Water Quality Monitoring System Using Server IOT (Internet of Things) and Sensor

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Abstract---*This research discusses the implementation of the Smart Farming System in hydroponic plantations that utilize remote data communication via the internet. In hydroponic plantations using control algorithm is programmed on the Arduino Uno micro controller with a pH Meter and EC Meter as measurement variables, as well as pumped water discharge rates and fertilizer doses as control variables. To monitor all control conditions using website-based information system was developed with a PHP programming language framework, namely CodeIgniter and MySQL as a database. This web server can be accessed by operators who are far from the plantation to monitor process variables and change set points. This web server is realized based on the concept of the Internet of Things and uses the Ethernet Shield communication module and the Hypertext Transfer Protocol (HTTP) communication protocol.*

I. INTRODUCTION

Water quality

Water is an important element for all life forms on earth. Based on Aquastat data, there are around 326 million trillion gallons of water on earth. The water is in a constant cycle Ninety-eight percent of the water is found in the sea, 1.6 percent is found in polar ice, 0.36 percent is found in ground water, aquifers and wells. As much as 0.036 percent is found in lakes and rivers and the rest is in the air as clouds and water vapor or in the bodies of living things [1]. The usual measurements are measurements of chemical, physical, biological and appearance test and color parameters [2].

Water quality in general shows the quality or condition of water associated with a certain activity or use. This water quality will difference from one activity to another, for example: the quality of water for irrigation purposes is different from the quality of water for drinking water needs. Water is a compound of hydrogen and oxygen with the chemical formula $H2O$ which is covalently bonded, this bond is formed by the bonding of electrons together. Based on its physical properties (in physics) there are three kinds of forms of water, namely water as a liquid object, water as a solid object, and water as a gas or steam object [3] [4].

Water classified

Water use in general can be classified into four groups based on the purpose of its use, water for irrigation purposes for water and energy generation purposes, water for industrial purposes and water for public purposes. Water for public

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purposes is distinguished from domestic consumption water and water for social and commercial consumption. The existence of water on earth is a natural process that continues and continues to spin, so it is a cycle (recycling), better known as the hydrological cycle. The hydrological cycle starts with the movement between the earth and the atmosphere and occurs through precipitation and evaporation. The process of recycling water in nature is carried out by energy sourced from sunlight With the using of sunlight the water cycle in nature continues to run By studying the hydrological cycle. [5]

Atmospheric Water (Rainwater)

Atmospheric water, also called rainwater, is a sublimation event of clouds or pure water vapor when it descends and through the air will dissolve objects contained in air, gas (O_2, CO_2, N_2, etc.), microorganisms, and dust of CO_2 gas in rain water will form carbonic acid (H_2CO_3) and make the rain water react acidically. Some kind of oxide gas can also be in the air including sulfur oxides and nitrogen oxides (S_2O_4 and N_2O_3). Both of these oxides together with rain water will form sulfuric acid and nitric acid so that after the water reaches the surface of the earth the water is not clean water or pure water. [6]

Surface Water.

Surface water is water that flows on the surface of the earth. Surface water can come from rain water that falls and flows on the surface to form a river that ultimately empties into the sea. Surface water comes from springs which are streams from ground water and a mixture of both. In general, surface water is polluted by impurities during drainage, for example by mud, logs, leaves or household and industrial waste [7].

II. SYSTEM LAYOUT

Groundwater

Some atmospheric water or rain water that falls to the surface will absorb into the soil and will become ground water. Before reaching the groundwater layer, the rain water will several layers of soil such as: Shallow ground water[21].

- *Shallow grounds*

Shallow ground water has a depth of 15 meters above ground level. This water is also called free ground water because the layer is not under pressure. Utilization of shallow ground water is used to meet household needs.

- *Deep Ground Water*

Water that has a depth of 50 meters from the ground surface and is also called artistic water. This groundwater is in the layers of translucent soil where the translucent soil layer is between the dense layers of water. This translucent layer of soil consists of rocks that contain many proses or so-called also sand mixed with gravel.

Water Temperature

Normal water temperature is the temperature of water that allows living things to metabolize and multiply. Temperature is a very important physical factor in water, because together with the substances / elements contained in it will determine the density of water, and together with pressure can be used to determine the density of water. Furthermore, the density of water can be used to determine water saturation [8].

Differences in the reception of solar radiation in each region cause differences in water temperature. This is related to differences in the geographical location of latitude and its position with respect to the sun. Besides solar heat, other factors that influence water temperature are currents, cloud conditions, upwelling and divergence and convergence of water bodies. In addition to the above factors, water temperature is also influenced by meteorological conditions such as evaporation, rainfall, air temperature, humidity and wind speed. The increase in water temperature in receiving water bodies, waterways, rivers, lakes, etc. will have the following consequences

- The amount of dissolved oxygen in the water decreases

- The speed of chemical reactions (reduction and oxidation) increases.

- The life of fish and other aquatic animals is disrupted.

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If the optimal temperature limit is exceeded, it will cause death in organisms that live in water. In addition, temperature can affect photosynthesis directly or indirectly. The direct effect of temperature has a role in controlling enzymatic chemical reactions in the photosynthesis process. High temperature can increase the maximum rate of photosynthesis, while the indirect effect is in changing the hydrological structure of the water column which can affect the distribution of phytoplankton. The effect of temperature can indirectly determine the mass stratification of water. Temperature stratification in waters is determined by weather conditions and the nature of each water such as the change of heating and stirring, water intake or discharge, shape and size of a water [9].

- Electrical Conductivity (EC)

    Electrical Conductivity (EC) is directly related to the concentration of dissolved ionized solids in water. Ions from the concentration of dissolved solids in water create the ability of water to produce an electric current that can be measured using a conductivity meter. EC serves to measure the electrical conductivity of materials contained in water. The more materials (metal minerals and non-metals) in the water, the measurement results will be even greater. Conversely, if very little material is contained in water then the result is close to zero or called pure water (aquadest) [10].

III. RESEARCH METHOD

Potential sensor of Hydrogen (PH)

The pH sensor used is a gravity analog pH meter SEN0161 sensor. This sensor operates at a voltage of 5 V and is able to measure the overall pH range (0-14). This sensor is capable of operating at temperatures from 0 - 60 ℃. The range of errors at 25 ℃ is only ± 0.1 pH. This means that the sensor has a fairly high degree of accuracy
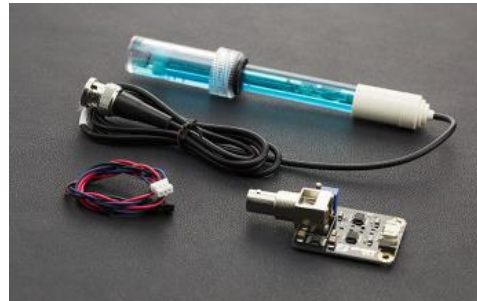

Figure 1: Ph Meter Sensor

The DO sensor used is a gravity

This sensor operates at a voltage of 3.0 ~ 5.5 V. The probe used in this sensor is a galvanized probe so that it does not need polarization time and can be operated immediately at any time. Solution solution of 0.5 mol / L NaOH and membrane cover on the probe can be replaced, so maintenance costs are low. This sensor is able to work in the DO range of 0 ~ 20mg / L.

Figure 2: Analog Gravity DO Meter Sensor

Supporting Hardware and Software

Hardware is physical components that can be seen, touched and tangible form that forms a unity of the system. This hardware is supported by software as a program as well as data that is created, formatted and stored digitally, including computer programs, documentation and various information that can be read and written by computers. In other words, software is an intangible part of a computer system. Here are some supporting hardware and software the author uses for this Job Training.

IV. IMPLEMENTATION DETAILS

I2C SD2405 RTC Module.

Figure 3: RTC Modul Sensor

RTC (Real Time Clock) is an IC (integrated circuit) which has the role of an electronic clock. RTC has a memory to store time in the form of seconds, minutes, hours, days, dates, months, and years in the register. The RTC used is I2C SD2405 RTC Module. This module works at 3V ~ 5.5V voltage and is able to record time up to 2099.
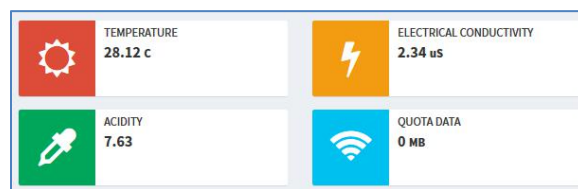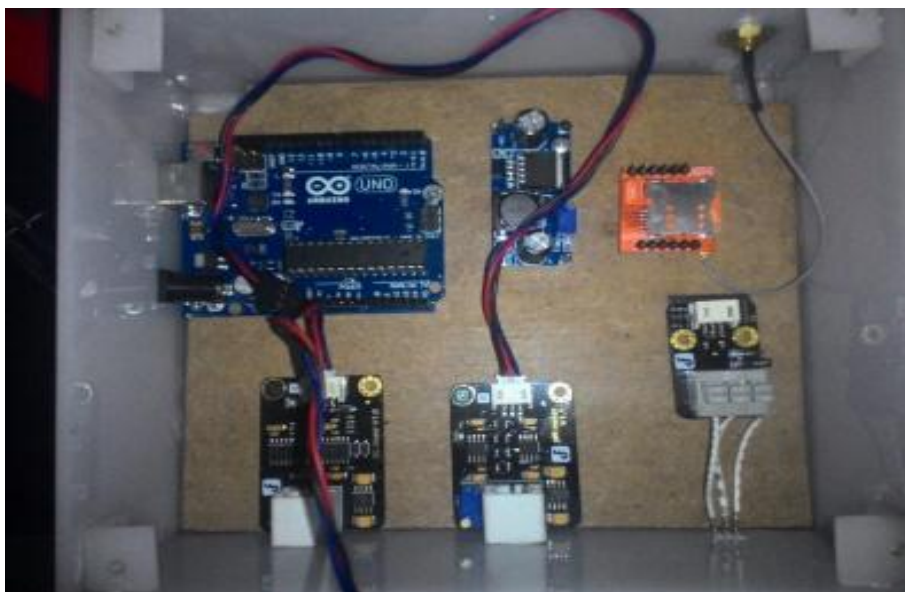

Figure 4: Clouds Monitoring   Sensor

Arduino Uno can be programmed with Arduino software. On the ATMega328 in Arduino there is a bootloader that allows you to upload new code for it without using an external hardware programmer. Arduino IDE is a very sophisticated software written using Java The Arduino IDE consists of [11]:

- Program editor, which is a window for users to write and edit programs in the Processing language.

- Compiler, a module that converts program code (Processing language) into binary code. However a microcontroller will not be able to understand the Processing language. What can be understood by microcontrollers is binary code. That is why a compiler is needed in this case.

- Uploader, a module that contains binary code from a computer into memory on the Arduino board. Sketch, an Arduino program code commonly referred to as sketch

V. CONCLUSION

Based on analysis, the following will be explained regarding the workings of the system. In this prototype, water quality sensors will provide input in the form of data. The data that has been received will be translated by the arduino microcontroller system and then stored in a micro SD module. The following is a scheme of how the prototype system will work. A smart farming system has been designed and implemented on an Internet-based hydroponic garden. The system consists of a hydroponic garden, monitoring and control devices that are built using a pH sensor, temperature and electrical conductivity connected to the microcontroller and able to monotorized by cloud Computing.

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