connection

```
// You should get Auth Token in the Blynk App.
char auth[] = "HfMZGaFTt38CfcaoQZkHxwa7f6MGJC_0";

// Your WiFi credentials.
// Set password to "" for open networks.
char ssid[] = "Incubator";  //Enter your WIFI Name
char pass[] = "Incubator";  //Enter your WIFI Password
```

The results of program 3 are shown in Figure 4.

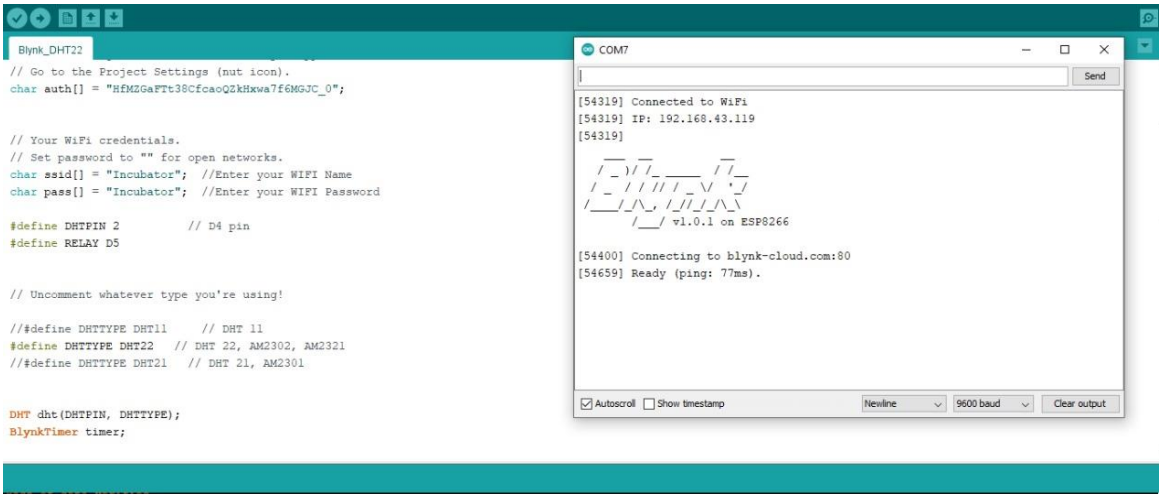


Figure 4. Connecting Internet and Blynk

Figure 4 shows that the NodeMCU ESP8266 tries to connect to an available wifi so it can connect to the internet. Temperature and humidity sensors can be read on the blynk application after connecting to the internet.

Program Code 4.
Virtual Pin Initiation

```
void sendSensor()
{
  float h = dht.readHumidity();
  float t = dht.readTemperature(); // or dht.readTemperature(true) for Fahrenheit

lcd.backlight();
lcd.setCursor(0,0); lcd.print("Temperature"); lcd.setCursor(11,0); lcd.print(t);
lcd.setCursor(0,1); lcd.print("Humidity"); lcd.setCursor(11,1); lcd.print(h);

  if (isnan(h) || isnan(t)) {
Serial.println("Failed to read from DHT sensor!");
    return;
  }
  // You can send any value at any time.
  // Please don't send more that 10 values per second.
Blynk.virtualWrite(V5, h);
Blynk.virtualWrite(V6, t);
}
```

Program code 4 shows the initiation of the virtual pin on blynk, namely virtual5 which is connected to the DHT22 sensor, namely humidity, virtual6 which is connected to the DHT22 sensor, namely temperature. Display results of temperature and humidity on LCD be seen in Figure 5.


Figure 5. Display results of temperature and humidity on LCD

Program Code 5.
Setup Code Reading

```
void setup(){
Serial.begin(9600);
Blynk.begin(auth, ssid, pass);
dht.begin();
lcd.begin();

// Setup a function to be called every second
timer.setInterval(1000L, sendSensor);
pinMode(D5,OUTPUT);
}
```

Program code 5 shows void setup. Void Setup functions as an initial setting for every Arduino IDE program that is created and used to register libraries and pins that will be used and run once.

Program Code 6.
Main Code to Run Repeatedly

```
void loop(){
  float h = dht.readHumidity();
  float t = dht.readTemperature(); // or dht.readTemperature(true) for Fahrenheit
  if (t > 39.3 ){
digitalWrite(D5, LOW);
Blynk.notify("Alert : Temperatureis over");
} else{
digitalWrite(D5,HIGH);
  }
Blynk.run();
timer.run();
}
```

Program code 6 shows a void loop. The void loop controls every input command to the program and executes every output command as long as the program is running. Void Loop functions to run every program command made in the Arduino IDE. Program code 6 shows that the lights work according to the program, when the temperature inside the egg incubator is more than 39.3ºC relay (D5, LOW) inactive and the light goes out and (D5, HIGH) active the light comes back on when the temperature inside the egg incubator is less than or equal to 39.3ºC.

### 3.2 Display Results of IoT on Smartphones

The following is a display of the blynk application system which is the most important part of monitoring. This application makes it easy for all users to monitor the hatching incubator remotely without having to go to the hatchery incubator.

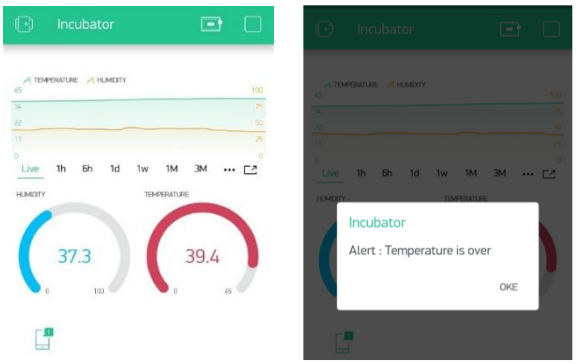


Figure 6. Notification Display on the Blynk Application

Figure 6 shows the display of the temperature and humidity values of the duck egg incubator in the blynk application on a smartphone.

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3.3 Tool Implementation

When the egg incubator is connected to 220 volt electricity, the light will turn on and the DHT22 sensor will read the temperature and humidity inside the incubator which will be sent to the blynk application to be used as a reference for heating execution via NodeMCU. The lights on the incubator are two 5 watt lamps. When NodeMCU is active, the wifi module will connect to the internet connection that has been set and send temperature and humidity values to the blynk application on the smartphone. This test is carried out by observing the state of the lamp at a certain temperature in the incubator. This test aims to maintain temperature stability according to the characteristics of the eggs being hatched. The results of this test can be seen in Table 1.

Table 1. Testing Lamp Conditions at Certain Temperatures

| No. | Temperature (°C) | Relay | Lamp |
|---|---|---|---|
| 1 | 37.5 | Active | On |
| 2 | 37.6 | Active | On |
| 3 | 37.7 | Active | On |
| 4 | 37.8 | Active | On |
| 5 | 37.9 | Active | On |
| 6 | 38.0 | Active | On |
| 7 | 38.1 | Active | On |
| 8 | 38.2 | Active | On |
| 9 | 38.3 | Active | On |
| 10 | 38.4 | Active | On |
| 11 | 38.5 | Active | On |
| 12 | 38.6 | Active | On |
| 13 | 38.7 | Active | On |
| 14 | 38.8 | Active | On |
| 15 | 38.9 | Active | On |
| 16 | 39.0 | Active | On |
| 17 | 39.1 | Active | On |
| 18 | 39.2 | Active | On |
| 19 | 39.3 | Active | On |
| 20 | 39.4 | Inactive | Off |
| 21 | 39.5 | Inactive | Off |

Table 1 shows that the lights work according to the program, when the temperature inside the egg incubator is more than 39.3ºC the light goes out and the light comes back on when the temperature inside the egg incubator is less than or equal to 39.3ºC. When the temperature inside the incubator is more than 39.3ºC, a notification will be sent to the blynk application on the smartphone. Notification display on the blynk application can be seen in Figure 6. This is very influential in maintaining temperature stability in the incubator to suit the characteristics of the eggs being hatched.

## 4. CONCLUSION

The temperature and humidity values inside the egg incubator can be monitored via the blynk application on a smartphone connected to the internet. Two lamps with a power of 5 watts each controlled by a 1 channel relay function properly. The light turns on when the temperature of the duck egg incubator is less than or equal to 39.3ºC and the light goes out when the egg incubator temperature is more than 39.3ºC. When the temperature inside the egg incubator is more than 39.3ºC, a notification will be sent to the blynk application on the smartphone.

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## REFERENCES

[1] M. B. Ramli, H. P. Lim, M. S. Wahab, and M. F. M. Zin, "Egg Hatching Incubator Using Conveyor Rotation System," *Procedia Manuf.*, vol. 2, no. April 2016, pp. 527–531, 2015, doi: 10.1016/j.promfg.2015.07.091.

[2] T. Saka, "DESIGN AND IMPLEMENTATION OF BY SAKA , Taofiq Olatunji ENGINEERING .," no. December, 2020, doi: 10.13140/RG.2.2.10003.91688.

[3] A. Al-Zaidi, "Optimum design calculation of eggs incubator," *Tech. Rom. J. Appl. Sci. Technol.*, vol.

4, no. 3, pp. 1–10, 2022, doi: 10.47577/technium.v4i3.6282.
[4] S. Purwanti, A. Febriani, M. Mardeni, and Y. Irawan, "Temperature Monitoring System for Egg Incubators Using Raspberry Pi3 Based on Internet of Things (IoT)," *J. Robot. Control*, vol. 2, no. 5, 2021, doi: 10.18196/jrc.25105.
[5] A. B. Umar, K. Lawal, M. Mukhtar, and M. S. Adamu, "Construction of an Electrically-Operated Egg Incubator," vol. 5, no. 1, pp. 1–18, 2016.
[6] . G. A., "Design, Construction and Performance Evaluation of an Electric Powered Egg Incubator," *Int. J. Res. Eng. Technol.*, vol. 03, no. 03, pp. 521–526, 2014, doi: 10.15623/ijret.2014.0303097.
[7] I. Nurhadi and E. Puspita, "Design of an Automatic Egg Incubator Based on ATMega8 Microcontroller Using SHT 11 Sensor," 2009.
[8] M. Suruthi and S. Suma, "Microcontroller Based Baby Incubator Using Sensors | Semantic Scholar," pp. 12037–12044, 2015, doi: 10.15680/IJIRSET.2015.0412050.
[9] F. Ali and N. A. Amran, "Development of an Egg Incubator Using Raspberry Pi for Precision Farming," *Int. J. Agric. For. Plant.*, vol. 2, no. February, pp. 40–45, 2016.
[10] M. F. Nuryanto *et al.*, "digilib . uns . ac . id," 2010.
[11] I. Ahmad, F. Ahmad, M. K. Domadi, and M. N. Hamzah, "Internet of Things ( IoT ) for Monitoring and Controlling the Integrated Incubator Using PLC with Raspberry Pi Gateway," *Int. J. Emerg. Eng. Res. Technol.*, vol. 8, no. 4, pp. 6–12, 2020, [Online]. Available: https://www.researchgate.net/publication/344878820_Internet_of_Things_IoT_for_Monitoring_and_Controlling_the_Integrated_Incubator_Using_PLC_with_Raspberry_Pi_Gateway
[12] D. Sivamani, | R Sagayaraj, | R Jai Ganesh, and A. N. Ali, "Smart Incubator using Internet of Things," *Int. J. Mod. Trends Sci. Technol.*, vol. 04, no. September, 2018, [Online]. Available: http://www.ijmtst.com/vol4issue9.html
[13] F. Fahmi, W. Shalannanda, I. Zakia, and E. Sutanto, "Design of an IoT-based smart incubator that listens to the baby," *IOP Conf. Ser. Mater. Sci. Eng.*, vol. 1003, no. 1, 2020, doi: 10.1088/1757-899X/1003/1/012153.

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