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# Data collection and analysis using the mobile application for environmental monitoring

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## Abstract

This paper considers the analysis of problems and methods of implementation of information systems for monitoring natural and industrial facilities. The new approach of data storage, integration and retrieval developed. The practical applicability confirmed through experience in the development of information systems for the processing and analysis of spatial data using a mobile application.

*Keywords:* Mobile application, information system, Arduino, environmental monitoring system

## 1. Introduction

Thanks to the development and improvement of electronics, microelectronics, digital systems, microcontrollers, robotics, information technology and other directions, one can see the rapid development of information systems and mobile applications for control and monitoring. One of the contributing factors is - an electronic designer and convenient platform to the rapid development of electronic devices - Arduino[1-11]. The platform is very popular all over the world thanks to the convenience and ease of programming language, as well as because of open architecture and software code, which is used in different technical domains [5-12, 14-17].

Currently, the number of technological, environmental, personal sensors as personal portable device increased enough. These sensors can be used to measure the quality of air, the temperature level of carbon dioxide or toxic substances in the air, humidity, etc. These devices are small in size and are additionally equipped with Bluetooth and Wi-Fi, which allows analyzing the collected data and compare them with previously stored information [1-5, 7, 12-14, 18].

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However, the problem of air quality for cities with a population of 1 million or more, need to be analyzed more detailed, as the climatic conditions characterized by excessive accumulation of the metropolis of pollutants in the atmospheric surface layer, which leads to the formation of smog. As it is known in calm weather or poor natural ventilation air pollution has a more negative impact on the health of the population and it is the most pressing environmental issue requiring urgent solutions [15].

Based on the mentioned problems, the need for the development of information systems (IS) for control and environmental monitoring (EM).

In this paper, we have developed the mobile software for EM carried out with the help of mobile device (MD), which allows you to monitor the status of the system, to assess the extent to which certain actions from the perspective of compliance as outlined previously mentioned plans, and from the standpoint of achievement. In case of deviations from the parameters of the state should be taken to eliminate or other measures to ensure the safety.

In this paper, to solve a specific problem, we proposed EM IS, which consists of the devices based on the Arduino with the possibility to obtain information about the environment through a variety of sensors and can be controlled by various actuators. One of the main advantages of Arduino is that the devices are programmed via USB without device programmers[1].

Considered ES system is developed for students, lovers of design of systems and devices, as an example of practical implementation, with a view to its improvement in the future. In addition in our ES we applied free cloud-based service for the Android applications, called Parse.

## 2. Sensors and their main characteristics

The development of IS requires equipments, sensors and details, which are presented in Fig. 1. Ease of use of sensors and their basic advantages over other sensors are concludes in their simplicity and lower price, which is useful for construction the system for ES (there is no need to solder the connection).
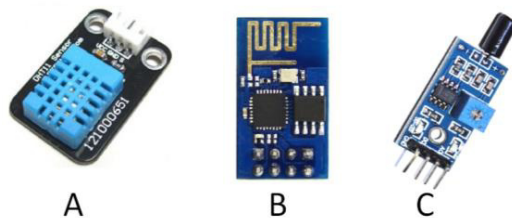


Fig. 1. Sensors: A - Temperature Sensor, B - Wi-fi module, C - Vibration sensor

1. Temperature Sensor Fig 1. A
Technical Specifications of Temperature Sensor[17] (see Fig 1. A and Table 1):

Table 1. Technical Specifications of Temperature Sensor.

| Item | Measurement Range | Humidity Accuracy | Temperature Accuracy | Resolution | Package |
|------|-------------------|-------------------|----------------------|------------|---------|
| DHT11 | 20-90%RH 0-50 ℃ | ±5%RH | ±2℃ | 1 | 4 Pin Single Row |

2. Wi-fi module, ESPRESSIF SMART CONNECTIVITY PLATFORM: ESP8266EX. Espressif Systems' Smart Connectivity Platform (ESCP) is a set of high performance, high integration wireless SOCs, designed for space and power constrained mobile platform designers[6]. Fig 1. B
3. Vibration sensor (digital + analog outputs) with sensitivity[19]. Fig 1. C
4. Arduino Uno[1] (see Fig. 2.)