Berlin Water Hackathon 2021

// Creating sustainable water systems with open data

Online School & Hackathon

PROGRAMME & CHALLENGE CATALOG

BERLIN
Senatsverwaltung für Wirtschaft, Energie und Betriebe

BERLIN OPEN DATA

EINSTEIN CENTER Digital Future

idea
international alliance for digital e-learning, e-mobility and e-research in academia

INTRODUCTION

While Berlin might not make international headlines as 'a city on the verge of a water crisis', the German capital – just like many others worldwide – is also predicted to face more and **more water related challenges in the near future**. Recent years' extreme weather events have already shown us what's at stake. 2017, for instance, recorded the heaviest rainfall event of the last 110 years, with about a quarter of the normal annual rainfall volume falling in only 18 hours. Increasingly frequent **extreme rainfall events, summer droughts, and increased heat stress urge us to rethink the relationship between the city of Berlin and its urban water system.** Understanding the complex interconnections between water networks and other critical infrastructures is key in this mission. With a diverse range of smart initiatives showing the way to future proofing Berlin's water infrastructure, there is still plenty of space for future development and a number of challenges awaiting to be resolved.

The **'Berlin Water Hackathon 2021'** invites students and professionals from various disciplines to join forces and tackle some of these wicked water problems in a creative and collaborative manner. The online event will kick off with **3 days of lectures and workshops (20-22 January)** introducing the state of the art and hands-on case studies from Berlin and beyond. The second part of the event will comprise a **2-day hackathon (25-26 January)** supported by the Berlin Senate Department for Economics, Energy and Public Enterprises. The best team project will be awarded by a prestigious jury of experts!

PROGRAMME

		Wednesday 20.01.2021	Thursday 21.01.2021	Friday 22.01.2021		Monday 25.01.2021	Tuesday 26.01.2021
09.30 - 09.45	Lectures & Workshops	*Warm-up Quiz*	*Warm-up Quiz*	*Warm-up Quiz*	Hackathon	Thomas Krause (SenWiEnBe) *Welcome speech*	Hackathon
09.45 - 10.45		Andrea Cominola (TUB - ECDF) *Introduction* *Student presentations from previous schools*	Franz Tscheikner-Gratl (NTNU) *Integrated approach for multi-utility rehabilitation planning of urban water infrastructure*	Julia Zimmermann (Technologiestiftung Berlin) & Victoria Boeck (Open Data Informationsstelle) *Thirsty City Trees – Open Source, Data and Community can fix it*		Hackathon	
11.15 - 12.30		Felix Lorenz (TUB) *WaterGridSense 4.0 - Towards Scalable and Dependable Water Infrastructure Monitoring*	Elżbieta Jarosińska (CUT) *The Urban Green - solutions to increase bioretention and reduce runoff in the cities*	Matthias Schroeder (SenUVK) *Wasserportal, Data and Water Management* / Katharina Goergens (SenWiEnBe) *EnergieAtlas – An outlook on energy*			
12.30 - 14.00		*Lunch Break*	*Lunch Break*	*Lunch Break*			
14.00 - 17.00		Robert Szczepanek, Marek Bodziony, Beata Baziak (CUT) *WORKSHOP* *Urban Hydrology Modelling in Practice*	14.00 – 15.30 Jochen Rabe (TUB – ECDF - KWB) *Introduction to the concept of green-blue infrastructures* / 15.30 – 17.00 Justin Abbott (Arup) *Green-blue infrastructures in practice*	*WORKSHOP* *Hackathon brainstorming session*			14.30-17.30 Jury introduction HACKATHON PRESENTATIONS Evaluation & Announcement of winners

*Please note that the programme schedule might be subject to change.

CHALLENGE DESCRIPTIONS

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Challenge I

How to engage citizens in the management of urban green by digital means?

Description

Although urban regions provide residents with convenient facilities and abundant services, increasing urban population poses great challenges to urban livability. For example, living in urban areas limits residents' access to nature and exposes residents to higher environmental hazards such as noise and air pollution, heat waves and other problems. Additionally, urban development can not only lead to more severe flooding events, but only increase risks of pollution and deterioration in ecosystems (Fletcher et al., 2013).
As an effective approach to urbanisation, public urban green spaces offer citizens not only recreational areas, but also improve urban living quality in the following regards: they serve as buffer to reduce noise and air pollution, they mitigate the impact of extreme meteorological events (e.g. heavy rainfall and flooding), maintain and enhance biodiversity in urban regions, etc. However, in many cities, the water needs of public green spaces are currently challenged by changing climate and non-regulated irrigation. If public understanding and awareness in urban green is enhanced, public vegetated areas can be better maintained and their environmental benefits being fully exploited.
One of the Berlin based initiatives with a goal of addressing and tackling such urban challenges is the "Gieß den Kiez" platform, which helps coordinate irrigation of trees in Berlin. On this web platform most city trees are shown with further information such as age, species, water requirements and received rainfall within the last 30 days. This Web-App invites all citizens to participate in the watering of our endangered tree population. Citizens can find out more about the water needs of trees in their neighborhood, mark their irrigation time and amount, and „subscribe" to care-taking of trees.
Besides the current features of the Web-App, various directions could be taken to improve the platform and its usability, thus encouraging more citizens to join and contribute to its efforts. The question is, what information, features, or further functions could make a digital app for urban green management more informative and attractive for the residents of Berlin and enhance better strategies for urban green irrigation and care?
On the one hand, the application has a great potential to build and empower communities. How could we exploit this opportunity and build an active network of users? Furthermore, these users would also need to connect with each other to ensure a proper coordination of the watering for each neighbourhood. With this in mind, how could a proper user management on "Gieß den Kiez" look like so that its users can connect and collaborate with each other in the future? Think about a user-centric design and the advantages of building public watering groups. On the other hand, the platform could serve as an awareness raising tool by showcasing different scenarios. What would happen if more citizens engaged in the watering of trees? What would happen when the next historical drought strokes the city? How can communities manage public green spaces under future climate scenarios?

References

The project Gieß den Kiez: https://www.giessdenkiez.de/
Paper "Understanding, management and modelling of urban hydrology and its consequences for receiving waters: A state of the art.": https://www.sciencedirect.com/science/article/pii/S0309170812002412

Suggested tools

Open-source software Storm Water Management Model (SWMM) from US EPA: https://www.epa.gov/water-research/storm-water-management-model-swmm

Available data

Observed climate data from Deutscher Wetterdienst (DWD):
https://opendata.dwd.de/climate_environment/CDC/observations_germany/climate/

Challenge II

How to create a distributed rainwater collection network in Berlin?

Description

Advocates of sustainable urban rainwater management frequently emphasize the importance of moving away from conventional storm- and rainwater management practices, large-scale, piped infrastructures and shift towards more decentralized solutions. These alternative solutions for harvesting rainwater – involving such technologies as green roofs, artificial wetlands, permeable pavements and infiltration trenches – are deemed to be better suited to manage rainwater in densely-populated cities, even more so in the wake of climate change. They are accredited with providing multiple benefits such as groundwater replenishment, flood control, aesthetic and leisure value. However, attempts to diversify our urban water systems often remain on the level of separate, small-scale pilot projects. Only a handful of developed cities actively strive for and succeeding in scaling up and implementing these principles in practice.

Although Berlin was once considered a pioneer of urban sustainable rainwater systems in industrialized cities in the late 1980s, by today it has lost this status (Soler et al., 2018). The question is, how could the city of Berlin diversify its rainwater harvesting system and mainstream a distributed collection network? Given the complexity of this topic, the challenge can be approached from various directions. There are important social aspects to be taken into consideration at the community level for instance. Who are the relevant actors in such a rainwater harvesting network? What are neighborhood-friendly solutions and how will the people connect? How can we maintain a community that is open for anyone to join and participate? Furthermore, there are numerous technical challenges to tackle. Given that we have mostly flat roofs in Berlin, how can rainwater be collected? How to organize the distribution of rainwater between participants? How well can we forecast supply and demand? When should we expect bottlenecks and how can we deal with them? Last but not least, we should not forget about organizational aspects, like the costs of such a network, how these costs could be covered or which regulations have to be considered.

References

Rainwater harvesting foundation guideline: http://www.rainfoundation.org/wp-content/uploads/2015/08/WaterHarvesting_lowresolution.pdf
Paper „Rainwater Harvesting and Social Networks: Visualising Interactions for Niche Governance, Resilience and Sustainability": https://www.mdpi.com/2073-4441/8/11/526/htm
„Rainwater Harvesting Handbook" by the Rural Water Supply Network (RWSN): https://www.rural-water-supply.net/en/resources/details/268
Paper "Rain and the city: Pathways to mainstreaming rainwater harvesting in Berlin": https://www.sciencedirect.com/science/article/abs/pii/S0016718518300162

Suggested tools

For accessing DWD data there is a R (https://github.com/brry/rdwd) and Python (https://github.com/earthobservations/wetterdienst) library

Available data

Precipitation data from DWD: https://opendata.dwd.de/
Drought monitor: https://www.ufz.de/index.php?en=37937

Challenge III

How to tangibly offer insights into the status of Berlin's water system in quasi real-time through a mobile application?

Description

Berlin authorities are constantly collecting considerable amounts of environmental and water related data. At the Senatsverwaltung für Umwelt, Verkehr und Klimaschutz (Senate Department for the Environment, Transport and Climate Protection), the Abteilung Integrativer Umweltschutz (Department of Integrative Environmental Protection) and the Referat Wasserwirtschaft, Wasserrecht und Geologie (Department for Water Management, Water Law and Geology) monitor the urban water cycle of Berlin, enabling experts to understand and assess Berlin's hydrological situation. There is publicly available data regarding surface water, such as rivers and lakes, (heavy) rainfall events, groundwater, runoff, and infiltration rates.

However, these diverse data sources are not connected and do not facilitate easy correlation or the extraction of location-based information for the user. Therefore, the aim of this challenge is the ideation of a mobile application, which makes the varied information from the mentioned data sources easily available to the people in and around Berlin. Users could be enabled to access hydrological information based on their current location, e.g. regarding the groundwater levels, nearby surface water and its condition, or precipitation data, as well as historical data. The app could also enable the communication of alerts to citizens, when extreme weather events or anomalies happen (e.g., floods). Finally, an additional functionality might allow reporting from users to the authorities, e.g. of non-functional pumps or water fountains or the flooding of streets.

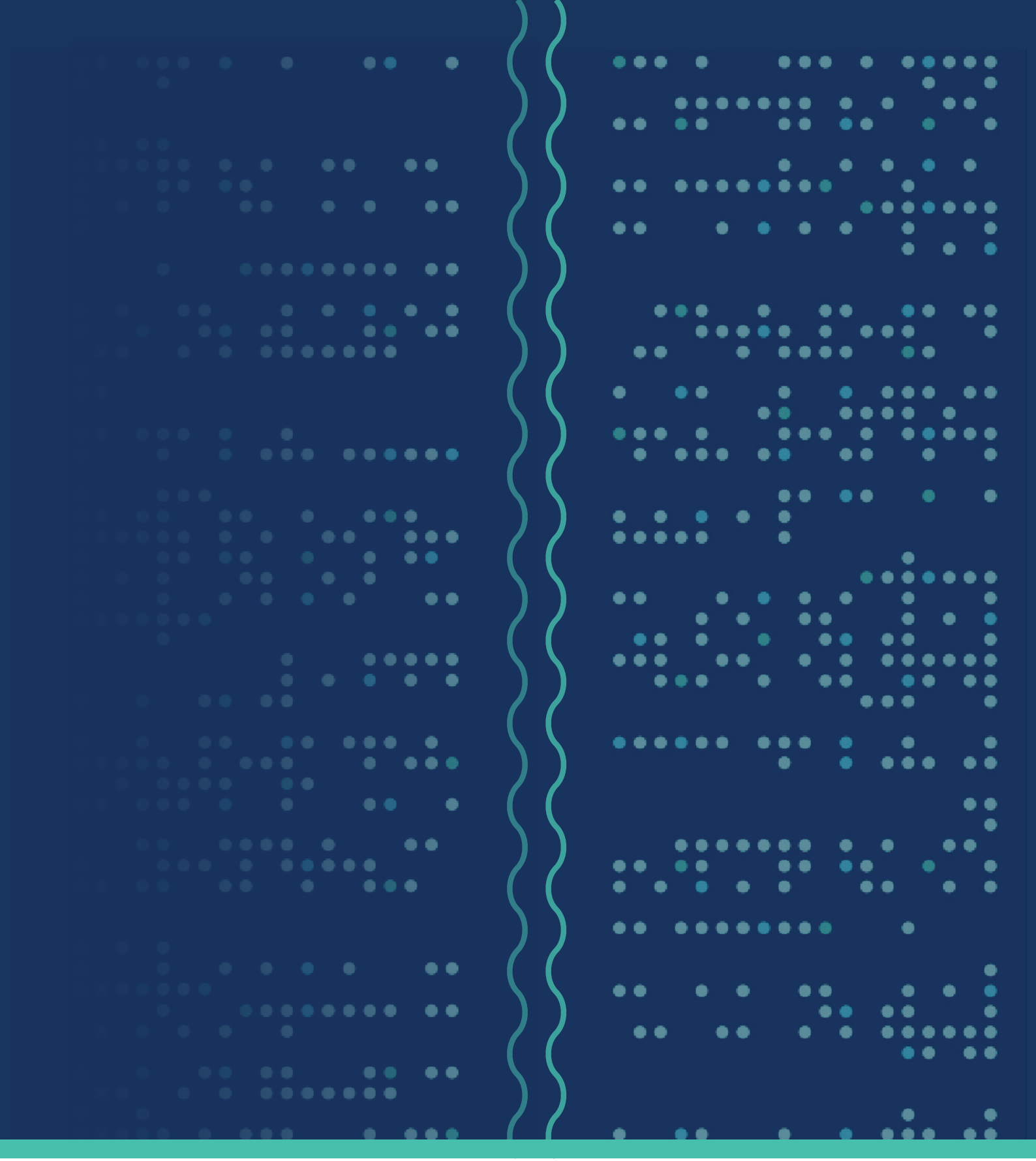
Participants working on this challenge should start with the general ideation of this application, i.e. envision, what the user can actually do with the app, what scenarios are interesting for the citizens, which information and visualizations are offered, and what possible use cases are. These visualizations could then also already be drafted programmatically or at least as a prototypical design with mock-ups. Similarly, the structure and architecture of the application could be developed as a clickable or paper prototype, in order to practically demonstrate the envisioned user interactions.

Suggested tools

Paper prototyping: https://www.uxpin.com/studio/blog/paper-prototyping-the-practical-beginners-guide/
Clickable Prototypes: InVision (https://www.invisionapp.com), or open-source alternative: Pencil Project (https://pencil.evolus.vn/Features.html)
For preliminary plotting: programming language & plotting library of your choice (e.g. matplotlib or plotly for python)

Available data

Gewässerkundliche Messdaten Berlin: https://wasserportal.berlin.de/start.php
Fachinformationssystem Geoportal Berlin: https://fbinter.stadt-berlin.de/fb/index.jsp



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