http://infor.seaninstitute.org/index.php/infokum/index
JURNAL INFOKUM, Volume 9, No.1, Desember 2020 ISSN : 2302-9706

DESIGN OF AUTOMATIC WATERING SYSTEM FOR HYDRAULIC PLANT MAINTENANCE USING MICROCONTROLLER BASED FUZZY SET METHOD

Khairuna[1], Sriani[2], Adi Hartono[3], Abdul Halim Hasugian[4]
[1,2,3,4] Universitas Islam Negeri Sumatera Utara
Email : [1]Khairuna@uinsu.ac.id, [2]sriani@uinsu.ac.id, [3]adi.hartono@uinsu.ac.id,
[4]abdulhalimhasugian@uinsu.ac.id

Abstract

The application of technology to agriculture provides an advantage in terms of increasing production or yields. In terms of maintaining a plant, it takes a long process, for example fertilizing, irrigation, synthesis of sunlight and others. Up to now, this work is still carried out by human labor so that it severely limits the yield or quantity of harvest. The application of technology for plant cultivation is planned to build an automatic irrigation system for hydroponic plants. Hydroponic plants are a type of plant that only need water in the process of growth. Thus a good irrigation system greatly affects the success of cultivating this type of plant. The results of this study are: First, designing a hydroponic plant maintenance system that works automatically with sensors and microcontrollers. Second, designing a control circuit using the ATMega8 Microcontroller as the system controller. And third, implementing the Fuzzy Set algorithm in the program so that the system can work properly.
Keywords: *Hydroponics, Watering, Microcontroller, Conductivity Sensor,Water Pumppriori*

1. Introduction

The application of technology to agriculture provides an advantage in terms of increasing production or yields. It is undeniable that technology and science are needed in improving the performance of a process. Since the stone age humans have created many tools that can help humans survive.

The direction of the discussion in this paper is how we use technology for its most basic interests, namely plant cultivation. In terms of maintaining a plant, it takes a long process, for example fertilizing, irrigation, synthesis of sunlight and others. Up to now, this work is still carried out by human labor so that it severely limits the yield or quantity of the harvest.

On this occasion, related to the application of technology for plant cultivation, it is planned to build an automatic irrigation system for hydroponic plants. Hydroponic plants are a type of plant that only need water in the process of growth. Thus a good irrigation system greatly affects the success of cultivating this type of plant.

The design is in the form of a series of controllers that are programmed to adjust the irrigation system automatically. With sensor detection the controller will regulate the water flow and give a warning if the water source is not available or runs out. Fuzzy Set method is used as an algorithm that provides a decision when the irrigation system should be adjusted. The controller used in this design is ATMega8, namely the AVR type micro controller. The topic of the design was raised with the title "Design of Automatic Irrigation Systems for Hydroponic Plant Maintenance Using Microcontroller-Based Fuzzy Set Methods". The discussion is discussed in the form of thesis writing in 5 chapters according to the applicable systematics. sector.

2. Literatur Riview

Hydroponics comes from the words Hydro (water) and Ponics (pengerjaaan), so that hydroponics can be interpreted as farming with water growing media. Hydroponics is a method of planting plants without using growing media from the soil. Hydroponic literally means planting in water containing a mixture of nutrients. Hydroponics, according to Savage (1985), based on the irrigation system it is grouped into: (1) Open systems, where nutrient solutions are not reused, for example in hydroponics using drip irrigation or trickle irrigation, (2) Closed systems, where nutrient solutions are utilized back by means of recirculation. Meanwhile, based on the use of media or substrate, they can be grouped into Substrate Systems and Bare Root Systems.

A microcontroller is a computer system that has one or more very specific tasks, in contrast to a PC (Personal Computer) which has various functions. Unlike a computer system that can handle a variety of application programs, a microcontroller can only be used for a particular application, another difference is in the comparison of RAM and ROM. On a computer system the RAM to ROM ratio is large, meaning that user programs are stored in relatively large RAM space. While the hardware interface is stored in a small ROM space, on a microcontroller the ratio of ROM to RAM is very large. This means that the control program is stored in Masked ROM bias ROM or PEROM flash which is relatively large in size. Meanwhile, RAM is used as a temporary storage area, including the registers used on the microcontroller concerned.

The AVR (Alf and Vegard's Risc Processor) microcontroller has an 8 bit architecture. Where everything is packaged in 16-bit code and most of the instructions are executed in 1 clock cycle, known as RISC (Reduced Insdruction Set Computing) technology. A transistor is a semiconductor device that is used as an amplifier, as a circuit breaker and connector (switching), voltage stabilization, signal modulation or as other functions. Transistors can function as a kind of electric faucet, where based on their input current (BJT) or their input voltage (FET), they allow a very accurate flow of electricity from the mains circuit.

Of the many types of modern transistors, originally there were two basic types of transistors, the bipolar junction transistor (BJT or bipolar transistor) and the field-effect transistor (FET), each of which worked differently. Bipolar transistors are so named because their main conduction channel uses two polarity of charge carriers: electrons and holes, to carry electric current. In BJT, the main electric current must pass through a limiting area / layer called the depletion zone, and the thickness of this layer can be adjusted at high speed in order to regulate the flow of the main current.

A pump is a machine or mechanical equipment that is used to raise fluids from the lowlands to the highlands or to flow fluids from areas of low pressure to areas of high pressure and also to boost the flow rate in a piping network system. This is achieved by creating a low pressure at the inlet or suction side and a high pressure at the outlet or discharge side of the pump. Program flowchart is a part that describes in detail the steps of the program process. The program flow section consists of two types, namely the program logic flowchart and the detailed computer

program flowchart. The program flow section is used to describe each step in a computer program logically. This part of the logic tools is prepared by the systems analyst.

3. Results and Discussion

System testing is carried out on a series of automatic irrigation systems on hydroponic plants with the aim of knowing and obtaining results in accordance with the planned theory. Before testing the automatic irrigation system on hydroponic plants, we will first discuss the system requirements used. In the design of an automatic irrigation system for hydroponic plants, the system is switched on by connecting the AC current to the power supply system, which will automatically turn on and be ready to initialize the system. In the design of an automatic irrigation system for hydroponic plants, the system is switched on by connecting the AC current to the power supply system, which will automatically turn on and be ready to initialize the system.

This process is the initial stage in the water source tank where the design of automatic irrigation systems for hydroponic plants requires water as a basic material in hydroponic planting and provides nutrients as nutrients for plants. The following is a picture of the process of filling water into the water source tank.

System testing is carried out to determine the function and performance of the entire system. Testing begins with checking the system work on the main parts of the system to the overall system performance. The following is the test carried out on the system with the following data. Testing is done by running a program that is created and has been uploaded to the controller ic. In this case the program is made to issue a data on each port. Data can be hexadecimal, making it easier to write and read binary values.

After comparing and uploading it to the controller ic, it is executed on the circuit. Testing can be done by measuring each output port and comparing it with the program being made. If it does not match it means that there is an indication of an error in the circuit. The measurement results are as follows.

Table 1 Data from the measurement of pins for each port

Pin	Vout(V)	Pin	Vout(V)	Pin	Vout(V)	Pin	Vout(V)
1	4,97	8	0	15	4,98	22	4,97
2	4,99	9	2,45	16	4,96	23	0,02
3	4,98	10	2,02	17	4,99	24	4,99
4	4,99	11	0,01	18	4,98	25	0,01
5	4,98	12	0,01	19	4,98	26	4,99
6	0,01	13	0,01	20	4,95	27	0,01

7	0,02	14	4,95	21	4,95	28	4,99

After analyzing the output logic of each port and comparing it with the program data, it can be seen that there is a match between the programs and there is no logic difference, so that it can be stated that the controller circuit is working properly and connected correctly. The test is carried out by measuring the output voltage of the power supply at load and without load. There are 2 output points of the power supply, namely the output after the diode rectifier and the output after the AN 7805 regulator. The following is the data from the measurement results of the power supply with the 220V input conditions from PLN. The measurement results are as follows.

Table 2 Data on the measurement results of the power supply with 220V input conditions

Load	Power Output **(V)**	Regulator Output **(V)**
No burden	15,9 V	4,99 V
Circuit Load	14,3 V	4,98 V
DC Pump Load	12,9 V	4,98 V

The data above shows that the power supply has decreased when it is loaded, this is normal because the output of the power supply does not use a voltage stabilizer. Meanwhile, the voltage regulator output remains stable and does not show a significant decrease. From this test it is stated that the power supply circuit is functioning properly. A simple test can be done to test whether the pump can work or not. Namely by providing voltage to the two terminals of the pump motor, if the motor rotates, the motor is functioning.

Table 3 Testing the load on the dc pump motor

Beban	**V motor (V)**	**I motor (A)**	**Motor Power (W) P=VxI**
No burden	12,3	0,11	1,353
Loaded	12,3	0,39	4,797

Sensor testing is quite simple and easy to do, namely by measuring the sensor output voltage in 2 conditions, namely immersed in water and in air (not immersed). With the following results.

Table 4 Testing of Water Conductivity Sensors

Condition	Vout(V)	Logic
In the air	4,98	1
In the water	0,19	0

The above test proves that the sensor works well because it can distinguish the presence of water or not. By detecting the output logic sensor, the controller can find out whether the tube is available water or not.

Conclusions

Based on the research conducted, the conclusions that can be drawn from the design of automatic irrigation systems on hydroponic plant maintenance using a microcontroller-based fuzzy set method include: Making automatic irrigation tools for hydroponic plant maintenance that work automatically can be realized, ATMega8 microcontroller gets input from conductivity sensors and in program using the C language, the fuzzy set control system is applied to the conductivity sensor. When the metal is immersed in water, conduction between the controller input and the ground.

Reference

[1] S. Džeroski, "Data Mining," in *Encyclopedia of Ecology, Five-Volume Set*, 2008.
[2] X. Wu, X. Zhu, G. Q. Wu, and W. Ding, "Data mining with big data," *IEEE Trans. Knowl. Data Eng.*, 2014.
[3] X. Wu *et al.*, "Top 10 algorithms in data mining," *Knowl. Inf. Syst.*, 2008.
[4] R. Sowmya and K. R. Suneetha, "Data Mining with Big Data," in *Proceedings of 2017 11th International Conference on Intelligent Systems and Control, ISCO 2017*, 2017.
[5] C. Borgelt and C. Borgelt, "Efficient Implementations of Apriori and Eclat," *PROC. 1ST IEEE ICDM Work. Freq. ITEM SET Min. IMPLEMENTATIONS (FIMI 2003, MELBOURNE, FL). CEUR Work. Proc. 90*, 2003.
[6] A. Bhandari, A. Gupta, and D. Das, "Improvised apriori algorithm using frequent pattern tree for real time applications in data mining," in *Procedia Computer Science*, 2015.
[7] D. S. Kusumo, M. A. Bijaksana, and D. Darmantoro, "DATA MINING DENGAN ALGORITMA APRIORI PADA RDBMS ORACLE," *TEKTRIKA - J. Penelit. dan Pengemb. Telekomun. Kendali, Komputer, Elektr. dan Elektron.*, 2016.
[8] A. Nursikuwagus and T. Hartono, "IMPLEMENTASI ALGORITMA APRIORI UNTUK ANALISIS PENJUALAN DENGAN BERBASIS WEB," *Simetris J. Tek. Mesin, Elektro dan Ilmu Komput.*, 2016.
[9] D. K. Pane, "Implementasi Data Mining Pada Penjualan Produk Elektronik Dengan Algoritma Apriori (Studi Kasus : Kreditplus)," *Pelita Inform. Budi Darma*, 2013.

[10] H. Toivonen, "Apriori Algorithm," in *Encyclopedia of Machine Learning and Data Mining*, 2017.
[11] J. Nahar, T. Imam, K. S. Tickle, and Y. P. P. Chen, "Association rule mining to detect factors which contribute to heart disease in males and females," *Expert Syst. Appl.*, 2013.