**Brief information about the project**

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| Title | Development of the humanoid robot Zhugirmek v1.0 |
| Relevance | Today, the fields of robotics and artificial intelligence are rapidly developing and are widely applied in medicine, industry, education, and everyday life. Humanoid robots represent one of the most complex and promising directions, as they can mimic human movements and establish natural interactions with people.<br>The relevance of the Zhugirmek v1.0 project includes:<br>The absence of a domestic humanoid robot in Kazakhstan;<br>The scientific and applied importance of the project — structural, kinematic, and strength analyses will be conducted, and a functional prototype will be developed;<br>Control via exosuit — a unique approach enabling intuitive motion-based control;<br>Use of affordable and accessible technologies such as Jetson, Raspberry Pi, Arduino, making the project cost-effective and widely applicable;<br>Social significance — the robot can be used in hazardous or hard-to-reach environments (mines, military zones, healthcare, elderly care, inclusive environments).<br>The Zhugirmek v1.0 project will elevate Kazakhstan's robotics industry to a new level and increase its international visibility. It will foster a culture of robotics development in the country, support the training of skilled personnel, and contribute to technological advancement. |
| Goal | The goal of the project is to solve structural, kinematic, and strength analysis of the Jugirmek v1.0 robot. Calibration method for remote control, unaffected by human-robot physical differences, will be developed. The goal is to streamline computations in modeling and problem-solving, offering a universal method for human-robot movement control. |
| Tasks | Perform structural analysis of the Zhugirmek v1.0 robot;<br>Conduct direct and inverse kinematic calculations;<br>Develop a 3D model using SolidWorks;<br>Perform strength (stress and deformation) analysis;<br>Design and build an exosuit control system;<br>Develop an autonomous control system using Jetson, Raspberry Pi, and Arduino;<br>Install and integrate cameras and sensors;<br>Write and publish scientific articles;<br>Develop an experimental working prototype. |
| Expected and Achieved Results | 2025:<br>Structural, kinematic, and strength analysis of the Zhugirmek v1.0 humanoid robot will be conducted. The structural scheme, joint parameters, working space, drive moments, and both forward and inverse kinematics will be determined.<br>An optimized 3D model will be created in SolidWorks.<br>Based on initial results, one scientific article will be prepared for publication in a journal indexed in Scopus or Web of Science.<br><br>2026:<br>Two articles will be prepared: one for an international conference (ICHRI 2026) and one for a domestic scientific journal. Both will include the project registration number and grant funding acknowledgment. |

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| | Strength and deformation analyses will be conducted, and critical points identified.<br>The working area of the Zhugirmek v1.0 robot will be specified.<br>A remote-control exosuit will be developed and integrated into the system.<br>The project results will be used as the basis for a doctoral dissertation defense.<br><br>2027:<br>A motion control system for the Zhugirmek v1.0 robot will be developed.<br>Drive forces and torque moments will be calculated; automatic control algorithms will be implemented.<br>A sensor-based autonomous control system will be developed using a Jetson microprocessor.<br>An experimental working prototype will be built and tested.<br>A patent from the Republic of Kazakhstan is expected to be obtained.<br>Based on final results, one more scientific article will be submitted to a high-impact journal indexed in Scopus or Web of Science. |
| Names and Surnames of Research Group Members with Their Identifiers (Scopus Author ID, Researcher ID, ORCID, if available) and Links to Corresponding Profiles | 1. Zholdassov Yernar, Scopus:H-index 2, https://orcid.org/0000-0002-1221-4474, https://www.scopus.com/authid/detail.uri?authorId=57305684300 Web of Science: H-index 0, ResearcherID: ABD-6982-2020<br>2. Baigunchekov Zhumadil, Доктор технических наук, Профессор, Scopus: H-index 5, https://www.scopus.com/authid/detail.uri?authorId=6506823633 ORCID iconhttps://orcid.org/0000-0002-5807-0541, Web of Science: H-3, AAA-9038-2020 |
| Publications list with links to them | 1. Ж. Т. Жумашева, Б. М. Сагитжанов, С. Ә. Төленов, Е. Н. Жолдасов, А. М.толеушова, Н. К. Досмагамбет, З. А. Рахматулла, "Структурно – параметрический синтез параллельного манипулятора с двумя схватами", Вестник Национальной инженерной академии Республики Казахстан. 2024. № 3 (93), стр. 53-62. https://doi.org/10.47533/2024.1606-146X.49<br>2. С. А. Толенов*, Б. М. Сагитжанов, Е. Н. Жолдасов, А. М. Толеушова, Н. К. Досмагамбет, З. А. Рахматулла, А. Т. Искакова, "СТРУКТУРНО-ПАРАМЕТРИЧЕСКИЙ СИНТЕЗ ПАРАЛЛЕЛЬНОГО МАНИПУЛЯТОРА С ДВУМЯ ПОЛЗУНАМИ", Вестник Национальной инженерной академии Республики Казахстан. 2023. № 4 (90), стр. 106-114. https://doi.org/10.47533/2023.1606-146X.39<br>3. Ж. Т. Жумашева, Б. О. Аманов*, С. Ә. Төленов, Б. М. Сагитжанов, Е. Н. Жолдасов, А. М. Толеушова, Н. Қ. Досмағамбет, З. А. Рахматулла, "КИНЕМАТИКА РУКИ ГУМАНОИДНОГО РОБОТА С ШЕСТЬЮ СТЕПЕНЯМИ СВОБОДЫ", Вестник Национальной инженерной академии Республики Казахстан. 2024. № 2 (92), стр. 27-35. https://doi.org/10.47533/2024.1606-146X.23<br>4. Daniyar Sultan, Batyrkhan Omarov, Zhazira Kozhamkulova, Gulnur Kazbekova,Laura Alimzhanova, Aigul Dautbayeva, Yernar Zholdassov, Rustam Abdrakhmanov, "A Review of Machine Learning Techniques in Cyberbullying Detection", Computers, Materials and Continua, 2023, 74(3), страницы 2625–2640, http://dx.doi.org/10.32604/cmc.2023.033682 |

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| | 5. Zhumadil Baigunchekov, Med Amine Laribi, Giuseppe Carbone, Azamat Mustafa, Bekzat Amanov, Yernar Zholdassov, "Structural-parametric synthesis of the robomech class parallel mechanism with two sliders", Applied Sciences (Switzerland), 2021, 11(21), 9831, https://doi.org/10.3390/app11219831<br>6. Zhumadil Baigunchekov, Giuseppe Carbone, Zhadyra Zhumasheva, Bekzat Amanov, Yernar Zholdassov, Serik Tolenov, Alibek Tleukhanov, Kinematics of the “Ai-Gerim” Robot Arm, Mechanisms and Machine Science, 2022, 120 MMS, страницы 11–18, https://doi.org/10.1007/978-3-031-04870-8_2<br>7. Zh. Baigunchekov, M.A. Laribi, R. Kaiyrov, E. Zholdassov, Inverse Kinematics and Workspace of a 3-PRRS Type Parallel Manipulator, Mechanisms and Machine Science, 2021, 103, страницы 71–78, https://doi.org/10.1007/978-3-030-75271-2_8 |
| Patent information | Гуманоидный робот-экскурсовод (Humanoid Guide Robot). Registration Number: 2023/0341.1 |