

# Interm Report

## **How to make a humidifier with a web interface control**

### **Abstract**

In the text we will show how can make a humidifier with web interface control. The goal of our project is to keep under full control the humidity level into 80 m<sup>3</sup> server room. We'll go through step by step from choosing type of humidifier, through the controlling, web interface planning until the buildup.

### **Introduction**

This report describes how to build and implement a portable humidifier controlled by web interface. This report also introduces the reader to the type of humidifier chosen that best suits our needs, it describes the temperature sensors, water level sensors in the tank, how and what elements will be connected with the web interface .

This report was divided into 3 parts: introduction, where will be presented the problem, objectives and work plan; state of the art, where general idea of humidifiers will be introduced; and project development, where process of building the humidifier will be presented.

During project our main objective is to build the humidifier with web interface for data center of 80 m<sup>3</sup>. The relative humidity which should be obtaining -with the use of the humidifier- is between 40 % and 70 % (+- 5). It should be autonomous for two days and it should posses water and humidity alarms. Moreover a good distribution of water vapour is expected. The humidifier should be compliant with the EU Directives 2006/42/CE 2006-05-17 and 2006/95/CE 2006-12-12.

In order to make our work more efficient, we distribute tasks between all members of team. To be sure that all tasks will be completed on time, the Gantt chart was created. Marta and Ivan are responsible for humidifier and composite box, while David and Peter are responsible for controlling system and web interface.

### **State of the art**

Why humidifying a data center so important? If the relative humidity drops below 40%, excess of static electricity may cause sparks which can damage servers and IT equipment. The high level of humidity is so hurtful too for electrical machines. This may be the reasons for downtime and it may cause large loss of money while replacing the equipment.

### **Types of humidifiers**

There are few types of humidifiers which we considered during searching for good solution to our project. Most of them are presented below.

#### **Evaporative Humidifiers**

In evaporative humidifiers mist is produced by blowing water through a wick filter with the use of a fan. The mineral dust and bacteria get trapped on the filter before the water evaporates into the air. The advantage of this kind of humidifier is that wick filter ensures a pure and clean mineral-free moisture output. Moreover, fans can be powerful enough to cover large areas with a single humidifier. And the power consumption is very low. This solution has also some disadvantages, like fact that fans

make more noise than other types of humidifiers (noise level depends on fan speed). What is more bacteria and mold can grow on wick filter very easily, however it may be reduced by using a bacteria treatment water additive, but still most wick filters need to be replaced approximately every 2 months.

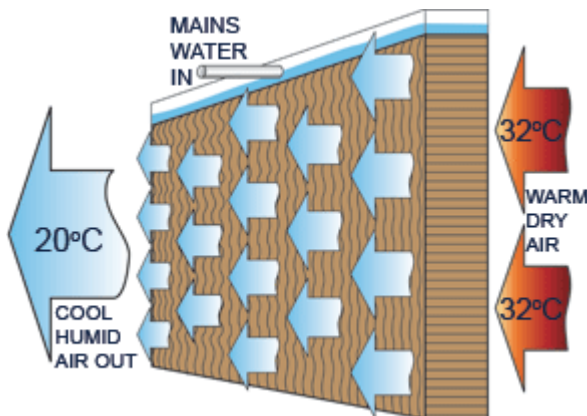


Fig. 1. Evaporative humidifier. Hot air goes through a wet filter causing the increase of humidity and decrease of temperature.

### Impeller Humidifiers

In impeller humidifiers there is a fan, which blow water through a diffuser and as a result it produces fine droplets. In contrast to evaporative humidifiers there is no filter, so there is no need to replace it what make cost of maintenance much lower. Moreover it is very quiet while working. Additionally there is low power consumption and these humidifiers are cheaper than evaporative humidifiers. On the other hand there is risk that bacteria and minerals can spread in the air along with the mist, what may cause white dust. It is also limited to small rooms only.

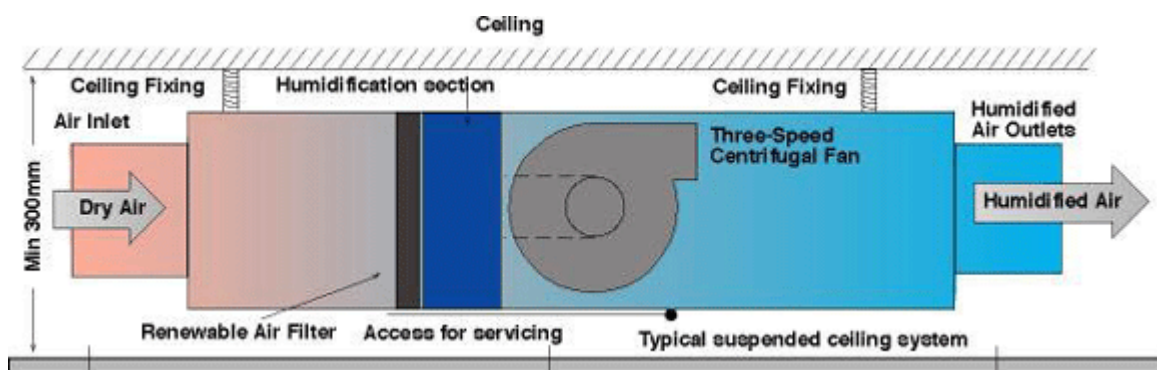


Fig. 2. Impeller humidifier. Air is blew by fan with a use of diffuser

### Ultrasonic Humidifiers

Ultrasonic humidifiers use high-frequency vibrations to dissipate water into the air. This method is the quiets of all. Additionally the power consumption is very low (when using cool mist) and there is no need for replacing wick filters. However there may occur white dust as in case of impeller humidifier. And similar to previous methods it is reserved for small rooms only.

### Warm Mist Humidifiers

These humidifiers heat the water and expel steam into the room. This method is very quiet and as result it produce pure and clean mineral-free moisture output. Furthermore there are no filters to replace. On the other hand there is a higher power consumption (heating element uses more

electricity than other humidifiers). Besides it is limited to small rooms only.

Fig. 3. Warm mist humidifier. Water is heated and mix with the air as a vapour

#### Humidifier with air compressor

The water is blown to air through nozzles with high-pressure air. Due to the high-pressure air the water come apart trough the nozzles. This method is very effective and provides good distribution. However, it is high energy consuming. Additionally, it is very expensive to build this type of humidifier.

### **Solutions for controlling**

There are two basic way to solve the controlling. Our objective to choose one from these tools what is the best to realize the controlled humidity-level in a server room. The options are the following:

#### PLC (Programmable Logic Controller)

PLC is a digital computer used for automation of electromechanical processes. PLCs are used in many industries and machines. PLCs have standard inputs/outputs, sometimes included Ethernet connection, the most important feature of the PLC is the universal usability, but usually PLCs are used in industry areas. The main difference from other computers is that PLCs are armored for severe conditions (such as dust, moisture, heat, cold) and have the facility for extensive input/output (I/O) arrangements. These connect the PLC to sensors and actuators. PLCs read limit switches, analog process variables (such as temperature and pressure), and the positions of complex positioning systems. On the actuator side, PLCs operate electric motors, pneumatic or hydraulic cylinders, magnetic relays, solenoids, or analog outputs. The input/output arrangements may be built into a simple PLC, or the PLC may have external I/O modules attached to a computer network that plugs into the PLC.

#### Microcontrollers ( $\mu$ C, MCU)

Microcontroller is the other way to electromechanical processes run automatically, MCU is a small computer or integrated circuit, everything what we need to controlling something (processor core, memory, programmable inputs/outputs peripherals) are integrated in a small card. Microcontrollers are used in automatically controlled products and devices. By reducing the size and cost compared to a design that uses a separate microprocessor, memory, and input/output devices, microcontrollers make it economical to digitally control even more devices and processes. You can program it to several functions. Revolve with an Ethernet card is possible to solve the connection with web interface, and  $\mu$ C-s have low energy consumption (milli- or microwatts). Microcontrollers are more sensitive to the environment (chemical material, temperature etc.) than PLCs.

### **Conclusions**

In our project we based on all search what we did looking for the most suitable solution. Finally, we decided for evaporative humidifier, because it is very cheap to build, as well as to maintain. Moreover, this method provides easy control and distribution of water vapour. What is more, it is possible to balance not very high efficiency with a good controlling. Cause the price, size and the low energy consumption we selected microcontroller to solve the controlling. During making decision we used tables with points, where 5 was considered as the best, while 1 was the worst mark.

Tab. 1. Table with points for each humidifier. 5 is the best, 1 is the worst.

| Ultrasonic humidifier<br>compressor | Evaporative humidifier<br>Impeller humidifier | Humidifier with the air       |
|-------------------------------------|-----------------------------------------------|-------------------------------|
| Cost 3 5 1 3                        | Maintenance cost 3 3 4 4                      | Consumption of energy 4 4 1 3 |
| Efficiency 3 1 5 3                  | Control 4 4 5 2                               | Total 22 23 21 22             |
| Complexity 3 5 1 3                  | Size 2 1 4 4                                  |                               |

Tab. 2. Comparison between PLC and microcontrollers

| Microcontroller | PLC                         |
|-----------------|-----------------------------|
| Cost 4          | Power Supply 12 V 3 230 V 3 |
| Programming 3 4 | Inputs/outputs 5 5          |
| Ethernet 5 5    | Total 20 19                 |

## Project Development

In the beginning we went to the server room for which the humidifier is designed. We could see how much space there is and where it is possible to place the new equipment. Next step was to choose the type of humidifier – as it was said we decided for evaporative one. We were also considering ultrasonic or the one with air compressor, but this solution is the cheapest and very economic. Then we had to design our own project. Now there are two ideas: one with rotating piece of cloth and another in which there is a frame with hygroscopic material and it is can be sprayed from the top or incepted water from down. We are looking for a good material for both ideas. Our next steps will be proving that this solution works and checking it with a different materials. For this purpose we are going to use a hairdryer, pc fans and little frame with a material inside and measure the humidity. After that we will decide on one of the solutions, than we are going to start building the humidifier, making a controlling system and web interface.

Fig. 4. Model of evaporative humidifier

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