BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA OFFICE OF THE MEMBER SECRETARY OF THE COMMITTEE FOR ADVANCE STUDIES AND RESEARCH, BUET, DHAKA

Application for the Approval of M.Sc. (Water Resources Development) Thesis Proposal

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6. Date of the First Enrolment in the Programme: 18th November, 2007

7. Tentative Title: FLASH FLOOD FORECASTING IN THE HAOR BASIN USING THE ARIFCIAL NEURAL NETWORK

8. Background and present state of the problem

Flash flood is one of the most growing concerns for its long run devastation. A flash flood is a flood that rises and falls quite rapidly with little or no advance warning, usually the result of intense rainfall over a relatively small area (AMS, 2000). Flash flood occurs almost every year during the March-May in the northeast part of Bangladesh. The low lying area of the northeastern part of Bangladesh especially Sunamganj, Sylhet and Netrokona districts is known as haor basin covering about 6000 sq. kilometer (NERP, 1995). Severity of flash flood depends on time and quantity of rainfall in the hill and drain out capacity of main rivers. When heavy rainfall occurs in the hilly regions of India, water quickly moves towards the haor basin areas of Bangladesh through a number of rivers and canals. In the haor area, boro paddy has grown extensively (about 98 %) as a result the boro crop largely damaged when the flash flood occurs earlier. More than 70% of the total crop was damaged by the 2000 flash flood (Sumon, 2008). The flash flood also causes destruction of the personal and public common properties. The most noteworthy damage is the loss of soil fertility due to sand deposition on the cultivable land. Moreover, the sand and silt cause filling up of the river beds and consequently causing problem to navigation in the dry season. If a proper forecasting system can develop the damage of flash flood can be minimized.

In the past, flash flood forecasting models have been developed by Garrote et al. (1995a, b), Nalbantis (1995), Ambrus et al. (1990) and Sumon (2008). Most of the models are of the distributed type, where forecasts are made at several locations within catchments. Conventional models are not ideal for real-time forecasting because they required large amount of detailed information (e.g., topographical map, river networks and characteristics, soil characteristics, rainfall, and runoff data) and the associated long computation time. A relatively new approach, Artificial Neural Network (ANN), an empirical modeling technique based on the direct analysis of measured data, appear to be a good alternative to models based on phenomenological hypotheses (Hsu et al., 1995). ANN has been successfully applied for forecasting of monsoon floods in Bangladesh (Liong, 2000; Islam, 2008). Multi-Layer Perceptron and Radial-Basis

Function Neural Networks, along with the Nearest Neighbour approach and linear regression are utilized for flash-flood forecasting in the mountainous Nysa Klodzka river catchments. It turned out that the Radial-Basis Function Neural Network is the best model for 3- and 6-h lead time prediction and the only reliable one for 9-h lead time forecasting for the largest flood used as a test case (Piotrowski, 2006).In this study, ANN will be applied to forecast flash floods in the haor basin area of Bangladesh. Because of the availability of Indian rainfall data, Tahirpur Upazila of Sunamganj district has been selected as a case study of this research.

9. Objectives with specific aims and possible outcome

The specific objectives of the study are:

1. To analyze rainfall characteristics in the upstream basins in India.
2. To develop an ANN model for forecasting flash flood water level in the haor basin area.
3. To propose suitable methodology for dissemination of flash flood forecast information.

This study is an attempt to establish a forecasting system which will provide information and warnings so that actions can be taken to protect lives and properties and reduce people's suffering and economic losses caused by the event.

10. Outline of the methodology/Experimental Design

This study will be carried out based on secondary data and field visits. Water level data of Laurergarh station of the Jadukhata rive in the Sunaganj district will be collected from Bangladesh Water Development Board (BWDB). Available rainfall data of the Cherrapunji station of India will be collected (Summon, 2008). Flash flood timing of the haor areas will be conducted during the field visit. Primary questioner survey will conduct to assess the people's opinion about the improvement of the flash flood forecasting.

Rainfall in the upstream catchments will be analyzed. Flood flow and water level prediction will be done by the artificial neural network, ANN model (Hu et al., 2005). Several comparisons of the prediction accuracy between rainfall-runoff neural network (RRNN) models and conventional hydrological models confirmed that the ANN-based approach is an effective alternative to conventional techniques for modeling the RR process (ASCE, 2000a, 2000b).Among various neural network techniques, feed forward techniques is closely related to statistical models that are a data driven approach and more suited for forecasted applications. Therefore feed forward neural network system will use to forecast water level in Laurergarh station of the Jadukhata river in the study area. The feed forward network will be trained using the back propagation method which is known as an optimization technique for feed forward. Training is a process of adjusting the connection weights in the network so the network's response best matches in the desired response. After the training, model will be validated with the using the measured discharge data. Finally, various statistical indicators will be applied to measure the goodness of fit of the model.

Dissemination of flood information to the local people is essential. This study will review the present flood warning dissemination system. Questionnaire survey will be conducted in the study area to collect opinion about the present flood forecasting and warning system in daily time step. Lead time of the forecasting will be 1-5 days. This study will develop methodology by the ANN model to forecast warning of flash flood to the local people.

11. References

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