

THE DEVELOPMENT OF CONTINUOUS GPS AND SEISMOGRAPH TELEMETRY NETWORK SYSTEM IN SUMATRA REGION

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Abstract

The development of telemetry network system has been used to measure seismic, coordinates, elevation and azimuth parameters of a location. Measurement results are sent via ACeS satellite network to the Hub Station on the Laboratory for Earth Hazards located in the Research Center for Geotechnology. The outline of telemetry system development is consist of five parts, i.e. measuring instrument, transmitter, transmission channel, receiver and display. cGPS receiver and Seismograph are measuring instruments is used in this experiment. By using modem terminal, measuring data result transmitted through ACeS satellite network. At the receiver divided to a modem terminal and multiple serial (RS232) converter that is connected to a hub server equipped with an automatic data storage system. After data processing at the Laboratory for Earth Hazard, measurement results can be displayed on a large screen that is placed in the public space via a LAN/Internet using web-based protocol.

Keyword : telemetry network system, cGPS receiver, Seismograph, data, data processing.

INTRODUCTION

Since 2002, continuous GPS network (cGPS) has been developed to study the tectonic movement of earthcrust and analyze potential sources of earthquakes, especially in the Sumatra subduction zone. Currently, 34 cGPS stations have been installed scattered on the west coast of Sumatra (Figure 1).

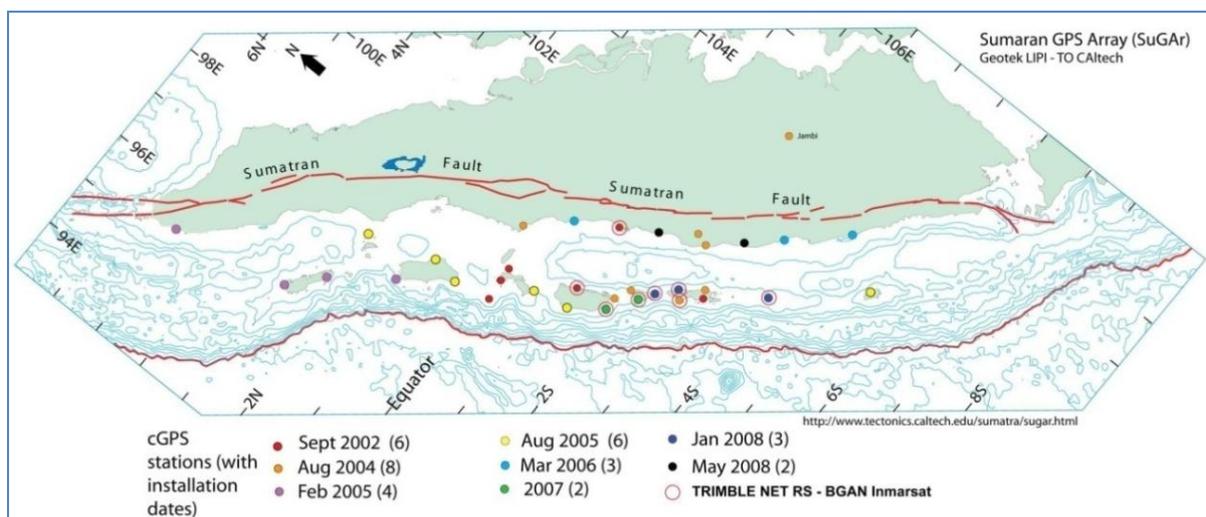


Figure 1. SuGAR cGPS station, until 2008, developed and operated by Research Center for Geotechnology-LIPI and EOS (Earth Observatory of Singapore)-NTU.

The development of telemetry network system has been done by using a satellite phone system that works with the PSN (Pasifik Satelit Nusantara) and ACES (Asian Cellular System). Telemetry network is used to measure the coordinates, elevation, azimuth and

seismic parameters in the region of Sumatra. Measurement results are sent via the FR190G modem to the Hub Station in the Laboratory for Earth Hazard under the Research Center for Geotechnology-LIPI.

After processing, measurement results can be displayed on a large screen that placed in the public space via a LAN / Internet using web-based protocol.

The need for quick and accurate information is necessary to support in earthsciences research performance. Related with earthquake and tsunami has been and probably will occur in the Indonesian region. Geographic condition and distance to be the main constraint to receive quick and accurate information, therefore, it is very important to develop a telemetry network system that is able realtime to record, store, display data and information continuously from the field. It's expected that, by using this system, the parties stakeholders are can provide quick and accurate the actual information to the public.

METHODOLOGY

The development methodology of telemetry network system shown in Figure 2.

- a. Defining and understanding the problem
- b. The design of hardware and software systems
- c. The design of the system flow chart
- d. Installing the hardware and software
- e. System design testing and evaluation
- f. Analysis of telemetry system

The hardware configuration of continuous GPS stations telemetry system over an ACeS network using a terminal modem FR190G can be described as follows:

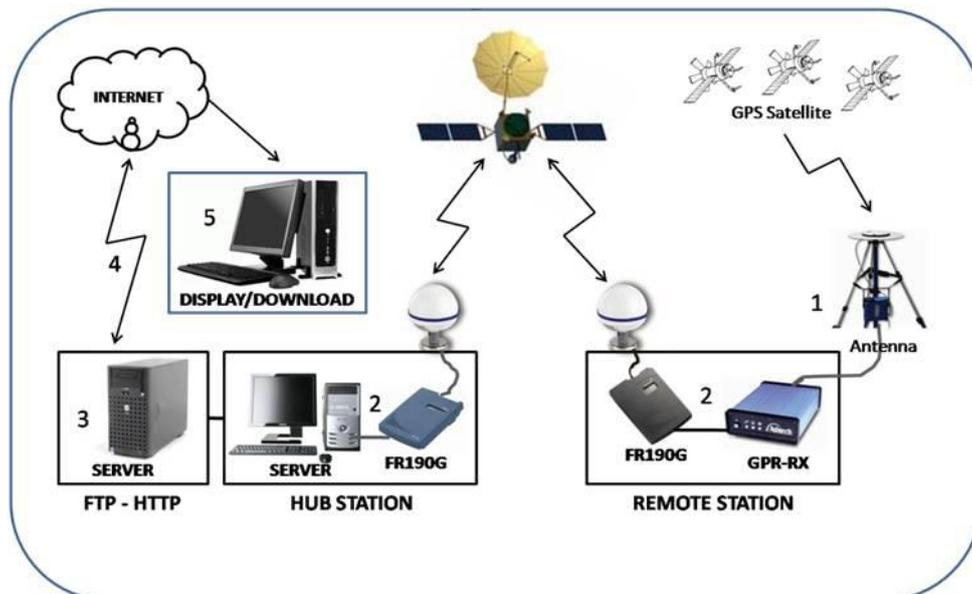


Figure 2. Telemetry network system configuration

The design of telemetry system flow chart shown in Figure 3.

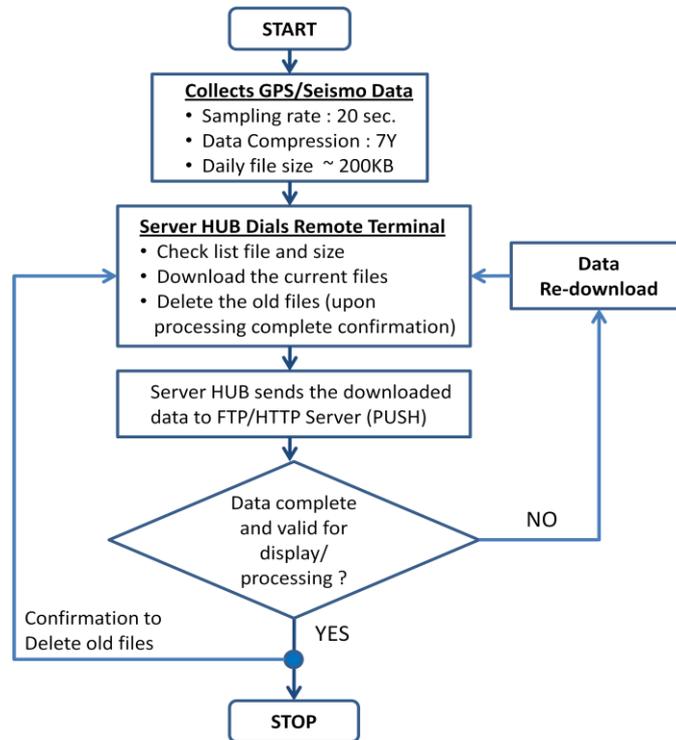


Figure 3. Data flow diagram from remote station to FTP/HTTP Server.

RESULTS AND DISCUSSION

- a. SuGAR new server with using FR190G-PSN Modem in Research Center for Geotechnology LIPI can be operated. Using cGPS station web system (Figure 4) it still need tests in order to make automatic data download system for entire cGPS SuGAR station can really work well.

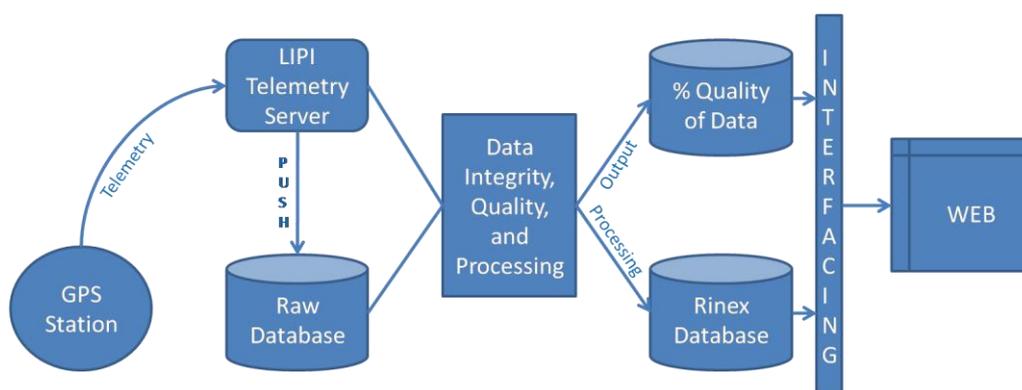


Figure 4. Data transmission process scheme in SuGAR telemetry network system.

- b. Field work has been done to visiting cGPS station for general maintenance, technical checking, and troubleshooting from instrumentation system in field (Figure 6). This activity still need to be done in period of time for the maintenance.



Gambar 5. cGPS station reactivation in TIKU region, West Sumatra, and Hub Station installation in data center, Bandung.

- c. Preliminary experimental result to examine the possibility of communication usage with radio wave shows that this technology have a good prospect to be further developed since it can reduce operational cost. Radio used are 2,4 GHz and 900 MHz.



Figure 6. Location of repeater station used for radio.

- d. The result of alternative telemetry system experiment with BGAN Modem from INMARSAT have a good prospect (Figure 7). In further activity, BGAN system test for data telemetry will be more intensified.



Figure7. Activity of BGAN modem setting in cGPS station.

- e. Physical development of SuGAR data processing laboratory following the draft of interior design have already reached 80% done for setting of network system instalation, hardware, software for internet, server, and data processing is still run (Figure 8).



Figure 8. Layout *Laboratory for Earth Hazard*.

- f. Website development from LabEarth and SuGAR already developed. However there are still some adjustments at database structure and hoped this website can be launched in the end of 2009.

From the results that have been achieved, there are several evidence which is:

1. In 16th August 2009 an big earthquake took place in Siberut Island region, Mentawai. Unfortunately an important data from this earthquake was not sent automatically to the center data since telemetry equipment (satelite telephone) in server computer. (lost its contact with telemetry unit at GPS station). It is because the PSN satellite network at that date was having serious problem.
2. In 30th September 2009, a big earthquake occur with 7.6 SR (Mw 7.6) near city of Padang in 70-100 kilometers deep. This eartquake caused big material loss and victims that reached more than 700 persons. Station of cGPS SuGAR in Padang-Mentawai region recorded the incident of earth facture movements well, however due to telemetry

network system could only send data from several cGPS station, it need to be downloaded manually. It is because of the quality of PSN satellite network which is getting worse.

As long with the efforts for functioning back the telemetry system which use PSN service with FR190G modem, LIPI team and EOS also make serious efforts to develop another telemetry technology for the alternative. The main reason is because GARUDA satellite used by PSN has almost run out of operational period. The indication is in this one last year communication network often have trouble. Incident of network “down” exact when big earthquake happened in West Sumatra region in August and September 2009 strengthen motivation to be more active in developing alternative technology for telemetry system.

CONCLUSION

Developing system of server telemetry network and SuGAR Laboratory to continue GPS network in Research Center for Geotechnology LIPI. Furthermore, this system will be developed for seismometer network system which have been set in several GPS station.

With the presence of this system, it's hoped that data removal process can be done faster than before, also with the data processing and analysis. The problems that occurs in telemetry process can be handled effectively and efficiently. This cGPS laboratory is also developed to be “*a center of excellent*” for geodesy/tectonic GPS research area. This laboratory can be used by the reserchers in related area, inside and outside LIPI.

In side of data processing, thIs activity can be said as a new chapter in earthquake and tsunami research in Sumatra. It has been done by the Research Center for Geotechnology LIPI along with another institution for more than 15 years. The existence of this natural disaster investigation laboratory, especially earthquake and tsunami will be more expanded. Student from undergraduate, graduate, and post graduate also can take a benefit from this laboratory for their research and study. Along with that, this laboratory and SuGAR network certainly will still need maintenance and assistance in order to opreate well and develop their progams.

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