INTERNET OF THINGS BASED FLOOD HEIGHT DETECTION

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Abstract

Flooding is a disaster that often occurs in residential areas today, one of which is Jalan Teratai Gg Mawar I, Surabaya Village, Kedaton District, where this village is in an area close to a river. Floods can occur due to overflowing water, one of the causes is a lack of awareness among people who still throw rubbish in rivers and because there are broken embankments. Therefore, we need a flood warning system technology that can help provide information on flood disasters efficiently. One way is by utilizing internet of things (IOT) technology which can provide data information in the form of water level. This research aims to monitor water levels for information when a flood occurs. Ultrasonic sensors are used to detect water levels, and NodeMcu is used to process and send data to smartphones via the WhatsApp application. The results of this research show a system that can monitor the condition of the river water level repeatedly and when it reaches the specified height, the system will send a flood warning using the WhatsApp application installed on the smartphone, and a buzzer as an alarm signal and LED lights are used. as an indicator that can inform alert, alert and danger status. With this flood warning detection system, it is hoped that it can provide information when a flood occurs.

1. Introduction

Flooding is a disaster that often occurs in the neighborhood, one of which is a village that is indeed in a lowland or area close to the flow of the river(Jan et al., 2022). The flood disaster that occurred was unexpected , many losses caused by the flood included loss of property and even loss of life(Soegoto et al., 2021). From the disasters faced by people living near the river flow, during heavy rains that last a long time residents have to go back and forth to see the condition of the river water level, for fear that if the water rises quickly it can cause losses. Meanwhile, the public does not get information or notification directly when this happens(Sandro Saputra et al., 2020).

One of the rivers that often floods on Jalan Teratai Gg Mawar I, Surabaya Village, Kedaton District is the PTPN7 flow river(Dita et al., 2021). Based on information from residents living around the lotus road river,

residents complained about the factors that cause flooding due to too much water discharge so that it can cause water overflow due to the river being too shallow(Pratama et al., 2021).

There are many things we can do to overcome these problems such as the use of IoT technology(Andraini et al., n.d.). IoT (Internet of Things) can be defined as a remote control or monitoring technology that utilizes an internet network that can be interconnected and exchange data through the internet network. IoT can also be used to retrieve data from a place using sensors and also remote access to control objects 2 somewhere(Ilma Fadhlia Furqaana, n.d.). One of them uses a smartphone device through applications such as WhatsApp that can work faster and more accurately so that flood disaster mitigation actions are more efficient. WhatsApp is the information medium used in this study. WhatsApp is a special account that requires a phone number(Pratama Zanofa & Fahrizal, 2021). This account serves as an interface to run code that will be built later(Technology et al., 2023).

Internet of Things-based flood early warning tools have been made by previous research such as those conducted. Designing a flood early detection tool using Arduino Uno microcontroller, ultrasonic sensor used as water level reader, LCD displaying water level information, buzzer as alert status notification, Thingspeak application can display water level graph data in safe or hazard conditions in real-time. designed a water level monitoring system as a flood detector. Using ultasonic sensors to detect water levels, all data is stored in a database and displayed on web pages and LCDs in real-time. designed a flood monitoring and early prevention system using Arduino Mega2560 microcontroversy, rainfall sensors, Rtc, and the Blynk application as a medium for delivering information(Teknologi et al., 2021).

Designing a flood detection system using water level sensors to measure water levels, LEDs and buzzers as indicators, NodeMCU as the controller of the entire system and sending water levels to the Blynk application. 3 designed a flood detection system using NodeMCU, water level sensor as a means of detecting water level, buzzer as an alert sign and led light as a dimmed light indicator for alert status. And the web is made to display information on the status of a safe or dangerous state(Silverio-Fernández et al., 2018).

In this study, the author designed an IoT-based flood surveillance and warning system using WhatsApp, that with the WhatsApp application residents can find out information on water levels approaching houses in village settlements. This system will monitor the river water level, where if the water has reached the alert and danger level, the system will send a flood warning using the WhatsApp application that has been installed on the smartphone, while residents around the PTPN7 river will hear information from the buzzer. (Raditya et al., 2023)Because not everyone has the WhatsApp application and not everyone has internet, so for residents around the river PTPN7 can hear information from buzzers and Led lights as a warning sign of flooding(Athallah & Agung, n.d.),(Kurniawan et al., 2019).

2. Research Methods
2.1 Research Stages

This research uses the Experimental method (trial). The purpose of this study is to obtain design results that can detect flood disasters based on the Internet of Things based on water level along with information in the form of text messages displayed on the whatsapp application. This experimental research was conducted on system design, both in hardware design and software design of this tool(Alfia et al., 2021).

A. Hardware Requirements

Table 1. Hardware Requirements

Hardware	Uses
Ultrasonic Sensor HC-SR04	As a sensor that functions to read the distance of the water level
NodeMcu	As a microcontroller of communication systems that already have Wifi sending data through an internet network connection.
LED Light	LED lights as an indicator light up dimly for alert status and danger.
Buzzer	as an output indicator that produces alarm sounds for flood warnings.
Jumper Cable	Serves as a link between components to other components.

B. Software Requirements

Table 2. Software Requirements

Software	Uses
Arduino IDE	As an application used for writing program code for Arduino microcontrollers.
Fritzing	As an application used to create a series of simulations in the form of basic drawings of making this system.
WhatsApp	Serves as a flood warning notification, which will send messages to WhatsApp users.

2.2 Flowchart

System flowchart or flow chart where the system is first run, the system will initialize the input/output device used to connect with external devices such as ultasonic sensors, buzzers and led lights.
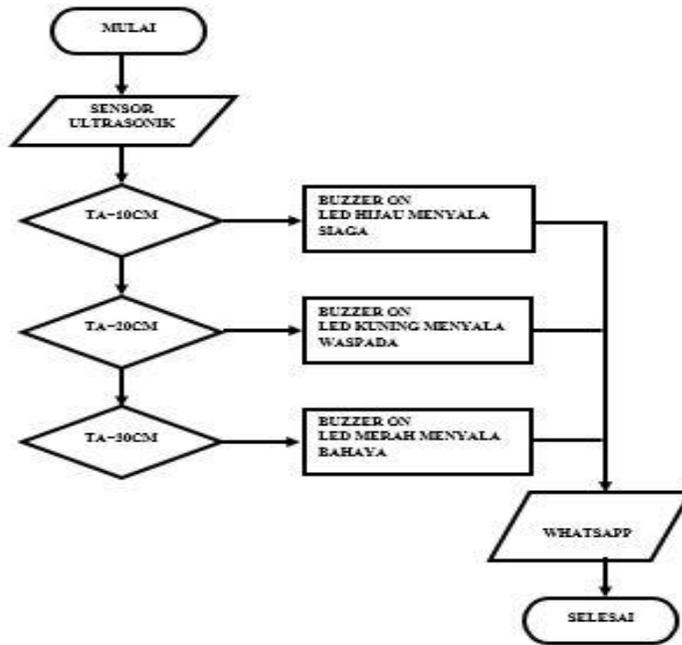
Fig 1. Flowchart

2.3 System Design

In the design of the water level detection system, flood surveillance and warning consists of several stages. One of them is the creation of block diagrams, flowcharts, schematics and source code is hardware design and explains how the system is formed and the workflow of the system.

2.4 Block Diagram

In making a system, there are several things that need to be considered, namely how to design tools that will be made according to theoretical basis. Before designing a system or circuit, first create a block of diagrams. Block diagrams are one of the simplest ways to execute the workings of a system and make it easy to localize errors from a system. With block diagrams we can analyze how the circuit works and design the hardware to be made in general. This aims to facilitate the process of making tools. Each block of the tool circuit has its own function, then it will be combined into a complete tool, and can work according to the desired purpose:
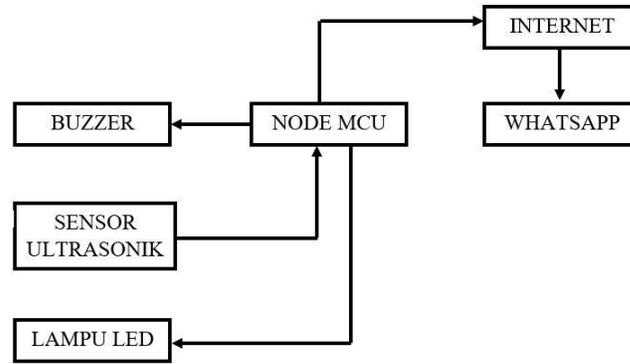
Fig 2. Block Diagram

2.5 System-wide circuit

The design of the entire circuit of tools consists of elements that are important to become one interconnected circuit. These elements are input circuits, control circuits, output circuits and also software programs that will be interconnected, circuits consisting of electronic components in the form of both inputs and outputs needed by Arduino uno in order to function properly
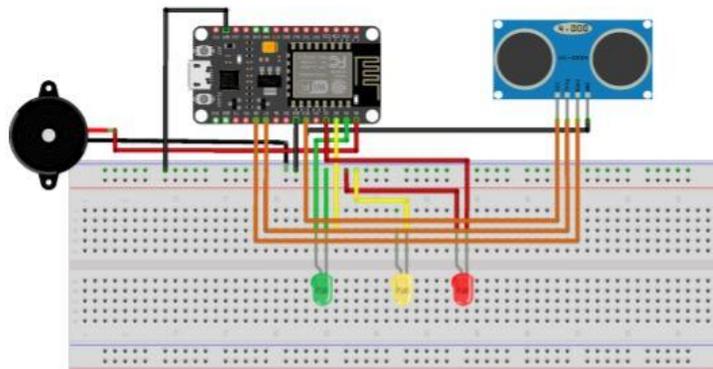
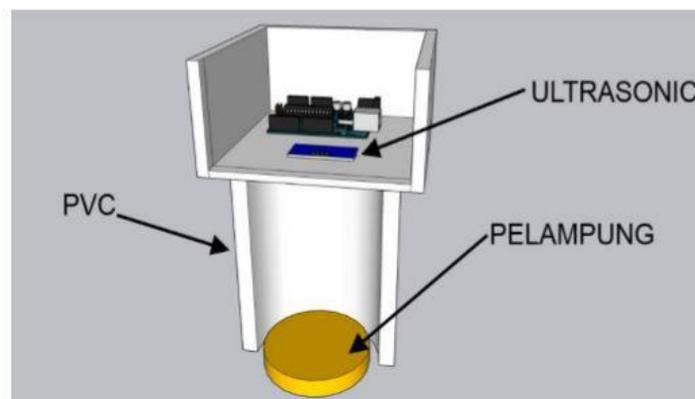

Fig 3. Overall Suite of Tools

Fig 4. Prototype Design

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3 Results and Discussion

     In this chapter, the author will explain the results of testing tools that have been designed and discussions to find out the results of compounding and implementation whether or not they are appropriate in the functioning of the tool. Some changes must have occurred in the design using the NodeMcu microcontroller and several other devices that at the beginning of the design were not included in the list. Implementation (OS, hardware and programming language used), implementation files analysis and system design of each module or relation and algorithm implemented. In addition, this chapter will also describe the results of the research stages, from the stages of analysis, design, results, testing and implementation. In the form of theoretical explanations, either qualitatively, quantitatively, or statistically.

3.1 Tool Testing

     Testing of the tool is carried out to find out whether the planned functions work properly or not. Tool testing is also useful to determine the level of performance of the function. Tests are carried out on each block of the circuit so that if an error occurs it can be known for sure. So how to find out how the ultrasonic sensor works to detect water level and provide a warning when the sensor detects the water level, the water level is divided into 3 parts, namely Alert, Alert, and Danger.

Fig 5. Physical Form of Tools

3.2 Ultrasonic Sensor Test Results

     After all are tested and run properly from the program and tool, the results of the ultrasonic sensor test can be seen in Table 4.4.

Table 3. Ultrasonic Sensor Testing

No	Distance	Buzzer	Led	Status
1	=>10CM- <=20CM	Sound Alarm	Illuminated Green Led	Ready
2	=>20CM - <=30CM	Sound Alarm	Illuminated Yellow Led	Alert
3	=>30CM	Sound Alarm	Illuminated Red Led	Danger

3.3 Test Table

The process of making an internet of things-based flood height monitoring tool, Flood warning detection system is to detect water levels with alert, alert and danger status states. The first flood detection system tests were performed on ultrasonic sensors. Ultrasonic sensors are tested for water reading sensitivity.

Table 4. Test Data View

No	Data	Time	Condition	Result
1	10cm	2023-10-25 18:44	Ready	Succeed
2	12cm	2023-10-25 18:45	Ready	Succeed
3	14cm	2023-10-25 18:46	Ready	Succeed
4	20cm	2023-10-27 15:09	Alert	Succeed
5	22cm	2023-10-27 15:10	Alert	Succeed
6	25cm	2023-10-27 15:11	Alert	Succeed
7	27cm	2023-10-27 15:13	Alert	Succeed
8	30cm	2023-10-27 15:08	Danger	Succeed
9	32cm	2023-10-27 15:27	Danger	Succeed
10	34cm	2023-10-27 15:27	Danger	Succeed

4 Conclusions

Based on the results of the research that has been carried out, the author can conclude as follows:

1. This research has been successfully created, an internet of things based flood height detection system, this tool can detect flood heights according to the height of the flood water, and can send notifications to WhatsApp according to the height of the flood.

2. From the results of testing the flood height detection tool, this tool has been tested ten times at different times and this tool can function well.

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