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Reliability of communication in water monitoring system

Abstract. *Stable communication channel between measurement device and other parts of system has significant impact on reliability of the system designed for environmental protection. In this paper is presented a research and result of test in situ of communication interface and protocols implemented in environmental monitoring system dedicated for monitoring quality of fresh water.*

Streszczenie. *Stabilny kanał komunikacji między urządzeniem pomiarowym a pozostałymi częściami systemu ma istotny wpływ na wiarygodność systemu zaprojektowanego do ochrony środowiska. W tym artykule zaprezentowane są badania dotyczące realizacji oraz testowania łącz komunikacyjnych w rozproszonym systemie pomiarowym przeznaczonym do monitorowania parametrów wód powierzchniowych*

Keywords: measurement systems, environmental protection, remote measurements GSM, 868MHz.
Słowa kluczowe: systemy pomiarowe, ochrona środowiska, pomiary zdalne, GSM, 868MHz.

Introduction

In distributed measurement systems that are designed to protect environmental resource on large areas, the reliability of instantaneous work is very important. In this case, the stable communication between measurement device and the main controller has a significant impact on reliability of the whole system. In designing communication structures we have to take into account the topography of monitoring area, weather, and distance of communication. We should ensure secure transmission channel for data that should be considered as sensitive or even strategical, and naturally also other requirements imposed by both system users and customers as well.

In this paper we focus on some aspects of signal transmission in distributed measurement system. We presented research and result of test of communication interface and protocols used in system.

Monitoring system

Authors are co-designers of distributed measurement system dedicated to fresh water monitoring. The system is installed on the Dobczyckie leak near Krakow (Poland). This lake is the main clean water intake for the city.

Figure 1. Measurement station positions on the Dobczyckie lake.

In previous work [1], [2],[3] authors established following assumptions of the system:

- set of the measurement parameters (temperature, pH, suspension, conductivity, chloride, ammonia, hydrocarbons)
- number and location of monitoring stations (presented on the Figure 1) and structure of measurement station
- communication structure (variant 1 – device communicates with server directly over GSM/GPRS, variant 2 – there is an on-shore transceiver having both ISM 868MHz radio and GSM/GPRS capability while measurement devices are equipped with only ISM radio)
- communication protocols (stack of TCP/IP/XMPP)

Communication interface – result of test

During field tests authors analysed two models of communication. For this experiment authors built measurement station which contains: controller Moxa W3454 (based on the ARM9) with integrated GSM/GPRS modem, radio-modem work on ISM band 868MHz, GPS receiver, and power source.

Authors tested two main communication model. One of them was GSM/GPRS. During this test author measured strength of GSM signal on the surface of lake. The second model of communication in system based on the 868MHz ISM band interface. In this case the mobile station on the surface water was equipment in $6/4\lambda$ omni-directional antenna with 9dBi gain. The Access Point to the Internet was installed 7m above water level and was equipment in first test had above antenna in second test had directional antenna with 11dBi gain. This allowed for the designation of the exact coverage GSM and 868MHz map and choose appropriate model of communication for this system.

Conclusion

When distributed systems are dedicated to monitoring natural environmental ecosystem we do not have universal method to construct communication channel. We have to analyse, and propose the structure of communication exactly for monitoring object. But only with test performed *in situ*, communication structure allows detection and elimination of errors, and distortions of signal transmission.

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