Developing water quality protection strategies and novel approaches to monitoring hydrological systems.

Ahmad Abdelal*

Department of Civil and Environmental Engineering, German Jordanian University, Jordan

Abstract

The most crucial phase of a multi-barrier strategy to providing clean drinking water at a reasonable cost is Source Water Protection (SWP). However, due to administrative and technical difficulties, adopting SWP techniques can be a difficult undertaking. The use of decision support tools can be very beneficial and result in time and resource savings when implementing SWP tactics. In addition to discussing alternative formulations for water quality assessment at the source, this paper critically evaluates various SWP techniques for surface waters that are currently in use. Regulations governing source water quality in Canada and other nations are also covered. These rules usually refer to stormwater management ponds, vegetated filter strips, pollution control through efficient farming practises, and fencing. A platform for hydrological monitoring called HydroMon3 can interface with several types of sensors. Utilizing the current surge in commercially accessible IoT-related electronics modules is what inspired the modular design. More than 20 locations in two separate watersheds were equipped with HydroMon3-based stream stage and tipping bucket monitoring devices.

Keywords: Water protection, Hydrological monitoring, ZigBee, Sensor.

Introduction

The frequency of floods in river basins has gradually increased water pollution in recent years, making flood control and water pollution management the network's main tasks. Real-time hydrological monitoring has grown in importance as a way to better understand the hydrology of the river, flood forecasting, the development of effective flood preparedness, and water pollution. A distributed real-time remote hydrological monitoring system based on the internet of things was created to overcome the limitations of human monitoring. Embedded and touch screen technology, fully digital administration of the dam water network, advanced GSM wireless communications, real-time monitoring and alarming, historical data, local and distant queries, hydrological trend predictions and analysis, and other features are all part of the system. The information acquired during lab and field testing was examined and used to confirm the device's low energy requirements. If this initiative is a success, it will be possible to cover important areas extensively for spatial and temporal data resolution. The Artificial Neural Network (ANN) model is developed using an MLP mesostructure with sigmoid and linear activation functions trained by the LM technique. Many samples of recorded meteorological and hydrological parameter data were used to train, validate, and assess the generated model. Based on the mean absolute error (MAE) for the target data set, error clustering evaluation was divided into percentage classes in accordance with the mean data value. This demonstrated a significant clustering of the errors in the highest water level predictions, which are 25% to 100% higher than the average water level [1-4].

It is possible to characterise watersheds and the effects of development, such as mining, on the project site and the environment by establishing a Hydrologic Information Systems (HIS) network to monitor water quantity and quality. The information can be utilised for regulatory compliance, risk management, infrastructure design, gaining ISO 14001 certification, evaluating effects on aquatic ecosystems downstream, and figuring out how well mining processes work. The data can also be used to examine whether mining operations have an impact on local residents' access to clean water and food. In order to monitor the physical condition of watersheds and the effects of mining systems on water resources, effective HIS monitoring and reporting give transparent and valuable data and information.

When it comes to understanding water security and water-energy-food (WEF) security in the context of mining, this thorough examination can offer both short- and long-term information that is pertinent. ZigBee technology is used in the hydrological monitoring system, which has many practical applications. ZigBee technology can be swiftly applied to different regions, and wireless modules are easily portable to other wireless applications. The ZigBee technology development kit has recently been updated, and its

***Correspondence to:** Ahmad Abdelal, Department of Civil and Environmental Engineering, German Jordanian University, Jordan, E-mail: ahmad.abdelal@gju.edu.do

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functionality is also constantly being improved, giving more and more people a wider range of options. Wireless sensor network sector has been observing general trends. As a result, the system's application potential is vast [5,6].

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