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Flood Notification System Using NodeMCU with Telegram Monitoring

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Flooding is a natural disaster that often occurs in Indonesia. Floods are often caused by the inability of rivers to accommodate water discharge, which is exacerbated by the handling of riverbank areas, resulting in an increased risk of natural disasters such as floods. Flood risk management is an urgent need considering the potential and pattern of disaster cycles in Indonesia that recur within a certain time interval. Flood risk management technology, both in terms of risk management technology and post-flood handling, is important for almost all regions in Indonesia. One of the technologies that can help with disaster risk management is an early warning system, which is an integrated system between hazard monitoring, disaster risk assessment, communication, and disaster preparedness that allows individuals, communities, and governments to take appropriate action in order to minimize the impact of disasters. By utilizing telecommunication networks and a simple and clear formulation of information, the dissemination of disaster information can be done quickly and precisely. A flood notification system is a system that serves as a warning and alert system in the event of a flood disaster. This system gives us a flood warning based on the water level. The brain of the prototype is the ESP8266 Nodemcu-based Wi-Fi module. In this system, it uses an SRF05 ultrasonic sensor and a water level float sensor to detect the water level. In this study, a prototype of a flood notification system that can be monitored with telegram commands was developed. Thus, access to flood information is easier and clearer. This system's information will be a warning of danger signs, allowing users to anticipate disasters, particularly flood disasters. This alert information is based on the water level.
Keywords: Flood, Nodemcu ESP8266, Sensors, Telegram

I. INTRODUCTION

One of the natural disasters that often occurs in several regions in Indonesia is flooding, which can be in the form of standing water on normally dry land such as agricultural land, settlements, and city centers. Flooding can also occur when the discharge or volume of water flowing in a river or drainage channel exceeds or is above its drainage capacity [1]. Floods also often cause unpredictable losses of life and property. Therefore, it is necessary to have a notification system for flood information as a form of warning.

In order to provide an early warning of a flood disaster, a system is needed that can detect changes in water levels, one of which is by using sensors. Sensors are transducers that function to process variations in motion, heat, light, magnetism, and chemistry into voltage and electric current [2]. The sensors used are an SRF05 ultrasonic sensor and a water level float sensor.

Research related to disaster early warning systems, more specifically flood disasters, includes: Abdul Rafid Fakhrun Gani [3], who developed a flood detection device using an Arduino Uno ATMega 328p as the system controller, as well as ultrasonic sensors and humidity sensors to detect the increase in water. The reading information will be sent via SMS notification. S. L. Allo and S. M. Martono [4] created a flood early warning system for the Remu River in Sorong City using an SMS gateway.

In this research, a prototype of an IoT-based early warning system was developed using Node MCU ESP8266, ultrasonic sensors, and water level float sensors. This system can monitor water levels and then disseminate water level information via notifications on Telegram.

II. METHODS

2.1. Literature Review

2.1.1. NodeMCU

NodeMCU is an integrated microcontroller board with the ESP8266 WiFi module which functions as a network connectivity between the microcontroller and the WiFi network.

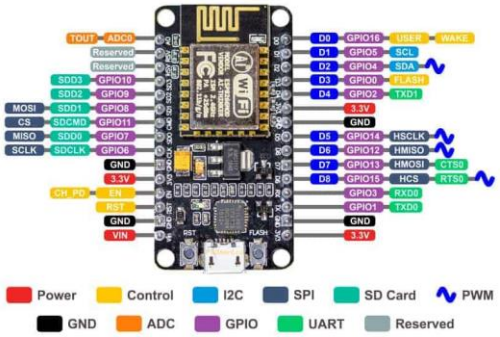

Figure 2.1. NodeMCU

NodeMCU has packaged the ESP8266 into a compact board with various features like a microcontroller and WiFi access capability, as well as a USB to serial communication chip. As a result, it only requires a USB data cable extension and an Android smartphone charging cable to program [5]. The ESP8266 is a WiFi module with TTL serial output equipped with GPIO. This WiFi module can be used standalone or with an additional microcontroller for control. The working voltage of the ESP8266 is 3.3 volts, so for the use of additional microcontrollers, you can use an Arduino or a NodeMCU [6].

2.1.2. SRF05 Ultrasonic Sensor

Figure 2.2. SRF05 Ultrasonic Sensor

Ultrasonic sensors are very popular sensors for detecting distance. Apart from being quite accurate sensors, the price is also quite affordable, so people will prefer to use ultrasonic sensors compared to other sensors [7]. SRF05 can measure distances in the range of 3 cm–3 m with a pulse length output that is proportional to the distance of the object. This sensor only requires two I/O pins to communicate with the microcontroller, namely TRIGGER and ECHO [8].

2.1.3. Water Level Sensor

Figure 2.3. Water level sensor

Water level sensor is also known as float sensor to detect the water level increased or decreased in terms of resistance varying. It consists of float connected to potentiometer [9].

2.1.4. Telegram Bot

Figure 2.4. Telegram Bot

Telegram Bot is a Telegram account that is designed to handle messages automatically. Users can interact with the bot by sending command messages through private or group messages [10]. Telegram also provides a platform for developers who want to utilize the open API and protocol provided through the development of Telegram bots documented on its official website.

2.2. Method

2.2.1. Stages of Research

The steps taken in this study to build a flood notification system using NodeMCU with telegram monitoring are as follows:

a. Analyze the problem.
b. Conducting a literature study.
c. Create a software design.
d. Create a hardware design.
e. Software development.
f. Hardware development.
g. Testing.

2.2.2. Creating a Software Design

The creation of a software design begins into a flowchart form to make it easier to develop software during the coding process. The flowchart of A flood notification system can be seen in figure 2.5.

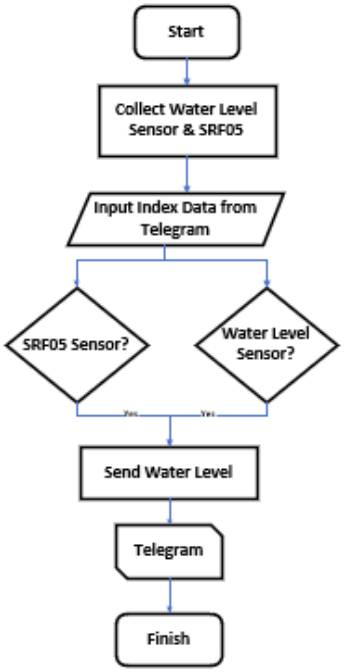

Figure 2.5. The flowchart of flood notification system

There are several commands that can be used to communicate with Telegram bots, including:

1. /start
   The command is used to start communication with the Telegram bot. Telegram users cannot use the bot if they have not sent the /start command.
2. /status
   The /status command is used so that the bot sends a message in the form of a water level report in the form of a value in cm and a percentage value of the water level.
3. /stop
   The /stop command is used to stop communication with Telegram users who have previously communicated
4. /aktif
   This command was created with the aim of having the bot resend or reactivate flood warning notifications and water level presentations.

2.2.3. Hardware Design

The hardware design of A flood notification system uses the main control in the form of Nodemcu ESP 8266. The sensors used in system are shown in table 2.1. along with the pins used.

Table 2.1. Sensors

Component Name	Sum	Pin
SRF05	1	D6, D7
Water Level Sensor	1	D4

After determining the type, quantity, and pin of each component, the next step is to design the wiring hardware design. This design will be used as a guideline when entering

the hardware development stage of a flood notification system. The results of the Wiring a flood notification system design can be seen in figure 2. 6.

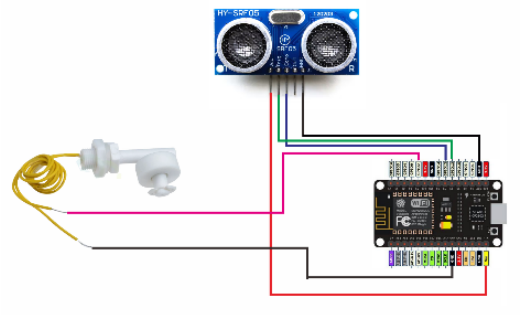

Figure 2.6. Wiring Design

In the wiring design, the red line is a 5V DC voltage taken from the ESP8266 MCU node, while the black line is ground, and the blue line is I / O.

III. RESULT AND DISCUSSION

3.1. Research Results

The research, entitled "Flood Notification System Using NodeMCU with Telegram Monitoring," produced a prototype that can be used personally and can be monitored through the Telegram application. The Flood Notification System is made up of Nodemcu as a data processing and processing unit, a sensor module as a sense input, and sensor output information that is sent via telegram. The software development process uses the Arduino IDE and is uploaded to the Nodemcu board using USB (Universal Serial Bus) connected to a computer or laptop.

All installed sensors use 5V DC voltage. This tool is operated with a 5V DC working voltage obtained from an HP adapter plugged into a power source. The USB port used to upload the program also functions as a power supply port when finished. Complete components, such as the SRF05 ultrasonic sensor and a water level float sensor, are installed in a container that will be filled with water to collect water level data.

3.2. Device Discussion

3.2.1. Dimensions Flood Notification System

An SRF05 ultrasonic sensor and a water level float sensor are mounted on a container with dimensions of p x l x t measuring 19.6 cm x 12.8 cm x 16 cm. This container will be filled with water to collect water level data on the sensors. The NodeMCU is installed in the outer area of the container to avoid water. This NodeMCU will later be connected to a computer or laptop to be programmed. A picture of the process of making a flood notification system can be seen in Figure 3.1.

Figure 3.1. Flood Notification System creation process

This container has a height of 16 cm, but later in the source code it is only programmed up to 14 cm because the location of the SRF05 ultrasonic sensor is at 16 cm, so it needs to be protected from water. A picture of the placement of sensors can be seen in Figure 3.2.

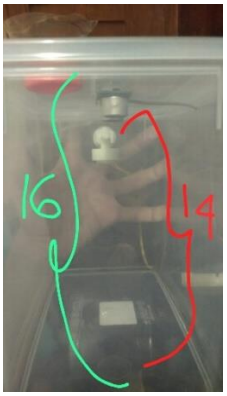

Figure 3.2. Sensors Placement

3.2.2. Telegram-Based Monitoring

The tool we developed uses the telegram application for interface monitoring because of the ease of access that telegram itself. Flood warning notifications and water level percentages will be sent to the recipient, namely the Telegram user who has initiated communication with the bot. With the application of EEPROM as user_id and username storage, if the detection tool restarts the system or restarts the microcontroller, the data from the user in the form of user_id and username will still be stored as the function of the EEPROM so that the bot can recognize who has started communication first with the bot by sending the message "Selamat datang, username yang tersimpan- Bot sudah menyala kembali".

Figure 3.3. Result of Flood Notification System

Based on the results of the Flood Notification System monitoring trial using the telegram application, data was obtained as in the following table 3.1.

Table 3.1. Data from The Flood Notification

Status	Water Level
Siaga	50 - 60 %
Waspada	60 - 80%
Awas 1	80 - 100%
Awas 2	80 - 100%

For the "siaga" status, the water level is between 50% and 60%, and the "waspada" status is between 60 and 80%. While the "awas" status will be divided into 2 categories with the same water level of 80–100%, there are differences in the float switch sensor readings. If the float switch reading is HIGH, it is still in the "Awas 1" status, and the bot will still send the status of the percentage of the water level. While for the LOW condition float switch reading, the status will change to "Awas 2," indicating that a flood has occurred.

With the percentage of water level below 50%, the notification tool and bot consider the surroundings safe and will not send any notifications to Telegram users who have begun communication with the bot. Telegram users can check the status of the water level by sending the /status command. If the bot has detected a level of 50–60%, the "siaga" status is declared active, so that the bot will send a notification to the telegram user it has recognized, in the form of a message saying "Siaga! Ketinggian air mencapai presentase level ketinggian air %," and so on until the status "Awas 1," while at some point the status changes to "Awas 2," then the message will change to "Awas! Banjir datang." Notification of the status "siaga, waspada, awas 1" in the form of a telegram message will be sent three times, while the message for the status "awas 2" will be sent to the user five times with a span of two seconds per message. If the notification has stopped being sent by the bot, it can be reactivated using the /active command.

IV. CONCLUSION

4.1. Conclusion

From the research we have conducted, it can be concluded Flood Notification System can be done more easily and in real-time via telegram. This system is able to monitor water levels in real time, and it runs well. This system provides alert information based on the water level obtained from the water level sensor and the SRF05 ultrasonic sensor.

4.2. Suggestion

This telegram bot also has drawbacks, such as the fact that the bot system can only be used by one telegram user, if a user initiates communication, the telegram bot will send a notification that other users are using the notification bot. so that it can be developed with devices that can be used en masse

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