Project acronym

SYNTROFOS

Project name:

Wearable Health Care Device to Track COVID-19 Symptoms

Name and Surname of the contact person:

Radovan Stojanovic

Contact person email address:

stox@ac.me

Partner 1 (SMART4ALL consortium member)
#12 MECOnet

Partner 2

Legal name of the entity:

ProSmart d.o.o. Beograd

Type of entity (padajući meni):
Industrial SME/Slightly bigger

Country:

Serbia

Years of Operation. Number of years (or fractions) since incorporation:

9

Organisation size: (Number of people employed in the organisation. Please remember that by the official EC definition, for a company to qualify as SME, it must have less than 250 employees (see Section 3.1 of the Guide for Applicants).:

14

Partner role: (Detail the role of each of the partners in the experiment)

General role of MECOnet will be transferring technology to cross border partner. In this case to the company ProSmart. Specific tasks include:
- interfacing and gatewaying SYNTROFOS device to other devices and hosts (gadgets, conventional hospital systems, IoT systems and general purpose telemedicine systems)
- analyzing, documenting, protecting, publishing and disseminating the results.
- providing IPR and trying to sell the updated device on global and local market.

General role of ProSmart will be accepting and overmastering the technology provided by MECOnet, while specific tasks will include:
- defining user requirements for SYNTROFOS in order to meet valid clinical standards.
- assisting in developing software for interfacing SYNTROFOS to mobile platforms (i.e. Android and IoS) as well as to hospital systems.

- testing overall systems, debugging and assisting in improvement.
- helping in promoting and selling system on regional market.

Key Data

Project Description (Describe your project in one sentence (max. 1500 characters including spaces):

The project will consists of 4 work packages (WPi), WP1: Development, WP2: Testing and improving, WP3: Dissemination and sustainability, WP4: Management and associated activities (Aij):

WP1:
- A1.1, development of client-client and client-host wireless communication protocol and interface for SYNTROFOS. The host can be other wearable device, gadget or hospital/clinical systems. Protocol should meet clinical standards in term of interfering, be low power as well as enough effective and fast. Starting point will be Blue Tooth Low Energy (BLE), as one of very promising protocols. Milestone: smart flexible BLE communication module for SYNTROFOS, including firmware and drivers. Responsible partner: MECOnet.
- A1.2, development software-application for SYNTROFOS interfacing to above host (Android, IoS and version for hospital systems). Milestone: host-side applications. Responsible partner: ProSmart.

WP2:
- A2.1, testing the SYNTROFOS-host system different modes of operation and communications. Debugging and re-testing. Milestone: testing data and findings. Responsible partner: BOTH.

WP3:
- A3.1 Documenting and publishing the results via EMBEDDEDCOMPUTING.ME. Milestone: 2 publications and 2 presentations. Responsible partner: BOTH.
- A3.1 Strategy for sustainability. Milestone: sustainability report. Responsible partner: BOTH.
- A3.3 Providing IPRs and trials to access the market. Milestone: possible patent. Responsible partner, MECOnet.

WP4:
- A3.2 Daily management

Select the vertical your project is addressing (padajući meni):
Digitized Anything

Excellence

Experiment Description
Describe your experiment and the differential advantages and enhanced value it offers. Demonstrate to what extent that proposed experiment is beyond the state of the art related with the application of CLEC in CPS and IoT (max 2000 characters with spaces).

Syntrofos device presents a low cost and flexible medical device designed for detecting and tracking symptoms of COVID-19 and similar infections. The simplest configuration of the device uses only headsets and mobile phone and it is capable of detecting respiratory problems. Depending on the customer's preferences that basic configuration of the device can be extended into a model with more sensors for tracking heart rate, temperature and oxygen saturation. The hardware comprises analog circuits for signal preprocessing, microcontroller and is accompanied with a demo software for visualization and altering. In order to make the device applicable in medical clinical practice the low-power non-disruptive Bluetooth 4.0 or higher communication will be added to the device during this

PAE, thus making the device compatible with the latest rigorous standards for biomedical equipment and hospital usage. Furthermore, a user friendly Android or IoS application, developed by ProSmart will complement the device and allow its seamless integration into already deployed communication infrastructure at the Clinical Centre of Serbia. It will be the very first case of usage of such technology at that scale, but initially not on patents, but just for the purpose of performance testing and concept proof on electronic patient simulators.

Innovation Level Description
Provide information about the level of innovation and novelty of the proposed project and how it is appropriate for applications in the SMART4ALL verticals (max. 1500 characters including space).

By Syntrofos, it is possible for everyone to have a personal COVID signal monitor, 24/7/365. SYNTROFOS basic version monitors temperature, pulse, respiration rhythm together with visualization of plethysmographic signal (PPG) and respiration signal (RR). The Mid version has oxygen saturation SpO2 measurement, while Syntrofos Pro includes the ECG signal monitoring. Therefore, the Syntrofos integrates several diagnostic apparatus otherwise manufactured and used separately and sequentially. Very specific yet characteristic symptoms of COVID-19 require these devices to be applied in this unique combination that has not been envisaged prior to the pandemic crisis. Instead the Syntrofos will allow these measurement to be incorporated within a single device and performed simultaneously, which is of particular importance for mass processing of patients that can now be done more efficiently and with a greater level of confidence. The existing prototype is currently at the TLR3 – experimental proof of concept. Initial tests demonstrated that it yielded sufficiently stable results to consider the device a fully functional affordable substitute to more complex and rather inaccessible diagnostic alternatives, which are in a shortage across South-East Europe throughout COVID-19. The principle can be applied to other fields, as example, precision agriculture and transportation. The proposed experiment aligns with the DIGITIZED ANYHTING vertical of the SMART4ALL project.

Soundness of the approach
Describe how the objectives of your proposed CTTE are relevant and in line with the SMART4ALL project objectives, verticals and competence fields. What is the anticipated TRL elevation? Please describe and justify. Although other combinations are possible, expected TRL elevation is from 5 to 7 (max. 2000 characters including spaces).

Objectives of this PAE are to reach a mature stage of product development and offer them at the markets of the South East Europe, to aid public health systems coping with the COVID-19 crisis by relieving hospital personnel from a tedious diagnostic procedures and by reducing the time to establish a clinical image of the patient, to reduce risks of disease spreading by allow individuals to perform self-diagnostics at home without unnecessary exposure to potentially infectious environments at COVID hospitals, to promote the innovative solution at the market and test it against rigorous requirements of the health system, and finally to promote MECOnet and ProSmart as socially responsible regional leaders and technological visionaries.

These objective are linked to the SMART4ALL vertical Digitized Anything and tackle the following competence fields (as listed in the SMART4ALL Guide for applicants): Medical and Health Applications, Location-based Technologies, Web and Mobile Applications, and Wireless Sensor Networks.

Throughout the proposed PAE the technology will evolve from the current TRL3 (prototype) into a fully functional system, tested in the real clinical environment and supported with an accompanying software support, thus reaching the TRL7.

Impact

Benefits of the collaboration
Describe how the collaboration between the partners will benefit each of them, in terms of technical and/or business/market expectations. Explain why this particular collaboration will lead to a successful experiment and high economic impact. Describe the resulting added value for the industry partner(s) and its/their customers, e.g. revenue or profit increase, cost reduction, market growth, energy savings, performance gain, newly created jobs etc. (max 2500 characters including spaces).

Benefits for MECOnet:
With this collaboration, MECOnet will have an opportunity to exchange the know-how from the field of biomedical devises and to embed the Syntrofos with a Bluetooth 4.0 technology. This technology will enable the low energy communication between the device and medical staff and together with an adequate software application it will became a market ready product that is suitable for using in the real environment. Moreover, since MECOnet doesn't have a collaboration with a health institutions in Montenegro, it will also benefit from this collaboration in terms that ProSmart will perform the testing of this experiment in the real environment, i.e. in the Medical Center of Serbia.
The greatest benefit of this collaboration is the fact that two SMEs will do the testing and certification with mutual efforts and they will launch the market ready solution that will have all performaces like those from the international competitors, but in the significantly lower price that is acceptable for Balkan's region health institutions.
Benefits for ProSmart:
ProSmart will benefit from this collaboration on two ways. The first is the fact that it will acquire some new knowledge regarding the construction of medical devices. The second benefit from the collaboration with MECOnet will be the chance to make and offer an innovative and completely new medical devise on Serbian market. The main idea of launching Syntrofos is offering a domestic product (medical device) on the market that is pretty much closed and monopoly oriented towards several international companies that are only providers of the medical equipment in Balkan's region.

Market Opportunity
Describe the market potential of the proposed CTTE in one of the SMART4ALL verticals. Provide a short market analysis (max. 2000 characters including spaces).

The global medical devices market reached a value of nearly $456.8 billion in 2020, having increased at an annual growth rate of 3.5% since 2015. The market is expected to reach $863.2.4 billion by 2030. Additionally, public expenditure in health related issues has risen by up to 3-4 times around the world. Harsh regulations and costly certification of biomedical equipment created a monopoly in this sector by several global players and prevented many small companies from entering the market prior to 2019. However, the COVID-19 pandemic has demonstrated all shortcomings of public health systems, particularly in the Balkans, where low income countries struggled to procure adequate medical equipment in sufficient quantities. This created a window of opportunity for new innovative solutions that are substitutes to more expensive inaccessible medical devices provided by the lobbing corporations. Furthermore, throughout the pandemic the medical professionals needed to learn new ways to cope with unexpected conditions of patients and asymptomatic clinical images, which lead to numerous problems in dealing with the disease. Uniqueness of the proposed device is that it is not

> just simple and low cost, based on the easily acquirable components, but it is also very immune to noise and artifacts offering reliable alternative in time of crisis.

Competition
Describe and analyse the degree of competition of your particular product/service and to what extent your proposal is disruptive and breaks the market, i.e. the products/services to be bought to market can be clearly differentiated from the competition (max 1500 characters including spaces).

> There are globally only 15 major global market players dealing with the biomedical equipment. They share 98% of the market, covering variety of medical fields from rehabilitation to imaging. In the South-East European these companies own slightly above 99% of the overall market. There technology is neither cheaper nor of better performance when compared to the alternatives. They are using their economic strength to push out majority of other players by either lobbing for more rigorous standards and more expensive certification procedures that require sales of several hundreds of thousands devices sold annually, or they opt to buy out promising and disrupting innovations from their competition. However, these companies have proven to be rather inert when it concerns prompt reaction to market changes and need in times of crisis such as the COVID-19 pandemic. More flexible and innovation oriented SMEs have been given a chance at the local level to provide alternatives to domestic markets in such cases. Currently, there is no device that can outperform the Sintrofos in terms of efficacy and level of integration of all necessary measurements conducted in parallel. Furthermore there is no solution that can be assembled and maintained with ease by using readily available electronic in the market. The proposed innovation also has a strong potential beyond the COVID-19 crisis as well as in diagnostic any endemic or seasonal respiratory infectious disease.

Implementation

Workplan
The workplan of the experiment should be clearly described and fully aligned with the objectives, including work packages, tasks and responsible partners. The time plan should be realistic and achievable, coherent and effective (max. 3000 characters including spaces).

> M1 to M6: MECOnet will integrate Bloetooth 4.0 communication protocol to SYNTROFOS. This period will also be used to agree upon key issues of business integration of the proposed innovation into the assortment of ProSmart products. Market will be probed and preparations for real industrial environment testing will be completed. Two visits of the ProSmart team (1-2 persons for 10-12 days) to the MECOnet premises in Podgorica is foreseen in this period.
>
> M7-M8: The ProSmart company will develop the visualization and data streaming software, including a system for centralized diagnostic for cases of large scale applications in hospitals. But it will also develop an accompanying Android App for personal access to information suitable for self-diagnostic by individuals. Special attention will be dedicated to the issues of security and protection of patient's identity. In parallel, an appropriate marketing strategy will be prepared. MECOnet staff will visit ProSmart company in Belgrade (1-2 persons for 7 days).
>
> M9 of the PAE will be dedicated to the real environment testing in the Clinique Center of Serbia in Belgrade where, ProSmart has already deployed a system for an ad-hoc Bloetooth 4.0 integration of medical devices. The tests will be performed without patients. The primary objective will be to test connectivity and reliability issues in the swarming scenario. Where appropriate, electronic patient

simulators will be used to test real time performance of the system. Finally, during this period a demo will be prepared and uploaded onto the SMART4ALL Marketplace.

In parallel dissemination of the project and publication of the results will be done as well as activities for doing project sustainable.

Complementarity of the Team
Describe the competences, experience and complementarity of the partners and their commitment to the project (2500 characters including spaces).

MECOnet is an innovative spin-off company established by experienced scientists, university professors, industrial and service experts with the aim to bridge the gap between academia and research institutions and practitioners. It comprises several departments icluding the MECOnet Institute and the MECOnet Innovative and Development Centre. The MECOnet institute is the only Western Balkan innovative company that has Nobel laureates at its board. The company accomplishes its key mission through excellence and innovation in sustainable design in high technologies, green ICT, smart production, smart environment and smart services, cyber physical systems and internet of things, technology for better health, smart specialization, technological entrepreneurship and knowledge dissemination and "know-how" transfer. MECOnet is a well-established regional player also due to its effort in publishing dissemination and promotion of scientific knowledge, leaded by resident experts with a high citation index and international experience.

ProSmart is a company that offers a wide range of services: consulting, engineering, designing and constructing of information and telecommunication systems in health systems, electrical power industry, waterworks, all sorts of industrial processes, intelligent buildings, etc. These services include design, production and implementation of SCADA systems, integration of the components of Technical Information Systems, technical consulting in the choice of adequate computer and telecommunication equipment, system support, production of software packages in the direction of integrated information systems realization, as well as enterprise intranet/internet solutions (client/server architecture). Their market presence is focused on management system in telemedicine, virtual hospitals, customer support services, webshop applications, facility access control and identification of employees, production transfer and distribution of water, electric energy consumption control of large industrial systems and industrial processes management.

Both companies possess complementary skills that are necessary to mature a complex innovation such as Syntrofos into a fully certified market-ready solution. While MECOnet provides scientific expertise at the highest level, ProSmart offers direct channels to promote the product at the healthcare sector and understands the logic and dynamics of the market and psychology of the potential customers.

Resources
Indicate how the lump sum will be allocated among eligible costs and among partners. Please justify them (max. 2000 characters including spaces)

MECOnet will invest 5 PMs of its project effort allocated to the WP7.
ProSmart will not receive any funding, but will invest its effort into the software development and adaptation of its own business model in order to find the best modus operandi for placing the technology into the market.

Does your proposal address current and future problems stemming from COVID-19 crisis?
<mark>Yes</mark>
No

If yes, please give more details.

The proposed PAE is directly inspired with problems associated with COVID-19 pandemic. It aims to deliver an effective and affordable solution for determining and tracking symptoms of the disease in time of global shortage of diagnostic devices. The main product of the experiment is envisioned as an alternative to a number of diagnostic devices that would otherwise have to be purchased and implemented separately.

Ethical issues, data protection and privacy

Are there any issues on ethics, data protection and privacy of relevance?
Yes
No

If yes, please describe the issue(s).*

No