# PROSIDING KONF INTER DESIGN OF AUTOMATION CONTROL UMB

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# DESIGN OF AUTOMATION CONTROL SYSTEM PARAMETER HUMIDITY FERTIGATION AEROPONICS SYSTEM IN CAISIM

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**Abstract**

Moisture plants are the main parameters that influence the amount of water and nutrients required in accordance with the characteristics of crops grown. This research aims to control the humidity in the aeroponic system according to the characteristics of the mustard plant with control methods using automation control at a certain humidity parameter. The control system in real-time using a computer, microcontroller Arduino UNO, DHT1 humidity sensor, actuator pumps and fans. Results of the automatic control capable of controlling moisture in the system aeroponic plants caisim aged less than 1 month with the state of humidity of 75% is a parameter characteristic of the mustard plant (caisim) planted, control response produces Td 263 seconds, Tr 323 seconds, Tp 0 seconds, ts 513 seconds, Mp 3.57%, 3.57% Ess.

***Keywords:*** **automation control systems, humidity, aeroponics, caisim**

## A. Introduction

Caisim can grow well in a hot air or cold air, so it can be cultivated from the lowlands and the highlands. Even so, in fact obtained better results in the highlands. Suitable planting area is starting from a height of 5 meters up to 1,200 meters above sea level. But usually cultivated in areas that have a height of 100 meters to 500 meters. Mustard plants resistant to rain, so it can be planted throughout the year. In the dry season to note is regular watering. [Syafri Edi. et al, 2010]. Potential and prospects aeroponic system for cultivation of crops mustard caisim because of some underlying problems that lead to saturation in the farming of land are: *the first*, the average land holding is small and even decreasing, *the second* the limited capacity of rice farming economy in increasing the productivity and income of farmers, *the third*, delays in efforts to diversify due to technical constraints, social and economic. Development of various horticultural crops, especially planting caisim can be improved, but still not on par with the market demand. This situation is possible among other things as a result of population increase, improved earnings and increased awareness of community nutrition [Samiati, B.A. et al, 2012]. Also, in big cities growing market demand requires good quality with various types of more diverse. The consequences of such a requirement led to increased demand for some types of vegetables [Perwitasari B. et al, 2012].

Demand for commodities is growing vegetables requires optimal management, both in terms of production, harvest and post-harvest, marketing and institutional aspects of the approach include mustard meatballs or caisim is a vegetable that is quite popular [Pabinru, M.A. et al, 1991 and Haryanto Eko. et al,. 2007]. Humidity of a plant are the main parameters that influence the amount of water needed nutrients, so as to improve efficiency in the electricity used for fertigation time already in control. By looking at some aspects of parameters such as air temperature, humidity, wind speed, duration fertigation, fertigation intervals, and age of the plant, it can be designed a control system of this fertigation. In studies using only moisture parameters [Ferdinand. 2012]. The aeroponic system can operate for a 4-week-old plants, with a set temperature of $26^0$C to $30^0$C and set humidity between 40% to 70% and water spraying nutrients interval lasts for 30 seconds. Arduino microcontroller is a microcontroller board based on the ATmega328 IC [Diansari Muthia. 2008]. One example that will be discussed this time is arduino Uno. Arduino UNO has 14 pin digital input / output (6 of which can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack an ICSP header, and a reset button. Arduino UNO contains everything needed to support the microcontroller, easy to connect it to a computer with a USB cable or supply it

by an AC to DC adapter or battery to get started. [Haryanto Eko. et al, 2007 and Fahrudin Fuat, 2006] System, and automatic settings. The system is an arrangement of the physical components that are connected and form a single unit to perform a particular action by organizing to control on direct and govern the work itself [Susila D Anas. 2006, Alimuddin, 2013 and Sumami Eni. 20131]. In the previous study with the system aeroponic is capable of operating on spinach aged 4 weeks with moisture $75^0$C and interval spraying for 30 seconds, with an average decrease in humidity of 0% - 5% when the system is in progress and not using a microcontroller Ardino so relatively complicated than using a microcontroller Ardino [Artanto Dian, 2012 and Ogata Katsuhiko, 2002]. The aim of research designs and manufactures automation control systems fertigation at a humidity parameter caisim with aeroponics system.

**B. Research Method**

Fertigation control system design parameters of temperature and humidity in the plant aeroponic system uses an Arduino UNO microcontroller and a humidity sensor has conducted a series of activities to complete this study. The methodology used for this study is *the first*, Studying the study of the system aeroponics to determine the extent of cultivation with the way the system aeroponic this is done, *the second*. to design the hardware in the form box aeroponics and devices consisting of a box reservoir, the counter holder, a lamp holder, as well as Styrofoam that is used to place the plant in netpot. *the third*, designing a power supply circuit 5Vdc *and* 12 VDC as the input voltage to the microcontroller Arduino UNO and as the input voltage with the fan or fan, fourth, Designing the system microcontroller Arduino UNO as controller humidity, fifth, designing sensor circuit DHT11 as readers humidity have an important role in this research, the sixth, Designing viewer LCD (Liquid Crystal Display) measuring 16x2 as output display will show the humidity reading of the humidity sensor DHT11 that has been integrated with a microcontroller Arduino UNO, seventh, design a relay circuit that serves as a switch or switching to turn the pump tank by turning on a fan or a fan of the parameters of moisture that has been specified by the controller microcontroller Arduino UNO, eighth, Designing program controller on the microcontroller Arduino UNO to be linked with a sensor humidity DHT11, Ninth, Test system aeroponics for later administration of nutrients can be channeled properly, tenth, Test humidity inside the box aeroponics uses moisture sensors

DHT11 is already integrated with the microcontroller Arduino UNO, eleventh compare the results of the reading of the humidity sensor DHIll to its original state, use mercury thermometer room, and a digital thermometer. Fertigation control system automation humidity parameters aeroponics lab scale system with a microcontroller Ardino.

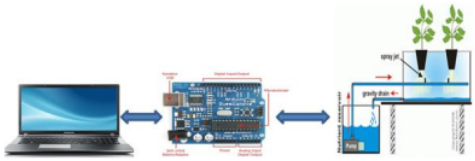

Figure 1. Integration of automation control system parameters fertigation humidity aeroponics on mustard plants

**C. Results and Discussion**

Results and discussion the testing and measurement iwhen the room humidity sensor detects humidity sensor box room and aeroponics. At the time of measuring the humidity sensor inside the box aeroponics when it was controlled by a microcontroller Arduino UNO. The boundaries used are at 77% humidity. The rooms were used in this study is the indoor rooms with room humidity of 75%. In addition to the testing of the program of the microcontroller Arduino UNO to perform according to its function or not, by monitoring and humidity control caisim plant nutrients. In this study the temperature sensor used is DHT11 sensor. Testing the humidity sensor aims to determine the sensor can function with validation on a digital thermometer. The first test conducted in the first, testing of room temperature carried out in room temperature room.

Table 1. Testing the humidity sensor calibration

| Testing | Room condition (°C) | Humidity % |
|---|---|---|
| DHT11 | Pada 28 C | 59 |
| | Pada 29 C | 62 |
| | Pada 30 C | 60 |
| Termometer Digital | Pada 28 C | 58 |
| | Pada 29 C | 61 |
| | Pada 30 C | 65 |

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| | 29 | 61 |
| | 30 | 65 |

The overall testing obtained the duration of the aquarium pump flow of nutrients and duration of fans live on temperature limits that have been determined. From the test results, it can be concluded that the system works in which the output of the entire state can work in accordance with the desired conditions. From these data may also include *disorders* that cause moisture difficult to control, namely the influence of moisture from outside the box aeroponic itself of the overall test, obtained the duration of the aquarium pump drain fan nutrition and length of life at the limits of moisture already in the set. From the test results can be seen some of the value system of the control response as the control performance with some criteria that can be shown in Table 2 for humidity.

Table 2 Characteristics of the system in response to changes in humidity

| ΔRH | Setpoint Humidity | Humidity | Td (s) | Tr (s) | Tp (s) | Ts (s) | Mp (%) | Ess(%) |
|---|---|---|---|---|---|---|---|---|
| 5% | 75% | 80% | 158 | 312 | - | 320 | 3,57 | 3,57 |
| 10% | 75% | 85% | 265 | 532 | - | 523 | 3,57 | 3,57 |
| 15% | 75% | 90% | 376 | 689 | - | 698 | 3,57 | 3,57 |

Table 2, Above produce an average of 263 seconds control response Td, Tr 323 seconds, 0 seconds Tp, Ts 513 seconds, Mp 3.57%, 3.57% Ess.

Td : Delay time
%Mp : *Percent maximum overshoot*
Tr : Rise time
%Ess : *error steady state*
Tp : Peak time
Ts : Settling time .fr

Delay time (Td) is the time it takes the system responds to reach a value of half of the setpoint, Rise Time (Tr) is the time it takes the system to respond to achieve value from the setpoint of the original values, Peak Time (Tp) is the time it takes the system to achieve the first peak of the overshoot, Maximum percent overshoot (Mp) is the maximum peak value of a control response of the overall value in common. Error Steady State (Ess) is the value of the error that occurred after reaching ordinary setting point shown in the steady state value of the oscillation.

## D. Conclusions

The conclusions are: *the first*, successfully designing wake control systems fertigation siste aeroponics to the parameters of humidity in the mustard plant, *the second*, the results of testing for 4 weeks with humidity setpoin 75% and room humidity of 80%, 85%, 90% resulted in an average repon control Td 263 seconds, 323 seconds Tr, Tp 0 seconds, 513 seconds Ts, Mp 3.57%, 3.57% Ess.

## E. Acknowledgements

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