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Design of Cooling Tower with IoT

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Abstract – *In this project, we will analyse the control system for pH control and also monitor the acid pump's critical parameters. This information will be stored in cloud through Ethernet.*

Key Words: pH; Vibration; Winding Temperature; IoT; Ethernet

1.INTRODUCTION

Industrial production processes needs cooling water for efficient, proper operation. Refineries, Steel mills, Petrochemical plants, Manufacturing facilities, Food plants, Large buildings, Chemical processing plants and electric utilities all rely on the cooling water system to do its job. Cooling water system controls temperatures and pressures by transferring heat from hot process fluids into the cooling water, which carries the heat away.

The cooling water heats up and must be either cooled before it can be used again or replaced with fresh makeup water. The total value of the production process will be sustained only if the cooling system can maintain the proper process temperature and pH. The cooling system design, effectiveness and efficiency depends on the type of process being cooled, the characteristics of the water and environmental considerations.

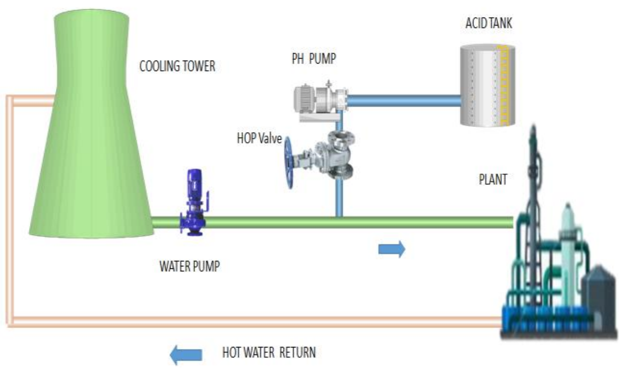


Fig 1 Basic process system

The cooling system operation can directly affect reliability, efficiency, and cost of any industrial, institutional, or power industry process. Monitoring and maintaining control of corrosion, deposition, microbial growth, and system operation is essential to provide the optimum Total Cost of Operation (TCO). The first step to achieve minimum TCO is selecting an appropriate treatment program and operating conditions to minimize system stresses.

2. EXISTING PROBLEM

Presently the cooling water samples are collected at regular intervals and sent to the central quality laboratory for measurement. Based on the result provided by the central laboratory, the dosage pump discharge hand operated valve is operated.

The primary objectives of cooling water treatment are to maintain the operating efficiency of the cooling water system and to protect the equipment that contacts the cooling water. These objectives are accomplished by controlling or minimizing deposition, corrosion, and microbiological growth on the cooling water equipment. The deposits that occur in cooling water systems are usually divided into two categories: scale and fouling. The presence of either type of deposit in the heat exchangers or in the film fill can interfere with heat transfer, thereby reducing the efficiency of operation.

3. DETAILS OF THE WORK

3.1 Our work

This project considers various aspects of cooling tower operating parameters. A critical review of common approaches to stable cooling tower operation within facilities has been undertaken examining the advantages and disadvantages. Various sensors will monitor the outlet water and in case if the parameters goes beyond a certain value, then the corrective action will be taken.

We have designed a control system which measures the real time pH value of the cooling water that leaves the cooling tower.
This signal will be amplified by a high impedance amplifier and standard voltage signal 0-5 V DC proportional to the 0 – 14 pH is transmitted to the micro controller.
The micro controller converts this voltage signal into 8 bit digital value and compared it with the reference value set by the user at the site.
The micro controller, depends on the error signal varied the speed of the pH pump, so that a proportional quantity of base will be pumped into the cooling tower discharge line to neutralize the water.

In addition to this we also designed a dosage pump protection system, which will continually measure the critical parameters of the pump. They are pump temperature and vibration.
If the temperature of the motor increases above 70 degree Celsius, an audible buzzer will be switched on to alert the operator that something went wrong with the pump.
The operator has to correct the fault line increasing the cooling water flow to the dosing pump.
In case if the operator does not correct the problem, the temperature will increase further. If it crosses 80 degree Celsius the pump will be stopped to save from mechanical damage.

Another safety future we have incorporated to this dosage pump is to check whether the pump is running smoothly or not. This check is being carried out by a vibration switch. If the vibration of the pump is more the vibration switch will be activated and the micro controller will stop the dosage pump.

All the measurement and the controlled parameters are displayed on the Programming Laptop. Also critical parameters are transmitted through Ethernet. The operator from any part of the plant can check the present valve through a mobile device connected to internet. If the controller is in IOT mode, the remote operator can vary the acid pump speed to control the pH from his / her smart phone.

3.2 Internet of Things

The “Internet of things” (IoT) is becoming an increasingly growing topic of conversation both in the workplace and outside of it. Broadband Internet is become more widely available, the cost of connecting is decreasing, more devices are being created with Wi-Fi capabilities and sensors built into them, technology costs are going down, and smart phone penetration is sky-rocketing. All of these things are creating a “perfect storm” for the IoT. Hence we use this concept to transmit our cooling tower data to internet so that the owner of the plant and the original equipment manufacturer can monitor the operation of the cooling tower online.

4. PROPOSED DESIGN

In the proposed system we use variable speed drive to control the speed of the water motor pump in accordance with the cooling tower outlet specifications. Electronic sensors are used to monitor the cooling water continually. Feedback actions are taken in order to correct any deviation. In case any abnormality, an alarm is generated and then the plant is tripped.

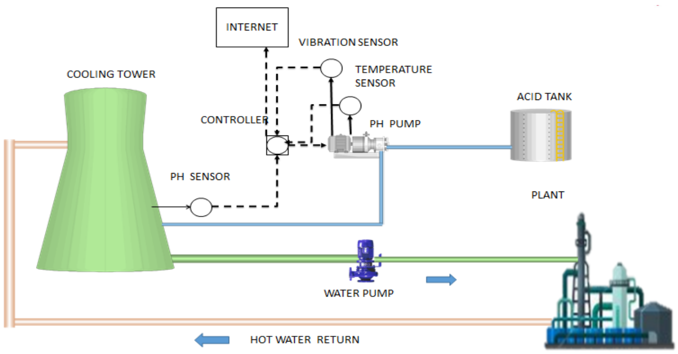


Fig 2: Proposed Scheme

4.1 Hardware Requirement

1. Arduino micro controller
2. Temperature sensors
3. Vibration switch
4. PH sensor
5. Pump Speed Raise push button
6. Pump Speed Lower push button
7. Local / IOT Selector Switch
8. Cooling Water Pump On /Off Selector Switch.
9. Ethernet module
10. High Power Motor Drive
11. Geared Motor with pump
12. Serial to parallel data converter
13. Mobile phone

4.2 Software Requirement

Arduino microcontroller programming Software
Computer USB interface Software
Blynk app

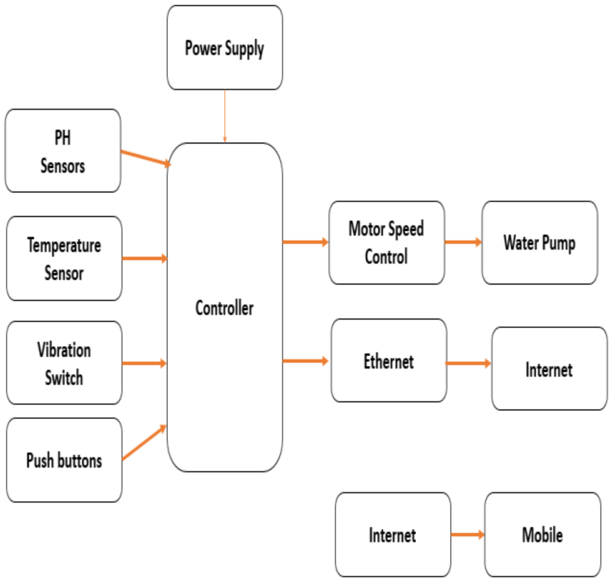


Fig 3 Block Diagram of the Proposed Scheme

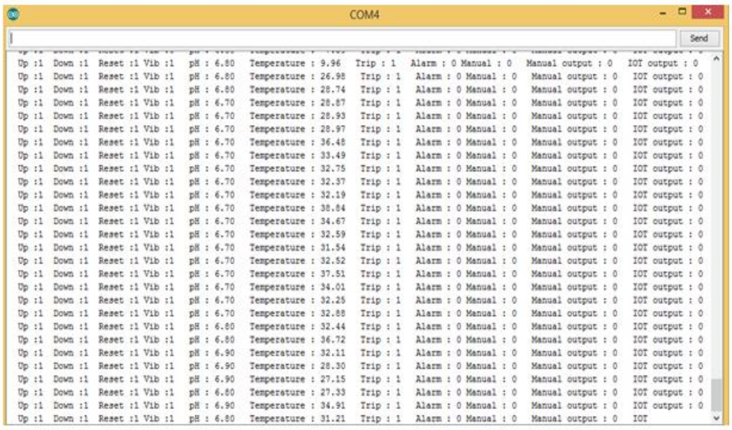
Blynk was designed for the Internet of Things. It can control hardware remotely, it can display sensor data, it can store data, vizualize it and do many other cool things. There are three major components in the platform:

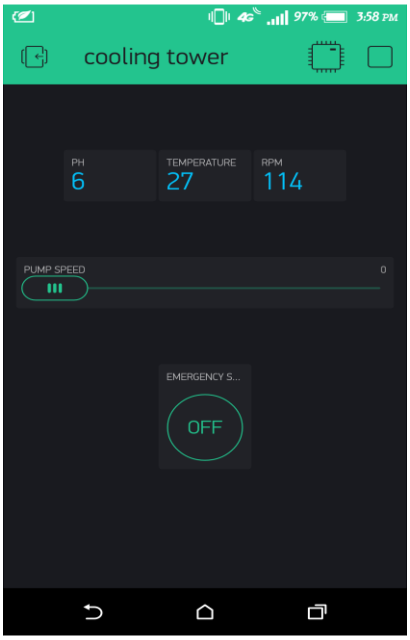
Blynk App - allows to you create amazing interfaces for your projects using various widgets we provide.

Blynk Server - responsible for all the communications between the smartphone and hardware. You can use our Blynk Cloud or run your private Blynk server locally. It's open-source, could easily handle thousands of devices and can even be launched on a Raspberry Pi.

Blynk Libraries - for all the popular hardware platforms - enable communication with the server and process all the incoming and out coming commands.

Every time a Button is pressed in the Blynk app, the message travels to space the Blynk Cloud, where it magically finds its way to your hardware. It works the same in the opposite direction and everything happens in a blynk of an eye.





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