Implementation of SMS Gateway in the Flood Notification System using Raspberry Pi

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Abstract. Flood disaster has become a national disaster that often occurs in the world today. Indonesia is one country that has a lot of flooding. The cause of the flooding is human error in environmental care. To overcome floods in the short term is to build a flood disaster mitigation system to anticipate more victims. This study aims to create an SMS gateway-based flood notification system. This mitigation system was built using ultrasonic sensors and rain sensors as input components, Raspberry Pi mini-computers as processors and GSM modems as outputs. This research resulted in a prototype of a flood notification system that can send SMS when floods occur. Tests have been carried out by varying the height of the water, which is between 0 cm to 20 cm. SMS will be sent to users when the water level is at 5 cm, 10 cm, 15 cm, and 20 cm. In prototype testing used a scale between 0 cm to 20 cm. From several tests conducted, the system has been able to send SMS to users. This research has provided innovations in the field of flood disaster mitigation using GSM communication systems and Raspberry Pi-based data processing.

1. Introduction
Flood disaster is one of the natural disasters that often occur in Indonesia today. Global Warming is one of the causes of flooding, such as rain that is not well distributed. But in addition to Global Warming, human error is another factor causing floods. The case looks like a forest when water reserves begin to be destroyed by some irresponsible people. Situations like this may be due to economic factors that make people choose shortcuts in making decisions to exploit forests illegally. The effect of illegal forest exploitation causes damage around the forest and can create a flood effect that afflicts nearby residents.

As for the causes of floods that are affected by forest destruction, for city residents also feel the same thing as residents around the forest that is flooding. Based on the problem of flooding around the city, garbage accumulation is one of the impacts of the flooding that occurred. The amount of garbage in the city sewers can cause sewers and floods.

The problem of flooding that often occurs in the community today is the lack of public awareness of the environment. The role of government for the people is needed to be aware of the importance of awareness of the importance of forests as a sustainable water storage area. As well as public awareness of the importance of throwing garbage in its place is a long-term program. The role of the government...
in anticipating long-term public perception is to carry out routine socialization activities on environmental awareness. And the role of government in the short term is to mitigate disasters to anticipate the coming flood.

Based on the importance of development disaster mitigation, the government nationally provides positive responses for private and government agencies to be able to contribute to building disaster mitigation tools or models [1]. The disaster mitigation model or tool is expected to be able to contribute to reducing flood victims in the future.

Based on the importance of developing tools and models to anticipate flood disasters, this study explains the design of flood disaster notification tools. The device built will send an SMS Gateway to the community around the area that has the potential to flood. The prototype was developed using a Raspberry Pi mini-computer as a processor in sending SMS to the public.

2. Related Works

Various research centers are currently developing tools or prototypes in disaster mitigation. Based on research conducted by previous researchers, some research results related to flood mitigation as a flood information system are the ability to send data from a flood detector using GSM data communication. This study provides information to users in the form of flood disaster information in data on date, time, location, and water level [2]. In another study, the use of the SMS gateway is to build a data communication service system based on disaster mitigation systems made by displaying flood and fire data information in the form of web and SMS [3][4][5][6]. In other studies, environmental management information systems have used SMS in sending data such as waste information management. The system provides information to the garbage officer to handle the waste [7], field construction information system [8], the student information system [9], and security monitoring [10]. In addition to using SMS Gateway based data communication in natural disasters, there is an Internet of Things (IoT) based communication system with the concept of exchanging data on a client and internet-based server such as a home fire information system [11][12] and flood information systems [13][14]. From several information systems developed, the average interface is a built-in web form. In another study, a disaster victim information system was built using a mobile application that aims to provide flood victims information to disaster management officers [15]. In previous studies, the use of internet networks in sending data is the main communication system in the process of distribution of disaster information.

3. Method

The research method in making tools begins with analyzing how the system works that the public receives aims to provide information on how the tool works until the flood information. Then the system analysis is developed into a design tool in the form of a block diagram.

In the analysis of how the system works begins with the admin inputting the user's phone number data, then the flood detection system monitors the floods and rain continuously. If there is a flood, then the detected flood is sent to the user according to the telephone number found on the flood detector via the GSM operator, as shown in Figure 1.
Figure 1. Analysis of how the system works.

The design of the tool system was built using a block diagram, as shown in Figure 2. The system consists of three blocks. Namely the input block which contained an ultrasonic sensor as a water level detection and rain sensor to detect rain. Whereas in the block was blocking data on water level and rain using a Raspberry Pi mini-computer. And the third block is the GSM modem Wavecom as the sender of SMS to users. Raspberry Pi was built using the Raspbian operating system. And the system program was developed using the Python and Gammu applications as a bridge application between the modem and the MySQL database.

Figure 2. System block diagram.

4. Results and Discussion
Based on the analysis and design of a flood notification system using SMS Gateway, the prototype of the flood notification system follows in Figure 3. In the prototype SMS Gateway based flood notification system uses several main components, namely rain sensor and ultrasonic sensor as a
component input, Raspberry pi as data processing or processing component. While the GSM modem as an output component that sends SMS to system users. In the flood detection pipe, there are rain sensors and ultrasonic sensors on the top side. And on the Raspberry Pi, there is a GSM Modem. In the SMS Gateway-based flood notification system construction was built in a condition as a prototype. The prototype in question is a condition in the form of laboratory experiments.

In Figure 4 is the result of SMS received by users of the flood notification system using the SMS gateway. The editorial format sent from the SMS gateway based flood notification system is "Flooding occurred with a height of 5cm in rain conditions". And on the other SMS, you can see the editor "There was a flood with a height of 10cm in conditions not raining". Of the two SMS sent, when the SMS was sent, information consisted of conditions when floods and rain occurred.

The test is carried out using water placed in a container with the water level changed, as shown in Table 1. The test is carried out to find out the status of the SMS sent, and the time the user's Mobile received the SMS. In this test, the rain sensor only sends information that there is rain or no rain on the SMS. Also, SMS sent at flood height 5cm, 10cm, 15cm and 20cm. In this case, the program flow runs every multiple of 5 cm. As seen in numbers 5 cm and 6 cm that at the height of 5 cm, the status of the SMS sent with the time of receiving an SMS is 6 seconds. While at the height of 6 cm not sent because the height is not a multiple of 5 cm. This test applies up to a height of 30 cm. While testing is carried out at the height of 20 cm. While the SMS time received, there are several time differences, and this is due to the processing time on the system of the cellular operator. In this test, when an SMS is received, it is not part of the error of the flood notification system that was built but is influenced by the service provider itself.

From this research, it is expected to provide the latest information on prototype disaster mitigation engineering by implementing ultrasonic sensors, rain sensors, Raspberry Pi, and GSM modems in sending flood information to users. And this research is useful for reducing disaster victims in general.

| No. | Flood Height in cm | Status of Sent SMS | Time the SMS was Received |
|-----|-------------------|--------------------|---------------------------|
| 1   | 0                 | Not sent           | -                         |
| 2   | 1                 | Not sent           | -                         |
| 3   | 3                 | Not sent           | -                         |
| 4   | 5                 | Was sent           | 6 second                  |
| 5   | 6                 | Not sent           | -                         |
| 6   | 11                | Was sent           | 4 second                  |
| 7   | 15                | Was sent           | 8 second                  |
| 8   | 20                | Was sent           | 4 second                  |

Table 1. Testing time for receiving SMS based on flood height.
5. Conclusions
Based on the importance of developing an SMS Gateway-based flood notification system, this research has produced a prototype of a flood notification system and has been able to send flood notifications via SMS. The system was built using ultrasonic sensors and rain sensor as input, Raspberry Pi as processor and GSM modem as output. From the test results, sending SMS is sent every height of 5cm, 10cm, 15cm, and 20cm. While the greater distance of 5cm and smaller 10cm does not send SMS. The prototype only sends an SMS for every multiple of 5 cm. Besides that, there are also some differences when receiving an SMS. The difference is not due to an error from the prototype system. The difference in reception time is due to the cellular operator system used. From the test method carried out it can be concluded that the prototype system has been able to provide meaningful information for the development of flood disaster mitigation systems.
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