PROTOTYPE OF MONITORING SYSTEM OF THE WATER GATE OF CIWULAN RIVER AT BIUK IRRIGATION AREA BASED ON IOT (INTERNET OF THINGS)

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ABSTRACT

The dam located in Tasikmalaya District distributes water from the Ciwulan River to the Biuk Irrigation Area. The dam has 2 water channel gate and 1 drain gate, where the opening of the water gate in the dam is still manual. In conducting water distribution, the officers must monitor the water level in the Biuk Irrigation Area and the water level in the Ciwulan River, so that there is a need for alert personnel at the water gate to control the distribution of water. To solve this problem, a system can be created that can help the dam officer to control the water gate and monitor the water level. This system utilizes the Arduino microcontroller that is connected with an ultrasonic sensor, water level sensor, servo motor, buzzer, 16x2 LCD and GSM module. The monitoring system open close he water gate of the Ciwulan River Biuk Irrigation Area can be monitored and controlled via the internet known as the Internet of Things (IoT). By using internet technology as a data sending medium, ultrasonic sensors and water level sensors will provide water level information and servo motors as a sluice mover to open the water gate. Based on the results of application testing to respondents, 88% of respondents strongly agreed with the existence of a dam monitoring system application, so that officers could be helped by the existence of a dam monitoring system application.

Keywords: Monitoring, Dam, Water Gate, Internet of Things (IoT), Arduino.

1. INTRODUCTION

Weir is a building made of river stone, gabion or concrete, which lies across a river which of course this building can also be used for purposes other than irrigation, such as for drinking water, electricity generation or for flood control [1] In the weir there is an important component in the form of a sluice gate which is used to regulate water expenditure.

Dam in the Ciwulan River Region, the Biuk Irrigation Area, located in Neglasari Village, Salawu District, Tasikmalaya District, irrigated an area of 26.00 Ha. In opening the closed the flooded sluice door is still manual, so that in opening the sluice door, there is a need for standby staff at the water gate to control the distribution of water. In addition the officers must always monitor the water level in the Biuk irrigation area and the water level from the Ciwulan river area, where there is a water level in the biuk irrigation area that is normal 50-60cm, medium 60-90 cm, standby more than 90 cm while the level is high the water in the river ciwulan that is being 20-30 cm from confusing and standby 1.5 m from wrecking. For the distribution of water to the Biuk irrigation area, it should not exceed 90 cm of water because the condition of the Biuk irrigation area network is built in mountainous areas so that the irrigation network is a high contour / line. Channel section on one side is a soil dike that is very prone to landslides. And on the other side is a cliff which often makes it difficult to control sediment [2].

IoT (Internet of Things) is a technology that allows control, communication, and collaboration with various hardware devices through the internet. IoT (Internet of things) appears as a form of change and development of information technology and internet networks [3]. The use of internet technology is very beneficial for people, organizations, and companies. Internet technology plays an important role for all circles. In addition to information sharing, internet technology is also used by companies to maximize company performance [4].

The monitoring system and open the floodgates of the Ciwulan river area of the Biuk Irrigation area can be monitored and controlled via the internet or better known as the *Internet of Things* (IoT). Arduino is one of the devices that fall into the criteria of the *Internet of Things*, via the internet network Arduino can be controlled with various devices such as Android devices [5]. By using internet technology as a data sender medium, ultrasonic sensors and water level sensors will provide water level information and servo motors as *actuators* sluiceto open the sluice gates which are controlled via android [6]. In addition to information on water level and information on opening the sluice gate, the information data generated is in the form of sluice status and water level status.

Based on the description and results of the Vice Mayor to the Office of Water Resources of the UDA PSDA of the Ciwulan-Cilaki River Region, then to facilitate operations and to minimize work accidents

in monitoring the water level and opening the sluice gate of the river area a prototype for opening the sluice gate and measuring altitude water through a smartphone by applying IoT (Internet of Things) technology. So the authors set the study entitled: "Protoype Monitoring System Open Close the Water Gate of the Ciwulan River Region of IoT-Based Biuk Irrigation Area (Internet of Things)".

1.1 Problem Identification

Based on the background problems that have been explained previously, the following problems can be considered:

a. Open the sluice lid is still manual.

b. Weir officers must always come directly to the weir to monitor water level.

1.2 Purpose and Objectives

The purpose of this final project is to build a prototype of a monitoring system to open the sluice gate and water level in the Ciwulan River Basin IoT (-based Irrigation Area*Internet of Things*). .

The objectives to be achieved from this research are as follows:

a. Building a system to assist weir officers in opening sluice gates through smartphones by applying technology (*Internet of Things*).

b. Weir officers can monitor water levels and water level through smartphones using IoT (technology*Internet of Things*).

2. RESEARCH CONTENT

2.1 IoT (*Internet of Things*)

According to (Burange & Misalkar, 2015) the *Internet of Things* (IOT) is a structure in which objects, people are provided with an exclusive identity and the ability to move data over the network without requiring two directions between humans to humans, namely sources to the destination or human interaction to the computer.

According to (Keoh, Kumar, & Tschofenig, 2014) the *Internet of Things* is a scientific development that is very promising to optimize life based on intelligent sensors and smart equipment that collaborate through the internet [7].

2.2 Web Service

W3Cdefines web service as an application software that can be identified by URIs and has interfaces that are defined, described, and understood by XML or JSON and also supports direct interaction with other application software using XML or JSON based messages via internet protocol. Web service is an application software that is not affected by the platform, providing methods that can be accessed by the network. Web Service will also use XML to exchange data, especially on two different business entities [8].

2.3 Built System

Analysis Analysis of the system to be built explains the overall system description. In the system to be built there is a hardware component in the form of a sensor that can read the water level connected to a microcontoller device, servo motor, 16x2 LCD and bzzer. Where the water level data that is read will be displayed on the web and android devices that are connected to the internet by utilizingtechnology *Internet of Things* (IoT)and with the help of GSM module hardware which contains SIM CARD, this GSM module is connected to the Arduino microcontroller for data communication between devices .

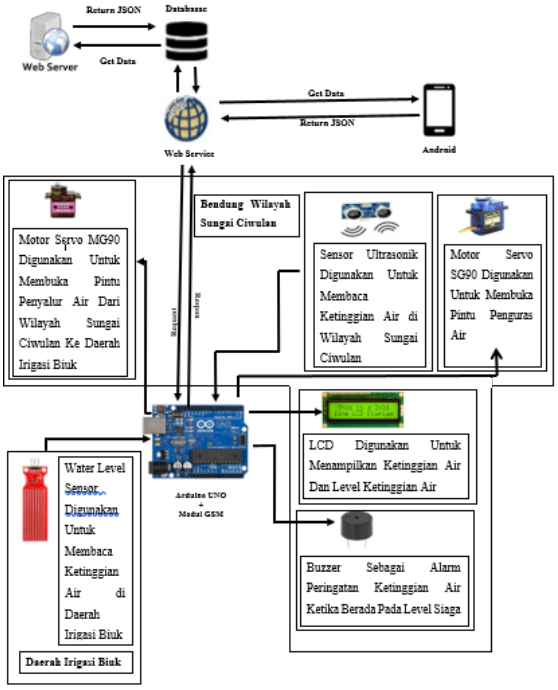


Figure 1. System Architecture That Will Be Built The

1. system on thedevice *android* will refresh the weir data every 15 minutes and the weir officer will open the channel door and drain the weir through the Android device.
2. Android devices will send weir data and access the weir data in the database through a webservice connection. Then the web service will send the weir data to the android device.
3. Arduino microcontroller will send the weir data and access the weir data in the database through a webservice connection.
4. Ultrasonic sensors and water level sensors will read the water level by sending ultrasonic waves and will read the distance from the reflected wave after crashing into water.

5. The servo motor will open the water channel door and drain door if the officer gives an order to open the drain door on the Android device.
6. 16x2 LCD will display water level information and level of water level.
7. Buzzer will sound every water level in the biuk irrigation area is on the alert level with water level> = 4.5 cm cm or when the river height ciwulan is on alert level with high water> = 7 cm.

The following is table 1 is the water level table on the Prototype of the Monitoring System Open the Door Closer of the Ciwulan River Area Irrigation Area of Biuk

Table 1. Water Height Table

Level of Ciwulan River Water	Level Level of HeightBiuk Irrigation Area
Normal> = 0 cm - <= 7cm	Normal> = 0 cm - <= 1.5 cm
Standby> = 7 cm	Medium> = 1.5 cm - <= 4.5 cm
	Standby> = 4.5 cm

2.4 Data Communication Analysis

In the data communication analysis stage is the analysis of hardware data communication to database and analysis of data communication from the database to the android application.

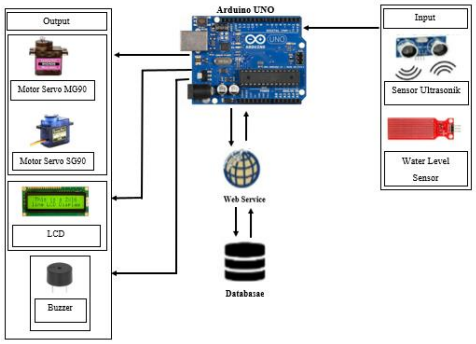


Figure 2. Hardware Communication to theDatabase

1. Ultrasonic Sensorand water level sensor sends water level data to the Arduino microcontroller level once every 10 seconds.
2. Arduino sends back the water level data to the database via a web service connection and will be stored in the database.
3. The database will receive a data request that will be sent to the Arduino to order to check the water level and open the sluice door.
4. 16x2 LCD will display water level information and level of water level.
5. Buzzer will sound every water level in the biuk irrigation area is on the alert level with water level> = 4.5 cm cm or when the river height ciwulan is on alert level with high water> = 7 cm.

Web service in this application building acts as data communication, namely data that will be taken by android devices and Arduino devices and then returns or returns to the device with JSON format that will generate weir data.



Figure 3. Android communication to Daatabase

1. Aplikasi android akan menampilkan data-data ketinggian dalam infografik setiap 15 menit sekali
2. Aplikasi android akan membentuk koneksi pada *web service* dengan mengirimkan *request* data-data bendung ke *server* melalui *web service* dan menerima data-data bendung dari *web service.*
3. Server akan menerima *request* data-data bendung dan mencari informasi yang di *request* oleh android.
4. *Web service* akan menyimpan *request* yang diminta oleh android di dalam database.
5. Server akan mengembalikan kembali data-data bendung yang diterima ke android dalam bentuk JSON agar android dapat membaca informasi yang di *request* .

2.5 Analysis Database

Analysis (Database) is divided into three namely erd (entity relationship diagram), and data dictionary. Following is ERD (Entity Relationship Diagram), and data dictionary from database analysis (Database) dbbendung on the system to be built.

2.5.1 ERD (*Entity Relationship Diagram*)

First widely used database modeling is to use ERD (Entity Relationship Diagram). The ERD (Entity Relationship Diagram) on the development of the system to be built can be seen in Figure 4

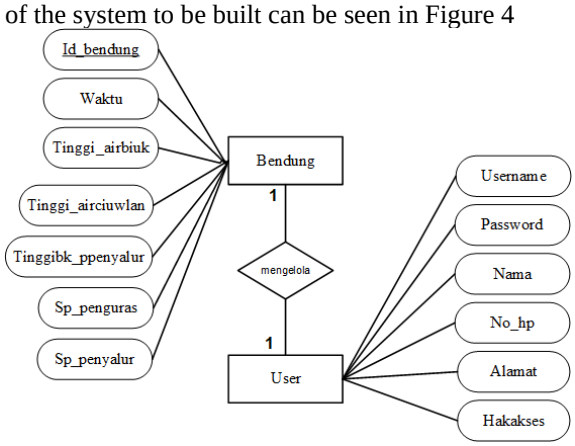


Figure 4. Hardware Communication To Database

2.5.2 Data Dictionary

Data dictionary of Entity Relationship System development system diagrams to be built can be seen in table 2

Table 2. Data Dictionary

No	Entity	Attributes
1.	Weir	Id_bendung, time, height_airbiuk, tinggi_airciwulan, highib_penyalur, sp_penguras, status, sp_penyalur
2.	User	Username, password, name, no_hp, address,rights

2.6 Data Access Design

Data design is a stage to map the conceptual model to the database model that will be used. Data design is divided into relation schemes and table structure design.

2.6.1 Relationship Scheme

Relationship scheme is a series of relationships between two or more tables in the database system dbbendung. As well as combining the attributes that have the primary key. So that the attributes of the user table, weir and history become one unit that is connected by the key file from the user table, weir and history. The following is the relation scheme of the open and close sluice monitoring system can be seen in Figure 5

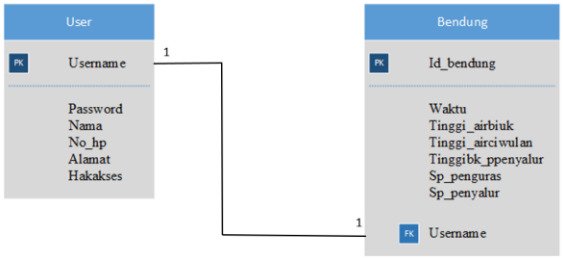


Figure 5.Relation Scheme

2.6.2 Table Structure

Table structure in the database analysis (database) dbbendung describes the details of the user table, weir and history that contain fields, data types, data lengths, and other information. The tables used in the database dbbendung monitoring system open the sluice gate are as follows:

a. User

Table Name :User

Primary Key : Username

Here below table 3 is the table structure of the user table:

Table 3. Table Structure User

Field	Data Type	Range Data	Keterangan
Username	Varchar	23	Primary Key
Password	Varchar	50	
Nama	Varchar	50	
No_hp	Char	13	
Alamat	Text		
Hakakses	Enum		Select one ('admin', 'officer')

b. Bendung

Tabel name : Bendung

Primary Key : Id_bendung

Here below table4 is the table structure of the user table:

Tabel 4. Table Structure Bendung

Field	Data Type	Range Data	Ket.
Id_bendung	Integer	11	Primary Key
Waktu	Datetime		
Tinggi_airbiuk	Integer	3	
Tinggi_airciwulan	Integer	3	
Tinggibk_ppenyalur	Integer	2	
Sp_penguras	Enum		Select one ('open', 'close')
Sp_penyalur	Enum		Select one ('open', 'close')

2.7 Design Of The Microcontroller And Sensor

Design of the microcontroller and the sensor is a split from the hardware components used. The following are the components used in the microcontroller and sensor devices needed by the system.Perancangan mikrokontroler dan sensor merupakan percangangan dari komponen-komponen hardware yang digunakan. Berikut pada adalah komponen-komponen yang digunakan pada perangkat mikrokontroler dan sensor yang dibutuhkan sistem.

Table 5. Microcontroller and Sensor

No	DevicesDevice Names	Function
1	Arduino Uno	As microcontroller
2	SIM800L V2 GSM	module As internet module
3	Ultrasonic Sensors	Used to read water level
4	Water Level Sensor	Used to read water level
5	Servo Motor SG	To open the door water

	90	
6	Servo Motor MG 90	To open the sluice door
7	16x2 LCD	To display the water level and water level
8	Buzzer	As a warning water level alarm is at the standby level
9	Jumper cumbbell	As an interface device

Next picture 6 microcontroller and sensor design is a design of the hardware components used in

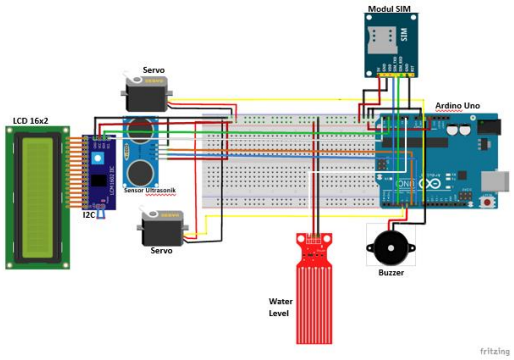


Figure 6. Microcontroller and Sensor

2.8 Impelemntasion Database

Creation is done by using phpMyAdmin. The following are tables 6 to 7 which are tables in the database dbbendung used in making the Monitoring System Open Close Water Gate of the Ciwulan River Region Irrigation Area of Biuk.

The following table 6 is the user table from the database dbbend on the Monitoring System Open Close the Water Gate of the Ciwulan River Region, the Biuk Irrigation Area

Table 6. Table User

```
CREATE TABLE `user` (
  `username` varchar(23) NOT,
  `password` varchar(8) NOT NULL,
  `nama` varchar(50) NOT NULL,
  `no_hp` char(13) NOT NULL,
  `alamat` text NOT NULL,
  `hakakses` enum('Admin','Petugas') NOT NULL
)
```

Here table 7 is a weir table from the database dbbendung on the Monitoring System Open Close the Water Gate of the Ciwulan River Region Irrigation Area Biuk.

Table 7. Table Bendung

```
CREATE TABLE `bendung` (
  `id_bendung` int(11) NOT NULL,
  `waktu` datetime NOT NULL,
  `tinggi_airbiuk` int(3) NOT NULL,
  `tinggibuka_penyalur` int(2) NOT NULL,
  `status_pintu` enum('Buka','Tutup') NOT NULL,
  `tinggi_airciwulan` int(3) NOT NULL
)
```

2.9 Mikrokontroler and Sensor Implementation

Following figure 7 and figure 8 is the implementation of a series of components used in the system.



Figure 7. Implementation of Microcontrollers and Sensors

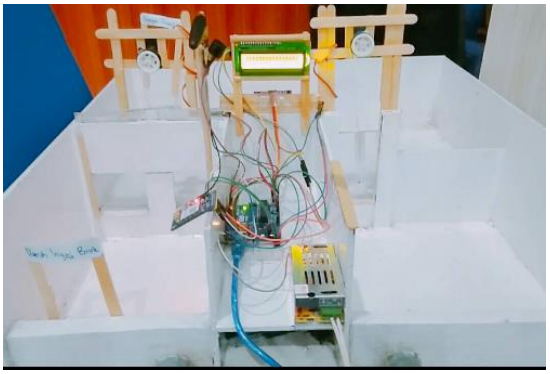


Figure 8. Implementation of Microcontrollers and Sensors

2.10 Interface Implementation Main Web Menu

Following figure 9 is the login menu interface display

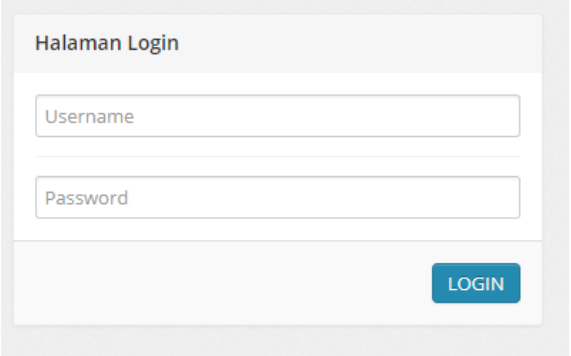


Figure 9. Login Menu Display

After the user has successfully *logged in*, the officer will enter the dashboard page, which will display information on the water level in the Ciwulan River Region, the water level in Biuk Irrigation Area, water level, height open the water channel door and the status of the drain door and

water distributor. In addition to the weir information, on the main page there are several control buttons namely the data refresh button, the channel door control button, the drain door open button and the drain door close button. Which can be seen in Figure 10

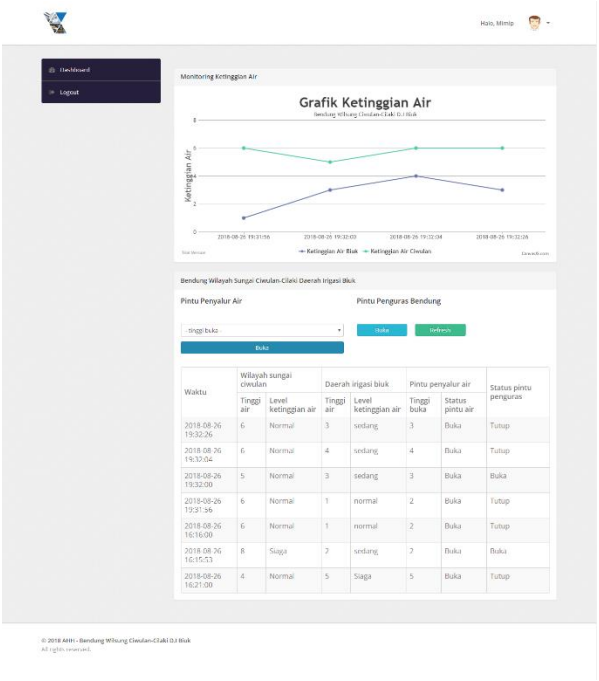


Figure 10. Display ofDashboard Interface

3. CLOSING

3.1 Conclusion

From the results of the monitoring system research open the sluice of the Ciwulan-Cilaki river area, this Biuk Irrigation Area, the authors draw the following conclusions:

a. Application of monitoring system open and close the sluice can help officers in monitor weir.
b. Facilitate the weir officer in checking the level of the water and opening the sluice door.

3.2 Suggestion

To develop a monitoring system open the sluice door on the weir, the writer gives suggestions that are expected to be realized and become the basis of further research. As for suggestions from the author, namely:

a. Implementing this system to the original dam
b. Adding sensors to measure mud height
c. Using anmodule *internet* that can supportconnectivity *internet* better.

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