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Prototype of Water Level and Rainfall Detection System as Flood Warning Based On Blynk Iot Application

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Abstract

Rainfall in the rainy season can last for about six months, resulting in continuous rain and increasing the amount of water that causes flooding. The community does not directly get information or be informed when it rains. To anticipate these problems, the Prototype of Water Level and Rainfall Detection System as a Flood Warning Based on the Blynk IoT Application is considered effective for developing a rainfall and water level monitoring system. By using the tool design method, flowchart, system analysis (SDLC), and testing using the black box testing method. The system detects the distance between the sensor and the water surface. If the distance to the water level is close to the sensor, the system will report a flood and then switch to the Blynk software. The mobile will display a message and the system can enter all distances into the program.

Keywords: Rainfall, Black Box Testing, IoT.

1. Introduction

Early warning is a notification that is able to read surrounding conditions by providing information quickly for preparedness in dealing with major disasters that occur. Early warning prototypes are usually used when natural disasters occur such as landslides, flash floods, floods and volcanic eruptions. The most commonly used early warning notification device is a siren that can emit a sound to warn the surrounding community to take immediate action or evacuate to another location to avoid danger. Floods are the easiest and most common natural disaster, especially for residents who live around river basins. This occurs because heavy rains result in high water levels in lakes and rivers, high water levels, and river environments filled with garbage that cover waterways, which is one of the causes of flooding. To avoid a flood disaster, we need a detection tool that is able to provide early warning quickly and stably. This water level and rainfall detector prototype is assembled from a set of various integrated components and is able to operate quickly and stably [1].

In the last 3 months of rainfall in Indonesia as much as 2.4% of the 4,708 observation points experienced rain with extreme rain criteria (> 150 mm/day). Extreme rainfall events occur in parts of Indonesia, including Sumatra, Java, West Kalimantan, South Kalimantan, North Sulawesi and South Sulawesi [2]. In this study, a flood detector prototype was created that can read the rise and fall of water levels and display water conditions, and can be directly connected via the Blynk IoT application by issuing fast and stable notifications [3]. This prototype is assembled from various components used, namely:

1. Arduino Uno R3: Arduino Uno R3 is a microcontroller board that functions as the brain of this prototype. This board controls the operation of the other components and performs the necessary data processing.
2. Rain Detector: Rain Detector is a sensor used to detect rain. This sensor will respond when water molecules fall to the surface, and this information is used to measure the intensity of rainfall.
3. Water Level Sensor: Water Level Sensor is a sensor used to measure the water level. This sensor can provide information about the rise and fall of water levels in real time.
4. Male Pin Header: Male Pin Header is a component used to connect other electronic components, such as cables and sensors, with Arduino Uno R3.
5. Tisch Cable: Tisch Cable is a cable used to connect components in a prototype and transmit signals and data between components.
6. Dot Matrix PCB: Dot Matrix PCB is a printed circuit board used to display water conditions or other information in the form of a dot matrix display.
7. Switch: A switch is a button used to activate or deactivate a prototype or change a certain operational mode.
8. Battery 18650 and Battery Holder: Battery 18650 and Battery Holder are components used to provide electrical power to the prototype, so that the prototype can operate independently without having to be connected to an external power source.

In addition, this prototype uses the Blynk IoT application to connect with mobile devices or other devices. The Blynk application provides an interface that makes it easy for users to receive notifications and view information about the water level and rainfall detected by the prototype [4]. Users can receive notifications through this application to get early warning of potential flood hazards. With the Blynk application, fast and stable notifications can be delivered to users to ensure preparedness and appropriate action in dealing with flood threats [5].

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2. Research Method

2.1. Literature review

The following is research that has been conducted and has a correlation with the research that will be discussed. In an effort to perfect the research, it is necessary to conduct a literature review [6]. Saryani, Harfizar, and Randi Arianto (2019) produce a prototype of the automatic clothesline that is made, as a whole it can work well and it is possible to be applied in everyday life. The use of sensors on the automatic clothesline prototype uses two sensor reading techniques, namely analog and digital. Nicko Pratama, Ucuk Darusalam, and Novi Dian Nathasia (2020) produce Identification of the problem is an activity to analyze the problem of flooding that often occurs in several areas, so that people experience losses ranging from material and fatalities. In addition, they also do not know when the flood will occur [7]. Muhammad Irfan Hafidhin, Adam Saputra, Yuri Ramanto, and Selamet Samsugi (2020) This study aims to build drying salting equipment using the Arduino UNO microcontroller[8]. The tool is used to detect rain and shine so it is very practical, because workers only put salted fish on the tool without worrying about the fish getting wet in the sun when it rains. Yosef Cafasso Yuwono, and Syah Alam (2019) This study aims to make automatic clotheslines equipped with light sensors, water sensors and also equipped with humidity sensors to measure the level of dryness of clothes. So you don't need to worry about clothes that are on the clothesline because they are protected by an automatic drying system where the roof will automatically close when the weather is cloudy or when it rains[9]. Mochammad Haldi Widianto (2018) This study aims to provide convenience in the driving process by utilizing LDR sensors and rain sensors [10].

3.1 Findings

In this study, the methods used include tool design methods, making flowcharts, and testing using the black box testing method [11]. The tool design method is used to design and develop a prototype system for detecting water levels and rainfall based on the Blynk IoT application. In this method, the design steps include identification of system requirements, component design, hardware and software development, as well as integration between sensors, microcontrollers, communication modules, and Blynk applications [12].

3.2 Problem

Furthermore, making flowcharts is used to visualize the sequence of steps in the system [13]. The flowchart provides a clear picture of how data from the water level and precipitation sensors is read, sent to the Blynk server, and displayed in the application [14]. The flowchart also includes flood testing and monitoring steps, as well as system shutdown procedures. By using flowcharts, developers can see and understand the workflow of the system as a whole [15].

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3.3 Research Implementation

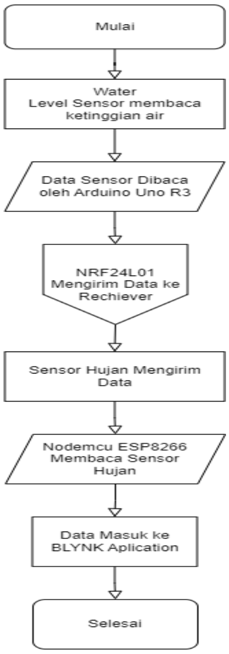

Figure 1. Flowchart

Testing using the black box method is an important approach in this study [16]. In black box testing, the main focus is on the functionality of the system without paying attention to the details of its internal implementation [17]. This test is carried out to ensure that the system is able to correctly read data from the water level and rainfall sensors, send data to the Blynk server, and display accurate information in the application [18]. In addition, black box testing also involves testing system responsiveness, integration between components, testing boundaries, and testing stability to ensure good system performance in various conditions [19].

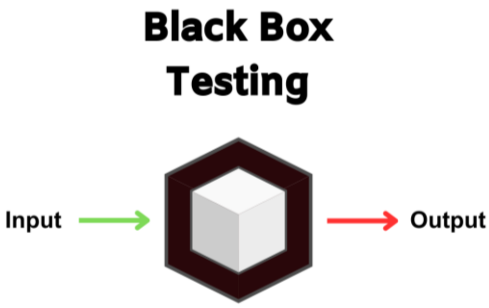

Figure 2. Black Box Testing

By combining the methods of designing tools, making flowcharts, and testing using the black box method, this research can obtain an effective system design, see and understand the workflow of the system visually, and ensure good functionality and performance in detecting water levels and rainfall as a warning. flood [20].

4. Result and Discussion

After designing and installing several components, the next step is to test each circuit component to ensure that it is as expected or desired [21]. For better understanding. Hardware specifications that will be used in testing the prototype of the Water Level and Rainfall Detector tool can be seen in the following table [22]:

Tabel 1. Hardware Specifications

Hardware	Spesification
Laptop	Acer one 14
Arduino Uno R3	Microcontroller ATmega328P, Operating Voltage 5V, Input Voltage (recommended) 7-12V, Input Voltage (limit) 6-20V, Digital I/O Pins 14 (of which 6 provide PWM output),PWM Digital I/O Pins 6, Analog Input Pins 6, DC Current per I/O Pin 20 mA, DC Current for 3.3V Pin 50 mA, Flash Memory 32 KB (ATmega328P) of which 0.5 KB used by bootloader, SRAM 2 KB (ATmega328P), EEPROM 1 KB (ATmega328P), Clock Speed 16 MHz, LED_BUILTIN 13, Length 68.6 mm, Width 53.4 mm, Weight 25 g
Nodemcu ESP8266	Mikrokontroler: Tensilica 32-bit RISC, CPU Xtensa LX106, Tegangan operasi: 3.3V, Tegangan Masukan: 7-12V, Pin Digital I/O (DIO): 16, Pin Analog Input (ADC): 1, UARTs: 2, SPIs: 1, I2Cs: 1, Flash, Memory: 4 MB, SRAM: 64 KB, Clock Speed: 80 MHz, PCB Antenna
Rain Detector	1
Water Level Sensor	1
NRF24L01	1

Software specifications used for testing the prototype of the Water Level and Rainfall Detector tool can be seen in the table below[23]:

Software	Explanation
IDE Arduino	Creating program listings
Blynk	To control the Arduino module via a smartphone
Draw.io	Making block diagrams and flowcharts

4.1 Overall Tools Testing

Testing the whole tool aims to find out that the overall system functions as desired both input and output [24]. As for the working reference tool [25].

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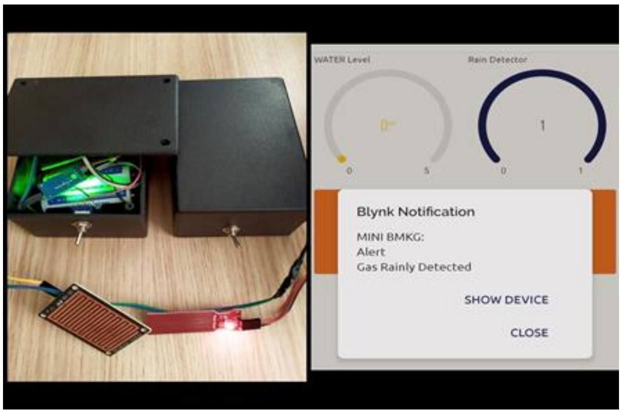
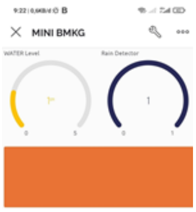
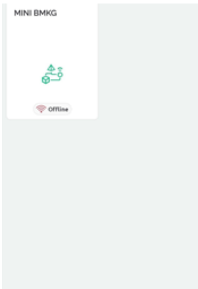
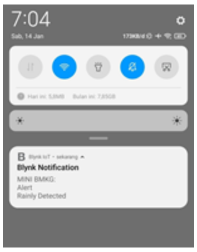


Figure 3. Tools Testing

Testing uses the Black Box Testing method, paying attention to the functional activities of the program by taking a complementary approach to finding bugs [26]. The following is a Black Box Testing table based on the tool design [27].

Tabel 2. Testing

No.	Plan	Design	Test Results	Implementation	Conclusion
1	Water Level Sensor Detector		The sensor will send a notification if the water level is detected by the sensor. The water level is declared safe if < 2		Valid
2	Rain Sensor Detector		The sensor will send a notification if Rain is detected		Valid
3	Blynk App Notifications		A notification will appear via the Blynk application		Valid

Based on the trials of the entire system that was made, there were two testing methods that were carried out both software and hardware, when testing the Arduino application, the only problems were connecting to the Blynk application, the problem was not affected by the program because it was not an error in the program but the Blynk application [28]. Then the trial was carried out again in hardware, namely by controlling the rain sensor and water level [29]. The results of the evaluation both Software and Hardware got good enough results so that they can be implemented in Prototype form [30].

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5. Conclusion

After conducting meticulous research and following a comprehensive design process, several noteworthy conclusions can be derived:

1. The methodology for detecting rain and preventing flooding based on Blynk IoT involves the development of a functional prototype. This prototype encompasses the utilization of a Rain Sensor and a Water Level Sensor, both of which are integrated with the Blynk IoT application. By employing these sensors and leveraging the capabilities of Blynk IoT, the system can effectively monitor and respond to rain events and potential flood situations.
2. Once the prototype has undergone rigorous testing and validation, it demonstrates the capability to provide real-time data. Users can access and view the gathered information promptly, enabling them to stay informed about the current rainfall status and potential flood risks. This real-time data display feature enhances the system's usefulness and aids in prompt decision-making.
3. The Blynk IoT application plays a crucial role in this system. When rain is detected by the Rain Sensor, the application will display the value of "1," indicating the occurrence of rainfall. Simultaneously, the Water Level Sensor, in the event of a flood, will promptly transmit flood notifications to the Blynk IoT application. This feature ensures that users are promptly alerted and informed about potential flood situations, enabling them to take necessary precautions and preventive measures.

By implementing the prototype with Rain and Water Level Sensors, integrating it with the Blynk IoT application, and leveraging the aforementioned functionalities, the system effectively addresses the need for rain detection and flood prevention. It provides real-time data visualization and ensures prompt notifications, contributing to a comprehensive and efficient approach for managing rain-related risks and mitigating potential flood hazards.

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