

The Development of Warning Flash Flood Warning Level 4 via Application Android and iOS

Dr. Wichit Nanglae*

*School of Computer and Information Technology, Chiang Rai Rajabhat University, THAILAND. E-Mail: firstiit[at]gmail[dot]com

Abstract—The purpose of this study was to The Development of warning flash flood warning level 4 via Application Android and iOS. The objectives are, 1) to explore the threat of flood, 2) create a flood warning to report information on 4 levels, 3) to evaluate the performance acceptance of flood warning. The research findings were as follows: 1) The test altitude sensor operates during flood = 50, 70, 100, 120 cm, altitude sensor = 50 cm. The areas with the highest flood. The Phao village = 65.5 level sensor=70 cm is a Nanglaenai village =73.75 level sensor 100cm level sensor is a Phao village =116.25 level sensor 120 cm is a Khuatae village = 133. 2) The flood warning include circuit audio recording signals send to a processing circuit to adjust / volume 4 levels with the processing / transfer volume to the walky-talky To broadcast station signals to the community and flood warning signal sounds and the Application Android and iOS is name: “Nanglae version 1.” 3) Assessment acceptable performance criteria for evaluating the efficiency of flood warning. Acceptance criteria 4 the following: The level of performance evaluation and acceptance. Average = 17.45 SD 4.383.

Keywords—Analysis of the Situation; Application Android and iOS; Nanglae District; Natural Disasters; Walky-Talky; Warning Flash Flood; Warning Level 4.

Abbreviations—Global System for Mobile Communications (GSM); Time Division Multiple Access (TDMA).

I. INTRODUCTION

BACKGROUND AND SIGNIFICANCE OF PROBLEM — The current disaster has caused a flood more frequently and with greater severity warning avalanche warning storm flood watch and Inundation This research has been to The development build flood warning for flood protection and participation of the community Nanglae district Sudden flood happening from flash flood, it was found that frequently happened during in the past. Mostly it came from heavy rain storm and also found that there were annually multiplied the severity and caused more frequency. These above reasons were in mountainous area and along with slope hillside above water, where it was increasingly developed as agricultural areas, tourist attractions, residences, and others..

Flooding disaster and landslide in watershed area caused by heavy rainfall in watershed area and was over potential of the ground, which could hold, so flash flood runoff to the ground along the slope and if the ground in that area had little resistance movement, it would be soil flow and other things along the upstream. The quantity of water flowing into the river with combination of several branches, if its flow rate or quantity of water was more than maximum flowing of

watercourse especially the narrowest range, it caused sudden flooding for flash flood in the area of central part of water, end of water with flash flood from watershed. Guideline for area of Nanglae Nai water management system from flash flood by installing watershed warning system and water course management system.



Figure 1: Damage Condition of Flash Flood in Nanglae Municipality Area

The Flash flood warning system is disaster that happens with other related factors such as weather condition, How is that area being? as high hill. When we use flash flood warning system by installing warning system, while rain is heavily falling then warning machine will report through radio communication system and Global System for Mobile Communications (GSM) used digital technology for controlling signal channel and sound signal in Time Division Multiple Access (TDMA) format that communication was called Short Message Service or another can be called Text Message [1]. Flooding disaster and landslide in watershed area caused by heavy rainfall in watershed area and was over potential of the ground, which could hold, so flash flood runoff to the ground along the slope and if the ground in that area had little resistance movement, it would be soil flow and other things along the upstream. The quantity of water flowing into the river with combination of several branches if its flow rate or quantity of water (measured in cubic meters/second) was more than maximum flowing of water course especially the narrowest range, it caused sudden flooding for flash flood in the area of central water course, ended water course with flash flood from watershed. [2, 3, 4, 5].

The development of flash flood warning system in Nanglae municipality area was done by flash flood warning machine under warning signal from watershed that installed through radio mobile signal and Global System for Mobile Communications (GSM) by verifying and signaling back to the destination, where the same frequency and channel were installed [Jaras Boonyathamma, 6; 10]

Guidelines for research, they are flash flood warning machine with out any signals of communication in NanglaeNai watershed area, ChiangRai by building 4 levels alarm system, which each level has different alarm signal that is 4 flash flood warning machines, they can alarm by 4 levels of surveillance and planning flash flood protection by alarming sound repetition until water levels down then they stop alarming signal but they transfer signal as sentence of speech as follows ; 1) (Level One) warning for level one. 2) (Level Two) warning for level two, surveillance. 3) (Level Three) warning for level three, move to the higher ground. 4) (Level Four) warning for level four, evacuate [Pareeya Chaivet, 7; Worawat Thowiwat & Suttisak Sorlump, 8; Suttisak Sorlump, 9].

All levels will be signal transmission between surveillance location of the destination at Nanglae district municipality and surveillance location at School of Computer and Information Technology, Chiang Rai Rajabhat University then run the public relation for people and community start the surveillance together with the next step of disaster prevention plan [11].

II. RESEARCH OBJECTIVES

1. To survey the disaster condition from flash flood of Nanglae district municipality.
2. To build 4 levels reporting flash flood warning machines.

3. To assess the acceptance performance of flash flood warning machine.

Research Methodology

Researchers have built 4 flash flood warning machines. When sudden heavy rain happens, they will have sensor system at the high level after that the sensor transmission will operate through radio communication signal to the end receiver that use the same signal channel. It can be the preparation for surveillance before flash flood starting. In part of assessment performance for acceptance in flash flood warning machine, researchers collected data from questionnaire respondents of performance assessment for acceptance in flash flood warning machine as follows, 1) Define code of for verifying questionnaire, 2) Self data collection by using questionnaire with population, who live in the target area of Nanglae district municipality, Village no. 14, where 684 people were sampling and 684 questionnaires from total 9,724 populations. Sampling in vulnerable area were 684 people and randomize 40 questionnaire respondents, 3) Verify the completion of questionnaire before processing with computer, 4) Interviewing population sampling from community leader at Village 14 with In-Depth interview and test for operation with population sampling, who suffer from disaster in Nanglae district municipality, 1) Expected benefits there are flash flood surveillance by community participation for flood prevention, 2) Obtain flash flood warning machine for flash flood prevention, 3) It will be an approach for disaster warning system to operate in the area.

III. SCOPE OF RESEARCH AND LOCATIONS

Scope of Research and Locations

Scope of variables in this research is to study the development of flash flood warning machine for flood, Location is Nanglae district municipality, 14 villages with 684 populations and do assessment of acceptance, which randomized from 40 questionnaire respondents. protection and participation of Nanglae district municipality community, which 4 issues are studied as follows, 1) Area based community research participation, 2) Design of flash flood warning machine, 3) Research based application, 4) Performance in application.

IV. RESEARCH HYPOTHESIS

- 1) An area spot in Nanglae district municipality is a spot for flash flood warning machine completely installed into 4 spots, 2) How do 4 spots of flash flood warning machine work?, 3) Which level does flash flood warning machine acceptance?

Sampling

Sampling in this research was 684 issues of questionnaire from 9,724 populations, who concerned in Nanglae district municipality, 684 populations were in vulnerable areas, and randomized for 40 people questionnaire responses during June to November 2014 with Purposive Sampling and

Stratified Sampling Variables Independent variables. 1) Build flash flood warning machine, 2) Nanglae district municipality officers were Head of Nanglae district municipality, Nanglae district municipality personnel Populations in the area. Dependent variables are, 1) Flash flood warning machine for surveillance and prevention plan, 2) Acceptance of flash flood warning machine

Research Populations

684 issues of questionnaire were collected by 9,724 populations, 684 persons were in vulnerable areas, and 40 persons were randomized in questionnaire responses.

Area of the Study

Flash flood in vulnerable area, Nanglae district municipality.

Populations

Populations in this research were 9,724 people, who concerned in Nanglae district municipality and occupied in other different positions of this organization. (Updated data on 11 July, 2013) Researched populations were divided into 2 sections as follows; Populations sequence no. 1-8 in Purposive sampling. Populations sequence no. 9 were researched by Stratified sampling [Krejcie & Morgan, 16] as "Table" 1, 2.

Table 1: Population (Nanglae Municipal Officers and Occupied in Different Positions of Nanglae Municipal District)

No.	Position	Amount (Person)
1	President of municipality	1
2	Vice President of district municipality (secretary and consultant)	4
3	Chief and Village Headman of Nanglae district municipality	17
4	Office clerk of Nanglae district municipality	21
5	Disaster prevention and mitigation	7
6	Maintenance division	9
7	Education division	14
8	Internal Audit	1
9	Populations village no. 1-14	9,650
Total		9,724

Table 2: Sampling Group in Municipality of Nanglae District and Occupied in Different Positions of Nanglae Municipal District) (from Table of R.V. Krejcie and D.W. Morgan [16])

No.	Position	Amount (Person)
1	President of municipality	1
2	Vice President of district municipality (secretary and consultant)	4
3	Chief and Village Headman of Nanglae district municipality	17
4	Office clerk of Nanglae district municipality	21
5	Disaster prevention and mitigation	7
6	Maintenance division	9
7	Education division	14
8	Internal Audit	1
9	Populations village no. 1-14	610
Total		684

V. DATA ANALYSIS

1. Researchers have taken verified and completed questionnaire then coded as criteria of each instrument.
2. Researchers have prepared the coded questionnaire for saving in statistically software program to process data that were collected and statistically calculated then analyzed results as research objectives for processing collected data and calculated statistically by presentation in form of table analysis then summarized research findings, discussion, and suggestions respectively.
3. Data analysis from community leader interviewing and Open-Ended questionnaire responses were analyzed by Content Analysis [Cronbach, 12; Holsti, 13; Palshikar, 15; Krejcie & Morgan, 16]

VI. RESEARCH STATISTICS

Statistical program used Percentage, Frequency, Mean, and Standard Deviation in part of performance analysis and acceptance,

1) Analysis of Reliability of acceptance assessment form by using Cronbach's Alpha Coefficient as follows; [Cronbach, 12]

$$\alpha = \frac{k}{k-1} \left(1 - \frac{\sum s_i^2}{s^2} \right) \quad (1)$$

when for questionnaire reliability. for items of questionnaire. for total number of variance of each items in questionnaire. s for variance of total score from each respondents.

2) Calculation for reliability and validity with content analysis The Development build Flash flood warning for flood protection and participation of the community Nanglae district. Data analysis was analyzed as follow; [Holsti, 13]

$$\text{Reliability} = \frac{2M}{N_1 + N_2} \times 100 \quad (2)$$

when M for Code number that all experts agreed. N_1 for all of the first expert coding. N_2 for all of the second expert coding

3) Analysis of frequency difference among acceptor and denier used Chi-square test as follows; [David J. Sheskin, 17]

$$\chi^2 = \sum_{i=1}^k \left(\frac{O_i - E_i}{E_i} \right)^2 \quad (3)$$

When The value of the measurement. E_i , the expected value. k , the number of groups.

VII. RESEARCH FINDINGS

The research findings were as follows:

1) The test altitude sensor operates during flood = 50, 70, 100, 120 cm altitude sensor = 50 cm The areas with the highest flood. The Phao village = 65.5 level sensor = 70 cm is a Nanglaenai village = 73.75 level sensor 100 cm level sensor is a Phao village = 116.25 level sensor 120 cm is a Khuatae village = 133.

2) The flood warning include circuit audio recording & audio transmission sound has been changed into electrical signals send to a processing circuit to adjust / volume 4 levels with the processing / transfer volume to the walky-talky To broadcast station signals to the community and flood warning signal sounds and the Application Android and iOS is name: “Nanglae version 1.”

3) Assessment acceptable performance criteria for evaluating the efficiency of flood warning. Acceptance criteria 4 the following: 1) easy to use flood warning is clear. 3) The flood warning useful function. 3) Flood warning is comfortable to use, quick to install. 4) The flood warning on the needs of the user. The level of performance evaluation and acceptance. Average = 17.45 SD = 4.383.

VIII. BENEFITS AND VALUES OF INVENTION

Benefits for development There is surveillance of flash flood by community participation for flash flood prevention.1) We received low cost flash flood warning machines. 2) It is prototype of flash flood warning machine from non-signal communication area. 3) We have received format for development of flash flood warning machine, which is able to store data and report through computer with sounds and illustrations.

IX. RESEARCH SUGGESTIONS

This research researchers have suggested as follows, 1) From this research, we suggested any organizations should be associated with flash flood prevention. They should accelerate to support for installation of flash flood warning machine of vulnerable areas in Chiang Rai such as Mae Sai district, Mae Chan district, etc, 2) Research Development Institute, Chiang Rai Rajabhat University should join with Provincial Prevention organization and flash flood warning machine should be installed into other areas, 3) Community should publicize knowledge and development from this research participation into other communities under the cooperation of Provincial Prevention organization.

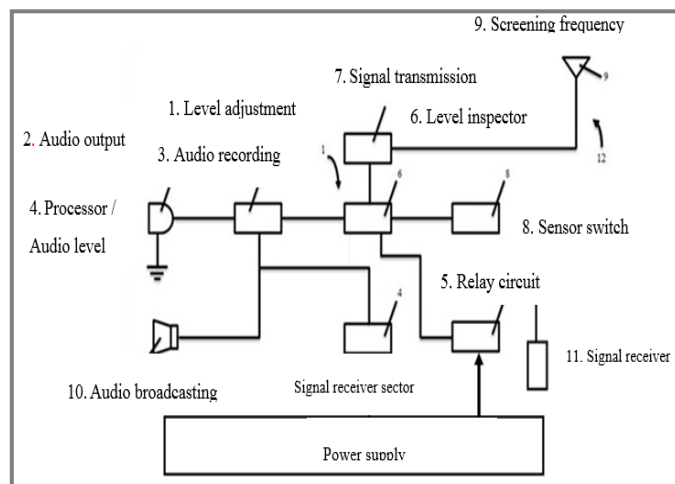


Figure 2: Functional Diagram of Flash Flood Warning Machine



Figure 3: Flood Warning Machine by Solar Energy, First Spot of Flood, Third Spot of Flood Warning Machine

X. WARNING SIGNAL SOUNDS AND THE APPLICATION ANDROID AND IOS

Warning signal sounds and via Application android and ios. 1) (Level One) warning for level one, 2) (Level Two) warning for level two, surveillance, 3) (Level Three) warning for level three, move to the higher ground, 4) (Level Four) warning for level four, evacuate [Huth & Ryan, 14].

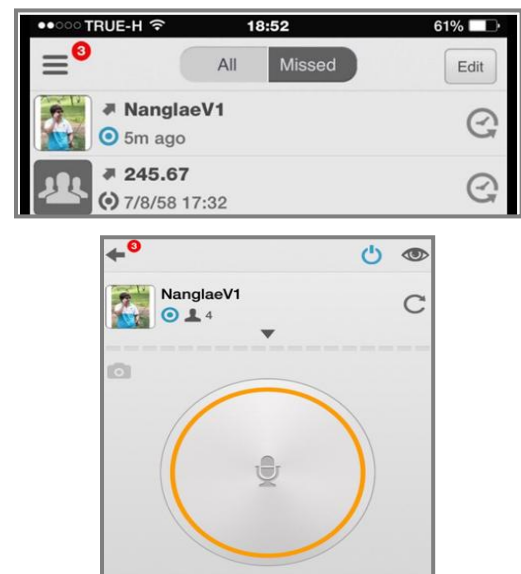


Figure 4: Flood Warning Machine via Application Android and IOS

XI. AWARDS AND PATENT

Awards: 2nd runner up Thailand Inventor's Day 2015 by National Research Council of Thailand (NRCT) Launched Year: 2015 [18].

Patent No.: 1301003661 Day filed May 23, 2557. Has been Intellectual property registration Thailand

Awards: Recognizes your Excellent contribution in Participating and Getting Gold Medal Award in 2015 Taipei

International Invention Show and Technomart (INST 2015) and Special Prize Award from Association European Inventors, Poland [19].



Figure 5: 2nd runner up Thailand Inventor's Day 2015 by National Research Council of Thailand (NRCT) Launched Year: 2015 [18]



Figure 6: Recognizes your Excellent Contribution in Participating and Getting Gold Medal Award in 2015 Taipei International Invention Show and Technomart (INST 2015) and Special Prize Award from Association European Inventors, Poland [19]

XII. NEXT RESEARCH RECOMMENDATIONS

1. This research should be comparative study of disaster prevention with other tools in order to get data and capacity of disaster prevention in different form.
2. Next research should be considered to conduct research in form of development progress for flood warning machine which store data and report through computer with sounds and illustrations.

3. Next research, the research procedures especially Information Technology should have been added for the study.

XIII. ACKNOWLEDGEMENT

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REFERENCES

- [1] Brochure of Flood Warning Machine (2012), "National Electronics and Computer Technology Center", Ministry of Science and Technology.
- [2] Ministry of Science and Technology (2004), "Landslide Warning Robot". [Online system]. Source: <http://www.most.go.th/main/index.php/news/organization-news/1353html> (8June 2013)
- [3] Water Information and Forecast Group, "Hydrology Division, Office of Water Management and Hydrology. Water Flow Rate Calculation". [Online system]. Source: http://water.rid.go.th/hyd/download/rating_curve_manual/manning_s_formula.pdf
- [4] Meteorological Department (2013), "Meteorological Declaration" Storm "Mung Kud". [Online system]. Source: <http://weatherwatch.in.th/>. (8 August 2013).
- [5] Department of National parks Wildlife and Plant Conservation. "Community based Research on Applying API Model II for Flash Flood and Land Slide Warning at Mae Na Sub-district, Chiang Dao District, Chiang Mai Province". [Online system]. Source: http://www.dnp.go.th/watershed/chiangdao/API_OK_2010_OK.pdf
- [6] Jaras Boonyathamma (2013), "Micro-Adapter (Adaptor)". [Online system]. Source: <http://www.neutron.mutphysics.com/physicsboard/forum/index.php?topic=474.0>, (2 August 2013).
- [7] Pareeya Chaivet (2011), "Model Checking based Verification for Flood and Landslide Early Warning System".
- [8] Worawat Thowiwat & Suttisak Sorulump (2010), "Critical API Model for Landslide Warning", *The 14th National Academic Symposium of Civil Engineering*. National Disaster Warning Center, Knowledge [Online system]. Source: <http://www.ndwc.go.th/web/>
- [9] Suttisak Sorulump (2012) "Landslide Disaster Management Technology". [Online system]. Source: <http://www.gerd.eng.ku.ac.th/News/Knowledge/LandslideDisasterManagementTechnology.pdf> (4 April 2013)
- [10] Research Bureau and International Cooperation, Information Technology Center. Department of Disaster Prevention and Mitigation, Ministry of Interior (2010), "Application of Geographic Information System of landslide Risk area for Analysis and Management", "A Case Study of Chawang district, Nakornsrithammarat Province".
- [11] Social Research Institute, Chiang Mai University, Hardware Instruction of "PIC16F84(A)". [Online system]. Source: http://www.thaimcu.com/article/getstart/pic16f84_hw.html
- [12] L.J. Cronbach (1990), "Essentials of Psychological Testing". (5th ed.). New York: Harper & Row, Pp. 202–204.
- [13] O.R. Holsti (1969), "Content Analysis for the Social Sciences and Humanities", London: Addison-Wesley.
- [14] M. Huth & M. Ryan (2004), "Logic in Computer Science Modelling and Reasoning about System", London: Cambridge University Press.

- [15] G.K. Palshikar (2004), "An Introduction to Model Checking", [Online]. Available: <http://www.embedded.com/showArticle.jhtml?articleID=17603352> (August 7, 2013).
- [16] R.V. Krejcie & E.W. Morgan (1971), "Educational and Psychological Measurement". *University of Minnesota*, Duluth.
- [17] David J. Sheskin (2007), "Handbook of Parametric and Nonparametric Statistical Procedures", 4th Edition, Boca Ratan: *Champion & Hall / CRC*.
- [18] 2nd Runner up Thailand Inventor's Day 2015 by "National Research Council of Thailand (NRCT)" Launched Year: 2015 URL: <http://rrm.nrct.go.th/>
- [19] Taiwan External Trade Development Council, TAITRA (2015), 2015 INST TAIPEI INT'L "2015 INST TAIPEI INT'L Winner List is here!" URL: <http://www.inventaipai.com.tw/index.html> URL: http://cloud.taiwantradeshows.com.tw/2015/inst/download/2015_winner.pdf, Pp. 9.



Dr. Wichit Nanglae, Workplace: Dean. School of Computer and Information Technology Chiang Rai Rajabhat University, Thailand. History of Education: 1995 Undergraduate Bachelor of Business Administration General Management All Rights Reserved, 2005 Internet and Information Technology Naresuan University Phayao Campus, 2014 Doctor of Philosophy Information Technology Quality Information Technology Phetchaburi Rajabhat University. Specialty: Major areas of research in computer technology. Research plan: 1) The experiment of pineapple sorting by image processing technique, 2) Creating a semi-automatic machine compressed straw in order to build a house from straw material, 3) The Study Model of Qualitative Information Technology in Six Sigma Process for Folk Literature Collection: A Case Study "Lanna Sor Folk Songs". Awards: 2nd runner up Thailand Inventor's Day 2015 by National Research Council of Thailand (NRCT) Launched Year: 2015, Patent No.: 1301003661 Day filed May 23, 2015. Thailand. Awards: Recognizes your Excellent contribution in Participating and Getting Gold Medal Award in 2015 Taipei International Invention Show and Technomart (INST 2015) and Special Prize Award from Association European Inventors, Poland.