e-AirQuality: A Dynamic Web Based Application for Evaluating the Air Quality Index for the city of Kozani

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Abstract—The purpose of this work is to provide access to meteorological data as well as information of the status of air quality for the city of Kozani in real time with a user-friendly interface. The application has been developed using only open source software. MySQL has been used as a relational database management system, PHP as the scripting language for the development of the application and to connect the application to the database and Javascript/HTML for the user interface programming. The users are separated to two different groups (simple users-visitors and authorised users). Each group is provided by a number of functionalities.

Index Terms—Web Based Application; MySql; PHP; Open Source Software; Air quality index;

I. INTRODUCTION

The ability of monitoring the air quality in the past decades was limited to collecting and storing measurements. Today any information can be viewed immediately in real-time via the internet and additional data such as historical measurements can be accessed easily through a website in a simple way and comprehensible way to the wide audience in which is addressed [1]. The right of access to environmental information has been enacted in European level through appropriate legislation, which are incorporated in the relevant Greek legislation see [2] and its references.

The aim of the web application is to provide meteorological and air quality information for the city of Kozani in real time. The system displays measurements of PM10 concentrations (particles with aerodynamic diameter smaller than or equal to 10 m), temperature, relative humidity, wind speed and wind direction. In addition it provides information about the air quality in the region by using an environmental indicators [3]. There is also an option to view, insert and update historical data measurements.

The Web based application ”e-AirQuality” is relying entirely on open source software tools. The advantages of open source software are many among them that allow the users to modify and improve the source code to fit the developers needs, all the tools are entirely free of charge etc. The development tools used in the e-AirQuality application are HTML, Javascript, PHP, MySql and Apache. HTML is the language for the internet user interface design [4]. Javascript is a scripting language and is utilised for checking and validating web form input values to make sure that no invalid data are submitted to the server [9].

PHP is a general-purpose scripting language that is especially suited to server-side web development where PHP generally runs on a web server. Any PHP code in a requested file is executed by the PHP runtime, usually to create dynamic web page content. It can also be used for command-line scripting and client-side GUI applications. PHP can be deployed on most web servers, many operating systems and platforms, and can be used with many relational database management systems (RDBMS). It is available free of charge, and the PHP Group provides the complete source code for users to build, customize and extend for their own use [5]. PHP primarily acts as a filter, taking input from a file or stream containing text and/or PHP instructions and outputs another stream of data; most commonly the output will be HTML. MySql is the most common Open Source Database Server and supported by many operating systems (Cross-Platform) [6]. Finally, Apache server is responsible to expect requests from various programs - users and then serve the pages, according to the standards set by the protocol HTTP (Hypertext Transfer Protocol) [7].

II. USER INTERFACE AND FUNCTIONALISM

This section describes in detail the user interface and the functions of the application "e-AirQuality" that is available to the user. Three groups of users having access to it. Each group has different functionalities with respect to the application. The first group are the regular users(visitors) which have the ability to see certain static information about air pollution and meteorological data. The second group are the ”authorised users” which share the informations available to regular users but also have the ability to view in real time environmental information about certain air pollution indices . The third
group are the administrators which have access to all the information available to regular or authorised users but also the privilege to insert, delete and modify the data entries of the various users.

In the sequel we will explain in details the functionalities of the various types of users. In the case of regular users (visitors) they gain access to a special designed table with certain static information such as the average hourly values of PM10, temperature, relative humidity, speed and wind direction in the city of Kozani. PM10 is of special interest for air pollution because it consists of very small liquid and solid particles floating in the air. Of greatest concern to public health are the particles small enough to be inhaled into the deepest parts of the lung. These particles are less than 10 microns in diameter (about 1/7th the thickness of a human hair) and are known as PM10. Is a major component of air pollution that threatens both our health and our environment and is a mixture of materials that can include smoke, soot, dust, salts, acids, and metals. Particulate matter also forms when gases emitted from motor vehicles and industry undergoes chemical reactions in the atmosphere [8]. Figure 1 shows a snapshot of hourly measurements.

The regular user also has access to the air pollution index, which determines the air pollution levers in the atmosphere. The used here air pollution index was adopted in the UK by the Committee on Medical Effects of Air Pollution Episodes (COMEAP) [10]. The index of current day is presented as a color image with appropriate scale. Figure 2 illustrates the above mentioned index.

The second group of users are the authorised users have access to more information. After login they can the see the air pollution index of the current day as well as index of the previous day and note the difference, see (Figure 3).

Using a drop-down list the authorised user can select the station, time interval, date and time period (from..to) as well as the measurement fields that wants to display. By default, the checkboxes that include environmental and meteorological data are selected, but the user has the ability to deselect all and select specific fields of measurement to display. Using Javascript the system checks for possible mistakes in the data-entry values and displays error messages. Figure 4 illustrates a snapshot history of measurements.

After selecting the desired fields in the form and clicking the "Report" button the application displays the various types of information on the screen. Figure 5 illustrates the results for the station Aristotelous in the city of Kozani, for a specific day in 2010.

In the case of wrong or missing data for a specific time and day the authorised user has the ability to enter/update the measurements. Namely, the authorised user selects the station, time interval of measurements, date and time period (from..to) and the field to enter/update the values. The application makes use of radio buttons so the user can update only one field every
The authorised users have also the ability to import measurement to the application. There is a two step sequence to perform this. In the first step, the user uploads a file (name.txt) with data values into the system. These values should be separated by a comma (,). In the second step these values are imported into the database successfully i.e. without errors the system displays an appropriate message. Figures 7 and 8 illustrate these two steps.

III. MySQL AND DATABASE ARCHITECTURE

MySQL is a very fast and powerful database management system. Allows you to store, search, sort and recall data efficiently. It uses SQL (Structured Query Language), the standard query language for databases in the world. The database architecture of the application consists of two tables. Table aristotelous_60 (Figure 9) where the fields date_time, mass1, pm10, rh, tout, so2, no, no2, ws, wd, co3, co, mass4, pm2_5, pm10_2. The field date_time (Type: datetime, format: yyyy-mm-dd hh:mm:ss) is primary key of the table and characterizes unique to each record. In other fields (Type: Double) stored hourly meteorological and environmental values.

The second table called "users" (Figure 10), are the entries of each user who wishes to have access to more information of the application. All fields are varchar type with the primary key loginname (user login name). The other fields are code, name, surname, phone number and cell phone number, e-mail and finally aprooved field indicates whether the user is activated or deactivated. The value received in this field have two states (0 or 1). If the value is zero (0), means that the user is not activated by the administrator of the application, in order to have full access to the system i.e. to be authorised user. Otherwise, if the field is one (1) the user can access additional functions(authorised users) of the application as described in the section 2.

The proposed application is part of a system air quality monitoring network, which was developed in the Laboratory of Atmospheric Pollution and Environmental Physics of Technological Education Institute of Western Macedonia, to monitor the air quality in Western Macedonia area, with focus on the industrial region of Prolemais Kozani basin. This system was co-financed by the TEIWM, Regional Operational Programm 2000 2006 Western Macedonia and recently by the municipality of Kozani. The architecture of this system is constituted by five terminal stations, which collect environmental information, the central station and a web server. Different technologies (ADSL, GPRS, ETHERNET) are used to transfer the data to the central station. The data are sent every half an hour to the main station which collects the complete set of data.
data and transfer them to the web server every sixty minutes, where under the e-AirQuality application proposed in this paper are presented to the users. The system is designed with no restrictions regarding the number of monitoring stations that can be included in the network. Further details on the design of the above mentioned air quality monitoring network can be obtained from [1],[2]

IV. CONCLUSION

A dynamic web application is proposed where users can be informed in real time the atmospheric and meteorological conditions of the city of Kozani. The "e-AirQuality" application was developed under the philosophy of the open source software and gives the ability of an easier application growth. The scripts that have been created can quite simply enriched to meet the augmentative user needs.

REFERENCES