Developing Flood Warning System for Upland Watersheds of the Chao Phraya Basin.

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Abstract

A study on the development of flood warning system is a part of project entitled "*Utilization of GAME-T Data Bases and Developed Models for Management Integration of the Chao Phraya Basin"*. The main objective is to developed the real time flood warning system using equipments and remote transmitting system developed in the country. The selected study area is Mae Wang watershed – a sub-basin of Ping river basin, Chaing Mai province where flood frequently occurred. The 4-client stations (5-chanels data logger with 2-automatic raingage, 2-TDR and 1- air temperature) were installed at Khun Wang, Tung Hlong, Sop Win and Pun Ton station. The equipment for water level measurement (2-chanels) was also installed at Sop Win and Pun Ton stations. The signal in Digital Radio Packages(DRP) from 4 - client stations was designed to transmit to the main server station at the Upper North Hydrological and Water Administration Center(UNHWAC), Chaing Mai at a given time interval as that operated by SCADA (Supervisory Control And Data Acquisition) system.

In this study, the system was set to transmit (DRP) data from all client stations to server station every 10 minutes. The developed computer software then translated the DRP- code and sending the data for downstream flood stage analysis (downstream of Punton station). In case of water level and soil moisture in watershed indicate at critical condition, the system is set to transmit data at every 1 minute. Preliminary result shows incomplete DRP signal to the main server but rather clear at Kog-Ma Research station, Doi Pui (temporary) server. The repeater is now in the process of installation to transmit the DRP from Kog-Ma to UNHWAC. The complete systems are hoped to be installed both at the main server station (UNHWAC) and at the target villages so that it can be operated by local organization.

Keyword : Flood Warning System, Upland Watershed , Chao Phraya Basin.

1. INTRODUCTION

In last 10 years, more than 200 peoples of Thailand were killed with the landslide events, because the upland watersheds with slope steeper than 35 percent were converted to agriculture.

Fig.1 The flood and landslide event at Mae Rak sub-watershed, Ping river basin. (September,16.2002)

Flood in Thailand not only major flood but also flash flood has damaged both the life and properties since history of Thailand. The measures to reduce such flood damages can be by engineering structure and also non-structure. One of the non-engineering structure is flood warning system that can immediately inform the people living downstream to take precaution before the flood reaching to villages. By this system the people suppose to make decision when the flood discharge would arrive and how much the time they have to evacuate to the safety locations. With the new technology of electric innovation and modern communication as well as GIS techniques, the decision support system for flood warning becomes more common and higher reliable forecasting.

The flood warning system developed in this study is aimed to install in upland watersheds where flash flood frequently occurred and to facilitate downstream communities people to be able to operate so that it can be used as a tools for making decision whether they suppose to evacuate or in what situation they should do in case of having heavy rainfall on the upstream.

The main target of the research is to design and verify the automatic data transmitting (ADT) system. The digital signal from clients station to the server was analyzed, and the process of real-time reporting situation by the network system was monitored and adjusted.

2. METHODOLOGY

To meet the main aim, the following procedures have been applied.

1) select the study area where flood frequently occurred,
2) designs the system prototype for data transmitting and computer modelling in flood calculating (Fig.3). The system develops could be sent and received the data from upper stations in every 10 minute,
3) develop the early warning network between server station and users at local area.
4) develop decision support system for flood warming with people participatory (next phase).

3. STUDY AREA

Mae Wang watershed at located at the upper ping watershed of Chao Phraya river Basin, Chaing Mai province (Fig.2.) has been selected to install and testing the system.

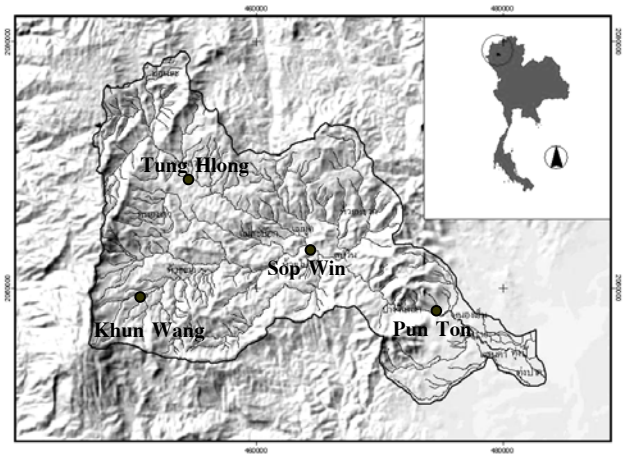


Fig.2: Study area: Mae Wang sub watershed at Chaing Mai.

4. RESULT AND CONCLUSION

4.1 The prototype of flood warning system

Flood warning system designed and developed based on the concept of SCADA system (Supervisory Control And Data Acquisition) (Daneels A. and W.Salter,1999) was installed at Mae Wang watershed as shown in Fig.2. The 4-client stations (5-chanels data logger with 2-automatic raingage, 2-TDR and 1-air temperature) were installed at Khun Wang, Tung Hlong, Sop Win and Pun Ton station. The equipment for water level measurement (2-chanels) was also installed at Sop Win and Pun Ton stations(Fig.3).

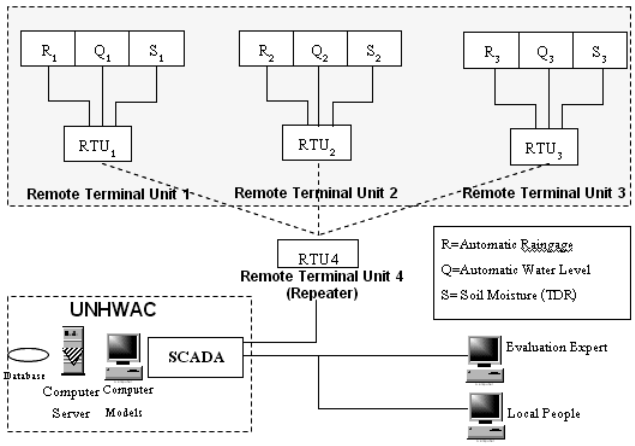


Fig.3: The conceptual model in data transmit from client stations to server station.

The signal in Digital Radio Packages (DRP) from 4 - client stations was designed to transmit to the main server station at the Upper North Hydrological and Water Administration Center (UNHWAC), Chaing Mai. The DRP developed in this investigation is shown in Fig.4

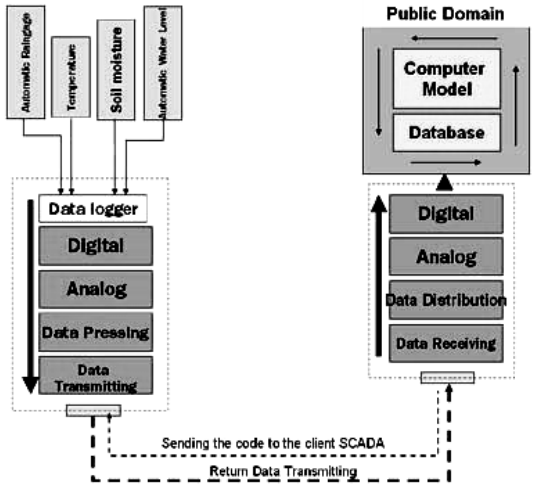


Fig.4: The system of data transmitting will be designed for the DSS

In the study, the system was set to transmit (DRP) data from all client stations to server station every 10 minutes. The developed computer software then translated the DRP- code and sending the data for downstream flood stage analysis (downstream of Punton station). In case of water level and soil moisture in watershed indicate at critical condition,

the system is set to transmit data at every 1 minute.

Preliminary result shows incomplete DRP signal to the main server but rather clear at Kog-Ma Research station , Doi Pui (temporary) server. The repeater is now in the process of installation to transmit the DRP from Kog-Ma to UNHWAC (Fig.5). The complete systems will be installed both at the main server station (UNHWAC) and at the target villages so that local person can operate it.

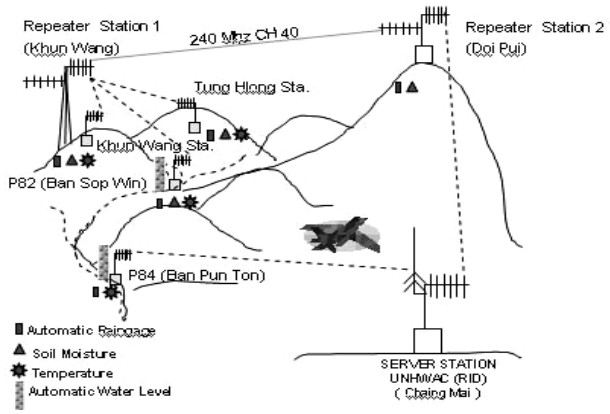
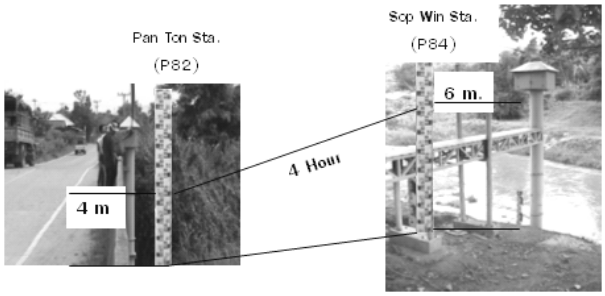


Fig.5: Data transmitting from 4-clients station to server station with repeater station, that install in Mae Wang watershed, Chaing Mai.

4.2 Flood Warning Decision Support System

The decision support system for flood warning in the selected area was designed based on the relationship and routing time of water level between Pan Ton station (up) and Sop win (down) using the on-going streamflow measurements at these stations. At present, the UNHWAC investigated that the routing time when water level at Sop Win is at 6.0 meter, it will cause flood at downstream Pun Ton at 4.0 meter (submerge the agriculture area and village) within 4 hrs (Fig.6).



(a) Pun Ton station (b) Sop Win station

Fig.6: Flood warning instrument for DSS (a) Pun Ton station is lower station, (b) Sop Win station is upper station.

4.3 User Interface

In order to ease the users to interface with the system, the-user-interface was designed to present the data and flood situation as shown Fig.7. The traffic light concept (Green→Yellow →Red) has been applied to inform water level (flood) situation.

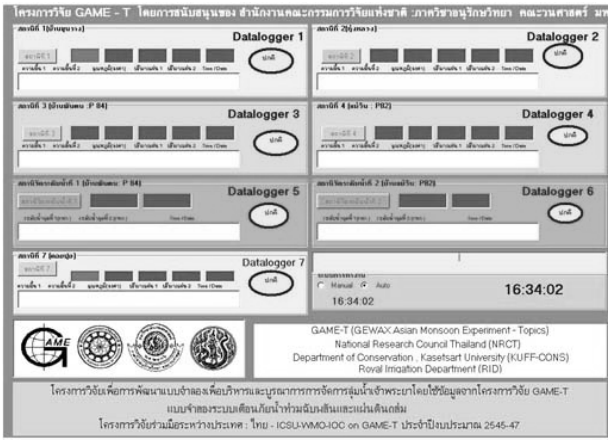


Fig.7: The computer models display at server station.

5. FUTURE STUDY

In phrase II (2004-2006), The project is designed to make Community-Based Decision Support System for (CBDSS) flood warning. The CBDSS will be implemented to other watersheds in the Chao Phraya basin.

The CBDSS is a computer network models, which analyze automatically the all information for flood event. The stakeholder (the chief of village, water manager, policy maker, water resources engineer, computer programmer, the expert system) will be accessed the data display by the network. This concept is shown Fig.8.

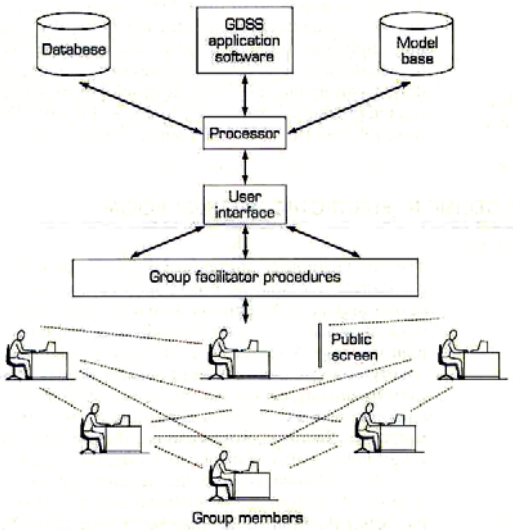


Fig.8: The relationship between DSS and participant for flood warning. (Source : J.L. Bennett,1987)

6. REFERENCE

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