Jurnal Ilmiah Teknik Elektro Komputer dan Informatika (JITEKI)
Vol. 8, No. 2, June 2022, pp. xx-xx
ISSN: 2338-3070, DOI: 10.26555/jiteki.v8i2.xxxx

MONITORING OF RIVER WATER LEVEL BASED ON INTERNET OF THINGS

Wahyu Padliansyah Liambo[1*], Sunardi[2]
[1,2] Department of Electrical Engineering, Universitas Ahmad Dahlan, Yogyakarta 55191 Indonesia

ARTICLE INFO

Article history:

Received Maret 20, 2024
Revised Maret 25, 2024
Published September 25, 2024

Keywords:

River Water,
Water Level Sensor,
HC-SR04 Sensor

ABSTRACT

River water level monitoring is the process of monitoring water in rivers that sometimes overflow and cause flooding. Residents need to know the water level to serve as an early warning. Therefore, it is necessary to have a measurement mechanism and river water level information in order to provide information to the community. Monitoring river water levels in this research uses the HC-SR04 ultrasonic distance sensor and water level sensor. Arduino Uno is used as a microcontroller. This research uses a prototype with water level measurements observed at <3 cm (low), 3-5 cm (medium), and >5 cm (high). The water level can be monitored from anywhere through Blynk. The implementation of the resulting water level has been successful in accordance with the parameter values on the water level sensor which is marked by the display of numbers on the LED, the color of the lights, and different alarm sounds for each water level. HC-SR04 ultrasonic sensor is able to measure and provide water level data in realtime and from any place using Blynk.

Corresponding Author:

Corresponding: Wahyu Padliansyah Liambo, Department of Electrical Engineering, Universitas Ahmad Dahlan, Yogyakarta 55191 Indonesia
Email: wahyu1900022079@webmail.uad.ac.id

1. INTRODUCTION

Indonesia is a country that has high rainfall. Rainy season in Indonesia usually four months every year. This is advantage because drought rarely occurs in Indonesian territory. Water is very beneficial for life as consumption material or irrigation on agricultural land [1].

Flooding is an ongoing problem still requires special handling various parties, both from the government and public. Flooding is not a trivial problem. Flooding can occur due to rising levels water due to above normal rainfall, temperature changes, embankments/dams breaking, rapid snow melting, obstruction of water flow in other places [2].

Internet of Things (IoT) is a everyday computing concept about connected objects to the internet and capable identify to other devices. IoT is classified in communication methods, although IoT too may include other sensor technologies, wireless technology or QR code. The real IoT is a fairly simple concept, which meaning it connects all physical objects in everyday life to the Internet. Along continued technological developments rapidly, nowadays it is known as the IoT.
di daftar Pustaka ada 25 pustaka, semua harus dirujuk dalam naskah

2. METHODS

Water level sensor get three results from the highest level has been determined on the sensor with the best data results namely using the water height value low = < 3 cm; Medium water level = 3-5 cm; and High water level = > 5 cm. Ultrasonic sensor get a distance of up to 10 cm from the detected water level will continuously provide data after the water level maximum sensor provides data less than 5 cm and more than 6 cm this sensor

cannot be used provide any more data due to sink. Ultrasonic sensor data will continuously send data to the Blynk components and software can be seen at Table 1.

Table 1. Research Tools

No	Tools and materials	Shape
1	Arduino IDE	software
2	NodeMCU ESP8266	software
3	Blynk	IoT Platform
4	Ultrasonic Sensors	Hardware
5	Water Level Sensor	Hardware
6	LCD I2C 16x2	Hardware
7	12 volt adapter	Hardware
8	Buzzer	Hardware
9	LED lights	Hardware
10	Cables	Hardware
11	PCB Board	Hardware

The system design of this tool consists of component design or design hardware and also wiring diagram shown in Figure 1 and Figure 2.

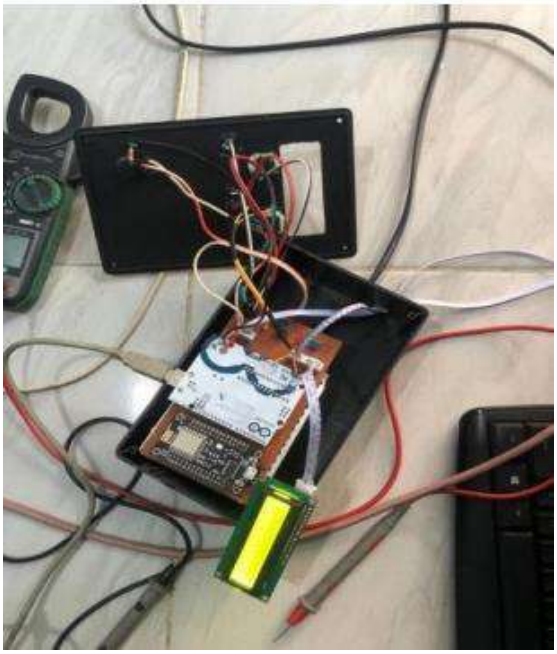

Figure 1. Hardware Design

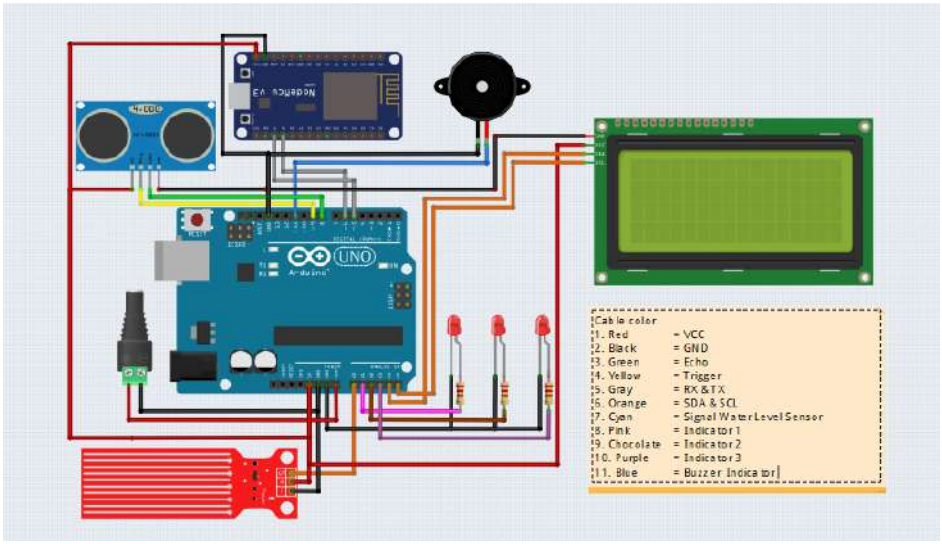

Figure 2. Wiring diagram

The river water level monitoring system based on IoT can develop by using block diagram and flowchart in Figure 3 and Figure 4.

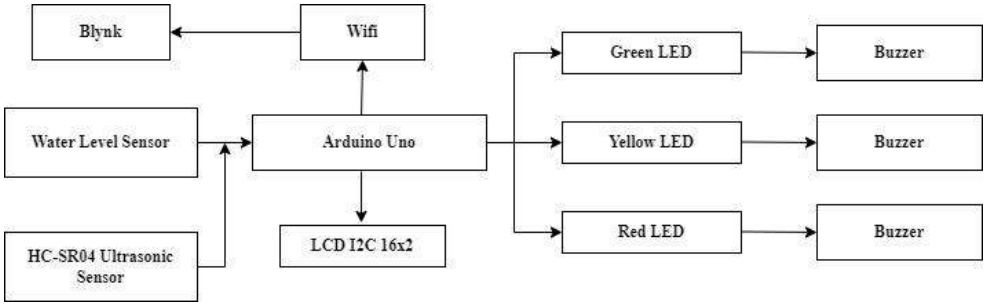

Figure 3. Block diagram

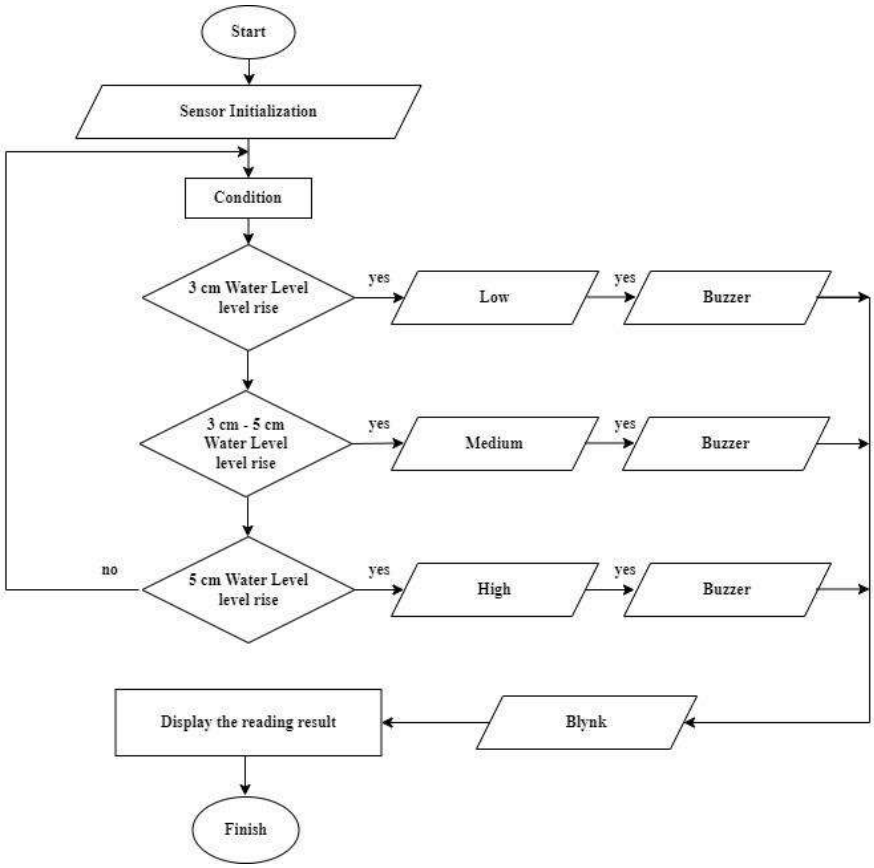

Figure 4. System flowchart

3. RESULTS AND DISCUSSION

River water level monitoring system based on IoT can carry out sensor testing and monitoring remotely with the Blynk app. Blynk can display sensor detection values Ultrasonic HC-SR04 and Water Level Sensor as shown in Figure 5.

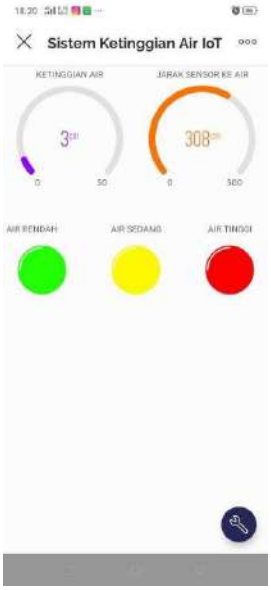

Figure 5. Display of the Blynk application

3.1. HC-SR04 Ultrasonic Sensor testing

This sensor testing aims to find out the performance of the sensor in detecting water height. Detection of the river water levels seen in Figure 6 and Figure 7.

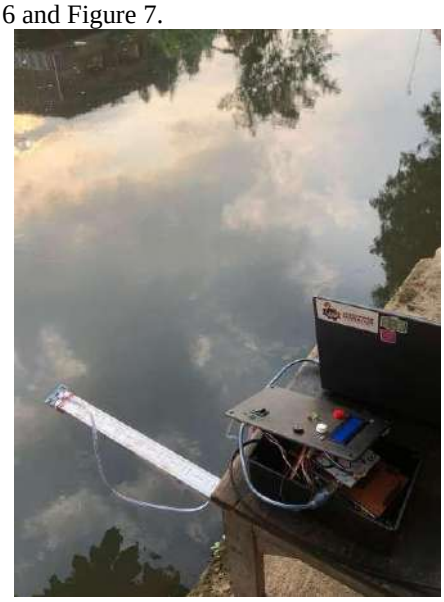

Figure 6. Ultrasonic Sensor Testing

Figure 7. Ultrasonic sensor distance testing

3.2. Ultrasonic Sensor Testing HC-SR04 on Aquarium

Testing the distance of the ultrasonic sensor in the aquarium aims to provide original distance data and sensor distance data. This test is done by detecting the increase in water in the aquarium. The condition of the ultrasonic sensor is higher than the water level sensor. The distance between the ultrasonic sensor and the water level sensor is 10 cm in order to provide output results on the ultrasonic sensor in accordance with the output results of the water level sensor. When the water level detects an increase in water at a height of 0.98 cm sensor distance data, the ultrasonic sensor will provide sensor distance data of 10.27 cm. In this ultrasonic sensor test, it has shown the monitoring results as desired and found error. Ultrasonic sensor testing in the aquarium can be seen in Figure 8.

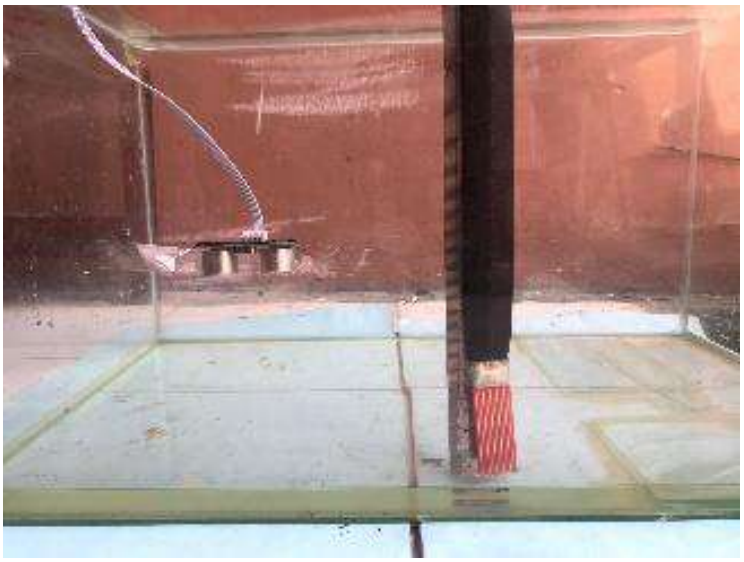

Figure 8. Ultrasonic sensor testing HC-SR04 on aquarium

Sensor testing was carried out 12 times to determine the accuracy of the ultrasonic distance sensor with 2 data, namely the original distance data and sensor distance data. The test results are shown in Table 2.

Table 2. Sensor test

Original distance data	Sensor distance data	Error difference
10 cm	10.27 cm	27 mm
10 cm	10.17 cm	17 mm
8 cm	8.10 cm	1 mm
7 cm	7.91 cm	91 mm
6 cm	6.48 cm	48 mm
5 cm	5.83 cm	83 mm
5 cm	5.12 cm	12 mm
4 cm	4.62 cm	62 mm
3 cm	3.79 cm	79 mm
2 cm	2.48 cm	48 mm
1 cm	1.00 cm	19 mm
0 cm	1.00 cm	100 mm
Average of error difference		50.5 mm

In testing the ultrasonic sensor there were 12 trials where in the 10 cm height experiment there was an error difference in the original distance data and sensor distance data. The original distance data issued 10 cm data, while the sensor distance data issued 10.27 cm data. The sensor can detect but get an error difference with an error difference of 27 mm. At a height of 2 cm there is an error difference and so is the height of 8, 7, 6, 5, 4, 3, 2, 1, and 0 cm where in these tests the ultrasonic sensor has detected the water level properly and in accordance with the desired command in this study. Testing on ultrasonic sensors cannot show the accuracy there is still an error difference in each test of the original distance data and sensor distance data.

3.3. Water level sensor testing

Water Level Sensor testing is carried out to find out if the sensor can detect water level. To see whether the sensor can detect the water level the river can be seen in Figure 9.

Figure 9. Water Level Sensor Testing

Water Level Sensor testing at this time uses three conditions, namely < 3 cm, 3-5 cm, and > 5 cm. Given the size of the sensor is so small. value < 3 cm gives a state of low water rise, value 3-5 cm gives a state of medium water rise, and at a state value > 5 cm gives a state of high water rise with input connected to the sensor input pin 12 V, and input 5 V from the Arduino Uno microcontroller voltage. Water Level Sensor test results can be seen in Figure 9. Water Level Sensor testing done can successfully detect the water level and send data to the Blynk app. Water Level Sensor data collection is carried out with 3 times data collection where data collection is carried out in the morning, afternoon, and evening for 7 consecutive days. The result of test can be seen in Table 3.

Table 3. Water Level Sensor test results for 7 days

Day	Morning	Afternoon	Evening
Monday	3-5 cm	3-5 cm	3-5 cm
Tuesday	3-5 cm	3-5 cm	3-5 cm
Wednesday	3-5 cm	3-5 cm	3-5 cm
Thursday	3-5 cm	3-5 cm	3-5 cm
Friday	3-5 cm	3-5 cm	3-5 cm
Saturday	3-5 cm	3-5 cm	3-5 cm
Sunday	3-5 cm	3-5 cm	3-5 cm

3.4. Water level sensor testing on Aquarium

Testing on the water level sensor in the aquarium is done by taking data with two data, namely the original distance data and sensor distance data. in taking the original distance data and sensor distance data there is a difference in error that is output on the LCD and output in the Blynk application. In the test there are 12 times the distance detection experiment that is at a distance of 0 cm, 1 cm, 2 cm, 3 cm, 4 cm, and 5 cm. Testing the water level sensor in the aquarium can be seen in Figure 10.

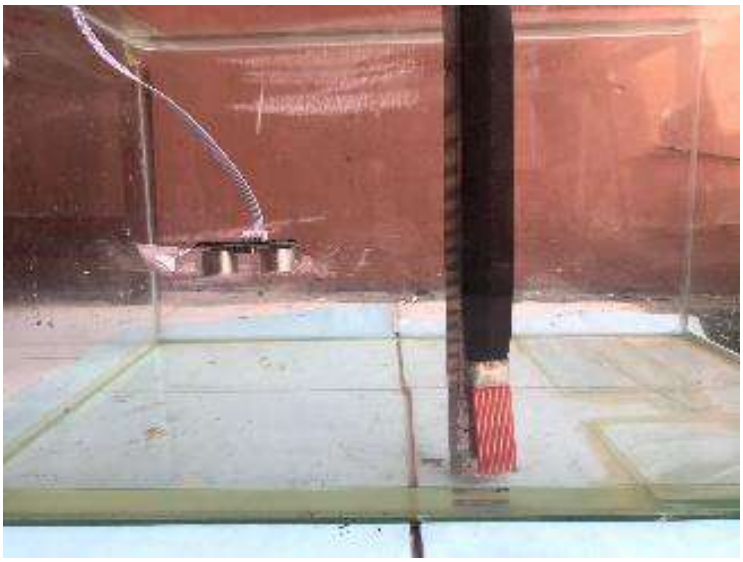

Figure 10. Water Level Sensor Testing on Aquarium

In the 0 cm distance experiment, there is an error release where the original distance data displays the result of 0 cm while the sensor distance data displays the result of 0.98 cm. At a distance of 0.98 cm, water level sensor has detected an increase in water that is 98 mm well. Testing at the original distance of 0 cm cannot show the accuracy of the error difference. These tests can be seen in Table 4.

Table 4. Test results of Water Level Sensor in Aquarium

Original distance data	Sensor distance data	Error difference
0 cm	0.98 cm	8 mm
1 cm	1.00 cm	0 mm
2 cm	2.90 cm	9 mm
3 cm	3.00 cm	0 mm
3 cm	3.67 cm	67 mm
4 cm	4.26 cm	26 mm
4 cm	4.99 cm	99 mm
5 cm	5.00 cm	0 mm
5 cm	5.00 cm	0 mm
5 cm	5.00 cm	0 mm
5 cm	5.00 cm	0 mm
5 cm	5.00 cm	0 mm
Average of error difference		17.71 mm

Table 4 is the result of testing the water level sensor. At a distance of 1 cm, 3 cm, and 5 cm the water level sensor has detected the water rise accurately and well while at a distance of 2 cm and 4 cm there is still an error difference in testing the original distance data and sensor distance data. Water level sensor has successfully detected with accuracy some conditions but in the state of 2 cm and 4 cm water level sensor can not detect accurately so that in this test Water Level sensor still has a difference error. Table 5 shows the results of testing the Water Level Sensor with 3 predetermined conditions, namely < 3 cm, >3-5 cm, and > 5 cm.

Table 5. Water Level Sensor test results with three conditions

Original distance data	Sensor distance data	Error difference
1 cm	1.00 cm	0 (accurate)
2 cm	2.90 cm	9 mm (inaccurate)
3 cm	3.00 cm	0 (accurate)
4 cm	4.26 cm	26 mm (inaccurate)
5 cm	5.00 cm	0 (accurate)

4. CONCLUSION

This river water level monitoring system uses an ultrasonic sensor HC-SR04 and a Water Level Sensor. Water Level Sensor gets three results from the height level that has been determined on the best data result sensor, namely using the value of low water level < 3 cm, medium water level 3-5 cm, and high water level > 5 cm. The Ultrasonic Sensor HC-SR04 gets a distance of up to 10 cm from the detected water surface which will continue to provide data after the maximum Water Level Sensor provides data < 5 cm and > 6 cm, the water level sensor cannot provide any more data because it sinks. Ultrasonic sensor HC-SR04 data will continuously send data to the Blynk application in realtime with the state of detection on the water level sensor reaching a maximum or called a high water level and the buzzer will continuously make a sound. Each state has a different buzzer sound in order to distinguish the three states namely low, medium, and high.

REFERENCES

[1.] Nafik, A. S. I. (2020). Rancang Bangun Prototype Monitoring Ketinggian Air pada Bendungan Berbasis *Internet of Things*. Jurnal Teknik Elektro Volume 10 Nomor 01 Tahun 2021, 10(1), 29-35.

[2.] Ain, F. Q., Sucahyo, I., & Yantidewi, M. (2023). Rancang Bangun Alat Monitoringdan Deteksi Banjir Menggunakan NodeMCU ESP8266 dan HC-SR04 berbasis IoT (BLYNK). *Berkala Fisika Indonesia: Jurnal Ilmiah Fisika, Pembelajaran dan Aplikasinya*, *14*(1), 1–10. https://doi.org/10.12928/bfi- jifpa.v14i1.24059

[3.] Akhiruddin. (2018). Rancang Bangun Alat Pendeteksi Ketinggian Air Sungai Sebagai Peringatan Dini Banjir Berbasis Arduino Nano. *Journal of ElectricalTechnology*, *Vol.3 No.*(3), 174–179. https://jurnal.uisu.ac.id/index.php/jet/article/view/963

[4.] Arduino, M., Untuk, U., Alat, M., Banjir, D., & Otomatis, S. (2020). *AnalisisCara Kerja Sensor Ultrasonik Menggunakan*. SF Preprints, *January 2020*. https://doi.org/10.13140/RG.2.2.24386.61123

[5.] Baskoro, F., Sari, R. Z. N., & Kholis, N. (2021). Studi Literatur: Pengaruh Penggunaan Modul *Wireless Sensor Network* pada Pengiriman Data SistemMonitoring Banjir Secara *Internet of Things*. Jurnal Teknik Elektro, 2021, 243–250. https://ejournal.unesa.ac.id/index.php/JTE/article/view/37573

[6.] Cahyadi, M. R., Akbar, S. R., & Widasari, E. R. (2018). *Implementasi Sistem Pendeteksi Ketinggian Air dengan Menggunakan Wireless Sensor NetworkNode Point To Point*. Jurnal Pengembangan Teknologi Informasi dan Ilmu Komputer, 2018, *2*(2), 715–722.

[7.] Fatimah, U., & Sitorus, S. (n.d.). *Sistem Monitoring Internet of Things (IoT) Ketinggian Air dengan Metode Simplex Berbasis Mikrokontroler*. Jurnal Cyber Tech, 2019, *x*, 1–10.

[8.] Hanggara, F. D. (2020). *Rancang Bangun Alat Deteksi Dini Banjir BerbasisInternet of Things (Studi Kasus: Kecamatan X)*. *SNTIKI*, 2579–5406.

[9.] Harnansyah, B. M., Sunaryantiningsih, I., & Fandidarma, B. (2021). PrototypePengontrol dan Monitoring Pompa Air untuk Pengairan Sawah Berbasis IoT. *ELECTRA: Electrical Engineering Articles*, *2*(1), 9. https://doi.org/10.25273/electra.v2i1.10499

[10.] Ilmuddin, I., & Putra, P. A. (2022). Perancangan Prototipe Pendeteksi Banjir Berbasis Internet of Things (Iot). *Tolis Ilmiah: Jurnal Penelitian*, *4*(2), 121– 129. https://doi.org/10.56630/jti.v4i2.246

[11.] Juanita, S., & Windarto. (2017). Rancangan Sistem Informasi Peringatan Dini Bencana Banjir. *Prosiding Seminar Nasional Multi Disiplin Ilmu & Call ForPapaer UNISBANK Ke-3*, *3*, 123–129.

[12.] Mukhtar, H., Perdana, D., Sukarno, P., & Mulyana, A. (2020). Sistem Pemantauan Kapasitas Sampah Berbasis IoT (SiKaSiT) untuk Pencegahan Banjir di Wilayah Sungai Citarum Bojongsoang Kabupaten Bandung. *Jurnal Teknologi Lingkungan*, *21*(1), 56–67. https://doi.org/10.29122/jtl.v21i1.3622

[13.] Robert J. Kodoatie dan Roestam Sjarief (2016). Pengelolaan Sumber Bencana Terpadu Banjir, Longsor, Kekeringan dan Tsunami. [Online]. vol. 20, no. 5, pp. 40–3, http://repository.unika.ac.id/369/7/10.12.0021%20Adhi%20Wicaksono%20DAFTAR%20PUSTAKA.pdf

[14.] Ningsih, R. (2019). Perancangan Sistem Monitoring dan Pendeteksi Banjir Menggunakan Metode *Background Subtraction* Berbasis *Internet of Things*(IoT). *JTEV (Jurnal Teknik Elektro dan Vokasional)*, *5*(1.1), 97. https://doi.org/10.24036/jtev.v5i1.1.106154

[15.] I. A. Prakoso and R. N. Rohmah, (2021). "Sistem Monitoring Pencemaran Air Dan Peringatan Dini Banjir Berdasarkan Ketinggian Air Berbasis Internet Of Things," [Online]. *13(*1),26. Available: http://eprints.ums.ac.id/id/eprint/95065,

[16.] Pratama, N., Darusalam, U., & Nathasia, N. D. (2020). Perancangan Sistem Monitoring Ketinggian Air Sebagai Pendeteksi Banjir Berbasis IoT Menggunakan Sensor Ultrasonik. *Jurnal Media Informatika Budidarma*,*4*(1), 117. https://doi.org/10.30865/mib.v4i1.1905

[17.] Ramadhan, T. F., & Triono, W. (2021). Sistem Monitoring Ketinggian Air danPengendalian Pintu Air Berbasis Microcontroler NodecodeMCU ESP8266. Jurnal Teknologi Informasi dan *Komunikasi*, *10*(2). https://doi.org/10.56244/fiki.v10i2.396

[18.] Ratna, S. (2020). Sistem Monitoring Kesehatan Berbasis *Internet of Things* (IoT). *Al Ulum Jurnal Sains dan Teknologi*, *5*(2),83. https://doi.org/10.31602/ajst.v5i2.2913

[19.] Riny Sulistyowati, Hari Agus Sujono, A. K. M. (2015). Sistem Pendeteksi BanjirBerbasis Sensor Ultrasonik dan Mikrokontroler. *Seminar Nasional Sains dan Teknologi Terapan*, *January*, 49–58.

[20.] Salamah, K. S., & Anwar, S. (2021). Rancang Bangun Sistem Pendeteksi BanjirOtomatis Berbasis *Internet of Things*. *Jurnal Teknologi Elektro*, *12*(1), 40. https://doi.org/10.22441/jte.2021.v12i1.008

[21.] Sofyan Radit Kurniawan, & Syamsudduha Syahrorini. (2021). The prototype formeasuring the height and monitoring of river water quality based on the Internet of Things. *Procedia of Engineering and Life Science*, *1*(1). https://doi.org/10.21070/pels.v1i1.875

[22.] Sundari, S., & Lestari, Y. D. (2022). *Perancangan dan Implementasi SistemMonitoring Ketinggian Banjir Berbasis Web dan IoT (Internet of Things) Menggunakan Sensor Ultrasonik*. SNASTIKOM, *10*(1), 29-35.

[23.] Suradi, S., Hanafie, A., & Leko, S. (2019). Rancang Bangun Sistem Alam Pendeteksi Banjir Berbasis Arduino Uno. *ILTEK : Jurnal Teknologi*, *14*(01), 2039–2043. https://doi.org/10.47398/iltek.v14i01.365

[24.] Tenda, E. P., Lengkong, A. V., & Pinontoan, K. F. (2021). Sistem Peringatan DiniBanjir Berbasis IoT dan Twitter. *CogITo Smart Journal*, *7*(1), 26–39. https://doi.org/10.31154/cogito.v7i1.284.26-39

[25.] Suyamin, "Banjir Bandang Terjang 4 Desa dari 3 Kecamatan di Konawe Utara Sultra", https://news.detik.com/berita/d-5641222/banjir-bandang-terjang-4-desa-dari-3-kecamatan-di-konawe-utara-sultra, 28 Maret 2024.

BIOGRAPHY OF AUTHORS

	**Wahyu Padliansyah Liambo,** Born in Kendari, 29 November 1999. He is a bachelor degree student of Electrical Engineering Department Universitas Ahmad Dahlan, Indonesia.
	**Sunardi,** Born in Sragen, 24 May 1974. He is a professor of Universitas Ahmad Dahlan. Bachelor degree obtained from Electrical Engineering Department Universitas Gadjah Mada, Indonesia. Master degree from Electrical Engineering Department Institut Teknologi Bandung, Indonesia. Ph.D. in Electrical Engineering from Universiti Teknologi Malaysia. Research interest: Information, Data Communication, and Research Methology