# DEODORIZATION TECHNOLOGY IN EMBEDDED SYSTEM-BASED CHICKEN COOPS

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***Article Information***

Received: 15-11-2023
Revised: 30-11-2023
Published: 15-12-2023

***Keywords***
*Odor Eliminator, Ammonia Gas Levels, Fogging System.*

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***Abstract***

*Village chickens are a type of chicken that has long been kept by rural communities. Free-range chickens also have an important role in meeting people's animal protein needs. Chicken manure deodorizing equipment is a very important tool in chicken farming to produce clean air in the chicken coop. One of the factors that supports the success of chicken growth is optimal environmental monitoring. A stable environment that meets your needs can improve the health and growth of chickens. In the process of growing free-range chickens, it can be influenced by the dirty air quality in the chicken coop, which can trigger the formation of ammonia gas. Chicken manure contains dangerous substances such as ammonia gas which can disrupt the health and comfort of chickens, as well as have a negative impact on the surrounding environment. The chicken manure odor removal tool is equipped with an MQ135 sensor and RTC (real-time clock). Based on the results of tests carried out, this tool is able to eliminate ammonia gas levels with a fogging system and regulate air circulation in the chicken coop automatically.*

## 1. Introduction

Native chicken is a type of chicken that has long been raised by rural communities. Native chickens also have an important role in meeting the animal protein needs of the community. One of the factors that support the success of chicken growth is optimal environmental monitoring. A stable and appropriate environment can improve the health and growth of chickens(Badarudin, 2021).

However, it turns out that the growth of native chickens can be affected by dirty air quality in chicken coops so that it can trigger the formation of ammonia gas(SUPRIYONO et al., 2021). Chicken manure contains harmful substances such as ammonia gas that can interfere with the health and comfort of chickens, as well as have a negative impact on the surrounding environment. Ammonia gas produced from chicken waste can cause air pollution and contribute to the formation of harmful particles(Akbar, 2021; Polepuri, 2021). The ammonia gas content in the chicken coop is about 5-25 ppm (part pert million). If the amount of ammonia gas exceeds 25 ppm it can be harmful to health in native chickens(Raharjo & Jamal, 2020). With ammonia levels of 30 ppm can interfere with chicken health and if ammonia gas reaches 40-50 ppm there will be a 15% decrease in growth in native chickens(Kasim et al., 2019).

This small-scale chicken farm in Notoharjo village, Central Lampung Regency, the owner of Mr. Rubiyanto, has a cage area of 2x7 meters and has 50 native chickens. A chicken coop that has such an area is not easy for chicken farmers to quickly conduct periodic supervision of the condition of the coop. Based on observations and interviews, the problem faced by partners is in removing the smell of manure still using the traditional method, which is in how to remove odors by spraying vaccines into the chicken coop. In addition, controlling the smell of feces on a regular basis can consume time. Because the system is considered less effective because it consumes a lot of time.

Liquid smoke is a liquid that produces a gas that can be inhaled and is used for food preservatives, treatment of farm animals and reducing odors produced by chicken manure. When liquid smoke is sprayed into the chicken coop, the compounds in the liquid smoke will interact with ammonia gas particles, thus minimizing the smell of ammonia gas up to 8 ppm. Liquid smoke does not contain harmful substances contained(Hasibuan et al., 2023).

According to research conducted by(Polepuri, 2021) namely to reduce ammonia gas in closed chicken coops by using an air circulation system. The system uses an Arduino Uno microcontroller, an MQ-135 sensor to detect ammonia gas with a threshold of 20 ppm (parts pert million) from chicken manure, an LCD to display ammonia gas levels and a DC fan is used to remove dirty air and replace new air automatically according to ammonia gas levels. This tool has worked well in monitoring ammonia gas and regulating air quality in the chicken coop using the MQ-135 sensor normal conditions of 3,657 ppm in a closed chicken coop. regulate the air quality inside the chicken coop. The use of DC fans in a chicken coop has a significant influence on the growth of chickens. DC fans can help maintain optimal air temperature in the enclosure, especially in hot weather conditions. By maintaining an appropriate temperature, chickens will feel more comfortable and less stressed(SUPRIYONO et al., 2021).

Furthermore, the research conducted by(Muchyar Hasiri & Arif Suryawan, 2020) has designed a sterilizer and cleaning of the chicken coop. This system uses a sprinkle mist nozzle as water spraying into the chicken coop and is controlled using Arduino Atmega 2560 and RTC DS137 to regulate the sterilization time for effective use. However, the system has the limitation of using the resulting sprinkle mist nozzle to reach the entire area of the chicken coop within a limited range.

Based on the research above, the author made a tool "Deodorization technology in Arduino-based chicken coops". This deodorizing technology is designed to remove ammonia gas from chicken manure and regulate air circulation in the coop automatically. Chicken manure deodorization technology in this cage uses the MQ-135 sensor to detect ammonia gas with a 20 ppm point, DC fan to regulate air circulation in the chicken coop, buzzer as an alarm or indicator when ammonia gas content is 20 ppm and a regulator switch is used to regulate the DC fan speed rotation. This tool is also equipped with an adjustable sprinkle nozzle used to spray liquid smoke in the form of fog into the chicken coop and RTC DS3231 to arrange spraying scheduling at 7 am when chickens are outside the cage for 10 minutes.

## 2. Research Methods

### 2.1 Prototype Method

The prototype method is a method that can be used to develop a device that will be redeveloped.(Kurniati, 2021; Muchyar Hasiri & Arif Suryawan, 2020; Yustiyanto & Budi Setia eko, 2023) The prototype method begins with the collection of user needs, in this case the user of the developed device is deodorizing technology in the chicken coop. Then creating a lightning design that will then be re-evaluated before properly producing the prototype is not something complete, but something that must be evaluated and modified again. Any changes can occur when a prototype is created to meet user needs and at the same time allow developers to better understand user needs. The following is a prototype image used by the author.

### 2.2 Microcontrollers and Sensors

Below are the microcontrollers and sensors that will be used by the author:

### 2.2.1 Arduino Uno

Arduino uno is an electronic board containing an atmega328 microcontroller(Srivastava et al., 2020). This device can be used to create electronic circuits from simple to complex. DC fan control and *adjustable sprinkle nozzles* can be implemented using relatively small boards.

### 2.2.2 MQ-135 sensor

MQ-135 is a chemical compound sensor or gas substance sensor that can detect high resistance values in ammonia (NH3), carbon monoxide (C0) and ethanol (C2H60)(Kasim et al., 2019; Rombang et al., 2022; SUPRIYONO et al., 2021). This sensor has a resistance value that will change if it detects the presence of ammonia gas.

### 2.2.3 Jumper Cable

Jumper cables are electrical cables to connect between components on the *breadboard* without the need for soldering. Jumper cables generally have *connectors or pins* at each end. *Connectors* for piercing are called male connectors, and connectors for piercing are called female *connectors.jumper cables* are divided into 3 namely: male to male, *male* to female and female *to female.*

### 2.2.4 RTC DS3231

RTC (*real time clock*) is a chip device that has the ability to measure accurately from seconds to years and store time data in *realtime*(Srivastava et al., 2020). RTC can store current clock information from the computer in question. In addition, the RTC is equipped with a battery as a power supply on the chip, so the clock will remain up-to-date even if the computer is turned off.

### 2.2.5 Nozzle Adjustable Sprinkle

*Adjustable sprinkle nozzles* are components used in fog spraying systems(Yatheendrdasan et al., 2020). *Adjustable sprinkle nozzles* have many uses, namely spraying insecticides, fungicides, herbicides, liquid fertilizers, and water. By using a high-pressure water pump machine so that it can produce fine liquid grains that can add air humidity.

### 2.2.6 Relays

*Relay* is an electrically operated switch (switch) and *electromechanical* component consisting of 2 main parts, namely electromagnet (*coil*) and mechanical (a set of *switch* contacts or *switches*). *Relays* use the Electromagnetic Principle to drive the switch contacts so that with a small electric current (*low power*) can conduct higher voltage electricity. For example, with a relay that uses 5V and 50 mA electromagnets is able to drive the *armature relay* (which functions as a switch) to conduct 220V 2A electricity.

### 2.2.7 DC Fan

A fan is a mechanical device used to create a continuous stream of gases such as air. In any cooling system, which uses gas as a conductor, the fan is a mandatory unit that creates airflow in the system. This system can be seen in simple fans used in households or external cooling fans for internal combustion engines. When it requires higher pressure, a *blower* is needed that is used to replace the fan.

### 2.2.8 Waterpump

*Waterpump* (water pump) is a device to move water from a place of low pressure to a place of higher pressure(Youssef, 2015). Basically, the *waterpump is the* same as a DC motor in general, it's just that it has been *packed* in such a way that it can be used in water.

### 2.2.9 LCD 16x2 IC

LCD (*Liquid Crystal Display*) is a display module with liquid crystals on the screen that is used as a display by utilizing an electric field to change the shape of the liquid crystals in it so as to form the display of numbers or letters on the screen. This 16x2 LCD consists of 16 characters and 2 lines, where the seven-segment display form has 192 stored characters equipped with *a back light* and can be addressed in 4 bit or 8 bit modes. This LCD serves to display a character number, letter or graph.

### 2.2.10 Buzzer

*Buzzer* is an electronic that functions to convert electrical vibrations into sound vibrations. Basically the way the buzzer works is almost the same as the *loud speaker*, the *buzzer* consists of a coil attached to the diaphragm(Srivastava et al., 2020). *Buzzers* are commonly used as an indicator that the process has been completed or an error occurs in a tool.

### 2.2.11 Power Supply

Power Supply is a type of device that functions to produce and provide electric current to devices that require voltage(Tâm et al., 2016). This electrical power source converts the alternating current (AC) voltage from the input to direct current (DC) voltage by carrying out the rectify and filter processes. The direct current (DC) voltage generated will be used to provide power supply to electronic devices that require direct current (DC) voltage.

## 2.3 Block Diagram

A block diagram is a visual representation used to illustrate the relationships and interactions between various components in a system or process. Block diagrams use shapes of geometric shapes, such as squares or rectangles to represent the main components and the links between those components are illustrated with arrows or lines. Block diagrams are used to simplify the complexity of the system and visualize the flow of information, signals, or functions between different components.

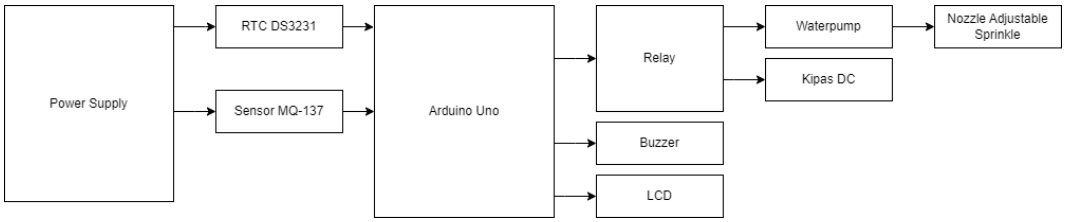


*Fig 1. Block Diagram*

*The power supply* is connected to a voltage of 220 *watts*, the *relay* is used to control large currents with a small current, *stepdown* to lower the voltage generated by the DC fan, the MQ-135 sensor will detect if the ammonia gas content is >20 ppm in the condition of the DC fan rotating then *the buzzer* will sound and if the ammonia gas content <20 ppm in the DC fan condition is not rotating then the buzzer does not turn on. Then RTC DS3231 schedules spraying on the deodorizer for 3 minutes and the system will run a *waterpump* to take water through the liquid smoke container automatically and the *adjustable sprinkle nozzle* will spray liquid smoke in the form of mist for 5 minutes.

## 2.4 Tool Design

The design of the tool is used in *sketch up software* in the form of 3D *modeling* to illustrate the shape of the deodorizer in the chicken coop that will be used in this study.

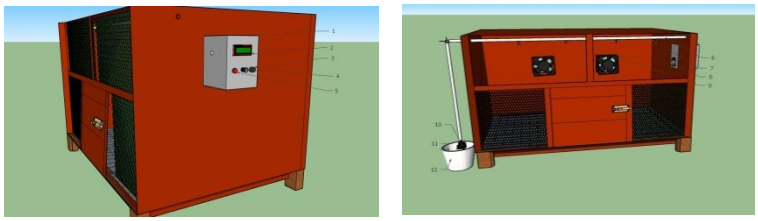

*Fig 2. Tool Design*

## 2.5 Tool Schematic Suite

A series of schematic tools or a series of components that will be used in this study and formed using *fritzing software* in the form of a picture of the overall components that have been assembled and will be implemented in real form on the system.

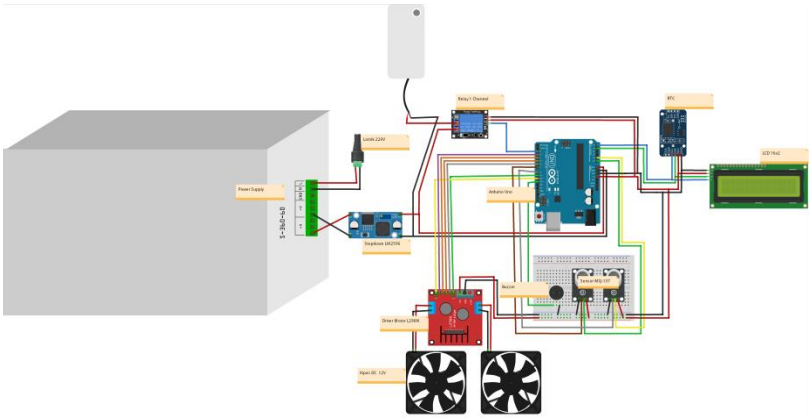

*Figure 2.3 Tool Schematic Suite*

## 2.6 Tool Implementation

After the materials and tools are collected, the next step is to implement the design of the tools that have been made. At this stage, the design results that have been implemented will be implemented software (*software*) and hardware implementation (*hardware*). Here is a picture of the implementation of the tool that the author will do.

*Figure 2.4 Tool Implementation*

In the picture above, the author made a *prototype* of deodorizing in a chicken coop with a size of 70 cm x 35 cm x 60 cm. *This prototype* is equipped with 2 fans, 4 *nozzle adjustable sprinkle*, LCD 16x2 I2C, and *waterpump*.

## 3. Result and Discussion

### 3.1 MQ-135 Sensor Testing

MQ-135 sensor testing was carried out on the chicken coop box and tested during the process of removing the smell of chicken manure with a long sensor measurement time from 12.00 to 11.00 with a set point of 20 ppm. The following are the test results of the MQ135 sensor.

*Table 1. Test Result of the MQ135*

| No | Time | Sensor MQ135 | Buzzer | Fan |
|---|---|---|---|---|
| 1 | 12.00 | 21,05 | Life | Life |
| 2 | 13.00 | 10,45 | Dead | Dead |

| | | | | |
|---|---|---|---|---|
| 3 | 14.00 | 18,02 | Dead | Dead |
| 4 | 15.00 | 21,56 | Life | Life |
| 5 | 16.00 | 8,74 | Dead | Dead |
| 6 | 17.00 | 5,23 | Dead | Dead |
| 7 | 18.00 | 5,95 | Dead | Dead |
| 8 | 19.00 | 8,84 | Dead | Dead |
| 9 | 20.00 | 4,21 | Dead | Dead |
| 10 | 21.00 | 5,95 | Dead | Dead |
| 11 | 22.00 | 3,20 | Dead | Dead |
| 12 | 23.00 | 2,45 | Dead | Dead |
| 13 | 00.00 | 2,84 | Dead | Dead |
| 14 | 01.00 | 4,02 | Dead | Dead |
| 15 | 02.00 | 3,06 | Dead | Dead |
| 16 | 03.00 | 2,17 | Dead | Dead |
| 17 | 04.00 | 1,33 | Dead | Dead |
| 18 | 05.00 | 3,84 | Dead | Dead |
| 19 | 06.00 | 10,85 | Dead | Dead |
| 20 | 07.00 | 14,23 | Dead | Dead |
| 21 | 08.00 | 20,05 | Life | Life |
| 22 | 09.00 | 3,33 | Dead | Dead |
| 23 | 10.00 | 1,41 | Dead | Dead |
| 24 | 11.00 | 20,95 | Life | Life |

### 3.2 RTC (*Real-Time Clock)* Testing)

RTC testing was carried out on chicken coop boxes using liquid smoke with a long measurement time from 07.00 to 07.12. The following are the test results from RTC.

*Table 2. Test Result from RTC*

| No | Time | Nozzle Adjustable Sprinkle | Pump |
|---|---|---|---|
| 1 | 07.00 | Light Up | Life |
| 2 | 07.01 | Light Up | Life |
| 3 | 07.02 | Light Up | Life |
| 4 | 07.03 | Light Up | Life |

| | | | |
|---|---|---|---|
| 5 | 07.04 | Light Up | Life |
| 6 | 07.05 | Light Up | Life |
| 7 | 07.06 | No Flame | Dead |

## 4. Conclusions and Suggestions

### 4.1 Conclusion

After testing and analysis on the deodorizer in the chicken coop, all the following conclusions can be drawn:
1. Based on the test results obtained, it can eliminate the chicken coop odor by 8 ppm using liquid smoke for 5 minutes and control poor air quality in the cage by using 2 DC fans.
2. In this study the author used MQ135 sensor and RTC (Real-Time Clock), and liquid smoke. The MQ135 sensor is used to detect ammonia gas in the chicken coop with the aim of maintaining air quality inside the chicken coop. Then RTC (Real-Time Clock) is used to set the spraying hour at 7 am for 5 minutes and the adjustable sprinkle nozzle is used for spraying in the form of fog and liquid smoke which is used to neutralize the quality of dirty air in the cage.

### 4.2 Advice

Making prototypes in this research has shortcomings and needs further development.
1. A sensor with higher resistance is required for a wider range.
2. Added elements of the Internet of Things (IoT) to see ammonia gas levels remotely through websites or smartphones.

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