MONITORING SYSTEM OF WATER HEAD BASED INTERNET OF THINGS (IoT) IN PT PJB UP CIRATA

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ABSTRACT

Water is a primary need for creatures, especially humans. Besides being used for drinking, water is used by humans for agriculture, power plants and so forth. In its use as a power plant, water is used to drive turbines for electricity. Cirata Reservoir is a reservoir whose main water source is from the Citarum river. Water in reservoir cirata widely used by residents around the reservoir area as a major resource for the surrounding residents. The use of water in the reservoir is very influential on the capacity of water in the reservoir for the cirata reservoir managers managed by PT PJB UP CIRATA must be smart to manage water in the reservoir, especially in electricity production. Uncertain weather is also a difficulty for PT. PJB UP CIRATA to manage water in the reservoir so that little difficulty in determining the water resources needed for electricity production.

Therefore, a device that can measure the height of the reservoir water automatically so that the water level data which is the main parameter to conduct electricity production can be received in real time. This tool uses arduino microcontroller which functions to convert analog data into digital with water level measurement using ultrasonic sensor so that data can be converted into digital water level data and displayed through the internet and airpun height data can be monitored as a whole.

Based on the system test done, it can be concluded arduino and ultrasonic microcontroller to measure water level as well as website-based monitoring system that is useful to monitor the water level in real time.

Keywords: Water, Microcontroller, ultrasonic sensor, Monitoring, remote monitoring.

1. INTRODUCTION

PT. PJB UP Cirata Is the largest hydropower company in Southeast Asia to produce an average of 1,428 GWh channeled through an extra 500 KV high-voltage air line to the Java Bali interconnection system. To produce electricity, PT PJB UP Cirata needs to use water 1080 m³ water / sec stored in cirata yane dam has a capacity of about 2,165 million m³.

1.1 Waduk Cirata

Waduk Cirata Has an area of about 62 km² has a water capacity of 2.165 million m³ with a minimum elevation or elevation of +205 m and elevation or normal height +220. Cirata reservoir is fed by the main water source, namely Citarum river and other creeks. For use in producing electricity the reservoir needs 1080 m³air / sec and has three reference seasons in the use of water for production.

1. Wet Weather
   The wet season is categorized as rainy season so that the water debit in the reservoir has an average of 221-223 m with the water capacity in the dam reaching 2,165 million m³ will consequently impact on the dam because the dam can only accommodate water with elevation or elevation as high as 220 m with 1.88 water, 4 million m³
2. Normal Weather
   At normal weather conditions the air height in the reservoir averages 220 m with an air capacity in the reservoir of 1,818.4 million m³.
3. Dry Season
   At the time of the dry season the water level can reach the kuran of 205 m while the eleveation or the minimum water level in the reservoir water is more than 185 m. At the height of the water in the dry season, the water state reaches less than 205 m so that electricity production can not be done because it prevents the disruption of the plant or turbine..

1.2 *Internet Of Things (IoT)*

Utilization of internet technology is very profitable for society, organization, and company. Internet technology is very important role for all circles. In addition to getting mutual information now Internet technology is also widely used by companies to maximize company performance. Internet technology that is used by companies today is IoT (Internet of Things) .Io (Internet of Things) itself is defined as a technology that allows the control, communication, and cooperation with various hardware (Hardware) through the Internet network. Internet of Things emerged as a form of change and development of information technology and Internet network. So as to make electronic devices easy to connect directly to the internet and the internet is able to meet the need for addressing and connectivity. [3]

1.3 Monitoring

Monitoring is the process of collection and analysis of information based on the indicators set out in a systematic and continuous about the activities/programs so that it can be done for correction action completion programs/activities that followed. Monitoring that can be described as awareness (awareness) of what is like to note, containing high-level monitoring carried out in order to make the measurement through time that shows movement towards or away from it. Monitoring will provide information on the status and trends of that measurement and evaluation is completed repeating from time to time, monitoring is generally done for a specific purpose, to check against the following process object or to evaluate the condition or progress towards a goal of management results over the effect of the action of some kind among other actions to defend the ongoing management.

1.4 Ultrasonic Sensors

Ultrasonic sensors are sensors that transmit sound waves and then monitor their reflections so they can be used to determine the distance between sensors and objects that reflect back the sound waves. This sensor can be used in various applications such as the car to crash, to hide the alarm when someone approaches the door, and measure the height of people. [7]



Figure 1 Sensor Ultrasonik HC-SR04

Tabel pin pin sensor ultrasonik HC-SR04

PIN	Keterangan
Pin 1	Vcc (Conected to Voltage +5V)
Pin 2	Trig (For send sound wave)
Pin 3	Echo (For accept sound reflection)
Pin 4	Grid (Conected for *ground*)

This emitting ultrasonic sensor emits a sound wave frequency of over 20 KHz. The ultrasonic sensor consists of an ultrasonic transmitter circuit called a transmitter and an ultrasonic recipient circuit called a receiver. The working principle of the ultrasonic sensor is as follows:Sinyal dipancarkan oleh pemancar ultrasonik. Sinyal tersebut berfrekuensi 20 KHz, biasanya digunakan untuk mengukur jarak benda adalah 40 KHz. Sinyal tersebut dipancarkan oleh pemancar ultrasonik.

1. The emitted signal will then propagate as a signal or sound waves with a sound speed ranging from 340 m / s. Then the signal will be reflected and will be received back by the receiver
2. Once the signal gets to the receiver section, then the signal will be processed to calculate the distance

Here is how ultrasonic sensors work:

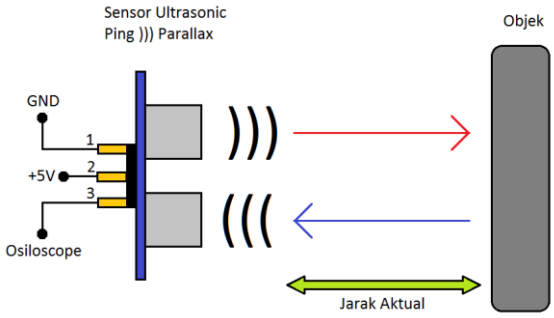


Figure 2 Cara kerja sensor ultrasonik

1. 5 *Microcontroller*

The microcontroller is a micro-sized computer in a single chip IC (integrated circuit) which consists of a processor, memory, and interface that can be programmed. So called because of the microcomputer in the IC or chip microcontroller consists of CPUS, memory, and i/o can we control with program. I/O is also called with GPIO (General Purpose Input Output Pins) which means: pin we can program as input or output as required. On a microcontroller chip generally have the following features:

1. Central processing unit ranging from 4-bit processor that is simple to high performance processor 64-bit.
2. Input/output network interfaces such as serial ports (UARTS).
3. other serial communications Interfaces like serial peripheral interface, IC and controller area network for the connection of the system.
4. Peripherals such as timers, and watchdog.
5. RAM for data storage.
6. ROM, EPROM, EEPROM or flash memory for storing programs dikomputer.
7. clock Generators are usually in the form of resonator an RC circuit.
8. analog to digital Converters

1.5.1 Arduino

Arduino micro-controller is a single-board that is open source, derived from the Wiring platform, designed to facilitate the use of electronics in a variety of fields. Atmel AVR processor has hardware and software has its own programming language.

Arduino is an open hardware platform also addressed to anyone who wants to make a prototype of interactive electronic equipment based on hardware and software that is flexible and easy to use. The microcontroller is programmed using the arduino programming language has similarities with the C programming language syntax. Due to its open so anyone can download the arduino hardware schematics and build it.

The Arduino using the ATMega microcontroller by Atmel as the base, but some individuals/companies who make a clone using the arduino microcontroller to another and remains compatible with the arduino hardware level. For flexibility, program inserted through the bootloader although there is the option to membypass the bootloader and use the downloader to program the microcontroller directly through port ISP.



Figure 3 Arduino Uno R3

2. RESEARCH CONTENTS

2.4 Analysis Of Architecture Design System

Architecture Analysis System is a system to be built, monitoring the height of this water is built with tools and ultrasonic microntroler sensors as a measure of water level. In addition, the ESP-8266 wifi module on the arduino is used for sending water level data over the internet using the REST API. The general design of this water level monitoring system is illustrated in the following block diagram:

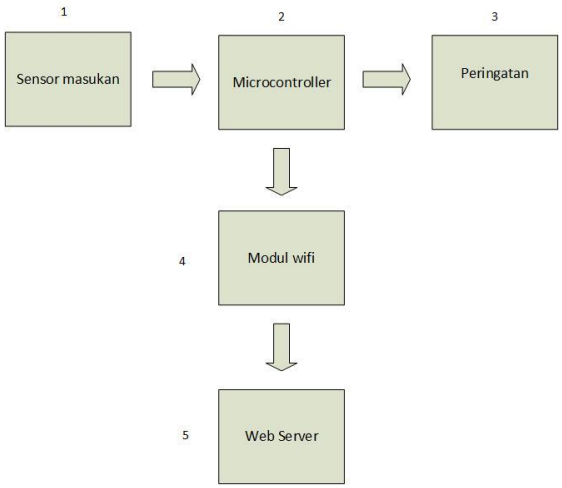


Figure 4 Analysis of the design of the system

System design analysis can be explained with the following details:

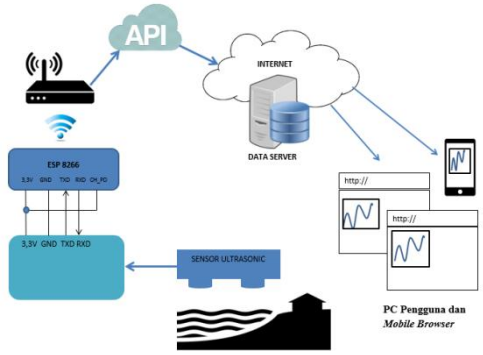


Figure 5 Architectural design of a system of Monitoring Water Head based

In the analysis of the design architecture of monitoring system in figure 5 above can be explained as follows:

1. Ultrasonic sensor is a device that emits ultrasonic light and is used as an altitude measuring device. This sensor emits waves against which it functions to measure the distance between the transmitted and reflected waves so as to provide the data information in the form of a value.
2. Arduino is a kind of microcontroller tool that serves to convert analog data into digital data. In this system arduino transforms analog data in the form of value and converted into digital data. So the value data in digital form can be seen in the application.
3. ESP8266 is a wifi module connected to an arduino that functions connecting the arduino to an internet network via a wireless or wireless network. ESP8266 function to send data to server through internet network.
4. The wifi modem is a wireless internet service provider.
5. Internet is the distributor of data to the server.

6. PC users are recipients of data transmitted over the internet with a web-based interface via computer and Mobile.

2.5 Context Diagram

Context diagrams are tools for analysis structures. This structured approach tries to describe the system in outline or overall. In this depiction, the system is regarded as an object that is not described in detail, because the emphasis is on system interaction with the environment that accesses it. Entity relationships that directly affect the data processing system of custody, purchase and sale of goods. Can be seen from the picture below:

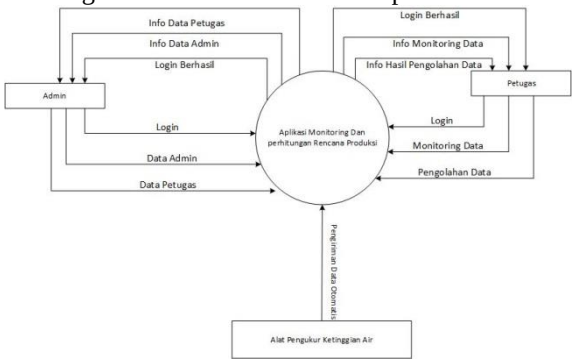
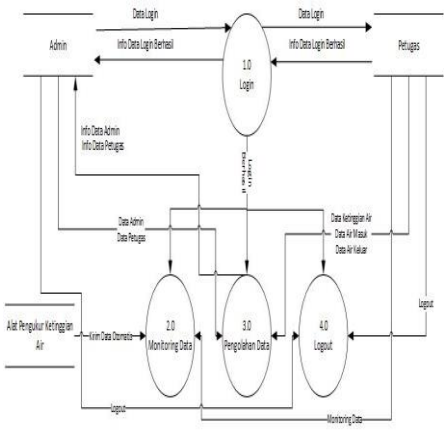


Figure 7 Diagram Konteks

2.6 DFD *(Data Flow Diagram)*

Data Flow Diagram is a system diagram illustrating how the application works logically. Starting from the highest level to the lowest level. In this design consists of preliminary design and detailed design in accordance with the stages of software engineering. The explanation of the initial analysis is a system analysis that describes the relationship between the system with the environment outside the system.

Figure 11 DFD



2.8 Implementasi Sistem

Setelah aplikasi dianalisis dan dirancang secara rinci, tahap selanjutnya adalah implementasi. Tujuan dari implementasi adalah untuk mengkonfirmasi modul-modul perancangan sehingga alat dan aplikasi dapat bekerja sesuai dengan yang di harapkan.

2.8.2 Implementasi Antarmuka

1. Antarmuka Website menu utama

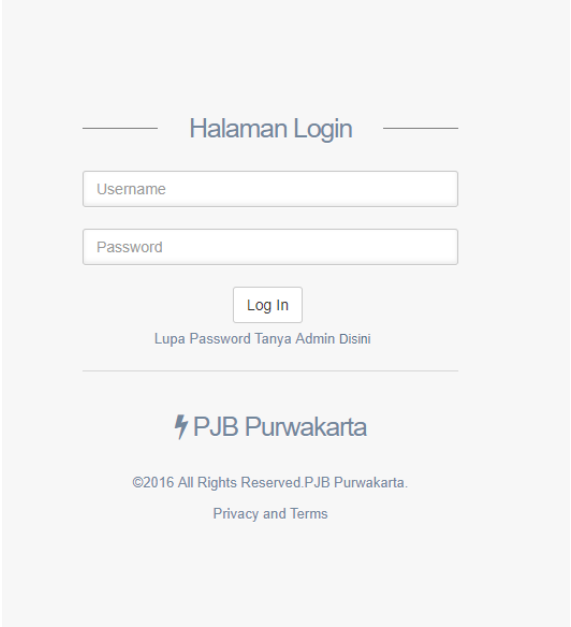


Figure 13 Antarmuka Menu Utama

2. Graphical interface bar for information on the amount of water that has been measured.

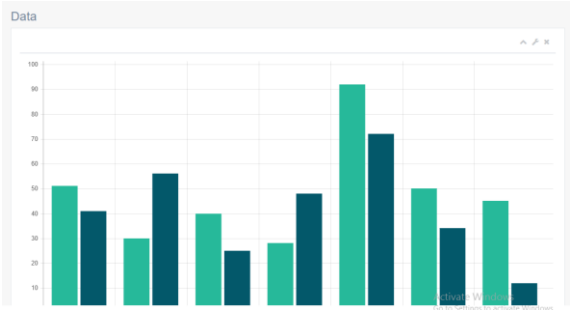


Figure 14 Antarmuka Menu Grafik Bar

3. Website Interface Monitoring water levels in real time.

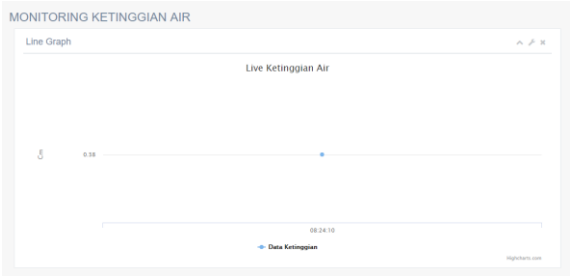


Figure 15 Antarmuka Monitoring

3. CLOSING

3.1 Conclusion

Based on the results of tests conducted in this study, conducted in the field can be concluded that the water level monitoring system gives good results.

1. Direction of data through internet by using wifi module ESP-8266 successfully sent and appear in web-based interface.
2. Water height information can be done in realtime.
3. The calculation of production plans can already be done by the system automatically
4. Testing of production plan calculation successfully done with error value 0,07%.
5. Ultrasonic sensor testing successfully done..

3.2 Advice

To improve further research and development, the authors provide suggestions in the form of:

1. Creating an automatic control system open the flood gate of the reservoir.
2. To be able to operate the system there must be electricity and internet in the water measurement area.
3. Add notification of water level of reservoir through sms.
4. Looking for a more accurate measuring instrument to measure the water level.
5. Adding a more accurate sensor to shave the water level of the reservoir.

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