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REVIEW Of the PhD Thesis

M.K. Nurgaliyev: Development and optimization of energy efficient wireless self-organizing sensors networks (in Russian)

The thesis is devoted optimizing and improving the energy efficiency of self-organizing wireless sensor networks on the example of LoRa and ZigBee technologies. Today, energy optimization is the cornerstone for wireless sensor networks. When deploying a wireless network nodes are assumed to be offline for a long period of time in synchronous or asynchronous mode. The traditional approach to the problem of reducing consumption comes down to three main areas: reducing the time of work in active mode, data processing at the local level in order to reduce the packet length, methods for efficient data routing through multiple relaying data from one node to another.

In the thesis, M.K. Nurgaliyev studied the parameters wireless sensor networks and their impact on the energy consumption of an individual node and the entire network. Research in this direction leads to the need to develop a consumption model for sensor network nodes.

The research method is the experimental determination power consumption of the wireless sensor network in synchronous and asynchronous mode of operation, modeling the power consumption of network nodes with asynchronous mode using Markov processes, experimental study influence of directional antennas on the power consumption of network nodes, forecasting the strength of the received signal using a computer learning.

The novelty and originality of the work lies in the fact that what's in it for the first time:

- developed a model that describes the energy consumption and operating time nodes of a wireless sensor network based on Markov chains, taking into account battery discharge dynamics;
- the influence of directional antennas on the reduction power consumption of nodes, and as a result, an increase in the operating time wireless sensor network;
- a model for predicting the transmitter power in room for a fixed position of the receiver using machine learning methods.

Evaluating the completeness of the solutions to the problems posed, I can conclude that they are fully implemented: the parameters that affect the time operation of wireless sensor networks in synchronous and asynchronous mode at different probabilities of sending data, the

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influence of directed antennas and proposed a RSSI prediction method for optimizing location of network nodes in the room. The results obtained in the framework of the dissertation work can be applied when deploying large sensor networks in an open terrain or indoors to predict the operating time of network nodes in synchronous and asynchronous mode. RSSI Prediction Method Using Machine Learning can be useful in predicting indoor RSSI distribution and buildings to deploy stand-alone networks that enhance security and people's comfort.

Nurgaliyev Madiyar demonstrates scientific curiosity to the problem, rigorous approach to work enabled he to gain experience in optimization of energy efficient wireless self-organizing sensors networks. His main results were presented at number of major international and national conferences and journals.

I confirm that the PhD thesis of Nurgaliyev Madiyar contains original research and new results. The thesis satisfies all the highest requirements for the doctoral dissertations, and the author of the dissertation certainly deserves to be awarded the degree of Doctor of Philosophy (PhD) in the specialty «6D071900 – Radioengineering, electronics and telecommunications»

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