

Brief information about the project

Name of the project	Design of a System for Monitoring and Analyzing Health Indicators of Patients with Metabolic Syndrome
Relevance	Metabolic syndrome is one of the key causes of cardiovascular diseases and diabetes, the prevalence of which is constantly increasing. Modern medical information systems are either highly specialized or difficult to use and require IT support, which limits their implementation. The project is aimed at developing an accessible, intelligent, and easily configurable remote patient monitoring system (RPM), which is especially important for remote regions and improving the quality of medical care.
Purpose	Develop the medical information system for remote monitoring, collection and processing the patient indicators with metabolic syndrome, which will help medical personnel to generate patient statistics quickly, his medical card and make preliminary diagnosis.
Objectives	1. Data collection and classification of metabolic syndrome patients in Almaty clinics. Construction of a mathematical model of clinical protocol for making preliminary diagnosis for metabolic syndrome patients, algorithm development. 2. Connection and configuration of IoT-devices, boards, and sensors to design remote patient monitoring. Evaluation of IoT-devices speed, accuracy and reliability. IoT-device interaction scheme creation. Identification of convenient and effective patient using ways. 3. Medical information system design for remote monitoring, collection, analysis and transmission of patient indicators for diagnosis purpose. Database development, definition of mobile application functionality. 4. Development and adaptation of informative, convenient and understandable interface (doctor/patient) of mobile application. 5. Mobile application creation that processes data from sensors, organize data transfer over SD-WAN using data protection libraries on microcontrollers. 6. Developed information system testing in the National Scientific-Medical Centre JSC (Astana).
Expected and achieved results	Expected Results 1) A mathematical model and algorithm for making a preliminary diagnosis for patients with metabolic syndrome will be developed. 2) A medical information system for collecting patient indicators for the purpose of diagnosis will be developed. 3) The SD-WAN network architecture will be developed and tested for deploying secure IoT-device scenarios. 4) The developed prototype of the medical system will be tested in the clinic of JSC "National Scientific Medical Center" (Astana). (LEC approval, Protocol No. IRB-

	A927 (No. 85) dated 22.10.2024, date of approval 22.10.2024). 5) The monograph "Design and implementation of medical information systems" in English will be published. 6) The results of the scientific research will be published in 2 (two) articles and/or reviews in peer-reviewed scientific journals indexed in the Science Citation Index Expanded and ranked in the first (1st) and/or second (2nd) quartile by impact factor in the Web of Science database and/or with a percentile of at least 65 (sixty-five) by CiteScore in the Scopus database, as well as in 2 (two) articles or reviews in a peer-reviewed foreign or domestic publication recommended by the CCSES. The articles will contain information about the identification registration number and the name of the project under which it is funded, with grant financing specified as the source. One of the articles will be classified as multidisciplinary based on the results of testing a prototype medical system in the clinic of JSC "National Scientific Medical Center" (Astana). 7) Scientific and technical documentation will be developed for a system for monitoring, measuring, and analyzing vital signs of patients with metabolic syndrome in Kazakh and Russian languages. 8) The results of the work will be distributed among the medical clinics of the Republic of Kazakhstan. 9) A textbook will be published with the heading of the REMC "Information and Communication Technologies in Medicine" in the Kazakh language. 10) 2 copyright certificates (https://qazpatent.kz/) for a mathematical model and a prototype of a medical information system will be obtained. 11) 1 (one) Doctors of Philosophy (PhD) will be prepared. Achieved Results 1) Collection and classification of data of patients with metabolic syndrome in clinics of Almaty have been carried out (Ethics Committee approval, protocol No. IRB-A927 (No. 85) dated 22.10.2024). 2) Construction of a mathematical model of the clinical protocol for making a preliminary diagnosis and development of an algorithm have been completed. 3) Classification of patient data has been performed and the algorithm and mathematical model of the diagnostic protocol have been developed. 4) Connection and configuration of IoT devices, boards, and sensors have been carried out; qualitative and quantitative evaluation of their performance will be conducted. 5) Convenient and effective methods of use by patients have been determined. 6) 2 articles have been published in peer-reviewed
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	journals recommended by CCSES. 7) 1 article has been published in a peer-reviewed journal indexed in Science Citation Index Expanded (Q2).
Research team members with their identifiers (Scopus Author ID, Researcher ID, ORCID, if available) and links to relevant profiles	Pyrkova Anna Yuryevna Scopus Author ID: 56278365200 ORCID: 0000-0001-8483-451X ResearcherID: O-2606-2014 Ordabayeva Gulzinat Koishyamanovna Scopus: 57218956952 ORCID: 0000-0001-9952-1620 Zueva Ekaterina Alexandrovna Scopus: 58097444900 ORCID: 0000-0003-0762-6260 Temirbekova Zhanerke Erlanovna Scopus: 57477869500 ORCID: 0000-0003-3909-0210 Ivashchenko Anatoliy Timofeevich Scopus: 35615666700 ORCID: 0000-0002-7969-2016 Seitaliyeva Aida Murzekenovna Scopus: 57193346937 ORCID: 0000-0003-0177-5599 Akhayeva Tamila Abdikalikovna Scopus: 42561001600 ORCID: 0000-0003-1929-4494 Akimniyazova Aigul Nurlankyzy Scopus: 57194415971 ORCID: 0000-0001-7283-3958 Akhayeva Aizhan Abdisadikova ORCID: 0009-0007-4741-6109 Yeren Nurganym Yerenkyzy
Usage	- Medical institutions (clinics, hospitals) - Remote patient monitoring - Personalized medicine - Prevention of chronic diseases - Telemedicine and rural medicine
Priority compared to real-world alternatives	Advantages of the project: • Narrow specialization on metabolic syndrome (more accurate diagnostics) • Integration of mathematical model + IoT + mobile application • Use of SD-WAN for secure data transmission • Application of homomorphic encryption • Focus on accessibility and ease of use Compared to systems such as Inspiren or Dusun: • deeper clinical analysis • adaptation to the national healthcare system • proprietary diagnostic algorithms
List of publications with links to them	1. Pyrkova A.; Akhmetova K.; Zhanuzakov M.; Tauassarova M.; Rakhmetulina A.; Niyazova R.; Orazova S.; Zielenkiewicz P.; Ivashchenko A. Regulatory

	Potential of piRNAs Targeting Klotho and Other Genes. // Genes, 2026, 17(2), 241, https://doi.org/10.3390/genes17020241 — Q2, percentile 58%, SJR 0.61. 2. Seitaliyeva A.M., Akhayeva T.A., Pyrkova A.Yu., Akimniyazova A.N., Akhayeva A.A., Zhalimbetova Zh.N., Ryspekova Sh.O., Dushimova Z.D. Analysis of the prevalence of metabolic syndrome and obesity among the population of Almaty. // Astana Medical Journal, Volume 125, Number 5, Astana, 2025. - https://doi.org/10.54500/2790-1203-2025-5-125-amj010 ISSN 1562-2940 (print), 2790-1203 (online) 3. Dzhsupbekova G., Ordabayeva G., Beketova A., Baispay G. Applying Artificial Intelligence Methods to Detect Network Traffic Anomalies. // Bulletin of the Academy of Civil Aviation of the Ministry of Science and Higher Education of the Republic of Kazakhstan, No. 3(38), Almaty, 2025. - https://doi.org/10.53364/24138614_2025_38_3_9 ISSN: 2413-8614 ISSN: 3079-2363 (Online)
Patents	-