11.8 PORTABLE AIR QUALITY MONITOR BASED ON LOW-COST SENSORS

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Background and Aims: National systems of automatic air quality monitoring are based on automatic measuring instruments that are installed in stationary air quality monitoring stations. Substantial financial resources are required for the procurement, installation, calibration, and maintenance of such measuring devices. For this reason, existing national and local air quality monitoring networks are not able to provide a high temporal and spatial resolution of measurement results. In the last ten years, as a possible alternative to the conventional approach to air quality monitoring, real-time monitoring systems using cheap (low-cost) sensors and sensor platforms have begun to be applied (Jovasevic-Stojanovic et al, 2015). This paper describes the basic characteristics of a portable air quality measuring device PAQMAN 2020 based on low-cost sensors. Part of the results of comparative measurements of this device with the measurement results of the reference instruments is presented in the paper.

Methods: PAQMAN 2020 uses an Arduino Mega microcontroller as a control board. An SDS011 sensor module is used for measurements of PM_{10} and $PM_{2.5}$ mass concentrations from the range of 0-2000 µg /m^3. A DHT22 sensor module is used for temperature (-10 to +40 °C) and relative humidity (20 to 90 % RH) measurements. NDIR S8 CO_2 module is used for the measurement of CO_2 concentrations in the range from 400 to 2000 ppm. The measurement results are stored in text files on the microSD card and displayed on the device's LCD display (LCD2004). Device programming was done in C through the Arduino IDE. Results of measurement could be downloaded from PAQMAN 2020 to PC over a standard USB serial port.

Key results: The PAQMAN 2020 was tested in the laboratory and in the field. Mean 15-minute or mean hourly values were compared, depending on the available time resolution of the results from the reference instruments. Figure 1 show comparison of PM concentrations (SDS011 as DUT vs ref.) measured in the laboratory. Determination coefficients (R^2 = 0.957 for PM_{10} and R^2 = 0.945 $PM_{2.5}$) indicate a very strong linear relationship between the measurement results of the reference instrument and the SDS 011 sensor.

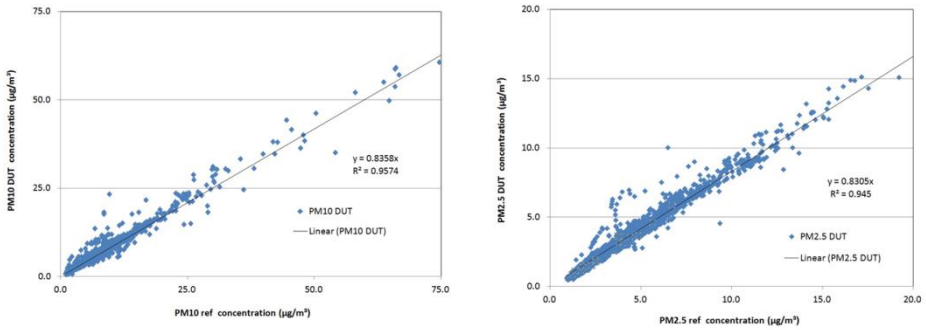

Figure 1. Comparison of results for the PM concentrations measured in the laboratory

Conclusions: The PAQMAN 2020 monitor was showed very good stability and reliability during the test period. So that, it could be applied for temporary or continuous indicative measurements of indoor and outdoor air quality.

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REFERENCES

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