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SPRINKLER IRRIGATION TEST WITH MICROCONTROL NODEMCU ESP8266

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ABSTRACT

Sprinkler irrigation is an alternative irrigation technology application that theoretically has a higher efficiency than open irrigation channels. In the form in the field, production of high-efficiency irrigation is achieved when most of the irrigation network is designed correctly and use an excellent tool and smooth operation. 4.0 to support the industry, irrigation precipitation can automatically be developed using the ESP8266 NodeMCU Android-based microcontroller. Tests in the laboratory by direct observation method. The statistical data analysis using the analytical statistic results of the T-test showed that the distribution of the automatic sprinkler water distribution compared to manual testing meets T-test. The relationship between the diameter of the emission and the discharge of water flowing in the pipeline sprayer through the use of Minitab software is Y = -319.6 + 0.017131 X (release), the value of R = 97.78% and R2 = 97.56 %, which means that the statistical relationship is very significant between the diameter of the emission and the discharge of the water flowing in the pipe sprayer.

Keywords: Microcontroller; laboratory; NodeMCU; sprinkler; irrigation

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1. INTRODUCTION

The problem of scarcity or excess water can make plants grow and produce well; K. Romadon [1]. Growth and plant development could be hampered or interrupted because water needs are not met on the ground. Agricultural production will decrease if the plant experiences water stress. al., 2015)[2]. Purwanto and Badrudin (1999)[3]; Winarbawa (2000)[4]; Adams et al. (2011)[5] The problem of scarcity or excess water can make plants grow and produce well; K. Romadon [1]. Growth and plant development could be hampered or interrupted because water needs are not met on the ground. Agricultural production will decrease if the plant experiences water stress (Nikolidakis et al., 2015)[2]. Overcoming the lack of water to improve the productivity and efficiency of water use in crop irrigation management technology requires an effective and efficient application. Design of irrigation systems through the use of automated technology to be an alternative that can improve the productivity and efficiency of the use of irrigation water in rice paddies. The use of automatic control systems in the field of irrigation has a significant impact on the improvement of the irrigation system and the efficient use of water resources, as well as for maintaining the level of water in the soil at a certain level in accordance with needs of the crop. (Lozano et al., 2010[6]; Cahyo, 2011; Sofiyuddin et al., 2011[7]; Romero et al., 2012[8]; Choir, 2012[9]; Saptomo et al., 2013; Coates et al., 2013[10]; Sánchez-Molina et al., 2015)[11].

Experiments and studies have been carried out to find water management technologies in agriculture using the Arduino Uno microcontroller AT mega328P (Sudirman Sirait) [12]. The design of automatic sprinkler plants with pump irrigation systems (Amuddin) [13]. The system based on the automatic microcontroller of bulk irrigation shows that the volume of irrigation to maintain soil moisture (Satyanto Krido Saptomo) [14]; Monitoring and control system for the cultivation of geoponic spray water using the NodeMCU ESP8266 that can increase the soil moisture value (Samuel Siregar) [15]. The design of automatic plant irrigation systems using wireless sensor networks produces irrigation configurations that can be controlled automatically (M. Dzulkifli S.) [16]. The intelligent and low-cost IOT-based modules for smart irrigation systems proved to be useful with their intelligence, low cost, and easy to transport, which makes it suitable for greenhouses, agriculture. (Neha K. Nawandar Vishal R. Satpute).

Water distribution uniformity is vital for the design of sprinkler irrigation systems — the movement of huge water droplets after leaving the sprinkler nozzle. Significantly affect the distribution of water from the sprinklers (YongchongLiaGengBaibHaijunYana.https://doi.org/10.1016/j.compag.2014.12.003). In this study, the operation of irrigation water bulk done automatically utilizes solenoid valves as actuators functioning open and close the water flow automatically to the microcontroller as a controller which gives commands to the actuator to open or close

2. MATERIAL AND METHOD

2.1. Material

This study was carried out in the field of tests of the Islamic University of Malang, covering the design model and the design of the sprinkler irrigation system. It is a series of hardware, automatic control systems, water level sensors, flow measurement devices, solar charge controllers, batteries and electronic devices. The research stages are the design of the automated control system, the design of irrigation networks, observation, and field trials that continue with the data analysis.

2.2. Automatic Control System Design

The first planning step is to design the software that continues to design hardware. In the software design and testing program that makes automated systems Writing a control program is written in the Arduino IDE and BLYNK page. Using programming language C / C ++ programming language. The hardware design consists of a series of ultrasonic sensors, soil moisture sensors, MCU V3 node water flow, MG996R servo, 10A 5V power supply, and two-channel relay.

Ultrasonic sensors have four pins that have their respective functions. Pin 1 is VCC pin two is trig, an echo three-pin and four gnd pin. The ultrasonic transducers used in this study ARE 1 fruit used to monitor water levels in the reservoirs. Figure 1 shows the water level sensor circuit. On each leg, it is connected to the NC sensor of the node, which is connected to the Vin V port at 5 feet, while the ground is connected to the leg and the ground port of the foot trigger is connected to the D2 port, the echo of the D3 foot in the port.

Investigation using soil moisture sensors from a tool to measure soil moisture, these devices have three legs that are A0 A0 nodeMCU legs connected to the foot, and the foot is connected to GND and VCC nodeMCU connected to the VCC nodeMCU foot. Water flow sensors have three wires: red, black, and yellow — water flow sensor used in this study up to 1 piece. The utility is to determine the discharge of water flow in the pipe. The red wire is connected to 3v nodeMCU, the black wires are connected to GND, and the yellow wire is connected to nodeMCU D6. MG996r servo motor mounted two pieces to rotate the wear of the alpkasi android tap automatically.

In the microcontroller block, several circuits are transmitted as the circuit breakers turn the system, the terminal barrier, the solar panels and the solar charge controller on and off as a support system that uses electrical energy. This energy will be channeled through the relay to drive 561 086 engines Valworx electric tap that automatically serves to open and close the flow of water to the irrigation network.

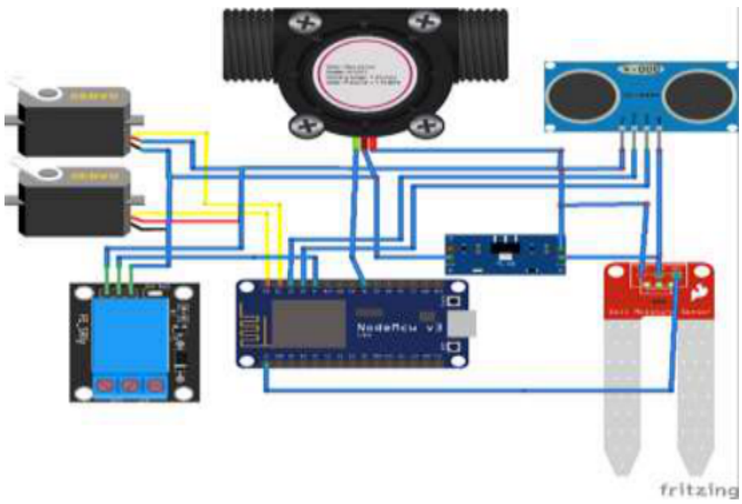

Figure 1 Water Level Sensor Networks

Vegetronix VH400 soil moisture sensors are used to detect soil moisture so that soil moisture level values are unknown based on volume (volumetric water content / VWC). The soil moisture sensor has three bare pins, red and black. Naked as a ground pin, red pin as Vin (3.3 V - 20 VDC) and black pin as the sensor output (0-3 V).

Setpoint level in the tank water level experiments determined at the height of 30 cm to 90 cm. When the field test at the water table level is less than 30 cm, the microcontroller will emit a signal to activate a relay that will activate electric motors to open the valves. And vice versa, when the level in the tank water level experiments is greater than 90 cm, the microcontroller will give a signal to activate the relay and drive motors for the electric valve cover. Water management systems will be more precise as the control process carried out by the system microcontroller, and the high-level water level can not only be monitored but also measured. Figure 2 shows a flow chart of the design irrigation pipes of the automatic control system in the rice fields.

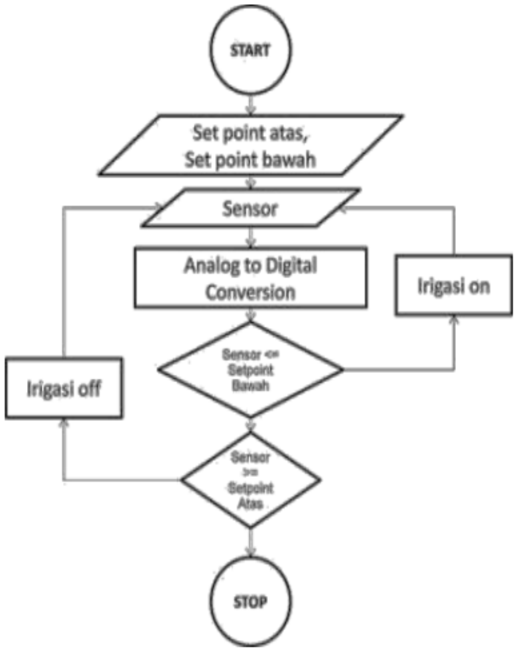

Figure 2. Flowchart of Automatic Control Systems

2.3. Installation of Automatic Control System on Piping Design

Pipe design Irrigation irrigation network installed in rice fields of 10 x 10 m using the pipe system. That uses the force of gravity — height difference with a 320 cm reservoir bottom elevation wetland. Sprinkler paddy in field four pieces provided with pipes 70 cm high and 260 cm away from the irrigation pipe. Figure 3 shows the network of irrigation pipe systems in rice paddies. Figure 4 Design of the irrigation pipe network through the use of automated technology.

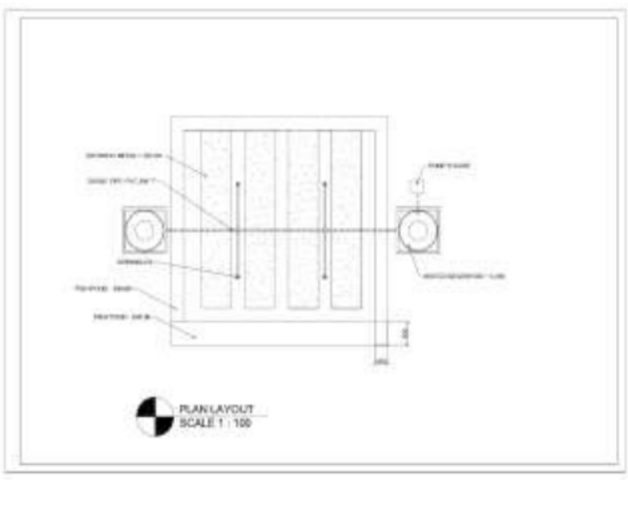

Figure 3. Network irrigation pipes in the field

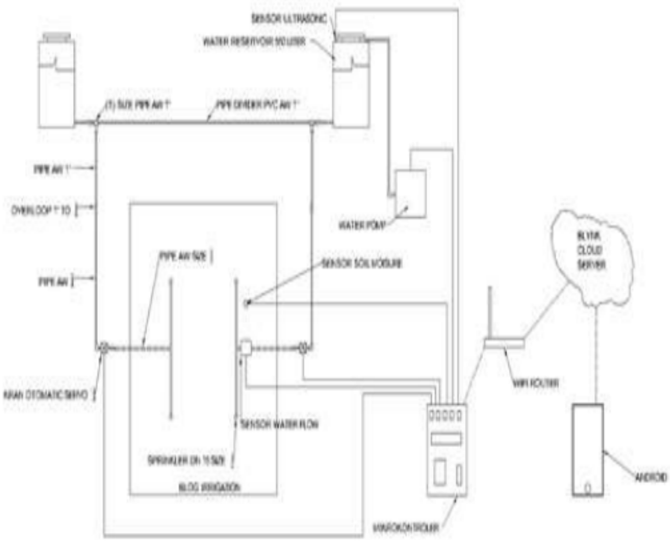

Figure 4. Layout automatic irrigation pipe

The manifold pipe taps are mounted with electric motors, controlled by an automatic control system of wetlands with the corresponding high set point. The water level in the tank is set at 30 cm to 90 cm from the bottom of the tank. Fill the water tank until the water level of 90 cm stops automatically filling the water in the tank, while the water decrease reaches 30 cm and then automatically begins to replenish the water in the tank. The arrangement of the control valve electrically detected using a water level sensor placed in the pipe is controlled by android. It is used to detect soil moisture sensor that is planted in field trials with a depth of between 5 and 10 centimeters.

2.4. Data analysis

Land irrigation operation performed with two models of pipe and open pipe completely open ¼ full. The data was then analyzed using a statistical approach. The analytical method used to determine the relationship between variables and parameters in the experiment. The program used to analyze the data is Minitab 8.0

3. RESULTS AND DISCUSSION

3.1. Testing and Field Experiment

The tests in the control system of the sprinkler irrigation network are performed automatically by draining the water from the reservoir to the sprinkler water level of a tank that ranges between 30 cm and 90 cm. Data collection was performed by manual and automatic. The display will show the nominal value of the water level sensors in the tank, the soil moisture sensors, and the water flow through the pipe.

In the field experiment to test the design of the automatic control system according to the plan of the wetland Figure 4. Observations made during the high water tendon down 5 cm continuously to limit the water tank to 30 cm high. The data obtained are the flow of water, the distribution of water by sprinkling diameter, the level of water in the tank, prolonged drainage, and soil moisture.

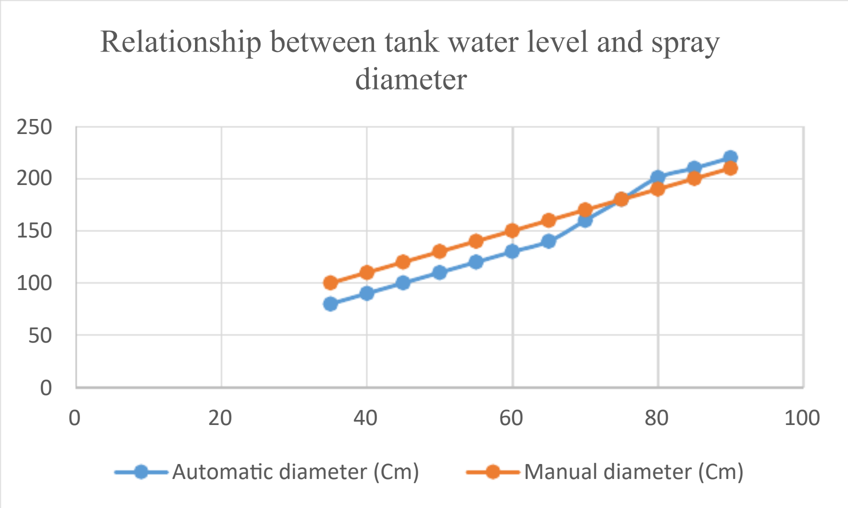

Figure 5. Relationship between reservoir water level and spray diameter

3.2. Analysis of Trial Results

Data obtained from the water level sensor readings of the high water tank. The results of the measurement of the jets of length and diameter of the water discharge pipe can be seen on the tendon of the screen and shed any water droplets of 5 cm. The data obtained can describe the performance curve of the automatic control system of the irrigation pipe network with the desired setpoint. From the research data, the performance of the control system will be analyzed according to a predetermined reference point, and the data is compared manually and automatically by the T-test. Figure 5. Results of the measurement value of automatic and manual models of sprinkler systems that level the water in the tank, the length of the diameter of the sprinkler spray.

After testing the data, the next step is to check the hypothesis. To test the theory in this study using a t-test, and utilizing the assistance program is the Minitab result.

Two-sample T for Otomatis vs. Manual

	N	Mean	StDev	SE Mean
Otomatis	12	145,1	48,4	14
Manual	12	155,0	36,1	10

Difference = mu (Otomatis) - mu (Manual)

Estimate for difference: -9,9

95% lower bound for difference: -40,0

T-Test of difference = 0 (vs >): T-Value = -0,57 P-Value = 0,712 DF = 20

T table = 2.08596 so that the count value T, T-table means that Ho is accepted or not there is a real difference to the value of automated and manual observations.

The regression analysis with Minitab is the relationship between water discharge and beam diameter Y (beam diameter) = -319.6 + 0.017131 X (release), the value of R = 97.78% and R2 = 97.56%, which It means that the statistical relationship is very significant between the diameter of the emission and the discharge of water flowing in the irrigation pipe.

4. CONCLUSION

The results showed that the distribution of the automatic sprinkler distribution compared to the manual test value T count <T table The accepted value of Ho means that the mechanical sprinkler irrigation design can work well. The relationship between the diameter of the emission and the discharge of water flowing in the pipeline sprayer through the use of Minitab software is Y = -319.6 + 0.017131 X (release), the value of R = 97.78% and R2 = 97.56 %, which means that the statistical relationship is very significant between the diameter of the emission and the discharge of the water flowing in the pipe sprayer.

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