

**МІНІСТЕРСТВО ОСВІТИ І НАУКИ УКРАЇНИ
УКРАЇНСЬКА ФЕДЕРАЦІЯ ІНФОРМАТИКИ
ЗАПОРІЗЬКИЙ НАЦІОНАЛЬНИЙ ТЕХНІЧНИЙ УНІВЕРСИТЕТ
ХАРКІВСЬКИЙ НАЦІОНАЛЬНИЙ
УНІВЕРСИТЕТ РАДІОЕЛЕКТРОНІКИ**

ПАТ «УКРТЕЛЕКОМ»

КП «НВК «ІСКРА»

НВП «ХАРТРОН-ЮКОМ»

ДП «РАДІОПРИЛАД»

ГО «ФРЕШКОД»



**СУЧАСНІ ПРОБЛЕМИ І ДОСЯГНЕННЯ В ГАЛУЗІ
РАДІОТЕХНІКИ, ТЕЛЕКОМУНІКАЦІЙ ТА ІНФОРМАЦІЙНИХ
ТЕХНОЛОГІЙ**

Тези доповідей

IX Міжнародної науково-практичної конференції
(03–05 жовтня 2018 р., м. Запоріжжя)

*Електронне видання комбінованого
використовування на DVD-ROM*



Co-funded by the
Erasmus+ Programme
of the European Union



Запоріжжя – 2018

4 СЕКЦІЯ «ІНФОРМАЦІЙНІ ТЕХНОЛОГІЇ В ПРОЕКТУВАННІ ТА ВИРОБНИЦТВІ»

УДК 004.9: 621.39

N.I. Furmanova¹, O.Yu. Farafonov¹, A.R. Kalynychenko²

THE MOBILE SYSTEM FOR ENVIRONMENTAL MONITORING

Environmental monitoring is complex observations of the environment, including components of the natural environment, natural ecological systems, processes in them, phenomena, assessment and changes forecast of the environment. Issues of environmental monitoring are relevant today. This is evidenced by a large number of scientific papers on this topic. Thus, in [1] environmental monitoring is considered as a part of Smart Cities and the importance of control with air content in urban cities is emphasized. Using the interval difference operators for analysis of air pollution from vehicular traffic is proposed in [2]. Wireless sensor networks using Wi-Fi are proposed in [3], but this decision has some constraints, so we are proposed using SIM modem.

Based on the considered analogs, we have put forward and implemented the following requirements: modularity, data gathering, presentation of information, energy consumption, price.

To be able to use complex on different objects, cities, countries-complex must have universal measurements. This flexibility has been achieved by using a series of sensors MQ, which allow you to measure a huge range of gases without changing the polling algorithm. The complex provides remote collection of information from a variety of monitoring modules located at a great distance from each other. The collection is carried out by transferring information from each module to the server using the SIM800L GSM modem. This solution has some advantages in comparison with the using of Wi-Fi. Firstly, mobile communication covers significantly larger territories. Secondly, in the absence of communication device will write data in the memory and send them later.

The ability to display information in the form of interactive graphs using any device with Internet access is implemented, as well as daily, weekly, monthly sampling data with information about exceedances. Reporting is carried out by a web application, where you can select the data for the certain period of time and look through them in the different forms.

¹ PhD, Associated Prof. Information technologies of the electronic devices department, Zaporizhzhia National Technical University

² Student, Zaporizhzhia National Technical University

One of the main tasks was to maximally reduce the cost of individual monitoring modules. This problem was solved due to relatively cheap components: a microcontroller (PIC16f887), gas sensors of the MQ series and a temperature and humidity sensor DHT. As sensors for determining the gas concentration optimally take sensors MQ-X series by FC-22. The main advantage of this series is that identical in function to the sensors ensure the measurement of the concentration of a whole range of gases. As a temperature and humidity sensor it was optimal to choose one product in order to reduce the cost and dimensions of the device – DHT22 digital sensor. It has ultra-low power consumption, lack of tying, long life time, digital interface.

Due to the use of surface mounting elements and plating of the board, we were able to place all components on a single-sided PCB. For the developed PCB of the device, we designed a rectangular shaped housing made of plastic. Since the model is developed as a prototype, to test the housing and the device as a whole, housing parts were manufactured using a 3D printer. The housing consists of four parts: the base, partitions with sensor mount and a lid. After testing it is possible to produce a series of pressure casting housings, that will reduce the cost of the housing unit as a whole in mass production.

When the module is turned on, the microcontroller calibrates the MQ-X gas sensors, and then it initializes the connection to the GSM module. After that, the cyclic starts measure the level of air pollution, the information is gathered from the sensors and sent it to the server. The time between measurement and sending can be changed from 10 seconds to several days. Sending data to the server occurs through the HTTP POST request. This allows to record the readings in the form of a JSON string and to process on the server side easy. When the SIM800 modem installed in the module is accessed to the server, the script parses the incoming JSON string to an array of data from each sensor, as well as information about the module and their place to the database.

When designing the complex, the ability to view information from any device in an easy and understandable way has provided. Therefore, for these purpose it was decided to create a web interface and present data in the form of interactive graphs. The web application was written in javascript, which makes a selection for a given period of time and displays this data using the library chart.js.

References

1. H. Song, R. Srinivasan, T. Sookoor and S. Jeschke, *Smart Cities: Foundations, Principles, and Applications*, Wiley; Hoboken, NJ, USA: 2017.
2. I. Voytyuk, N. Porplytsya, A. Pukas and T. Dyvak "Identification the interval difference operators based on artificial bee colony algorithm in task of modeling the air pollution from vehicular traffic," 14th International Conference The Experience of Designing and Application of CAD Systems in Microelectronics (CADSM), 2017, pp. 58–62.
3. M. Pavani, P.T. Rao, "Real time pollution monitoring using Wireless Sensor Networks", 2016 IEEE 7th Annual Information Technology Electronics and Mobile Communication Conference (IEMCON), pp. 1–6, 2016.