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GRAPHICAL USER INTERFACE IN THE SMARTRIVER SYSTEM

The paper presents the concept of building a web application for the implementation of the graphical user interface in the SmartRiver system. The concept of cooperation with the data processing module from distributed measurement sensors and the presentation of information about the operation of the system on geographic maps will be discussed.

GRAFICZNY INTERFEJS UŻYTKOWNIKA W SYSTEMIE SMARTRIVER

W referacie zaprezentowano koncepcję zbudowania aplikacji internetowej na potrzeby realizacji graficznego interfejsu użytkownika w systemie SmartRiver. Omówiona zostanie koncepcja współpracy z modułem przetwarzania danych z rozproszonych czujników pomiarowych oraz prezentacji informacji o działaniu systemu na mapach geograficznych.

1. INTRODUCTION

SmartRiver is a distributed measurement system designed to monitor the condition of flood embankments and environmental parameters implemented as part of the project "SmartRiver: Intelligentes Odergebiet / SmartRiver: Intelligent Nadodrze" [1]. The architecture of the system consists of several software and hardware modules and will be presented later in the paper. Specialized software and hardware modules have been developed for the functioning of specific tasks. One of the key modules for the functioning of the system is the Graphical User Interface (GUI) developed by the authors of the paper. Basic information about the SmartRiver system, its architecture and the most important functionalities of the GUI, how it is built and works will be presented.

2. SMARTRIVER SYSTEM

The basic task of the SmartRiver system is to supervise the parameters of flood embankments using a set of nodes and measuring sensors installed in the flood embankments, from which data are transmitted to the measurement database via a wireless communication link [2-5]. Measurement data from the sensors are collected in the Middleware module [6], which is a kind of distributed database. The Middleware module also provides the ability to configure security at the level of a dedicated configuration layer of nodes. The status information of system nodes is presented in the GUI module, which is implemented in the form of a web application.

2.1. System architecture

The system consists of a hardware part, which is based on wireless measurement nodes. These nodes read the measured quantities from sensors located in the embankments and then send them via a wireless communication link to the gateway. Gateways aggregate data from individual nodes and send it via an encrypted LoRaWAN wireless link to the Middleware module. Middleware is a software module running on a server with the access to the Internet. The architecture of the system is shown in Figure 1.

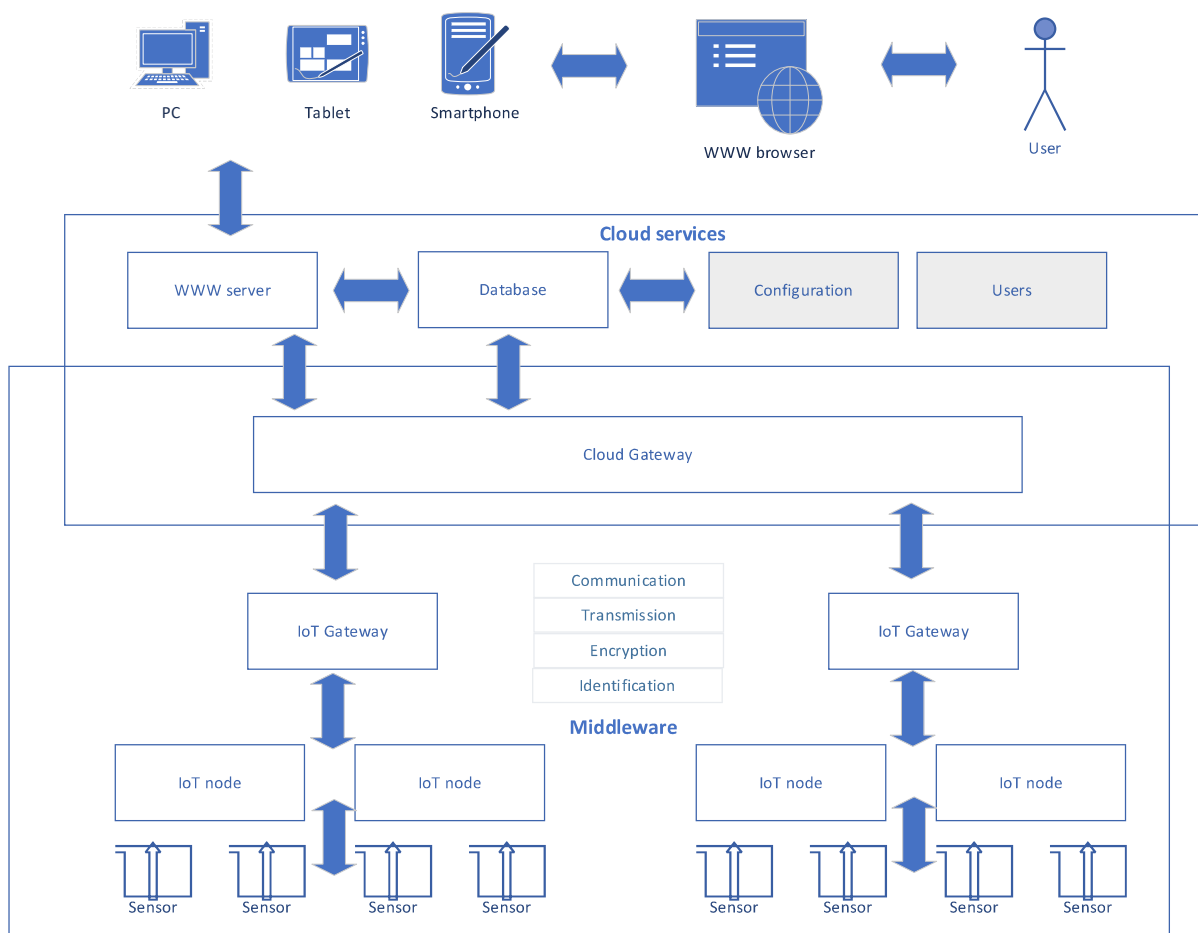


Fig. 1. System Architecture
Rys. 1. Architektura systemu

2.2. Middleware and variables

The distributed Middleware module performs the tasks of supervising measurement nodes using a wireless network, taking into account the required level of security of the transmitted data. All information about the operation of the Middleware module and the sensors supervised by it are processed in the form of so-called variables, which have their unique name in the system and represent one of the measured quantities in the system, e.g. the height of the water column. Variables can only be processed programmatically. GUI module use Middleware variables to present the state of system.

2.3. Graphical user interface

For the purpose of presenting the status of sensors in the system and performing administrative tasks, a module is implemented that performs GUI tasks in the form of a web application. This solution makes it easier to use the system, because there is no need to install any software on the user side of the system. All you need is a web browser and access to the Internet. It is also possible to work on mobile devices, such as smartphones, using a browser built into the system of such a device.

2.4. GUI cooperation with Middleware

A Middleware module is an independent software module and it can work with other modules, i.e. other modules can be its clients. The GUI module as a client of the Middleware module establishes communication with Middleware using an encrypted, secure network connection. With this connection, it is possible to exchange data between the modules. Physically, the modules can work on other server computers. For the purpose of exchanging data on the state of the Middleware module variables, the mechanism of subscription of the Middleware module variables by the GUI module was used. This allows the GUI module to be informed about changes in the values of the Middleware module variables without the need for the GUI module to periodically check these values, which optimizes communication between the modules.

2.5. Configuration

One of the basic functionalities of the GUI is its configuration. The GUI module stores in the configuration such information as: a list of system users with their permissions, a list of Middleware variables that are presented in the system and configuration of geographical maps. The GUI module collects configuration information in a database. The configuration module can only be managed by authorized persons – administrators of the system.

2.6. Security

Working with the system requires logging in using the correct account and password. The list of user accounts is divided into groups, which are managed by the system administrator. Groups have a scope of permissions for specific functionalities in the SmartRiver system, e.g. a user with a low level of permissions cannot view detailed reports. TLS communication will be used.

2.7. Choosing the language version of the GUI

The application also has the ability to choose the language version – Figure 2. After switching the language, all information visible to the user is presented in the selected language. This will allow users to increase readability and accessibility to the content presented on the pages.



Fig. 2. Language version selection
Rys. 2. Wybór wersji językowej

2.8. Geographical maps

Status information of the sensors and the current values of the measured quantities in the system can be presented in several ways. An attractive way to present the state seems to be the use of geographical maps with superimposed information in the location where the sensors are physically located (Figure 3). The status of the sensors can be presented using certain colors, e.g. red indicates alarm state, green normal state, etc. After clicking on the selected point, the user obtains detailed data in a new window that appears.

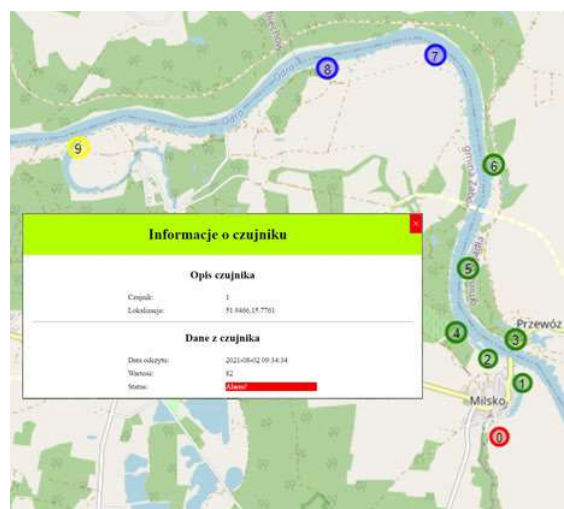


Fig. 3. View on the geographic map
Rys. 3. Widok na mapie geograficznej

3. SUMMARY

The article presents functional assumptions and a description of the appearance of the GUI for the SmartRiver system. Ultimately, the system will enable the assessment of the state of flood protection and indication of the location of the flood risk. Assessments obtained from the system of continuous monitoring of flood embankments may be an indication to carry out a more detailed identification of flood risk on a given section of the embankment using geophysical methods.

The implementation of the system is based on hardware solutions of measurement and software sensors. In the hardware solutions, the sensors used are aimed at determining the condition of the embankments in which the development of filtration and erosion processes takes place. In flood embankment monitoring systems, temperature, humidity, pore pressure, ground pressure, etc. are measured. Access to data is carried out using the Middleware module. Access to individual functionalities and data for the users is carried out using the GUI module described in the article.

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