

AUTOMATIC IRRIGATION SYSTEM TO SEE DRY SOIL CONDITION BASED WIRELESS SENSOR NETWORK

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Abstract: This research explains, if the soil condition is dry, then sensing logic will work and the notification in the form of data will be sent to the owners of agricultural land through a wireless sensor network that is connected to a computer network. Landowners can control irrigation systems and monitor the state of the ground through the sensing logic, which sensing logic will directly read if the condition of the soil is dry or wet, then the wireless sensor network will transmit signals over a data packet by RSSI indicator, on the other hand it will test the use of physical layer to support the bandwidth frequency. The relay is the motor of the pump, when it is measured by a multimeter the relay is off, the voltage generated at 20.97 Volt because at the off moment, the voltage does not fall / fall to ground so that the output is greater but when the relay is active or pump is on, the voltage becomes 0.7 Volt, next the resistance value in dry condition is higher, but when the hygrometer sensor measures soil in wet conditions the voltage becomes 1.215V. Further applications for wireless sensor networks in automation management system for irrigation will also monitor the condition of water in the soil, when water condition is dry then the valve cover of water flow will open automatically.

Key words : ATmega32, Microcontroller, Sensor Hygrometer, Sensor and Transducer, Wireless Sensor Network

I. INTRODUCTION

As we know that Indonesia is a country with a majority of the occupation is farming. In that activity, water is one component that is very important to improve the quality and get the best of food production. So, the efficient water drainage is essential for agricultural land in order to flow through paddy crops according to the needs, but today the farmers provide water flow continuously without observe the plants need toward water so it will produce the less quality of plants. This work includes the reduction of the length of time and construction techniques with controls which are applied to identify or find out when the soil condition is dry, sensing logic will determine the soil in dry conditions and signaled to the microcontroller, and this response makes the motor will operate, here in after Wireless Sensor Network will respond to the delivery package - a package of data, so it will command watering and will simultaneously operate the water extraction water to agricultural areas. On the other side, this system will be used to determine the pattern of dry soil conditions in the form of frames for every soil condition. The construction of a data base for several kinds of land and land forms comparisons to be made with automatic sensing will be done with the control logic associated with the use of zigbee network.

II. MAIN COMPONENT OF HARDWARE

2.1 Mikrocontroller ATmega32

ATmega32 Microcontroller is a microcontroller manufactured by Atmel and categorized as microcontroller of low-power CMOS 8-bit based AVR RISC architectures. This microcontroller has a clock and working height up to 16 MHz, the size of flash memory is large enough, SRAM capacity is 2 Kbytes, 32-port I / O that is sufficient to interact with the LCD and keypad [6].

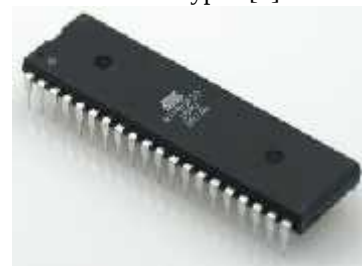


Figure1: Microcontroller ATmega32

2.2 Wireless Sensor Network

Wireless Sensor Network (WSN) is defined as one type of a distributed wireless network, which utilizes the Embedded System technology and a set of node sensor, to operate the sensor chip process, monitoring, data transmission, and presentation of information to the user, through the communication on the Internet. Sensors include many types, including humidity, radiation, temperature, pressure, mechanical, motion, vibration,

position, and others. Each type of sensor has the software (applications, operating systems) and hardware, which will be combined and run into the WSN system. [4]

Main components of the WSN Sensor Node :

- *Censorship*

The first component of the nodesensor is the sensor itself. The sensor is an electronic device that is tasked to scan on an environment or the physical object, it produce the scanned data (as a result of measurement), which can be processed into information. The sensor can not work without the ADC (Analog to Digital Converter), which are discussed in the next point, which the function is converting analog signals into digital signal.

- *Transceiver*

Transceiver is an electronic component that combines the components of Transmitter and Receiver in running the functions of transmitting and receiving the signals. In the nodesensor, Transceiver assist in the task of the Controller, associated with the analog signal and digital signal from a scanned result by the nodes sensor, which is operated by the sensor.

- *External Memory*

The third component of node sensor is External Memory. External memory is an additional memory which is required by the node sensor and the WSN system for the storage of the scanned data (User Memory) and storage of process and execution by the program (application) and operating systems (Program Memory).

- *Controller*

The fourth component of nodesensor is controller. Controller is an electronic device that use to operate the data processing, control of the functions from other components in the nodesensor, and displays the tasks performed by other components of nodesensor and nodesensor itself. The controller may include a microprocessor, microcontroller, embedded systems, and other electronic devices relatively in the small form.[4]

- *Power Source*

Energy resources on WSN on nodesensor is very limited, it only rely on source of batteries. For that, we need the Power Source for additional electrical energy source, especially for implementation in the areas that difficult to find the source of electrical energy. The issue of energy efficiency in WSN can be solved either with network protocols, algorithms used in applications and operating systems, Routing, until the Power Saving in the form of Dynamic Power Management (DPM) and Dynamic Voltage Scaling (DVC).

- *Analog to Digital Converter (ADC)*

Analog to Digital Converter (ADC) is an electronic board which convert an analog signal into a digital signal form. It is caused by the input of the transducer (part of the nodesensor) in the form of analog signals, which must be converted into digital signals [4].

Figure 2: Component of Node Sensor on WSN

2.3 Relay

Relays are electrical switches which open or closed circuit or other circuits under certain conditions. So relay is basically a switch that is opened and closed with electrical power through a relay coil contained inside [2].

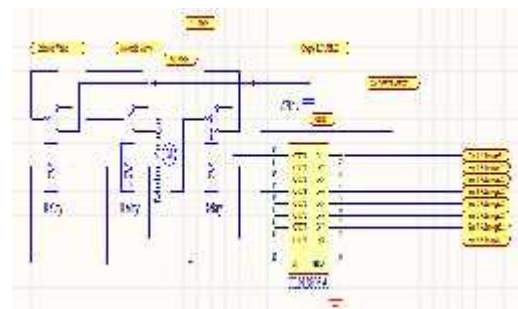


Figure 3: Relay Circuit

2.4 Integrated Circuit (IC) LM7805

IC LM 7805 (regulator) is an IC that is used to stabilize the voltage of the power supply in case of changing the voltage. In IC 7805, the last two digits are 05 indicates the output voltage which is designed. IC LM 7805 having output voltage of 5 volts.

The advantage of IC LM 7805:

1. Does not require additional external components.
2. Having protection against short-circuit current
3. Having a constant output voltage
4. Having low currents
5. Having a very small output ripple
6. Low financing

This regulator generates a stable output voltage of 5 volts on the condition that the input voltage is given at least 7-8 volts (greater than the output voltage) while the maximum extent allowable input voltage can be seen in the IC datasheet LM78xx because the output voltage produced will not be stable or less than 5 Volts [4]. For more details can dilhat image of the IC LM 7805.



Figure 4: IC LM 7805

III. RESULTS

From the results of tests and measurements that have been conducted by researchers, there will be a discussion on it, in which the results of the test and measurement is known that in the relay, which will be measured using a multimeter during voltage relay is inactive and active, for more details can be seen in the table below.

Table. 1 Result of Test and Measurement during active and non-active relay.

No	Voltage Condition Relay 1, Relay 2, Relay 3 (Volt)	
	Non Active	Active
1	20,97	1,8
2	20,97	1,8
3	20,97	1,8

The further results show you the test and measurements results on ATmega microcontroller 32 using a multimeter that allows you to adjust the movement of the water pump, then drain the water to the farm. For more details can be seen in Table2.

Tabel. 2 Result of Test and Measurement for Microcontroller ATmega32

No	Microcontroller ATmega 32	
	Non Active	Active
1	0,02 Volt	4,02 Volt

Next to the results of tests and measurements on sensing logic (hygrometer sensor), measured with a multimeter, for more details can be seen in Table 3 below.

Table. 3 Result of Test and Measurement for Hygrometer Sensor

No	HygrometerSensor (Volt)	
	Soil ConditionDry	Soil ConditionWet

1	1,205	0,530
2	1,407	0,863
3	1,635	1,215

When the sensor 1 of area 1 sends a signal in the form of LED blinks, so soil humidity is below the threshold value, and the LCD will display the message "Dry conditions – drain the water" and the main unit will be responsible for sending signals. Furthermore, the sensor 2 will determine the levels of water, and the LCD display "Wet – don't drain the water", as well as the valve position will be closed.

If the soil conditions is dry and it is required a water flow, the sensor will send a signal 1 (ON) so that each valve will follow the command to open a water channel, then the hygrometer sensor will continue to monitor soil humidity in realtime.

For the performance of wireless sensor network which lies in the physical layer with excellent performance which produce a low SNR, range capabilities of signal operating is up to 100 meters with a bit rate of 250kbps or at a frequency of 2.5 GHz.

IV. CONCLUSION

From the test and measurements results that have been done, The conclusion is:

Hygrometer sensor will work if the soil conditions is dry, after the information is received, then the driver ULN 2803 and the responses will make the motor ON, pump driver is ULN2803 driver that will supply the relay to drive the water pump, so the pump will automatically stop. Optimization and efficient water management system is necessary in the need for water content, so that the production plant will be enhanced by utilizing water resources. Sensor which designed by wireless will depend on the threshold value of soil humidity. So the work will be developed by wireless sensor network management system for a better performance in the future.

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