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Smart dispenser based on the Internet of Things

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ABSTRACT

Human health is highly dependent on adequate daily fluid intake. Unfortunately, public awareness of monitoring water consumption remains low. This research aims to design and build an Internet of Things (IoT)-based smart dispenser capable of automatically and personally recording and monitoring water consumption. This system uses an RFID sensor to identify the user, an infrared sensor to detect the presence of a glass before filling it, and a water flow sensor to measure the volume of water consumed. Each user's water consumption data is sent and recorded in a Google Spreadsheet, and the desired volume of water can be adjusted in the Blynk application. Test results show that the system can work effectively in recognizing the user, controlling the water flow according to the set volume, and transmitting data accurately to the IoT platform. This tool is expected to raise awareness of the importance of body hydration and support digital health monitoring in homes, schools, offices, and healthcare facilities.

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1. INTRODUCTION

Humans also need water to meet more than 60% of the body's fluid needs to prevent dehydration [1]. Clean, measured drinking water is crucial for maintaining human health. The World Health Organization (WHO) recommends a minimum of 2 liters of water per day for adults, but in reality, many individuals are unaware of or don't record how much water they consume each day. This lack of awareness can lead to mild dehydration, which impacts concentration, organ function, and even metabolic balance [2]. In practice, many people don't pay attention to how much water they consume each day. This is exacerbated by busy schedules and the lack of devices that can automatically record drinking water consumption. This condition can lead to mild to chronic dehydration, especially in workplaces, schools, or healthcare facilities. Therefore, an automated system is needed that can remind and monitor water consumption in a personalized and measured manner [3].

A dispenser is a device that collects drinking water before pouring it into a container, whether electrical or non-electric, making it easier to draw water from the container. Dispensers operate on the principle of a heating element, a cooling machine, or a regular water dispenser [4]. Using a dispenser can be more efficient and effective if you use an automation system on the tap and water pump, thereby saving the existing drinking water supply [5].

Di era modern, kebutuhan akan sistem distribusi air yang efisien, higienis dan terkontrol semakin meningkat. Dispenser konvensional umumnya masih menggunakan sistem manual tanpa fitur identifikasi pengguna sehingga tidak memungkinkan pemantauan penggunaan air secara individu. Tanpa adanya sistem identifikasi pengguna, pengelola tidak dapat memastikan apakah setiap individu telah menggunakan air dalam jumlah minimal yang dibutuhkan untuk menjaga kesehatan. Perkembangan teknologi digital dan Internet of Things (IoT) telah mendorong inovasi dalam pembuatan perangkat otomatis, temasuk dalam sistem distribusi air minum. Dispenser konvensional masih memiliki banyak keterbatasan, seperti pemborosan air, kurangnya control sistem akses dan kurang higienis akibat interaksi langsung. Untuk itu diperlukan sistem smart dispenser yang mampu bekerja secara otomatis, efisien dan aman melalui integrasi berbagai sensor [6]-[10].

In this research, NodeMCU ESP8266 will be used as a microcontroller or the brain of this design. NodeMCU ESP8266 is used because it has a WiFi module that can be connected to the internet so that it can be monitored remotely [11]-[14]. In this design, a water flow sensor is installed which functions to measure how much water discharge is released from the gallon so that it can monitor how many liters of water are used in the gallon [15]. Then, an RFID sensor is used as an identification system to provide access only to certain users, as well as record water consumption individually [16]. In the design, an infrared sensor is also installed which functions to detect the presence of a glass before activating the water flow [17].

2. METHOD

This research aims to design a smart dispenser based on the internet of things. The design of this smart dispenser uses ESP8266 and ESP32 where ESP8266 is connected to a water flow sensor, an infrared sensor and ESP32 is connected to an RFID sensor. Figure 1 shows the components used in designing a smart dispenser based on the internet of things where the Ipower supply functions to supply electrical power to the ESP8266 and the water pump. The ESP8266 microcontroller receives input from the water flow sensor and displays it in the blynk application. The ESP32 microcontroller receives input from the RFID sensor and displays user data on a spreadsheet. The relay functions to activate the water pump when the sensor is active. To identify users, the smart dispenser uses an RFID sensor and a water flow sensor functions to calculate how much gallon water output is used and an infrared sensor to detect the presence of a glass.

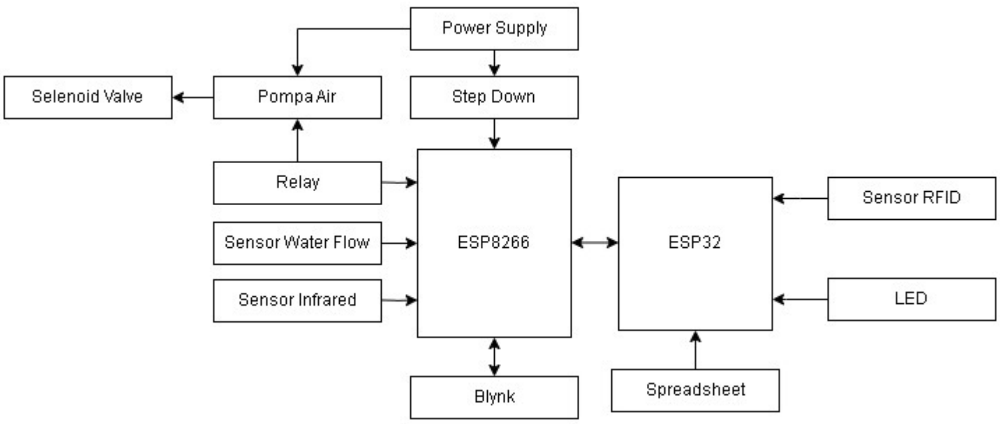


Figure 1. Block diagram of the smart dispenser

Electronic device design involves designing the components that will be used in the device assembly process. This design aims to streamline the process and minimize errors by planning the system hardware, which can be tested in advance to ensure proper operation. The design for this device includes a circuit as shown in Figure 2.

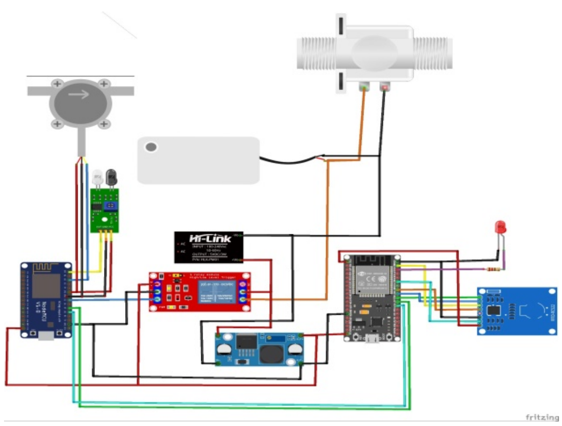


Figure 2. Smart dispenser control circuit

Mechanical design is a stage in hardware development. This design aims to reduce the error rate in hardware development, thus achieving optimal results. Only with mechanical design can the system be tested in real-world conditions to determine whether the device performs effectively. The design of this device can be seen in Figure 3.

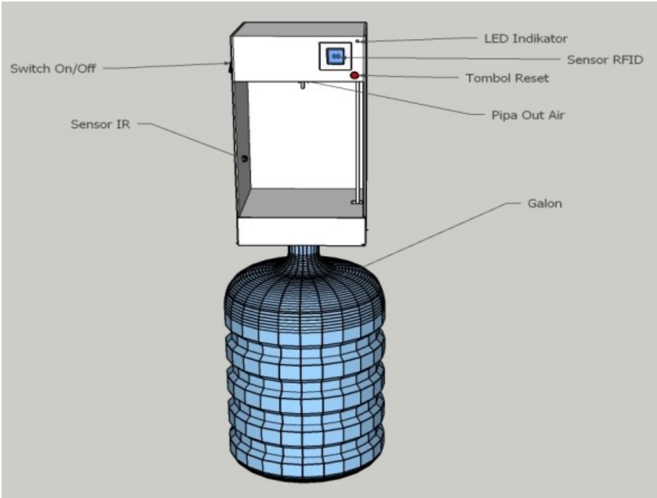


Figure 3. Smart dispenser design

The way this smart dispenser works is when the user brings the RFID card close to the dispenser, the RFID sensor reads the data from the tag to identify and verify the user's identity. If the data is detected as valid, the system will activate standby mode for the next process. After that, the infrared sensor will detect the presence of a glass, if the glass is detected then the microcontroller will activate the pump, after the pump is active the water starts flowing to the solenoid valve then flows again and rotates the propeller on the water flow sensor. The sensor sends a pulse signal to the control system which then calculates the water volume based on the number of pulses. Once the desired volume is reached, the system will automatically stop the water flow. The water flow sensor will detect how much water output is used each time water is drawn. Data from the water flow sensor will be displayed on the blynk interface and how much water users use will be displayed on a spreadsheet.

3. RESULTS AND DISCUSSION

The purpose of testing and measuring the equipment is to ensure that all components are functioning properly and as intended. The infrared sensor on the smart dispenser was tested to ensure its ability to detect the presence of a glass under the faucet before dispensing water. The infrared sensor serves as a safety system, as water will only flow if it detects an object in the appropriate location.

Table 1. Infrared sensor test results

No	Object	Distance (cm)	Sensor detected	Water flow	Information
1	Plastic cups	2	Yes	Yes	Detected
2	Glass cup	3	Yes	Yes	Detected
3	Drinking bottles	2	Yes	Yes	Detected

Test results showed that the sensor could detect the presence of the glass, and the system activated the water pump, causing water to flow from the faucet. If no object was detected, the system would not activate the water pump.RFID sensor testing on the smart dispenser was conducted to ensure the sensor's ability to accurately and consistently read and recognize RFID tags from each user. The RFID sensor serves as user identification, allowing the system to record who uses the dispenser and how much water each user consumes. Test results showed that the sensor could detect the presence of the glass, and the system activated the water pump, causing water to flow from the faucet. If no object was detected, the system would not activate the water pump.RFID sensor testing on the smart dispenser was conducted to ensure the sensor's ability to accurately and consistently read and recognize RFID tags from each user. The RFID sensor serves as user identification, allowing the system to record who uses the dispenser and how much water each user consumes. Table 2 showed that the RFID sensor was able to read tags effectively at an optimal distance of approximately 2-3 cm. Furthermore, each time a user was detected, their name was automatically recorded in a spreadsheet along with water usage information.

Table 2. RFID sensor test results

No	Username	Distance (cm)	Read	Recorded
1	Windy	2	Yes	Yes
2	Odi	5	No	No
3	Reza	3	Yes	Yes

Testing the water flow sensor on the smart dispenser aims to ensure that the sensor can measure the volume of flowing water accurately and stably. Test results show that the sensor can read water volume with high accuracy if properly calibrated. This test proves that the water flow sensor functions effectively as a water volume meter in a smart dispenser system, as shown in Table 3.

Table 3. Water flow sensor test results

No	Actual Volume (ml)	Detected Volume (ml)	Difference (ml)	Error (%)
1	300	302	2	0.67
2	200	205	5	2.5
3	100	110	10	10
4	400	405	5	1.25
5	500	520	20	4

The Blynk app on the smart dispenser was tested to ensure the water monitoring function was working properly. The main display in the Blynk app consists of information about the remaining water in the gallon and a slider to adjust the water output. The gallon's remaining water test is performed using data from the water flow sensor , which calculates the amount of water that has been dispensed. This value is then subtracted from the initial gallon capacity and displayed in real time in the Blynk app. Meanwhile, the water output test is performed by pressing a slider in the app, which will activate the water pump to flow water. The test results show that it can display remaining water information accurately and is able to control the water flow well and responsively, as shown in Figure 4.

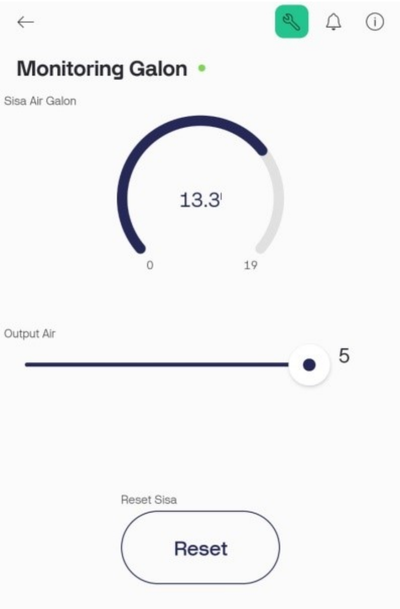
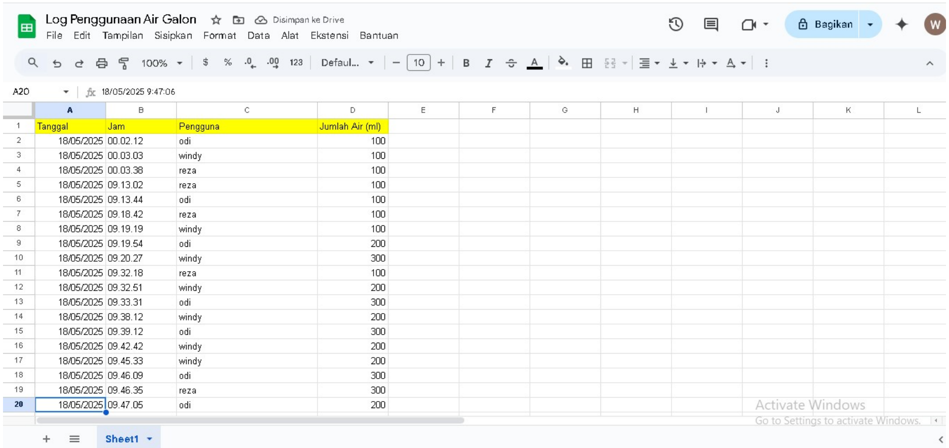


Figure 4. Blynk view

Testing the Blynk app on the smart dispenser also included a water level reset feature, which allows users to reset the remaining water level displayed on the gallon. This feature is useful after refilling the gallon, allowing the app display to reflect the new capacity of the gallon. Testing the water level reset function was conducted by ensuring the reset button in the app accurately resets the displayed value. Test results showed that the reset feature functioned properly.

The spreadsheet testing on the smart dispenser aims to ensure that each user's water usage data is recorded completely and accurately. This spreadsheet displays important information such as the date and time of use, the user's identity as recognized by the RFID sensor, and the amount of water consumed based on readings from the water flow sensor . During the test, each time the dispenser was used, the data was automatically sent to the spreadsheet via an internet connection. The recorded data format includes columns for the date, time, user name, and amount of water (in milliliters). The test results showed that the system can correctly record all water usage activities, as shown in Figure 5.



	Tanggal	Jam	Pengguna	Jumlah Air (ml)
2	18/05/2025	00.02.12	odi	100
3	18/05/2025	00.03.03	windy	100
4	18/05/2025	00.03.38	reza	100
5	18/05/2025	09.13.02	reza	100
6	18/05/2025	09.13.44	odi	100
7	18/05/2025	09.18.42	reza	100
8	18/05/2025	09.19.19	windy	100
9	18/05/2025	09.19.54	odi	200
10	18/05/2025	09.20.27	windy	300
11	18/05/2025	09.32.18	reza	100
12	18/05/2025	09.32.51	windy	200
13	18/05/2025	09.33.31	odi	300
14	18/05/2025	09.38.12	windy	200
15	18/05/2025	09.39.12	odi	300
16	18/05/2025	09.42.42	windy	200
17	18/05/2025	09.45.33	windy	200
18	18/05/2025	09.46.09	odi	300
19	18/05/2025	09.46.35	reza	300
20	18/05/2025	09.47.05	odi	200

Figure 5. Spreadsheet view

4. CONCLUSION

After designing and testing, it was concluded that the device performed as intended, with the sensor parameters operating very well. The Blynk application can display remaining water information, control water output, and efficiently reset the water volume. Data integration with a spreadsheet also ran smoothly, allowing each user to effectively monitor water consumption.

REFERENCES

[1] A. Haetami, A.F. Priatna, and I. Suryani, "Efek Dehidrasi terhadap Fungsi Tubuh Manusia," *Jurnal Kesehatan*, vol. 13, no. 2, pp. 45–52, 2022.

[2] World Health Organization, "Water: Essential for your body," *WHO Publications*, 2021.

[3] C. Shorten and T. M. Khoshgoftaar, "A survey on Image Data Augmentation for Deep Learning," *J. Big Data*, vol. 6, no. 1, 2019, doi: 10.1186/s40537-019-0197-0.

[4] D. Tangdiongan, Y. A. Pangaribuan, and M. Kurniawan, "Pengaruh Elemen Pemanas dan Pendingin pada Dispenser Air," *Jurnal Mesin dan Energi*, vol. 5, no. 3, pp. 101–106, 2017.

[5] Y. N. Prasetyo and A. Supriyadi, "Otomatisasi Dispenser Menggunakan Mikrokontroler Berbasis Sensor," *Jurnal Elektronika dan Kendali*, vol. 8, no. 2, pp. 90–95, 2019.

[6] Y. A. Putra and M. Yuhendri, "Smart Monitoring Pompa Air Otomatis Berbasis Human Machine Interface Dan Internet Of Things," *JTEIN J. Tek. Elektro Indones.*, vol. 4, no. 2, pp. 863–876, 2023.

[7] N. Imansyah and S. H. Widiastuti, "Sistem Kontrol dan Monitoring Penggunaan Air Berbasis IoT Menggunakan Modul ESP8266," *Jurnal Informasi dan Teknologi*, vol. 4, no. 3, pp. 108–113, 2022.

[8] I. N. T. A. Putra et al., "Perancangan Sistem Monitoring Ketersediaan Air Otomatis Menggunakan Aplikasi Blynk Berbasis Internet of Things (IoT)," *Jurnal Ilmu Komputer dan Sistem Informasi*, vol. 2, no. 1, pp. 34–42, 2023.

[9] U. G. Sharanya, K. M. Birabbi, B. H. Sahana, D. M. Kumar, N. Sharmila and S. Mallikarjunaswamy, "Design and Implementation of IoT-based Water Quality and Leakage Monitoring System for Urban Water Systems Using Machine Learning Algorithms," *2024 Second International Conference on Networks, Multimedia and Information Technology (NMITCON)*, Bengaluru, India, 2024, pp. 1-5, doi: 10.1109/NMITCON62075.2024.10698922.

[10] A. F. Ikhfa and M. Yuhendri, "Monitoring Pemakaian Energi Listrik Berbasis Internet of Things," *JTEIN J. Tek. Elektro Indones.*, vol. 3, no. 1, pp. 257–266, 2022, [Online]. Available: http://jtein.ppj.unp.ac.id/index.php/JTEIN/article/view/233.

[11] P. B. Agarkar, A. V. Dange, T. K. Adhav, N. Sangle and N. D. Kapale, "Efficient Water Resource Management: An IoT-Based Smart Water Level Monitoring and Control System," *2023 4th International Conference on Computation, Automation and Knowledge Management (ICCAKM)*, Dubai, United Arab Emirates, 2023, pp. 1-5, doi: 10.1109/ICCAKM58659.2023.10449619.

[12] M. Govindasamy, K. Jayanthi and S. Rajagopan, "IoT Product on Smart Water Quality Monitoring System (Iot Wq-Kit) for Puducherry Union Territory," *2023 Second International Conference on Advances in Computational Intelligence and Communication (ICACIC)*, Puducherry, India, 2023, pp. 1-5, doi: 10.1109/ICACIC59454.2023.10435019.

[13] S. Mehta and A. Singh, "Integrating IoT and AI for Holistic Water Quality Monitoring and Management," *2024 5th IEEE Global Conference for Advancement in Technology (GCAT)*, Bangalore, India, 2024, pp. 1-5, doi: 10.1109/GCAT62922.2024.10923899.

[14] R. Hidayat and B. Santosa, "Penggunaan NodeMCU ESP8266 dalam Sistem Pemantauan Air Minum," *Jurnal Teknologi dan Rekayasa*, vol. 11, no. 4, pp. 211–217, 2021.

[15] S. A. Nugroho and A. R. Pratama, "Implementasi Sensor Water Flow pada Sistem Monitoring Air," *Jurnal Otomasi dan Kontrol*,

vol. 7, no. 2, pp. 55–60, 2020.
[16] F. Ramadhan and L. Maulana, "Penerapan RFID untuk Kontrol Akses dan Pemantauan Konsumsi Air," *Jurnal Sistem Informasi dan Komputerisasi*, vol. 9, no. 1, pp. 44–50, 2021.
[17] L. Widodo and M. Faizal, "Deteksi Gelas Menggunakan Sensor Infrared pada Sistem Dispenser Otomatis," *Jurnal Elektronika dan Informatika*, vol. 10, no. 3, pp. 123–128, 2022.