IoT-Based System of Monitoring Realtime Air Quality with MQ135 and Automatic Chicken Feeding

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Abstract—IoT technology is useful for chicken farming to control the condition of the farm concerning some problems such as odour, temperature fluctuations and feeding time system. This study used MQ135 to detect ammonia odour level, DHT11 to check room temperature, and RTC3231 to regulate feeding time. The data obtained from the sensor was sent by wemos to the fire base and MySQL to be read on android so that it can be monitored directly by the breeder. When the ammonia level is above normal it will turn on the odour fan. If DHT11 reaches the value above 30°C, it will turn on the cooling fan, and turn on the heating light when the temperature is below 25°C. As RTC3231 sets the time at 07.00 and 14.00, the chicken feeder will automatically open to feed the chickens according to the time set. Table 1 and 2 show that the experiment obtained a value of 100% working well. This study succeeded in monitoring environmental conditions through Android and executing automatic feeding at the predetermined time. Thus, it can be concluded that the use of IoT technology for monitoring and feeding system automation in chicken farms is highly recommended.

Keywords—MQ135, IoT, DHT11, Wemos, Firebase

I. Introduction

The development of information technology is now getting faster, the distance and time is no longer an obstacle because of its widespread use of IO technology [1]. With IoT technology, we can control and monitor the hardware remotely through internet facilities [2]. The use of Android technology is also rife today as done by Saraswati by utilizing the Ease of Android Technology [3]. Ramadhan conducts experiments using IoT with Android to feed broiler chicken via smart phones remotely. Because of the distant location of the chicken farm, he uses IoT to improve the work efficiency of a chicken farmer [4]. The same procedure is applied by Prastisca in her research with which she used IoT to provide fish food automatically so that the fish does not experience a lack of food that can lead to cannibalism and harm the fish farmers [5] [6].

Meanwhile, Munsyi conducts an IOT research to monitor the state of the environment on cattle and chicken farm, especially the levels of carbon dioxide, temperature, air moisture and noise from a distant place. Resultantly, when the farmer is far from the farm, he will receive warning and find out if one or some of those conditions are beyond standard [7] [8]. Similarly in agricultural field, Muangprathub monitors the condition of soil moisture and irrigation remotely by using Mobile Application [9].

In chicken farms, there are some problems such as unpleasant odour that can stress the chicken, unstable temperature and irregular feeding schedule which influence chicken health, and eventually affect the quality of the chicken. These problems can be overcome with the use of the MQ 135 sensor to monitor the level of ammonia in the air for odour and air quality control [10], DHT11 to determine the air temperature and moisture for temperature control [11], and RTC3231 to determine the time for automatic feeding. When those 3 modules are combined with IoT technology using Wemos D1 microcontroller, the result will help chicken farmers to overcome the problems faced [12].

II. Research Methodology

This study used R & D research with 4 characteristics of development in development (R & D)

1. The problem that will be solved is related to innovation or Application of technology in training.
2. Development, Model, Approach, Method, Media and Learning Techniques to petrify the competence of the training participants.
3. Product development must pass the expert test and field test.
4. The results of development, models, approaches, methods, media and learning techniques need to be documented neatly and are reported in accordance with the originality research rules.

Out of all R & D steps, only step 1-9 were used.

R & D research steps

1. Determine potential and problems
2. Collect information
3. Designing product design
4. Product design validation
5. Repair Product Design
6. Product trial
7. Product revision
8. Test usage
9. Product revision
10. Making mass products

In this study, several designs were used, including software and hardware design

1. Software design

![Figure 1: Use Case Diagram](image)

In Figure 1 the Use Case was used to design android applications and android studio to develop products, while in hardware manufacture the study used the Wemos module as a microcontroller, MQ 135 module for odor monitoring, DHT11 module for blade monitoring and RTC 3231 for timing. Firebase data base to store the data is obtained in the sensor module so that later it can be displayed for the monitoring form and using MySQL for the database used in the History form.[13].
There are 2 entities, namely the user and the Smart System where the user can monitor the state obtained by the module in real time and can see the history of events, while the smart system can provide feed when conditions have been planned. Data storage is done with firebase and Mysql because it can get data in realtime[14].

2. Hardware design

![Schematic of Ammonia and Temperature Monitoring Device](image)

The schematic of Figure 2 shows the use of a Wemos microcontroller. There are input sensors in the form of MQ-135 and DHT11. The output results are fan relays, cooling fan relays and heating lamp relays. The MQ-135 sensor functions to monitor ammonia gas levels in the chicken coop and if the ammonia level is more than 25 ppm, the ammonia fan relay will automatically turn on and remove ammonia gas from the cage. Temperature monitoring using a DHT 11 sensor serves to monitor the temperature in the chicken coop. If the temperature in the chicken coop is more than 30°C, the cooling fan relay automatically turns on to lower the coop temperature and vice versa if the temperature is below 25°C, the heating lamp relay automatically turns on to warm the chicken coop. The 9V battery functions as a power source used to power the chicken coop, fan and heating lamp.

![Chicken Feeding Device Schematic](image)

The schematic of Figure 3 is the Arduino Uno microcontroller. There is an input sensor in the form of an RTC DS3231 and four push buttons. The output is an N20 motor and a 20x4 LCD. The RTC sensor DS3231 functions to adjust the schedule for feeding chickens. To set the feed schedule, you can press the push button. The left button function is used to move the cursor to the left, the right button is used to move the cursor to the right, the ok button is used to
select and the finish button is used to end the feed schedule setting. The output date, time and feed schedule will be displayed on the 20x4 LCD.

III. Results and Discussion

![Figure 4. hardware circuit.](image)

In Figure 4 there is an Arduino Uno at the top left which functions to process data when scheduling chicken feeding. At the bottom left there is a 4 channel relay that functions as a switch to turn on or turn off both the fan, lights and feed door. On the top right there is a Wemos D1 R1 which functions to process MQ-135 and DHT11 sensor data. Finally, at the bottom right, there is the RTC DS3231 sensor which is used to regulate feeding according to a predetermined schedule.

![Figure 5. Interface on monitoring system on android](image)

In Figure 5 is a display of conditions where the ammonia is below 25 ppm so that there is normal ammonia data and the status of the fan is off and at a temperature of 30°C and a humidity of 76% the temperature data mentions a cold temperature, the status of the fan is off and the light is on.
Figure 6. Interface on the Event History system that has taken place.

In figure 6. The table above records the history of all occurrences of ammonia conditions, temperatures and times that have occurred. While the table below records the history of feeding and feeding time.

Table 1. MQ135 and DHT11 Sensor Test Results

<table>
<thead>
<tr>
<th>No</th>
<th>MQ 135</th>
<th>Ammonia fan</th>
<th>DHT11 Temperature</th>
<th>Cooling fan</th>
<th>Lamp</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>25 ppm</td>
<td>Turn off</td>
<td>33°C</td>
<td>Turn on</td>
<td>Turn off</td>
</tr>
<tr>
<td>2</td>
<td>20 ppm</td>
<td>Turn off</td>
<td>34°C</td>
<td>Turn on</td>
<td>Turn off</td>
</tr>
<tr>
<td>3</td>
<td>24 ppm</td>
<td>Turn off</td>
<td>28°C</td>
<td>Turn off</td>
<td>Turn off</td>
</tr>
<tr>
<td>4</td>
<td>27 ppm</td>
<td>Turn on</td>
<td>25°C</td>
<td>Turn off</td>
<td>Turn on</td>
</tr>
<tr>
<td>5</td>
<td>29 ppm</td>
<td>Turn on</td>
<td>31°C</td>
<td>Turn off</td>
<td>Turn off</td>
</tr>
<tr>
<td>6</td>
<td>30 ppm</td>
<td>Turn on</td>
<td>23°C</td>
<td>Turn off</td>
<td>Turn on</td>
</tr>
<tr>
<td>7</td>
<td>22 ppm</td>
<td>Turn off</td>
<td>35°C</td>
<td>Turn on</td>
<td>Turn off</td>
</tr>
<tr>
<td>8</td>
<td>23 ppm</td>
<td>Turn off</td>
<td>30°C</td>
<td>Turn off</td>
<td>Turn off</td>
</tr>
<tr>
<td>9</td>
<td>33 ppm</td>
<td>Turn on</td>
<td>22°C</td>
<td>Turn off</td>
<td>Turn on</td>
</tr>
<tr>
<td>10</td>
<td>21 ppm</td>
<td>Turn off</td>
<td>27°C</td>
<td>Turn off</td>
<td>Turn off</td>
</tr>
</tbody>
</table>
In Table 1, 10 tests were carried out on the MQ135 sensor to detect the smell of ammonia and DHT 11 to detect the temperature, in the experiment it was known that when the MQ135 detected more than 25 ppm the ammonia fan would turn on and when it was less than 25 ppm the ammonia fan would turn off, in the experiment already in accordance with applicable regulations. On the DHT11 sensor there are rules where when the temperature is above 30°C the cooling fan will turn on to cool the room and when the temperature is below 30°C the fan will turn off, and when the temperature is below 25°C the light will turn on and then at a temperature above 25°C the light will turn off. In the experiments that have been carried out, all conditions are in accordance with what is applied.

Table 2. Test Results for the RTC 3231 Module

<table>
<thead>
<tr>
<th>No</th>
<th>RTC 3231</th>
<th>Motor N2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>07.00</td>
<td>Open</td>
</tr>
<tr>
<td>2</td>
<td>09.00</td>
<td>Closed</td>
</tr>
<tr>
<td>3</td>
<td>13.00</td>
<td>Closed</td>
</tr>
<tr>
<td>4</td>
<td>14.00</td>
<td>Open</td>
</tr>
<tr>
<td>5</td>
<td>16.00</td>
<td>Closed</td>
</tr>
<tr>
<td>6</td>
<td>20.00</td>
<td>Closed</td>
</tr>
<tr>
<td>7</td>
<td>07.00</td>
<td>Open</td>
</tr>
<tr>
<td>8</td>
<td>10.00</td>
<td>Closed</td>
</tr>
</tbody>
</table>

The test results in table 2 are in accordance with the applicable rules, when at 07.00 the N20 motor will open the chicken feed and at 14.00 it will also open, for other times the N20 motor is closed because it is not feeding time. This can be seen in tests 1, 4, and 7 where at the time of feeding the motor is scheduled to open.

IV. Conclusion

From the research carried out to monitor and automate using IoT technology it can be concluded that this design is applicable. The process of Monitoring Ammonia and Feeding automatically can be done with IoT technology, when ammonia reaches an excessive limit, the ammonia fan runs perfectly and when the temperature is hot the cooling fan will work. This can be seen in Figure 5 about the condition of the hardware.

The test result in table 1 and table 2 is in accordance with the established rules so that the performance of the device has worked as planned, in table 1 of 10 experiments all value data is successfully displayed on android as shown in table 5, and the value of feeding in table 2 is also present in figure 6.

For further research, it is possible to add the hardware which is able to carry out the process of cleaning the cage automatically when there is excessive ammonia.

References


