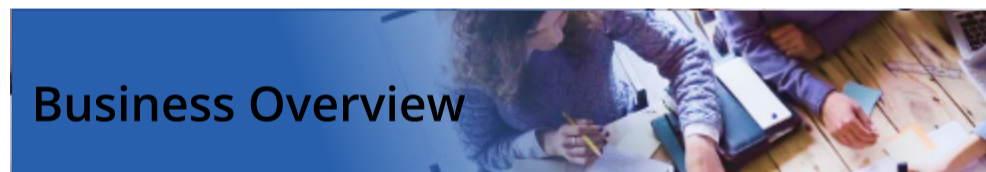


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- Criteria for open platform in AHA and AAL domains which EkoSmart complies with:**
- Open Source
  - Open Standards Based
  - Federatable
  - Shared Common Information Models
  - Vendor and Technology Neutral
  - Supports Open Data
  - Provides Open APIs
  - Open Usage (adoptability)
  - Open Adaptation



## Business Overview

The project was initially funded by European Regional Development Fund and aimed at Slovenian market, but is currently being developed and extended to provide the ability to be used internationally, starting with Italy and Austria.

The purpose of the EkoSmart program is to develop a smart city ecosystem with all the support mechanisms necessary for efficient, optimized and gradual integration of individual areas into a unified and coherent system of value chains. The program focuses on three key domains of smart cities: health, active living and mobility; and forms strategic relationships with municipalities and other areas of smart cities, such as energy, smart buildings, involvement of citizens, smart communities, etc. Ekosmart introduces the universal architecture of a smart city, based on the combination of self-learning and self-optimizing agents enabling the realization of all the concepts of smart cities,

such as interoperability, self-adaptivity and self-configurability, open data, semantic interoperability, and integration of social capital.

The EkoSmart is founded on high quality and varied consortium of the most advanced partners in these areas, with strategic links to smart home and health programs. The consortium consists of 25 partners from various fields: two research institutions (Anton Trstenjak Institute of gerontology and intergenerational relations and Jožef Stefan Institute), five faculties at two universities (UL – Faculty of Electrical Engineering, UL – Faculty of Computer and Information Science, UL – Faculty of Sport, UL – Faculty of Medicine, and UM – Faculty of Electrical Engineering and Computer Science), five other public institutes (University Clinic Golnik, National Institute of Public Health, University Medical Center Ljubljana, URI-Soča, Adolf Drolc Health Care Centre), ten small and medium sized enterprises (Cosylab, Alpineon d.o.o., Elgoline d.o.o., Inova IT d.o.o., Marand d.o.o., Nela razvojni center d.o.o., RC IKTS d.o.o., Robotina d.o.o., SRC systemske integracije d.o.o., Špica International d.o.o.), and three large companies (Iskra d.d., Medis d.o.o., Telekom Slovenije d.d.).

The value proposition of EkoSmart lies in the ambition to integrate solutions in different areas into a common ecosystem. This provides users with better user experience and choice of which services and products he or she wants to use and subscribe to. Even bigger benefits exist for the service providers as the platform not only represents a place where they can provide their products but also allows them to easily integrate other services into their own product making it better and increasing its value. Too often the practice of introduction of smart cities shows limited focus on certain areas and lacks connection with others. One of the important objectives of the EkoSmart program is therefore the development of the platform with the same name which allows easy integration of sector-specific solutions into a common ecosystem and will, as such, facilitate the identification and support of inter-sectoral value chains. This platform will be compatible with global solutions and will include concepts such as the Internet of Things (IoT).

Compared to other similar solutions in the field, EkoSmart is placed on electronic and mobile health offering self-configurable, self-integrating, self-optimizing, flexible and adaptable universal architecture with simple addition of modules. The platform allows intensive development and implementation of new ICT methods and concepts, such as IoT and methods of artificial intelligence as a backbone of technology and human society development. Emphasis is put on the concept of smart specialization – the introduction of interconnected comprehensive chains, and markets.

In terms of economy, the vision of the EkoSmart program is to launch Slovenian solutions in the field of smart cities on the world market. The realization of this vision is based on

several major approaches namely the concentration of knowledge and experience, focus on the user, evolutionary development and flexible architecture.

[Learn more about Ekosmart](#)

## Technical Overview

The EkoSmart platform collects, combines and connects different services, devices, service providers and users in a common platform. While the platform does not provide any specific devices or services it allows other devices, services and products to be added and interconnected through it. It serves both as a marketplace for services and products as well as hub for easy interconnection, extension and integration of existing devices and products. While the EkoSmart platform does not provide any specific device on the *Physical layer* it allows each service provider to add multiple physical devices that connect directly to the platform, without the need of an intermediate application. The data sent by the device is stored on the server and visualised out of the box, the platform allows the devices to be configured through the platform, if the device supports over the air configuration. The physical device can connect to the platform with secure or insecure HTTP connection, which is based on REST API. For each device metadata, that describes the device, must be provided by the device provider. The metadata contains information such as device unique ID, device type, data type (numerical or text), visibility (public, private).

Furthermore, for each device several alarms can be added through the application layer, alarms are notifications that are triggered by a specific set of rules based on arithmetical and logical operations. There is no limit which devices can connect to the platform; the only prerequisite is that the device provider obtains authentication token for the device type. Currently the following devices are connected: smart watch, temperature sensor, GPS tracker (for tracking and showing city buses), blood pressure monitor.

The *Service layer* is based on WSO2 API Manager framework, which makes the communication between different services, devices and applications through API calls easier to implement and more reliable. Each service or device connected to the platform must provide metadata at registration which defines type of communication (Custom API, SOAP, REST or Websocket) and description of data

provided. The data provided by the devices and services can be stored either externally (device provider) or internally on the platform. The storage is implemented with [CKAN](#) open source framework for data management. The data stored on the platform can be either in (JSON, XML, CSV) format.

The services and devices can publicly expose their API calls, or parts of it, which allows other partners to integrate and interconnect their services. Depending on where the data is stored, connection can go through the *Interoperability layer* or directly to device/service provider.

The main purpose of the *Application layer* on the platform is to provide users and service providers with one place for providing and subscribing to services, products and devices in the domain of e-health and smart cities. While each device or service can provide its own separate application that can be downloaded through the marketplace part of the platform, service providers are encouraged to use data visualisation tools integrated into the platform. For all IoT devices, the platform provides visualisation of the data on the map (for devices with location). This is especially useful for devices tracking ambient metrics (temperature, air quality) devices for tracking (show buses on the map, show location of a user who triggered an alarm). For the devices and services providing the numerical data, this can also be visualised on the platform automatically and it also works with time-series data.

The service providers can also set certain rules for the data received on the platform. In most cases these rules are different alarms, defined rules based on simple arithmetical and logical operations. When the alarm is triggered the subscribed user(s) are notified about the event. The devices, products and services are discoverable through marketplace, which is based on PrestaShop framework. Each participating partner can add one or more services or products to the platform with accompanying metadata (image, title, description, type, reference number, quantity and price). The types of products on the marketplace can be separated into 3 groups: a) Physical devices (e.g. temperature sensor); b) Intermediate services (e.g. not meant for the end users as machine learning algorithm that detect unusual patterns in data); c) Services for end user (e.g. home care for older adults).

[Learn more about Ekosmart](#)

EkoSmart is a platform, developed in Slovenia, to help develop a smart city ecosystem with all the supported mechanisms for efficient, optimized and gradual integration of individual areas into a unified and coherent system of value chains.

The development of the platform and accompanying modules and services was co-funded through the European Regional Development Fund, between 2016 and 2019.

The EkoSmart program consisted of six projects contributing in their respective ways to the realization of the program vision:

- Research and development project No. 1 (RDP1) – Design of a smart city ecosystem
- Research and development project No. 2 (RDP2) – Smart mobility.
- Research and development project No. 3 (RDP3) – Active living and wellbeing.
- Research and development project No. 4 (RDP4) – E-health and mobile health.
- Research and development project No. 5 (RDP5) – Integrated health services.
- Research and development project No. 6 (RDP6) – Solution prototypes.

One of the important features of the EkoSmart program is the integration of the solutions in different areas into a common ecosystem, delivering a platform with the same name (EkoSmart platform) which allows easy integration of sector-specific solutions into a common ecosystem (featured in the program, as well as others) facilitating, as such, the identification and support of inter-sectoral value chains. This platform is compatible with global solutions and includes Internet of Things (IoT) features.

The main purpose of the platform is to easily connect and integrate multiple external services and provide users with unified UI experience. Therefore, the data collected and retained depends on the services that users use. By using a specific service, the user has to agree to the terms and conditions specified by the service. Some data about the users is however stored on the platform in order to make it easier for the user to use for example username, user information, billing information and such.

Services provided on the platform are proprietary and subject to the service provider licences.

[Learn more about Ekosmart](#)



## Projects



### Design of a smart city ecosystem

#### Purpose:

The purpose of the RDP1 is to provide a methodological framework for systematic and gradual development of a smart city with an emphasis on the identification of sectoral and inter-sectoral value chains. In addition, the RDP1 will deliver a design of a common platform, which will enable easy access to open and standardized data and services of a smart city. The architecture of the common platform will be open and will allow the integration of other areas of smart cities, not just those considered in the EkoSmart program.

#### Key partners:

The key project partners are experienced in the development of data and service platforms (JSI, FCIS, FEE) with their solutions successfully marketed in the international arena (MARAND). Other companies, project holders of other RDPs (TS, ISKRA, RC-IKTS), will also participate in the identification of inter-sectoral value chains and the integration into a common ecosystem.

#### Main objectives and outcomes:

Problem addressed by the RDP: Integration of various areas of smart cities into a common ecosystem.

Business and technological objectives of the RDP: Delivering technological solutions for the establishment and maintenance of the ecosystem, sustainable business model design.

Expected final outcome(s): a modular platform of a smart city, a business model.



### Smart mobility

**Purpose:**

The purpose of the project is to design a comprehensive infrastructure for supporting the implementation of a smart urban mobility concept. Research will focus on advanced sensor technologies, hardware components and communication networks in order to examine opportunities for optimal integration into a comprehensive smart city platform and the development of advanced eServices, offering the smart city ecosystem user a personified experience of their setting inside the urban transport system. The main purpose of the overall architecture design for providing smart mobility is to examine technological options for the integration of advanced, open, interconnecting devices (IoT), aggregation of data from these sources (sensors, HW components, networks), data processing and enrichment based on the analytical and algorithmic methods and procedures, and their use for the citizen in a wide range of scenarios based on the merging of data from different domains.

**Key partners:**

The RDP2 project holder is Iskra company, internationally recognized and experienced in the field of traffic management. The group will also be joined by Špica International, a leading Slovenian provider of software, systems and solutions for supply chain management, logistics and automatic identification; Alpineon, the developer of innovative products and services in the areas of sensor technology, signal processing, image and voice technologies and biometrics; Inova, the developer of innovative mobile and embedded solutions and services on different platforms; FCIS: Data technology laboratory, experienced in the field of data analysis and simulations; and FEE: Multimedia laboratory, experienced in the development of user interfaces.

**Main objectives and outcomes:**

Problem addressed by the RDP: Rigid traffic light systems, unresponsive to the real traffic situation.

**Subproblems:**

Expensive smart traffic light equipment.

Incompatibility of different subcontractors.

Lack of IoT involvement in the Intelligent Transportation Systems concept.

Expensive sensor equipment, high maintenance costs.

A multitude of provisionally reliable transport applications.

**Business objective:**

Development of a useful and open controller 'mind', accompanied by sensor equipment and useful traffic applications.

**Expected outcome:**

A pilot run in a city with the aim to demonstrate a properly responsive traffic light system depending on the real traffic conditions. The pilot will include the results of the project: a smart gateway for local traffic management, sensor equipment, traffic management logic, developed supporting applications for road users and centralized traffic management.



## **Active living and wellbeing**

### **Purpose:**

The purpose of Active Life and Well-being project is to develop approaches and prototypes to provide ICT support for the family within the EkoSMART ecosystem aimed to connect its members, to communicate, to promote quality family time, active life, health-friendly lifestyle and well-being. Research will focus on the integration of support activities into ecosystem services in smart cities and the recognition of connectivity options with other services of a smart city based on the needs of end users, concept definitions and testing, the development of motivation mechanisms, acceptability and trust of users, and design functionality. Active living, health-friendly lifestyle and well-being are key in enhancing the health of individuals and families in the community, directly affecting the quality of life in society and indirectly impacting its social and economic well-being.

### **Key partners:**

The RDP3 project holder is RC-IKTS company, experienced in developing ICT solutions to raise awareness of a health-friendly lifestyle for different target users. The company successfully promotes its solutions based on active and healthy life worldwide. For the fourth consecutive year it organizes international symposiums on healthy living, which in the future might be focused on our project theme of a family as the basic cell of a smart city. The group will also be joined by the following institutions: UL FEE: Multimedia laboratory, UL FCIS: Laboratory for Computer Graphics and Multimedia; TS; and UL FS: Laboratory of Kinesiology.

Main objectives and outcomes

### **Problems addressed by the RDP:**

Fast pace of life undermining the importance of the family as the basic cell, and opportunities for intergenerational integration within the family.



Lack of systematic inclusion of the importance of the family into planning strategies for smart cities and their integration with individual functionalities.

**Business objective:**

MyFamily software solution aimed at bringing families closer and enabling the intergenerational engagement for better quality of life in the EkoSmart ecosystem.

**Technological objective:**

Integration with existing solutions 24alife and the EkoSmart platform to connect with other RDPs providing individual functionalities.

**Expected final outcome(s):**

- Products, solutions, applications.
- Technologies, business models.
- Functional modules for active and healthy families in a smart city.
- Integration of modules into 24alife.
- Integration of modules into the EkoSmart platform.



## **E-health and mobile health**

**Purpose:**

The results of the RDP4 will enhance the protection and safety of the healthy, the elderly, the chronically ill and the disabled with the introduction of modern information and communication technologies (ICT) into an integrated, electronic and mobile medical care (EMC). Value chains developed in the project will upgrade the quality of today's treatment of and care for aforementioned groups with the help of electronic and mobile devices and related software solutions, especially with the use of body sensors and wearable devices, which enable the monitoring of condition and health based on measurements and artificial intelligence algorithms using data in the cloud, the EkoSmart platform or a mobile device. It is necessary to create systems to help the blind and visually impaired, the cognitively and physically disabled and the elderly living alone at home, and to enhance their quality of life. Chronic patients regularly or occasionally requiring medical care must be provided with uninterrupted mobile health monitoring and its integration into the system of comprehensive medical care in a way that will ease the burden on the health system.

**Key partners:**

The RDP4 project arose from a broader EMC initiative with around 300 partners wanting to participate and get informed about the developments in this field. For the implementation of the RDP4 the following organizations were carefully selected from a group of EMC partners: IJS, UMC Ljubljana, UL FM, MEDIS, UL FCIS, INOVA, UM FEECS, HCCM, Spice, ELGOLINE, SOCA, NELA, SRC, SEMANTIKA, MARAND, COSYLAB. The partners have specific knowledge in areas necessary for the implementation of the EMC and are of key importance in these areas in Slovenia and internationally.

**Main motives, objectives and outcomes:**

Motives for the implementation of the RDP4:

- The standard of public health quality became stagnant as evidenced by long queues and overburdened medical personnel.
- Difficult implementation of new ICT solutions into the Slovenian health care due to technological and ideological barriers.
- Many excellent EMC prototypes do not translate into practice due to uncoordinated efforts of all the health care stakeholders.

Business and technological objectives of the RDP4:

- To identify the needs and define solution designs for EMC.
- To modernize and optimize individually tailored care to maintain health, prevent disease and enable early diagnosis for people with an increased health risk.
- To use the potentials of economy, medicine and science for the development of a comprehensive EMC system in Slovenia, which will reduce the rising costs in health and social sectors.
- To strengthen, enrich and upgrade the supply of the ICT-enabled products and services in the field of health.
- To exploit the potential integration of Slovenian knowledge to increase export shares in EMC products and services.

Expected outcomes of the RDP4:

- Establishing a network of Slovenian EMC stakeholders and all three levels of health care.
- Creating at least ten advanced ICT-enabled medical devices or services, designed in collaboration with medical or nursing staff.
- Conducting at least five pilot studies to test the usefulness of the products developed by patients, caretakers, and doctors.
- Establishing at least two new clinical trials (neurology and cardiology) supported by EMC technology.
- Facilitating at least two transfers of technology or knowledge into economy.

- Publishing at least twenty scientific publications in recognized scientific journals.



## **Integrated health services**

### **Purpose:**

The purpose of the Smart System of Integrated Health and Care project is to develop approaches and prototypes providing basic conditions for effective transformation of Slovenian health care system. The development of prototype applications of modern ICT technologies and telemedicine treatment in the management of chronic diseases will provide full integration of the individual levels of health care, efficient and secure exchange of information between the various stakeholders at the national level (national registries, billing system, analyses of large volumes of data), and basic conditions for the development and sustainability of health and social systems.

### **Key partners:**

The RDP5 project holder is Slovenian Telekom, a provider of comprehensive communications services in Slovenia, whose role in Slovenia enables it to consolidate the entire ecosystem to facilitate telemedicine treatment. Advanced technologies and concepts will be introduced to the project by the participating Public Research Organizations (FCIS, FEE and UMCL, FM). The project involves health care providers (UMCL, UCG), where selected chronic diseases are treated. In addition, the **National Institute of Public Health** participates in the project as the administrator of the National e-Health Information Infrastructure, as well as information solutions providers for healthcare providers (SRC, RC IKTS), which will be integrated into the telemedicine platform prototype. The testing of the e-homecare prototype will be carried out by ATI.

### **Main outcomes and objectives of the project:**

- To develop a model of integrated medical treatment and establish related infrastructure.
- To develop a system foundation for extending the model of integrated medical treatment at the national level.
- To improve life quality and safety of chronic patients and extended home care.
- To ensure safe use of medicines and reduce the number of referrals to clinical pharmacologists.

- To implement a prototype pilot of integrated medical treatment and care (clinical pathways, KPI).

**Project outcomes:**

Integration of stakeholders in health treatment and chronic patients care at the national level.



**Solution prototypes**

**Purpose:**

The purpose of the RDP6 project is to integrate laboratory prototypes from projects RDP1 through RDP5 and test them in relevant environments. The test will be held at the subsystems level as well as at the level of operation of the smart city ecosystem as a whole. The project is very important because it demonstrates accomplishments in other projects. Special arrangements will be needed to ensure relevant environments for testing.

**Key partners:**

All the consortium partners will participate in the RDP6 project.

**Main outcomes and objectives of the project:**

Delivering, setup and testing of systems prototypes in target environments (TRL5-6), including variants that are similar in function to those in the real world.

**Testing and validating the results of all other RDPs:** RDP 1, RDP2, RDP3 RDP4, RDP5, as well as cross-sectoral integration. Prototypes of each RDP are not interdependent.

Conjunction points: RDP1 (ecosystem) and RDP6 WP1 (methodology).

Source: <http://ekosmart.net/>