



IF₄TM

Institutional framework for development
of the third mission of universities in Serbia



Report of PoC Program realization





IF4TM

D3.5 Report of PoC Program realization

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TABLE OF CONTENT

DOCUMENT CONTROL SHEET.....	2
TABLE OF CONTENT	3
1. Development of the D3.5 Operational Manual for Proof-of-Concept Program	4
2. Proof-of-Concept Program applications.....	5
3. Meeting at the Ministry of Education, Science and Technological Development	11
4. Implementation of PoC projects and support activities.....	12
4.1 3 PHASE voltage converter (3Phase)	12
4.2 Robust low-cost fiber-optic 2D deflection sensor (FOS2D).....	13
4.3 Keystone distortion free fingerprint optical scanner (GOLDFINGER)	14
4.4 From waste to eco building (ECO POSTS).....	15
4.5 Highly efficient information system for parking support (HEISPS)	15
4.6 Device for ultrasound washing and disinfection of medical instruments and vessels (MedIn)	16
4.7 Torque sensor based on magnetomechanical effect in commercial steel (TorqSens) .	17
4.8 Fixture for fabrication of custom made artificial bone grafts at dental CAD/CAM systems (art-boneFIX)	19
4.9 Molecular sensor for malignancy screening (SensORing)	19
4.10 Other PoC projects	20

1. Development of the D3.5 Operational Manual for Proof-of-Concept Program

The Operational Manual for Proof of Concept Programme is a document developed within the WP3 Technology transfer and innovation dimension, more precisely within the Activity 3.5 Improving TRL level through implementation of Proof-of-Concept Programme for selected research ideas.

The Manual was designed in such a way to provide the set of recommendations and instructions for researchers on the mechanisms and tools for validation of their laboratory prototypes and commercialization of research results.

The main objective the Manual strives to build and improve the commercialization potential of university researches by raising the Technology Readiness Level (TRL) of research results and building capacity of researchers to make their research results marketable.

Having in mind the main goal of the Manual, it further explains the concept of PoC program and gives a preview supporting activities:

- Market Research
- Business model development
- Development of commercialization strategy
- IP evaluation and protection
- Technology/concept validation.
- Development of prototype
- Development of technical feasibility study
- Fundraising or crowd-funding support.

Further on, it explains the conditions for participation in PoC program, foreseeing the pilot phase to be implemented at seven Serbian higher education institutions (HEIs) during the IF4TM project and the Program realization outside and after the project. It provides the information on eligibility conditions, application and selection procedures, as well as the concrete support actions for research teams to be selected within the Program.

The Manual was finalized in December 2017, and was made publically available at the project website at the [following link](#).



2. Proof-of-Concept Program applications

The pilot phase of the Proof-of-Concept Program was initiated at seven Serbian higher education institutions participating in the IF4TM project in December 2017. The call for application for PoC program was published both at the project's website and the websites of the institutions participating in the pilot PoC program:

- **University of Kragujevac**
 - [University website](#)
 - [BSO website SR](#)
 - [BSO website EN](#)
 - [CTC website](#)
 - [CEVIP website SR](#)
 - [CEVIP website EN](#)
- **University of Belgrade**
 - [University website](#)
 - [AcademLink](#)
 - [Universities in Serbia](#)
- **University of Novi Sad**
 - [BSO website SR](#)
 - [BSO website EN](#)
- **University of Nis**
 - [University website](#)
- **State University of Novi Pazar**
 - [University website](#)
- **Belgrade Metropolitan University**
 - [University website](#)
- **Technical College of Applied Sciences Zrenjanin**
 - [Website of institution](#)

The call for applications was opened until the 15th February 2018, and was prolonged until the end of the February on request of the potential applicants.

For this call, fourteen applications were received as presented in the Table 1.



Table 1. List of received applications for the PoC program call

No.	PoC project	Project full name	Applicant's institution
1	3Dphotext-less	System for photogrammetric 3D digitization of textureless objects	UNS, Faculty of Technical Sciences
2	3Phase	3 PHASE voltage converter	UNI, Faculty of Electronic Engineering
3	art-boneFIX	Fixture for fabrication of custom made artificial bone grafts at dental CAD/CAM systems	UNS, Faculty of Technical Sciences
4	AUTOCONN	Development of the injectable, living autologous connective tissue	UKG, Faculty of Medical Sciences
5	Combined Biomass Gasifier	Development of a combined biomass gasifier for the use in combined heat and power systems	UKG, Faculty of Mechanical and Civil Engineering in Kraljevo,
6	ConBoil	Control system for electric hot water boilers	UNI, Faculty of Electronic Engineering
7	FOS2D	Robust low-cost fiber-optic 2D deflection sensor	UNS, Faculty of Technical Sciences
8	GOLDFINGER	Keystone distortion free fingerprint optical scanner	TCAS
9	ECO POSTS	From waste to eco building	TCAS
10	HEISPS	Highly efficient information system for parking support	SUNP
11	HPC	Heat pump control	UKG , Faculty of Mechanical and Civil Engineering in Kraljevo
12	MedIn	Device for ultrasound washing and disinfection of medical instruments and vessels	UNI, Faculty of Electronic Engineering
13	SensORing	Molecular sensor for malignancy screening	UBG, Institute of Molecular Genetics and Genetic Engineering
14	TorqSens	Torque sensor based on magnetomechanical effect in commercial steel	UKG, Faculty of Technical Sciences in Cacak

The applications were mostly multidisciplinary (see Figure 1) and the most covered scientific areas were electrical and electronic engineering (covered by approximately 60% of applications) and medical engineering (covered by almost 70% of all applications).

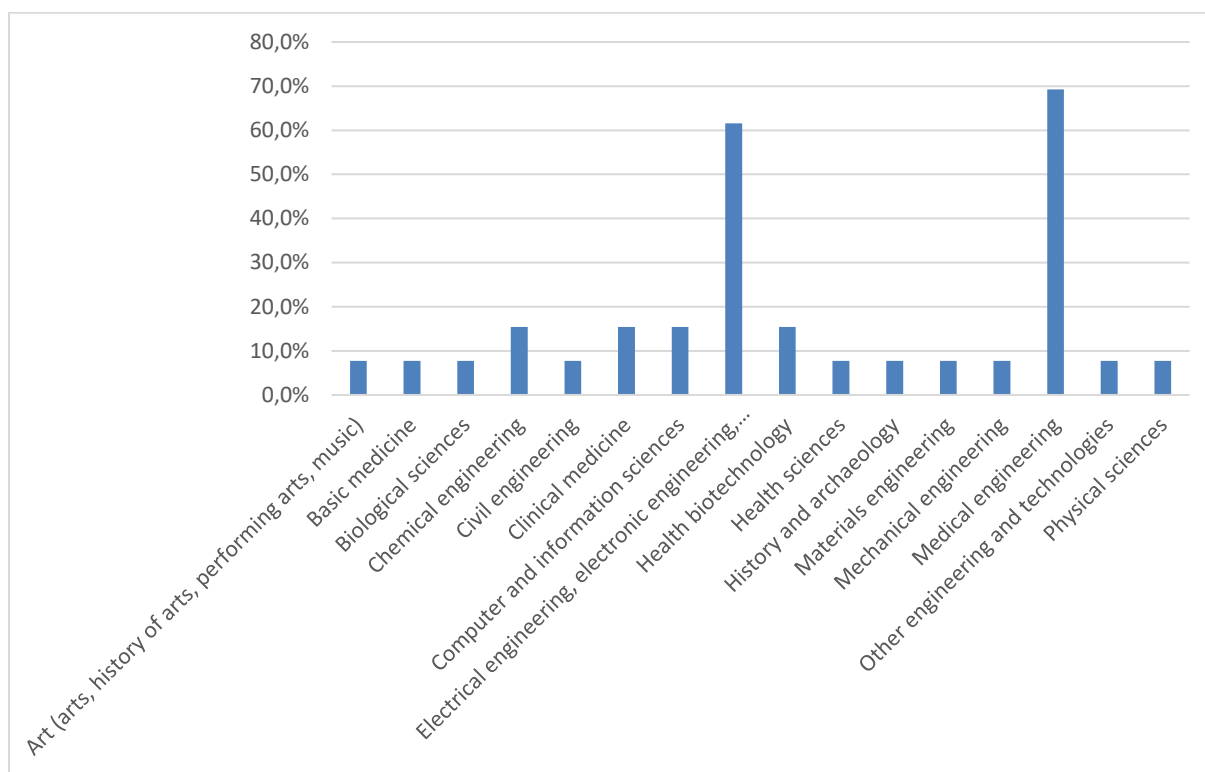


Figure 1. PoC projects across the scientific fields

With reference to the support requested, the most needed were support actions such as market research, development of prototypes, IP evaluation and commercialization strategy, which clearly reflexes the support that most usually lacks at Serbian universities or are commonly very occasional.

The reviewing process was conducted in line with the selection criteria defined by the PoC Manual. For that purpose UKG team, as Task leader, prepared table (Table 2) for reviewers for monitoring of review process and calculation of final score of all applied PoC projects. Received applications were reviewed by at least two reviewers, selected based on their expertise and mainly proposed from partners' institutions within IF4TM project, as it is stated in the Table 3 below. For each PoC application and appointed reviewer UKG team prepared and delivered NDA model. After reviewer's signature of NDA the PoC application package was delivered for review. The whole review process was monitored by UKG as Task leader and members of Evaluation Committee.

Table 2 – Review form with predefined criteria and weight factors

Three independent reviewers (two from the Serbian HEIs and one from the EU HEIs) are assigned to each application that meets the following requirements: **I)** submitted in a timely manner respecting the set deadline, **II)** fully filled and completed, and **III)** submitted in English language.

The general aspects that will be assessed in evaluation criteria accompanied by the weight factors are as follows:

Technology (30%) – Applications need to clearly describe the technology in question and to demonstrate its innovativeness. Opportunity to protect intellectual property related to the technology will also be assessed. Additionally, the impact on raising Technology Readiness Level will be taken into account when assessing the technology.

Application (25%) – Potential for industrial application of technology including the definition of target groups' problems, proposed solution, technical feasibility as well as regulatory and other barriers.

Market (20%) – Market potential will be assessed in terms of competitive advantage, sales potential and market size.

Team competences (25%) – Competences and skills of researcher/s to carry out and manage the research project such as research competences, capacities to market, project management skill and available resources).

The scores for individual criteria can range from 1 (very poor) to 10 (excellent)

Criteria	Relative Weight Factor	Reviewer Score (1-10)	Score with factors	Questions
Technology	30%		0	
Description of technology	10%		0	How clearly is the technology described?
Level of innovativeness	10%		0	What is the innovativeness level of technology?
IP protection	5%		0	Can the technology be protected in terms of IPR (10 – protected, 0 – not protectable)
TRL level	5%		0	What is the TRL level of the technology (refer to 1. Proof of Concept (PoC) Background and Objectives)
Application	25%		0	
Definition of the problem of target groups	5%		0	How well is the problem of target groups described?
Proposed solution	10%		0	How the proposed technology addresses the problem
Technical feasibility	5%		0	Is the technology technically feasible?
Regulatory issues and other barriers	5%		0	Are there any regulatory or other barrier for application of the technology?
Market	20%		0	
Competitive advantage	10%		0	Please describe what makes your technology better positioned on the market?
Sales potential	5%		0	What is the market share that a product can reasonably be expected to achieve within a given time frame?
Market size	5%		0	What is the size of the market, regarding the potential buyers and financial value
Team competences	25%		0	
Researchers competences	10%		0	Are the research competences of researchers satisfying?
Competences for marketing	5%		0	Do the researchers have other skills required for PoC (entrepreneurship, IP knowledge, commercialization knowledge, marketing skills, etc.)?
Project management	5%		0	Are the management skills of researchers a satisfying level?
Resources	5%		0	Are all necessary resources available (both human and material)
		TOTAL	0	

Based on the results of reviewers' evaluation, the Committee will make decisions on cofinancing through PoC Programme on quarterly basis and kind of support that will be provided to applicants taking into consideration specificities of technology and its validation, i.e. raising TRL level.

Table 3 – Results of review process of received PoC applications

No.	PoC project	Applicant's institution	Reviewer#1			Reviewer#2			Reviewer#3			TOT/
			Name	Inst	Scor	Name	Inst	Scor	Name	Inst	Scor	
1	3Dphotext-less	Faculty of Technical Sciences, University of Novi Sad	Prof. Dr. Vladimir Milovanovic	UKG	63		IST		Dr Edis Mekic	DUNP	62	62.50
2	3Phase	Faculty of Electronic Engineering Niš	Dr Darko Marčetić	UNS	42.5	Asst. Robert Ojteršek	UM	68.5	Dr Jelena Filipović	UBG	56	55.67
3	art-boneFIX	University of Novi Sad - Faculty of Technical Sciences	Dr Vukašin Kuč	UBG	69		UB		Dr Marko Milojković	UNI	89.5	79.25
4	AUTOCONN	Faculty of Medical Sciences Kragujevac	Dr Jelena Cvejić	UNS	48.5		UNIBA		Dr Darko Mitić	UNI	88.5	68.50
5	Combined Biomass Gasifier	Faculty of Mechanical and Civil Engineering in Kraljevo, University of Kragujevac	Dr Dragana Štrbac	UNS	84		IST		Dr Marko Milojković	UNI	93	88.50
6	ConBoil	Faculty of Electronic Engineering, Niš	Prof. Dr. Nebojsa Lukic	UKG	64		UB		Prof. dr Edin Dolica	DUNP	76.5	70.25
7	FOS2D	Faculty of Technical Sciences, University of Novi Sad	Prof. Dr. Aleksandar Peulic	UKG	69.5	Dr. Franz Kohl	DUK	85	Dr Vukašin Kuč	UBG	70.5	75.00
8	GOLDFINGER	Technical College of Applied Sciences in Zrenjanin	Dr Edis Mekic	DUNP	80.5		UNIBA		doc. dr Igor Franc	BMU	71.5	76.00
9	ECO POSTS	Technical College of Applied Sciences in Zrenjanin	Dr Djordje Celic	UNS	47.5				Marko Vujinovic	BICKG	69	58.25
10	HEISPS	State University of Novi Pazar	Prof. Stevan Stankovski	UNS	19	Asst. Robert Ojteršek	UM	72.5	Vladimir Vukadinovic	UKG	58	38.50
11	HPC	Faculty of Mechanical and Civil Engineering in Kraljevo	Dr Aleksandar Radakovic	DUNP	57		UB		Dr Marko Milojković	UNI	94	75.50
12	MedIn	Faculty of Electronic Engineering, Niš	Vladimir Vukadinovic	UKG	53	Dr. Martin Bradl	DUK	47	Dr Jelena Filipović	UBG	57.5	52.50
13	SensORing	Institute of Molecular Genetics and Genetic Engineering, University of Belgrade	Dr Saša Nikolić	UNI	89.5		IST		Prof. Silvana Andrić	UNS	38.5	64.00
14	TorqSens	University of Kragujevac, Faculty of Technical Sciences in Cacak	Dr Vukašin Kuč	UBG	69	Asst. Robert Ojteršek	UM	80	Edis Mekic	DUNP	81	76.67

Based on the scores appointed by the reviewers, ten research teams were selected by the Evaluation Committee composed of:

- Prof. Dr. Vesna Mandic, University of Kragujevac
- Prof. Dr. Goran Stojanovic, University of Novi Sad
- Marina Vukobratovic Karan, Ministry of Education, Science and Technological Development
- Mladjan Stojanovic, Serbian Innovation Fund
- Jelena Jevtovic, University of Kragujevac.

In the final committee decision for support within the pilot phase of the PoC Program, the consultation with applicants home institutions with reference to institutional support in commercialization of technologies.

Ten PoC projects approved finally were:

- 3 PHASE voltage converter (3Phase)
- Fixture for fabrication of custom made artificial bone grafts at dental CAD/CAM systems (art-boneFIX)



- Development of a combined biomass gasifier for the use in combined heat and power systems (Combined Biomass Gasifier)
- Robust low-cost fiber-optic 2D deflection sensor (FOS2D)
- Keystone distortion free fingerprint optical scanner (GOLDFINGER), latter changed with ECO POSTS project
- Highly efficient information system for parking support (HEISPS)
- Heat pump control (HPC)
- Device for ultrasound washing and disinfection of medical instruments and vessels (MedIn) instead of ConBoil
- Molecular sensor for malignancy screening (SensORing)
- Torque sensor based on magnetomechanical effect in commercial steel (TorqSens).

3. Meeting at the Ministry of Education, Science and Technological Development

Ten selected teams were eligible for the support within the pilot phase of the PoC Program. In order to determine the scope and the type of the support to be provided by the IF4TM project and its experts, a [meeting was organized at the Ministry of Education, Science and Technological Development in May 2017](#).

AGENDA	
<p>Friday, 18th May 2018 Ministry of Education, Science and Technological Development Nikola Tesla 12, Belgrade</p>	
09:45 – 10:00	Registration of participants
10:00 – 10:30	Molecular sensor for malignancy screening Institute of Molecular Genetics and Genetic Engineering, University of Belgrade
10:30 – 11:00	Fixture for fabrication of custom made artificial bone grafts at dental CAD/CAM systems University of Novi Sad - Faculty of Technical Sciences
11:00 – 11:30	Robust low-cost fiber-optic 2D deflection sensor Faculty of Technical Sciences, University of Novi Sad
11:30 – 12:00	Keystone Distortion Free Fingerprint Optical Scanner Technical College of Applied Sciences in Zrenjanin
12:00 – 12:30	Coffee break
12:30 – 13:00	Torque Sensor based on Magnetomechanical Effect in Commercial Steel University of Kragujevac, Faculty of Technical Sciences in Čačak
13:00 – 13:30	Development of a combined biomass gasifier for the use in combined heat and power systems Faculty of Mechanical and Civil Engineering in Kraljevo, University of Kragujevac
13:30 – 14:00	Heat Pump Control Faculty of Mechanical and Civil Engineering in Kraljevo
14:00 – 14:30	Coffee break
14:30 – 15:00	Highly Efficient Information System for Parking Support State University of Novi Pazar
15:00 – 15:30	3 PHASE voltage converter Faculty of Electronic Engineering, Niš
15:30 – 16:00	Control system for electric hot water boilers Faculty of Electronic Engineering, Niš

Attendance List	
Event:	PoC program meeting
Venue:	Ministry of Education, Science and Technological Development
Date:	18/05/2018
Organisers:	Ministry of Education, Science and Technological Development

No	Name	Organisation	Signature
1	MILAN STAMBOVIĆ	IFTM	[Signature]
2	DRAGAN STAMBOVIĆ	IFTM	[Signature]
3	HAJDUK VUKOBRODIĆ	IFTM	[Signature]
4	HAJDUK VUKOBRODIĆ	IFTM	[Signature]
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Agenda and attendance list of the meeting

Ten selected PoC research teams presented their innovative solutions, technologies and research results to the members of Evaluation Committee.

Based on their presentations and support requested in the PoC application, the Evaluation Committee brought a decision with the recommendation of the support actions to be provided to them by the IF4TM project upon the approval of the local PoC contact persons.

Out of ten selected research teams that asked for some kind of support, the Evaluation Committee decided that eight of them can receive the support within the IF4TM project. The remaining two PoC teams requested support for purchasing equipment and consumables, that overcome the scope of the project, and thus they were advised and directed to other support mechanism offered by as the Innovation Fund of the Republic of Serbia, H2020 program and other EU funding opportunities.

4. Implementation of PoC projects and support activities

The implementation of the selected PoC projects was started in June 2018, when two study visits were also planned to the partner EU universities in Maribor (June 2018) and Lisbon (July 2018), attended by the members of the 5 PoC projects team: TorqSens, 3Phase, MedIn, FOS2D and Sensoring projects teams. In January 2019, another study visit to the laboratories of the University of Maribor was organized with the additional validation of the new prototype developed and tested within the TorqSens project.

More about study visits on links:

<http://www.if4tm.kg.ac.rs/news/visit-to-the-university-of-maribor-within-the-implementation-of-poc-projects.html>

<http://www.if4tm.kg.ac.rs/news/visit-to-the-instituto-superior-tecnico-in-lisbon.html>

In cooperation with the Intellectual Property Office, which is a project partner (IPOS), consultations, meetings, patent search and IP valuation were organized for FOS2D, art-boneFIX and TorqSens projects. For the HEISPS project, a series of meetings with local government representatives and companies have been organized to support the development of prototype and testing in real time.

For all PoC teams, a set of documents and procedures related to the protection of intellectual property were prepared, also organized their participation in CB training delivered by WIPO and specially adapted NDA contracts for each of the projects.

A brief overview of the implemented support activities of selected PoC projects is provided in the following sections of this report, avoiding details of PoC projects and their implementation that could destroy the novelty and patentability of technology or other forms of intellectual property protection.

4.1 3 PHASE voltage converter (3Phase)

The subject of 3Phase PoC project is three phase voltage convertor as a high-performance device whose main function is the transformation of 24V DC to three-phase voltage in the form of: $3 \times 380V$. Since the device has already been developed, the support requested was in terms of marketing, realization of business model and commercialization.

As a part of the support, the team visited the Instituto Superior Tecnico (IST) in Lisboa, particularly Instituto de Engenharia de Sistemas e Computadores,

Investigação e Desenvolvimento em Lisboa. Visit to the Portuguese university was valuable for PoC team in terms of better understanding of development procedure of the device, possible problems, technical improvements and electrical scheme changes to be considered before the next phase of project realization.

Prof. Dr. Luis Caldas from IST, commented the concept and suggested some technical changes related to the ATMEGA8 microcontroller, potential dead zone problem, IR drivers and power supply methods. Also, the possibility of additional unit inside the device was discussed that should provide a greater working autonomy of the device and increase of powering stability during its work.

In the following period, the team also used the online platform ESPACENET to search for similar devices in the form of patents. According to the patent base, the project team decided that there is insufficient novelty for the patent application.

The next phase, the final selection of electrical components and controllers for 3f device was performed. The device was specified to be based on using three IR2184 drivers for controlling the three phase bridge. Each branch of the bridge included two n-type FETs IRF3205. Finally, ATmega8 microcontroller was planned to be used for developing the device control logic.

In December 2017, the team started their work on development of Printed Circuit Board Scheme in PROTEL and control logic algorithm and by the end of February 2019, PCB Scheme was finished and initial control algorithm was developed. Further, project members have started with acquiring required programming knowledge for programming specified microcontroller.

4.2 Robust low-cost fiber-optic 2D deflection sensor (FOS2D)

The subject of research within the FOS2D PoC project is the development of a sensing system based on Fiber Optic Curvature Sensor (FOCS) for continuous static and dynamic monitoring of deformation of building structures.

For the realization of this PoC project, support actions include IP evaluation and IP protection, technology/concept validation and development of prototype. The team from University of Novi Sad received the support in form of study visit to the Instituto Superior Técnico (IST), Lisbon where the team members participated in the capacity building activities organized by IST experts. These included the training of the search for patents on the Espacenet website and training of value proposition design. The topic of the discussion with the professor Jorge Proença from the Civil Engineering Department and CERIS was the application in the real environmental conditions of the proposed sensor system within this PoC project.

The necessary experiments were conducted in order to compare two different methods for deformation determination: geodetic and 2D deflection sensor based on

FOCS. The experiment showed that the proposed system with a 2D deflection sensor can be successfully used in the monitoring of deformations.

Based on the experiment and measurement results, a scientific manuscript "Comparison analysis of deformation determination by applying fiber optic 2D deflection sensor and geodetic measurements" was prepared and sent to the open access journal "Sensors" (IF: 2.475) to consideration for publication.

Also the consultations were held with regards to the protection and management of intellectual property. The meeting was held at the University of Novi Sad with the participation of team members and experts from Intellectual Property Office.

The methodology of Office's service IP pre-diagnosis was implemented with addressing the relevant issues on IP: novelty, prior publications, patent database search, ownership on research results and IP management in the process of possible commercialization.

After the meeting during the September, IPOS experts drafted a report on IP pre-diagnosis on with the customized recommendations and annexes on basic information for possible IP protection for all IP rights, trademark, industrial design, soft IP, copyright and more in detail focused on patent protection.

Since the preparation of documentation for the application for protection of intellectual property is in the final phase, in the next period it is planned that the prepared documentation be submitted to the Intellectual Property Office of Republic of Serbia for consideration.

4.3 Keystone distortion free fingerprint optical scanner (GOLDFINGER)

The GOLDFINGER PoC team based their application on the fingerprint optical scanner as a type of optoelectronic security system that uses fingerprints for biometric authentication to grant user access to information or to approve transactions.

The team requested the support of development of the prototype of the scanner, more precisely the resources for its development. Within the PoC Program, efforts were made to find a manufacturer who can make a custom made optical prism.

Meanwhile, the team decided to withdraw their application and leave the Program.

Respecting their decision, the Evaluation Committee decided to accept another PoC application from the same institution instead of the one that was withdrawn - From waste to eco building (ECO POSTS). The ECO POSTS requested the support in form of development of technical feasibility study and fundraising or crowd-funding support.

4.4 From waste to eco building (ECO POSTS)

The primary area of interest is solving the waste accumulation problem, primarily composite polymer waste and glass waste, 80% of which is unrecyclable using known, conventional, technologies. One of the most important areas of impact is its high energy-efficiency and its multiple impact in area of environmental protection.

The realization of the project would also help creating new work places: collecting, sorting and processing plastics, which is often done by workers from marginalized social groups, which have a hard time finding job, and with low qualifications.

The innovation is reflected through the development of a technological solution whose final product is ECO MATERIAL, which is totally ecologically acceptable, that possesses great mechanical, thermal and hydro-insulating properties, which can be recycled time and time again without the loss in quality, and which possesses all the positive properties of all used components, while annulling the negative ones.

Up to the moment of admitting the patent application, the team produced several products whose characteristics and properties they wish to examine, improve and certify:

- Material Prototype - laminar thermal and hydro-insulating floor lining
- Material Prototype - laminar thermal and hydro-insulating wall lining
- Product Prototype

The team requested the support of PoC program in terms of:

- Technical feasibility study and
- Fundraising or crowd-funding support.

4.5 Highly efficient information system for parking support (HEISPS)

Support requested by the HEISPS team is related to the development of the prototype of the system and additional consultancy support on the issues of developing and validation of the system. Since the validation needed to be realized on the field, institution cooperation between PoC team and the provider of the parking services was prerequisite for this.

The State University of Novi Pazar sent a letter of intention in order to establish the official cooperation with the Public parking company.

The letter was followed by the meeting attended by the management of PC Parking Service Novi Pazar, university's representative Mr. Edis Mekic, PoC team and PC IT department. At the meeting, they discussed the overall organizational aspects of PC, their field of work, parking resources, open and closed parking areas in the city.

Additionally, the various payment methods and parking space availability systems PC use were discussed.

To support the development of proposed solution, the PC Parking Service Novi Pazar opened databases for collecting parking data on all three closed parking spaces in Novi Pazar up 07/09/2018. The analysis showed that they do not have compatible systems of tracking parking lots and that they have combination of semi-automatic tracking and counting cars by parking service staff. The conclusion of the analysis was that online database of parking service was unstable and new database needs to be established.

Supported by SUNP department of Economics developed, the team developed the Business plan based on CANVAS method.

The implementation of the suggested solution for smart parking was carried out using the surrounding Android Studio. The application is client server based, where client side was done as Android application, while software side was based on PHP script language, and necessary data were stored in JSON format and MySQL tables. For uploading the maps, the team used Google Maps API for Android.

4.6 Device for ultrasound washing and disinfection of medical instruments and vessels (MedIn)

The MedIn project is based on the introduction of ultrasound technique into the process of washing medical instruments and vessels, which would improve the quality of washing. The support they found most beneficial for their project, the team members requested assistance with market research, business model development, commercialization strategy, IP evaluation and technical feasibility study.

In order to provide the requested support, a study visit Instituto Superior Tecnico in Lisboa was arranged. Study visit included presentations of POC projects and planned activities, State of the Art Search principles and practical learning of Value Proposition Design methodology through a case study. The overall goal of the visit was to build the capacities of PoC team members through consultations with Portuguese experts from the field in question.

During the visit, the team members visited Institute for Systems and Robotics and Prof. Dr. Joao Sanches. Having in mind that the main part of MedIn device is development of the control logic, the visit to ISR allow them to learn about opportunities and possible concepts for acquiring new technologies, as well as learning new possible procedures for implementing and testing new features. Additionally, after the presentation of functionalities of the proposed device and its control algorithm, prof. Sanches advised the team how to test their system and to find

a strategic partner from some medical institution, in terms of testing and validating our proof of concept.

The support for development of commercialization strategy and feasibility study is provided in-house.

After search of existing patent solutions and detailed analysis of similar technical solutions, the team found that there was no significant contribution of proposed MedIn device. However, the innovative aspect can be achieved by developing brand new control logic and in that way improve cleaning cycles and reduce the consumption of electricity and required quantities of chemical agents.

The team conducted the detailed evaluation of employees in medical institutions and dentist ordinations about their requirements about cleaning machines which they are using. After detailed examination of controllers, it was decided that the most suitable one would be “CompactDAQ” controller, manufactured by National Instruments.

Control logic pseudo-code was completed. It consists of 19 steps, and recently it has been programmed in Lab View software package.

For the proposed technology, the Business model was developed using Canvas method, where determination of value, customers/users, distribution channels, income, key activities/resources/partners, and cash flow for the following 12 months were developed and defined.

4.7 Torque sensor based on magnetomechanical effect in commercial steel (TorqSens)

Within the PoC program, TorqSens team from the Faculty of Technical Sciences Cacak, University of Kragujevac, realized a new version of torque sensor with just one coil and performed a series of laboratory tests to validate its functionality.

One of the support actions was study visit to the University of Maribor and its laboratories. The team met their experts (Prof. Hamler Anton and Prof. Jozef Ritonja) who agreed to provide the support in terms of development of 3D FEM model of the torque sensor, lab testing of material characteristics for quality FEM validation and performance testing of the sensor prototype for validation of its capabilities and functionalities. The aim was also to compare it with competitive products available at the market.

The 3D CAD/CAM model of torque sensor developed by the TorqSens team was sent to Prof. Hamler from the University of Maribor who performed a number of FEM simulations in different working conditions. The results confirmed the proposed concept for further producing the torque sensor. Also, it was found that the better

results might be obtained if exact magnetic characteristics of used steel shaft were known and implemented in simulations.

During the period from July to November of 2018 with the aim of realization of a new prototype of torque sensor, the team developed a completely functional prototype of sensor with just one coil. This new sensor was improved version of the previous torque sensor with two coils. It has simplified construction, completely new electronics for power supply, based on microcontroller, as well as electronics for data acquisition, signal processing and conditioning. Also, it can be connected to the personal computer for programming and data logging. A number of tests has been performed in Laboratory for Electrical Machines, at Faculty of Technical Sciences in Cacak, University of Kragujevac, with new sensor to test and verify its performance. Accordingly, the new prototype is now in a form of finished product that can be used by end-user.

Additional study visit to UM organized in January 2019 with aim to perform additional laboratory testing and validation of new prototype developed by PoC team, as well as to discuss modalities of improvements of sensor capabilities and performances.

After the study visit to Maribor, a meeting with experts from Intellectual Property Office (IPOS, partner in IF4TM project) was arranged where IP aspects of the TorqSens PoC project discussed. Methodology of IPOS service IP pre-diagnosis for university was implemented with addressing the relevant issues on IP: novelty, prior publications, explanation on overall patent system, patent database search, ownership on research results and IP management in the process of possible commercialisation.

During March 2019 TorqSens project team members participated in the training about the creation of a business plan and took participation in all three trainings organised by the Creativity Center of the University of Kragujevac, established within IF4TM project, held by Ivan Markovic from Business Innovation Center Kragujevac (BICKG partner in IF4TM).

As result of those training and mentoring activities the Business model for TorqSens sensor based on Canvas method was developed. It was good bases for elaboration of comprehensive Feasibility Study consisting of the technical feasibility part for the proposed technology and sensor production, as well as economical part of the study elaborated by Prof Dr Nenad Stanisic from Faculty of Economics, University of Kragujevac. The Feasibility Study was finished in May (belongs to the Act3.6 in IF4TM).

During this period, TorqSens team worked also on preparation of patent application for the proposed technology and sensor. This document is to be finished during June 2019 and application procedure will be started thereafter.

Details on current and further activities in commercialisation of the TorqSens results were discussed at the meeting held on May 27, 2019 with Prof. dr Vesna Mandic and

Prof. dr Nenad Stanisic, from the University of Kragujevac. Special intention was devoted to the commercialisation of the technology, for finding financing models for starting production and a proper way of placing product on the market.

4.8 Fixture for fabrication of custom made artificial bone grafts at dental CAD/CAM systems (art-boneFIX)

The project proposes the solution for design and production of more versatile fixture needed for clamping porous blocks of biocompatible material, which is required for their fabrication on a dental CNC machines where discs for CAD/CAM systems are used.

The support requested was related to the consultancy services in the area of market research, IP valuation and IP protection that is provided in-house by the experts of the University of Novi Sad.

Currently the project is in the phase of the testing where flexible design has been selected as the most appropriate and its functionality will be tested with the use of numerical methods (Finite Element Method - FEM).

FEM analysis showed good results, with low distribution of stress and low displacement in XYZ direction, thus showing that the selected design will perform as intended.

After analysis the fabrication of the first prototype of the new design is needed in order to test it under real-life conditions. Upon the completed testing, further design modification will/should be considered in order to improve the new design of the fixture.

4.9 Molecular sensor for malignancy screening (SensORing)

SensORing proposed technology is a molecular sensor made of circular synthetic DNA molecule with potential to distinguish malignant from non-malignant tissue. In their application the SensORing team requested financial support for development of prototypes and consulting services.

For the purpose of networking, establishing the contact with foreign experts in order to provide consultancy for development of the PoC project, the team participated in the study visit to the University of Maribor, more precisely the Center for Human Molecular Genetics and Pharmacogenomics at Faculty of Medicine. The team had a meeting with Prof. Uros Potocnik from the Centre when they discussed on the possibilities of collaboration. Since Prof. Potocnik has experience and expertise in

transferring the technology from the laboratory environment to the clinical practice, the team negotiated about the possibility of laboratory testing and validation of the SensORing solution.

As the another type of support requested by the SensORing included the financial resources for development of prototypes and purchase of consumables (which is not eligible PoC support action during the pilot phase), the Evaluation Committee suggested applying to the Innovation Voucher at the Serbian Innovation Fund, whose representative was one of the members of the Evaluation Committee.

4.10 Other PoC projects

After the analysis of the proposed technologies and solutions, for other projects the required support exceeded the scope of the IF4TM project and the pilot phase of PoC Program, so they were instructed and directed to other support providers such as Serbian Innovation Fund, H2020 program and other EU and Serbian initiatives . These PoC projects were:

- Development of a combined biomass gasifier for the use in combined heat and power systems (Combined Biomass Gasifier)
- Heat pump control (HPC).



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