Centre for
Smart Cities and
Infrastructure

GETTING DEEP INTO DIGITAL TWINS

ANNUAL REPORT 2022

STRATEGIC PARTNERS

Bentley Advancing Infrastructure

YIT

Skaitmeninė Statyba

STATICUS

INHUS

KAUNO TILTAI

FOR CSCI 2022 WAS YEAR OF AWARDS AND GETTING DEEP INTO DIGITAL TWINS!

It started with wining “The best BIM project of the city model” nomination at Lithuanian “Digital Construction 2022“ event.
And later in International „Going Digital Awards in Infrastructure 2022“ our Kaunas Digital Twin was nominated as one of 3 finalist in the category of “Facilities, campuses, and cities”, and we got Founders’ Honouree acknowledgment.

SO, WHAT WE ARE DOING WITH CSCI KAUNAS DIGITAL TWIN PROJECT?

Read this Darius Pupeikis introduction to our project, which he presented to commission of „Going Digital Awards in Infrastructure 2022“ and you will get the idea.

My main scientific field is related to BIM, Digital Twins (DT) and Building Data Science, and my current position is a Head of CSCI. It‘s the University‘s department which mission is to build, sustain and develop a community focused on smart cities and infrastructure, advancing the field through lifelong learning, research and innovation.

The project Kaunas DT is focused on the digitalisation of the built environment, by giving an emphasis on the University Campus, Old Town, and central city areas. The main project's platform is Bentley‘s Open Cities Planner, and currently accommodates the results of research and study projects. Our main achievement and ongoing goal is to integrate different digitalisation technologies of the built environment by applying them to practical real-world tasks.

Let‘s dive in into technology and discuss about two states of DT:

The first state represent existing situation of physical environment. The Kaunas DT implements state-of-the-art digitalisation technologies such as photogrammetry, lidar, thermophotogrammetry and 360 panoramas. The next one is BIM, which appropriate to distinguish into 3D model and attribute parts. This framework shows common digitalisation technologies which we are focusing on. I would say, that each technology has its advantages and disadvantages, E.g., we used reality-capturing technologies which are good in geometrical representation, aesthetics, and speed of digitalisation aspects. However, it's poor in semantics, i.e. usually for meaningful DT, we need high level machine-readable, standardised, and structured data. BIM is slow but gives huge opportunities concerning semantics, i.e. attributes, classes, distinct elements, etc. IoT and various APIs are unique in dynamics, which could provide periodically updated data from any sensor, device, or equipment. It‘s popular to store data in a database and spread it through standardised protocols. Finally, we can't avoid historical data, which is usually CAD-based and without affordable machine-readability. Anyway, during the past decades, humanity collected much data about the built environment.

The next state is a future state, which is related to forecasting future events, actions or behaviour. During the implementation we simulate some shading effect for solar panels, people movement, buildings energy perfomance, flooding. Also we used data analysis and ML based algorithms for forecasting thermal energy and electricity consumption. Point cloud clustering we used for segmentation of buildings from a terrain.

Now let‘s illustrate some of the uses cases.

For example, the flood simulation carried out with Bentley‘s Lumen RT software, allows for the assessment of potentially risky areas in the territory and, on that basis, preventive decisions could be taken for the protection of buildings, utilities or other objects. The impact of shading on PV solar panels is a significant factor in achieving efficient electricity generation. In this case, a reality capture serves as a guide for the possible placement and orientation

of the panels on horizontal, angled or even vertical surfaces of the built environment. Indoor air quality monitoring is an important factor to ensure efficient use of thermal energy, supply of fresh air and maintenance of optimal relative humidity. Based on the results of the monitoring, adjustments to the HVAC system could be made in premises or zones. And, geometric measurements, which can be useful in a wide range of situations, but based on our experience it is important to have an assessment of the geometric dimensions of the building structures when it comes to renovation. Dimensions provide the basis for the production of customised prefabricated building elements, thus significantly reduce construction time. We have building called MLAB. It's a prototyping laboratories, one of the most modern buildings on the KTU campus, which is part of Kaunas DT and for which the CSCI team has carried out various digitalisation activities. We used Bentley's OpenBuildingsDesigner for BIM modelling, by focusing not only on creating a geometric representation of the architectural, structural and MEP systems but also on the semantics, i.e. the standardised attributes. As well, it's worth to mention, that this BIM model is classified according to the national construction classification system, which we currently developing in LT. Particular attention is paid to proper export to the IFC format, by checking and linking classes, types, and their properties. Also, we have used the iTwin.js platform to integrate BIM, IoT and API data, to develop an algorithm for predicting thermal energy consumption by using ML algorithms. Currently, linear regression and XGBoost ML methods were used for the forecast. However, any AI approach could be implemented. Bentley Legion software was used to simulate the evacuation of people from a building. This way, we can see the risk areas where people are crowding and take preventive actions, such as distributing the flow evenly according to the capacity of the exits.

Let's introduce more implementations within the OCP platform. Thermalphotogrammetry, the technology, which enables the creation of a 3D thermal model that can be used to assess the heat loss of a building or the thermal energy performance of a building or an entire block. The 360 panorama technology allows for visual representations that can be useful in asset management, seeking of construction progress or other use cases. In an urban context, it is a useful technology to provide more information about the building indoors. Integration with BIM enables projects to be presented to the public, evaluated in an urban context or for seeking a construction progress. In the future, we can see very useful integrations using the semantic part of BIM models

E-modernisation is another Kaunas DT sub-project, which aims to assess a residential neighbourhood as an independent energy island, using 3D model data and integrating the results into DT. For this purpose, calculations were applied for the use of different energy sources, assessing the consumption and economic aspects of solar energy, heat pumps, electricity grid and centralised heating networks.

Few words about software and hardware. As I have mentioned before, the main Kaunas DT platform is the OCP, which we believe has progressed significantly in the last few years. Various integrations have emerged that have allowed us not only to host reality capturing data but to integrate some subsets of BIM models, and stream data through HTML embeddings and other sources. For reality capturing purposes we used drones, lidars, cameras and Bentley's Context Capture family software. For BIM and 3D modelling – Open Buildings, Microstation, and a couple of other tools we have been using. Zabbix – it's our middleware for Efento sensors data aggregation, storage and streaming. Python and related packages as Pandas, Sklearn, TensorFlow we used for data analytics and ML. And finally, iTwin.js, which we started using two years ago, attracts developers and seeks interdisciplinarity between IT and civil engineering fields.

Let's summarise some points

The main challenges we faced are related to interoperability. The lack of implementation of standardised data formats into the software. Especially the semantical part. However, in this case, iTwin.js helped to deal with these issues because of its strong customisation capabilities. The interdisciplinarity is crucial for the development of DT. For the built environment it is important to have experts in the field of civil engineering, architecture, IT, facility management, data science, etc. Only an interdisciplinary team could achieve valuable results. They should work hand in hand. Think with the end in mind. Use cases should be identified at the beginning, but in parallel with an assessment of the feasibility of implementing them. Looking from a technological perspective, DT is a combination of different digitalisation technologies, which have their advantages and disadvantages. It is important to focus on the strongest sides of a particular technology by applying it to a particular use case.

IN 2022 WE STARTED WITH NEW INTERNATIONAL SMARTWINS PROJECT

The Smartwins project aims to provide KTU with the know-how required to carry out studies on the benefits of smart technologies in assessing the energy performance of buildings by the end of 2025. Embracing smart technologies such as Building Information Modeling (BIM), smart sensors, IoT and digital twins provides access to instantaneous data on the energy performance of infrastructure. These digital technologies and 4.0 practices provide a better understanding of how systems interact to improve the energy efficiency of constructed buildings and develop new, more energy-efficient designs. Digital twin technology also enables these issues to be made accessible to new audiences by bringing the dataset to life in a virtual representation of a building.

The consortium brings together partners from complementary sectors: academia, R&D, innovation and entrepreneurship, and research management and dissemination.

Partners: Kaunas University of technology, Politecnico di Milano, The Centre for Research and Technology-Hellas (CERTH), Contecht, Innotrope

SmartTwins Project

WE ALSO BECOME A PART OF BUILDING PERFORMANCE DIGITALISATION AND DYNAMIC LOGBOOKS FOR FUTURE VALUE-DRIVEN SERVICES (CHRONICLE) PROJECT

CHRONICLE will deliver a holistic, life-cycle performance assessment framework and tool-suite for different building variants, supporting sustainable design, construction and/or efficient renovation and investment decision making. It will be methodologically integrate ongoing initiatives, like EPCs, Level(s), SRI, under the umbrella of the Digital Building Logbook concept. Continuous monitoring and analysis of the actual building performance over its lifetime, will be based on a powerful digital twin framework. The proposed data availability and accessibility within CHRONICLE will extend the limits of the EU energy related policies while the aggregated EPC advanced information will facilitate efficient energy planning. To this end, CHRONICLE will allow all stakeholders to realize in quantified terms the short- and long-term impact of the project activities, from policy to practice, and across the whole building life cycle.

The expected impact of the project is to contribute to the efficient and sustainable use of energy, accessible for all is ensured through a clean energy system and a just transition.

CSCI team are helping with continuous monitoring and analysis of the actual building performance over its lifetime, based on a digital twin framework.

SHORT UPDATE ON OUR OTHER THE MOST IMPORTANT PROJECTS:

INTERNATIONAL:

NEXT-GENERATION DYNAMIC DIGITAL EPCS FOR ENHANCED QUALITY AND USER AWARENESS

Work in final stages. More on it in 2023.

A NOVEL DECENTRALIZED EDGE-ENABLED PRESCRIPTIVE AND PROACTIVE FRAMEWORK FOR INCREASED ENERGY EFFICIENCY AND WELL-BEING IN RESIDENTIAL BUILDINGS

„In 2022, we created a solution to integrate building life cycle information into the BIM 6D model of the building. An important part of our solution is the developed application programming interface (API), which can automatically process various files related to the life cycle of the building (PDF, Excel) and the semantics of the building itself (IFC), to summarize this information. The goal is to combine this API with the digital twin being developed in the project, to combine building semantics with building life cycle information. Using this API, information from various pilots used in the project was successfully processed.
In 2023, we promise to further develop the BIM 6D model, to continue work on API integration into the digital twin being developed in the project. We also promise to apply the solution to other pilots used in the project.“

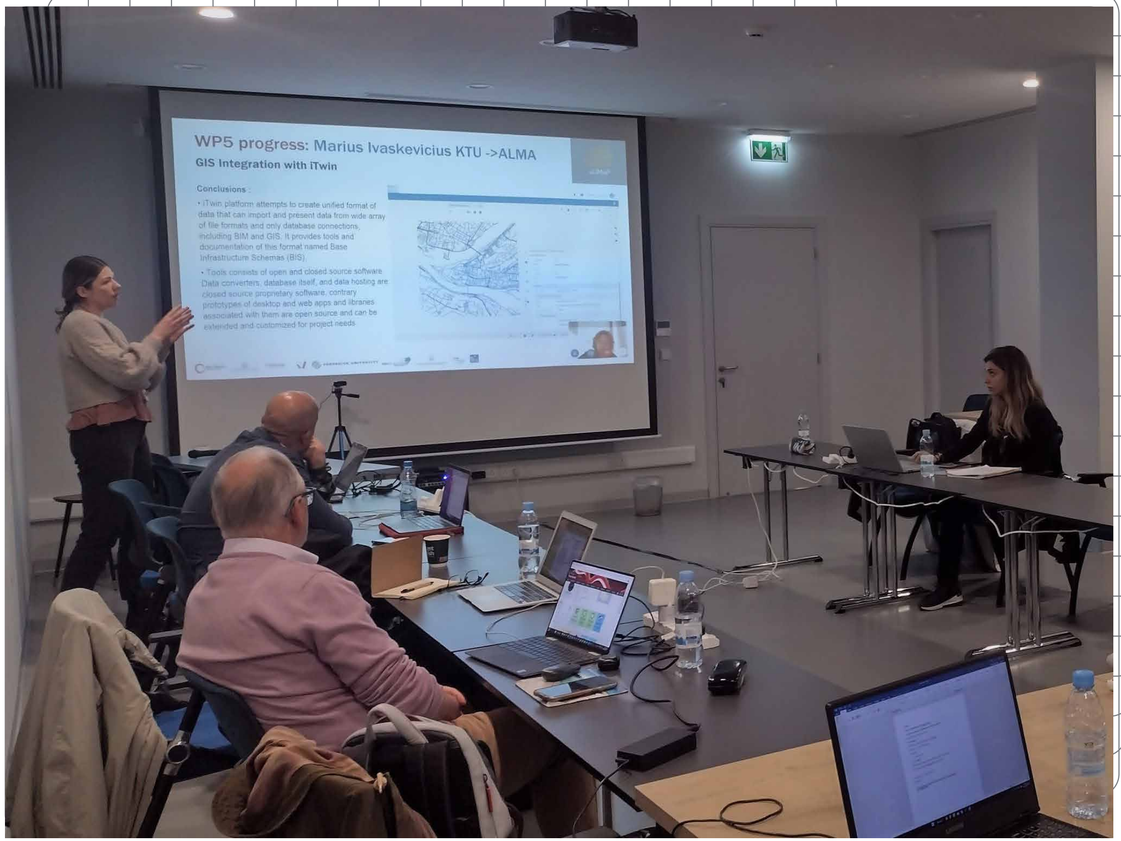
Justas Kardoka

DEVELOPMENT OF UTILITIES MANAGEMENT PLATFORM FOR THE CASE OF QUARANTINE AND LOCKDOWN –

“During the year 2022 7 KTU researchers conducted a total of 12.5 months secondments with Horizon2020 eUMaP project to partner companies located Italy, Cyprus and Greece. During these secondments our researchers were working on tasks related to WP3: Recording crisis features in building services, WP5: Integration of Digital Technology Monitoring and Management (BIM) into eUMaP and WP6: Utilities management under crisis conditions. Within these packages the secondees have applied Data Science and Machine Learning technologies while analyzing building energy consumption data, utilized GIS technologies to identify the change in citizens behavior during the lock-down period, explored data integration possibilities employing open standards as IFC, analyzed how control measures in building services influence energy consumption and more. The secondments have resulted in several publications (below).

Furthermore, in July KTU team participated in the 2nd eUMaP plenary meeting in Athens, Greece. During the meeting the progress of the project was presented by all project partners and new discussions initiated regarding the future development of eUMaP platform. Finally, in November a workshop was also organized by partners from Rome where among others KTU researchers were sharing their expertise in topics relevant to the project.“

Lina Morkūnaitė



- Energy-Saving Potential in Planning Urban Functional Areas: The Case of Bialystok (Poland)
- Conducting smart energy audits of buildings with the use of building information modelling
- Employment of digital twins for the implementation of energy audits
- An Analytical Model for the Impact of Building Control and Automation Upgrade on Space Heating Energy Efficiency

NATIONAL:

BIM-LT

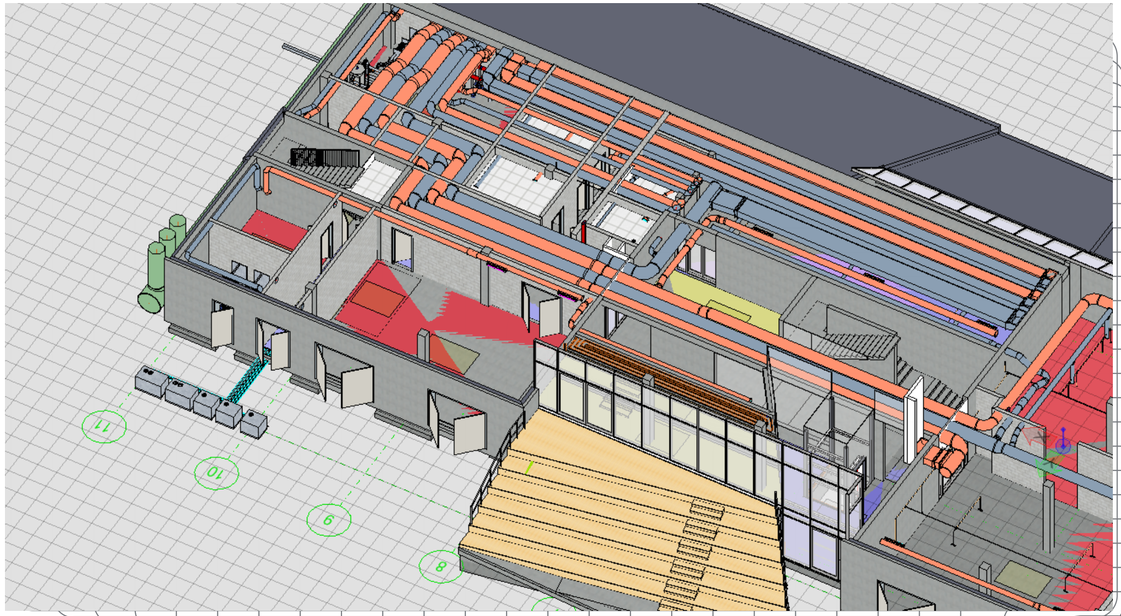
DEVELOPMENT OF TOOLS FOR INCREASING THE EFFICIENCY OF THE LIFE CYCLE PROCESSES OF PUBLIC SECTOR STRUCTURES USING BULDING INFORMATION MODELING

Development of National Construction Information Certification system and BIM normative documents are in progress of piloting stage. More on it in 2023.

MLAB DIGITALTWIN

“The MLab building project is one of the first digital twins of a building in Lithuania. This digital twin integrates several things: BIM model, photogrammetric model and microclimate sensor information. In 2022, the MLab BIM model was filled with mechanical, electrical and plumbing (MEP) system. Also, the model was classified according to the National Construction Information Classifier (NSIK). This process is continued in 2023. MLab's construction phases were sequentially captured by drone photography of the building and the creation of corresponding 3D models. The models have been uploaded to the Bentley OpenCities Planner platform, making it easy to track the entire construction process. Indoor microclimate sensors were acquired and tested in the auditoriums of the Faculty of Civil Engineering and Architecture. Their integration into Bentley OpenCities Planner and iTwin was also done.”

Ignacio Villalon Fornes



3D MODELS OF HERITAGE

In order to preserve endangered cultural heritage objects, KTU CSCI with KPD carries out measurements of heritage objects using advanced methods. During the measurement work, the valuable properties of the objects are recorded, so that, if necessary, they can be restored in the future or, in general, the entire object can be restored.
In 2022, 4 objects were measured: the laying of the Birželiai manor homestead, the owner's house of the Birželiai manor homestead, the palace of the Linkavičiai manor and the palace of the Vileikiai manor. With the help of drone photogrammetry, 3D models of these objects were created, while LiDAR technology scanned the interior of the objects. Based on the data collected from the measurements, object drawings were created: floor plans, facades, sections, details. The material is uploaded to https://kvr.kpd.lt/.

In the coming year, it is planned to measure 4 more objects:

- *Laukžemė manor manor house;*
- *Zacišė manor manor house;*
- *Savičiūnai manor homestead;*
- *The manor house of Parudinė manor homestead.*

Vytautas Bocullo

DIGITWIN
HACKATHON

WE ORGANIZED FIRST BUILT ENVIRONMENT DIGITWIN HACKATHON

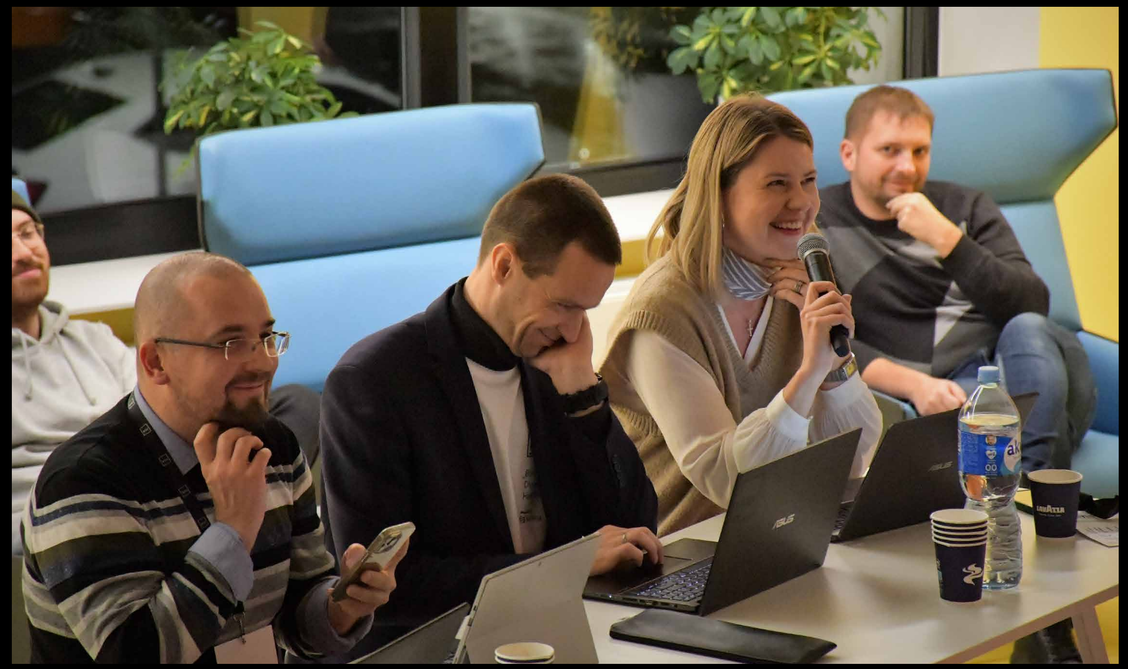
We organised first Hackathon specifically dedicated to the topic of built environment digital twins. It was the first one to talk about this topic in Lithuania. Built environment DIGITwin hackathon looked into Digital Twins – the future of buildings and infrastructure management, and enabled the development of creative ideas on the application, functionality, safety and usability of this technology. Almost 80 people from 14 groups generated ideas, visions, design of mock-ups, concepts and initial prototypes for the future of digital twins of built assets. Students and researchers, professionals working in the fields of civil engineering, information technology, architecture, automation, energy and environmental engineering were invited to take part in the hackathon. The majority of the participants were students of civil engineering and information technologies. Participants worked in teams of 3-6 members.

Participants of this hackathon gained abilities to contribute to the development of ideas and apply digital twin technology, which will become the foundation of smart cities of the future.

“Not only did we had a large number of participants, but we also had a wide range of professionals from construction, IT, investment funds and other businesses who came to advise and mentor our young innovators. The participants’ ideas and their execution impressed members of the jury, and we hope that the teams will not stop here, and perhaps some of them will establish their own start-ups” – said FCEA dean Andrius Jurelionis.

The main prize went to the team that developed a prototype system that would indicate in which rooms people are trapped or hiding during fire, with this data transmitted to firefighters by the dispatchers of the Fire and Rescue Service. According to the team, the biggest challenge was to find the appropriate sensors that could work in high temperatures.

Second place was awarded to the team developing a navigation app to help people find their way around buildings, find the right ward in a hospital or the right terminal at an airport. The biggest challenge for this team was the lack of GPS signal indoors, which meant finding ways to ensure location recognition.



Third place went to the team that devised and linked different sensors to detect the tilt and shift of building structures and mapped this data in a digital twin model. The team believes that such an application has high market potential in infrastructure and complex building maintenance sector.

Zeljko Djuretic, Head of Academic Programmes at “Bentley Systems” shared his knowledge with the participants during the first phase. Sandip Jadhav, the co-founder of “CCTech” in India, interacted with the participants remotely and shared his experience of working with digital twin technologies.

Participants were advised by representatives of “INHUS”, “Staticus”, “Bentley Systems”, KTU Centre for Smart Cities and Infrastructure, KTU Virtual and Augmented Reality Technology Laboratory and KTU Startup Space.

IN 2022 WE TALKED A LOT ABOUT DIGITAL TWINS

INTERNATIONAL:

We are partners with Staticus company and we are developing a more environmentally friendly automated façade system that is integrated into the building's control systems. IoT and the use of digital twins is central to this work and you can find more information in this article:

CSCI brings digital twin expertise to façade project

Dean of the Faculty Andrius Jurelionis told the LRT program "Good day, Lithuania" about the Kaunas digital twin being nominated for the international "Going Digital Awards in Infrastructure 2022" awards.

Full video in Lithuanian

For our national broadcaster LRT our colleague Vytautas Bocullo told about our digitization projects of heritage buildings in extremely poor condition.

Full video in Lithuanian

In November international conference "Sustainable Consumption and Production: How to Make it Possible" organized by the KTU Institute of Environmental Engineering was held. It aimed to examine the challenges arising from restructuring the economy according to the European Green Course Plan. Among other presentations the Dean of KTU Faculty of Civil Engineering and Architecture, Prof. Andrius Jurelionis' presented about the Digital Twins we are developing.

Watch full presentation (in LT)

IN 2022 WE ALSO PUBLISHED A LOT OF SCIENTIFIC ARTICLES, THERE IS SOME EXAMPLES:

Artificial intelligence solutions towards to BIM6D: sustainability and energy efficiency

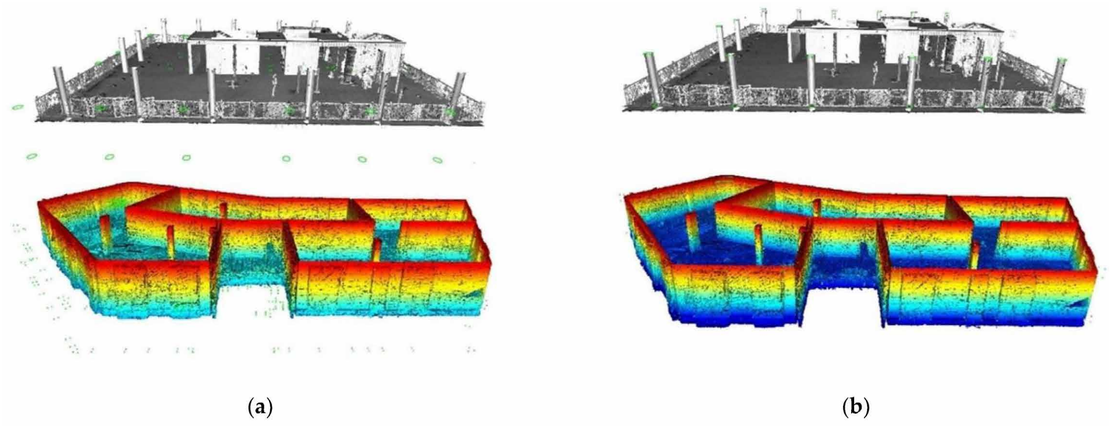
by Justas Kardoka; Agnė Paulauskaitė-Tarasevičienė, Darius Pupeikis

BIM6D is an aspect of building information modelling (BIM) that allows for a detailed analysis of a building's energy performance in order to improve energy and light efficiency, which in turn leads to a more sustainable building utilization. Predictions of a building's energy consumption can have added value in different aspects and for different building actors, be they engineers, architects or the building users themselves. The objective for this study is to explore mathematical and artificial intelligent approaches for predicting thermal energy consumption in buildings and to examine its use for BIM6D. The dataset used in the research includes several years of hourly thermal energy consumption collected in one block of Kaunas city. Experiments have been carried out using different forecasting methods. In terms of prediction accuracy, it is worth highlighting the Extra tree with MAE <3.5 kWh and Support vector regression(SVR) with MAE ≤ 2.63 kWh. However, Extra tree seems to be the best in terms of MAPE (38.65%). Although prediction time is not the most critical parameter, it should be noted, that Extra Trees, SVR and auto-regressive models were found to be the most time-consuming (from 2 to 4 minutes) to linear models (< 1s.) and extreme gradient boosting (~3 s.) and that these results may influence the selection of a model for real-life operation.

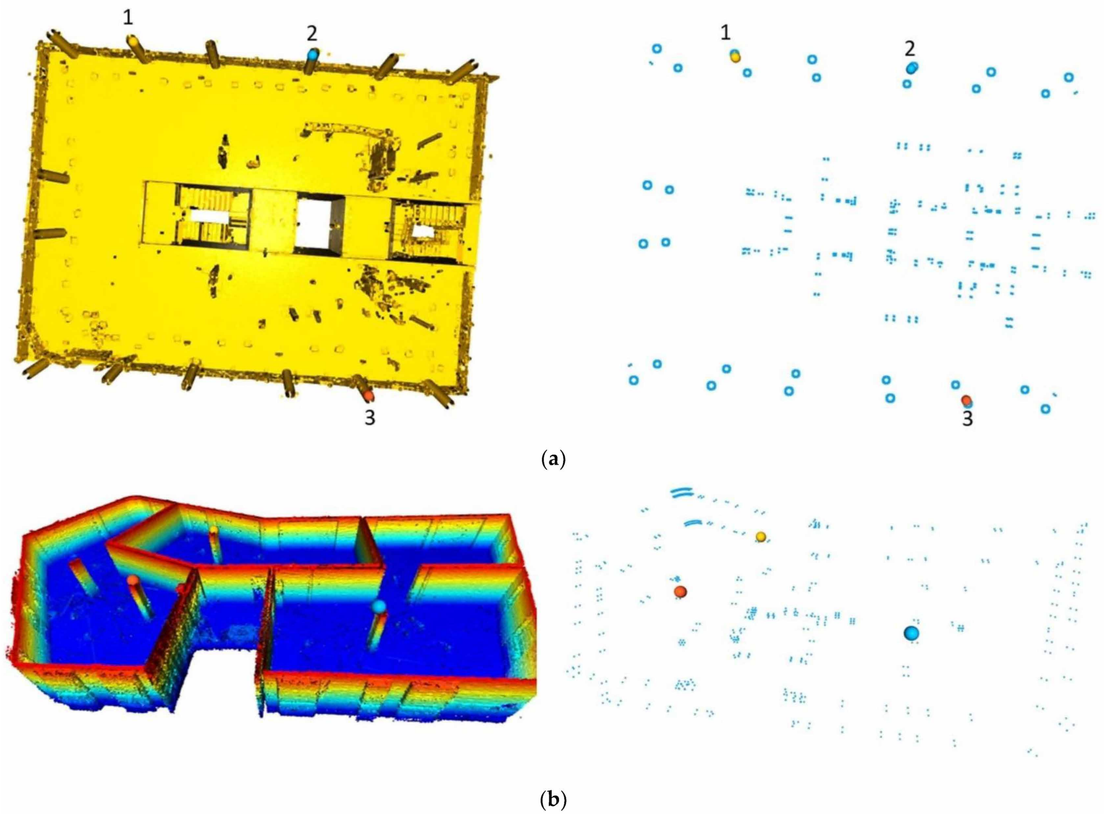
Automation of Construction Progress Monitoring by Integrating 3D Point Cloud Data with an IFC-Based BIM Model

by Paulius Kavaliauskas, Jaime B. Fernandez, Kevin McGuinness and Andrius Jurelionis

Automated construction progress monitoring using as-planned building information modeling (BIM) and as-built point cloud data integration has substantial potential and could lead to the fast-tracking of construction work and identifying discrepancies. Laser scanning is becoming mainstream for conducting construction surveys due to the accuracy of the data obtained and the speed of the process; however, construction progress monitoring techniques are still limited because of the complexity of the methods, incompleteness of the scanned areas, or the obstructions by temporary objects in construction sites. The novel method proposed within this study enables the extracting of BIM data, calculating the plane equation of the faces, and performing a point-to-plane distance estimation, which successfully overcomes some limitations reported in previous studies, including automated object detection in an occluded environment.



(a) (b)



(a)

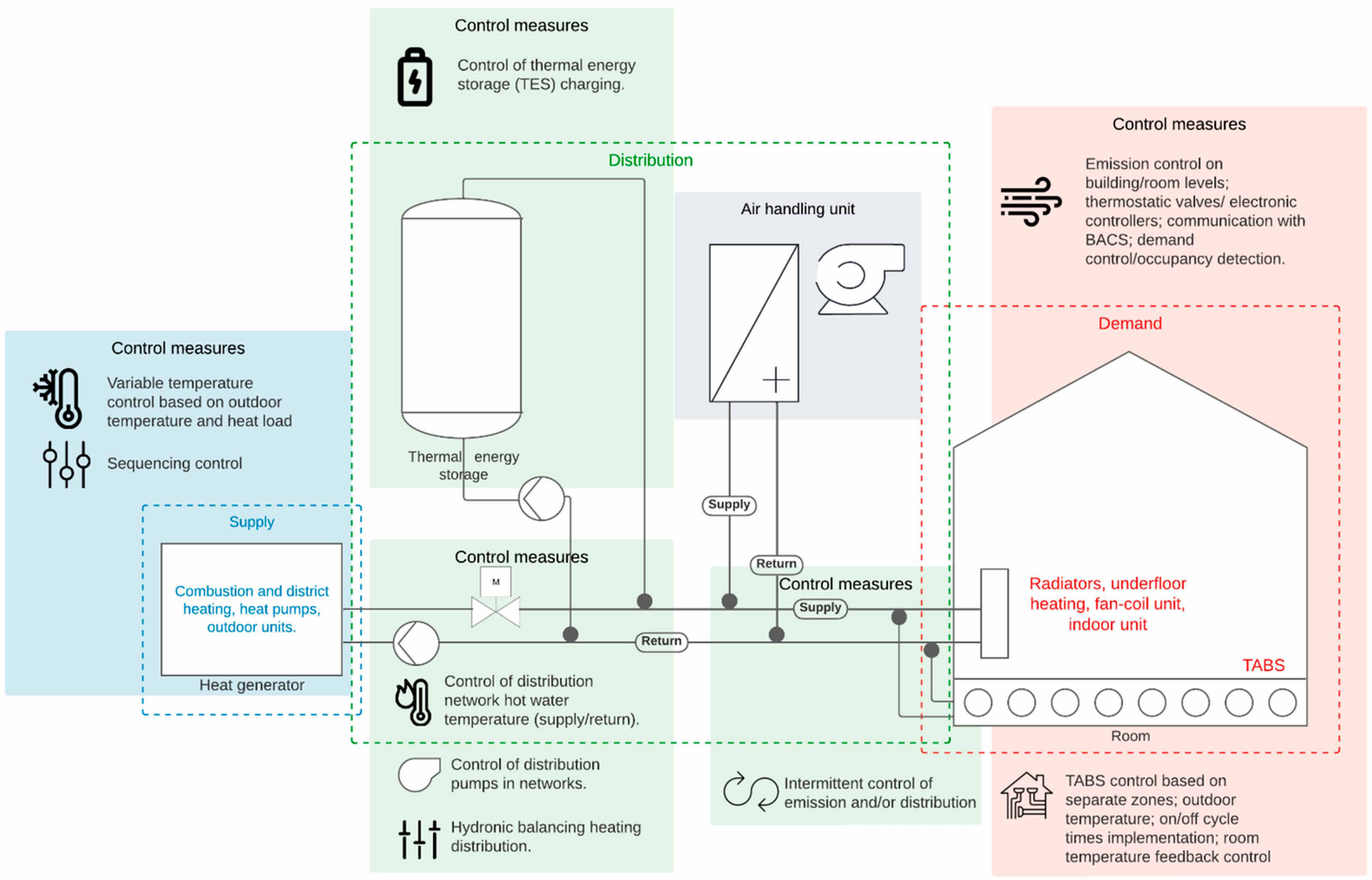
(b)

Six datasets consisting of point clouds collected by static and mobile laser scanning techniques including the corresponding BIM models were analyzed. In all the analyzed cases, the proposed method automatically detected whether the construction of an object was completed or not in the as-built point cloud compared to the provided as-planned BIM model.

An Analytical Model for the Impact of Building Control and Automation Upgrade on Space Heating Energy Efficiency

by Lina Morkunaite, Darius Pupeikis, Andrius Jurelionis, Paris A. Fokaides and Agis Papadopoulos

Intelligent building management systems are proven to lead to energy savings and are an integral component of smart buildings. The procedures developed in the EN standards describe the methodology for calculating the energy savings achieved by improving the automation and control levels of separate services in building systems. However, although this method is used in practice, it is rarely applied or investigated by the research community. Typically, energy savings resulting from a single automation improvement intervention in a building heating system are observed, while the holistic view of combined automation upgrades is not considered. Therefore, the purpose of this study was to assess the energy savings resulting from several upgrades to control levels in the heating system components of the building. In addition, this research provides a rationale for the impact of multiple automation and control options for heating systems as well as examines the difference in energy savings. Finally, an analytical model is developed and demonstrated to assess the feasibility of building automation and control upgrades, by determining the allowed investment according to a set of predefined indicators.



An enhanced framework for next-generation operational buildings energy performance certificates

by Stavros Koltsios, Paris Fokaides, Phoebe-Zoe Georgali, Apostolos C. Tsolakis, Panagiota Chatzipanagiotidou, Eglė Klumbytė, Andrius Jurelionis, Lina Šeduikytė, Christos Kontopoulos, Christos Malavazos, Christiana Panteli, Mija Sušnik, Gerfried Cebrat, Dimosthenis Ioannidis, Dimitrios Tzovaras

The improvement of the energy performance of buildings is identified as one of the core challenges toward achieving a carbon-neutral built environment. In the 2018 recast of the Energy Performance of Buildings Directive, the European Commission has emphasized the need for improved schemes, to ensure the best possible evaluation of the actual energy performance of buildings, taking into consideration all the parameters related both to their construction and operation. Significant research efforts have been designated in this area, to identifying the additional information required to not only improve the energy performance certification process but also to provide more thorough reports to end-users. To increase comprehension, awareness, and thus genuine involvement, cutting-edge digital technologies are expected to be used. The research project entitled “Next-generation Dynamic Digital EPCs for Enhanced Quality and User Awareness” (D^2EPC GA 892984) introduces a comprehensive approach to next-generation Energy Performance Certificates that addresses the main challenges and gaps in buildings' energy assessment process, by introducing additional layers of information for the assessor and the user. A non-exhaustive list of the novel set of Energy Performance Certificates indicators, proposed in D^2EPC includes energy, smart readiness, wellbeing, comfort, financial, and sustainability related indicators. In this study, aspects of employing advanced digital solutions, like Building Information Modelling and Geographical Information Systems for the certification process are also demonstrated, through a well structured, high-level, detailed representation of the next-generation Energy Performance Certificates system architecture. This framework elaborates on individual components and their interaction, toward delivering the envisioned final enriched cloud-based platform, that will enable dynamic Energy Performance Certificates based on (near) real-time field data. This study aspires to initiate the discussion within the scientific community of buildings' energy assessment on the required practices for digitizing and enriching the certification process of buildings, in compliance with Industry 4.0 practices.

Next-generation energy performance certificates,what novel implementation do we need?

by Lina Seduikyte; Phoebe-Zoe Morsink-Georgali; Christiana Panteli; Panagiota Chatzipanagiotidou; Koltsios Stavros; Dimosthenis Ioannidis; Laura Stasiulienė; Paulius Spūdys; Darius Pupeikis; Andrius Jurelionis; Paris Fokaides

Energy performance certificates are being utilized through the European Union Member States to document and asses the energy performance of the building stock, while they are used as measures to investigate and adopt policies that would lower the final energy consumption and environmental footprint. After several years of implementation, the current EPC schemes have enlighten the domain energy efficiency in the building sector, but at the same time they have been identified with several challenges and deficiencies that deteriorate the quality of the results. This study performed under the H2020 project “Next-generation Dynamic Digital EPCs for Enhanced Quality and User Awareness (D^2EPC)“, aims to analyze the quality and weaknesses of the current EPC schemes and aspires to identify the technical challenges that currently exist, setting the grounds for the next generation dynamic EPCs. The present work reveals that current EPCs schemes are based on a cradle-to-gate rationale, completing their mission after the certificate to the building user, overlooking the user’s behaviour and the actual energy performance of the building that might change dynamically within time. In this study, the idea of the dynamic EPCs is introduced, a certificate that will allow the monitoring of the actual performance of buildings and the users’ behaviour profiles on a regular basis. The introduction of novel indicators and the integration of BIM and GIS are also discussed.

Comparative Study of Construction Information Classification Systems: CCI versus Uniclass 2015

by Darius Pupeikis; Arūnas Aleksandras Navickas; Eglė Klumbyte; Lina Seduikyte

By classifying BIM data, the intention is to enable different construction actors to find the data they need using software and machines. The importance of classification is growing as building projects become more international, generating more data that rely on automated processes, which help in making better decisions and operating devices. Different classification systems have been developed around the world. Each national construction information classification system (NCICS) aims to classify information on the built environment and thus meet national needs and ensure compliance with the principles of regional and international building information systems. The research purpose of this paper is to present a comparative assessment of two construction information classification systems, CCI and Uniclass 2015. The following methods were used: the expert assessment of NCICS alternatives; the assessment of NCICS alternatives; and a strengths, weaknesses, opportunities, and threats (SWOT) analysis of NCICS alternatives. We concluded that in the initial phase of NCICS development, CCI ontologies should be adopted as a base consisting of construction entities, spaces, and elements, with the gradual addition of complexes of buildings and infrastructure, along with roles and phases of the building life cycle (BLC). An explanatory NCICS development note should be drawn outlining the principles of classification and identification; the ontological structure; development and updating possibilities; methods of integrating existing national and international classification systems; and methods of integrating data of construction products, time, cost, or other individual characteristics.

PROJECTS CREATED BY SCHOOLCHILDREN SURPRISE EXPERTS – INTERNATIONAL PROJECT “DESIGN. ENGINEER. CONSTRUCT. LITHUANIA”

IN 2022 WE...

... ENDED 3RD SEASON

More than 70 schoolchildren participated in the 3rd annual “Design. Engineer. Construct! Lithuania” project held by KTU Faculty if Civil Engineering and partners from Great Britain: “Class Of Your Own”, “Bentley Systems”, “Staticus”, and “Inhus”. Students from 5 Lithuanian schools competed in creating an “Education Centre for Climate Change and Ecology”. The centre would be in Kaunas Neris Embankment, just opposite of Kaunas Castle. During the midterm presentations students were given advice on the projects.

Moments from final event

design...
engineer...
construct!®

LITHUANIA

... ORGANIZED CHALLENGE AND VISITED LONDON

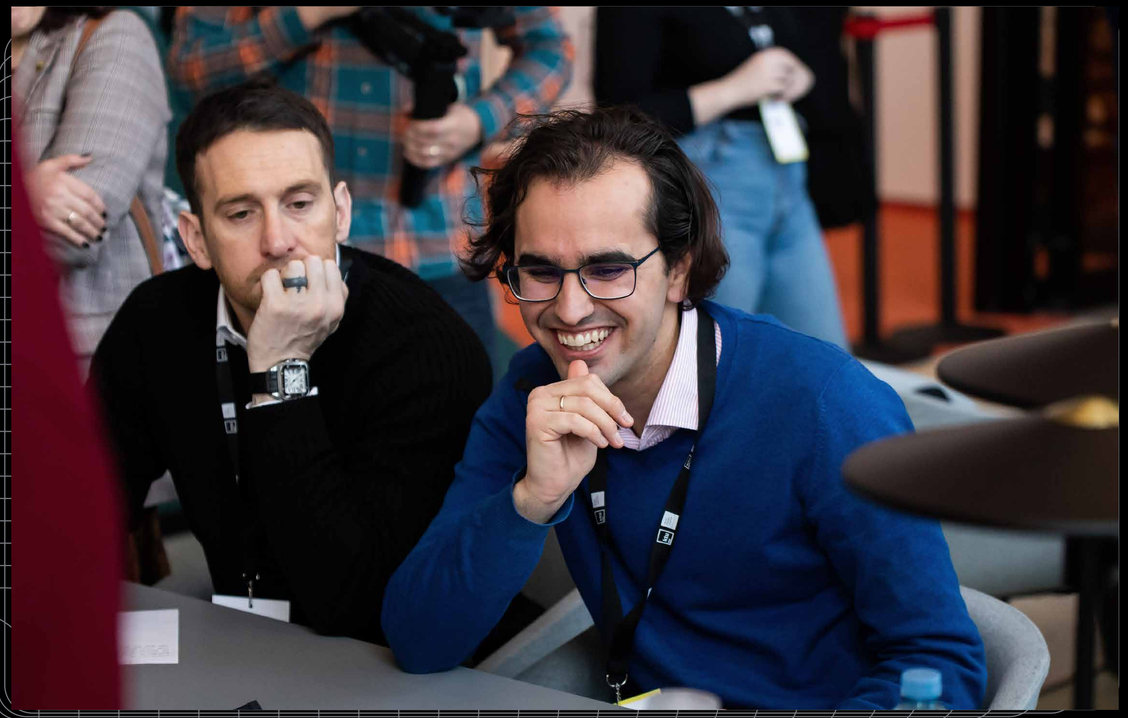
The organizing team, together with the challenge of the Lithuanian Community House in London winning team students and their teacher visited London. The participants visited the famous architect Sir John Soane's museum. Faculty partners from the Bartlett School of Architecture introduced students to their school of architecture and the ongoing exhibition of student work. DEC LT project partners from "Class of Your Own" organized a walk around the London Olympic campus, presenting its regeneration plan and history.

What we saw in London

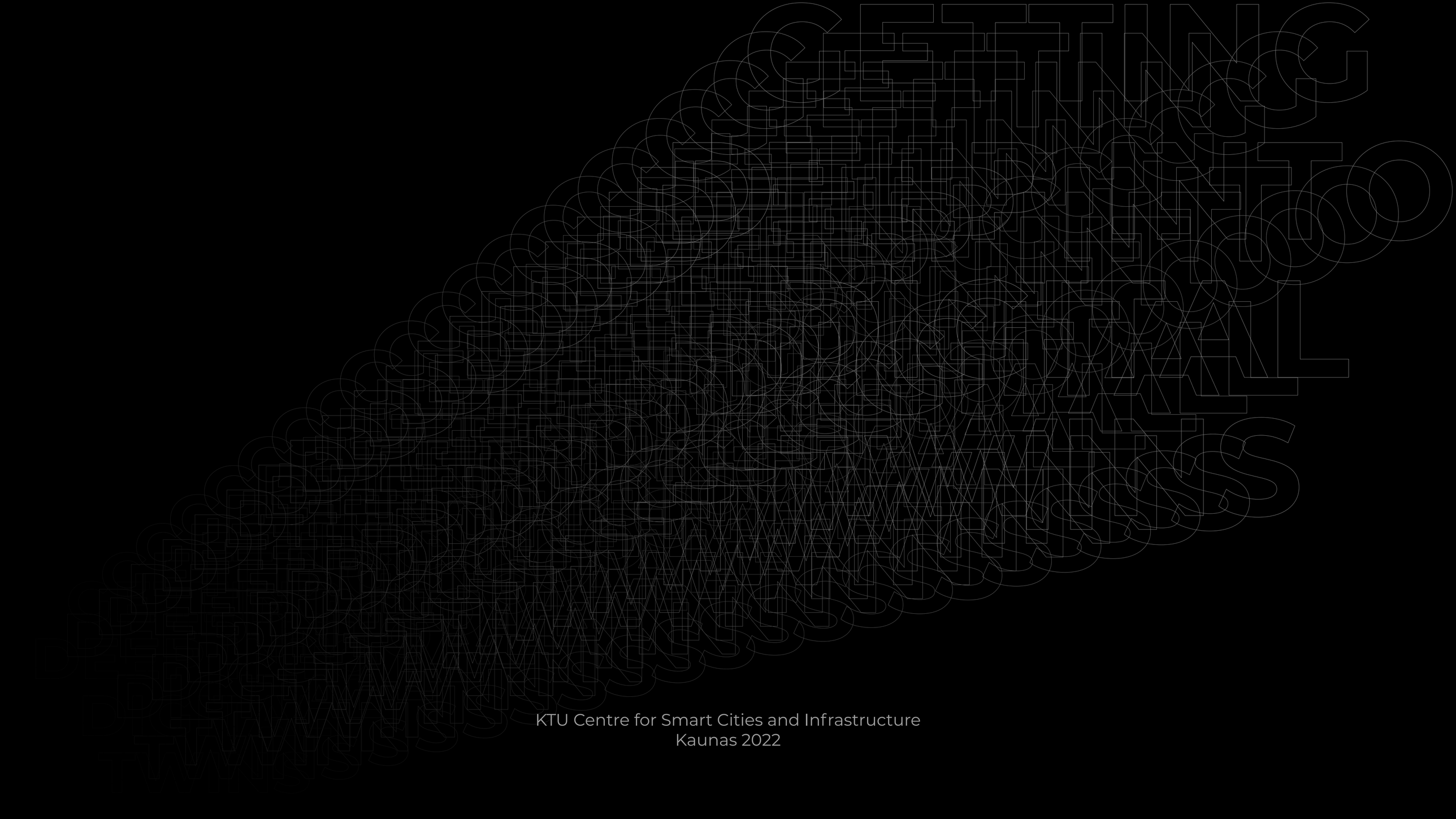
... STARTED 4TH SEASON WITH SOS TOWN PROJECT.

In September 2022 the 4th season on the project was opened. Each year, organizers choose tasks from real-life, and this year's task was dictated by war, earthquakes and other disasters. The ongoing war in Ukraine, earthquakes in Turkey, and other disasters force people to leave their homes and seek temporary shelter. Although some refugees are able to find shelter in the homes of good people, most refugees settle on temporary SOS campuses. The number of teams participating continues to grow and a record number of 16 groups started in this years' season. The teams are building an aid town on the territory of the former missile base in the Kaunas district.

Moments from 4 season




KAUNO
GIMNAZIJA



KTU Centre for Smart Cities and Infrastructure
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