Mobile-Openbts Implementation Of Natural Disaster Victims Search

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***Abstract*— The OpenBTS network is an ideal solution for emergency GSM networks that can be quickly implemented in post-disaster situations. This thesis develops a mobile analysis system-OpenBTS for the search for victims of natural disasters. OpenBTS system built is portable, so it can be referred to as mobile-OpenBTS. Mobile-OpenBTS allows to be taken using a human transport vehicle one of the SAR team vehicles, which is a vehicle in a post disaster situation. The built system can identify the location of mobile-OpenBTS and predict the distance of the victim's location from the mobile-OpenBTS position, either directly the location of the victim is visible or invisible, in which case it is trapped in ruins or has died. People uses cellular phones for mobile activities so cell phones are used to locate the victims. GPS Tracker is used for determining the location of mobile-OpenBTS, while empirical approach is used for predicting the distance of the victim's location. The built system allows the SAR team to capture images of victims or victim's location using the SAR team's mobile phone, then photo and victim data sent and stored on mobile-OpenBTS. The final condition of the stored data will be sent to the POSKO. The process of sending data using the mobile network system-OpenBTS used. Data transmission from mobile-base stations to POSKO is done autosend. All data of victims that have been sent in POSKO can be seen in web based application.**

Keywords— disaster, mobile-OpenBTS, location, distance, mobile phone, portable, GPS

I. INTRODUCTION

Natural disasters have always seen as forcemajore as something as beyond human control, therefore, to minimize the occurrence of disaster victims, awareness and community preparedness is needed for disasters. Disaster awareness and preparedness is ideally already owned by the public through the local local wisdom, because given region of Indonesia is an area that has a risk to disasters. The higher the danger, vulnerability and incompetence, the greater the disaster risks faced. Based on the potential hazards and the level of existing vulnerabilities, it can be estimated that the risk of disasters will occur in Indonesia is high. By knowing the risks that occur due to the disaster community and cooperate with the government expected to carry out disaster prevention [1].

The higher the likelihood of disaster occurring, the higher the risk of casualties resulting from the disaster. The victim search process can be very difficult because the victim may be buried in the ruins of a building or landslide so that the victim is not visible by naked eye. Therefore an effective victim detection method is needed to assist Search and Rescue (SAR) teams in the victim search process. One way to detect the existence of a victim is to utilize objects commonly carried by the victim as a search parameter, for example a cell phone. In addition, cell phones can also be used by the victim to inform the SAR team about the condition and whereabouts of the victim through short messages or telephone service if the victim is still in a minor injury [1]. However, in the event of a disaster there is a possibility that the GSM network will no longer function. While the victim's mobile phone may still be in active condition and continue to search for BCCH (broadcast control channel) transmitted by GSM network through BTS (Base Transceiver Station). Therefore an emergency GSM network is needed that can be implemented quickly at the disaster site [2].

OpenBTS is a fast open source GSM network solution that is widely used as an alternative GSM network. Rapid installation and system configuration make this technology excellent for implementation in disaster locations. By utilizing the basic features as Base Transceiver Station (BTS), OpenBTS can be utilized to detect cellular phones located in the coverage area. OpenBTS system built is portable, so it can be referred to as mobile-OpenBTS.

II. THEORY

A. *OpenBTS*

OpenBTS (Open Base Transceiver Station) is open source software that being used to revolutionize mobile networks using legacy protocols telco, traditional complex, and the owner of the hardware system with internet protocol and flexible network architecture. This architecture is open to innovation with anyone, which enables the development of new applications and services simplify setup and operation of mobile networks. And for that I use the OpenBTS OpenBTS V5.0 there are features GPRS Support, A3-A8-A5 / 1 authentication and encryption, support handover, and files more structured. Here's a simple architecture of OpenBTS contained in Figure 1 [5].

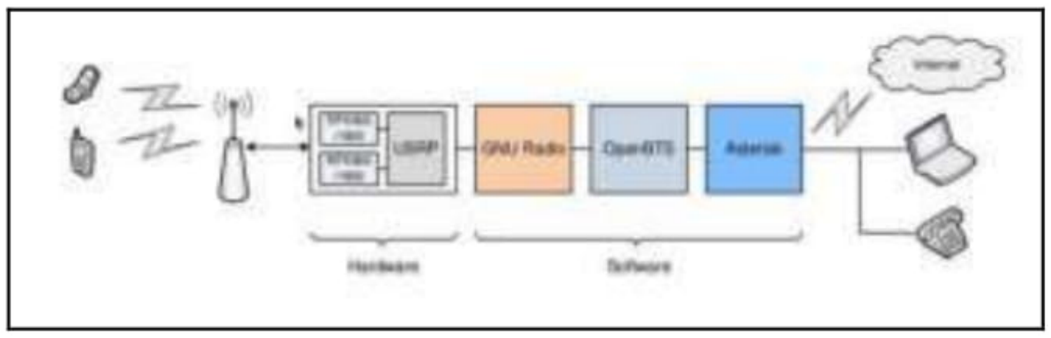

Fig 1. OpenBTS Simple Architecture [2]

B. *Universal Software Radio Peripheral* (USRP)

Fig 2. USRP RAD1

From the hardware side of USRP RAD1 consists of:

1. Universal Software Radio Peripheral (USRP) as a radio signal transmitter that replaces the functions of BTS USRP1 commercial mobile carrier.
2. Communication Call and SMS using Global System for Mobile Communication (GSM) - 2G
3. Data Communication using General Packet Radio Service (GPRS) - 2.5G
4. Radio Frequency 900 - 1800 MHz (used 900 MHz)
5. Power transmitter 100mW
6. ClockTamer 52 MHz
7. Sensitivity Rx -65 dBm
8. IP 192.168.99.1
9. Port 16001

In terms of software used in USRP RAD1 consists of:

1. Linux Operating System in this case is used Ubuntu Linux 14.04 LTS
2. BTS software used by OpenBTS Version 5.0
3. Database used sqlite3
4. Phone app using asterisk
5. Registration application using sipauthserve
6. SMS smqueue application
7. File delivery application using FTP
8. Programming language using python and PHP

C. USRP Hardware Driver (UHD)

USRP Hardware Driver (UHD) is a device driver that is provided by Research Ettus for use by the USRP product. This product supports Linux, MacOS, and Windows platforms. Some of the included GNU Radio framework, LabVIEW, Matlab and Simulink using UHD. Functions provided by UHD can also be accessed directly with the API UHD, which provides native support for C ++. UHD also provides portability across the USRP product family. The developed ppplications for specific models will support the model USRP another USRP if proper consideration is given to the sample rate and other parameters. PyBOMBS (Phyton Managed Bundle Build Overlay System) is a management system to resolve dependencies or collection of several applications for radio software includes installation UHD [1].

D. *Asterisk*

Asterisk is free, open source framework for building communication applications that can transform ordinary computer into a feature-rich communications server or central phone. Functions Asterisk used in OpenBTS is PBX Switching Core, which serves to handle incoming calls towards Asterisk, calls can come from a variety of interfaces and Asterisk can be used to create and deploy a wide variety of applications and services of telephone, including IP PBXs, VoIP gateways, call center ACDs and IVR systems. Asterisk is released under the GNU General Public License (GPL) and is available to download for free [3].

E. *Smqueue*

OpenBTS need a store and forward facility such as a conventional GSM network SMS center for sending SMS to the disaster's victim. This function is represented by smqueue application. Smqueue using the standard RFC 3428 as a method to send instant messages between users on the network OpenBTS. This standard is an extension of SIP, therefore the procedure to connect any follow these protocols [2].

F. *GPS Tracker*

GPS Tracker or often called GPS Tracking is AVL (Automated Vehicle Locater) technology that allows users to track the position of vehicles, fleets or cars in real time. GPS Tracker utilizes a combination of GSM and GPS technology to determine the coordinates of an object, then translate it in the form of a digital map [7].

G. *Crontab*

Crontab (Cron Table) is a daemon app (running behind a screen) that is used to run a scheduled task at a time on a linux operating system. Every user on a system that has a crontab file, allows the file to perform an action that has been specified in the specified time. Crontab commonly used for automatic backup, sync files, etc [8].

III. ANALYSIS AND DESIGN

The following is a flowchart of the overall built system listed in Figure 3. The system starts with the victim's mobile victim autoregistration system to OpenBTS. The next step is to send SMS broadcast to all IMSI that have been registered on the system. The SAR team can predict the distance of the

victim's location, take photos of the victim or the location of the victim's discovery and can perform telephone or SMS service. After all victim data goes to mobile-OpenBTS, data will be sent to autosend central POSKO, where the mobile-OpenBTS location when sending the data can be tracked using GPS Tracker.

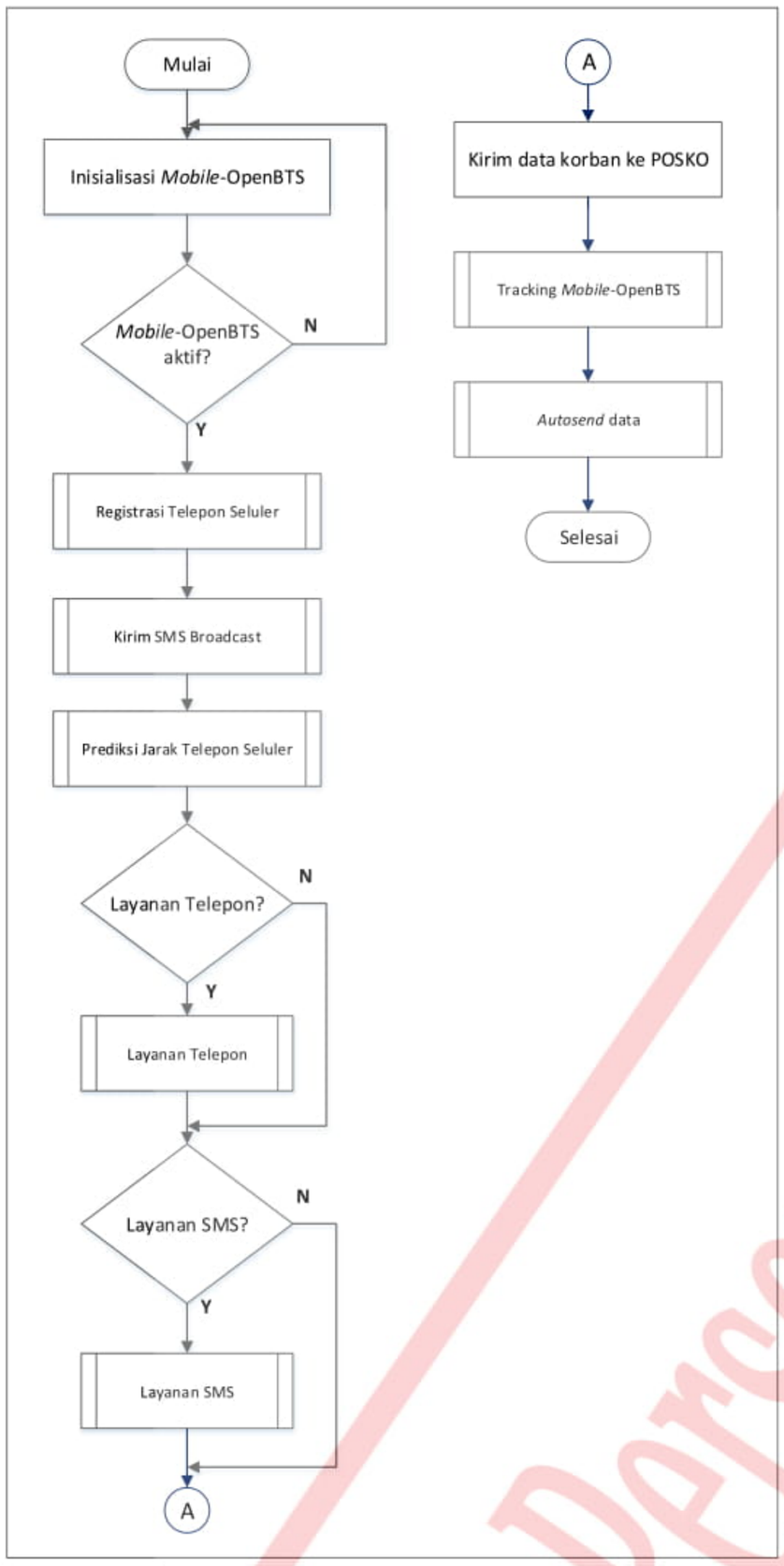

Fig 3. Flowchart System

IV. IMPLEMENTATION AND TESTING SYSTEM

Implementation of the system is done by first installing all software listed in Table 1 into MiniPC / Laptop. After the installation process is complete and then we do a case study topology settings as shown in Figure 4.

TABLE I. LIST COMPONENT INSTALLATION FOR OPENBTS

Name	Quantity	Information
MiniPC/Laptop	1	Hardware
USRP RAD1	1	Hardware
Telepon seluler	5	Hardware
GPS Module	1	Hardware
Ubuntu 14.04 LTS 32bit		Operation System Software
UHD v.3.8.3		Software Driver USRP RAD1
SIPAuthServe		Application Software SIP
SMSQueue		Application Software SMS Gateway
Asterisk v.11.7.0.5		Software VoIP PBX
OpenBTS v.5.0		Software OpenBTS
Coding script Pyython and PHP		Source Code

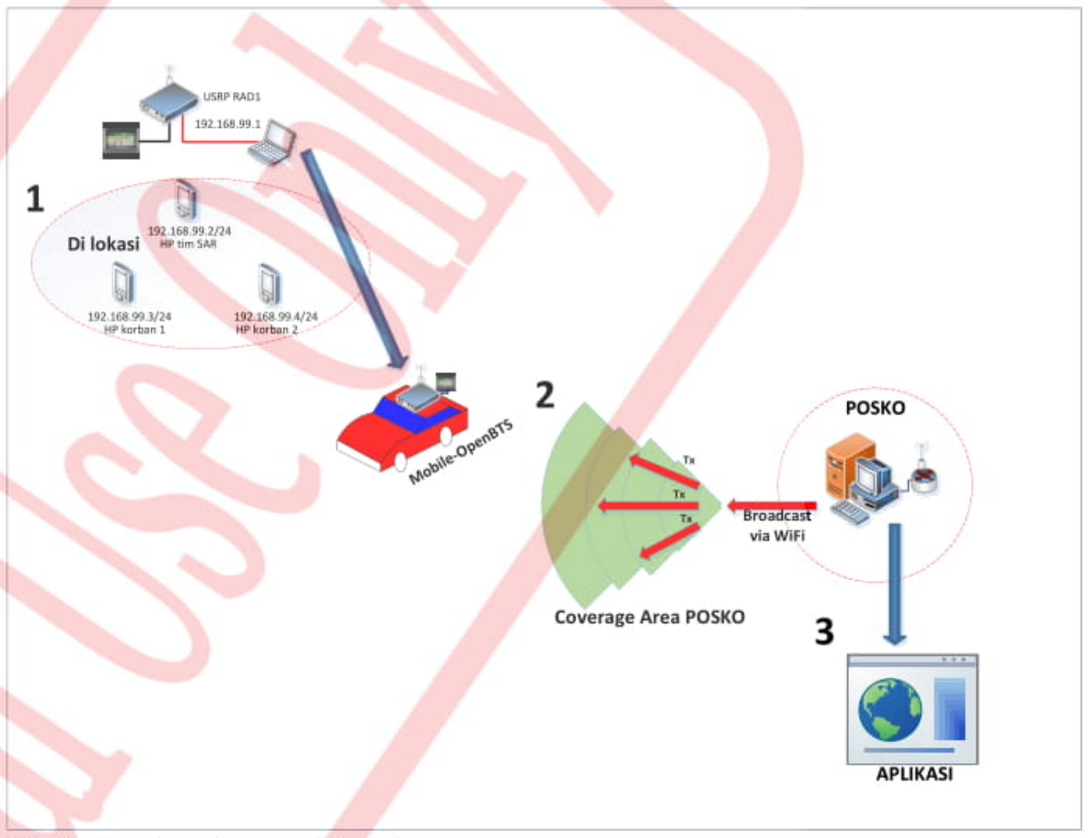

Fig 4. Testing System Topology

Fig 5. Output in the app

V. CONCLUSION

The conclusion of this research is :

1. The process scenario from the search for natural disaster victims described in the use case diagram, activity diagram and sequence diagram contained in chapter III of section III.2.11 illustrates activities that can be done by the SAR team that predict the distance of the victim, take a picture of the victim or the location of the victim and Telephone service or SMS, while activities that can be done by the victim who in the condition of minor injuries are telephone and SMS service.

2. GPS Tracker is used to determine the location of mobile-OpenBTS, this tracking is used to know the movement of mobile-OpenBTS when walking towards the central POSKO. Tracking time by default is per 10 seconds.
3. Based on the research results, the received capacity of BTS is 100 mW so the maximum distance produced is 30 meters.
4. Transmission of victim data from mobile-base stations to central POSKO using autosend data principle. POSKO broadcast via WiFi, POSKO will continue to search BTS that one coverage with the POSKO. When there is a BTS that goes into the coverage area of WiFi POSKO then POSKO will take the existing data on the BTS. The time required for a single shipment and receive the answer / reply on the package is 30ms, in the autosend application is done twice the delivery time, so the total time is 60ms. In relation to the length of the application process run it depends on the operator, by default the application will stop after receiving the data transmission, but the application can be repeated per time interval using standard linux operating system crontab scheduling.

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