

Tsunami Early Warning System Using VIPO

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Abstract- Tsunami Early Warning System (TEWS) suddenly popular since the tsunami which hit the city of Banda Aceh and surrounding provinces of Nanggroe Aceh and Pangandaran in West Java and surrounding areas who have swallowed losses of property and lives of so many. Tsunami early warning system using VIPO, as one distribution channel distribution of information, be prepared to assist the government in the Climatology Meteorology and Geophysics Agency (BMKG) in the event of disseminating information to communities around the tsunami disaster areas before the storm arrived.

VIPO (Virtual Phone) is a tsunami information dissemination system laid by the tsunami of information obtained from BMKG on the radio transmitter and received by a device equipped with an FM radio receiver LCD screen and supports the Subsidiary Communications Authorization (SCA), so information can be received at the terminal VIPO distributed to tsunami-prone communities.

In experiments performed in Pangandaran Beach and its surroundings obtained satisfactory results, where the tsunami disaster information can be sent in a short amount of time to the receiving device, although using a simple system. Field trials have been successfully conducted in Pangandaran Beach and its surrounding areas with excellent results despite the use devices mini transmitters, the main constraint on the soil surface around Pangandaraan hill cause to be obstructed signal reception.

I. PRELIMINARY

Tsunami in Aceh and Pangandaran some time ago leaving a deep wound for the Indonesian nation, especially to victims of disaster. These events not only claimed hundreds to hundreds of thousands of lives, but also leaves a deep anguish for victims who are still alive because they lost a lot of things that not a few even lost entirely from the treasure to the family and relatives. This condition triggered the government and several research institutes from home and abroad to build and develop a system that can detect and provide warning information about the possibility of a potential earthquake or a tsunami caused by earthquakes or other natural events. This is so that people can always be vigilant and take immediate measures to be undertaken that might be done as soon as possible. One study conducted by the Research and Development Center (RDC), PT. Telkom (Telkom-RDC) is to develop a tsunami early warning system or also called virtual phone (VIPO), which laid the information on radio transmitters. This development was done in collaboration between TELKOM-RDC with Climatology Meteorology and Geophysics Agency (BMKG), and the Directorate General of Post and Telecommunications (DG Postel), which facilitated supported also by the Office of Pangandaran STO

as the location for placement of radio transmitters and other support systems.

Tsunami warning system is designed with the intention of utilizing VIPO as one disaster information dissemination system, especially the tsunami disaster, to the public directly, where the system is designed for easy to implement, cheap in maintenance costs as well as an affordable device price by the community.

II. SYSTEM OVERVIEW

A. System Description

Tsunami early warning system utilizing VIPO is a system that provides early warning for residents, especially in tsunami-prone areas such as coastal areas, where indicated the possibility of tsunamis arising. This system is connected with the main control system as a detector BMKG tsunami and access system for dissemination of information. In the system developed, the information will be disseminated to the 'ride' the FM radio channel used by the radio broadcaster, known as SCA (subsidiary carrier authorization). With this method, a person who was listening to radio broadcasts, will get information about the earthquake and tsunami hazards there is any possibility in real time (less than 1.5 minutes), after getting information from BMKG system.

VIPO is a terminology that is used to represent a device that functions as a virtual phone to communicate in one direction, whereby the device will be placed in the home and brought the user. VIPO device will have a unique identity number, so that the transmission of information can be directed to a particular identity without acceptable by other devices with different identities. Although there are methods that enable the transmission of information broadcast to all devices simultaneously. Information delivery system will utilize the SCA channel is superimposed on an FM radio broadcast. In this study, the device is used as the receiving device VIPO tsunami early warning.

B. System Configuration

VIPO system connected with the Tsunami disaster information resources available in the office of Climatology Meteorology and Geophysics Agency (BMKG) Indonesia. Tsunami disaster information is then disseminated through various media, including this VIPO system.

Once information is received by the server VIPO the information disseminated in a way modulated the information signal with an FM radio that reaches the target area for dissemination of information carried by the tsunami.

Furthermore, through the radio terminal will be equipped with modules VIPO will display tsunami information on the LCD screen mounted on VIPO receiving terminals, as shown in the following figures:

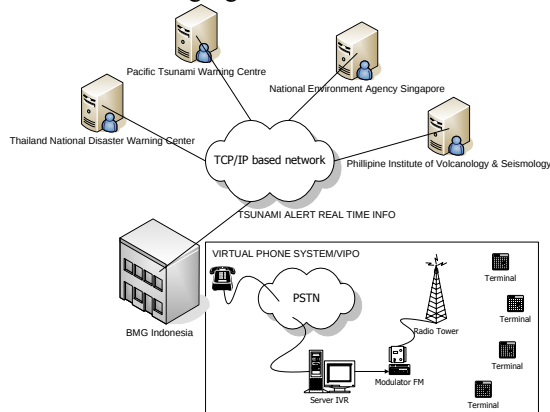


Figure 1. System Configuration VIPO.

Each terminal has a terminal ID is useful for addressing the information to be provided. Information can be directed to the terminal, the terminal groups or terminal depending on the needs of individuals who will be given an information dissemination through VIPO server.

C. Element System

VIPO system consists of two (two) parts, namely the transmitter and the receiver. Transmitter section consists of: SCA Modulator, SCA Generator, and Software Applications. While part of SCA Receiver integrated with the broadcast radio. The function of each part is as follows:

- i. The data modulator to modulate the function of existing data on the server VIPO or from the Internet that contains specific information about the tsunami early warning. The appliance is connected to the SCA Injector for transmission to the receiver terminal.
- ii. Subsidiary Communications Authorization (SCA) Injector function to generate the carrier frequency to carry data from results of the data unit is injected into the FM modulator for Mixer prior to transmission.
- iii. SCA receiver functions to receive signal SCA to didisplaykan on LED monitors installed in the terminal, even this signal as a trigger for siren or loudspeaker.
- iv. Software Applications VIPO consisting of: data grabber to "grab" data from online BMKG, Text format converter to convert XML data into binary format and a modem connector as a gateway to the injector through a connection SCA R232. Modem connector serves also set connection and data transmission and error correction.



Figure 2. Transmitter VIPO



Figure 3. Prototype Receiver VIPO

III. PROTOTYPE VIPO

A. Terminal

Terminal created as a common radio channel receiver combined with a device SCA receivers. The terminal is equipped with LCD display for displaying information received and lighting / speaker indicator if there is any information from the incoming BMKG. The terminal also has a specific ID for privacy and powered by AC or DC power input so the terminal can easy and comfortable to carry anywhere.



Figure 4. Recipient VIPO

B. Display

VIPO terminal equipped with a display to show information such as time stamp, magnitude and event or location of earthquake and tsunami potential so that people can be more vigilant.



Figure 5. Recipient VIPO

C. Protocol Information

Protocol information is used as a 'communication' between the transmitter and receiver so that information can be received by the terminal tsunami VIPO as well. Structure of VIPO protocol informations are composed in the 'package' with the following composition:

Start Flag Length [OptionalParams]

Figure 6. VIPO Information Protocol

The communication protocol consists of:

- i. Start early flags of the packet of information (length 1 byte).
- ii. Data length (including the optional params, body message and terminator (FF)).
- iii. Optional parameters namely sending information types such as: terminal ID, time stamp, alarm type and validity period.
- iv. body of the message is the message content according to information released by BMKG.
- v. Terminator i.e. the end of the message packet.
- vi. Checksum as a error correction code for the validity of data.

Alarm type parameter can be adjusted in accordance with the type of information selected parameter values are:

- no tsunami potential
 - i. tsunami potential
 - ii. news
 - iii. advertising

Examples of message content:

07-04-09 20:29 WIB
5.6 SR 5.6 217km Tenggara
Mentawai Sumbar
Tdk Potential TSUNAMI

IV. FIELD TRIAL

A. Location & Time Trial

Research development of tsunami early warning system using VIPO was implemented and tested starting in January 2008 - December 2009, which specifically for the development of applications made during the nine months from March to November 2009. After going through the stages of research, conducted field trials on Pangandaran beach - Tasikmalaya and surrounding areas. The test was conducted on January, 17-20, 2010.

Results of field trials in addition to getting a good appreciation of the internal team, also from BMKG, DG Postel and Telkom - Pangandaran, where this is proven by their direct participation in the measurements carried out.



Figure 7. Trial Location VIPO

B. Trial Configurations

The test pilot is to determine the performance and test the reliability and coverage of the system to send information to a device used by the user. To transmit data, the team uses a mini transmitters with high power 300 Watt and 40 meter antenna high at 88 MHz frequency. Data is sent every 1 minute by the server that contains information from BMKG about the earthquake and possible tsunami.

C. The Trial Results

With good cooperation among team members and assisted by colleagues TELKOM - Pangandaran, piloting a satisfactory result. Measurements made to more than 10 points from around Pangandaran beach, until the air the farthest distance is 18.59 km which is the location Batu Karas.

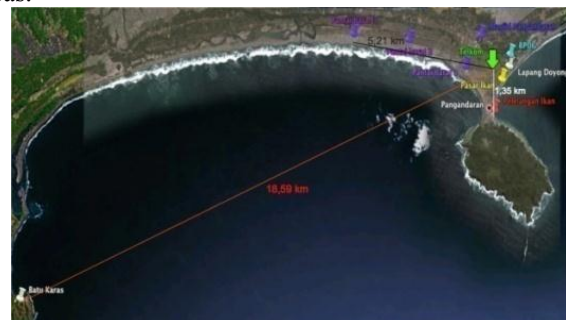


Figure 8. Aerial photo location VIPO Trial

Here is information on testing and test results VIPO:

- i. Test Date: 17 - January 19, 2009
- ii. Transmitter Frequency: 88.0 Mhz
- iii. Transmitter Location: STO Pangandaran
- iv. Deconvolution Power: 300 Watt
- v. Radius reception: 7 KM (Non-LOS), 43 KM (LOS)
- vi. The point of testing:

Pangandaran Beach:

- i. Pangandaran highway roundabout mosque
- ii. Prawn Breeding Pole Hall (BPUG)
- iii. Inclined field
- iv. Fish Market
- v. Fish Auction

Batu karas

- i. Beautiful beaches Batu Karas

- v. SCA input dedicated to a radio station frequency and must remain, this may interfere with the terminal owner who wants to move the broadcast.

D. Analysis Vipo System

From the VIPO trial, was obtained trial data as follows.

No.	Lokasi	Koordinat		Hasil
1	Bundaran mesjid Pangandaran	7° 41' 02.08" LS	108° 39' 14.12" BT	OK
2	BPUG	7° 41' 20.22" LS	108° 39' 49.14" BT	OK
3	Lapang Doyong	7° 41' 30.91" LS	108° 39' 48.17" BT	OK
4	Pasar Ikan	7° 41' 43.18" LS	108° 39' 39.37" BT	OK
5	Pelelangan Ikan	7° 42' 11.70" LS	108° 39' 30.73" BT	OK
6	Pantai Indah Batu Karas	7° 45' 05.49" LS	108° 30' 03.23" BT	OK

Table 1. VIPO trial results

- i. Altitude test points ranging from 0.5 - 5 m above sea level so that all points of testing to receive broadcast / alarm information.
- ii. Information disturbed the alarm if the level of acceptance in an extreme undulating ground surface in addition to the radio emission is low due to use temporary transmitters.
- iii. Antenna heights are relatively quite utnuk reach the entire area due to antenna type used is the Omni so the radio beam evenly.

V. CONCLUSION

- i. Tsunami early warning system utilizing VIPO dissemination is one of the ideal system, where information could be reached directly into the community without the need for high maintenance operating costs.
- ii. Fore it is possible not only for tsunami early warning information that is sent, but can add other information such as weather information and other disasters.
- iii. And not only that, the news information is also expected to be sent to enrich the information for the community., Particularly those living in remote coastal locations.
- iv. Shipping signal tsunami information dissemination through the SCA did not affect the radio signals but currently not all radio stations have SCA input channel so that not all stations can provide this service.