

Implementation of the SMS Gateway in the Flood Early Warning Information System for Village Warning and Community Information

Dedi Satria, Syaifuddin Yana, Elin Yusibani, Saumi Syahreza, Zulfan



Abstract: Flooding is a national disaster that often occurs in Indonesia. Flood disasters require long-term and short-term action. In the short-term system, the government currently emphasizes state and private institutions to jointly reduce flood victims by developing a flood disaster early warning system. Therefore, this study discusses the making of flood early warning information systems by utilizing GSM communication systems as a means of communication between clients and servers. The GSM communication service used is the SMS Gateway. The SMS gateway service is used for the first time sending data from a flood detection system to a flood information system. Second, disseminating flood information to the public. In this study, the flood warning system for flood early warning works with the integration of three modes. The three systems are flood detection systems, flood alarm systems, and flood early warning information systems. Flood detection systems are built using ultrasonic sensors and rain sensors as inputs, Arduino Uno as data processors and GSM SIM900 modules as outputs. The alarm system consists of GSM SIM900 module as Input, Arduino Uno as processor and electric alarm as output. The flood early warning information system was built using a Wavecom GSM modem, and data processing using PHP, MySQL DBMS, and Gammu. The communication system between each system uses SMS data. This method as a whole began in a flood detection system that sends flood and rain data to the flood early warning information system. And the flood warning system sends alarm activation data to the alarm system. Finally, the system distributes flood information to the public via SMS Gateway. This research is expected to help the community in anticipating more victims with flood information previously obtained.

Keywords: Early Warning System, Information System, Flood Disaster, GSM, SMS Gateway.

I. INTRODUCTION

Indonesia is currently one of the countries vulnerable to natural disasters. Not only Indonesia but many other countries are susceptible to the Flood disaster. Flood disaster is one of the tragedies that often occur due to extreme weather and other global influences. The causes of floods experienced by the world today are the effects of global warming, destruction of forests, and garbage. The impact of forest destruction and rubbish is what has dominated flooding to date. In general, the role of the community and the government is an effort to reduce the number of victims. The purpose of the government is to provide crucial public awareness-raising that the forest is a container for natural water storage. And disposing of trash in its place is a major factor in anticipating flooding in the city area. The role of the government in the socialization of public awareness is one of the long-term programs that must be prepared by the government. for the short-term plan is to provide a disaster mitigation system that can provide information to the public about the occurrence of a disaster early on. Therefore, several countries offer policies to various government and private institutions engaged in research to create multiple tools that can reduce disaster victims [1].

Tools for disaster mitigation are a significant component in detecting the onset of floods. Mitigation tools can consist of hardware and software components. So, therefore, this work aims to develop a disaster mitigation tool in the form of integration between the flood detector system with the flood early warning information system. The system aims to provide information to the public via SMS in the form of a client and server system model.

II. LITERATURE SURVEY

From several surveys that have been carried out, there are several jobs related to the idea of development to be carried out.

Mitigation systems in the form of the internet of things (IoT) have been developed using the integration of sensor systems and information systems. Some cases of a disaster have applied the concept of the Internet of Things (IoT) such as fire information systems [2] [3]. And some of the landslide information system [4].

Revised Manuscript Received on October 30, 2019.

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While in the flood mitigation system some use the integration of hardware and software systems in the form of client and server systems to produce a web-based flood information system [5] [6]. The communication system developed on the network uses internet-based data communication services.

In contrast to the GSM-based flood disaster mitigation system has also been built as a flood monitoring system that provides location-based flood information with a web-based interface [7]. And, several other products use Google Maps [8]. Besides that, there is also an early warning system that sends flood data directly to users via SMS [9][10]. In general, GSM-based data communication in the form of SMS Gateway-based data exchange is still used. This is because GSM towers are more often found in remote areas than Internet services [11]. SMS-based applications are yet being developed in other sectors such as the waste notification system that aims to provide information to garbage trucks to collect garbage at specific locations using the wireless sensor network (WSN) concept [12]. And a waste management monitoring system using GSM data communication [13]. From most of the methods described above, the sensor data processing system uses Arduino. Arduino is a friendly microcontroller board for the embedded system application development process [14]. And some use the ATMEGA328 Microcontroller [15].

III. METHOD

The method of building a flood early warning information system for village alarms and community information uses two stages, namely the analysis phase of how the system is implemented and the system design stage. The methodology used also uses the SDLC (Software Development Life Cycle) method.

A. System Analysis

The system analysis stage is a description of how the system works from flood detection to the distribution of flood information to the community and village alarms. The system works with a flood detection system consisting of flood and rain height sensors sending data to the information system server via SMS. Flood and rain data are processed and stored in database form. The results of data processing produce a decision to send data to sound the alarm to the alarm system. Furthermore, the server also sends flood warning information to community members around the flood location via SMS message. Fig. 1 is a description of how the system works as a whole.

B. System Design

The system design stage is a detailed description of the stages of making a prototype of a flood detector system and a flood early warning information system. First, to detect water level design, flood detector design is needed. Flood detectors are built using pipes which have buoys on the inside. On the upper side, there is an ultrasonic sensor that will detect the distance between the sensor and the float. And on the top side, there is a flood detector system box that has a rain sensor outside, as shown in Fig. 2.

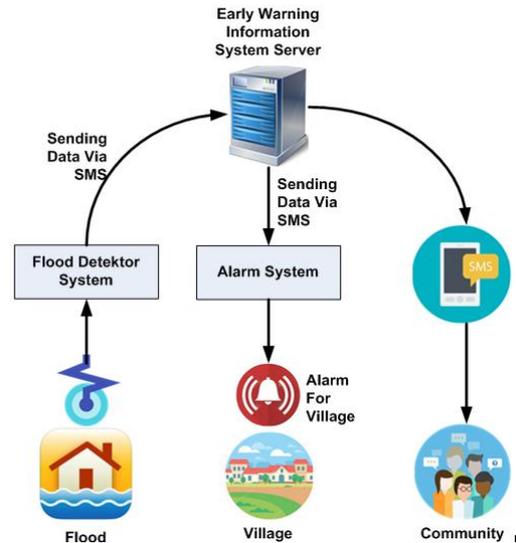


Fig. 1. Analysis of How the System Works

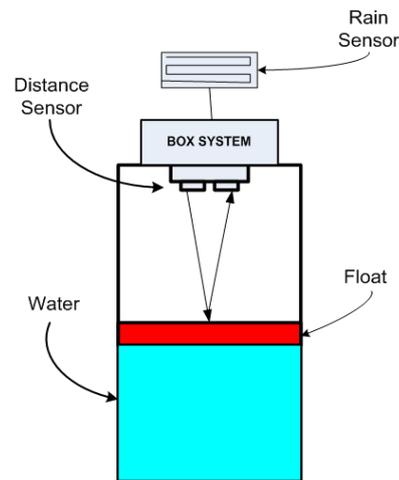


Fig. 2. Flood Detector Construction Design

The next stage is the block diagram design of the flood detector system. A detailed flood detector system consists of three blocks, namely an input block consisting of ultrasonic sensors and rain sensors. Second, the processing block consisting of the Arduino Uno board and the third is the output block consisting of the GSM SIM900A modem, as shown in Fig. 3. Whereas for the alarm system block diagram consisting of the GSM SIM900A modem as an input block, the Arduino Uno board as the processing block and block The output consists of an electric relay and alarm, as shown in Fig. 4.

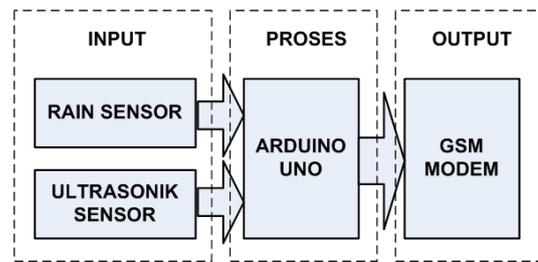


Fig. 3. Block Design Diagram for Flood Detector Systems

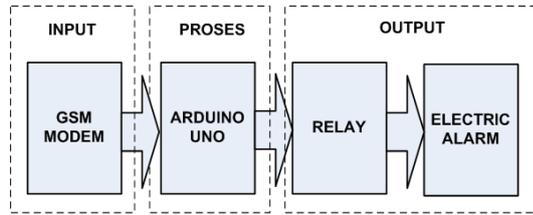


Fig. 4. Block Alarm System Diagram Design

The final design stage is the design of flood early warning information systems. At this stage, the design uses a context diagram model. In Fig. 5, it can be explained that there is a Flood detector system as an object that sends flood and rain data to the early warning flood information system server. While the operator object enters the telephone number data of community members around the village to the flood early warning server. While the server sends information to community members via SMS and alarm data to the alarm system via SMS.

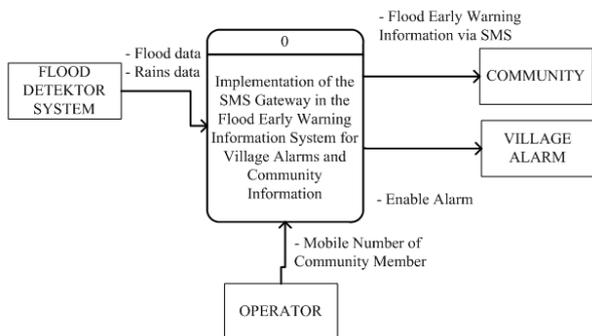


Fig. 5. Information System Context Design Diagrams

The flood early warning information system was built using PHP engine, MySQL server as a DBMS and Gammu as an intermediary between the modem and the MySQL database.

IV. RESULT

Based on the analysis and design of the SMS Gateway based flood warning information system, on some hardware system modules have been successfully built, namely flood detection systems and alarm systems.

The hardware system in a flood detection system consists of an ultrasonic sensor as input from the height of the flood and a rain sensor to determine the condition of the rain during a flood while the preposing system uses an Arduino Uno microcontroller. While on the output there is a SIM900A SMS modem module. The flood detection system can be seen in Fig. 6.

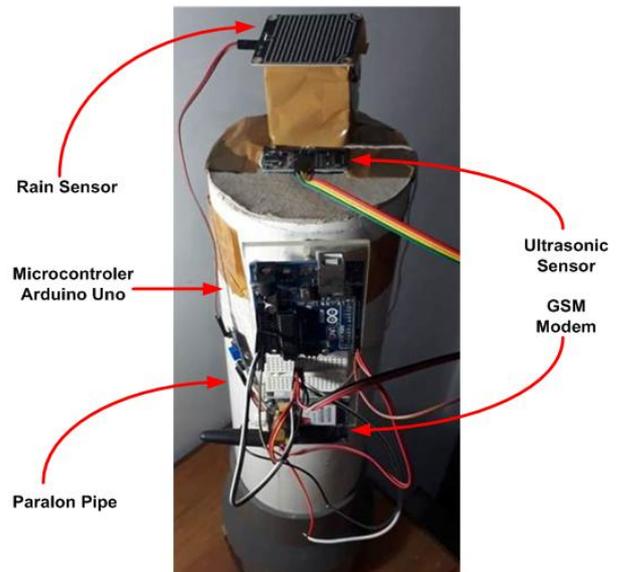


Fig. 6. SMS Based Flood Detector System

The next hardware system is an SMS gateway based alarm system. The alarm system is activated if the server sends an SMS signal to the alarm system. The alarm system is built using a GSM modem module as input, the Arduino microcontroller as the processor, and the output is a relay that is connected to an electric alarm, as shown in Fig. 7.

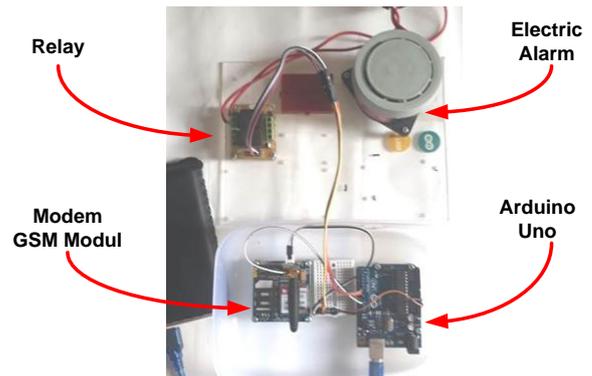


Fig. 7. SMS based alarm system

Besides the hardware system, there is a software system. The software system is a flood early warning information system located on the server. The information system consists of a community form, as shown in Fig. 8. The community form consists of a community name and a mobile number. While the flood report, as in Fig. 9 is the flood information sent by the flood detection system via the SMS Gateway. Flood information consists of information on flood height, rain conditions, date and time. For flood reports contain information on the date, time, flood height, rain condition, and list of people receiving SMS flood information.

ACKNOWLEDGMENT

This research was funded by the university collaboration research scheme (PKPT) from the Republic of Indonesia Ministry of Research and Higher Education (Ristekdikti) through contract number 119 / SP2H / LT / DRPM / 2019. This research was carried out with the assistance of a laboratory from a partner team namely an electronic laboratory from the physics department at Syiah Kuala University, and we thank the Research Team from Serambi University of Mecca and the partner team from Syiah Kuala University for providing technical research consulting and laboratory facilities.

REFERENCES

- R. J. M. Mercado, "Design of wireless sensor networks using embedded Programmable System-on-Chip (PSoC) as applied to community-based flood early warning systems (CBFEWS)," in *2016 International Conference on Advances in Electrical, Electronic and Systems Engineering (ICAEEES)*, 2016, pp. 214–223.
- S. S. Dewi, D. Satria, E. Yusibani, and D. Sugiyanto, "Design of Web Based Fire Warning System Using Ethernet Wiznet W5500," in *Malikussaleh International Conference on Multidisciplinary Studies (MICO MS 2017)*, 2018, pp. 437–442.
- S. S. Dewi, D. Satria, E. Yusibani, and D. Sugiyanto, "Prototipe Sistem Informasi Monitoring Kebakaran Berbasis Google Maps dan Modul GSM," *J. JTIK (Jurnal Teknol. Inf. dan Komunikasi)*, vol. 1, no. 1, pp. 33–38, 2017.
- N. pan Ju, J. Huang, R. qiu Huang, C. yang He, and Y. rong Li, "A Real-time monitoring and early warning system for landslides in Southwest China," *J. Mt. Sci.*, vol. 12, no. 5, pp. 1219–1228, 2015.
- D. Satria, S. Yana, R. Munadi, and S. Syahreza, "Design of Information Monitoring System Flood Based Internet of Things (IoT)," in *Malikussaleh International Conference on Multidisciplinary Studies (MICO MS 2017)*, 2018, pp. 629–639.
- D. Satria, S. Yana, R. Munadi, and S. Syahreza, "Sistem Peringatan Dini Banjir Secara Real Time Berbasis Web Menggunakan Arduino dan Ethernet," *J. JTIK (Jurnal Teknol. Inf. dan Komunikasi)*, vol. 1, no. 1, pp. 1–6, 2017.
- D. Satria, S. Yana, R. Munadi, S. Syahreza, and M. Munawir, "Implementation of GSM based Flood Data Communication in the Flood Disaster Location Information System," *IOP Conf. Ser. Mater. Sci. Eng.*, vol. 506, no. 1, 2019.
- D. Satria, S. Yana, R. Munadi, and S. Syahreza, "Prototype of Google Maps-Based Flood Monitoring System Using Arduino and GSM Module," *Int. Res. J. Eng. Technol.*, vol. 4, no. 10, pp. 1044–1047, 2017.
- S. Azid, B. Sharma, K. Raghuwaiya, A. Chand, S. Prasad, and A. Jacquier, "SMS Based Flood Monitoring and Early Warning Systems," *ARPJ. Eng. Appl. Sci.*, vol. 10, no. Vol. 10, No.15, pp. 6387–6391, 2015.
- E. Kuantama, P. Mardjoko, and M. A. Saraswati, "Design and Construction of Early flood warning system through SMS based on SIM300C GSM modem," *Proc. 2013 3rd Int. Conf. Instrumentation, Commun. Inf. Technol., Biomed. Eng. Sci. Technol. Improv. Heal. Safety, Environ., ICICI-BME 2013*, pp. 115–119, 2013.
- A. J. Falade, O. Mohammed, A. Y. Abdulrahman, and L. Kadir, "Tower sharing and the associated constraints in multi-operator GSM base transceiver station," *Int. J. Wirel. Mob. Comput.*, vol. 11, no. 3, p. 198, 2016.
- D. Satria, Zulfan, Munawir, and T. Hidayat, "Implementation of wireless sensor network (WSN) on garbage transport warning information system using GSM module," *J. Phys. Conf. Ser.*, vol. 1175, no. 1, 2019.
- M. Kavitha et al., "Garbage Bin Monitoring and Management System Using GSM," *Int. J. Innov. Technol. Explor. Eng.*, vol. 8, no. 7, pp. 2632–2636, 2019.
- S. Sharmila, N. D. Babu, J. R. Nishanth, and R. Nivethika, "Automated Road Control System Using Arduino," *Int. J. Innov. Technol. Explor. Eng.*, vol. 8, no. 7, pp. 1953–1956, 2018.

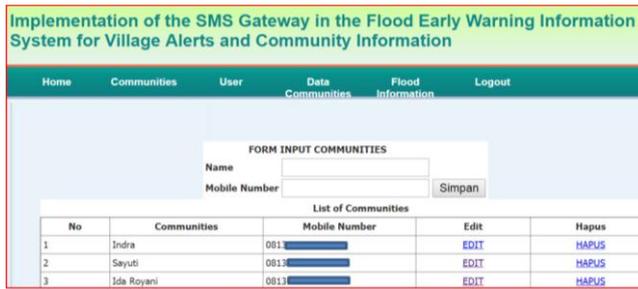


Fig. 8. Community Form

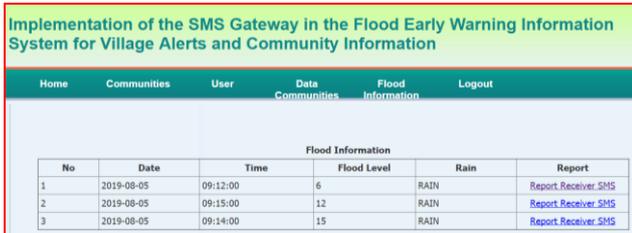


Fig. 9. Flood Report

List of Communities Receiver SMS Report
For Info Flood Date 2019-08-05 Time 09:12:00 Flood level 6 cm, Rain Condtion RAIN

No	Name Communities	Mobile Number	Status
1	Indra	0813[REDACTED]	Text Send
2	Sayuti	0813[REDACTED]	Text Send
3	Ida Royani	0813[REDACTED]	Text Send

Fig. 10. SMS recipient info flooding

As for the SMS information to the public, the flood warning information system server automatically distributes information received from the flood detection system to the public via SMS with the editor, as shown in Fig. 11.

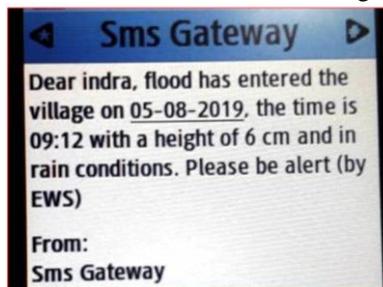


Fig. 11. SMS flood information to the public

V. CONCLUSION

Based on the results discussed, that the flood early warning information system consists of three integrated systems, namely flood detection systems, alarm systems, and flood early warning information systems. All three systems send information using an SMS gateway to other systems. Flood detection systems send flood and rain data to the flood warning system using SMS data. The flood early warning information system sends data to activate alarms using SMS, and the distribution of flood information to the public using SMS. Therefore, from the development of an SMS Gateway based flood warning information system, this can help the community in getting flood information early.

15. K. Swarupa, N. B. Tatini, and M. S. Mounika, "IOT Based Smart Room Controlling Using Arduino," *Int. J. Innov. Technol. Explor. Eng.*, vol. 8, no. 7, pp. 2572–2575, 2019.

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