

# REPORT ON

## ENTREPRENEURIAL CASES 2018: "ENTREPRENEURSHIP IN ICT" AND ENTREPRENEURSHIP WITH ICT"

THE ICT ENGINEER OF 21ST CENTURY: MASTERING  
TECHNICAL COMPETENCIES, MANAGEMENT SKILLS,  
AND SOCIETAL RESPONSIBILITIES

**TEAMSOC ZAGREB 2018 MULTIPLIER EVENT**

Prepared by:



**TeamSoc21**  
The ICT Engineer of the 21st Century

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Erasmus+ Programme  
of the European Union



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Faculty of Electrical Engineering and Computing  
Zagreb, Croatia

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**TEAMSOC21 Zagreb 2018 Multiplier Event**

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# 1. INTRODUCTION

*Vedran Podobnik*

*University of Zagreb Faculty of Electrical Engineering and Computing  
TEAMSOC21 Project Coordinator.*

## The ICT Engineer of 21st Century: Mastering Technical Competencies, Management Skills, and Societal Responsibilities (TeamSoc21)



*TeamSoc21 logo*

TeamSoc21 project URL: <http://sociallab.education/teamsoc21>

TeamSoc21 project at the official ERASMUS+ dissemination platform: <https://goo.gl/SYii7e>

TeamSoc21 project Facebook page: <https://www.facebook.com/teamsoc21>

TeamSoc21 project Instagram page: <https://instagram.com/teamsoc21>

TeamSoc21 project duration: 1 September 2017 – 31 August 2019 (2 years)

TeamSoc21 project budget: 224,137.00 EUR

TeamSoc21 project team: 100+ lecturers and students from 12 universities from 8 EU countries

There is a critical need for educating millions of new "ICT engineers of the 21st century" throughout the EU because they will be one of the crucial parts of the companies in the **Industry 4.0 era** which is ahead of us. Surely, such highly skilled professionals will be equally important for both **multinational companies** consisting of hundreds of thousands of employees as well as for establishing hundreds of thousands of new **start-up companies**. The "The ICT Engineer of the 21st Century: Mastering Technical Competencies, Management Skills, and Societal Responsibilities (TeamSoc21)" project is a step forward in that direction, taken by consortium of 12 universities from 8 EU countries. The main objective of the TeamSoc21 project is to set up a transnational multidisciplinary intensive study program in the field of ICT-based entrepreneurship.

The TeamSoc21 curricula, which will be available as an open educational resource (OER), consists of four main topic groups:

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- **"entrepreneurship"** as a core topic;
- **intercultural topics**, with focus on "multicultural teams";
- **ICT topics**, with focus on "entrepreneurship based on ICT";
- **student start-up projects**, with focus on "entrepreneurial cases on how ICT can contribute to innovative societal development".

„*Entrepreneurship*“ as a core topic of the TeamSoc21 curricula follows a multidisciplinary approach that includes **technology innovation** processes, **business and management** development, **intellectual property**, as well as **technology policy** issues.

*Intercultural* part of curriculum uses interactive approach and focuses on **multicultural team** building through exchange of practices from different cultures and by analysing societal challenges from **local, regional and global perspectives**.

*ICT* part explains why ICT is one of **Key Enabling Technologies**. It includes practical examples tailored specifically for TeamSoc21 providing knowledge/insights into hot ICT topics – **“entrepreneurship in ICT”** and especially **“entrepreneurship with ICT”** – which offer potential solutions for some of the biggest societal challenges.

*Student "start-up projects"* elaborate entrepreneurial cases related to the role of ICT in responding to societal challenges defined by "Europe 2020"<sup>1</sup> and "Horizon 2020"<sup>2</sup> programs. Entrepreneurial projects will be based on the **“blended” mobility** approach and organized in two phases: (i) **preparatory (virtual mobility)**; and (ii) **execution phase (physical mobility)**. Physical mobility will be implemented through two two-week workshops hosted by partner universities in 2018 (Zagreb) and 2019 (Valencia). Workshop participants will be students and professors from partner universities as well as industry/start-up experts from the hosting country.

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<sup>1</sup> [https://ec.europa.eu/info/business-economy-euro/economic-and-fiscal-policy-coordination/eu-economic-governance-monitoring-prevention-correction/european-semester/framework/europe-2020-strategy\\_en](https://ec.europa.eu/info/business-economy-euro/economic-and-fiscal-policy-coordination/eu-economic-governance-monitoring-prevention-correction/european-semester/framework/europe-2020-strategy_en)

<sup>2</sup> <https://ec.europa.eu/programmes/horizon2020>



## Blended mobility of higher education students



*Blended mobility is a hybrid approach to mobility allowing students and lecturers to work closely before, during and after the TEAMSOC21 workshop.*

 **60+**

Total number of participants

 **24 days**

Total duration

### *TeamSoc21 blended mobility for students – combining virtual and physical mobility*

The TeamSoc21 project aims to achieve the following **Erasmus+ program objectives**:

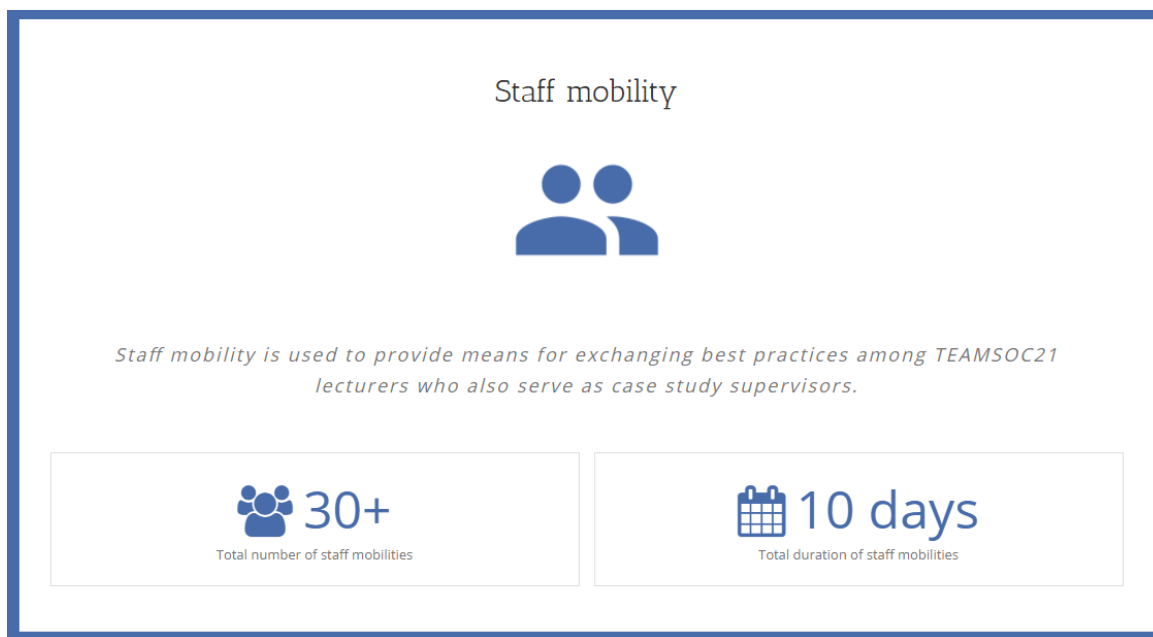
- enhancing **relevance of student knowledge, skills and competences**
  - especially in fields of transversal skills and entrepreneurial experiences for engineering students;
- developing **open and innovative practices for digital era**
  - ICT is one of the central pillars of the project;
- supporting the production and adoption of **open educational resources (OER)**;
- pursuing **priorities enlisted in general EU strategies**
  - "Europa 2020, Innovation Union" – "smart, through more effective investments in education, research and innovation");
- pursuing **specific EU strategies**
  - "Horizon 2020" – "all societal challenges will be covered in TeamSoc21 entrepreneurial cases";
  - "Education and Training 2020"<sup>3</sup> – "enhancing creativity and innovation, including entrepreneurship" and "making lifelong learning and mobility a reality").

<sup>3</sup> [http://ec.europa.eu/education/policy/strategic-framework\\_en](http://ec.europa.eu/education/policy/strategic-framework_en)

Additionally, the TeamSoc21 project aims to achieve the **specific Croatian higher education objectives** as well:

- **internationalization** of higher education;
- enhance **mobility rates**;
- better **link of education with the labour market**.

The first two specific objectives are achieved through enabling Croatian students to participate in Erasmus+ "blended mobility" as well by hosting TeamSoc21 Intensive Program Workshop 2018 in Zagreb, while the third specific objective is targeted through the entrepreneurial-oriented cases.



### *TeamSoc21 staff mobility for lecturers*

Implementation of the project will have positive effects on needs of **participating organisations, target groups** and **relevant stakeholders** that will be affected by the project:

- *Participating organisations* – "TeamSoc21 universities" – popularization of entrepreneurship among students;
- *Target groups* – "students (and professors) at TEAMSOC 21 universities" – enhance relevance of student (and professor) knowledge, skills and competences; "high-school students from TeamSoc21 Workshop hosting countries" – popularization of STEM studies through Multiplier Events;
- *Relevant stakeholders* – "TeamSoc21 countries" – better link of education with the labour market.



**Vedran Podobnik**

University of Zagreb Faculty of Electrical Engineering and Computing  
*TeamSoc21 Project Coordinator*

**Jurica Babic**

University of Zagreb Faculty of Electrical Engineering and Computing  
*TeamSoc21 Project Manager*

## 2. TEAMSOC21 PARTNERS

*International project with 12 members from 8 countries.*

University of Zagreb, Faculty of Electrical Engineering and Computing  
(UNIZG-FER)



University of Zagreb,  
Faculty of Electrical Engineering and Computing



CROATIA, Zagreb

Project Coordinator, Steering Committee, Partner

The University of Zagreb (1669), which consists of 34 faculties and academies, is the oldest and biggest university in the South-Eastern Europe. With its comprehensive programmes and over 50,000 full-time students the University of Zagreb is the strongest educational institution in Croatia. Specifically, the Faculty of Electrical Engineering and Computing, through education and innovation in fields of electrical engineering, computer science and information and communication technology, prepares students for leading technological and societal development of Croatia.

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Project reference: **2017-1-HR01-KA203-035408**



## How do we innovate at the UNIZG-FER?

As Croatia's leading academic institution, we combine knowledge of our professors, curiosity of our researchers and open-mindedness of our students to foster innovation in our society and economy.

## How do we use ICT to tackle societal challenges?

For example, we use ICT to develop innovative mobile applications for persons with complex communication needs (e.g., persons with Down syndrome). For more info check out our [ICT-AAC project](#).

## How do we promote intercultural environment?

Intercultural dialogue attracts a lot of attention in Croatia, the youngest member of the EU. This is why at our university we encourage interaction between different cultures, communities and people.

### Contact:

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UNIZG-FER Team Leader

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## Universitat Politècnica de Valencia (UPV)



UNIVERSITAT  
POLITÈCNICA  
DE VALÈNCIA

Universitat Politècnica de Valencia



SPAIN, Valencia

Steering Committee, Partner

UPV is a public Higher Education Institution actively involved in international cooperation and mobility projects. UPV hosts over 36,000 students and employs over 5,000 people (teaching, research, administrative, services staff). It is the first technological university in Spain according to international rankings (e.g. Shanghai Ranking of World Universities) and offers 33 undergraduate programmes, 73 official Master's degrees and 28 Doctorate programmes.

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## How do we innovate at the UPV?

Technical University of Valencia ranks in the top 3 technical universities in Spain and Teelcommunication School provides around 25% of the research at UPV representing only 4% of the staff.

## How do we use ICT to tackle societal challenges?

ICT is used widely at UPV, including teaching and research applications, like Sakai facilities, remote teaching, etc.

## How do we promote intercultural environment?

UPV is the second university in Spain that welcomes ERASMUS student which gives an idea of the intercultural and plurinational environment that the campus provides.

### Contact:

Felipe Penaranda Foix

UPV Team Leader

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## Hochschule für Telekommunikation Leipzig (HfTL)



Hochschule für Telekommunikation Leipzig  
University of Applied Sciences

Hochschule für  
Telekommunikation  
Leipzig



GERMANY, Leipzig

Steering Committee, Partner

HfTL is a private university under the patronage of the HfTL Trägergesellschaft mbH – a wholly owned subsidiary of Deutsche Telekom AG. It has full recognition by the Ministry of Science and Art of the federal State of Saxony, making it the only corporate-funded private university in Germany. HfTL specializes in academic teaching, research and training in the field of information and communications technologies (ICT) and management.

## **How do we innovate at the HfTL?**

HfTL is the only corporate German university which is specialized on ICT. The study programs are continuously brought in line with the technical and societal development.

## **How do we use ICT to tackle societal challenges?**

As DT as one of the leading ICTelcos set & follows trends in order to facilitate and improve daily life with ICT products, HfTL plays an important role in the relevant field in both education&research.

## **How do we promote intercultural environment?**

HfTL is a globally acknowledged specialized university, offers study programs in ICT for students from all over the world. It is a leading partner of the European network of comparable universities.

### **Contact:**

Birgit Graf

HfTL Team Leader

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## Szechenyi Istvan University (SZE)



Szechenyi Istvan University



HUNGARY, Győr

Steering Committee, Partner

The university serves and will serve the economy and society of the city and the area with the continuous expansion of the educational spectrum. At our university the students can choose subjects from other programmes and can study simultaneously two undergraduate programmes. An economics student can enrich his/her knowledge by listening in on law or engineering subjects. In addition to the twelve thousand students attending the university full time there are five thousand students learning in correspondence courses and distant learning courses. Most recently we have begun to offer e-distant learning courses.

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## **How do we innovate at the SZE?**

The University provides a unique and innovative training students with high-level, valuable, professional, and practical education, in addition research activity in the region, which serves primarily the engineering focused production activities.

## **How do we use ICT to tackle societal challenges?**

The University – in accordance with the traditions – pursues predominantly applied research. Particular attention is paid to ICT research activities that are multidisciplinary and interdisciplinary projects, which have a social and economic aspect to them and deal with critical problems.

## **How do we promote intercultural environment?**

The university have established a working educational and research co-operation with more than 150 European institutions of higher education, and industrial partners and with numerous international partnerships outside Europe. The University welcomes cca. 500 foreign students.

### **Contact:**

Marta Meszaros

SZE Team Leader

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## University of Telecommunications and Post (UTP)



University of  
Telecommunications and Post



BULGARIA, Sofia

Partner

University of Telecommunications and Post trains students in the area of telecommunication technologies, telecommunication informatics, wireless communications and broadcasting, telecommunication networks as well as management of information technology.

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## How do we innovate at the UTP?

The University of Telecommunications and Post (UTP) combine knowledge of academic staff and researchers for implementation of innovations in the area of telecommunications, ICT and service management.

## How do we use ICT to tackle societal challenges?

UTP develop innovative mobile applications for disabled persons, for smart houses and future trends of implementation of sensor networks for automation and control of industrial processes.

## How do we promote intercultural environment?

The University of Telecommunications and Post encourage interaction between different cultures and communities in the area of computer and communication technologies for better social life.

### Contact:

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UTP Team Leader

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## University of Zilina (UNIZA)



University of Zilina



SLOVAKIA, Zilina

Partner

The University of Zilina was established as the Railway College on 1st September 1953 by the separation from the Czech Technical University in Prague. It has gone through numerous changes during its history. Finally, in 1996, it was renamed from the University of Transport and Communications to the University of Žilina in Žilina. The University as a public university provides education at all three levels of higher education (Bachelor's degree, Engineer/Master's degree and Doctoral degree) in both full-time and part-time forms. Approximately 11 000 students currently study in all forms of study. There are more than 1 500 employees and 650 of them are university teachers.

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## **How do we innovate at the UTP?**

We are unique in Slovakia, offering education in transport and communications. Our faculty offers innovative study programs in ICT based on this tradition, but connected to industry requests too.

## **How do we use ICT to tackle societal challenges?**

Our education and research are inter-disciplinary. We are developing apps, networks, hardware answering specific user demand – smart cities, urban transport, health, secure ICT.

## **How do we promote intercultural environment?**

We finished project oriented to internationalization of our university one year before. We have active contact with non-European universities. In last semesters we had students from Taiwan and Brazil.

### **Contact:**

Peter Marton

UNIZA Team Leader

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## Institut Mines Telecom – Telecom Bretagne (IMT-TB)



Institut Mines Telecom –  
Telecom Bretagne



FRANCE, Brest

Partner

In the 30 years since its creation, Telecom Bretagne has affirmed itself as a pioneering “Grande École” in education, research and enterprise. It trains multi-discipline engineers able to assume important responsibilities. Recognised for its dynamism and its very substantial international dimension, Telecom Bretagne has partnerships with more than 100 establishments of higher education and research throughout the world. It collaborates with MIT and the Lausanne École Polytechnique Fédérale on the subject of pedagogic innovation. More than a thousand students, from 50 countries, follow engineering courses on two quite exceptional campuses situated at the heart of very active high-technology clusters.

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## **How do we innovate at the IMT-TB?**

Founded in 1977, Telecom Bretagne is one of the most prestigious graduate engineering schools in France, at the cutting edge of the Information Technology sector in both research & teaching.

## **How do we use ICT to tackle societal challenges?**

We innovate in all areas of Information Technology, including the Internet of Things, Domotics, Medical Imagery, Intelligent transport & Didactics.

## **How do we promote intercultural environment?**

50% international students, study of two foreign languages; 6 months abroad.  
Intercultural Communication and Management courses: students and staff.  
Well-established research I/C programme.

### **Contact:**

Catherine Sable

IMT-TB Team Leader

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## Technical University of Kosice (TUKE)



### Technical University of Kosice



SLOVAKIA, Kosice

Partner

Technical University of Košice (TUKE) was established in 1952. The content of education and research at University includes the entire complex of sciences and economics. The TUKE seeks to maintain a cohesive and interdependent relationship between their teaching, research and service activities with accordance to European state of Art. The TUKE has 9 faculties with 17 030 students and 1880 staff. The TUKE has been the first and so far the only university in Slovakia to meet the criteria of the international standard EN ISO 9001:2000 and it received the quality certificate in the area of providing educational and research processes and enterprise activities within a public university (certification by TÜV SÜD Slovakia s.r.o.).

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## How do we innovate at the TUKE?

TU support innovations in education (modern ICT infrastructure for students & staff, free wifi everywhere in the campus), excellent research centers. Special support for startups & innovative ideas.

## How do we use ICT to tackle societal challenges?

TU have barrier free center for disadvantaged students, e-learning and online documents for students (exams, study results, application forms), internet in the dormitories.

## How do we promote intercultural environment?

TU provide support for international students of all 3 levels of study. We have several student organizations: Best, ESN, IAESTE. We organize events for different cultures/nations.

### Contact:

Maria Gamcova

TUKE Team Leader

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## University of Oradea (UO)



University of Oradea



ROMANIA, Oradea

Partner

The mission of the University of Oradea, is to promote knowledge, research and training through partnerships between teachers, students and community. In the last 22 years, the University answered the changes occurred within the national educational policy, demographic changes, requirements of the market economy, local and regional needs and new technologies. All these changes have led to new expectations from students, academic and administrative staff. University of Oradea offers to our students the necessary training to contribute to society development. This training is conducted in 15 faculties which offers a wide range of initial training and postgraduate courses.

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## How do we innovate at the UO?

University of Oradea's mission, is to promote knowledge, research and training through partnerships between teachers, students and community.

## How do we use ICT to tackle societal challenges?

UO is a creative, energetic, active and innovative university. Professors and researchers are very enthusiastic and determined to experience all the new opportunities offered by informational technology.

## How do we promote intercultural environment?

UO promotes intercultural dialogue. The city of Oradea ever since the Middle Ages was a cosmopolitan city inhabited by several nationalities what assures a special diversity.

### Contact:

Istvan Polgar

UO Team Leader

[isti.polgi@gmail.com](mailto:isti.polgi@gmail.com)

## University of Debrecen (UNIDEB)



University of Debrecen



HUNGARY, Debrecen

Partner

University of Debrecen is one of Hungary's five elite-research universities, offering the widest choice of majors in the country for over 29,000 students, including 3,741 international students. UD's 1500 lecturers of 14 faculties endeavour to live up to the elite university status and to provide high quality education. Our goal is to train professionals possessing all necessary skills and knowledge to enter the regional, national, or international labour market with a competitive degree. More than 1000 lecturers with doctoral degrees (PhD), 25 doctoral schools, and the volume of internationally renowned research publications and projects attest to the scientific dominance of the university. 139 of the lecturers and researchers are Doctors of the Hungarian Academy of Sciences and 27 are members of the Academy.

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## **How do we innovate at the UNIDEB?**

Strong collaborations are established with companies committed for social challenges. Not only researchers but our students are involved in these activities implying the need of innovative thinking.

## **How do we use ICT to tackle societal challenges?**

Several research groups work on how ICT can be applied in health care systems (e.g. devices and services for health monitoring and prevention, supporting older persons to remain active and healthy).

## **How do we promote intercultural environment?**

Our faculty runs undergraduate and postgraduate programs in English for international students, where also exchange students are welcome. So, real intercultural environment is given for our students.

### **Contact:**

Marianna Zichar

UNIDEB Team Leader

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## Technical University – Sofia (TUS)



Technical University – Sofia



BULGARIA, Sofia

Partner

The Technical University of Sofia is the largest educational and scientific complex in Bulgaria in the field of technical and applied science with an institutional accreditation grade of 9.5 (on the scale of 10) for the period 2012 – 2018. As the first and largest polytechnic center, which supported the establishment of most of the higher technical colleges in the country, it sets the educational standards and national priorities for the development of engineering education and science.

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## How do we innovate at the TUS?

We are introducing a system for promoting the students' active participation in research and project orientated training for master and PhD students.

## How do we use ICT to tackle societal challenges?

Development of algorithms and methods for signal processing in biometric systems and systems using human-computer interface.

## How do we promote intercultural environment?

There are three foreign language Faculties: German, French and English providing strong international student and teachers exchange and interaction.

### Contact:

Georgi Iliev

TUS Team Leader

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## University of Osijek The Faculty of Electrical Engineering in Osijek

(FERIT)



# FERIT

Faculty of Electrical Engineering, Computer  
Science and Information Technology, JJ.  
Strossmayer University of Osijek



CROATIA, Osijek

Partner

The Faculty of Electrical Engineering in Osijek is a faculty of the Josip Juraj Strossmayer University of Osijek. Faculty of Electrical Engineering in Osijek has developed into a respectable member of the University of Osijek implementing study programs in electrical engineering (power systems, automation, communications) and computer science (process computing, software and hardware engineering) and related research at the highest level. In 2013 over 2230 students, more than 60% of students at technical studies at Josip Juraj Strossmayer University of Osijek, are studying at the Faculty, out of which 450 entering first year, with 105 post-graduate students, 110 members of teaching staff, out of which 55 full-time professors and lecturers, 32 research assistants, 6 teaching assistants, 17 laboratory technicians and about 30 visiting teachers from other international and Croatian universities and companies.

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## How do we innovate at the FERIT?

FERIT and Innovations: Projects, Cooperation with Industry, Institutions  
and SME's.

## How do we use ICT to tackle societal challenges?

FERIT and Societal Challenges: STEM Promotion, Mobile/Web Apps for  
Vulnerable Groups, Labor Market and Environment-friendly and Secure  
Production.

## How do we promote intercultural environment?

FERIT and Intercultural Environment: Mobility, Erasmus+/IAESTE  
Students/Lecturers, Cross-Border Projects.

### Contact:

Drago Zagar

FERIT Team Leader

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## 3. TEAMSOC21 2018 REPORTS

*Ignac Lovrek*

*University of Zagreb Faculty of Electrical Engineering and  
Computing*

*TEAMSOC21 Steering Committee member*

*Leader of the Working Group for Preparation of Croatian Sci-  
ence and Technology Strategy*

## Entrepreneurial Cases 2018: "entrepreneurship in ICT" and "entrepreneurship with ICT"

There are two general challenges for the development of information and communication technology (ICT) in the European Union (EU): a significant increase in the number of scientists and professionals capable of contributing to the research, innovation, production and services, and the new qualifications they need to have, i.e. technical competencies, management skills and societal responsibility. This problem will be presented from two points of view: ICT sector itself and employment in it.

The ICT sector includes manufacturing and service industry, as specified by the Organization for Economic Cooperation and Development (OECD) and implemented in European Union<sup>4</sup>. This classification includes the following sub-sectors:

### *Manufacturing industry*

- Manufacture of electronic components and boards
- Manufacture of computers and peripheral equipment
- Manufacture of communication equipment
- Manufacture of consumer electronics
- Manufacture of magnetic and optical media

### *Service industry*

- Telecommunications
- Repair of communication equipment
- Computer and related activities
  - Computer programming, consultancy and related activities
  - Data processing, hosting and related activities; web portals
  - Software publishing
  - Repair of computers and peripheral equipment

In addition, *ICT Trade industry* includes *Wholesale of computers, computer peripheral equipment and software*, and *Wholesale of electronic and telecommunications equipment and parts*.

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<sup>4</sup> NACE Rev.2 Statistical classification of economic activities in the European Communities, Eurostat, European Communities, 2008

About 90% of the economic activities in the EU are related to the service industry, and the remaining about 10% to the manufacturing.<sup>5</sup> Within the service industry, dominant are *Computer and related activities* (~56 %) and *Telecommunications* (~34 %), while *Manufacture of communication equipment* is the key manufacturing activity in the EU (~ 4 %).

It should be noted that Asian economies (China, South Korea and Taiwan) are characterized by a completely different pattern of activities, with a lower share of services and a significantly higher share of manufacturing in the sub-sectors *Manufacture of electronic components and boards*, *Manufacture of computers and peripheral equipment*, and *Manufacture of consumer electronics*. The US ICT sector is closer to the EU ICT sector, with a higher share of the manufacturing.

ICT sector represents 4.8% of GDP in the EU and generates 25% of total business expenditure in research and development (R&D)<sup>6</sup>. Further on, ICT sector contributes 20% directly to the overall productivity growth, and an additional 30% to overall investments in ICT in other sectors.

The latest data (available through Eurostat) describing ICT from the employment perspective are presented in Figure 1-3.<sup>7</sup>

The total number of ICT specialists in the EU-28 (2005-2015) including the percentage of total employment is shown in Figure 1. It is a workforce of more than 7.8 million professionals representing 3.6% of total employment in EU. The growth is evident but inadequate, as the estimated gap in 2017 is about 1 million.

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<sup>5</sup> Mas M., Fernández de Guevara J., Robledo J.C., López-Cobo M., “*The 2017 PREDICT Key Facts Report. An Analysis of ICT R&D in the EU and Beyond*”, EUR 28594 EN, doi:10.2760/397817

<sup>6</sup> ICT Research & Innovation

(<https://ec.europa.eu/programmes/horizon2020/en/area/ict-research-innovation>)

<sup>7</sup> ICT specialists in employment

([http://ec.europa.eu/eurostat/statistics-explained/index.php/ICT\\_specialists\\_in\\_employment](http://ec.europa.eu/eurostat/statistics-explained/index.php/ICT_specialists_in_employment))

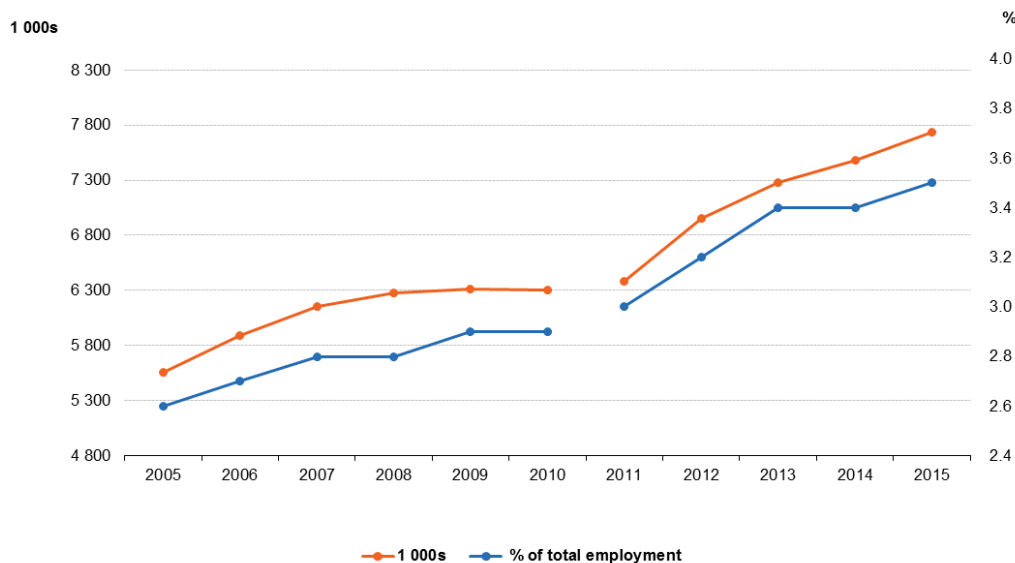
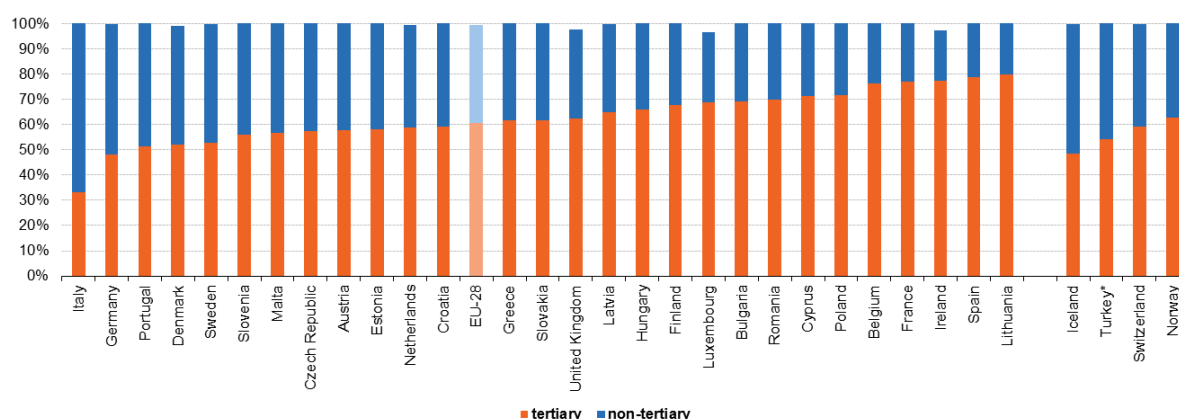


Figure 1 – ICT specialists in the EU-28, 2005-2015  
(in 1 000s and as a % of total employment)

Regarding qualification structure, the majority of ICT specialists have completed tertiary-level education (university degree), with an EU-28 average of 61 % (Figure 2). These specialists are ICT engineers!

The number of ICT specialists in Europe (2015) as a % of total employment is shown in Figure 3.

The difference between the countries regarding the level of education and percentage of total employment is significant, among the TeamSoc21 countries as well.



(\*) 2006 data is used instead of 2005

Figure 2 – ICT specialists by level of education, 2015

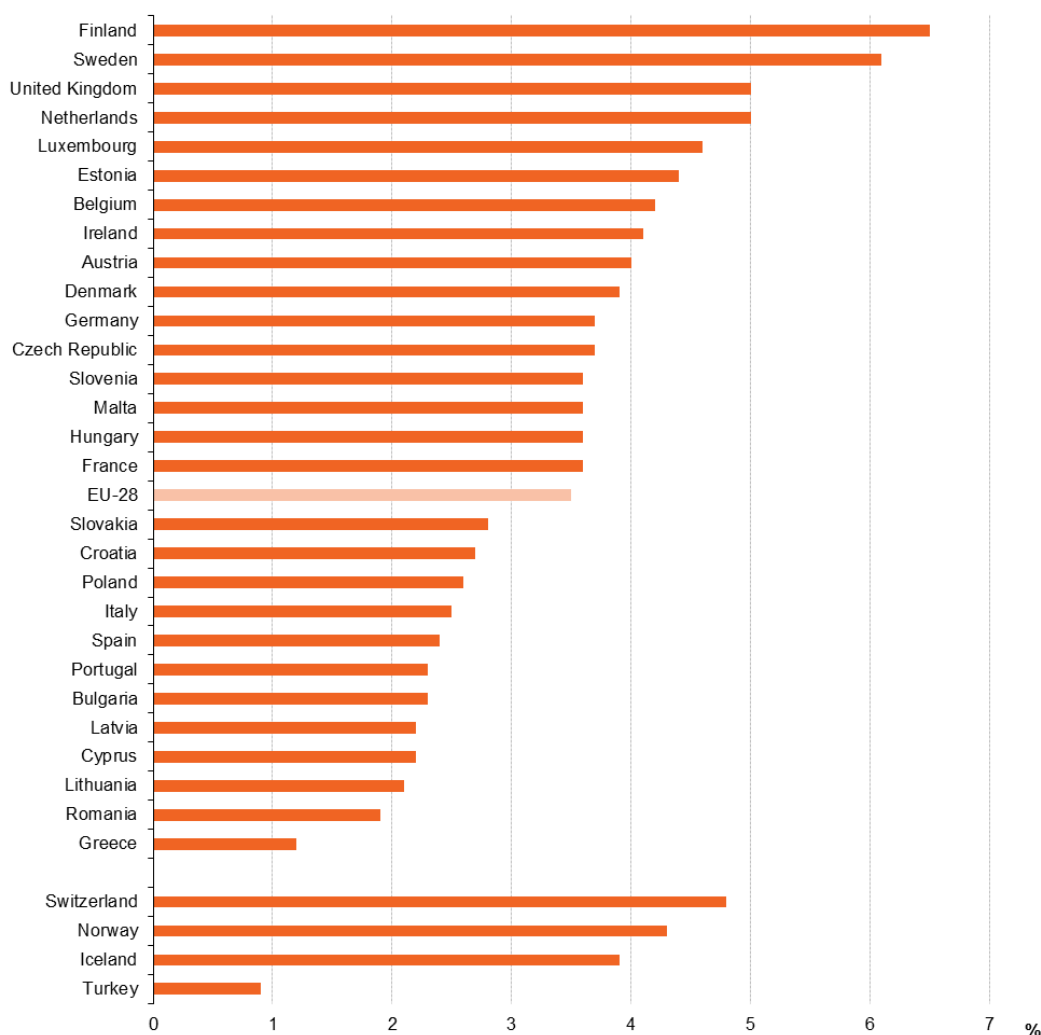


Figure 3 – ICT specialists in Europe, 2015  
(as a % of total employment)

The lack of ICT professionals, especially ICT engineers, is not the problem of the ICT sector itself, but a general problem. Recall just the digital market, the digital transformation and Industry 4.0. Such role of ICT is recognized in *Digital Agenda for Europe* and many others European strategic documents, as well as in *Horizon 2020 – The framework programme for research and innovation* (2014 – 2020). ICT is present in all parts of the Horizon 2020, starting from *Excellent science*, through *Leadership in enabling and industrial technologies* (LEIT) up to *Societal challenges*.<sup>8</sup>

<sup>8</sup> Horizon 2020 in brief – The EU Framework Programme for Research & Innovation, European Union, 2014

*Research in the area of Future and Emerging Technologies (FET) is a part of Excellent science. Leadership in enabling and industrial technologies includes Key Enabling Technologies (KET), while Societal challenges comprise the following global societal challenges:*

- Health, demographic change and wellbeing (SC1 “Health & Ageing”)
- Food security, sustainable agriculture and forestry, marine and maritime and inland water research, and the bio economy (SC2 “Food”);
- Secure, clean and efficient energy (SC3 “Energy”)
- Smart, green and integrated transport (SC4 “Transport”)
- Climate action, environment, resource efficiency and raw materials (SC5 “Environment”);
- Europe in a changing world - inclusive, innovative and reflective societies (SC6 “Society”);
- Secure societies - protecting freedom and security of Europe and its citizens (SC7 “Security”).

The focus of ICT-related activities in LEIT in the period 2016-2017<sup>9,10</sup> was on the following topics: a new generation of components and system; advanced computing and cloud computing; future Internet; content technologies and information management; robotics and autonomous systems; micro- and nano-electronic technologies and photonics, as ICT Key Enabling Technologies (KET).

Work programme for 2018-2020<sup>11</sup> expands the ICT domain with the following topics: technologies for digitising European industry; European Data Infrastructure: High Performance Computing (HPC), Big Data and Cloud technologies; 5G; Next Generation Internet (NGI); as well as with research and innovation related to digitising and transforming European industry and services: digital innovation hubs and platforms, and cybersecurity.

However, the Horizon 2020 expands research and innovation to the dimensions of entrepreneurship and business by offering so-called horizontal actions related to innovation and entrepreneurship support, responsibility and creativity (help to startups and prospective tech entrepreneurs to achieve market success, innovation procurement and pre-commercial procurement, responsible ICT-related research and innovation, synergies between artists, creative people and technologists, support to experimentation frameworks and regulatory compliance).

Mapping of TeamSoc21 programme onto Horizon 2020 is shown in Figure 4.

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<sup>9</sup> A guide to ICT-related activities in WP2016-17

<sup>10</sup> Horizon 2020 Work Programme 2016 – 2017, 5.i. *Information and Communication Technologies*

<sup>11</sup> Horizon 2020 Work Programme 2018 – 2020, 5.i. *Information and Communication Technologies*



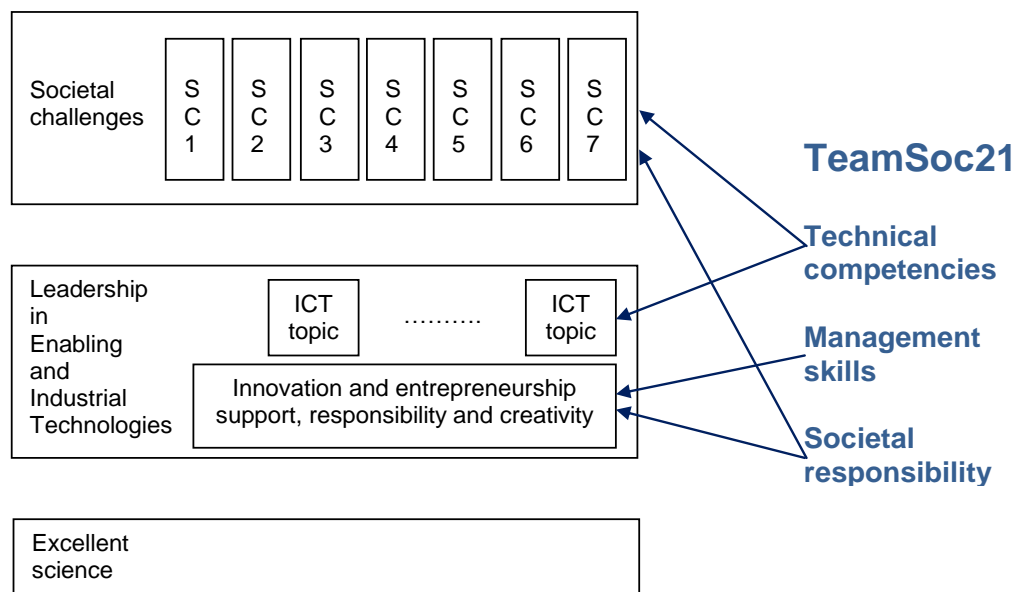


Figure 4 – Mapping of Teamsoc21 programme onto Horizon 2020

TeamSoc21 central activity is development of entrepreneurial cases by international student teams. The following 5 cases are prepared for the year 2018:

- Smart Agriculture based on Internet of Things: Watering and Fertilization Management, EC2018-1 (H2020 “Food” challenge);
- Data Analytics for Healthy Food in the Cloud, EC2018-2 (H2020 “Health” challenge);
- Smart Automotive Systems in Urban Areas: Parking for Big Cultural and Sports Events, EC2018-3 (H2020 “Transport” challenge);
- 3D Printing as a Tool in Environment Protection, EC2018-4 (H2020 “Environment” challenge);
- Real-Time ICT-based Security Solutions for European Borders Protection, EC2018-5 (H2020 “Security” challenge).

Lectures on selected ICT, managerial and social topics will complement teamwork-based entrepreneurial case development. Visits to ICT companies involved in research, development, innovation and provisioning of digital services will be organized in order to provide insight into the industrial perspective of topics covered by TeamSoc21.

As already stated, lack of skilled workforce is a particular problem facing Europe that (will) affect(s) the European research and innovation potential. Part of the problem is an insufficient focus on education in the STEM fields (*Science, Technology, Engineering and Mathematics*) and attracting young people to STEM. This is why STEM studies are considered within TeamSoc21 in the wider context of ICT.

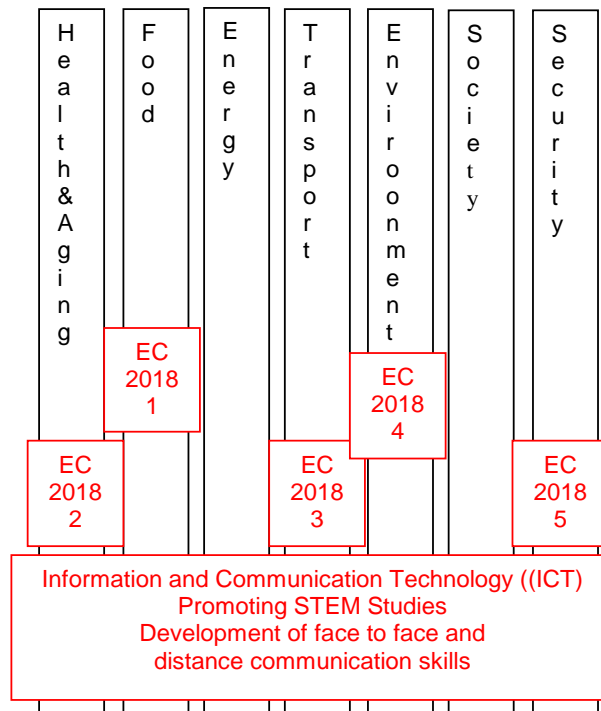


Figure 5 – TeamSoc21 entrepreneurial cases

**Ignac Lovrek**

University of Zagreb Faculty of Electrical Engineering and Computing  
TEAMSOC21 Steering Committee member

## Entrepreneurial Case Preparation Process

TeamSoc21 Entrepreneurial Cases for the Zagreb 2018 Intensive Program Workshop were selected through the **three-step preparation process**. It is worth mentioning that TeamSoc21 utilizes the same methodology which the preceding INNOSOC project has used for preparing Case Studies. In the first step, which took place in the period from November 2017 to December 2017, the *Call for Entrepreneurial Case Proposal* was sent to all 12 TeamSoc21 partners and each partner could propose up to two Entrepreneurial Cases tackling H2020 societal challenges. The proposals should have been done by filling the specially prepared template, which can be found on the following four pages of this document.

# TeamSoc21 2018

## Entrepreneurial Case proposal

H2020 challenge addressed by the Entrepreneurial Case  
(please choose from the drop-down list)

Choose a H2020 challenge

Entrepreneurial Case title  
(please insert title – max. 8 words)

Brief description of the Entrepreneurial Case  
(please insert 150-250 words)

*Entrepreneurial Cases will be “solved” by TEAMSOC21 student teams (4-5 students in each team) who will propose founding a start-up company (or alternatively a new unit within the existing company if this is the most appropriate organizational structure for solving the proposed Entrepreneurial Case) that will produce some new product(s) and/or offer some new service(s). Student teams will have 10 weeks (8 weeks of virtual mobility and 2 weeks of physical mobility) for “solving” the Entrepreneurial Case and they will be supervised by technical, business and societal experts affiliated with TEAMSOC21 consortium members and their partners.*

*The proposer of this Entrepreneurial Case does not need to provide all three types of experts (i.e., technical, business and societal). For the proposer of the Entrepreneurial Case it is enough to provide at least one expert from at least one domain (technical, business and societal) and the TEAMSOC21 Steering Committee will assign the missing experts to all selected Entrepreneurial Cases from the pool of available TEAMSOC21 experts. On the last page of this document there is a space for the proposer to name one or two experts relevant to the proposed Entrepreneurial Case and willing to be engaged in the TEAMSOC21 activities.*

Please describe the Entrepreneurial Case you are proposing. Explain why you think the proposed Entrepreneurial Case is an opportunity/need. Explain why you think it should be discussed from the technical, business, and societal perspective?

What questions do you see as the most relevant from the technical aspect of the proposed Entrepreneurial Case? These are going to be the first “technical” tasks student teams will work on.

(please insert 3-5 bullets)

*The technology, and especially ICT, was in focus of all consortium projects (ESM, SUSCOMTEC, INNOSOC) so it will remain in the focus of the TEAMSOC21 project as well.*

Please give examples of questions that focus on the most relevant technical issues of the proposed Entrepreneurial Case, such as technology used, knowledge/skills/expertise of people within the (start-up) engineering team that will work on the technical solution, etc.

EXAMPLE:

- Student teams will need to identify and provide more details about specific technologies which can be used within the Entrepreneurial Case, such as Internet of Things (in case of Entrepreneurial Case dealing with digitalization of food production), 3-D printing (in case of Entrepreneurial Case dealing with digitalization of medical treatments), 5G (in case of Entrepreneurial Case offering a new communication service), etc.

What questions do you see as the most relevant from the business aspect of the proposed Entrepreneurial Case? These are going to be the first “business” tasks student teams will work on.

(please insert 3-5 bullets)

*The TEAMSOC21 Entrepreneurial Case development will be done according to the “Business Model Canvas” framework, which identifies 9 business model building blocks: Customer Segments, Value Proposition, Channels, Customer Relationships, Revenue Streams, Key Resources, Key Activities, Key Partnerships, and Cost Structure. Brief introduction to the framework can be found here:*

*<https://www.youtube.com/watch?v=QoAOzMTLP5s> and <https://www.youtube.com/watch?v=IP0cUBWTqPY>.*

Please give examples of questions that focus on the most relevant business model building blocks of the proposed Entrepreneurial Case, such as customer segment identification, value proposition definition, etc.

EXAMPLE:

- Student teams will need to identify potential customer segments for products/services they will develop/offer as the result of “solving” the proposed Entrepreneurial Case, such as car drivers (in case of Entrepreneurial Case dealing with digitalization of parking), 18-35 years old females (in case of Entrepreneurial Case dealing with digitalization of birth control), etc.

What questions do you see as the most relevant from the societal aspect of the proposed Entrepreneurial Case? These are going to be the first “societal” tasks student teams will work on.

*(please insert 3-5 bullets)*

*In the TEAMSOC21 project we don't want that students think only about technical and business aspects of start-ups whose foundation they will design, but we want that they also think about the impact founding and functioning of their start-ups will have on a society as a whole.*

Please give examples of questions that focus on societal issues such as impact on labour market, customer data protection, working conditions, environment, quality of life, distribution of wealth, etc.

EXAMPLE:

- Student teams will need to provide more details about how Entrepreneurial Case impacts labour market, such as driverless taxis have a negative impact on the need for taxi drivers (in case of Entrepreneurial Case dealing with driverless car-sharing), or how Entrepreneurial Case impacts environment, such as driverless taxis have a positive impact on the environment because they optimize travel routes (in case of Entrepreneurial Case dealing with driverless car-sharing), etc.

**Key web-links and/or papers that can be used to understand the Entrepreneurial Case**

*(please insert 2-3 links and/or papers)*

**Examples of existing companies (including start-ups) working in the broader area defined with the Entrepreneurial Case**

*(please insert 2-3 links)*

TEAMSOC21 partner proposing the Entrepreneurial Case  
(please choose from the drop-down list)

Choose a TEAMSOC21 partner

Experts (one or two) from the TEAMSOC21 partner who proposed Entrepreneurial Case development  
(please insert info)

**Expert 1 name:**

**Expert 1 e-mail:**

**Expertise area:** technical/business/societal aspects (please mark one or two aspects which are closer to the expert knowledge and experience)

**Expert 1 webpage:**

(Expert 2 is not mandatory, please erase if you propose only one expert)

**Expert 2 name:**

**Expert 2 e-mail:**

**Expertise area:** technical/business/societal aspects (please mark one or two aspects which are closer to the expert knowledge and experience)

**Expert 2 webpage:**

Primary contact at the TEAMSOC21 partner proposing the Entrepreneurial Case  
(please insert contact info)

**Name:**

**E-mail:**

After all Entrepreneurial Case proposals were collected, the TeamSoc21 Steering Committee analysed all received proposals and selected five Entrepreneurial Cases for the Zagreb 2018 Intensive Program Workshop. Some of selected Entrepreneurial Cases were

~ 45 ~



result of merging two related or complementary proposals received from TeamSoc21 lecturers from different universities

In the second step (December 2017 – January 2018) of the TeamSoc21 Entrepreneurial Case preparation process, TeamSoc21 lecturers that proposed selected Entrepreneurial Cases were asked to extend their proposals by filling the specially prepared template, which can be found on the following five pages of this document.



# TeamSoc21 2018 Entrepreneurial Case proposal (extended version)

Entrepreneurial Case title

*(please insert title – max. 8 words)*

**Keywords**

*(please add 3-8 keywords separated by a semicolon)*

H2020 challenge addressed by the Entrepreneurial Case

*(please choose from the drop-down list)*

Choose a H2020 challenge

Brief description of the Entrepreneurial Case

*(please insert 150-250 words)*

*Entrepreneurial Cases will be “solved” by TEAMSOC21 student teams (4-5 students in each team) who will propose founding a start-up company (or alternatively a new unit within the existing company if this is the most appropriate organizational structure for solving the proposed Entrepreneurial Case) that will produce some new product(s) and/or offer some new service(s). Student teams will have 10 weeks (8 weeks of virtual mobility and 2 weeks of physical mobility) for “solving” the Entrepreneurial Case and they will be supervised by technical, business and societal experts affiliated with TEAMSOC21 consortium members and their partners.*

*The proposer of this Entrepreneurial Case does not need to provide all three types of experts (i.e., technical, business and societal). For the proposer of the Entrepreneurial Case it is enough to provide at least one expert from at least one domain (technical, business and societal) and the TEAMSOC12 Steering Committee will assign the missing experts to all selected Entrepreneurial Cases from the pool of available TEAMSOC21 experts. On the last page of this document there is a space for the proposer to name one or two experts relevant to the proposed Entrepreneurial Case and willing to be engaged in the TEAMSOC21 activities.*

Please describe the Entrepreneurial Case you are proposing. Explain why you think the proposed Entrepreneurial Case is an opportunity/need. Explain why you think it should be discussed from the technical, business, and societal perspective?

~ 47 ~

What questions do you see as the most relevant from the technical aspect of the proposed Entrepreneurial Case? These are going to be the first “technical” tasks student teams will work on.

(please insert 3-5 bullets)

*The technology, and especially ICT, was in focus of all consortium projects (ESM, SUSCOMTEC, INNOSOC) so it will remain in the focus of the TEAMSOC21 project as well.*

Please give examples of questions that focus on the most relevant technical issues of the proposed Entrepreneurial Case, such as technology used, knowledge/skills/expertise of people within the (start-up) engineering team that will work on the technical solution, etc.

EXAMPLE:

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(please insert 3-5 bullets)

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*<https://www.youtube.com/watch?v=QoAOzMTLP5s> and <https://www.youtube.com/watch?v=IP0cUBWTqPY>.*

Please give examples of questions that focus on the most relevant business model building blocks of the proposed Entrepreneurial Case, such as customer segment identification, value proposition definition, etc.

EXAMPLE:

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(please insert 3-5 bullets)

*In the TEAMSOC21 project we don't want that students think only about technical and business aspects of start-ups whose foundation they will design, but we want that they also think about the impact founding and functioning of their start-ups will have on a society as a whole.*

Please give examples of questions that focus on societal issues such as impact on labour market, customer data protection, working conditions, environment, quality of life, distribution of wealth, etc.

EXAMPLE:

- Student teams will need to provide more details about how Entrepreneurial Case impacts labour market, such as driverless taxis have a negative impact on the need for taxi drivers (in case of Entrepreneurial Case dealing with driverless car-sharing), or how Entrepreneurial Case impacts environment, such as driverless taxis have a positive impact on the environment because they optimize travel routes (in case of Entrepreneurial Case dealing with driverless car-sharing), etc.

Key web-links and/or papers that can be used to understand the Entrepreneurial Case

(please insert 5-10 links and/or papers)

*This section should give main references connected to the Entrepreneurial Case. The role of these references is twofold: i) they support and or elaborate in more details statements given in the remainder of this document; and ii) they are initial reading list for students. Please provide citations according to the IEEE Citation Reference guidelines (<http://www.ieee.org/documents/ieeecitationref.pdf>). All references should be cited at least once in the text in the remainder of this document by inserting "[x]" mark in the text, where "x" is the number of the reference (same as when you write scientific papers).*

[1] Reference 1

[2] Reference 2

...

[10] Reference 10

Examples of existing companies (including start-ups) working in the broader area defined with the Entrepreneurial Case

(please insert 2-3 **company names and links to company websites**)

- Company/Start-up 1 **name: link**
- Company/Start-up 2 **name: link**
- Company/Start-up 3 **name: link**

### **Knowledge and skills needed for developing the Entrepreneurial Case**

(please add 3-8 knowledge units and/or skills separated by a semicolon)

*Four students (from different partner universities) will be allocated to the each Entrepreneurial Case. Students will bid for Entrepreneurial Case in the process of student allocation. Students will rank their choices of Entrepreneurial Case based on two criteria: i) interest for the Entrepreneurial Case topic (students will determine their interest for the topic based on the Entrepreneurial Case description given in this document); and ii) knowledge and skills needed for developing specific Entrepreneurial Case (students will determine their capability for working on the Entrepreneurial Case based on the list of knowledge and skills given in this section). We differentiate two categories of knowledge and skills: “prerequisite” (P) and “desirable, but not necessary” (D). Please mark each knowledge unit and skill with one of these categories (i.e., (P) or (D)).*

Example of a knowledge unit: “TCP/IP protocol stack” (P); “wearables for e-health” (D)

Example of a skill: “statistical analysis in the language/tool R” (P); “web-page programming” (D)

**Figures describing this Entrepreneurial Case** (please insert 2-3 print quality figures; we are going to use these figures in our publications (web/brochures) so please be careful about copyright – insert only figures which are not copyrighted or provide us with source citation or whatever information which allows us to publish these photos (e.g. inserted photo is a photo taken by you and showing your lab); give a one line caption for every inserted figure)

**INSERT FIGURE HERE**

Figure 1. One line caption

**INSERT FIGURE HERE**

Figure 2. One line caption

**INSERT FIGURE HERE**

Figure 3. One line caption

TEAMSOC21 partner proposing the Entrepreneurial Case  
(please choose from the drop-down list)

Choose a TEAMSOC21 partner

Primary contact at the TEAMSOC21 partner proposing the Entrepreneurial Case  
(please insert contact info)

Name:  
E-mail:

**Experts who will coordinate the Entrepreneurial Case development**  
(info will be inserted by the TeamSoc21 Steering Committee)

Expert 1 name:  
Expert 1 e-mail:  
Expertise area: technical/business/societal aspects

Expert 2 name:  
Expert 2 e-mail:  
Expertise area: technical/business/societal aspects

Expert 3 name:  
Expert 3 e-mail:  
Expertise area: technical/business/societal aspects

Expert 4 name:  
Expert 4 e-mail:  
Expertise area: technical/business/societal aspects

Expert 5 name:  
Expert 5 e-mail:  
Expertise area: technical/business/societal aspects

Expert 6 name:  
Expert 6 e-mail:  
Expertise area: technical/business/societal aspects

In the last step, which took place January-February 2018, of the TeamSoc21 Entrepreneurial Case preparation process, TeamSoc21 Steering Committee members finalized

the preparation of each Entrepreneurial Case selected for the Zagreb 2018 Intensive Program Workshops.

Entrepreneurial Cases were published online and the process of TeamSoc21 students allocation to Entrepreneurial Cases has started. On average, four TeamSoc21 students are grouped together to work on Entrepreneurial Case development through their TeamSoc21 blended mobility. Each student group (of total 10 groups) will be supervised by one or more TeamSoc21 lecturers who are experts in technical, business, and societal aspects of the Entrepreneurial Case. Final results of student work will be presented during Zagreb 2018 Intensive Program Workshop in late April 2018 (Zagreb).

Detailed description of the five TeamSoc21 2018 Entrepreneurial Cases is given in the next section of this report, as well as they are available online (<http://sociallab.education/teamsoc21/case-studies/zagreb-2018>).

## **4. TEAMSOC21 21 ENTREPRENEURIAL CASES**

## Smart Agriculture based on Internet of Things: Watering and Fertilization Management

**Case study URL:** <https://goo.gl/qcqnRG>

**Authors:** Birgit Graf, Dominik Schneider, and Franziska Plate

**Keywords:** smart agriculture; Internet of Things; (sensor) technology; qualitative benefits; work conditions

**H2020 challenge addressed by the Entrepreneurial Case:** Food security, sustainable agriculture and forestry, marine and maritime and inland water research, and the Bioeconomy

### Description of Entrepreneurial Case:

You are an Entrepreneur and you believe in the idea of connected agricultural areas. With your idea agriculture shall be optimized regarding watering and fertilization. To realize the idea, hardware like sensors or actuators and new connectivity variants like NB-IoT or 5G can be used. Connected sensors can measure soil conditions and send the information to farmers, fertilizer manufacturers or other interested parties. With the sale of sensors or the sale of the whole smart agriculture solution, direct business models can be achieved. Based on data about soil conditions, indirect business models can be achieved. In example, data analytics can be used to generate data insights, which can be valuable in various use cases. Furthermore, the idea of Smart Agriculture can be adopted with other technologies like Virtual Reality to further optimize farming.

In this case study students can elaborate...

- an assessment/evaluation of suitable technologies
- direct and indirect business models
- the end to end value chain and essential stakeholders/partners
- a detailed business case
- a market analysis
- a distribution concept
- societal topics regarding Smart Agriculture
- other technical, business and societal topics.

### Questions that need answers during the Entrepreneurial Case development

#### Technical aspect

- Which technology do you see as the most relevant/fitting solution for the Smart Agriculture use case? (NB-IoT, GPS, Bluetooth, UMTS, LTE, Wifi, ...)
- Based on which criteria do you select the fitting technology? (strengths, weaknesses, opportunities, threats, costs)
- Which environmental parameters would you like to measure with the help of the sensor and the corresponding technology? (temperature, humidity, wind, ...)



- Which external factors influence the implementation of the technology? (country, climate, politics, regulation, ...)
- Which data security and privacy should be considered?

### Business aspect

- In which aspects does a Smart Agriculture solution support a farmer?
  - For which kind of product? (animals, crops, fruits, ...)
  - For which kind of activity? (harvest/production, sales, marketing, ...)
- Which costs and which financial and qualitative benefits arise from the use of a Smart Agriculture solution?
- Should a farmer consider an “as a service” approach or buy and run a solution by himself?
- Which are the most relevant partners/stakeholders to realize the use case and what are their requests towards an agriculture enterprise? How does the end to end value chain look like?
- Create a Business Model Canvas for the agricultural business model (as is) and compare it to an agricultural Business Model Canvas which has implemented a Smart Agriculture solution (to be).

### Social aspect

- Work conditions: How do work conditions change for farmers and their employees concerned? Which are positive and which are negative impacts?
- Labour Market: Does a Smart Agriculture solution create or cost jobs? How do job profiles change within the agricultural and the IT sector?
- Environment: Does the implementation of a Smart Agriculture solution affect the environment? If yes, which are the likely effects?
- Regulation: Is there a necessity for politics to either foster or decelerate a Smart Agriculture solution? How should political measures look like?
- Consumer: Are there any effects for consumers to be taken in account?
- Globalisation: Do smart agriculture solutions work in developed countries in the same way as in developing countries?

### Key web-links and/or papers that can be used to understand the Entrepreneurial Case

- [1] <http://www.fao.org/docrep/018/i3325e/i3325e.pdf>
- [2] <https://link.springer.com/book/10.1007/978-3-319-61194-5>
- [3] <https://m2m.telekom.com/telekom-m2m/insights/narrowband-iot>
- [4] [http://www.huawei.com/minisite/iot/img/nb\\_iot\\_whitepaper\\_en.pdf](http://www.huawei.com/minisite/iot/img/nb_iot_whitepaper_en.pdf)
- [5] [http://www.deere.com/en\\_US/docs/html/brochures/publication.html?id=004d03e7#7](http://www.deere.com/en_US/docs/html/brochures/publication.html?id=004d03e7#7)
- [6] <https://www.bosch.com/explore-and-experience/smart-agriculture-more-sleep-for-growers>
- [7] <https://teliasoneranorge.github.io/showcases/agriculture>

### Examples of existing companies (including start-ups) working in the broader area defined with the Entrepreneurial Case

Robert Bosch GmbH: [www.bosch.de](http://www.bosch.de)  
 Fraunhofer Institut: [www.fraunhofer.de](http://www.fraunhofer.de)  
 Claas KGaA mbH: [www.claas.de](http://www.claas.de)  
 Vital Fields: [www.vitalfields.com](http://www.vitalfields.com)

## Knowledge and skills needed for developing the Entrepreneurial Case

*(“prerequisite” (P) and “desirable, but not necessary” (D))*

### Knowledge about

- state-of-the-art technologies, e.g. network trends like “5G” as well as IT trends like “(Narrowband-)Internet of Things, Virtual Reality” (P);
- automation and optimization possibilities enabled by Business Intelligence and Data Analytics (D);
- industry insights and market needs of “agriculture” (P);
- biological and geographical backgrounds (D);
- entrepreneurship and foundation of start-ups (P);
- marketing and distribution concepts (D);
- people, resource and change management (D);
- environmental law and compliance (D).

### Skills

- research and analytical skills (P);
- economic skills for the identification of value streams, creation of business models and development of business cases (P);
- conceptual thinking and ability to transfer business requirements into technical implementation details (P);
- commitment, determination and ability to work in a team (P);
- independent and conscientious work in distributed teams (P);
- creativity and innovative thinking (P);
- visualization and presentation skills (P).

## Figures describing this Entrepreneurial Case



Figure 1. Digital weather measurement system



Figure 2. Smart machine



Figure 3. Farmer using a tablet for watering and fertilization management

## Data Analytics for Healthy Food in the Cloud

**Case study URL:** <https://goo.gl/VXkfPY>

**Authors:** Drago Zagar and Goran Martinović

**Keywords:** cloud computing; data analysis; food; health; mobile and web applications

**H2020 challenge addressed by the Entrepreneurial Case:** Health, demographic change and wellbeing

### Description of Entrepreneurial Case:

With too little physical activity, stress and other factors, an unhealthy diet significantly affects a large number of people contracting chronic and other current diseases (e.g., diabetes, cardiovascular diseases, neurological disorders or metabolic syndromes), as in [1], [2]. Mobile and web technologies enable entry and collection of data on people's condition and needs, while portable devices and sensors can be used as a source of valuable data that can facilitate planning a healthier diet adjusted to the diagnosis, condition and symptoms of a patient or a user with a certain level of risk of developing a disease [3], [4]. The analysis of the input and collected data should enable preparation of a nutrition profile of the user, planning, adjusting and monitoring eating habits and nutritional options, as in [5], [6]. On the other hand, the cloud provides infrastructure, computing, development/platform and analytical capabilities for developing a balanced diet system, as in [6], [7]. At day, week, and month levels, your start-up company should be able to suggest healthy food, give recommendations for its consumption, find places that sell healthy food, and avoid or warn of places selling unhealthy food. As in [8], [9], based on the principle of machine learning from the data, your company should also enable self-monitoring of patients' condition and follow-up by a physician and/or a nutritionist.

### Questions that need answers during the Entrepreneurial Case development

#### Technical aspect

- Find and define sources, formats and content of data sets that can be used to identify symptoms and needs, and define dietary requirements of users depending on their habits.
- Model, design (and optionally develop a proof-of-concept of) a web and mobile solution for data entry, collection and storage in a database, and for generating a plan, advice, and offer of healthy food. Fine-tune the interface from the point of view of user experience to the needs of users that need to adjust their eating habits.

- Select and adjust data analysis procedures suitable for creating a diet plan, generating advice and warnings, and displaying offers referring to providing healthy food.

### Business aspect

- Based on the nature and symptoms of a disease or risky eating behaviours as well as requirements for adapted nutrition and possibilities of finding healthy food offers, identify target groups and specific user requirements of users from the point of view of the patient, users with risky eating behaviours, doctors, nutritionists and food providers.
- Define channels aimed at including the target groups into the company IT system, and a customer relationship model that should allow users to adjust the IT system to the user's requirements based on data analysis results.
- Develop a model of financial sustainability and profitability for your start-up company based on the ability to promote and offer healthy food through advertising, social networks and web shops.

### Social aspect

- Evaluate, define and incorporate into your start-up company ways of how healthy eating planning will positively influence other aspects of healthy and interesting lifestyles, such as sport, health, tourism, and entertainment.
- Explain ways and benefits of raising awareness of healthy eating and its impact on the health of individuals and society and use them to improve your company's services and/or products through the model of cooperative learning.
- Develop a healthy eating support system and encourage its impact on the production of healthy and environmentally friendly food.

### Key web-links and/or papers that can be used to understand the Entrepreneurial Case

- [1] A. Abbas, et al. "Personalized healthcare cloud services for disease risk assessment and wellness management using social media," *Pervasive and Mobile Computing*, vol. 28, pp. 81-99, June 2016.
- [2] V. Apaolaza, et al. "Eat organic – Feel good? The relationship between organic food consumption, health concern and subjective wellbeing," *Food Quality and Preference*, vol. 63, pp. 51-62, Jan. 2018.
- [3] V. Kumari Yeruva, S. Junaid, Y. Lee. "Exploring social contextual influences on healthy eating using big data analytics," in *2017 IEEE Int. Conf. on Bioinformatics and Biomedicine (BIBM)*, Kansas City, MO, USA, 2017, pp. 1507-1514.
- [4] C.-H. Wu, C.-H. Hung, J.-C. Ke. Analysis techniques of food nutrient data," in *Proc. ASE Big Data & Social Informatics 2015 (ASE BD&SI 2015)*, Kaohsiung, Taiwan, 2015, Article No. 11.
- [5] F.M. Shiddieq, R. Kastaman, I. Ardiansah. "Development of people food consumption patterns information system based on web mobile application," *2015 3<sup>rd</sup> Int. Conf. Adaptive and Intelligent Agroindustry (ICAIA)*, 3-4 Aug. 2015, pp. 267-273.



- [6] Big data and analytics, [Online]. Available: <https://azure.microsoft.com/en-us/solutions/big-data>.
- [7] M.M. Al-Jefri, et al. Using machine learning for automatic identification of evidence-based health information on the web,” in 2017 Int. Conf. on Digital Health (DH '17), London, UK, 2017, pp. 167-174.
- [8] D. Ntalaperas, et al. “DISYS: an intelligent system for personalized nutritional recommendations in restaurants,” in 19<sup>th</sup> Panhellenic Conf. on Informatics, Athens, Greece, 2015, pp 382-387.
- [9] S. Wolfert, L. Ge, C. Verdouw, M.-J. Bogaardt. Big data in smart farming – a review,” Agricultural Systems, vol. 153 pp. 69-80, May 2017.

Examples of existing companies (including start-ups) working in the broader area defined with the Entrepreneurial Case

Nextdoorganics: <https://angel.co/nextdoorganics>

Tvornica zdrave hrane: <https://www.tvorniczdravehrane.com>

Fruit Street: <http://www.fruitstreet.com/fruit-street-health-focused-delivering-cdcs-diabetes-prevention-program-raises-additional-physician-funding>

## Knowledge and skills needed for developing the Entrepreneurial Case

*(“prerequisite” (P) and “desirable, but not necessary” (D))*

- mobile and/or web application programming (P);
- data analysis (P);
- cloud computing (D);
- big data (D);
- basics of entrepreneurship (D).

## Figures describing this Entrepreneurial Case

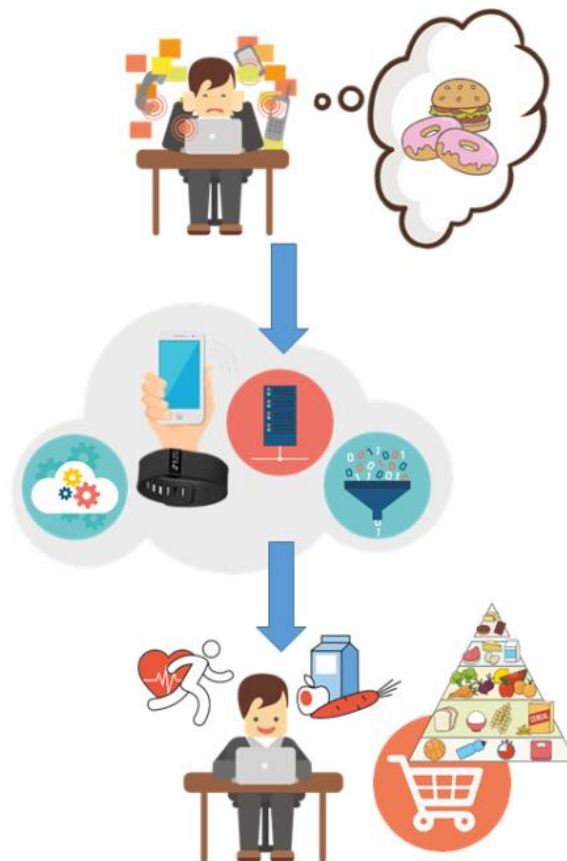


Figure 1. Data analytics in changes of nutrition habits

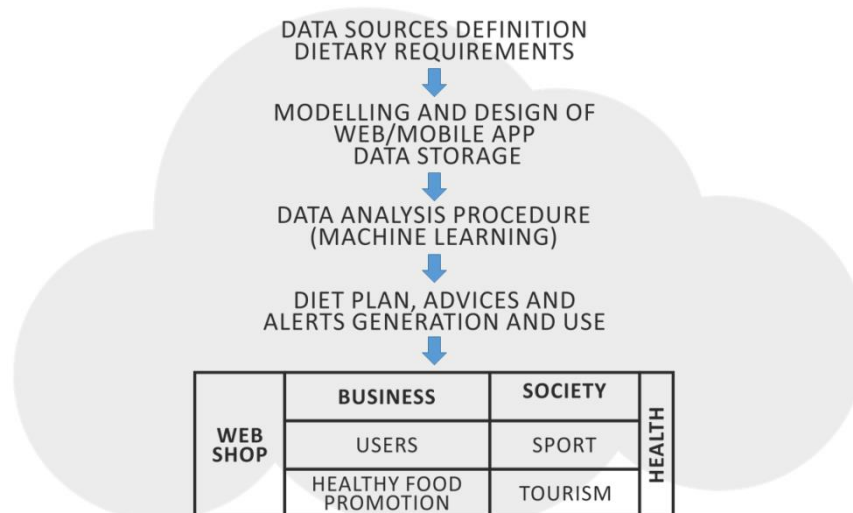


Figure 2. The main challenges of data analytics in relation to healthy food

## Smart Automotive Systems in Urban Areas: Parking for Big Cultural and Sports Events

**Case study URL:** <https://goo.gl/eWuLMM>

**Authors:** Mate Liszi, Michal Hodon, Michal Varmus

**Keywords:** automotive systems; transportation; parking; events; business

**H2020 challenge addressed by the Entrepreneurial Case:** Smart, green and integrated transport

### Description of Entrepreneurial Case:

Organization of big cultural events (like open air music festivals), or sport events, are still challenges for organizers from point of view of parking of visitors' cars. Often, several parking locations are available. Visitors try to seize the nearest possible parking place to the stadium. This way, parking places in parking locations very near to the stadium are seized first. The later visitor comes, the farther parking place from stadium are free for his/her car. During this process of looking for free parking places, high risk of congestions and collisions is typical. This causes higher air pollution and fuel consumption too. Using of Internet of Things (IoT) technologies can help to prevent mentioned negative impacts. In frame of the Entrepreneurial Case, students supervised by lecturers, will collaborate on looking for technical, business and societal solutions how IoT can be used for development of smart parking solutions that could be used during big cultural and sport events. Their task will be oriented to relations between IoT solution owner and IoT solution producer (ICT company) and event organizer (event agency).

It should be possible to use the proposed solution very flexible. Some system of sensor network (wireless?) could be installed only during the cultural or sport event. After using at one place, it could be possible to use the system at another place, for another event. Sensors should count cars that come in and out of parking location, to support decision of visitors or event organizers about desired parking place. For example, current situation at all parking locations that can be used during the cultural event could be displayed as a map in the mobile devices (smartphone, tablet). In this description, the parking location is some place with several parking places that can be seized in different ways, no exact layout for parking places exists.

Proposed solution is an opportunity for the big cultural or sport events that are organized in places which are not used for such events regularly (e.g., small airports, camping areas). These locations do not provide some stable infrastructure for monitoring of cars and are not regularly used for car parking.

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Using of proposed solution needs to be discussed from several perspectives – technical, business and societal, to identify possible weaknesses of this concept.

## Questions that need answers during the Entrepreneurial Case development

### Technical aspect

- Student teams will need to identify and provide more details about IoT (Internet of Things) implementation issues as of the core technology of the Entrepreneurial Case: Energy Harvesting, Low-power computation, Long-range & low-power communication, Sensory selection, Web technologies, Smart Phone programming techniques, 3-D printing.
- What technical equipment do you need for business, production, installation and service? How many employees do you need? What are the annual costs of the business?
- Is your solution universal or is it possible to modify the specific customer requirements?
- How do you design the installation? (Environmental Analysis, Design Solutions, Delivery, Installation, Training, Service)
- What is the length of delivery and how many people are needed to solve one project? What are the costs of one project?

### Business aspect

- What is the organizational structure of your business and competence model?
- Analyse market and try to find cultural and sports events that are potential customers for your technical solution and define crucial factors of success in this kind of business. Try to identify in detail customers segments and justify them. What main value you will promote to customers and which communications channels and tools you will prefer and why?
- What about your customer relationship management? What tools you will prefer? What is your strategy? How you will distribute your product?
- Try to identify crucial partners for your business and relationship with them. What cooperation strategy do you choose with them?
- What will be your price strategy? Try to calculate cost (production, development, people, distribution, marketing communication, etc.).

### Social aspect

- What role does your solution play in a smart city policy?
- What benefits bring your solution to the issue of sustainability of a green policy?

- Try analysing similar solutions in the world. How you can measure and describe social and environmental impacts of your solution?
- How would you characterize the social significance of your proposal? How would the quality of life of people be changed using your proposal? How your solution impacts local revenues and costs?
- Think about the possible positive and negative impacts of your solution (societal, green politics, quality of life etc.).

### Key web-links and/or papers that can be used to understand the Entrepreneurial Case

- [1] The triple layered business model canvas: A tool to design more sustainable business models  
<http://www.sciencedirect.com/science/article/pii/S0959652616307442>
- [2] The B2B Knowledge Gap  
<http://www.sciencedirect.com/science/article/pii/S0167811616300040>
- [3] Deployment of an open sensorized platform in a smart city context  
<http://www.sciencedirect.com/science/article/pii/S0167739X16305519>
- [4] Development of B2B marketing theory (Amjad Hadjikhani, Peter LaPlaca)  
<https://www.sciencedirect.com/science/article/pii/S0019850113000618?via%3Dihub>
- [5] Harnessing marketing automation for B2B content marketing (Joel Järvinen, Heini Taiminen)  
<https://www.sciencedirect.com/science/article/pii/S0019850115300018?via%3Dihub>
- [6] The future of B2B marketing theory: A historical and prospective analysis (Roberto Mora Cortez\*, Wesley J. Johnston)  
<https://www.sciencedirect.com/science/article/pii/S0019850117300263?via%3Dihub>
- [7] Citizen-centric data services for smarter cities (Unai Aguilera, Oscar Peña, Oscar Belmonte, Diego López-de-Ipiña)  
<https://www.sciencedirect.com/science/article/pii/S0167739X16304770?via%3Dihub>
- [8] Methodology for the of building process integration of Business Model Canvas and Technological Roadmap (Miguel Angel Toro-Jarrín, Idalia Estefania Ponce-Jaramillo, David Güemes-Castorena)  
<https://www.sciencedirect.com/science/article/pii/S004016251600010X?via%3Dihub>
- [9] Mobile Phone Based Parking System. (Kinyanjui K. and Mwaura Kahonge A. (2013). International Journal of Information Technology, Control and Automation, 3(1), pp.23-37.  
<http://wireilla.com/papers/ijitca/V3N1/3113ijitca03.pdf>
- [10] Smart Parking System Based on Embedded System and Sensor Network. (Ibrahim F., Nirnay P., Pradeep, S., Pradip, O. and B. N. Shardoor 2016). International Journal of Computer Applications, 140(12), pp.45-51. <http://www.ijcaonline.org/research/volume140/number12/shaikh-2016-ijca-909532.pdf>

### Examples of existing companies (including start-ups) working in the broader area defined with the Entrepreneurial Case

Banner Engineering: <https://www.bannerengineering.com/us/en.html>

Cleverciti Systems GmbH: <https://www.cleverciti.com>

Parquery AG: <http://parquery.com>

Smart Parking Limited: <https://www.smartparking.com>

TIBA Parking Systems: <http://www.tibaparking.com>

## Knowledge and skills needed for developing the Entrepreneurial Case

(“prerequisite” (P) and “desirable, but not necessary” (D))

- ability to adapt and cope with new technologies (P);
- some technical and programming knowledge (P);
- ability to work in a team (P);
- analytical skills (P);
- software design (D);
- hardware design (D);
- presentation skills (D);
- basics of management and marketing (D).

## Figures describing this Entrepreneurial Case

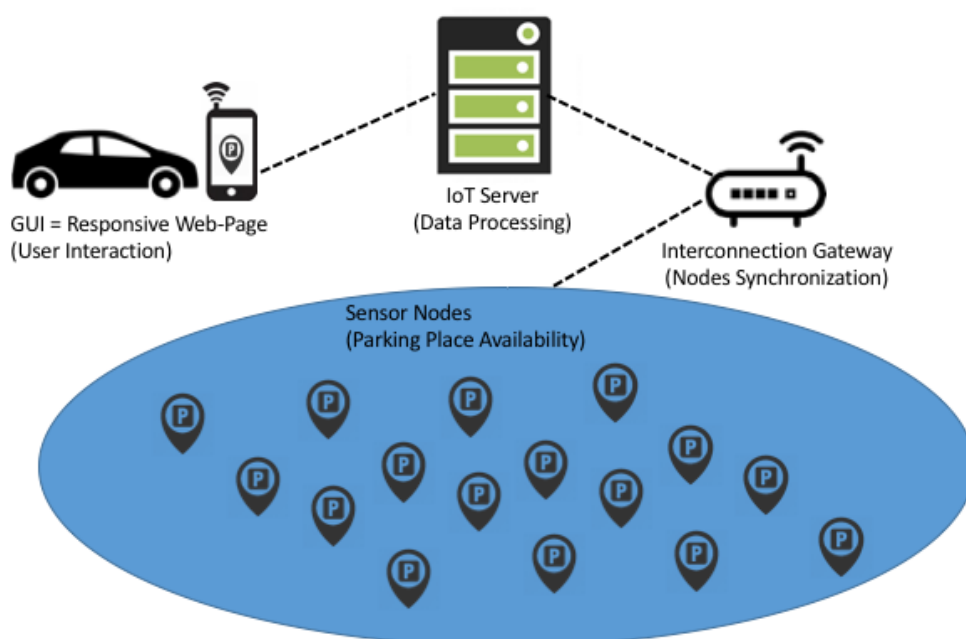


Figure 1. Principle of a smart automotive system

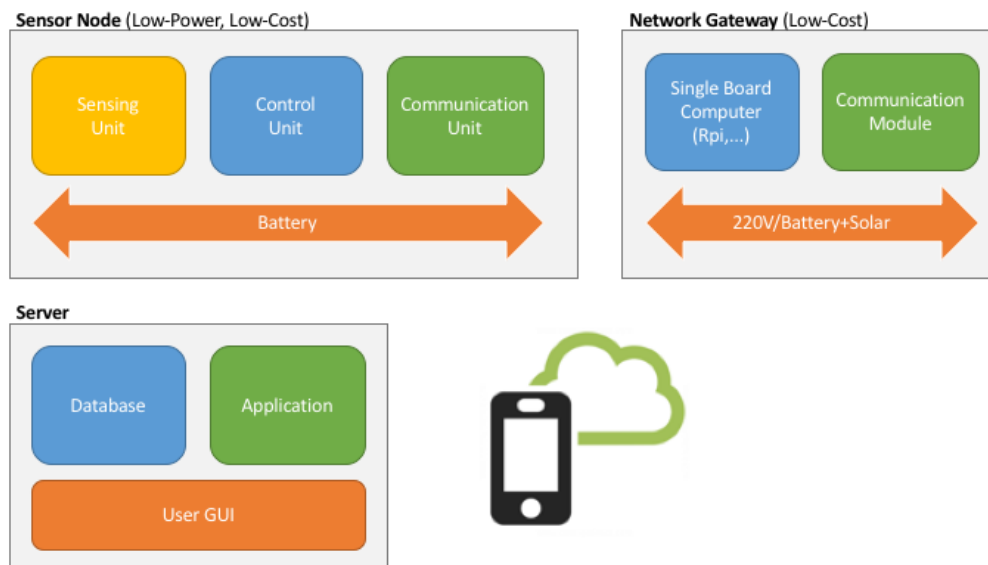


Figure 2. Technical units of a smart automotive system

## 3D Printing as a Tool in Environment Protection

**Case study URL:** <https://goo.gl/A3Fg9e>

**Authors:** Marianna Zichar

**Keywords:** 3D printing; 3D modeling; waste reduction; environment protection; 3D printing as a service; innovation

**H2020 challenge addressed by the Entrepreneurial Case:** Climate action, environment, resource efficiency and raw materials

### Description of Entrepreneurial Case:

One of the most important tasks for humans is to save the earth for the next generations. There are so many fields where changes should be done in order to protect our environment. Latest inventions in technology, such as 3D printing, can support this intention efficiently. If an enterprise could offer special services for people, which are beneficial for them and also for the environment, why not to launch a start-up company with this objective [1]? For example, broken part of devices can be reproduced with a 3D printer preventing it to become waste. Or 3D printed objects can be used to prolong the lifetime of devices, household gadgets, etc. Reducing the amount of waste is of high importance [2]. Let us imagine that we would like to start an enterprise based on the mentioned idea: to provide 3D printing as a service. What we have to do first is to overview what kind of devices, raw materials, special skills, software products, business plan we would need to have success. It is also of high importance that what kind of printing services the people may be interested in. Usage of environment friendly materials and technologies could be an added value to the success of the enterprise.

### Questions that need answers during the Entrepreneurial Case development

#### Technical aspect

The topics that should be discussed first by the team:

- Basics of 3D printing as a representative of additive technology [3], [4].
- Which is the most practical 3D printer type to purchase first for the company?
- Overview and classification of raw materials [5].
- First steps in getting to know a free design software.

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## Business aspect

In case of a start-up company dealing with 3D printing as a service, the following business aspects should be reviewed first [6], [7]:

- Student teams will need to determine what services the company will provide.
- Student teams will need to identify potential customer segments for services they will develop.
- Student teams will identify what kind of interfaces they can use to reach the potential customers.
- Student teams will explore how the cost of their services can be determined.

## Social aspect

3D printing can not only reform the producing, but can change the behaviour of customers due to having societal aspects as well [8], [9]:

- Student teams will explore how 3D printing can have positive impact to environment protection by extending the lifecycle of objects, gadgets, etc.
- Student teams will identify the advantages of 3D printing that support the environment protection.
- Student teams will overview what skills an employee should have to be able to make 3D models.
- Student teams will investigate impacts of possible 3D printing services on labour market (including employment of people with some kinds of disabilities).

## Key web-links and/or papers that can be used to understand the Entrepreneurial Case

- [1] T. Koslow, "Best 3D Printing Companies 2017 – The 40 Most Innovative", Available: <https://all3dp.com/1/top-3d-printing-companies-3d-printer-manufacturers/>
- [2] J. Constantino, "3D Printing and Environmental Sustainability", 2015. Available: <https://blogs.baruch.cuny.edu/3djasminec/files/2015/12/3DP-Article.pdf>
- [3] What is 3D printing, A definitive guide to additive manufacturing, Available: <https://www.3dhubs.com/what-is-3d-printing#a-brief-history-of-3d-printing>
- [4] K. V. Wong, A. Hernandez, "A Review of Additive Manufacturing", *International Scholarly Research Network ISRN Mechanical Engineering*, Volume 2012, 10 pages, Available: <http://downloads.hindawi.com/journals/isrn.mechanical.engineering/2012/208760.pdf>
- [5] TE. Halterman. "New research says that a new bioeconomy may be driven by 3D printed cellulose materials", 2015. Available: <https://3dprint.com/70827/3d-printed-cellulose-materials/>
- [6] P. Holzmann, R. J. Breiteneker, A. A. Soomro, E. J. Schwarz, "User entrepreneur business models in 3D printing", *Journal of Manufacturing Technology Management*, Vol. 28 Issue: 1, pp. 75-94, 2017. Available: <http://www.emeraldinsight.com/doi/pdfplus/10.1108/JMTM-12-2015-0115>
- [7] M. K. Niaki, F. Nonino, "Impact of additive manufacturing on business competitiveness: a multiple case study", *Journal of Manufacturing Technology Management*, Vol. 28 Issue: 1, pp. 56-74, 2017. Available: <https://doi.org/10.1108/JMTM-01-2016-0001>

[8] O. Reichardt, "3D Printing and its Impacts on Society", 2014. Available: <https://www.thersa.org/discover/publications-and-articles/rsa-blogs/2014/01/3d-printing-and-its-impact-on-society#>

[9] A. Pirjan, D. M. Petrosanu, "The Impact of 3D Printing Technology on the Society and Economy", *Journal of Information Systems & Operations Management*, Vol. 7 Issue: 2, pp. 360-370, 2013. Available: <ftp://ftp.repec.org/opt/ReDIF/RePEc/rau/jisomg/Wi13/JISOM-WI13-A19.pdf>

Examples of existing companies (including start-ups) working in the broader area defined with the Entrepreneurial Case

Desktop Metal: <https://www.desktopmetal.com>

Materialise: <http://www.materialise.com/en/home>

Sculpteo: <https://www.sculpteo.com/en>

## Knowledge and skills needed for developing the Entrepreneurial Case

(*"prerequisite" (P) and "desirable, but not necessary" (D)*)

- basic ICT knowledge (P);
- to have interest in 3D printing (P);
- experience in 3D technologies (D);
- to be curious and prolific Internet researcher (D).

## Figures describing this Entrepreneurial Case

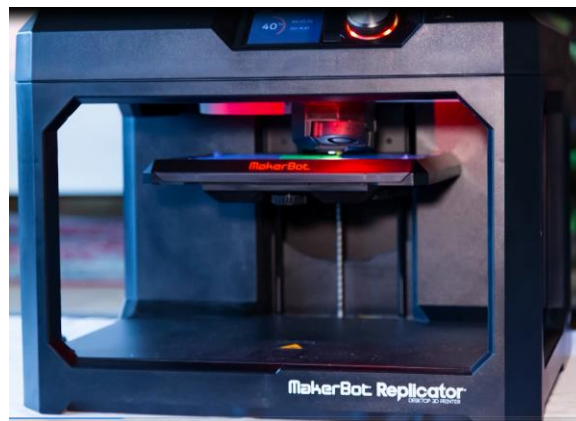


Figure 1. A desktop 3D printer based on the FDM technology





Figure 2. Case for an electronic toothbrush designed by a student (to replace a broken one)



## Real-time ICT-based Security Solutions for European Borders Protection

**Case study URL:** <https://goo.gl/aeuu2U>

**Authors:** Filip Tsvetanov and Svetla Radeva

**Keywords:** sensor network; wireless sensor networks; cloud structures; border security; innovations

**H2020 challenge addressed by the Entrepreneurial Case:** Secure societies - protecting freedom and security of Europe and its citizens

### Description of Entrepreneurial Case:

The security of the borders of European countries is a key factor in ensuring a high quality of life for its citizens [2]. One of the main challenges is to manage the flow of people and goods arriving at our external borders, while tackling the issues of smuggling of goods and illegal migration. The construction of fences between borders is not a sufficiently effective measure, as the facilities on the border are usually damaged as well as the fences cut or jammed by illegal immigrants. A new entrepreneurial opportunity to reduce the traffic of illegal migrants in hard-to-reach and poorly populated border regions is the adaptation of (i) the processes for collecting, processing and analysing sensors data from border surveillance and (ii) wireless sensor networks constructed by specialized sensors for border control and uploading sensors data in a cloud structure. The use of wireless surveillance networks based on radio-controlled and long-life battery-powered sensors provides an effective way for effectively controlling illegal immigration, drug trafficking and other security breaches at the EU borders [1], [3], [4], [5]. The information from these sensors transmitted to the cloud integrated systems with simple but highly standardized interfaces showing real-time information that can help the border guards in the decision making of their command and control centre [6]. The entrepreneurial case can be realized through the creation of a security systems company. This company will offer security-consulting services. The consulting services will include an analysis and evaluation of existing networks to guard the borders of the EU and their ability to integration to cloud structures.

## Questions that need answers during the Entrepreneurial Case development

### Technical aspect

Student teams will need to identify and provide more detail on the analysis of existing wireless communication networks at European borders, including answers to questions such as:

- Analysis of the hardware features and technological capabilities of wireless sensors suitable for working in remote and hard-to-reach regions.
- Analysis of the communication capabilities of the appropriate sensors.
- Analysis of the possibilities for building wireless sensor networks, the necessary communication hardware and possibility of its installation in hard-to-reach regions.
- Software challenges in transmitting, storing and processing real-time sensor data.
- Possibilities used sensor integration, cloud structures and evaluation proposals for modernizing existing networks.

### Business aspect

The student team will need to:

- Identify potential customer segments of the technology under discussion to enhance border security.
- Describe a list of key project development activities.
- Describe what will the consulting department offer to potential customers?
- Elaborate upon on how will the assessment and proposals made on the existing security system lead to an increase in EU border security in real time?
- Describe the cost structure of the project implementation.

### Social aspect

The student team will have to provide more details about how entrepreneurial event affects the safety and security of EU citizens, and on protection of the transmitted data of the existing security systems:

- How will the entrepreneurial case lead to increased citizens' security?
- How do you see the possibilities of building joint teams from neighbouring countries to develop a common project to protect their borders?
- Do you think that improving border security will reduce illegal traffic and increase legal migration?
- How resolving the entrepreneurial case will increase the exchange of classified information between EU Member States and reduce response times in specific cases, for example in the search for criminals, illicit trafficking in human beings, searching for cars, searching for smuggled goods, etc.

### Key web-links and/or papers that can be used to understand the Entrepreneurial Case

[1] Hammoudeh, M and Adebisi, B and Al-Fayez, F and Lloyd, H and Newman, R and Bounceur, A and Abuarqoub, A, (2017) A Wireless Sensor Network Border Monitoring System: Deployment Issues and Routing Protocols. IEEE Sensors Journal, 14, <https://e-space.mmu.ac.uk/618050/6/ieee-wireless-sensor.pdf>

- [2] Horizon 2020 - Work Program 2018-2020 Secure societies - Protecting freedom and security of Europe and its citizens [http://ec.europa.eu/research/participants/data/ref/h2020/wp/2018-2020/main/h2020-wp1820-security\\_en.pdf](http://ec.europa.eu/research/participants/data/ref/h2020/wp/2018-2020/main/h2020-wp1820-security_en.pdf)
- [3] Sarra Berrahal, Jong-Hoon Kim, Slim Rekhis, Nouredine Boudriga, Deon Wilkins, and Jaime Acevedo, Border surveillance monitoring using Quadcopter UAV-Aided Wireless Sensor Networks, JOURNAL OF COMMUNICATIONS SOFTWARE AND SYSTEMS, VOL. 12, NO. 1, MARCH 2016 pp. 67-83, <https://hrcak.srce.hr/file/264893>
- [4] Surveillance Wireless Sensor Networks: Deployment Quality Analysis, <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.723.8940&rep=rep1&type=pdf>
- [5] Atif Alamri, Wasai Shadab Ansari, Mohammad Mehedi Hassan, A Survey on Sensor-Cloud: Architecture, Applications, and Approaches, 2013, International Journal of Distributed Sensor Networks, <http://journals.sagepub.com/doi/full/10.1155/2013/917923>
- [6] Wireless Sensor Networking in the Internet of Things and Cloud Computing Era, [https://ac.els-cdn.com/S1877705814026927/1-s2.0-S1877705814026927-main.pdf?\\_tid=887b9918-13ca-11e8-9997-00000aabb0f01&acdnat=1518862303\\_f5ed2b00be1b794a6ca807148121c8b4](https://ac.els-cdn.com/S1877705814026927/1-s2.0-S1877705814026927-main.pdf?_tid=887b9918-13ca-11e8-9997-00000aabb0f01&acdnat=1518862303_f5ed2b00be1b794a6ca807148121c8b4)

### Examples of existing companies (including start-ups) working in the broader area defined with the Entrepreneurial Case

SSR Engineering: <https://ssreng.com>

Optix: <http://www.optixco.com>

Thales: <https://www.thalesgroup.com>

ADS: <https://www.adsgroup.org.uk>

### Knowledge and skills needed for developing the Entrepreneurial Case

*(“prerequisite” (P) and “desirable, but not necessary” (D))*

- sensor networks (P);
- border sensor networks (P);
- data transfer (P);
- wireless engineering (D);
- network security (D);
- cloud technology (D).

## Figures describing this Entrepreneurial Case

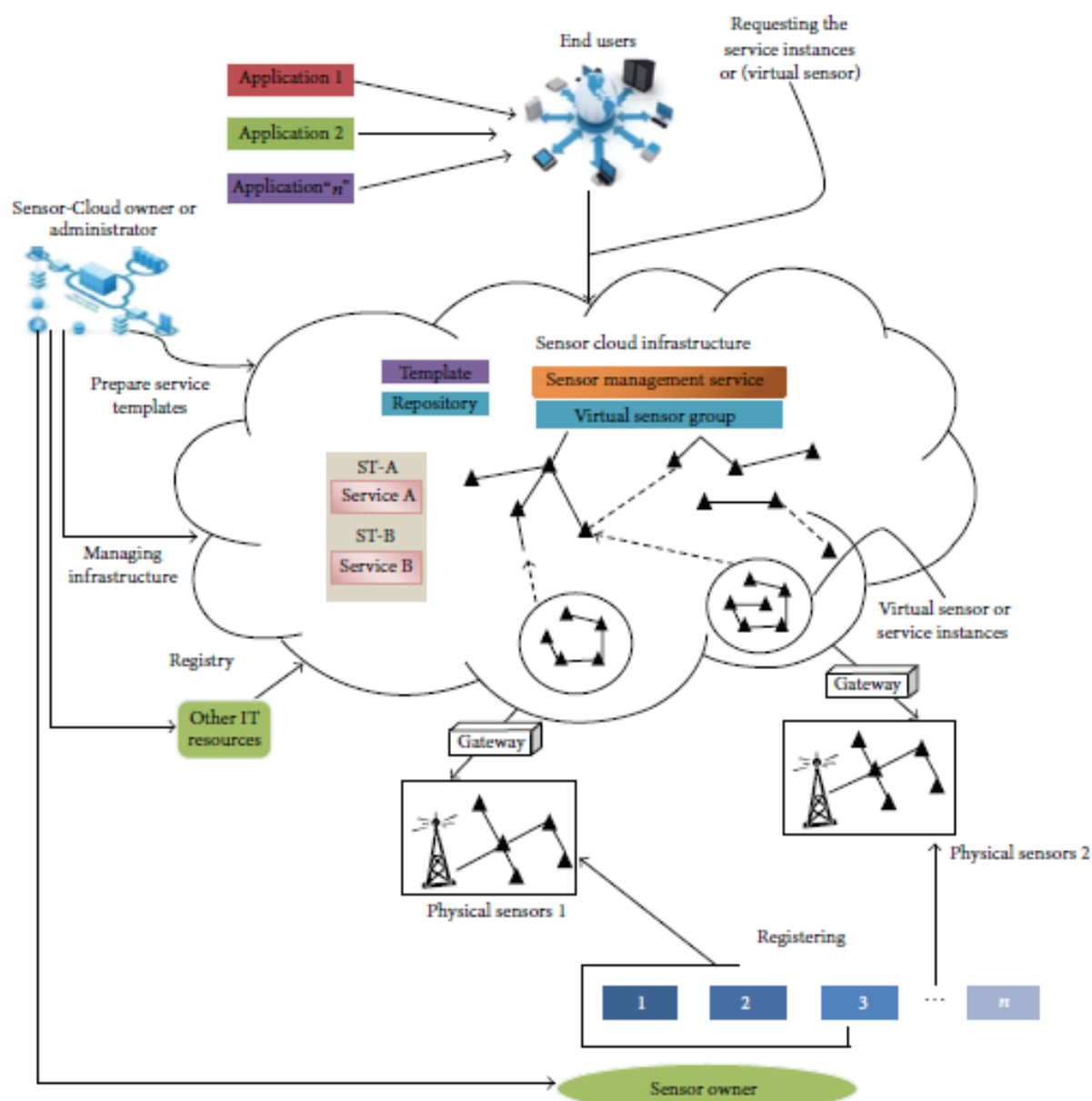


Figure 1. Sensor cloud architecture [5]

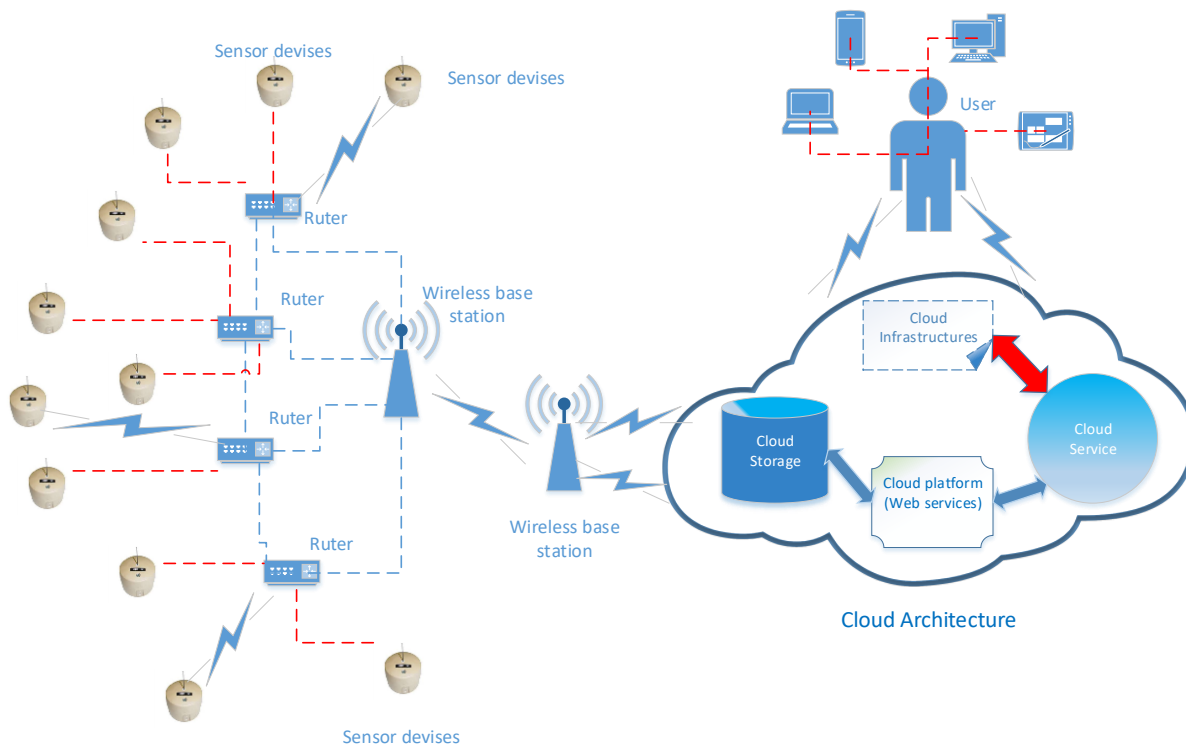


Figure 2. Block diagram of integrating Wireless Sensor Networks with Cloud Computing

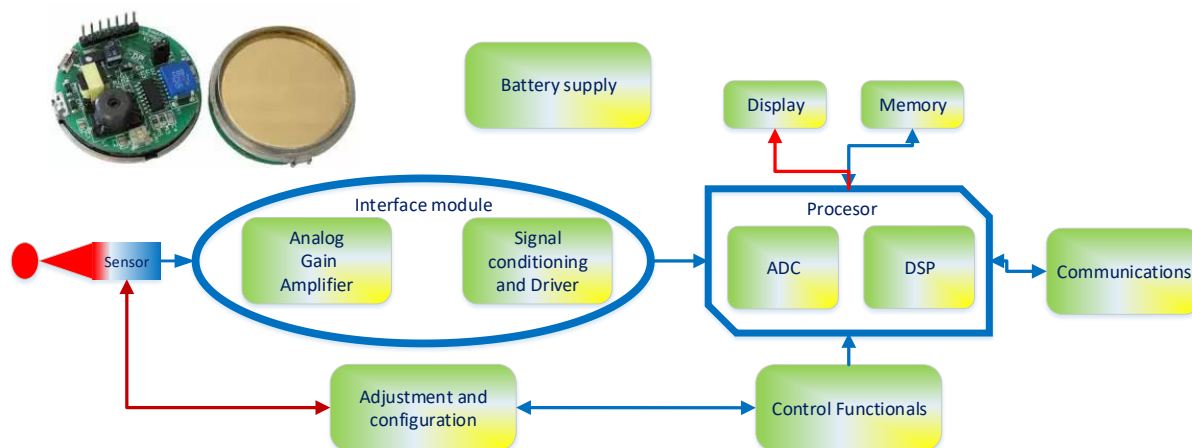


Figure 3. Block diagram of a smart sensor

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