R&D Project Overview «Water Watch AI Plus»

Creation of a digital platform for monitoring and forecasting water resources in the Kyrgyz Republic to ensure sustainable management of limited water resources and minimize the risks of water scarcity, pollution, and irrational use.

Contact Person:
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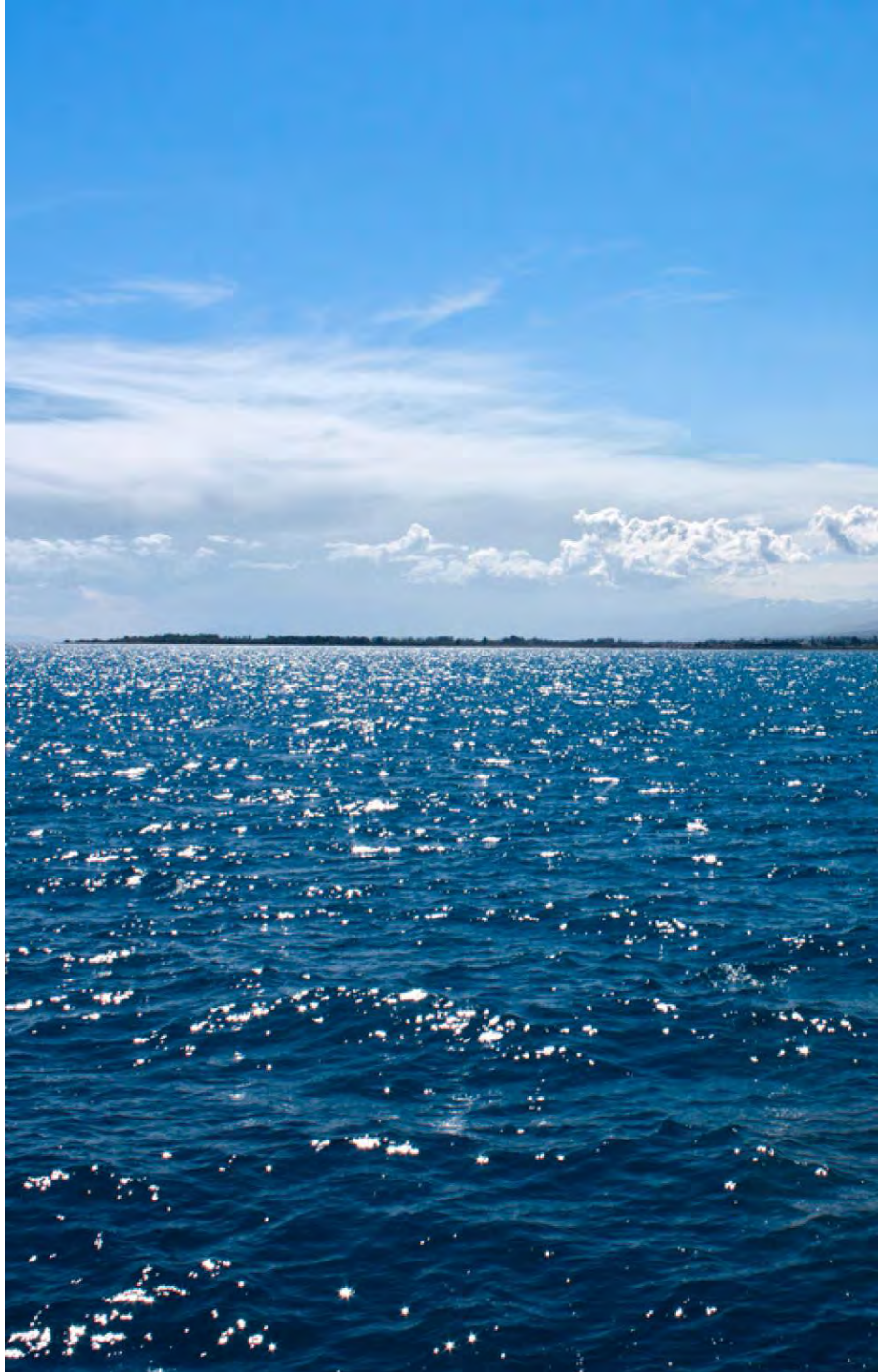


Research Background

What we know at the start of the project

The Challenge

The Kyrgyz Republic is one of the countries with abundant water resources. The country is one of the leaders among Central Asian countries in terms of water availability (the Republic of Tajikistan ranks first). The total volume of available water resources in Kyrgyzstan is estimated at 2,458 cubic kilometers, including 650 cubic kilometers of water (26.4%) stored in glaciers, 1,745 cubic kilometers in lakes (71%), as well as 13 cubic kilometers of potential groundwater reserves (0.5%) and 44.5 to 51.9 cubic kilometers of average annual river flow, or 2%.

It is important to note that water resources are unevenly distributed across the country, and Kyrgyzstan itself uses 20-25% of the total runoff. It is known that up to 95% of water in Kyrgyzstan is used for irrigation and agricultural water supply. At the same time, in all regions, the withdrawal of water resources from sources exceeds their use, and domestic, industrial, and other water consumption is minimal.

Existing Studies & Current Results
Pros and Cons

Currently, there are a number of organizations in the field of water resources management that implement their own policies and projects, namely:

- Hydrometeorological Service under the Ministry of Emergency Situations of the Kyrgyz Republic
- Institute of Water Problems under the National Academy of Sciences of the Kyrgyz Republic
- Water Resources Service under the Ministry of Internal Affairs, Agriculture, and Food of the Kyrgyz Republic
- Central Asian Institute for Applied Earth Research (CAIAR)
- Higher education institutions under the Ministry of Education and Science of the Kyrgyz Republic

There are a number of challenges facing all organizations involved in addressing the issue of rational use of the country's water resources in the context of climate change:

- Technical wear and tear and obsolescence of the network of permanent and manual hydrometric monitoring stations
- Low level of digitization of processes and limited use of modern information technologies, including artificial intelligence
- Low level of maturity of analytical culture and data-driven decision-making
- Lack of open access to hydrometric data collected by the Hydrometeorological Service under the Ministry of Emergency Situations of the Kyrgyz Republic
- Lack of motivation for cooperation and collaboration among individual organizations
- Lack of systematic funding for initiatives from donors and government authorities
- Lack of public awareness of the risks of irrational use of water resources

"Макулдашылды"
Кыргыз Республикасынын Экономика
жана коммерция министрлигине караштуу
Монополияга каршы жөнгө салуу кызматы

2023-ж.

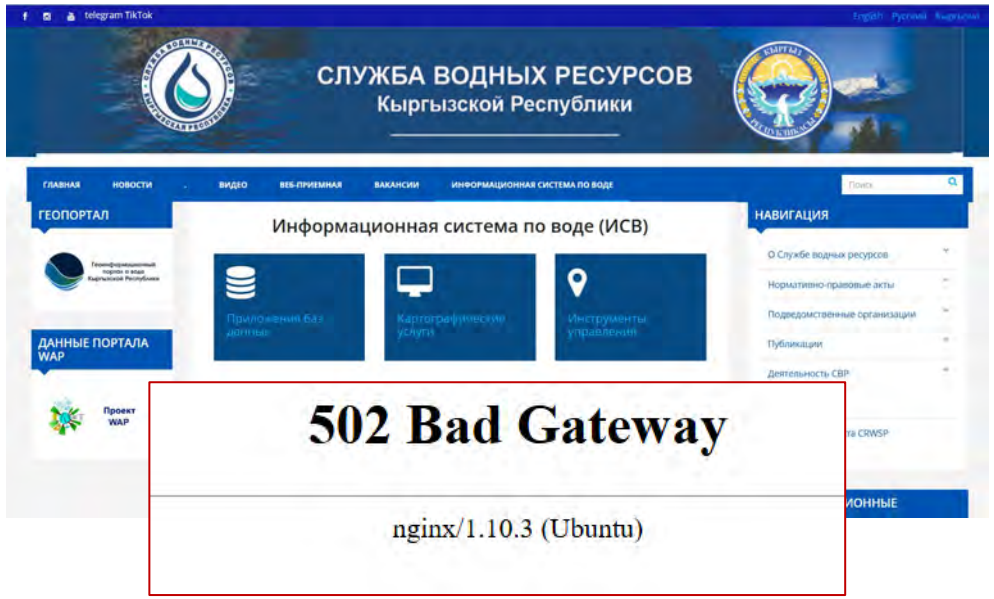
"Бекитилди"
Кыргыз Республикасынын
Өзгөчө кырдаалдар министрлиги

2023-ж.

Кыргыз Республикасынын Өзгөчө кырдаалдар министрлигине караштуу Гидрометеорологиялык кызматы тарабынан берилүүчү акы төлөнүүчү кызматтын баалардын прейскуранты

Баштапкы маалымат.

	Баштапкы маалымат үчүн акы төлөнүүчү кызматка кирген жумуштардын аталышы.	Маалыматтын баасы (сом)			
		Сутка	Пятида	Декада	Ай
	Гидрологиялык маалымат.				
1	**Суунун деңгээли**				
	Рейка боюнча деңгээл	15	20	25	38
	Өзү жазуучу аспап боюнча деңгээл	15	50	88	213
2	**Агымдын тереңдиги**				
	10 вертикал боюнча гидроствордогу тереңдик	15	63	125	375
	10 вертикал боюнча узунунан кеткен тереңдик	15	38	75	225
3	**Суунун чыгымы**				
	Деңгээл боюнча эсептелген чыгым	15	25	50	125
	10 вертикал боюнча агымдын ылдамдыгы	15	25	50	125
	Өлчөнгөн чыгым	15	25	50	125
4	**Суу үстүндөгү буулануу**	15	25	50	125
5	**Суунун мөөнөттөгү температурасы**	15	25	50	125
6	**Толкундоо**	15	25	50	125
7	**Муз кубулуштары**				
	Шыргаландын катмарынын калыңдыгы	15	25	50	125
	Бир чуңкурдагы муздун калыңдыгы	15	25	50	125
	Муз түзүлүшүнүн түрү .	15	25	50	125
	Муздун үстүнкү катмарынын абалы жана мүнөздөмөсү	15	25	50	125
	Бөгөп калуулардын жана үйөрлөрдүн болуусу	15	25	50	125
8	**Суунун күңүрттүүлүгү**				
	Шиленділердин салмакталган чыгымы (бир вертикал боюнча)	15	25	50	125
9	**Жер астындагы катмарлар**				



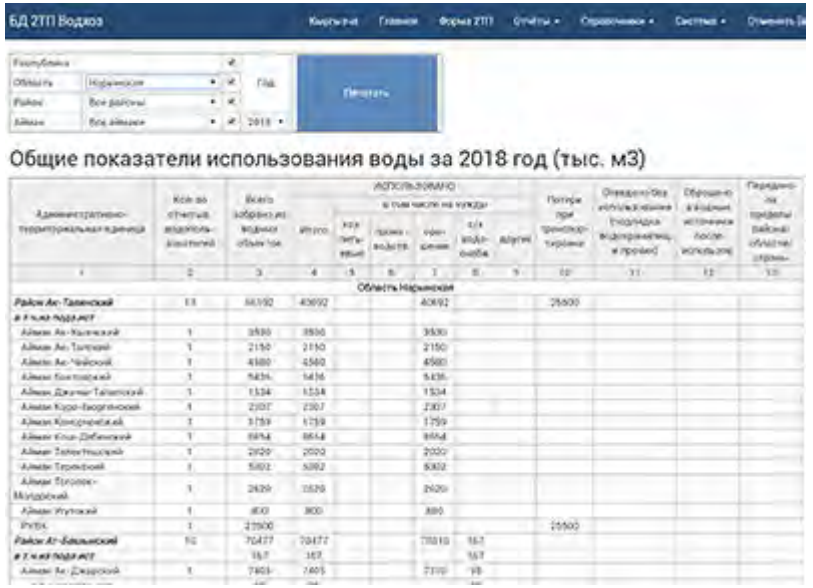
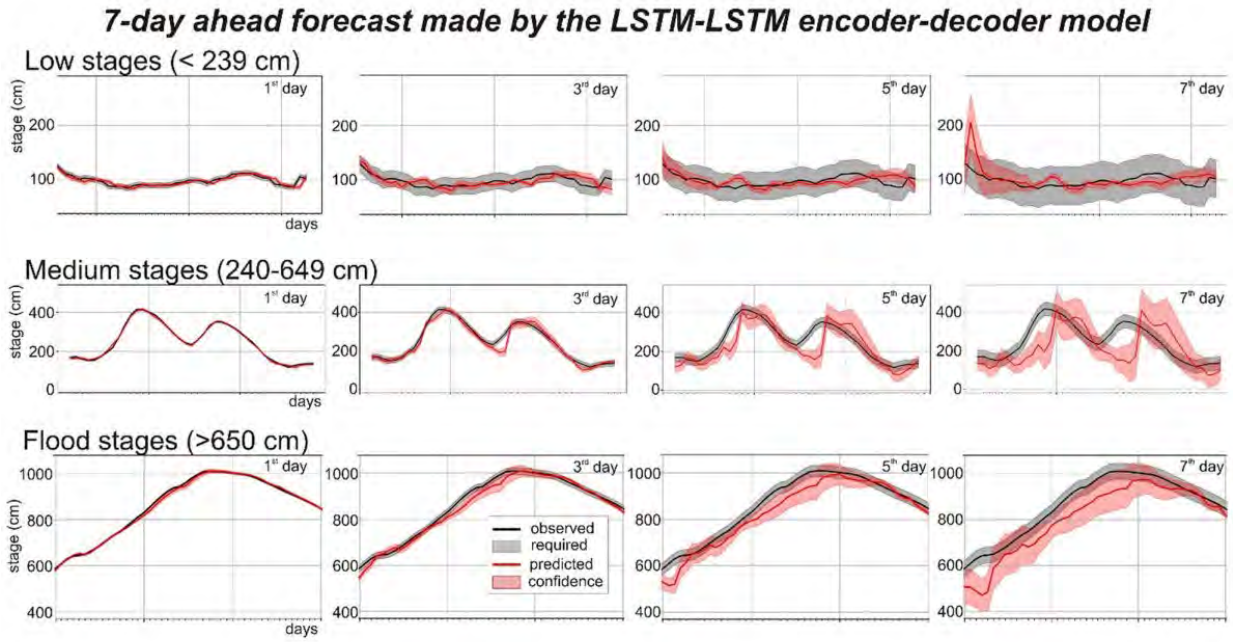
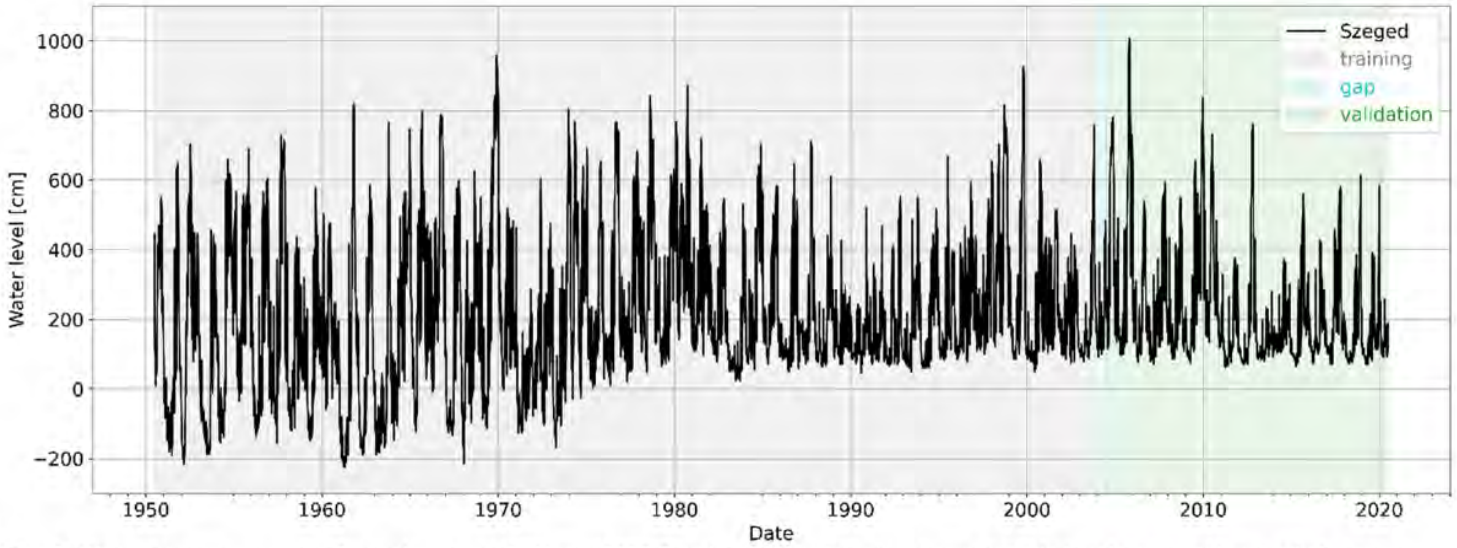


Fig. 1 The study area is the Tisza River in Central Europe. The input data of the model created for Szeged originate from 11 upstream and downstream gauging stations





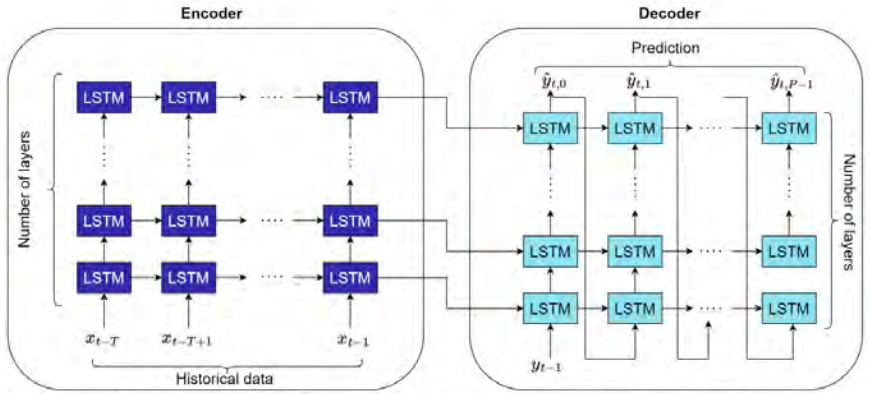


Fig. 3 Architecture of the LSTM encoder–decoder model. T is the number of past data, P is the length of the prediction (forecast horizon). The y_{t-1} is the real (known) target data at the t−1 time point, and $\hat{y}_{t,j}$ is the prediction given at the time t−1 for the date t+j

Fig. 2 Water stages measured at Szeged between 1951 and 2020. The data were split to training and validation datasets with a gap in between

Project Resume

The Objective:

Create a prototype digital platform for monitoring and forecasting water resources in the Kyrgyz Republic to ensure sustainable management of limited water resources and minimize the risks of water scarcity, pollution, and irrational use.

Expected Result:

Achieving a balance between the environmental, economic, and social interests of the population.

Project Duration:

Phase 1. January – December 2026
Total Project Duration – 3 years

Amount of financing requested :

The total amount for the first phase of the project is **4,300,625 KGS**,
including: first half of 2026 – **1,984,375 KGS**, second half of 2026 – **2,316,250 KGS**.

Project Operator:

OSCAR & SONS: Research & Development – KyrgyzIndustrialTechnologies LLC dba (KIT LLC)

UNDP SDGs match

UNDP’s Sustainable Development Goals

The project is aimed at the following UNDP’s sustainable development goals:

- Good health and well-being
- Clean water and sanitation
- Responsible consumption and production
- Sustainable cities and communities
- Life on land

Specific challenges and needs of the target audience

Segments	Challenge	Need
State Agencies	1. Ensuring sustainable management of **limited water resources** and **minimizing the risks** of water scarcity, pollution, and irrational use 2. Cooperation **with neighboring states** on transboundary water resources	Have access **to forecasting results and recommendation services** for planning actions and measures to ensure sustainable management of limited water resources and minimize the risks of water scarcity, pollution, and irrational use.
Households	1. Rolling water shutoffs for the population 2. Low level of water treatment and quality in the regions 3. Level of wear and tear on water supply systems	To be able **to obtain information on the state of water supply systems**, water distribution and supply regimes, pollution levels, and water quality in order to provide feedback and submit requests to local authorities with the aim of taking measures to improve the population's access to clean water.
Agriculture Businesses	1. Opaque and unpredictable access to crop irrigation 2. Wear and tear on irrigation systems 3. Inefficient use and significant water losses	Have **transparent access to forecast and actual data** on water supply and consumption **for planning irrigation activities and minimizing inefficient use of irrigation water.**
Scientific Community	1. Lack of access to data for conducting fundamental research 2. Lack of access to the results of research conducted by other research groups	Have **transparent access to water resource** data for **fundamental and applied scientific research** and to develop collaboration between research groups.
Business Community	1. Inefficient use and significant water losses by water consumers 2. Inefficient water supply planning by regulatory authorities 3. Wear and tear of irrigation systems 4. Low level of water treatment and quality in regions 5. Level of wear and tear of water supply systems	Have transparent access to data on the needs of water suppliers and consumers in order to create commercial solutions for customers using the implementation of advanced technologies for rational water use.

Expected Results

The expected outcome of achieving this goal is to strike a balance between the environmental, economic, and social interests of the population, including:

1. Creating an effective mechanism **for monitoring and forecasting** water resources.
2. Improving the **decision-making process** for water resource management.
3. **Reducing the risks** of water shortages and related conflicts.
4. Increasing the **sustainability of agriculture and other water-dependent** sectors of the economy.
5. Raising awareness and **improving the skills of specialists** and the local population in the field of water use and ecology.

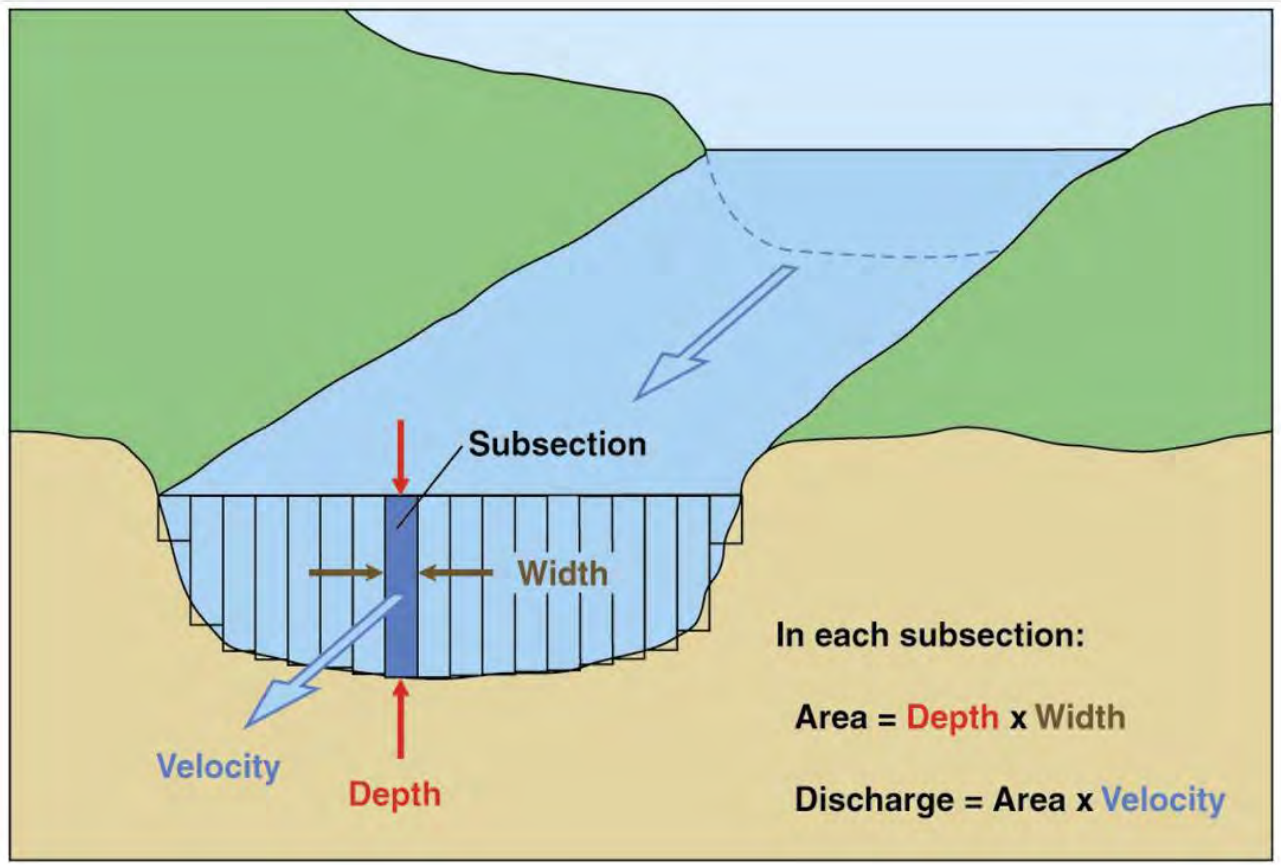
Key milestones of the first year of the project

Phase 1 – Preparatory (3 months). The main tasks of this phase include collecting and analyzing available data on water resources, auditing existing scientific research and analyzing its results, forming a project team, establishing partnerships and institutional cooperation with key project stakeholders, including gathering requirements and expectations.

Phase 2 – Solution Development (6 months). Iterative creation of a prototype solution, including the design, development, and testing of digital platform components based on theoretical and real monitoring data. Configuration of artificial intelligence algorithms and models.

Phase 3 – Implementation and evaluation (3 months). This stage involves the pilot implementation of the digital platform prototype, evaluation of its effectiveness, and the necessary training of representatives of key stakeholders and project partners. The key outcome of this iteration is the creation of a digital platform prototype, as well as its pilot implementation, evaluation, and presentation of results at the KIT Forum 2026.

Technique for calculating water consumption



$$Q = \sum_{i}^{n} q_i = \sum_{i}^{n} v_i a_i = \sum_{i}^{n} v_i (w_i d_i) \qquad 5.1$$

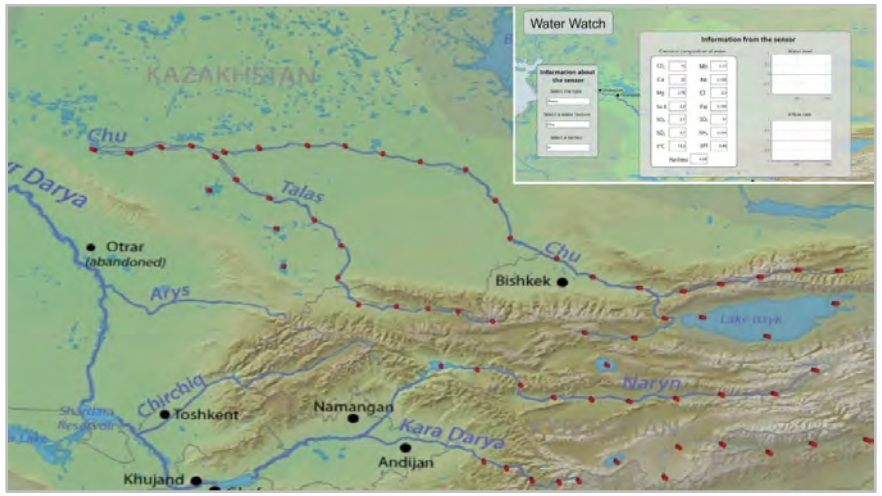
where

Q = total stream discharge
q_i = discharge in subsection i
v_i = mean flow velocity normal to subsection i
a_i = crossectional area of subsection i
w_i = width of subsection i

$$= \begin{cases} \frac{b_2 - b_1}{2} & \text{if } i = 1; \\ \frac{b_{i+1} - b_{i-1}}{2} & \text{if } 2 \le i \le n-1; \\ \frac{b_n - b_{n-1}}{2} & \text{if } i = n \end{cases}$$

d_i = depth of subsection i
b_i = distance from shoreline datum to center of subsection i
n = number of subsections dividing the stream crossection

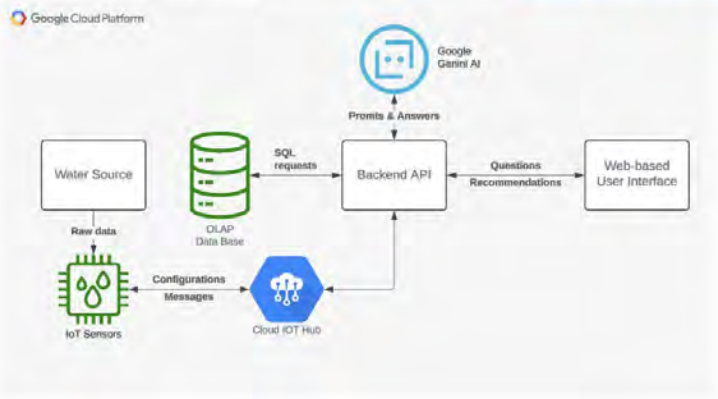
Concept Technical Solution



Google Gemini

Solution Architecture

Link to the MVP



Solution Demonstration

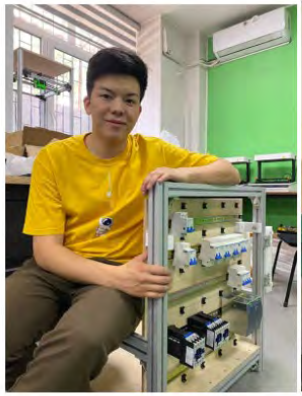
Link to the MVP

The Team

The project team is a cross-disciplinary team that includes full-time and external consultants from various subject areas, including:

- Chemical technology and water resources ecology
- Hydrology and hydrometry of water resources
- Instrument engineering and electronics
- Mathematical modeling and simulation
- Decision-making theory and project management
- Information technology, web programming
- Data science and artificial intelligence

The team members and specialists are representatives of the scientific, educational, and business communities who possess the necessary and sufficient competencies to implement the project.



DEEP TECH PIONEERS
hello tomorrow


Oman Abyshev
Smart Ozonator AI

Results

Awards

- **Astana Digital Bridge 2025** – AI Science section Finalist
- **HTP x MIT DeepTech Program** – Finalist
- **II Place Award** at Green Spark Contest Uzbekistan – 2025
- **Gran Prix for the Best Scientific Project** at the International Conference on Industry 4.0 Technologies
  Prize for the Best Scientific Report at the International Conference on Industry 4.0 Technologies
- **I Place Award** at “100 Ideas for Kyrgyzstan” by government of the Kyrgyz Republic – 2024
- **II Place Award** at “Alatoo Hub Battle” by Center of Innovation and Research – 2024
- **Finalist** of the “Deep Tech Pioneer” by Hello Tomorrow – 2024
- **Finalist** of the “Build with AI 2024 Hackathon” by Google – 2024
- **Finalist** of the “Youth Cup for Green Solutions” by Aga Khan Fund – 2024
- **I Place Award** – Make-A-Thon

Research Papers Published

BIO Web of Conferences 160, 02003 (2025) https://doi.org/10.1051/bioconf/202516002003
EESTE2024

Study and assessment of qualitative indicators of water sources in the Issyk-Kul mountain ecosystem

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[1]I. Balasagyn Kyrgyz National University, Bishkek, Kyrgyz Republic
[2]Kyrgyz State Medical Academy named after I. K. Akhunbaev, Bishkek, Kyrgyz Republic

Abstract. In the work for the subsequent creation of models for forecasting and assessing the quality of water sources using machine learning methods on the basis of the obtained data, the selection and justification of research objects (water resource of the Issyk-Kul region) was carried out. Systematization of water resource objects (lake, river, waste, surface and groundwater) was carried out. Data collection for water quality testing in the Issyk-Kul region was carried out, including organoleptic indicators of investigated water samples from different sources (color, taste, odor, turbidity), determination of water hardness, assessment of heavy metal pollution - cation content (total iron), pH and temperature of water samples from each source. The qualitative characterization and systematization of the obtained data on water samples of different sources were studied and systematized to contribute to the database of future machine learning algorithms, which can be used as tools for analysis and prediction of water resources results.

1 Introduction

Nowadays, the search for ways to solve the main ecological problem, which is related to the protection of the environment from the impact of increased growth in the level of technogenic load on various sectors of our life activity, is becoming more urgent. A comprehensive approach to solving this problem includes new approaches to the use of estimation models and machine learning algorithms for the possible prediction of geo- and biological resources and their distribution [1-4].

The group of such resources includes: raw materials, biodiversity, coal and oil deposits, soil, water and others. The range of these resources, their internal interrelation, as well as the issues of rational use are quite relevant and in demand both for us and the whole region of Central Asia. This relationship is determined primarily by the fact that the presence of a large number of technogenic zones, in general, determines the state of the entire mountain ecosystem, its stability, the state of parameters of basic resources and processes responsible for the livelihood of the population of mountain territories [5-6].

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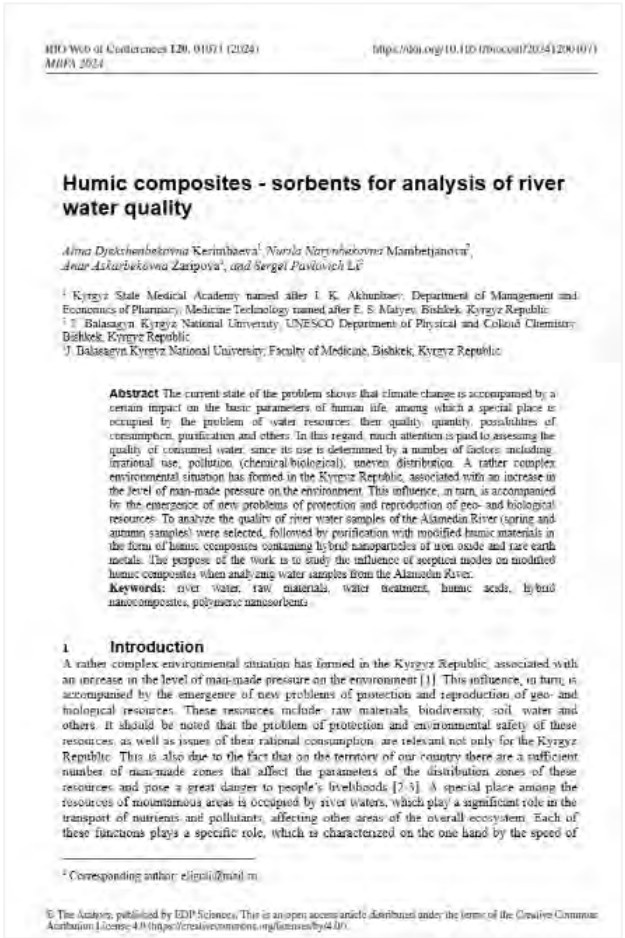

BIO Web of Conferences 120, 01071 (2024) https://doi.org/10.1051/bioconf/202412001071
MHFA 2024

Humic composites - sorbents for analysis of river water quality

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[1] Kyrgyz State Medical Academy named after I. K. Akhunbaev, Department of Management and Economics of Pharmacy, Medicine Technology named after E. S. Matyev, Bishkek, Kyrgyz Republic
[2] I. Balasagyn Kyrgyz National University, UNESCO Department of Physical and Colloid Chemistry, Bishkek, Kyrgyz Republic
[3] I. Balasagyn Kyrgyz National University, Faculty of Medicine, Bishkek, Kyrgyz Republic

Abstract The current state of the problem shows that climate change is accompanied by a certain impact on the basic parameters of human life, among which a special place is occupied by the problem of water resources: their quality, quantity, possibilities of consumption, purification and others. In this regard, much attention is paid to assessing the quality of consumed water, since its use is determined by a number of factors: including irrational use, pollution, (chemical/biological), uneven distribution. A rather complex environmental situation has formed in the Kyrgyz Republic, associated with an increase in the level of man-made pressure on the environment. This influence, in turn, is accompanied by the emergence of new problems of protection and reproduction of geo- and biological resources. To analyze the quality of river water samples of the Alamedin River (spring and autumn samples) were selected, followed by purification with modified humic materials in the form of humic composites containing hybrid nanoparticles of iron oxide and rare earth metals. The purpose of the work is to study the influence of sorption modes on modified humic composites when analyzing water samples from the Alamedin River.

Keywords: river water, raw materials, water treatment, humic acids, hybrid nanocomposites, polymeric nanosorbents

1 Introduction

A rather complex environmental situation has formed in the Kyrgyz Republic, associated with an increase in the level of man-made pressure on the environment [1]. This influence, in turn, is accompanied by the emergence of new problems of protection and reproduction of geo- and biological resources. These resources include: raw materials, biodiversity, soil, water and others. It should be noted that the problem of protection and environmental safety of these resources, as well as issues of their rational consumption, are relevant not only for the Kyrgyz Republic. This is also due to the fact that on the territory of our country there are a sufficient number of man-made zones that affect the parameters of the distribution zones of these resources and pose a great danger to people's livelihoods [2-3]. A special place among the resources of mountainous areas is occupied by river waters, which play a significant role in the transport of nutrients and pollutants, affecting other areas of the overall ecosystem. Each of these functions plays a specific role, which is characterized on the one hand by the speed of

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DOI: 10.1051/bioconf/202412001071

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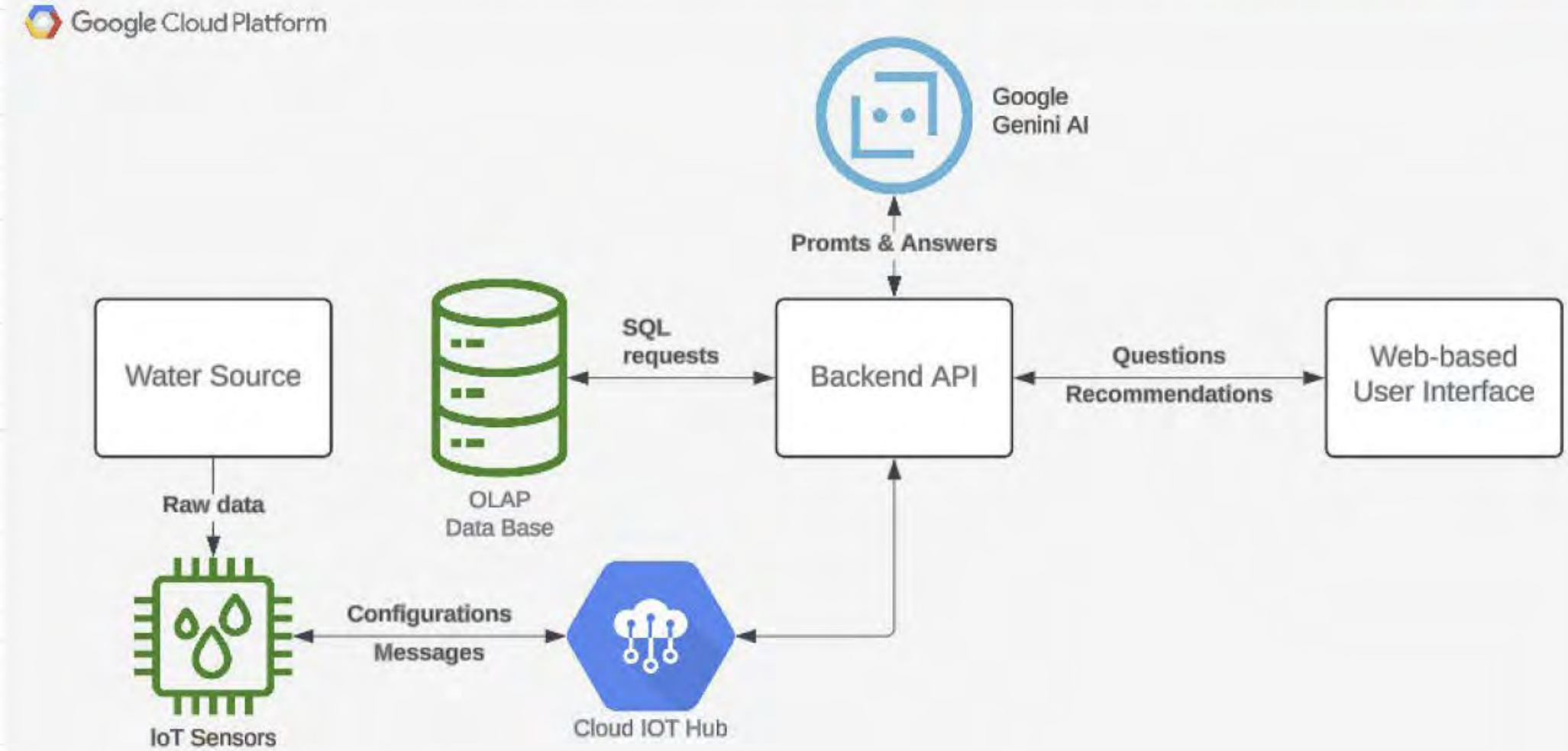
Application for a
Software Copyright Certificate

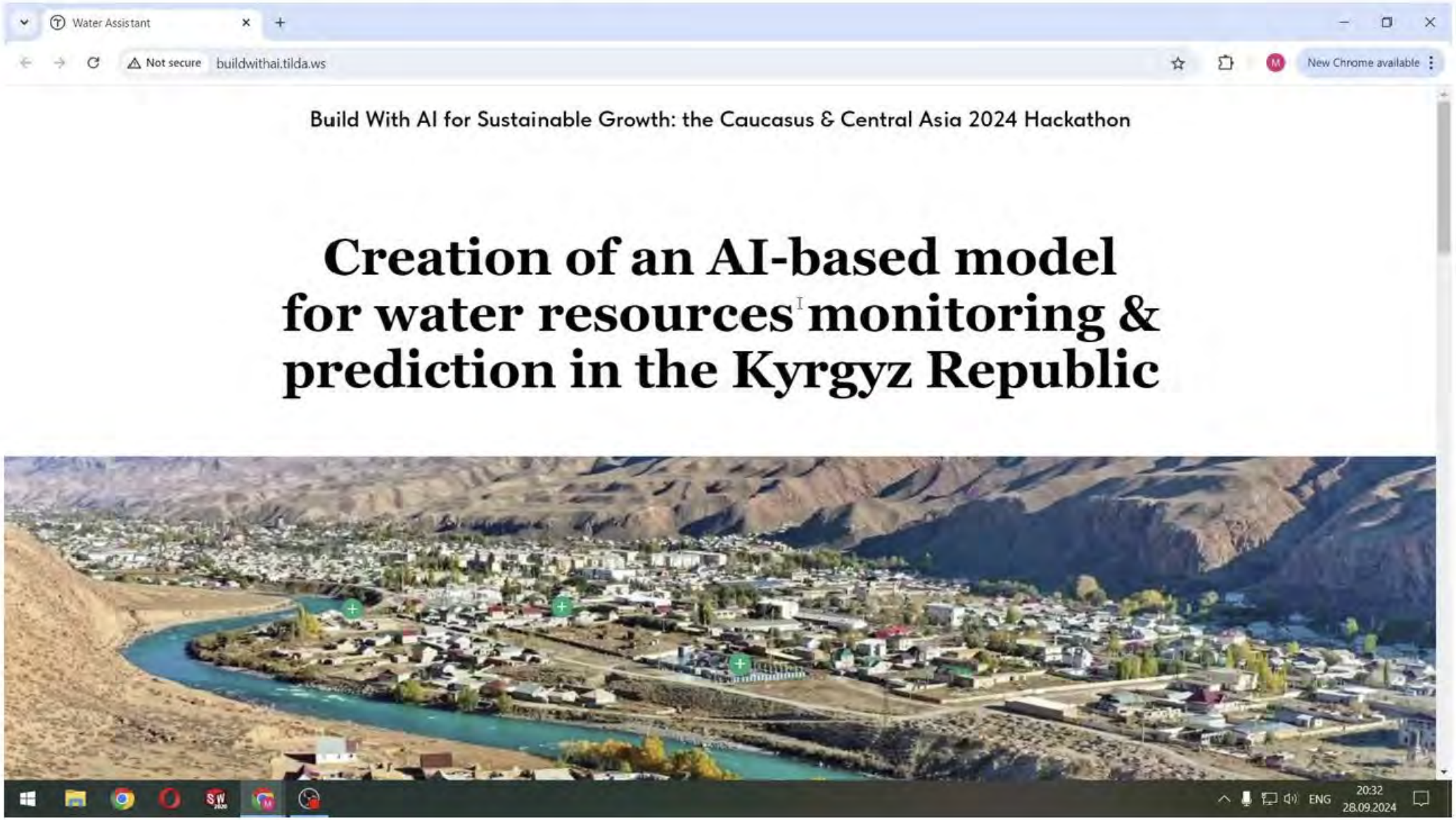
Solution Architecture

[Link to the MVP]



Solution Demonstration

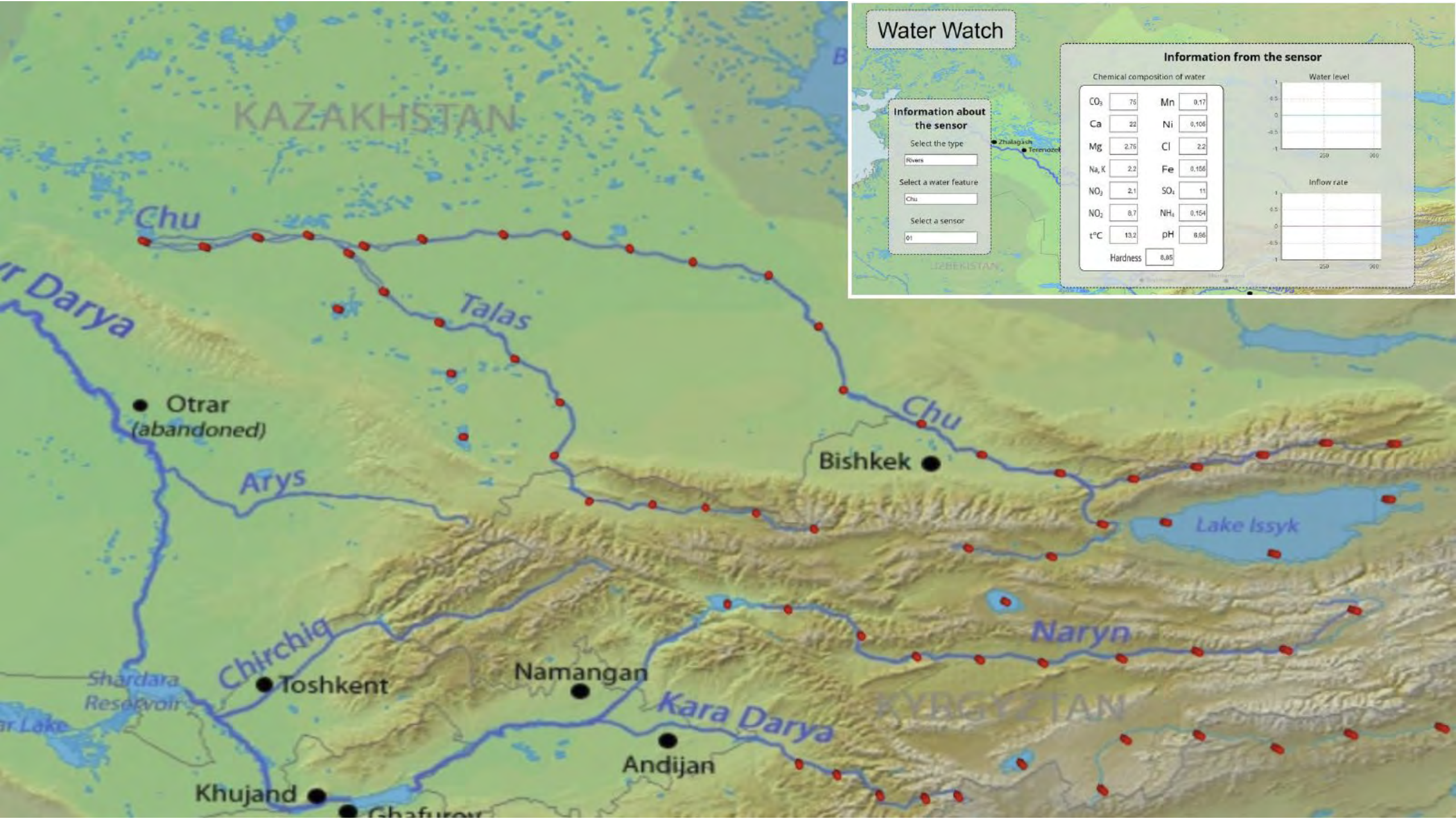
[Link to the MVP]



Results

Link to the MVP

- Web-based MVP using Gemini and GCP has been created
- Simulation model for Water Usage Management developed
- 20+ user interviews (scientists) has been conducted
- 5+ villages in Kyrgyzstan have started using the App
- 50+ users have started performance testing of the App
- we have presented the App to Kyrgyz State Water agencies


KAZAKHSTAN
Chu
Talas
Chu
Otrar
(abandoned)
Arys
Bishkek
Lake Issyk
Naryn
Chirchiq
Shardara
Reservoir
Toshkent
Namangan
Kara Darya
KYRGYZSTAN
Andijan
Khujand
Ghafurov
Water Watch
Information from the sensor
Chemical composition of water
Information about the sensor
Select the type
Rivers
Select a water feature
Chu
Select a sensor
01
Water level
Inflow rate
Zhalagash
Terenozek
UZBEKISTAN
CO3 75
Ca 22
Mg 2,75
Na, K 2,2
NO3 2,1
NO2 8,7
t°C 13,2
Mn 0,17
Ni 0,106
Cl 2,2
Fe 0,156
SO4 11
NH4 0,154
pH 8,66
Hardness 8,85

User Feedback

“The App requires more detailed management features in order to start using collected data from different water sources. You also need start thinking how you will place sensors on mountain peaks ...”

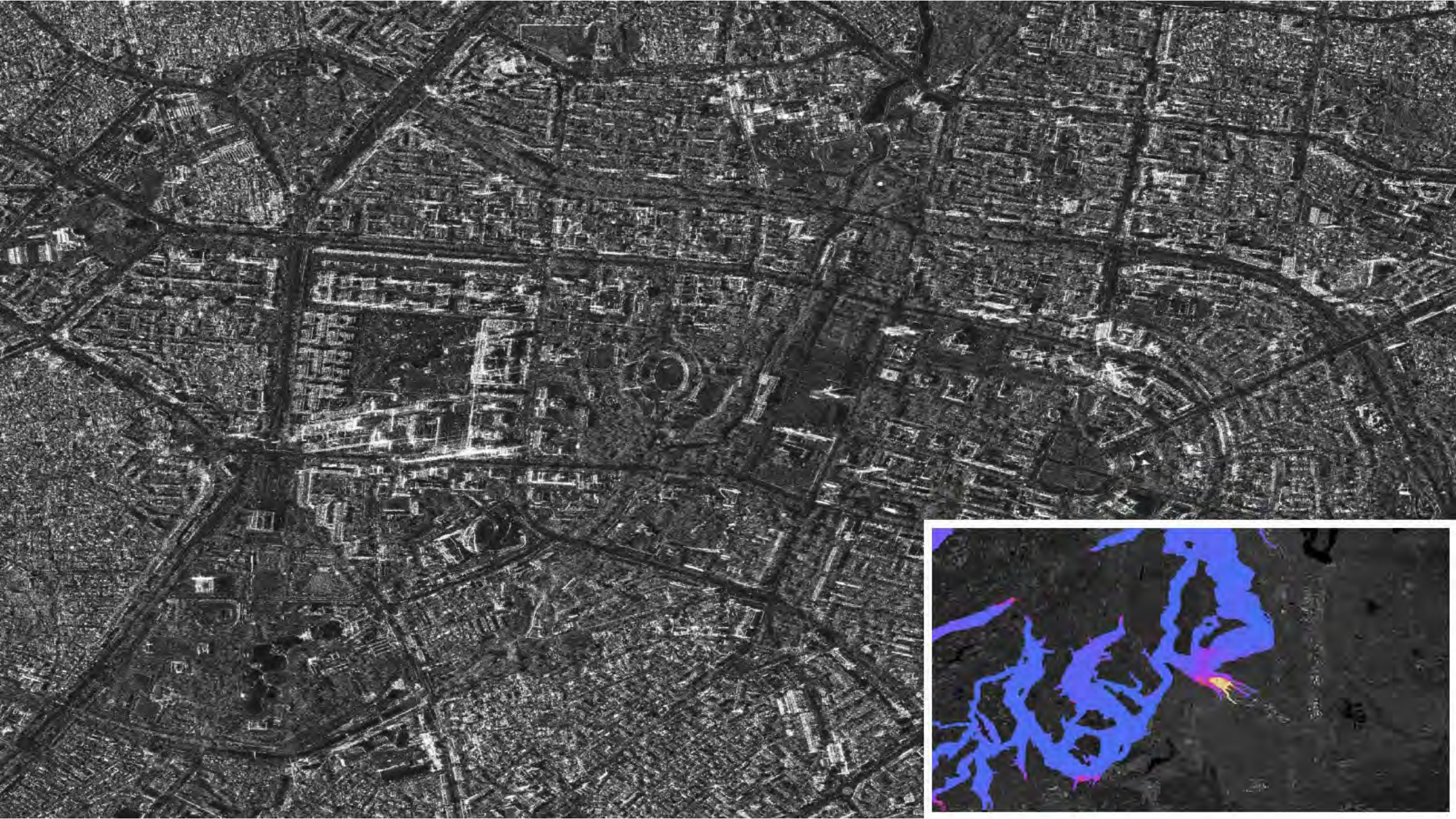
Kalipa Salieva, PhD, Kyrgyz-Turkish University

“This MVP is simple, but useful. I used the App to check the quality of water in my village in Naryn region. I have collected the data from the Archive and get interesting insights”

Meerim Abdykerimova, student at Kyrgyz Medical Academy

“This App is useful. I applied it to assess the level of water quality in Bishkek city. I recommend improving the site and adding a control panel for entering historical data on observations”

Bakyt Borkoev, Bishkek citizen



The Next steps

- Resolve bugs at Web UI
- Make robust Web App using Node.JS stack
- Get more historical data from States
- Finish up with hardware part and launch FAT in Kyrgyzstan
- Scale the solution for other countries in Central Asia region
- Update business model

Partners & Sponsors

High Technology Park
of the Kyrgyz Republic

The High-Tech Park of the Kyrgyz Republic is a zone with a high-tech park regime for legal entities and individuals who are residents of the High-Tech Park and operate in accordance with the provisions of the Law on the High-Tech Park.

The main objectives of the High-Tech Park include:

- developing the domestic software development industry, information, new, and high technologies
- creating a comprehensive system of state support for domestic knowledge-intensive businesses
- promoting the results of companies' scientific and technical activities on domestic and international markets, increasing exports of software development and information technology services
- attracting investment by creating a favorable tax and business environment for international representatives of the information technology development industry
- stimulating the development of science and education to increase the number of specialists in the field of information technology

Kyrgyz National University
named after J. Balasagyn

Preliminary fundamental research within the framework of this project was supported by the Institute of Fundamental Sciences at Zh. Balasagyn Kazakh National University.

The project “Optimization and management of water quality pollution control for the construction of regional water ecosystem models based on machine learning” will be implemented from January 1, 2024, to December 31, 2026.

The project is supported by the Ministry of Higher Education, Science and Innovative Technologies of the Kyrgyz Republic and is funded as a research grant.

The amount of grant funding is 7,800,000 soms ($89,142).

Investment Sources

Mixed financing is expected to be used for the implementation of this project, including:

- Attracting grant financing from the Kyrgyzstan High-Tech Park
- Attracting grant financing from donor organizations and international cooperation agencies (World Bank, GIZ, KOICA, JAICA)
- Attracting financing from the European Bank for Reconstruction and Development
- Attracting project financing from the German Research Foundation (DFG) for fundamental research
- KyrgyzIndustrialTechnologies LLC's own funds
- Participation in international competitions and hackathons

Risks

Risk Type	Mitigation Measures
Risk of insufficient or no access to data	Development of alternative solutions and information sources (for example, indirect satellite data).
Technical risks associated with software development and technology integration	Regular testing and involvement of experienced developers
Financial risks	Diversification of funding sources, thorough financial planning
Managerial risks	Clear distribution of roles, regular meetings and reporting

Assumptions

1. The High Technology Park is ready to support the project team in institutional cooperation with government agencies, scientific organizations, and the IT community.
2. The main stakeholders in the project are the Hydrometeorological Service under the Ministry of Emergency Situations of the Kyrgyz Republic, the Institute of Water Problems under the National Academy of Sciences of the Kyrgyz Republic, the Water Resources Service under the Ministry of Internal Affairs, Agriculture, and Food of the Kyrgyz Republic, and higher education institutions under the Ministry of Education and Science of the Kyrgyz Republic
3. The main stakeholders of the project will participate and provide the necessary support without hindering the implementation of the project.

Conclusion

The project aims to improve the efficiency of water resource management and forecasting in the Kyrgyz Republic, which is critically important given the limited availability of water resources and growing pressure from climatic, economic, and demographic factors.

The expected results and effects of the project will be achieved through the creation and implementation of a digital platform for monitoring and forecasting water resources in the Kyrgyz Republic to ensure sustainable management of limited water resources and minimize the risks of water scarcity, pollution, and irrational use.

A key advantage of the project is the implementation of a digital platform based on modern technologies, including artificial intelligence and automated monitoring, which will provide real-time access to up-to-date data, improve the accuracy of forecasts, and enhance the quality of decisions made. This, in turn, will minimize the risks of shortages, pollution, and inefficient use of water resources.

Thank you!

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