Centre for
Smart Cities and
Infrastructure

ktu
1922

ANNUAL REPORT
2023

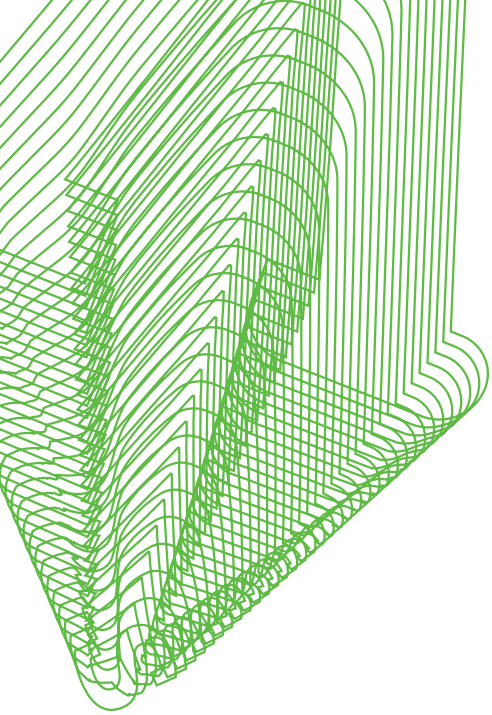5 years
IN DIGITALIZATION

STRATEGIC PARTNERS

Bentley®

INHUS

KAUNO TILTAI

Skaitmeninė Statyba

STATICUS

YIT

Darius Pupeikis
Head of CSCI

Five years on when we launched the Centre for Smart Cities and Infrastructure. It has been an eventful year. The activities started with small team, but now the team is composed of specialists in a wide range of fields: information technology, architecture, engineering, electronics, etc. The first project was simply the digitisation of our city, Kaunas, using reality scanning technology. Then came the challenges, the mistakes, the reflections, and where digitisation generates real added value for the end user. What is the ROI - Return of Investments? A good saying that is particularly relevant to our work is 'start with the end in mind', think about the use cases before you start digitising the built environment. In the long run, this approach has proved to be a good one and has helped to generate real added value for our projects.

Thanks to the partners, and enthusiasm from team, in the last five years the faculty has been involved in more than 10 international and national research projects with clear activities related to digitisation, where we did our part and we created our own projects, to test some ideas, to get new skills. We are happy, that our work was acknowledged nationally in Digital Construction 2022 and internationally in Going Digital Awards in Infrastructure 2022 events.

Now our Centre is well known for our innovations for research and studies.

CSCI is a distinctive entity at Kaunas University of Technology, established through a collaboration between the university and industry, where company representatives play a direct role in setting strategic priorities. Over the past five years, we have fostered strong mutual trust and solid partnerships, enabling CSCI to operate as an ecosystem for testing novel ideas and innovations.

We are at the forefront of developing digital twin of the university campus, shared virtual reality applications that utilize digital environments for education, and much more. I believe this creates substantial value for the community of the Faculty of Civil Engineering and Architecture – including our teachers, students, and partners.

CSCI embodies the faculty's key strategic priorities: contributing to the development of more resilient and sustainable cities of the future, advancing innovative teaching methodologies, and preparing tech-savvy architects and creative engineers to lead in tomorrow's world.

Andrius Jurelionis
Dean of the Faculty of Civil Engineering and Architecture Kaunas University of Technology

David G. Robertson
Director – University partnerships Bentley Systems

Bentley began our partnership with KTU over 6 years ago and was really excited to join the Center for Smart Cities and Infrastructure from its inception.

KTU-CSCI is proof that academia and industry are in tight alignment, everything is relevant, and grounded in real world challenges and solutions. As a global software provider for major infrastructure projects Bentley Systems focus is upon design, construction and asset lifecycle with particular focus on Infrastructure Digital Twins. It is this focus, and the 'can-do' reputation of those at KTU – CSCI that brings Bentley to very close alignment with the team there. Among our near 5,500 Bentley colleagues worldwide, Kaunas is now firmly on the map. In particular the willingness to share example datasets has proved to be unique, and something we regularly point to when other institutions and users look for examples of what is possible. We look for everyone to be as focused, as committed, and as competent as this team – they are an excellent point of reference for the world.

5 YEARS JOURNEY: 2019 HIGHLIGHTS

FIRST STEPS

▶ **The official opening of CSCI.**

▶ A Memorandum of Understanding on collaboration in the field of smart cities and infrastructure for 5 years was signed cementing the intention to cooperate

▶ First training courses:
  • Building Information Management,
  • National Construction Information Classification System,
  • Building Data Analytics and Applied Machine Learning.

▶ Application of artificial intelligence to address built environment challenges.

▶ BIM-LT project was launched, aiming to create tools for increasing the efficiency of construction planning, design, construction, operation and management of Lithuania public sector structures.

▶ Undergraduate students defended their final projects without paper drawings in CSCI for the first time in the history of the Faculty of Civil Engineering and Architecture.

▶ Design. Engineer. Construct! Lithuania workshop in Kaunas.

▶ First results of building reality mesh of central area of Kaunas city.

▶ The launch of DEC LT project!

▶ CSCI activities and strategy for Kaunas were presented at the Bentley's annual conference 'Year in Infrastructure 2019' in Singapore.

Our first annual report:
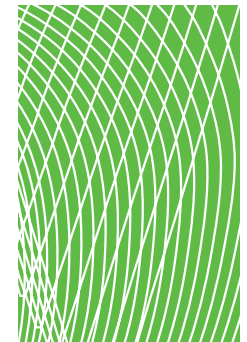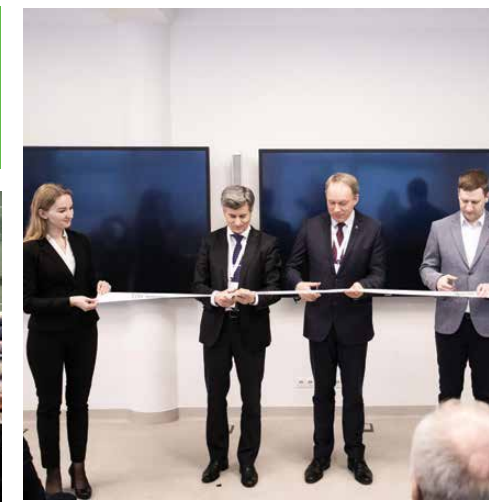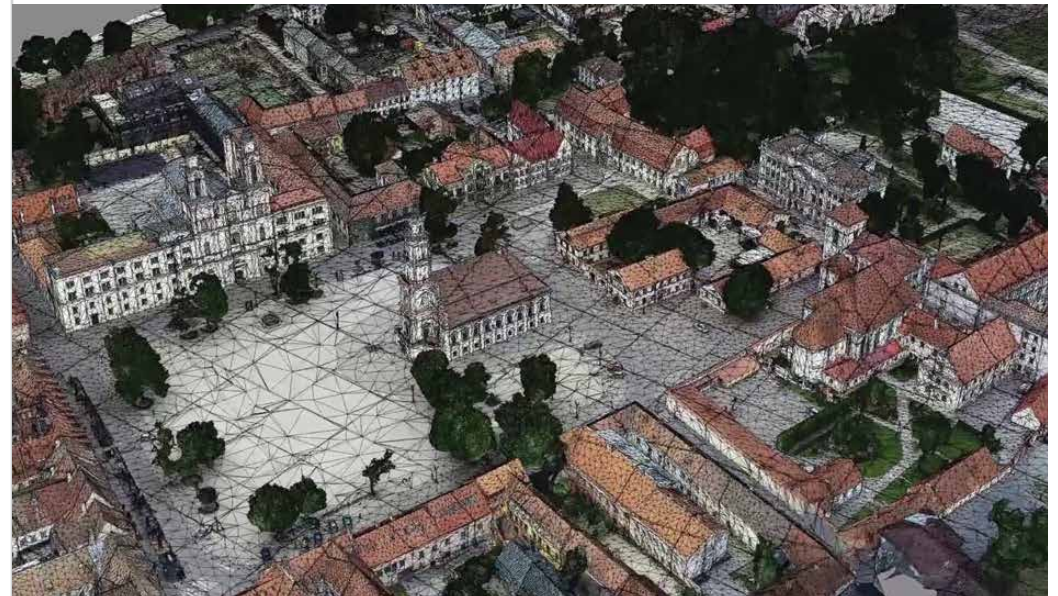
5 YEARS JOURNEY: 2020 HIGHLIGHTS

WORKING UNDER COVID19 LOCKDOWN

- ▶ Data Analytics and Machine Learning course for the AEC sector was launched.

- ▶ Kaunas Digital model was published for the public use.

- ▶ First year of DEC LT project finished with 12 teams and we started the second season.

- ▶ We organised online conference "Construction 4.0 for Smart Cities" during RESTA event.

- ▶ The establishment of the Lithuanian National Construction Information Classification System and the creation of its information system approved by the Government. The project was developed by KTU CSCI and VGTU teams.
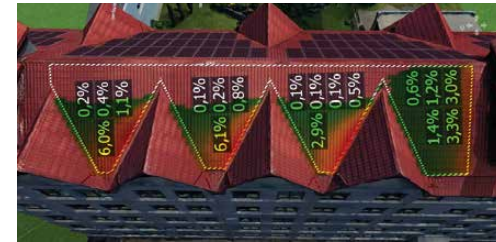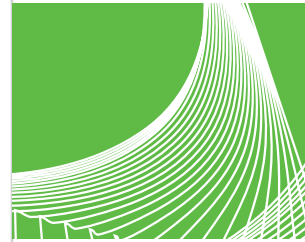

Our second annual report:

5 YEARS JOURNEY: 2021 HIGHLIGHTS

GROWING NETWORK

▶ During various projects we expanded the partnership with more than 45 internationally recognised institutions to foster mutual collaboration.

▶ More than 20 KTU researchers with different expertise were involved in CSCI projects.

▶ Regular participation in Construction Classification International Technical Committee by making policy regarding common standardisation of construction information between the Baltic Sea Region and neighbouring countries.

▶ CSCI course 'National Construction Information Classification System' was launched for the first time.

▶ 'Super namai' published 'BIM Guide' – the first book about BIM in the Lithuanian language with Darius Pupeikis as a co-author.

▶ CSCI became a member of Proptech LT.

Our third annual report:
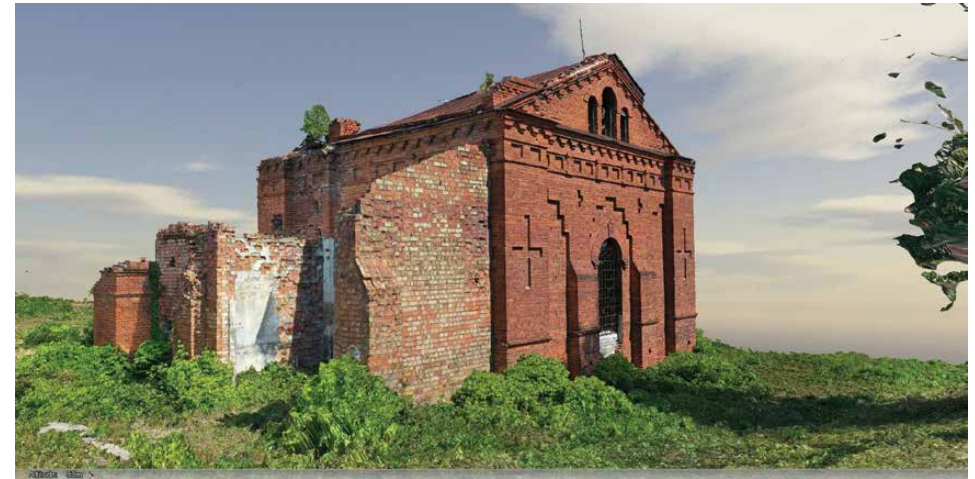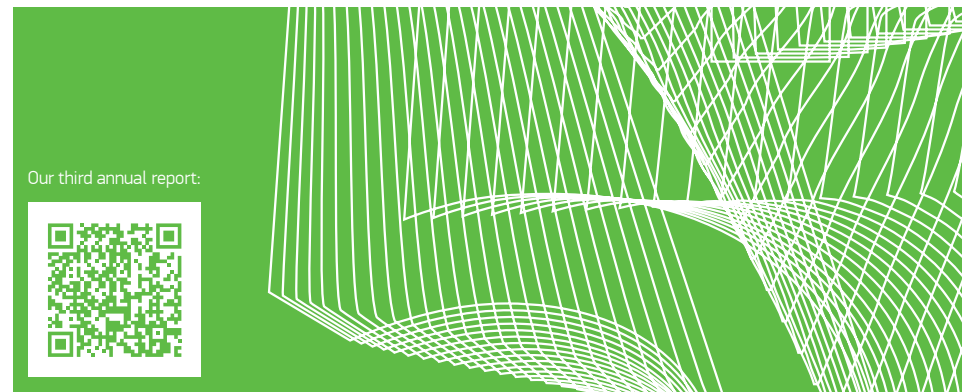
5 YEARS JOURNEY: 2022 HIGHLIGHTS

YEAR OF AWARDS AND RESEARCH

▶ CSCI won the nomination of 'The best BIM project of the city model' at Lithuanian 'Digital Construction 2022' event.

▶ In International 'Going Digital Awards in Infrastructure 2022' our Kaunas Digital Twin was nominated as one of the three finalists in the category of 'Facilities, campuses, and cities' and Founders' Honours acknowledgment.

▶ We organised the first built environment DIGITWIN hackathon. 14 teams participated.

▶ After the end of 3 season of 'Design. Engineer. Construct! Lithuania' for high school students we organised a special challenge with the unique opportunity for participants to visit London's Olympic district and Lithuania's embassy in UK.

▶ 2 new international projects SmartWins and CHRONICLE started.

▶ Our initiatives started to show in students final projects and more and more research articles by KTU team were published in construction digitalisation topics.

Our fourth annual report:

5 YEARS JOURNEY: 2023 HIGHLIGHTS
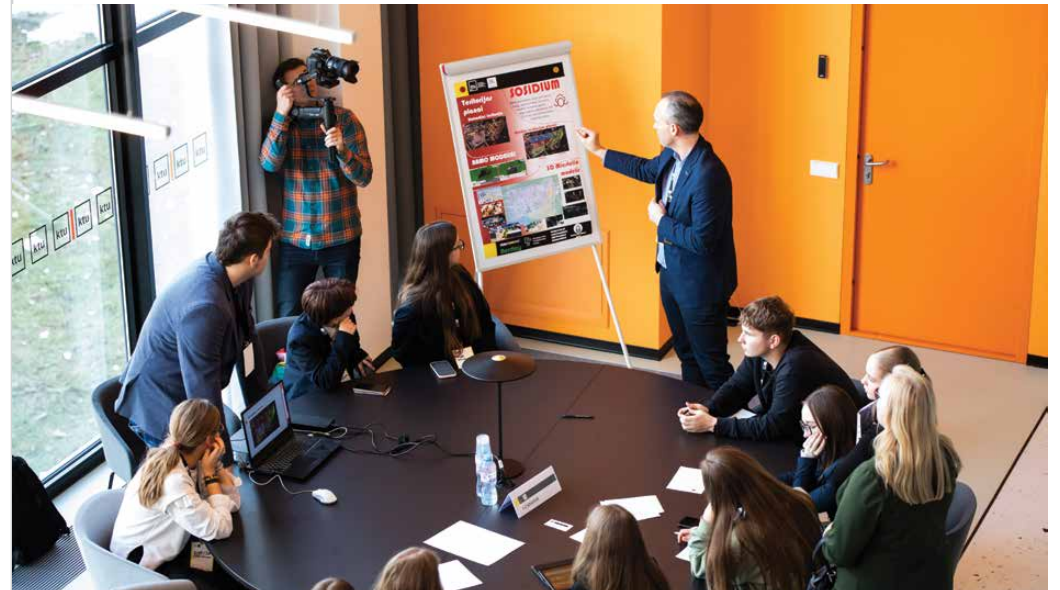
FOCUS ON DIGITAL TWINS

▶ The advisory board gathered for an extraordinary meeting, where memorandum of understanding was extended by another five years.

▶ Our projects were presented at Smart City Expo World Congress 2023 in Barcelona, by Andrius Jurelionis, the Dean of KTU Faculty of Civil Engineering and Architecture.

▶ CSCI team presented our projects in an opening event of KTU interdisciplinary prototyping laboratory centre M-Lab and in Study Fairs in Kaunas and Vilnius.

▶ We organised an experience sharing event about buildings sustainability for our industry partners.

▶ We presented for Lithuania STEAM centres representatives about our projects and collaboration.

PROJECTS

During these 5 years, our team have started or participated in a quite impressive number of projects. But as a part of the KTU Faculty of Civil Engineering and Architecture, our team are participating in various national and international projects. In some of them we are partners and sharing our know-how and doing tasks, related to our field, in others we took the steering wheel and are coordinating the entire project.

In the next pages, we will shortly present the main projects and what we have achieved in 5 years.
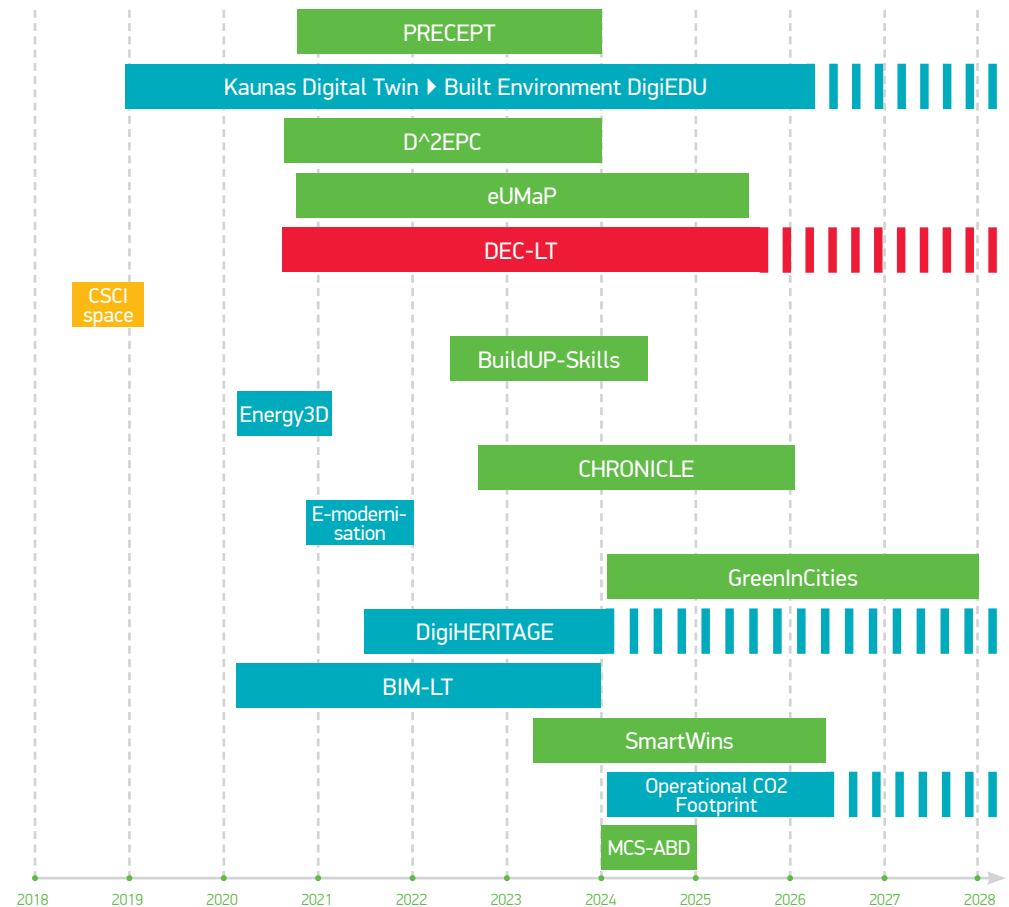
The CSCI has served as a driving force, fostering innovation and collaboration across diverse fields. Its role as a 'locomotive' has inspired SEBERG researchers and faculty members to engage in high-level, international research activities. Through its steadfast focus on digitization and sustainability, CSCI has positioned itself as a hub for groundbreaking advancements.

Paris A Fokaides
Chief Researcher
Faculty of Civil Engineering and Architecture

CSCI PROJECTS TIMELINE:

- 🟩 International;
- 🟦 National/internal projects;
- 🟥 Project for Shool students

Timeline bars:
- PRECEPT (International)
- Kaunas Digital Twin ▶ Built Environment DigiEDU (National/internal)
- D^2EPC (International)
- eUMaP (International)
- DEC-LT (Project for School students)
- CSCI space
- BuildUP-Skills (International)
- Energy3D (National/internal)
- CHRONICLE (International)
- E-moderni-sation (National/internal)
- GreenInCities (International)
- DigiHERITAGE (National/internal)
- BIM-LT (National/internal)
- SmartWins (International)
- Operational CO2 Footprint (National/internal)
- MCS-ABD (International)

Timeline years: 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028

16 17

FINISHED BEFORE 2024:

INTERNATIONAL:

A novel decentralised edge enabled prescriptive and proactive framework for increased energy efficiency and well-being in residential buildings

The overall goal was to make the building transformation from reactive to proactive more attractive to stakeholders, more reliable, secured and cost-effective, environmentally friendly, and in line with grid needs, thus enabling the acceleration of building proactiveness transformation. PRECEPT's ambition was to deliver the next-generation of Smart Home (IoT) industry.

🌐 *https://www.precept-project.eu*

Dynamic digital energy performance certificates

After 36 months of hard work and dedication, the Horizon 2020 project presents its final results. Thanks to the efforts of the 13 members of the consortium, the concept of the Next Generation Dynamic Energy Performance Certificates (EPCs) for buildings has been introduced and established in order to empower the regular energy classification of buildings and allow for an EU-wide deployment.

🌐 *https://www.d2epc.eu/en*

Build-Up Skills: rebooting the National Construction Platform and Roadmap

The rebooted National Platforms updated the Status Quo Analysis and National Roadmap to reflect the new realities of the building sector. This was done by addressing the necessary skills development activities related to digital technologies, and smart buildings including e-mobility, resource efficiency, circularity, integration of renewable energy technologies, heating, and cooling, industrialised deep renovation, Life Cycle Carbon Assessments, etc. while considering the wider EU recovery context.

🌐 *https://www.statybininkai.lt/lt/projektai/buildupskillslt2030*

FINISHED BEFORE 2024:

LOCAL:

Energy 3D

Building energy efficiency is one of the biggest problems in Lithuanian energy and construction industries as the largest part of existing buildings is not energy efficient. To improve energy efficiency buildings are renovated. Installation possibilities of renewable energy sources (RES) are often considered during preparation of renovation. During this project, the accurate 3D model of a specific area with known dimensions, orientation, coordinates of the objects in the model, was reconstructed by photogrammetry from a large number of photo fixations (photographs with positioning data). As 3D model recreates real environment it allows to simulate sunlight during different time of the day in every season.

Assessing the possibilities of sustainable modernization and energy supply of the city block using the digital twin (E-Modernization)

The aim of the project was to create a digital twin for the urbanized district and assess the potential for modernization and energy supply. The modernization twin concept is used in the modernization project - the developed method quickly evaluates the calculated geometrical parameters of buildings, combining their physical characteristics with a 3D model of the terrain, created by applying the photogrammetry of unmanned aircraft. The digital twin allows for a much more accurate assessment of the energy supply potential of the entire quarter, including the development of RES-based technologies.

Development of tools for increasing the efficiency of the life cycle processes of public sector structures using information modelling of a building (BIM-LT)

🌐 https://statyba40.lt/titulinis/bim-lt-projektas

DigiHERITAGE

In order to preserve endangered cultural heritage objects, KTU CSCI with Culture Heritage Department 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.

JUST STARTED OR CONTINUES:

INTERNATIONAL:

Development of utilities management platform for the case of quarantine and lockdown (eUMaP)

The aim of the project eUMaP is to implement multi-disciplinary activities that will lead to the development of an open platform through which local authorities will be able to plan and manage the demand and supply of building utilities in the case of quarantine or lockdown, including energy, water, waste and telecommunication networks.

🌐 https://eumap-project.eu

Building performance digitalisation and dynamic logbooks for future value driven services (Chronicles)

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 integrate ongoing initiatives methodologically, 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 entire 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.

🌐 https://www.chronicle-project.eu

SmartWins

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 building energy performance by the end of 2025. Embracing smart technologies such as Building Information Modelling (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.

🌐 https://smartwins-project.eu

GreenInCities

An EU-funded journey transforming climate action. The GreenINCities community is at the forefront of developing transformative, nature-based solutions. By valuing both human and non-human needs, we fuse data-driven innovation with neuroscience to co-create a sustainable future. Embark with us towards a proactive approach to climate adaptation and mitigation.

🌐 https://www.greenincities.eu

KAUNAS 3D

Kaunas Digital Twin

This is one of our most important projects, which gave us opportunity and knowledge needed to open a lot of other projects. In various industries, digital twins are used as real-time virtual representations of real-world physical systems or process technologies. A digital twin serves as a counterpart of a physical object for practical purposes, such as system simulation, integration, testing, monitoring, and maintenance.

'The digital twin of the city can be used for simulations of transport, people flow, energy modelling needs, management of buildings and related infrastructure. A part of the data that is safe to make it public can be opened to the residents,' says Darius Pupeikis, the Head of the Centre of Smart Cities and Infrastructure.

At the moment, the Kaunas Digital Twin project team is experimenting with various methods to create a digital city twin. Certain technologies are already being tested at the KTU student campus, and in the university buildings. For example, the team is building a digital twin of the new KTU M-Lab Laboratory.

'In a new building, all data can be collected: the locations of pipelines and communications are recorded in the digital model. Sensors can be installed to help monitor the vital parameters of the building while maintaining it. Once completed, it will be an internationally unique project in terms of its detail. The successful solutions can be applied in business or in the city itself,' says Pupeikis.

Kaunas Digital Twin was created using the OpenCities Planner platform by infrastructure engineering software company Bentleys, Inc.

design... engineer... construct!®

LITHUANIA

Design. Engineer. Construct! Lithuania

KTU Faculty of Civil Engineering and Architecture, together with partners, organises the project-based learning programme Design. Engineer. Construct! Lithuania. It is carried out together with partners from United Kindgom 'Class of your own'. In the 2019-2020 school year, teams from 3 schools (KTU Engineering Lyceum, Vilnius Žemyna and Panevėžys J. Balčikonis Gymnasiums) created the James Bond Hotel. Later more schools joined. Each year students are creating socially and locally relevant projects. From SOS town for refuges, to new train station for Rail Baltica. We want them to not just try civil engineering and architecture field, but to think more about our world and solutions to various problems.

During the project, participants work in teams of 5 (+ -1) students. During the year-long project, teams have to perform the analysis of the received task, find out the client's needs, the current market, the location of the building. They have to come up with their project idea, logo, and provide a description. Later, plan spaces, style, prepare 3D drawings and visualizations. Throughout the project, meetings with various experts, mid-term reviews, excursions take place. The participants are consulted by lecturers and students of Kaunas University of Technology.

CSCI - MUTUAL BENEFITS FOR ACADEMIA AND INDUSTRY

STATICUS

Skirmantas Bakas,
Head Of Design Department at Staticus

Staticus has been closely cooperating with the Centre for Smart Cities and Infrastructure (CSCI) of the Kaunas University of Technology (KTU) for the fifth year. As one of the largest companies of facade design, installation and maintenance services in Northern Europe, we enjoy partnerships that create long-term benefits for customers, partners and society.

By contributing to the support, development and formation of the centre's activities, especially by creating digital twins of the built environment, not only do we strengthen and improve the image of the construction market, but also encourage the development of academic activities outside the university.

With the help of the most advanced technologies and specialists, together we have created a sustainable, next-generation hybrid facade system (HUF). It is a solution that allows you to extend the life cycle of facade elements and reduce the CO_2 footprint left during the production and operation of the façade even up to 75%

By participating in the annual DEC LT project, we contribute to the attractiveness of engineering studies among high school students. I am glad that the number of participants is growing every year.

The Built Environment Digital Twin Hackathon event also brought interesting experiences to our team. It has become an excellent medium for young specialists to share knowledge and solve problems. I believe that this type of hackathon provides not only motivation to improve, but also thoughts on how ideas could be developed in everyday activities.

And by getting involved in the study process and events, we hope that we have created an academic environment where young professionals will be better prepared for real business challenges and will have relevant knowledge that is necessary in the modern construction market.

CSCI's activities are a platform that allows you to share experience, contribute to the education of schoolchildren and students, and open up opportunities for various R&D projects.

STRATEGIC PARTNERS IDEAS:

INHUS

Rytis Mušauskas,
Chief Executive Officer at INHUS Engineering

In order to achieve the best results, business cannot be disconnected from academic institutions. Cooperation with the KTU Smart Cities and Infrastructure Centre is inseparable for us from the aspiration to create advanced solutions adapted to the cities of the future. Involvement in the activities of the centre is a direct path to continuous improvement and the opportunity not only to follow market changes, but also to shape them. By participating in the Centre's activities, we have the opportunity to contribute to the development of innovative technologies, which are later reflected in our daily activities, increasing the company's efficiency and competitiveness.

The Centre's drive to digitise building and infrastructure management is a step forward in creating cities that are smarter, more efficient and more sustainable. For us, it is an opportunity to work with the latest technology, and for the construction industry, it means more productivity, less risk of errors and a greener future.

We are glad that this project of the technology Center brought us very close to other participating businesses, helped us discover more synergies and opportunities in joint projects.

STRATEGIC PARTNERS IDEAS:

YIT

Kęstutis Vanagas,
General Director YIT Lietuva

We use building information management (BIM) in our activities, we are advanced and constantly deepen our knowledge of digital construction. We aim to promote BIM and use it effectively, so joining the establishment of KTU CSCI seemed very natural. Our employees participate in trainings and seminars organised by the Centre. We believe in the importance and benefits of digital construction. Learning is a continuous process, especially in the field of digital construction. Technologies change, age, and we constantly have to learn new things. And a good engineer will always be in demand in the labour market, valued by the employer, and his work will be interesting, demanding responsibility and well paid. Especially those who constantly follow and apply innovations in digital construction. So, if you stop, you will inevitably fall behind. By cooperating with KTU, we can achieve symbiosis and even better results.

STRATEGIC PARTNERS IDEAS:

KAUNO TILTAI

Aldas Rusevičius,
Chief Executive Officer

Six years ago, we joined the creation of the Centre for Smart Cities and Infrastructure (CSCI) without any hesitation, understanding relevance of this initiative. The processes taking place around us are gaining lightning speed in all areas - fast travel, technology, and finally - lifestyle. It is more important than ever to make decisions, to organise and coordinate processes, anticipate challenges not just any way, but smartly and harmoniously. When rapidly evolving technologies obey practical needs, life situations (energy, transport infrastructure, buildings, heritage objects, etc.), it becomes much easier to trust them.

Seeing the enthusiasm with which the CSCI team develops ideas and projects that create value, we feel a mature, promising partnership. We appreciate the activity of Centre enthusiasts in participating in international projects and sharing knowledge with others. One of CSCI's strengths is its interdisciplinary (IT, civil engineering, architecture, data science, AI, etc.) vision of construction progress. It is synergy, not individual actions, that creates the highest quality and most sustainable result. I would like to single out the main strengths of CSCI - combining knowledge, concentration of competences and openness to future innovations. All this allows the organisation to grow and compete in a healthy way, to develop digitization experts. In addition, gathering and developing a community supporting the ideas of Centre is no less important. Well, and finally, the awards that CSCI received from the digital community only confirm that it is going in more than the right direction. We are pleased to be strategic partners in this breakthrough. We have no doubt that in the future there will be many unique opportunities to see the importance of digitisation in our everyday life. Good luck!
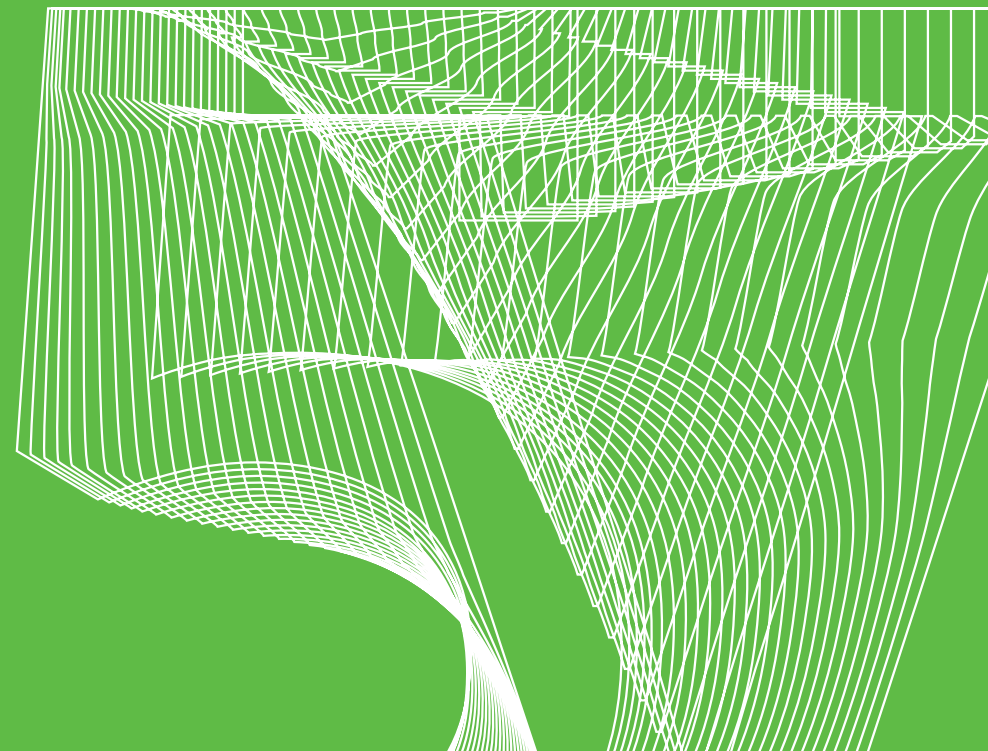
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