

## European Academic Smart Cities Network – Renewable Urban Energy Systems, Sustainable Mobility and ICT Technology Nexus for Smart Cities Studies

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### 1 ABSTRACT

The European Academic Smart Cities Network (EU-ASCIN) project at the University of Applied Sciences (UAS) Technikum Wien, founded by the municipal government of the city of Vienna in November of 2013, aims to set up an academic smart cities network in Central and Southeastern Europe. Within the framework of the project, cooperation with national and international universities and research institutions will be established.

The UAS Technikum Wien already offers study programs with some of the main topics of smart cities concept, such as smart energy, smart environment, and smart mobility. In the context of the project, these study programs will be evolved by introducing the concept of smart cities. In the first step, the introduction will be performed as courses of existing programs, and finally it could result in an independent joint or double degree program.

International cooperation with partner universities, research institutions, and other academic networks should stimulate the development of the smart cities study programs through know-how exchange, staff and student mobility, and future joint projects.

For the further development of the project and support of the new study program, a Web-based platform will be established. The platform will provide up-to-date information concerning technological progress, new concepts, introduced legislative regulations and current events in the area of smart cities. Information will be presented on different levels of complexity depending on the target audience students, teaching staff, or people simply interested in smart cities. After completion of the project, the platform will act as point of information for academic education and research.

The proposed paper will point out the general framework, the main objectives and the current state of the project progress.

### 2 INTRODUCTION

#### 2.1 Motivation

Smart City Vienna is the initiative introduced by the municipal government of the city of Vienna in 2011, which aims to "...consistently and continuously modernize the city in order to significantly reduce energy consumption and emissions without having to forego any aspects of consumption or mobility"<sup>1</sup>. The main objectives of the initiative are reducing CO<sub>2</sub>-emission resulting into achieving EU-targets, reducing energy consumption through increasing the use of renewable energy concepts, promoting multi-modal transportation possibilities thereby reducing individual motorized transport share and place Vienna as modern center for research and technological development. An important topic of the initiative is the integration of citizens in the smart city concept, by providing the possibility for participation in decision-making process. By increasing interest of the wide public about responsible and considerate use of the natural resources, the concept of smart city can be invoked into live.

Academic education contributes in the wide extent to research and innovation and is an important component of the smart cities implementation process. Currently, the institute of Energy Systems and Electrical Propulsion at the Technical University Vienna is the only academic project partner involved in the Smart City Vienna initiative. The initiative designates only limited involvement of the academic education in the implementation of the smart cities concept. The EU-ASCIN project aims to fill this gap in the Smart City Vienna initiative and to contribute to the development of an independent smart cities study program.

## 2.2 Project Framework

### 2.2.1 Involved Institutions

The UAS Technikum Wien got involved in smart cities sub areas through existing study programs. On the one hand bachelor's program Transport and Environment extensively covers the area of Smart Mobility. On the other hand bachelor's program Urban Renewable Energy Technologies and master's Renewable Urban Energy Systems are dealing in the large extent with the sub areas of Smart Energy and Smart Environment. UAS Technikum Wien has already participated in a number of national and international projects in the research area of renewable energy systems in the past several years.

UAS Technikum Wien is the only institution responsible for the realization of the EU-ASCIN project. Departments "Information Engineering and Security" and "Renewable Energy" have commonly submitted the project proposal. These two departments are responsible for the technical implementation of the project with the goal to increase competence in the smart cities sub-areas smart mobility and smart energy and to initiate cooperation with other academic organizations.

Project management of EU-ASCIN underlies the area of responsibility of MOOSMOAR Energies OG, which is an external consulting company with the main emphasis on renewable energy systems.

Endowed professorship for career field research and gender mainstreaming and diversity management representative are also involved in the project implementation process. The sub-goals of the EU-ASCIN project are examination of the existing job market and consideration of the gender aspects. The questions to answer from this point of view are: which job options are offered by the market, which areas are still not covered by existing educational programs and what are future job positions resulting from developments in the smart city area.

In the light of the latest research programs, which aim to establish equal opportunities despite differences in age, gender, cultural and ethnic backgrounds, education, career and other fields of life, gender and diversity aspect should also be considered. Thus, EU-ASCIN pursues the idea of equality from begin on in form of consistent screening of the project activities with respect to diversity and gender equality.

One of the main ideas of the EU-ASCIN project is the establishment of the partner cooperation on the academic education and research level. For this purpose several project partners were chosen.

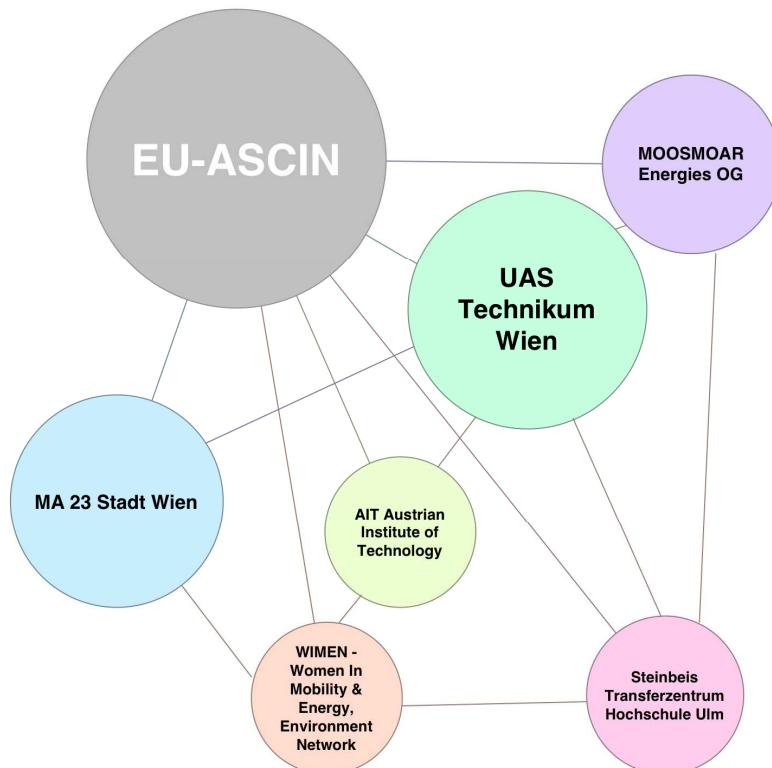


Fig. 1: EU-ASCIN project partners.

Project partners' main role is to contribute with their ideas, their own contacts and partnerships, their professional know-how to the development of the academic network and smart cities study program. Those cooperation partners include Austrian Institute of Technology (AIT), Women In Mobility & Energy, Environment Network (WIMEN) and Steinbeis transfer centre at the university Ulm in Germany. AIT, department Energy and Mobility is the program coordinator of the EU-Initiative for smart cities and project manager of the "Joint Programme for Smart Cities of the European Energy Research Alliance"2.

UAS Technikum Wien and AIT are involved into EU strategy-process for education – SET Plan Education and Training Initiative for Photovoltaic Solar Energy. WIMEN is network of women, which perform extensive work in the areas of mobility, energy and environment. Steinbeis center for decentralized and renewable energy systems maintains the European Network of Danube Universities. University Ulm areas of research are smart grids, smart cities and renewable energy. The cooperation between University Ulm and UAS Technikum Wien exists since 2012. Cooperation was performed in form of a summer academy "Green Waves Summer School" with emphasis on renewable energy.

The involvement of the project partners includes several workshops and meetings during the whole project run-time. As mentioned above, cooperation partners contribute with their know-how and participate in the project in role of councillors in cases where their knowledge is needed. Second point of this cooperation is collective elaboration of the smart cities study program, where project partners can share their work experience and practical knowledge. This contribution is essential, as the study program should cover the future needs of the job market. Further goal of this cooperation is the joint maintenance of the set up educational and informational platform, where project partners can provide relevant information for the students, lecturers and people involved.

### **2.2.2 Project run-time and funding**

EU-ASCIN project proposal was submitted within the framework of the 14. Announcement of Universities of Applied Sciences Funding Program "Internationalization of Education and Research" provided the municipal government of the city of Vienna. Project is planned for the total run-time of 3 years, starting in November of 2013. The set up Web-platform and implemented smart cities study program will be maintained after project completion.

### **2.3 Project Goals**

EU-ASCIN aims to establish an academic network in the area of smart cities based on the cooperation with international universities in Central and Southeastern Europe. Bachelor's degree programs Urban Renewable Energy Technologies and Transportation and Environment as well as master's degree programs Renewable Urban Energy Systems and Intelligent Transport Systems at the UAS Technikum Wien are extensively involved into sub-areas of smart cities. Within the framework of this project, these study programs will be elaborated and a new international interdisciplinary "Smart Cities" specialization will be established. Using provided competence in the area of smart cities, the visibility and presence of the smart cities theme in the wide public will be enhanced. Beyond the specialization "Smart Cities" all possibilities for a joint degree study program will be evaluated.

Onwards the presentation of the network should be implemented by a Web-platform, which provides information and details to recent technological innovations and upcoming events. The platform presents the know-how of the project partners for the possibility of future cooperation and joint research proposals.

Beyond the idea of expert-forum, platform will address students and research-staff who are interested in the study possibilities at the universities of cooperation partners. From the project framework analysis 3 main objectives could be defined. The graphical representation of those can be found below.



Fig. 2: EU-ASCIN project goals.

### 2.3.1 Establishment of the international academic smart cities network

The main goal of the project is the establishment of the academic smart cities network, resulting from the cooperation with the international universities in central Europe and Southeastern region. The network shall provide important contacts for the future project cooperation and joint degree programs.

### 2.3.2 Integration of the Smart Cities Subject in education programs

There is already successfully implemented cooperation with other academic institutions, which are manifested in several double degrees programs at the UAS Technikum Wien. Inter alia, these programs are European master's of science in Intelligent Transport Systems in cooperation with the Linköping University and Czech Technical University and double degree program Information Systems Management in cooperation with Kharkov National University of Economics. Based on these long-standing experiences with multiple degrees programs an own smart cities study program can be developed. For this purpose the established cooperation with the project partners can be of particular use.

### 2.3.3 Scientific Presence

The two sub goals of this goal are: firstly, implementation of the Smart Cities Conference Vienna, which aims to establish the city of Vienna as international centre of competence for smart cities research and development; secondly, development of the Smart Cities information and education platform which should provide people interested in smart cities subject with relevant information, as technical innovation, legislative regulations, recent events, cooperation and possible funding opportunities for research projects. Educational platform offers a possibility to enhance the competence using the e-learning methods. Smart Cities Conference Vienna is the finale step of the EU-ASCIN project. UAS Technikum Wien and cooperation partners together with the municipal government of the city of Vienna will organise a scientific conference. The program with duration of one or several days will link the highlights from the scientific community and will represent in particular most significant projects in the economic environment of the city of Vienna. One of the important issues of the conference will be gender and diversity aspect. Inspired by the Intelligent Transport Systems (ITS) Congress in Vienna, 2012 Smart Cities Conference will emphasize "Women in Smart Cities" aspect and offer various possibilities for participation and meetings.

### **3 RELATED PROJECTS AND NETWORKS**

#### **3.1 The North See Region Programm 2007-2013**

The North Sea Region Programme is a EU-level cooperation project involving Sweden, Denmark, Germany, the Nederland, the Flemish Region of Belgium, the UK and Norway. These countries are connected by the North Sea and share many of the common problems and challenges. The main objective of the cooperation is to share the know-how and experiences, to ensure higher quality of life, sustainable and balanced future in provided region.<sup>3</sup> One of the projects implemented within the framework of the North See Region Programme is the Smart Cities project. The general purpose of the project is to interconnect the governments and academic partners, using ICT technology and e-services in particular. The project includes implementation of the Smart Cities Regional Academic Network, which is led by Edinburgh Napier University. The network partners include the Edinburgh Napier University, MEMORI and UAS Oldenburg, commercial and several associate partners from across the North See Region.<sup>4</sup> The academic network plays supportive role in the project, by offering practical knowledge, implementing pilot projects, defining white papers and providing good practical methodologies. Academic partners work in close cooperation with the municipal governments to improve e-services, by implementing local IT-infrastructure, developing surveys and analytical tools.

#### **3.2 RCE Vienna**

Regional Centre of Expertise on Education for Sustainable Development Vienna is a network of existing academic organisations with the main objective to provide higher education level for sustainable development to local and regional communities. The project implements an interdisciplinary, informational and educational communication platform for promoting sustainable development concepts among the regional stakeholders.<sup>5</sup> The relevant themes of the RCE Vienna are sustainable urban and regional development, smart cities themes and processes, climate change and sustainable entrepreneurship. Several projects in these areas are “Green Buildings Solutions”, “Eco-Mobility in the Austrian-Hungarian boarder region (EMAH)” and “Sustainability Challenge”. “Green Buildings Solutions” is a three-week summer-school program with the main theme of energy-efficient building, urban planning, passive house concepts and renewable energy sources. EMAH project looks into mobility behaviour of local residents in the Austro-Hungarian boarder region with the main goal to jointly develop eco-mobility concepts. “Sustainability Challenge” is an interdisciplinary study program with emphasis on sustainable and resilient development in the area of smart cities. Program includes lectures on e-governance, sociological and ecological aspects, climate change and sustainable urban planning.

#### **3.3 SMART Community – Technology – City, TU Wien**

Research centre for Energy and Environment at the Vienna University of Technology is a cross-faculty network, which deals with several smart cities sub-aspects. The network includes more than 20 lecturers and their assistants from more than eight faculties, which are organised in 19 working groups. Research fields of the SMART community include energy sustainable housing and infrastructure; sustainable and low-emission mobility; climate-neutral energy generation, storage and distribution; environmental monitoring and climate-change; efficient use of fissile resources; and sustainable technologies, products and production. SMART community also offers several lectures dealing with sub-aspects of smart cities, enterprise services, research projects implementation and know-how exchange. <sup>6</sup>

### **4 UAS TECHNIKUM WIEN IN THE CONTEXT OF SMART CITIES**

Smart cities concept introduces the cities of future, which are more sustainable, resilient, energy efficient, resident friendly and offer higher quality of life for all population groups. The numerous definitions of smart cities, consider at least the areas of Smart Mobility, Smart Environment, Smart Government, Smart Living, Smart Economy and Smart People.

UAS Technikum Wien intentionally delimits its scope of themes, and concentrates on 3 sub-aspects of smart cities, such as smart people, smart energy and smart mobility. The sub-aspect of smart people includes state-of-the-art education, active citizen participation in smart city concept and social awareness. UAS Technikum Wien identifies itself as a role model and forerunner for societal opinion, therby the aspect of smart people is the key aspect in implementation of smart cities concept.

Smart mobility is the main research area of the bachelor's degree program Transport and Environment and master's degree program Intelligent Transport Systems. Smart Energy is the field of employment of bachelor's degree program Urban Renewable Energy Technologies and master's degree program Renewable Urban Energy Systems.

Existing study programs each concentrates on own sub-area, unaware of possible synergies and cooperation possibilities. After introducing the area of smart cities in the scientific community and since the inception of the Smart City Vienna Initiative in 2011, UAS Technikum Wien is designated to set up the competence and offer networked and joint study course in smart cities.

As it can be seen from the related projects in 3. Related Projects And Networks, there is no particular study program in smart cities, each project offers own focus, either on energy or on mobility.

The main goal of the UAS Technikum Wien in this context is to fill the gap on the educational and research level, by introducing an integrative system approach, where smart mobility and smart energy are interconnected and expanded by the aspects of the ICT and urban planning.

EU-ASCIN project is the first scheduled step towards the holistic integration of the smart cities theme in the educational program. Subsequently existing study programs should provide a well-founded basis to build on the smart cities competence.

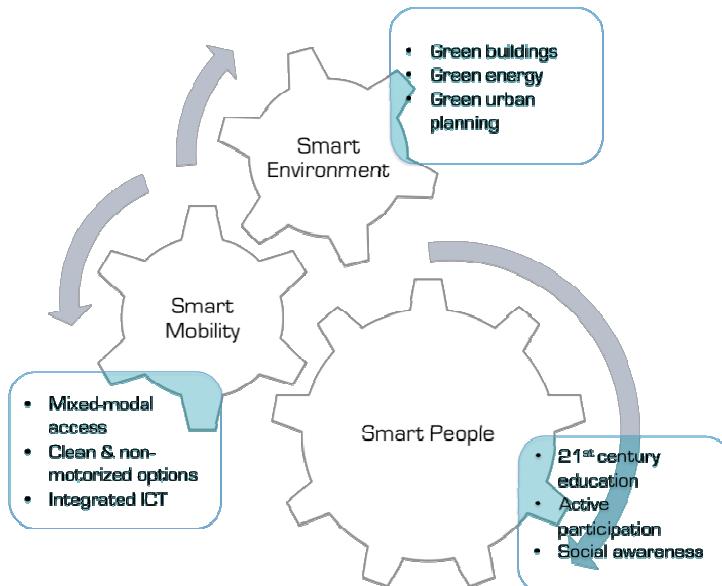


Fig. 3: EU-ASCIN topics

#### 4.1 Smart Mobility

Smart Mobility is a sub-aspect of smart cities, which focuses on energy efficient, low-emission, safe, comfortable, economically efficient and accessible transportation modes. People take an active part in this concept by living the smart cities concept and choosing consciously "intelligent" solution. Definition of the smart mobility emphasizes in the first line optimized and intelligent use of the infrastructure, considering existing state of the art information and communication technologies. Main driver indicators of smart mobility according to Boyd Cohen are mixed-modal access, clean and non-motorized options and integrated ICT.7 Bachelor's degree program at UAS Technikum Wien with duration of 6 semester focuses on telematics, traffic management, traffic information systems, multimodal transportation modes, environmental aspects of the traffic engineering, electro mobility, driver assistance systems and traffic simulation.

The number of student projects aim to implement the theoretical fundamentals in state of the art technical projects. Those projects include smartphone app development for traffic information, indoor navigation, multimodal ticketing, software development for traffic simulation, fleet management, and container management, methodical analysis of traffic survey, congestions and routing optimization.

The ambitions of this study program are to provide students with wide and well-founded basic knowledge, which can be deepened in following master's degree program Intelligent Transport Systems.

By introducing the concept of Smart Cities, these two study programs will be enhanced and interconnected with renewable energy aspects, practical implementation of electro mobility concept and alternative propulsion types.

#### **4.2 Smart Energy**

Smart Energy is the core concept of smart cities, with the main objective to provide future smart city residents with climate-friendly, available and high quality living space and to support their needs according to the sustainable economy concepts. Smart energy includes energy- and resource-efficient concepts primarily based on renewable energy technology concepts. These concepts are using resilient resource systems and innovative approaches for strategic planning. The use of the ICT is an important part of smart energy concept. The area of smart energy covers wide thematic aspects as energy generation, energy-conscious buildings design, urban planning and smart grids. Boyd Cohen includes smart energy as main driver of smart environment sub-aspect.<sup>7</sup>

The Urban Renewable Energy Technologies bachelor's degree program offers a well-founded education with three topical focuses: renewable energy technologies, industrial-scale plants and buildings – energy – design. Students learn how to develop and set up the power supply systems of the future as well as how to dimension these systems and combine them into an integrated system to provide the world with the power it needs. The knowledge acquired during the bachelor's degree can be enhanced by following up master's degree program in Renewable Urban Energy Systems.

#### **4.3 Future Study Programs**

By using synergies of the both areas of smart mobility and smart energy, and by the expertise and well-founded technical competence, a new specialization in the area of smart cities becomes possible. In the first line it is a good chance to implement first cross-faculty study courses and subsequently joint research projects. Additionally, after successful cooperation of both faculties and using emerged network contacts from EU-ASCIN an own joint degree master's program is also conceivable.

### **5 CURRENT STATUS OF THE PROJECT**

The implementation of the EU-ASCIN project can be devided into 4 main parts: conception and planing stage; implementation phase with start-up projects; visibility and public work; and supervising project management. The subject of gender and diversity monitoring is an integrate part of all project phases.

Currently EU-ASCIN project is on the midway in the conception and planning phase, with workpackages 1 and 2 beeing completed. Within the workpackage 3 a workshop with project partners will be held, this workpackage is already planned and organized.

Independent from the project plan, the first steps towards information and communication platform are beeing made. A Web page of the project has been published, providing in the first line project key facts and additional information about project partners. The next step of the project determines detailed conception and further implementation of the platform, considering the input of the project partners from the workshop.

#### **5.1 Conception and Planning**

##### **5.1.1 Work package (WP) 1**

The project started in November 2013 with the conception and planing phase. Within the WP1 the current status of national and international activities in the research and development area of smart cities was evaluated. The main goals of the WP1 are on the one hand to define the positioning of the UAS Technikum Wien in the smart cities research context and to define the focus of possible research and study areas and on the other hand to provide the demand analysis of the job market in smart cities relevant areas.

The WP1 was implemented jointly by teams of smart mobility and smart energy each with their own focus. The result of the this workpackage is summarized in a report with the main focus on economic area of the city of Vienna.

According to this workpackage, UAS Technikum Wien is placing its own activities in the smart cities mainly in the thematic areas of urban energy technologies, environment, transportation systems and ICT. These areas are disignated to be enhanced and integrated in an own study focus. Within the reasearch work, the gaps

in the existing smart cities academic projects and smart cities educational programs have been determined. The main gap emerged is the missing interconnection between the energy and mobility areas. EU-ASCIN aims to fill this gap by considering the isolated interconnection between energy, mobility and ICT technologies.

Furthermore, within the WP1 the decision was made to use existing endowed professorship position for career field research at the UAS Technikum Wien for the demand analysis of job market in smart cities area. The knowledge of the endowed professorship was already used in the preparation and design of several study programs. Many years of experience on this field should be used to consider the demands of professional market from begin on in smart cities study program design. Using the scientific methods and practical approach, a report considering job market analysis will be provided.

### 5.1.2 Work package (WP) 2

Existing smart cities networks were evaluated within the conception phase aiming to find possible synergies and potential partners. The objective of the WP2 is to consider the experiences of existing smart cities networks in EU-ASCIN project and to establish the interconnection to the future informational and educational platform.

Within the WP2 the cooperation partners of the EU-ASCIN project were designated. There already existing cooperation within the Energy and Transportation area with Austrian Institute of Technology and European Network of Danube Universities (Ulm). The result of this work package will be concentrated in an own report, providing overview over existing academic networks, their main objectives and methodical approach. Furthermore, report will provide recommendations concerning cooperation and synergy possibilities.

### 5.1.3 Further Steps

According to the project plan, the next phases after conception and planning are the implementation phase and public work. The future work packages and next steps can be found in the table below.

| Phase                         | WP   | Description  | Expected Results  |
|-------------------------------|------|--|---|
| Conception and Planning Phase | WP1  | Evaluation Smart Cities activities in research and development     | Report containing research and development activities, including gender and diversity aspect and demand analysis of the job market        |
|                               | WP2  | Evaluation Smart Cities networks                                   | Report containing existing networks in the area of smart cities   |
|                               | WP3  | Workshop with the project partners                                 | Workshop report, gender and diversity review  |
|                               | WP4  | Initiate research cooperation with network partners                | Research map  |
|                               | WP5  | Design and planning of study programs                              | Brief descriptions of study programs and concepts for student projects  |
|                               | WP6  | Design and planning of informational and educational platform      | Concept paper   |
| Implementation Phase          | WP7  | Develop study programs   | Curriculum matrix and detailed content of teaching  |
|                               | WP8  | Implementing international student projects                        | An international student project is performed   |
|                               | WP9  | Implementing and shaping of informational and educational platform | Document content analysis, screen design, specification to hardware and software; Platform is online                                      |
|                               | WP10 | Prepare research proposal  | Innovative project idea is selected; Call for submission is found; Research proposal is written;  |
| Visibility and Public Work    | WP11 | Publication study programs   | Study programs are online   |
|                               | WP12 | Release informational and educational platform                     | Platform is approved for network partners and the general public  |
|                               | WP13 | Smart Cities Conference Vienna                                     | Conference theme is set, tender is finalized; conference platform is online; conference is organized and conference content is finalized; |
| Project Management            | WP14 | Gender and Diversity Monitoring                                    | On-going review of gender and diversity management; an annual gender and diversity monitoring report is provided                          |

Table 1: EU-ASCIN work packages

## 6 CONCLUSION

After evaluating the current smart cities activities and existing academic research status it can be concluded that a lot of projects are simply restricted to particular aspects of smart cities concept. It has been determined that there is a number of study programs at several universities which focus on selected sub-aspect of smart cities, such as telematics, energy management, renewable energy systems, traffic management, information and communication technology, solar technology, urban planning, etc.



As the motivation for EU-ASCIN project, it also has been observed that only a few joint projects exist, which are using synergies between individual sub-aspects, and no study program exist which provides interconnected courses and holistic knowledge in smart cities context.

UAS Technikum Wien is going to fill this gap by providing the first of its kind smart cities course with the possibility for an own study program, which considers gender and diversity aspects and is wholly designed considering the requirements of the job market.

Finally UAS Technikum Wien will use developed competence in the smart cities areas to expand own fields of research and submit new projects.

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