FLOOD MONITORING SYSTEM

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Hanya ALLAH Yang Maha Mengetahui
segala hikmah disebalik
setiap perkara yang berlaku
dan yang akan terjadi

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ABSTRACT

Flood monitoring system has been use not only to monitor the flood parameter current situation but also to alert the flood warning impact and to predict the flood. In this project a model of flood monitoring system has been construct to represent the understanding of the basic concept of sub-systems that involve in real-time monitoring system. The monitoring system divides into three basic sub system, taking real-time data system, forecasting and processing the data system and warning system. This project use visual basic as the interface of the data forecast and data process. In order to put up the model, the author familiarized with the flood disaster itself, study the development of previous system and study the current flood monitoring system that use in Malaysia.

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Chapter 1

Introduction

In Malaysia, major floods usually occurred during the northeast monsoon due to continuous heavy rainfall. The largest floods on record occurred in 1926 and were followed by recurrence of severe floods as in 1931, 1947, 1954, 1957, 1967, 1971 and 1992 *(Flood commission committee)*. Following the great 1926 floods, a radio warning system was set up and this became the nucleus of Malaysia's radio network *(Telekom website)*.

It was believed that flood warning services were first provided for the flood events of 1926 when floods occurred along the Sg. Kinta in Perak and Sg. Kelang, Sg. Selangor and Sg. Bernam in Selangor. It is also known that the flood warning system based on river alert levels of the Sg. Kelantan at Bradley Steps, Kuala Krai (now known as Tangga Krai) to warn the people of Kota Bharu downstream, has been in use since pre-war years *(Ir. Hj. Keizrul)*.

It is interesting to note the role of the police in reading and transmitting the rainfall and water level information via VHF sets to the Flood Warning and Relief Committee in Kota Bharu. Stage correlation methods were generally used for forecasting

floods in major rivers such as Sg. Muar, Sg.Perak, Sg. Pahang and Sg. Kelantan *(Ir. Hj. Keizrul)*.

Flood disaster becomes the most significant natural disaster in Malaysia in terms of its area extent, population affected and economic damaged. Since the major flood incidence in 1971, flood mitigation function has been designated to the Department of Irrigation and Drainage (DID), *(Hydrology and Water Resources Division website)* which is also known as 'Jabatan Pengairan Dan Saliran' (JPS).

After the floods of 1971, the flood warning systems of major rivers subjected to severe flooding were reviewed. The major deficiencies identified were inadequacy of rainfall and water level station networks to provide timely and reliable real-time data *(Ir. Hj. Keizrul)*

Based on this review and its recommendations, telemetric stations, both rainfall and water level, were established at strategic locations to enable the transmission of real-time data to flood operation centers. The review also highlighted the need for more accurate flood forecasting techniques to replace the empirical river stage correlation technique, and recommended the use of mathematical models, which would take into account, among others, the rainfall and watershed characteristics as well as river configurations *(Ir. Hj. Keizrul)*.

As an important component of the non-structural flood mitigation measures, the Hydrology Division of DID in 1973 established the pioneer telemetric network in this country for the purpose of flood forecasting and warning. A total of 25 telemetric stations at remote sites of Sg. Perak, Sg. Pahang, Sg. Terengganu dan Sg. Kelantan were then built to transmit automatically the real-time rainfall and water level data to the state DID

office. Flood forecasts were prepared and disseminated to trigger off flood relief operation. *(Hydrology and Water Resources Division website)*

1.1 Aim Of Project

The aim of this project is to study flood-monitoring system and to construct the model of flood monitoring system.

Objective:

1. Study the development of flood monitoring system in Malaysia by focusing on the flood parameter and technology used.

2. Develop a flood monitoring system model that represent the understanding of the real system, which more compatible for flood prone area that far from the river.

1.2 Importance Of Study

The importance of studying the flood monitoring system and developing the system model, are base on points below:

1. Current water level stations have been built only near the river and hydro dam.

2. A lot of flood events that occurred previous years were located far from the river and those area does not have any flood monitoring system

3. Flood mitigation program need more occasion period to conclude the solution that should be taken and to complete the project.

Flood water-level stations only near the river and hydro dam.

Currently water level is only measure at the certain river and dam, and so far no measurement been done at the flood prone area that located far from the river.
As we refer to Table 1.1 below, in state of Johor for example all the water level station is located at river and dam.

Station id	Station Name	River Basin	Last Update	River Level	Normal level	Alert Level	Danger Level
2626480	Sg.Muar di Kg Awat	Sg.Muar	01/03/2004-15:00	14.49	17.60	18.00	18.60
2527490	Sg.Muar di Buloh Kasap	Sg.Muar	01/03/2004-17:00	4.55	7.92	8.53	9.14
2529480	Sg.Juasseh di Kemalah	Sg.Muar	01/03/2004-17:00	21.50	27.00	30.00	32.00
2528480	Sg.Segamat di Segamat	Sg.Muar	01/03/2004-17:00	4.73	7.32	7.92	8.53
2328480	Sg.Muar di Bukit Kepong	Sg.Muar	01/03/2004-17:00	-0.40	1.83	2.43	2.74
2130490	Sg Lenik di Kangkar Chaah	Sg.Batu Pahat	01/03/2004-17:00	0.11	10.00	13.10	14.00
1929480	Sg.Simpang Kiri di Sri	Sg.Batu Pahat	01/03/2004-17:01	0.65	1.00	2.00	2.60

	Medan						
2030481	Sg.Bekok di Bekok Dam	Sg.Batu Pahat	01/03/2004-17:01	14.61	10.00	15.00	17.50
2130491	Sg Bekok di Bt 77 Jln Y.P	Sg.Batu Pahat	01/03/2004-17:01	4.32	5.94	6.55	7.16
2030480	Sg Bekok di Yong Peng	Sg.Batu Pahat	01/03/2004-17:01	-0.12	1.83	2.13	2.74
1931480	Kolam Air di Sembrong Dam	Sg.Batu Pahat	01/03/2004-17:02	8.34	8.00	9.00	12.00
1931490	Sg Sembrong di Batu 2	Sg.Batu Pahat	01/03/2004-17:02	1.61	2.74	3.20	3.66
1831480	Sg Sembrong di Parit Karjo	Sg.Batu Pahat	01/03/2004-17:02	0.39	1.68	1.98	2.59
1832480	Kolam Air di Machap Dam	Sg.Benut	01/03/2004-17:05	15.23	15.00	16.50	18.00
1833480	Sg.Benut di Simpang Rengam	Sg.Benut	01/03/2004-17:05	4.85	5.00	6.00	6.40
1737490	Sg.Johor di Rantau Panjang	Sg.Johor	27/02/2004-19:03	11.42	4.00	7.00	9.00
1636480	Sg.Skudai di Kg Separa	Sg.Johor	01/03/2004-17:06	16.35	17.10	17.70	18.92
1738480	Sg.Johor di Kota Tinggi	Sg.Johor	01/03/2004-16:04	-0.00	1.00	1.50	2.70

Table 1.1 Johor On-line river data.

The numbers of flood event occur at area far from the river has increased and that *flood plain areas do not have any automatic flood monitoring system.*

Most flash flood event happened because of the over flow of the river. But some of the cases of flash flood occur because of the drains in that particular flood prone area is stuck.

At present there are 134 numbers of manual flood warning stations had been set up all over the country. Yet, this manual flood warning stations need to be improved into an automatic one, plus the number of flood prone area increase day by day. As much as 9% of the land areas in Malaysia, amounting 29,000 sq. km are flood prone. *(Flood commission committee)*

Due to rapid development as well as changes of catchments conditions, some of the existing drainage system cannot cope up with excessive surface flow discharge. As a result, flash flood occurs whenever there is a downpour. *(Flood commission committee)*

On 28 January 2004, the celebration of Chinese New Year festival for resident in Taman Lapangan Ria Ipoh, was destroyed because of flood event. This flood event happened, cause by the development of major housing project nearby, since drainages in that area were not able to accommodate the high capacity of rain pour and cause a flash flood as during heavy rain. *(Sin Chew Jit Poh Newspaper)*

There was industrial and house development at low level area or known as flood plain. One of example is Taman Sri Muda at Shah Alam. This area is really low and suppose been clarified as flood plain area. *(Drainage and Flood Mitigation Division)*

Flood mitigation program need more occasion period to conclude the solution that *should be taken and to complete the project.*

There was one flood mitigation project in Klang that causes the JPS takes nearly 10 years to complete it just because of the social issues. That long delay happens for the reason that some of the landowner doesn't what to sell his land for the project construction.

The Smart Project involves the diversion of flood runoff from the catchment area (near the confluence of the Klang river and the Ampang river) through a bypass tunnel before it is being directed back to the Klang River downstream. This Smart tunnel only can be completed by year 2006. (*Drainage and Flood Mitigation Division)*

1.3 Background Of Study

Basically, the main element in automatic flood monitoring system can be separate into 2 parts which is:

- The flood forecast
- The flood alert

Figure 1.0 shows that elements for both parts in flood monitoring which were connected by a controller. This controller has a function as a brain to the system. Without this brain the flood monitoring system have to be function manually.

The controller devices will receive signal given by the sensor. Base on programming that already set internally, the controller will predict the flood. This programming was based on calculation that more to civil engineering. When the flood

prediction declare that the flood is going to occur, controller will send a signal to alert devices to decimate the warning.

Beside of predicting flood, the controller will be utilized to collect the data. This data is important for further research in predicting flood.

The communication system utility is connecting the controller to each sensor and alert devices. Acting like hands to the brain, this element is very important to carry the right information.

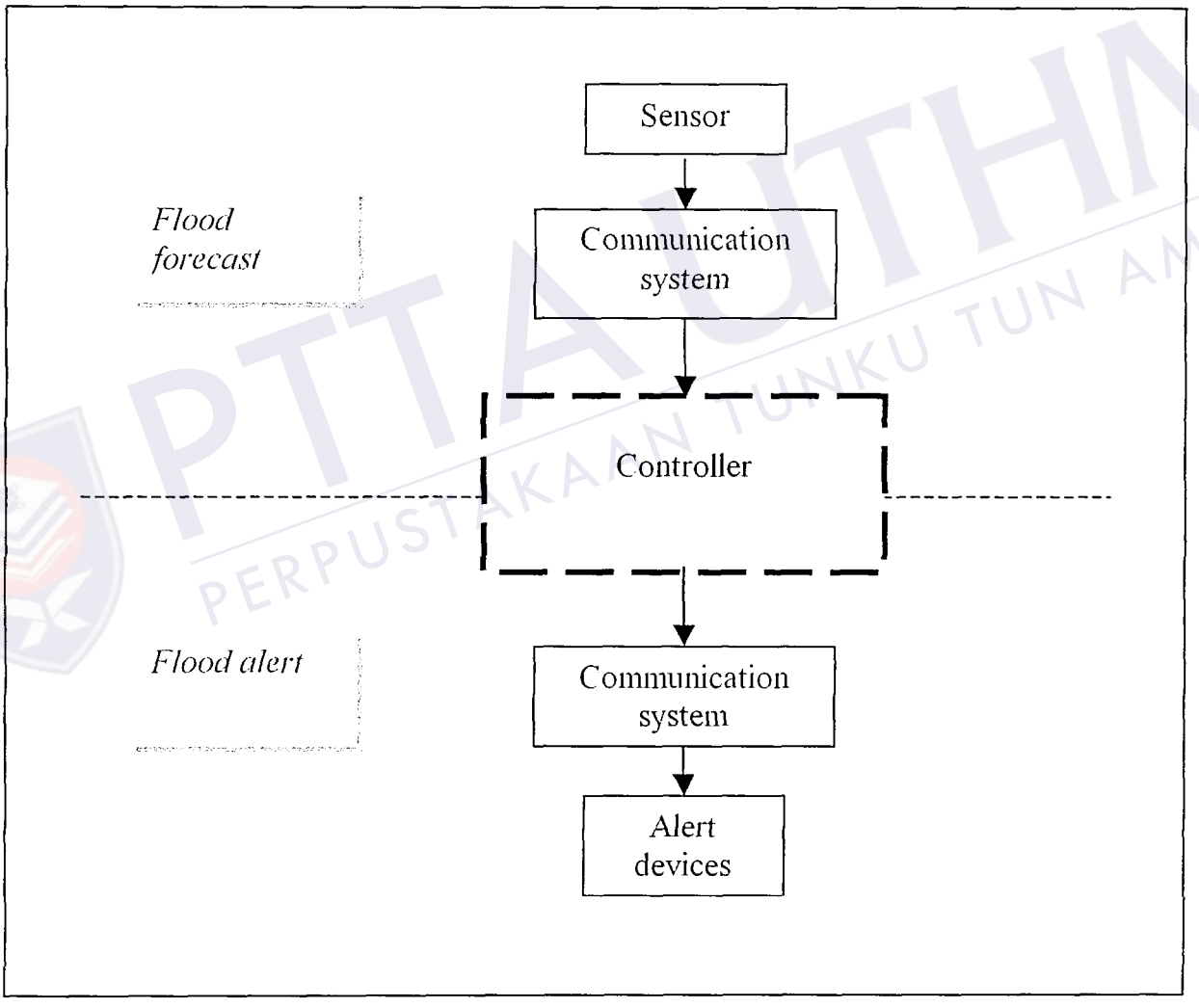

Figure 1.0 Basic flood monitoring system diagram

Chapter 2

Literature Review & Theoretical Background

2.0 Introduction

The understanding of flood monitoring system should begin from the familiarization of the flood disaster itself. The parameter of flood must be identified in order to know what kind of equipment that can be used to measure it. Some issues according to the flood phenomena also must be recognized too.

There are two flood monitoring system that being study in this project that been used in Malaysia. First is the flood forecast and warning system handle by Department of Irrigation and Drainage (DID). The system basically covers all over the country and become the main system in monitoring the flood activity. Other system which is cover only Kuala Lumpur city handle by Dewan Bandaraya Kuala Lumpur (DBKL) will represent one minor system that so far playing main role using latest technology in monitoring the flood.

To get idea in improving the current system, the literature review also cover some other alert and monitor system, which can be implement to the current system. Some

component that being used or might be use in flood monitoring system is been studied. The components cover four main particular aspects, which are sensors, control devices, communication devices and alert devices.

2.1 Issues and Flood Parameters.

2.1.1 Definition of flood

Floods continue to be not only a 'problem' but in some respects an increasing problem, catching individuals and communities by surprise in a repetitively exasperating way, and causing disruption, damage and death. *(Keith Smith)*

Definition of flood:
Chow (1956), "A flood is a relatively high flow which overtaxes the natural channel provided for the runoff." Rostvedt (1968), "A flood is any high stream flow which overtops natural or artificial banks of a stream." Ward (1978), " A flood is a body of water which rises to overflow land which is not normally submerged." *(Keith Smith)*

The main elements of river and coastal flooding as well as flooding in shallows depressions which is caused by water-table rise, rainwater flooding on level surfaces and sheet wash flooding on low-gradient slopes, both resulting solely from torrential rainfall, and flooding caused by the backing-up or overflow of artificial drainage systems, especially in urban area. *(Keith Smith)*

In some major urban areas, especially those having complex underground transport network services, the threatened subsurface flooding of these facilities as a result of rising groundwater levels now constitutes a major problem. *(Keith Smith)*

2.1.2 Parameters that causes floods

Flood disaster can cause of one of the factors or parameters as shown in the Figure 2.1 and sometimes it happened by combination of several factors.

Flooding characterizes the following main parameter *(Vladimir)*:

- The critical level of water in the river, since which flooding of floodplain begins
- Boundaries and maps of flooded territories
- Economic objects and habitation structures subject to damage on flooded territories.

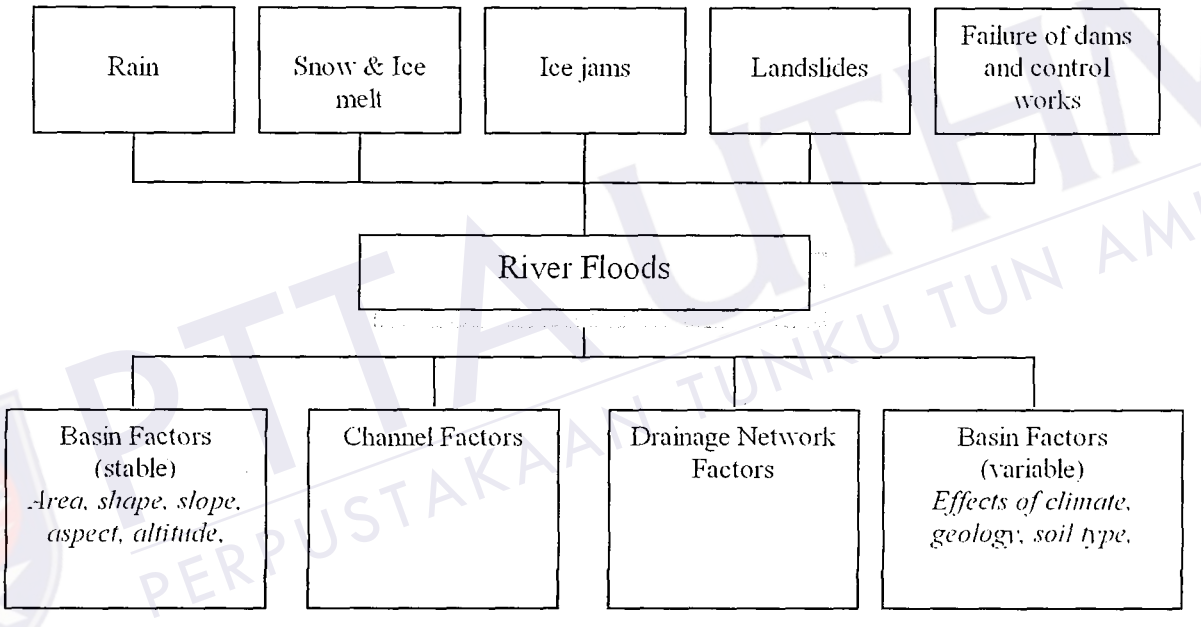

Figure2.1 Causes of flood

There are two main factors that cause flood. First, it is natural causes. Malaysia rain capacity is quite high, within 2,500mm per year for peninsular and 3,500mm per year for Sabah dan Sarawak. Although the average of rain capacity is 200mm per month but what is really happen is the 200mm raining can pour down within one day or a few hours. This kind of situation might cause regular flash flood in city area. For those certain

area that near to the sea, the increasing of sea water level might cause flood. When the raining water cannot flow to the sea, as the sea water level is increase highly. *(Drainage)*

Besides nature causes, human action also become one reason of flood which is seriously making the flood situation much more worse. The high speed of country development, cause a lot of construction of house, industrial area and road infrastructures all over the country. Those constructions affect the water absorption capability of the land surface. When the current drainage system cannot cope to the rain capacity, the water will over flow the border and cause flood. *(Drainage)*

2.1.3 Nature of flood warning

The practical aim of flood forecasting is to reduce the loss of life and the economic damage caused by floods. However, this aim can only be achieved if an accurate forecast is translated into a reliable warning message, which is then disseminated to the people at risk who, in turn, take effective loss-reducing actions before the arrival of the flood. *(Keith Smith)*

It is important to distinguish between a flood forecast, which is a scientific evaluation of an event in real time leading to the issue of a general alert about hazardous conditions, and a flood warning which contains additional information, including recommendations or order for action, such as evacuation or emergency flood proofing, specifically designed to safeguard life or property. *(Keith Smith)*

A good flood warning will not only provide advance information on the likely magnitude, location and timing of a flood event but it will also specify the nature of the loss-reducing actions to be taken and will be tailored, in terms of its content and delivery, to achieve an optimal behavioral response from a targeted group of recipients. *(Keith Smith)*

(Keith Smith) Flood warning can be viewed as the end part of an integrated sequential system, which starts with a river, tidal, or storm-surge forecast. In detail, the

design of flood warning system can be complicated, and alternative views exist with respect to theoretical structures, as shown in figure 2.2

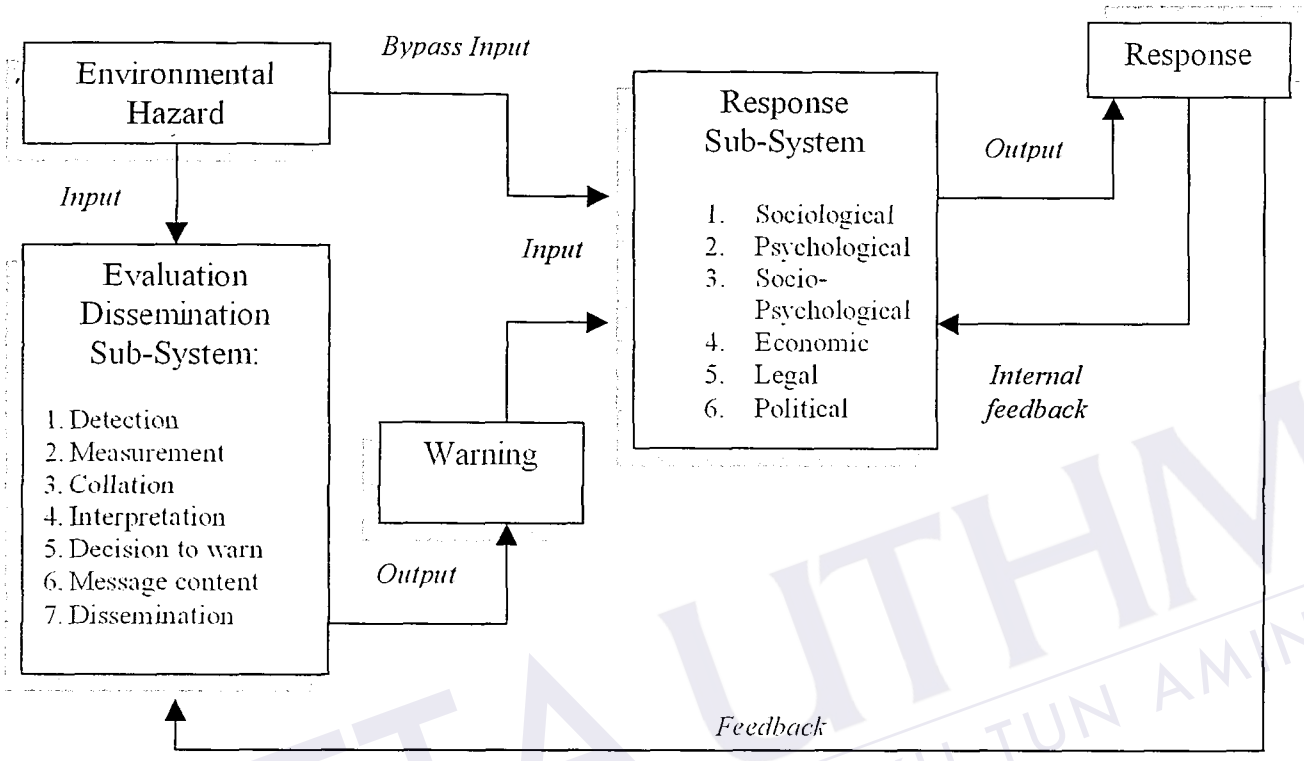

Figure 2.2 Alternative conceptualization of the design of an integrated flood warning system.

2.2 Flood Monitoring System in Malaysia.

In Malaysia one of the major activities in the field of applied hydrology being carried out by *DID* is the provision of flood forecasting and warning services. As flood is a significant natural hazard in Malaysia, non-structural measures such as providing early flood forecasting and warning services will contribute towards reducing loss of lives and properties and disruption to socioeconomic development *(Ir. Hj. Keizrul).*

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