International Journal on Smart Material and Mechatronics
IJSMM Vol. 11 No. 1 2024 DOI. 10.20342/IJSMM.11.1.498

p-ISSN: 2356-5314
e-ISSN: 2460-075X

Water Level Monitoring System, Water Discharge, Rainfall in Rivers Based on IoT

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Abstract — The purpose of this research is to create an IoT-based monitoring system for water level, water discharge and rainfall on rivers, to make it easier for users to get information so that they are always ready if the air starts to rise in the rainy season. In developing research on water level monitoring systems, water discharge and rainfall on IoT-based rivers, researchers used the Research & Development Borg & Gall method. The results of the study indicate that the monitoring system can function properly and is in accordance with the objectives that have been designed by the researcher. The system is designed to use a water level sensor to measure the water level, a water flow sensor to measure water flow and a rain gauge sensor to measure rainfall. For output using LCD, lamp and buzzer. The monitoring tool has also been integrated by Telegram. The results for the water level get a range of 25 cm until 125 cm, for the speed of water discharge it gets a range of 10 until 40 mL/s and for rainfall, it gets a range of 1346 until 20193 mm/h.

Keywords — Monitoring System, Water Level, Water Discharge, Rainfall, Telegram, Internet of Things.

I. INTRODUCTION

Flood is a disaster that ranks second after landslides. As of October 12 2020, flood disasters in Indonesia in 2020 had 636 incidents. Fatalities); 49 people died & went missing, 18 people were injured, and 627,825 were affected & displaced. Houses (units); 803 were seriously damaged, 2,882 were moderately damaged, 8,522 were slightly damaged, and 88,668 were submerged. Damage (units); 13 health facilities, 55 worship facilities, and 74 education facilities [1].

According to [3] Flood Prone Areas are; areas that have the potential to have high rainfall; rocky areas with low water absorption; the area around the river and into the flow of river water; areas with densely populated settlements and slums; and areas affected by floods.

One of the cities that often experiences flooding is DKI Jakarta. The cause of flooding in DKI Jakarta is high rainfall intensity as the main trigger, another factor is the influence of lowland landforms; lack of water absorption; reduced catchment areas due to high population growth causing increased housing needs; lack of public awareness to carry out soil and water conservation efforts; and the implementation and enforcement of regulations issued by the central government and regional governments are not yet optimal [2].

Along with increasingly advanced technology and communication needs, the use of gadgets or smartphones that are also connected to the internet has an important role in today's life. Because, now people get information and can search for information via the internet especially on various social media platforms. This makes the people of Jakarta very fast and easy to access information anytime and anywhere.

One of the internet developments that is currently being developed is the Internet of Things (IoT). Internet of Things (IoT) is a concept that can connect internet devices to be able to communicate with each other via the internet network (Shidiq, 2018).

There are so many benefits of the Internet of Things (IoT) that can be used as an idea that can help or facilitate human work. The Internet of Things (IoT) can also be used to create tools that can be used to detect water levels, water discharge and rainfall in rivers based on the Internet of Things (IoT) as a medium of information for the community.

The tools that will be realized by researchers use a water level sensor to measure the water level in the river, a water flow sensor to measure the speed of water discharge and a rain gauge sensor to measure rainfall. In the research conducted, the monitoring system uses the concept of the Internet of Things (IoT) where the data is measured sensors will be sent and processed by the ESP32 module, then the data that has been processed will be displayed via the LCD and by giving input to Telegram, then Telegram will send the latest data. So a monitoring system for water level, water discharge, rainfall in rivers based on IoT was created to provide information on the results of the monitoring carried out.

II. RESEARCH METHOD

The method used in this study is the Research & Development (R&D) research method with the Borg & Gall development model. The Borg & Gall R&D method consists of ten steps, but researchers only use four steps, namely data and information collection, planning, initial product development, and testing.

In the input device there are water level sensors, water flow sensors and rain gauge sensors. Water level sensor to measure water level, water flow sensor to measure water discharge, then rain gauge sensor is used to measure rainfall.

On the output device there is an Indicator Light on the monitoring system to indicate that the system is active by measuring the water level that has been detected by the sensor. The buzzer will also be active when water has been detected by the top sensor, which is 0.125 and a 20×4 LCD which functions to display data in the form of letters and characters.

The input and output devices are respectively connected to the ESP32 module as a WiFi-equipped controller. The ESP32

p-ISSN: 2356-5314
e-ISSN: 2460-075X

module will process sensor measurement data then the data will be displayed using a 20×4 LCD. Then the ESP32 module also uses the internet network to send sensor measurement data to a database that functions as a data store for sensor measurement results that have been processed. Then the data that has been processed will be displayed via the LCD and by giving input to Telegram, then Telegram will send the latest data to the user.

III. RESULT AND DISCUSSION

Figure 1. Device's design

Figure 2. Actual device

The results of testing the water level monitoring system, water discharge, rainfall in rivers based on IoT

TABLE 1
WATER LEVEL SENSOR TEST RESULT

Water Height (cm)	High (Vdc)	Low (Vdc)
25	4,915	0,3
75	4,583	0,3
125	4,873	0,5

In Table 1, the results of testing the water level sensor using a multimeter measuring instrument obtained a voltage with a measured regulator input value of 12.09 Vdc.

TABLE 2
RAIN GAUGE SENSOR TEST RESULT

Condition	Rainfall Measurment	Voltage (Vdc)
Detected	12,116 mm	3,457 V
	2,692 mm	3,474 V
	1.346 mm	3,479 V
Not Detected	0,000 mm	0,04 V

In Table 2, the results of the rain gauge sensor test using a multimeter measuring instrument obtained a voltage with a measured regulator input value of 5,056 Vdc.

TABLE 3
WATER FLOW SENSOR TEST RESULT

Water Flow	Voltage (Vdc)
0mL	28,6 V
7mL	1,587 V
11mL	1,852 V
18mL	3,439 V

In Table 3, the results of testing the water flow sensor using a multimeter measuring instrument obtained a voltage with a measured regulator input value of 5,056 Vdc.

TABLE 4
OVERALL DEVICE TEST RESULT

No	Date	Weather	Time	Telegram Display: Water Height, Water Flow, Rainfall
1	9 May 2022	Sunny	13.17	
2			14.30	
3			15.21	
4	11 May 2022	Sunny	13.26	
5			14.19	
6			15.22	
7	13 May 2022	Cloudy	13.22	
8			14.28	
9			15.15	
10	23 May 2022	Cloudy	13.24	
11		Overcast	14.18	
12		Cloudy	15.39	
13	25 May 2022	Overcast	13.38	
14		Light rain	14.25	

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15		Light rain	15.43	
16	27 May 2022	Overcast	13.38	
17		Overcast	14.25	
18		Light rain	15.34	

The researcher tested the telegram. When the user gives input in the form of "/information" text, the telegram will display the latest data that has been measured by the water level sensor, water flow sensor and rain gauge sensor. However, when the water level sensor has detected the water level with a height of > 125 cm, the telegram will send an automatic message by sending a text in the form of "Warning" and the buzzer on the monitoring system tool will also sound. However, sending data from the device to the telegram is also heavily influenced by the signal, because it can result in delays in the data being sent.

Researchers tested the system as a whole. The results of these tests are that the system can work properly, because the water level sensor can detect the water level properly, the water flow sensor can calculate the water discharge properly and the rain gauge sensor can calculate rainfall properly. Likewise with Telegram which can work very well when giving input in the form of text that reads "/information" and when sending automatic text if the water has touched the highest water level sensor.

IV. CONCLUSION

After conducting research on the IoT-based monitoring system for water level, water discharge and rainfall in rivers, it can be concluded that the IoT-based monitoring system for water level, water discharge and rainfall in rivers has been successfully designed and is in accordance with the research objectives conducted by researchers.

The IoT-based monitoring system for water level, water discharge and rainfall in rivers is designed using ESP32 as a microcontroller. Water level sensor, water flow sensor and rain gauge sensor are used as inputs. The Telegram application as internet of things works well, the telegram application can be accessed remotely by users

making it easier to monitor water level, water discharge and rainfall in the river. If the height is less than and above 25 cm then the green light will be active, if the water level is above 75 cm then the yellow light will be active and if the water level is above 125 cm then the red light and buzzer will be active, and a notification will be sent on a telegram saying " warnings".

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