"GREEN" SMART ROOM MANAGEMENT INFORMATION SYSTEM

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The following paper is about developing a system to monitor and maintain the microclimate of a specific area. The developed system is used to collect, process, classify and display the data formatted in HDF5 format supplied by various systems and sensors. The monitoring system allows you to monitor the changes in microclimate of interest, display them in different ways, and identify values that go beyond the preset norm, as well as notify users about the anomalies.

Keywords: microclimate monitoring information system

Introduction: Nowadays, automated climate monitoring systems are being implemented in many places and are used to monitor the status of relevant environmental parameters in residential and administrative buildings, greenhouses, as well as in unattended and partially serviced facilities, museums, libraries, archives, art galleries, storage facilities and many other similar locations. Such monitoring systems relieve the need for human resources, therefore generating the data stream of information with minimal to no human interaction, analyze it and notify the user of any anomalies or events [1].

Typically, such systems include microclimate temperature meters and controllers (the client sector) and data collection and display servers (the server sector) (Figure 1). At the same time, the composition and structure of such systems for various applications is essentially the same. As a convenient addition, a mobile application can be created to interact quickly with the system via an API.

For example, if we are observing the temperature, and it exceeds the permissible rate of change set by the user, the system will send a notification and, if it is configured to do so, will execute corrective actions. It is worth noting that automated monitoring systems are especially relevant in the study of a hazardous environments, in such cases as chemical pollution or radiation, since they allow monitoring the state of the environment without danger to human health via direct interaction, which allows to preserve the life and health of the operating personnel.

Objective: The project goal is to create the microclimate monitoring information system, which allows you to dynamically monitor the status of the sensors as well as monitor the changes in their readings, while being able to warn the user if the changes go beyond the specified limits of absolutes values or rates of changes.

Development: The effectiveness of the monitoring systems is largely determined by the server software architecture, which serves to analyze and display the collected data online, which is in turn obtained and pooled from various sensors and stored in HDF5 format [2].

After existing solutions analysis, DigitalOcean cloud service was chosen to host the web application. The application allows you to manage the connected sensor systems by adding or removing IP addresses and a description of the sensors, as well as connecting or removing entire sensor systems altogether.

The server part of the microclimate monitoring system allows to:

1) Gain online control of a sensor system which consists of boards operating in master and slave modes as well as sensors and other peripherals.
2) Turn on and off the various sensors, set the parameter statuses, specify the threshodls and the norms of critical values (These values will be checked on the board and if not within the limits of the norm, a notification will be sent to the user via the e-mail).
3) Switch sensor systems modes: auto (all of the data is processed on the server), semi-auto (only critical parameters are processed locally, the rest on the server) and autonomous (all of the data is processed locally).
4) Present the information in a tabular and graphical form.
5) Warning users about "dangerous" values using e-mail notification.
6) Update configuration file (stored in json format).

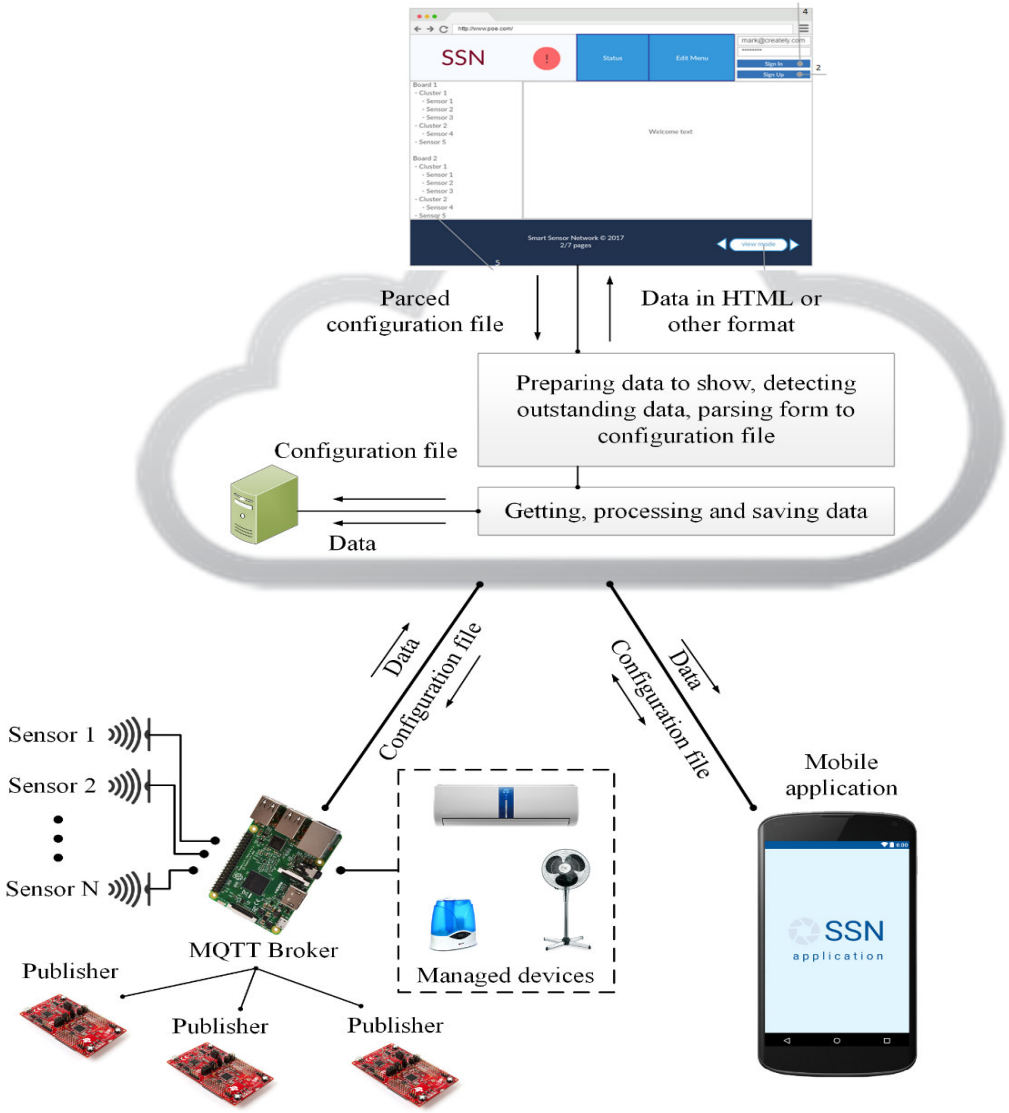

Fig. 1 "Green" smart room information system scheme

The software is developed using Django framework, implementing the MVC pattern, where the HDF5 files from sensor systems represent the "model". Then the data is analyzed, processed and validated according to the configuration file in json format and sent to the "view" sector[5]. In order to make the configuration file editing more user friendly, it is also displayed and is editable using html form (Figure 2).

```
{ "masters": [{    //boards array
  "menu": [{    //1st level is always menu
   "submenu": [{    //2nd and others are always submenu
    "Name": "X",    //Sensor name
    "Active": "true",    //Activity
    "Critical": "true",
    "Pin": "25",    //sensor pin
    "Mode": "semiauto",    //active mode (auto, semi-auto, autonomous
    "Type": "parameter",    //type (parameter, cluster, master)
    "IP": "",    //
          "Master": "",    //master ip, if it is slave
    "Email":"proteus11@ukr.net",//email for notifications
    "url": "192.168.2.20/acceleration/x",// dataset path in hdf5 file
    "MinNorma": "0.1,1,0.9", //
    "MaxNorma": "0.6,3,1.1"    //
 } …
```

Fig. 2 – Configuration file fragment

The configuration file contains the list of valid IP addresses for controllers and sensors connected to it in order to make the system flexible and universal. This allows the user to independently edit the connected systems, their boards and sensors [3].

The configuration file supports endless nesting, which allows to create complex systems (Fig. 3).

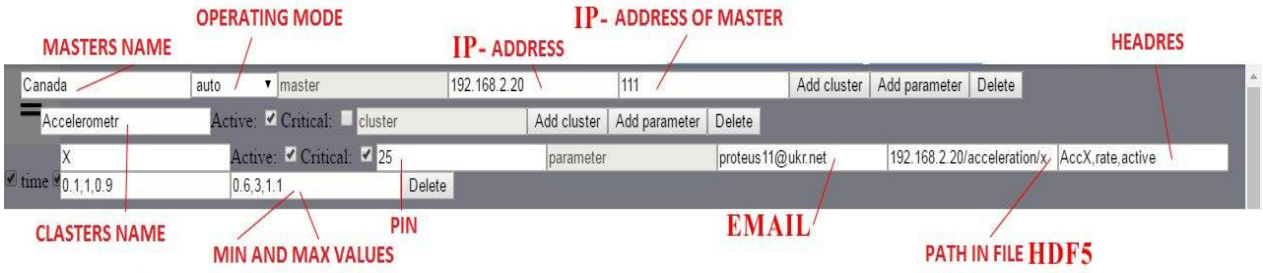

Fig. 3 – Configuration file editing form

Web-application is able to show dynamic changes in the data in both tabular and graphical views with various filters available for cases with multiple or convoluted data sources. It allows the user to inspect only the values of interest to them, in a convenient way.

Conclusions: Due to its uniqueness, the application has great potential. Implemented web application for the server part of the climate monitoring system allows you to dynamically track the status of the specified sensors and monitor changes in their indications, warning the user if the changes go beyond the limits of the allowed thresholds. This system does not depend on the type of connected sensors, which makes it very flexible and universal.

SOURCES

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Зеленая "информационная система управления smart room

Следующий документ посвящен мониторингу и поддержанию развития системы микроклимата. Разработанная система используется для сбора, обработки, отображения и классификации данных, представленных в различных форматах. Система мониторинга позволяет отслеживать изменения показателей микроклимата, отображать их по-разному и определять значения.

Ключевые слова: информационная система мониторинга микроклимата.