Brief information about the project

Name of the project	AP19678552 «Improving the energy efficiency of mobile and static wireless sensor nodes in indoors and outdoors»
Relevance	The development of information and communication technologies, Data science and cybernetics makes it possible to process, analyze and use a large amount of data to predict and determine the correlation between various physical quantities, continuous monitoring in hard-to-reach places and increase the level of human comfort and safety by wireless sensor networks.
	This project is aimed at optimizing and improving the energy efficiency of wireless sensor networks. The authors in their studies on energy consumption cite traditional linear models of network node power consumption and do not take into account the nonlinearity of battery discharge and node power consumption in the event detection mode, which requires a probabilistic approach.
	Optimization of the nodes' energy consumption can also be achieved by the optimal position of the nodes when deploying the network. The optimal node position is the task of the minimum number of nodes and data transmission power and maximum coverage. Determining the location of a mobile node of a wireless sensor network is also an urgent task today, for example, when using unmanned vehicles. In large buildings and indoors, the accuracy of determining the position of mobile nodes is sharply reduced when using traditional localization methods.
	Due to the above problems, this project is relevant. The main idea of the project is to develop a model of energy consumption of wireless sensor network nodes and increase the energy efficiency of mobile and static nodes using directional antennas and study their operation indoors and outdoors.
Purpose	The aim of the project is to develop a model of energy consumption of mobile and static nodes of a wireless sensor network and increase their efficiency using directional antennas.
Objectives	Task 1. Development of a model of consumption of nodes of large wireless sensor networks during regular data transmission and data transmission when events are detected for static and mobile network nodes in order to predict the lifetime of sensor networks for their successful deployment and maintenance;
	Task 2. Investigation of the sensor network operation when using directional Smart antennas with multi-directional pattern in irregular terrain with obstacles, as a result of which patterns will be revealed between the parameters of the sensor network, such as the power of the transmitted and received signal, the number of nodes and

	node density, the distance between nodes, antenna parameters, and irregularity of terrain;

Task 3. Determination of the optimal position of static nodes of a wireless sensor network in irregular terrain and indoors using machine learning methods in order to increase network lifetime, reduce interference and multipath propagation effect, as well as optimal space coverage;

Task 4. Determining the location of mobile nodes of a wireless sensor network of irregular terrain and indoors using machine learning methods and Smart antennas. |
| Expected and achieved results | In the process of working on the Project, at least three articles will be published in foreign scientific publications indexed in the Web of Science and Scopus databases, and having a percentile of at least 35, as well as one article in a domestic publication recommended by the Committee for Quality Assurance in the Field of Science and Higher Education; or at least two articles in foreign scientific publications indexed in the Web of Science and Scopus databases, and having a percentile of at least 65, in accordance with the tender documentation.

The main results of the project will be a power consumption model of wireless sensor network nodes in regular transmission mode and event detection mode, new knowledge about the dependence of the RSSI signal in irregular terrain and indoors, as well as a model for determining the localization of mobile nodes indoors. The economic and social effect of the implementation of the project results will be achieved by reducing the number of devices, increasing the lifetime, optimizing the location of nodes, training domestic specialists in the field of telecommunications and information networks and improving the accuracy of identifying users in large premises without the use of GPS trackers. |
| Research team members with their identifiers (Scopus Author ID, Researcher ID, ORCID, if available) and links to relevant profiles | 1. Nurglaliyev M. – supervisor, SSR. ORCID: 0000-0002-6795-5384; Scopus Author ID: 57202335235
2. Saymbetov A. – LSR. ORCID: 0000-0003-3442-8550; Scopus Author ID: 57230318400
3. Kuttybay N. – SSR. ORCID: 0000-0002-5723-6642; Scopus Author ID: 57196375521
4. Dosymbetova G. – SSR. ORCID: 0000-0002-3935-7213; Scopus Author ID: 57202334195
5. Zholamanov B. – JSR. Scopus Author ID: 57258537000
6. Koshkarbay N. – JSR. Scopus Author ID: 57257861100
7. Kapparova A. – Engineer Scopus Author ID: 58028607300 |

	8. Orynbassar S. – Engineer. Scopus Author ID: 58028274600
List of publications with links to them	-
Patents	-