SSRG International Journal of Electrical and Electronics Engineering
ISSN: 2348 – 8379 /doi:10.14445/23488379/IJEEE-V7I10P102
Volume 7 Issue 10, 12-15, October 2020

Remote Monitoring and Control of Poultry Farm based on IoT Technology

Tran Ngoc Son#, Le Thi Hoan#, Nguyen Cao Cuong#, Pham Van Minh#, Roan Van Hoa#

#*University of Economics - Technology for Industries, Viet Nam*

Abstract

The Internet of Things (IoT) technology, based on the wireless sensor network, is developing rapidly and permeating into agriculture, including poultry farming. Standard chicken raising can bring high economic efficiency to farmers and farm owners. However, the problem is always facing the current disease situation in chickens. Temperature and humidity are the most important factors for chickens, especially chicks. Because an inappropriate temperature directly or indirectly affects the health of the chickens, it increases the rate of diarrhea, respiration and mortality if the chick is under heat stress. In this paper, we focus on the application of IoT technology for remote monitoring and management of poultry farm parameters. Users can monitor the temperature, humidity and images of chickens in the barn, control the temperature by turning on and off the light on the web. Simultaneously, it helps solve the actual problem of when the module will automatically turn on or off the lights to ensure the right temperature is maintained. In addition, when detecting someone entering the cage, the system will issue an alert and record the time diary so that the user can review it.

Keywords — *Internet of Things (IoT), Sensors, Esp8266, Smart livestock farming.*

I. INTRODUCTION

The environmental conditions monitoring and control's ability is crucial and demands a good research level in fields ranging from climate change in agriculture and zoology. According to the world's agricultural produce survey, chicken is among the most favorite products. It is a nutrient-rich food providing high protein, low fat, low cholesterol, and low energy than other kinds of poultries. From the last few years worldwide, there has been an increased level of awareness regarding food products' safety like chickens, and there has been a high demand for good quality and quantity chicken food. Along with the rapid development of IoT technology, IoT has become an important development direction in a new round of industrial revolution and is an essential driving force of industrial structure reformation in the world [1-3]. The safety equipment targeted is the safety helmet that the worker uses inside the mine [4]. IoT technology used in the way of monitoring the parameters of water which could be viewed online using the mobile the app, the system will also help to control the water wastage by automatically tripping the Water valve after a certain threshold set by the user [5]. Because the IoT industry's development is a primary engine power for realizing the intelligence and modernization of farming and livestock farming, IoT technology used in agricultural production has gotten more and more attention from the countries worldwide [6]. For example, Hua Li designed and developed a remote monitoring system based on IoT technology for the henhouse environment to raise management efficiency and lower production costs [7]. IoT technology can significantly influence smart livestock farming by using real-time sensing, data analysis, information technology, and decision-making to improve animal health, welfare, and production efficiency.

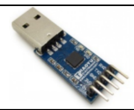
From the above analysis, the paper proposes to design the poultry farm remote control and monitoring system based on IoT technology with the main contributions: Monitoring and controlling the temperature and humidity in the barn; Monitoring pictures of chickens' activities and expressions; Detect someone moving in front of the door, issue a warning and log to review the video as needed.

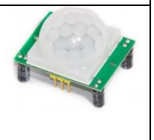
The rest of the paper is organized as follows. The second section introduces the proposed model, an IoT-based livestock management system. The experimental results will be given in the third section. Finally, the fourth section is the conclusions of this paper.

II. LIVESTOCK MANAGEMENT SYSTEM BASED ON IoT

A. Electronic Components

TABLE I: Detailed table of electronic components

No.	Name of electronic components	Total	Picture
1	USB UART CP2102	1	
2	Wifi transceiver circuit ESP8266 V7	1	
3	Foot soles ESP8266 V7	1	
4	DHT22 temperature and humidity sensor to the foot	1	

5	Module 2 relay activated H/L (5VDC)	1	
6	Breadboard	2	
7	Wire plug male, male, female	20	
8	Pressure reducing circuit 3.3V AMS1117	1	
9	Motion temperature sensor PIR HC-SR501	1	

B. *System Architecture*

a) Equipment assembly design

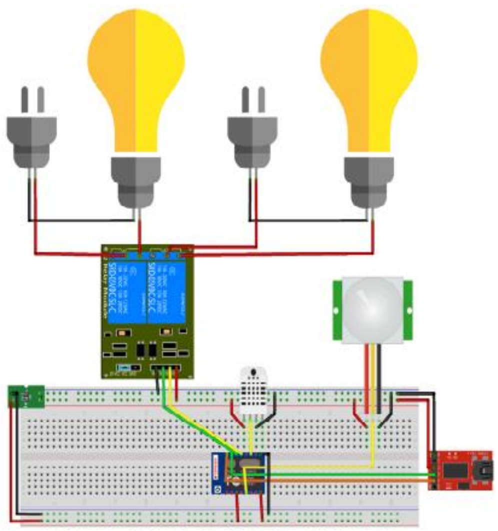


Fig 1: Control circuit diagram

Connect the heat sensor, relay and motion sensor to the 5V source. ESP8266 circuit is connected to a 3.3V source. Signal wire of DHT22 sensor, relay and PIR sensor is connected to ESP8266 circuit as follows:

ESP8266 v7	Connection
GPIO02	Signal DHT22
GPIO04	Relay 1
GPIO05	Relay 2
GPIO14	Signal PIR

b) Process control circuit performed

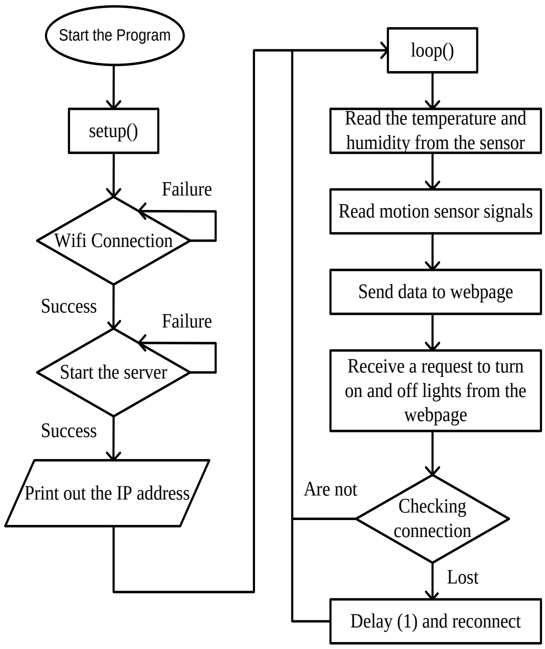


Fig 2: Processed by the controller circuit

First, you need to set the wifi name and password so that the esp8266 circuit can connect to wifi.
const char ssid = "Wifiname";*
const char password = "Wifipassword";*

Create a server port 80
#define LISTEN_PORT 80
WiFiServer server(LISTEN_PORT) ;

In the setup () function, the ESP8266 connects to the wifi network
WiFi.begin(ssid, password);

while(Wifi.status()!=WL_CONNECTED)
delay(500); Serial.print(".");

Then, start the server and print the IP address to the Serial port
server.begin();
Serial.println(WiFi.localIP());

In the loop (), read the temperature and humidity from the sensor
temperature = dht.readTemperature();
humidity = dht.readHumidity();

At the same time, read the motion sensor's signals to send to the webpage
int new_motion_sensor_state = digitalRead(14);

c) System architecture

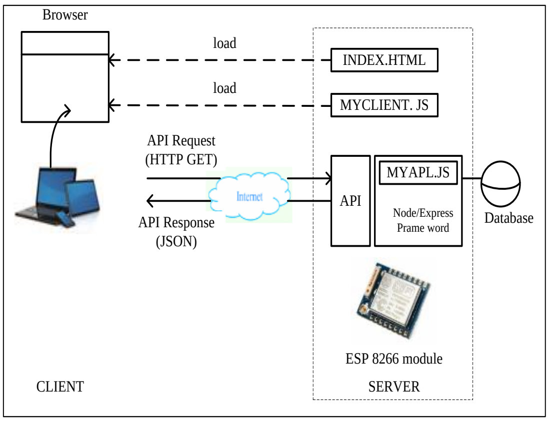


Fig 3: System architecture

myapi.js – is a server-side Javascript code that uses Node and Express framework to create a simple web server.

index.html – web interface page displayed to the user.

myclient.js – The Javascript code processes when the HTML page is loaded, connecting the interface and the server. It calls to API server running on the ESP8266 module, retrieves data and displays it on the web.

C. Monitor Screen

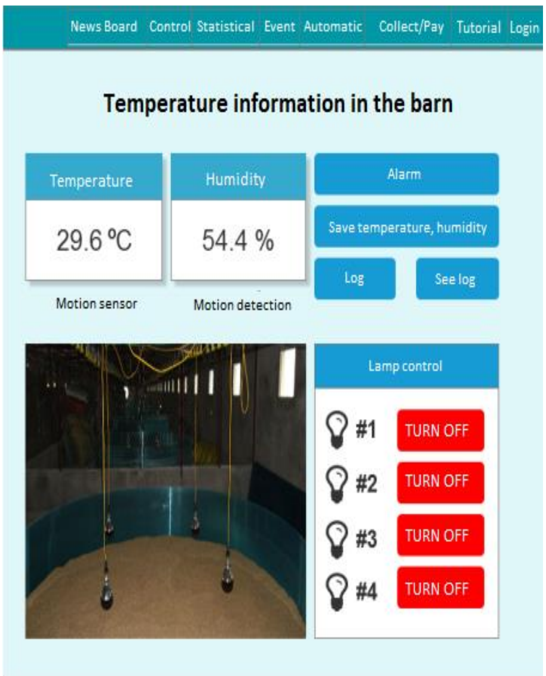


Fig 4: Monitor screen

The monitor screen contains information about current temperature, humidity in the house and motion sensor information.

When motion is detected, the system will sound an alarm and record the time.

Users can also turn on and off lights right on the web with light control buttons.

The system automatically records the current temperature and humidity in the house every hour. The user can also use the button to save the temperature or record the time if required.

D. Statistics Screen

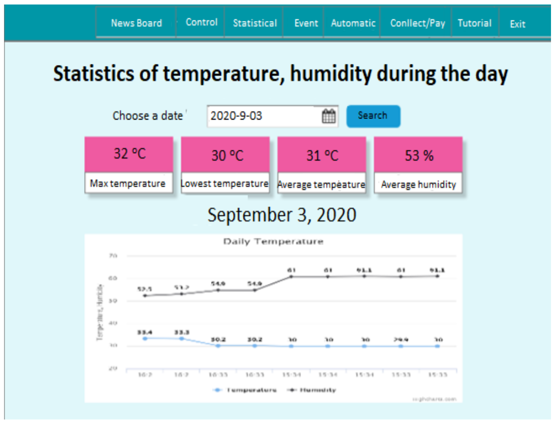


Fig 5: Monitor statistics of temperature, humidity

III. THE PROBLEM OF AUTOMATIC LAMP ADJUSTMENT

A. Modeling the Problem

Suppose, in a barn with n bulbs, when L_1, L_2,…, L_n are turned on, the house's temperature will increase by an amount t_1, t_2,…, t_n °C respectively. Similarly, when the bulbs are turned off, the temperature will also decrease by an amount of t_1, t_2, ..., t_n °C (data t_1, t_2, ..., tn can be determined based on an actual survey).

The temperature sensor is located in the house's center to know what the current temperature is in the house. Because the sensor is placed in the middle, the closer the bulb is to the sensor, the greater the temperature effect.

The user needs to enter maximum and minimum temperatures to maintain the proper temperature for the flock. The system will calculate which lamps to turn on or off to reach the right temperature.

- In case 1, if the current temperature is less than the minimum allowable temperature (MIN), we suggest turning on an extra light bulb to increase the temperature in the house.
- Case 2, if the current temperature is greater than the maximum allowable temperature (MAX), we suggest turning off the light bulb to reduce the house's temperature.
- Case 3, if the present temperature is within the allowable range, no further action is required.

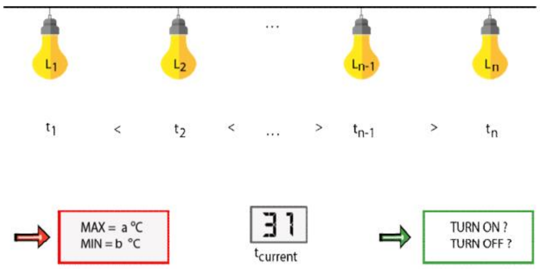


Fig 6: Model of lamp adjustment problem

B. Solution

a) Question

The above problem becomes, for a sequence of positive numbers t_1, t_2, ..., t_n. Find the subset of that sequence summed by S ($S = t_{MIN} - t_{current}$).

Input: Sequence of numbers t_1, t_2, ..., t_n and sum S

b) The idea of using dynamic planning

Set f [i, j] = true if it is possible to find the sum j from the sub-sequence of elements $t_1, t_2, \ldots, t_i$. Otherwise, f [i, j] = false.

If f [i, S] = true, it means that we can find the substring. If the result is false, we change S by incrementing S by 1 until $S \leqslant t_{MAX - tcurrent}$

Calculate f [i, j] using the formula: f [i, j] = 1 if f [i – 1, j] = 1 or f [i – 1, j – t [i]] = 1.

c) Algorithm settings

Pseudocode:

```
procedure sub setup
   For i := 0 to n do                          {1}
      set f[i][0] to true;                     {2}
   For i := 1 to n do                          {3}
   For i := 1 to sum do                        {4}
      set f[i][j] to f[i-1][j] or f[i-1][j-A[i];   {5}
      return f[n-1][sum];
      end
```

d) Apply to the chicken farm

Fig 7: Experimental images when applying at chicken farms

IV. CONCLUSIONS

The Modules achieve the set goals and meet the needs, in line with reality. Users can monitor the temperature, humidity and pictures of chickens in the barn, control the temperature by turning on and off the light on the web. Also, solve the real problem of when the module will automatically turn on or off the lights to ensure the right temperature is maintained. In addition, when detecting someone entering the cage, the system will issue an alert and log the time so that the user can review that time.

With cheap components and materials, this module is perfectly suitable for chicken farmers, helping the farmer monitor the chickens more easily and effectively, restricting access to the cage to avoid spread germs.

ACKNOWLEDGMENT

This study was supported by the University of Economics - Technology for Industries, Viet Nam; http://www.uneti.edu.vn/.

REFERENCES

[1] Da Xu Li, He W, Li S, "*Internet of things in industries: A survey*," IEEE Transactions on Industrial Informatics, 0(4): 2233-2243, 2014.

[2] Xiong Benha, Yang Zhengang, Yang Liang, Pan Xiaohua, "*Review on application of Internet of Things technology in animal husbandry in China*," Transactions of the Chinese Society of Agricultural Engineering, 2015 (S1): 237-246.

[3] S B Aanandh, Chinmaya Kar, Nihal Siddiqui, "*Safety Information Modeling: Smart Safety Devices & Internet of Everything*," IJISA International Journal of Intelligent Systems and Applications, Vol. 7 (2), pp. 41-49, 2015.

[4] Anay Majee, "*IoT Based Automation of Safety and Monitoring System Operations of Mines*," SSRG International Journal of Electrical and Electronics Engineering (SSRG – IJEEE), Volume. 3. Issue. 9, pp. 17-21, September 2016.

[5] Muhammad Moazzam Ali, Mashal Jabeen, "*IoT Based Monitoring and Control of Water Parameters*," SSRG International Journal of Electrical and Electronics Engineering (SSRG – IJEEE), Volume. 7, Issue. 8, pp. 17-21, August 2020.

[6] Zhao qi, "*Research on application of Internet of Things technology in Pig industry of rural areas*," MS thesis, Jiangxi agricultural university, Nanchang, Jianxi, China, 2014.

[7] Li. H, Wang. H, Yin. W Li. Y, Qian. Y, Hu. F, "*Development of a Remote Monitoring System for Henhouse Environment Based on IoT Technology*," Future Internet, 7: 329-341. Accessed June 6, 2016.

[8] Kolapo Adetomiwa, "*Adoption And Utilization of Artificial Intelligence (Ai) In Poultry Production: Evidence From Smart Agricultural Practices In Nigeria*" SSRG International Journal of Agriculture & Environmental Science 7.3 (2020): 46-54.