Chapter 34
IoT Setup for Co-measurement of Water Level and Temperature

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ABSTRACT

Recent time has witnessed severe scarcity of water owing to deficient rainfall in India. The current climatic conditions in the country, project the rise in temperature and arid conditions contributing substantially towards the evaporation losses. In order to deal with the looming crisis, it is peremptory to minimize evaporation losses in the water bodies, at least measure them to get a fair idea and initiate corrective measures. This paper aims to develop a system for continuous monitoring of the water level as an indicator to the evaporation process. The system also indicates temperature of the water which influences the evaporation rate.

1. INTRODUCTION

In recent times, our country is facing acute shortage of water owing to the deficient annual rainfall. In order to deal with the crisis, it is vital to efficiently conserve the existing resources. The process of evaporation being a major contributor to water loss, poses a severe threat to the water bodies, adding further to the scarcity of water. Hence to combat the grave situation, there is an urgent requirement to monitor the evaporation process.

Several standard practical techniques and approaches to measure evaporation have been reported earlier in the US Geological survey evaporation study reports (Earl, 1962; Hughes, 1967). Over a period of time, numerous methods have been practiced and implemented in order to estimate surface water evaporation. Some of the major methods identified in the reports by World Meteorological Organization's Hydrology

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Commission (Finch & Calver, 2008) and Bureau of Indian Standards Reservoirs Sectional Committee (Bureau of Indian Standards, 2002) include pan evaporation, analytical methods such as mass transfer method, energy budget method, details of which are subsequently discussed in section 2.

The direct measurement of evaporation from water surface using Class A PAN evaporimeters were conducted (Fekih & Saighi, 2012) and a suitable mathematical model was developed to estimate the rate of evaporation using energy budget equation.

Estimation of the rate of evaporation is becoming increasingly necessary for the preservation of water resources. The necessity and demand of such assessment will grow in the near future. The various conventional methods adopted for measuring the evaporation rate lack precision, accuracy and are very much prone to errors. Hence, there is a necessity of understanding in depth the factors and parameters affecting the evaporation rates and thereby developing a more precise monitoring system to address the issue. Such precise measurement can also aid in the decision making under certain critical situation.

In this project, we have adopted the indirect evaporation measurement method and have developed the sensor to monitor the water level which quantifies the evaporation rate. The system also monitors the temperature of the water.

This paper proposes an IoT set up to display the monitored data in real time on internet, fulfilling the notion of analyzing and there by devising measures to prevent the enormous evaporation losses in view of the scarcity of water the country is facing.

2. BASIC CONCEPTS

Evaporation refers to a surface phenomenon that causes the vaporization of liquid into gaseous state from the liquid surface. The evaporation rate quantifies the loss of water due to evaporation from a unit surface area of water body in unit time. The evaporation rate is majorly influenced by the water temperature, humidity of the air, amount of water available, area of the water surface, atmospheric temperature.

2.1. Factors Influencing the Rate of Evaporation

Following factors are responsible for the change in the evaporation rate:

2.1.1. Temperature of the Water Body

Water molecules are in continuous motion and a minimum amount of energy is required when a molecule need to escape from the water surface. When the temperature of a water body increases, the energy of the molecules also enhances. Higher the temperature, greater is the kinetic energy of the molecules near the water surface and as a result, more number of molecules escape the water surface, thereby increasing the rate of evaporation.

When the faster molecules from the surface escape, the remaining molecules of the water body has a relatively lower kinetic energy causing the reduction in the water temperature known as the evaporative cooling.

Water bodies get heated due to solar radiation, thermal radiation and when water inflow into it from external sources. Sunlight will increase the kinetic energy of the water molecules leading to higher