

Internet of Things for Monitoring and Controlling Ammonia Gas and Temperature in Chicken Farms

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Abstract— This research aims to develop a tool to monitor and control temperature and ammonia gas levels in chicken farms. Ammonia gas (NH₃) is an indicator of pollution that is harmful to the health of chickens, humans, and the environment. Ideal ammonia levels in cages should not exceed 30 ppm, while the safe threshold for chickens and humans is 25 ppm. High temperatures can increase ammonia levels, thus negatively affecting the health and productivity of broilers. The developed tool uses an MQ135 sensor to detect ammonia gas levels and a DHT22 sensor to measure temperature and humidity. The data obtained will be processed by ESP32 as a microprocessor. The measurement results are displayed on the LCD, and the tool is equipped with a WiFi module to connect it to the internet. A DC fan serves as an automatic control system to keep the temperature and ammonia gas levels within safe limits. Through an application built with MIT App Inventor, users can access real-time temperature data and ammonia gas levels. With this system, it is expected that chicken health and farm productivity can increase, and the risk of pollution due to ammonia gas can be minimized. This research is expected to be a reference for the development of monitoring and control technology in the livestock sector, providing effective solutions for farmers to create a healthier environment for chickens.

Keywords: NodeMCU, MQ135, DHT22, Firebase, MIT

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I. INTRODUCTION

Internet of Things or often called IoT is an idea where all objects in the real world can communicate with each other as part of a unified system using the internet as a connection. internet as a connector. How the Internet of Things Works is by utilizing an argument programming where each command argument produces an interaction between fellow machines.it produces an interaction between fellow machines that are connected automatically without human intervention and at any distance [1]. One of the fields that has been researched in the application of chicken farming IoT.

Although broiler chicken is a good and promising business business, however, on farms in Indonesia, especially in cages, still has some problems. One of them is the pungent smell of the cage. odor. This is due to the absence of monitoring temperature and ammonia gas levels in chicken coops.

Ammonia gas is a chemical compound with the formula NH₃ which is one of the indicators of air pollution in the form of odor, which is a colorless gas with a pungent odor, one of the compounds that cause the smell of chicken manure because of the decomposition process by bacteria in chicken manure. Ammonia is a chemical compound that has soluble properties. When in the form of gas, it has properties that can cause irritation and burning. Excessive ammonia levels in the cage

can Ammonia levels in the cage should not be more than 30 ppm, because the threshold level of ammonia in humans and chickens is 25 ppm. The pungent smell of the cage is influenced by the increase in ammonia gas levels due to the influence of temperature, the ideal threshold for temperature is 30 °C [3]. ideal threshold for temperature is 30°C [3]. This causes development and health of broiler chickens to be disrupted so that the production of the farm becomes decreased due to the gas content and temperature in the chicken coop is not stable

II. METHODS AND MATERIALS

A. Method

The method used is the device design method hard (hardware) and software (software). This tool consists of several components, including the power supply circuit as a voltage source, ESP 32 for data processing, DHT-22 as a temperature detector in chicken farms broiler, MQ-135 as a detector for livestock ammonia gas levels.

B. Material

1. Ammonia

Ammonia gas is a gas that is harmful to animal and human respiration, so farmers must know the gas levels in the cage and farm environment. Ammonia gas content in the cage has a certain tolerance limit for chickens that can reduce their productivity. Cage attendants can smell ammonia at around 20 ppm. The maximum level of ammonia that can be tolerated for 8 hours is 25 ppm. Ammonia concentrations reaching 20-25 ppm can actually trigger respiratory diseases in chickens. Ammonia production of more than 25 ppm can also cause livestock to experience oxidative which can affect meat quality.

2. Firebase

Firebase is an application development platform provided by Google. Firebase has several features, including a realtime database that is stored in the cloud, this service uses an Application Program interface (API), data is stored as JSON and synchronized in real time to each connected client, if there are changes to the stored data, then each connected user will receive data updates automatically [5]. Firebase uses the HTTPS protocol to communicate between client applications and Firebase services. In this tool, Firebase is used as an intermediary media that distributes sensor values to the application. The logo can be seen below.



Fig 1: Firebase

3. MIT App Inventor

MIT App Inventor is opensource software used to create applications on the web-based android operating system. The application created using MIT App Inventor will later become a bridge interface or user interface to the queuing system that will be created [9].

MIT App Inventor supports connectivity to IoT devices via protocols such as Bluetooth, Wi-Fi, and HTTP. In this tool, the application is made with MIT App Inventor by using HTTP and TCP/IP network protocols to send and receive data from the server. The logo of MIT App Inventor can be seen in the picture below.



Fig 2: MIT App Inventor

4. Tool Schematic

Figure 2 above is a series of ammonia gas monitoring systems, temperature and humidity using Spreadsheet. Nodemcu will read and run the program that has been entered into it. The MQ135 sensor will detect ammonia gas levels in the chicken coop. The program will work continuously according to what is in the nodemcu and can be controlled and monitored with a smartphone using MIT AppInventor.

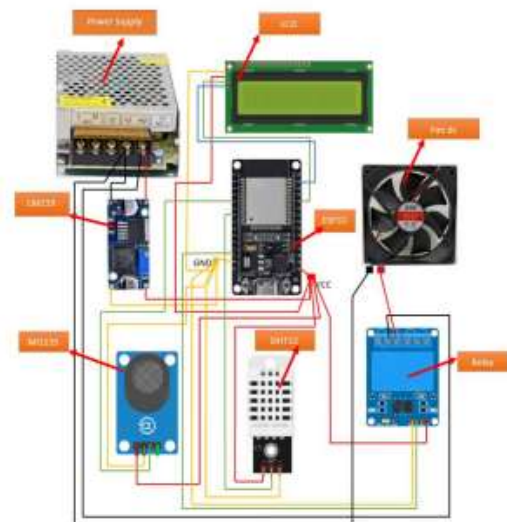


Fig 3: Overall circuit

5. Sensor MQ135

Gas sensors are electronic devices that can produce electrical signals as a function of interaction with chemical compounds, in this case gas or vapor of organic compounds [10]. The MQ-135 sensor can function to detect the presence of ammonia gas. Basically this sensor consists of an aluminum tube surrounded by silicon and at its center there is an electrode made of aurum where there is a heating element. When the heating process occurs, the coil will be heated so that the SnO₂ ceramic becomes a semiconductor or as a conductor so that it releases electrons and when ammonia is detected by the sensor and reaches the aurum electrode, the MQ-135 sensor output will produce an analog voltage [11].



Fig 4: MQ135 Sensor

6. Sensor DHT22

The DHT 22 sensor is a combined sensor of temperature and humidity sensors whose output is a calibrated digital signal [12]. DHT22 sensors and the like are widely used for temperature monitoring [7].



Fig 5: Sensor DHT22

7. NodeMCU (ESP32)

ESP-32 is a microcontroller module introduced by Espressif System that functions to control and accommodate all ports and ICs so that it can control the driver so that the device or port connected to the microcontroller can function properly. Because the ESP-32 also has a Wi-Fi module on its chip, it is very supportive for creating Internet of Things web applications and systems and can connect to internet networks



Fig 6: NodeMCU (ESP32)

C. Research Flowchart

The figure below is the stages used in this research, which starts from the study of literature, testing, analysis and conclusion in this research. in the chicken coop and temperature using a tool to measure to measure ammonia gas levels and temperature.

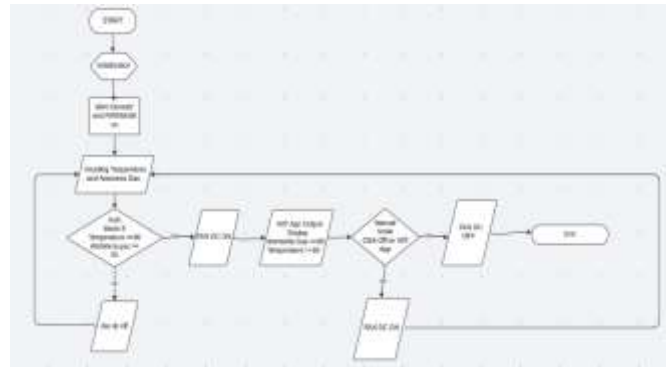


Fig 7: Flowchart

III. RESULT AND DISCUSSION



Fig 1: Implementation of Tools

Testing is done to see if the tool is functioning properly and the sensor can read the gas and temperature on the chicken farm as well as monitoring and controlling through the android application. The test results that have been measured are used as data for analysis, from the results of these tests and measurements as an evaluation of the information obtained to be able to achieve maximum results.

This testing process is carried out by testing whether the data from the MQ135 and DHT22 sensors can send information properly, as well as displaying data on the MIT App Inventor. displaying data on the MIT App inventor

3. 1 NodeMCU Testing (ESP32)

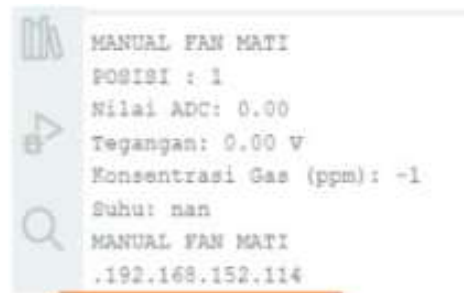


Fig 2: Testing Nodemcu with smartphone

the connection display in the serial monitor gets the IP connected to the ESP32 which is 192.168.152.114.

3.2 Testing ESP32 Connection with Firebase

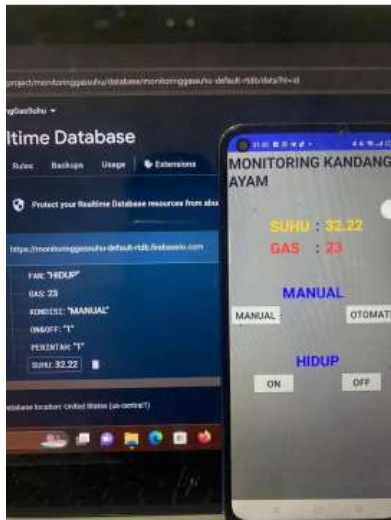


Fig 3: Testing ESP32 with Firebase

In the realtime database data when the tool is running, it can be seen that the the value in the real-time database and MIT smartphone is the same. then the tool and fan mode conditions are also appropriate.

3.3 Device testing

a. Ammonia Gas Sensor (MQ135)

testing ammonia gas conditions in excess of the program setting of 25 Ppm, from 5 times the test obtained gas levels 30-37 so that the dc fan starts

TABLE I
SOIL MOISTURE SENSOR TESTING

No	Ammonia Gas Level Detected (ppm)	Time	Fan Condition on Tool
1	30 Ppm	14:36:15 WIB	ON
2	36 Ppm	14:38:20 WIB	ON
3	37 Ppm	14:40:23 WIB	ON
4	33 Ppm	14:42:22 WIB	ON
5	36 Ppm	14:44:21 WIB	ON

b. Temperatur Sensor (DHT22)

TABLE I
TEMPERATURE READING

No	Ammonia Gas Level Detected (ppm)	Time	Fan Condition on Tool
1	24,95 *C	14:36:15 WIB	OFF
2	25,93 *C	14:38:20 WIB	OFF
3	29,90 *C	14:40:23 WIB	OFF
4	30,88 *C	14:42:22 WIB	ON
5	33,88 *C	14:44:21 WIB	ON

Excess temperature conditions from the program settings are 30 °C fan on, from 5 times the test obtained 3 times the temperature test ranged from 24-29 °C so that the dc fan was off and 2 tests of temperature readings ranged from 30-33 °C so that the dc fan was on.

IV. CONCLUSION

From creating an Internet of Things (IOT) monitoring system and controlling ammonia gas and temperature in broiler chicken farms, it can be withdrawn Conclusion as follows:

1. After making the tool, it was found that this tool can measure ammonia gas with an error of 6%, and temperature with an error of 0.9%, and this tool can be implemented for chicken farming.
2. In designing this tool all components are connected correctly and can measure ammonia gas and temperature on chicken farms, and can be used monitoring and controlling on a smartphone using MIT App Inventor.
3. In this tool for sending data to Firebase connect by doing checking the firebase that has been created on Google's FireBse with check the data in real time on the database and then the data is available seen with a firebase delay of 0.1-1 second.
4. The microcontroller used is NodeMCU ESP32, ESP32 di Connect using WiFi, as monitoring and controlling can be done remotely on the MIT App Inventor dashboard display smartphone
5. In the application of monitoring and controlling ammonia gas and temperature Chicken farms have succeeded in displaying measurement data obtained from the IoT platform for parameters originating from firebase.

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