Central Union of Municipalities in Greece

«PROVIDING SUPPORT SERVICES IN THE DESIGN ANDIMPLEMENTATION OF PROJECT ACTIVITIES

“Improving Healthcare Access through a Personal Health MonitoringSystem – EHEALTH Monitoring”»,

In the framework of the implementation of the "INTERREG V-A Greece -Bulgaria 2014-2020" Cooperation Program »

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1. Introduction

Training is an important part of the field of eHealth. And while that statement is patently true, it also leads to many questions: Who should be trained? How often should training take place? What should training consist of? Who should conduct the training?

eHealth Monitoring Project is of significant importance and for this reason all the involved stakeholders must be trained in order to know how to use the system as well as be aware of the beneficial results it will yield. For this reason, KEDE was responsible to provide training to all partners by conducting training sessions.

This report describes the significance of eHealth Monitoring project and provides information regarding telemedicine in Greece and Bulgaria. Following these, it highlights the importance of eHealth applications and presents the system which is developed and its components. Moreover, it refers to the training sessions that took place and explains the way in which the system functions.

2. Project Objectives and Expected Results

The aim of the project is the development of an e-health monitoring system at a transnational level, which is based on Information and Telecommunication Technologies as well as personal non-invasive sensors. This system will provide remote monitoring of citizens' health outside the traditional hospital environment and it will also create a permanent interconnection of citizens with medical staff.

The system that is suggested brings personalized and economic health monitoring to all residents of the two countries. The strategic goal is the improvement of public health and quality of life, by adopting technologies which can adjust to citizens' personal needs and concurrently, are of high credibility and low cost. The main goal of this project is the study, design and development of an innovative, user-friendly, portable, personal and at the same time low cost e-health system that can be used by everyone. This system will consist of a central information system and personal portable devices which will provide:

- remote monitoring of citizens' state of health
- constant monitoring of patients' compliance with their medical treatment
- live connection with medical staff

The project's results can be summarized as follows:

- Low-level system design to enable extensive real-time and reliable biomedical data acquisition
- Intelligent hierarchical integration
- System networking
- Development of a scalable innovative remote health monitoring system, fulfilling all requirements for its further integration in future needs
- Dissemination, standardization and exploitation of results

This integrated remote healthcare monitoring system will:

- Introduce in the clinical practice a new e Health approach
- Create a new wireless product that will decrease the cable tangle at the bedside
- Allow an effective prevention of medical complications
- Allow less experienced professionals to conduct remote health monitoring under the supervision of more highly educated professionals
- Save time for both the patient and the health professional by reducing unnecessary visits and tests, while at the same time assuring that critical cases are seen more quickly
- Keep patient close to the local healthcare experts when away from home,
- Provide healthcare in emergencies and remote areas, this system being able to ensure healthcare monitoring even to those living in remote areas, or regions cut off during emergencies

3. Benefits of eHealth Monitoring Project

The project will undoubtedly produce multiple benefits to the target – groups. With respect to *doctors*, diagnosis when a patient lives in a remote village and ask for the opinion of a specialized colleague can be made in a more effective manner. Going further, there is direct access to patients' record, reduction in time of diagnosis, direct information and communication with colleagues through the network.

Employees in health centers and hospitals can use new technologies and their job can be facilitated to a high extent, increasing the efficiency and reducing the time spent on an incident. Therefore, productivity is enhanced, mistakes are reduced and sense of security for patients and health professionals increases.

Communication time between hospitals is drastically reduced, there is an upgrade of the provided health services at the level of local government and there is also a wide coverage of medical incidents. Finally, the working environment of medical staff has been modernized with the use of technology and services based on international standards, as well as training of doctors are facilitated and upgraded.

Concerning *citizens*, benefits are related to direct contact with the doctor, even if they are miles away, immediate service and increase of care by avoiding repetitions, delays and mistakes. Information about public health issues, epidemics and prevention are of significant importance, as well as reduction in the cost of care without unnecessary expenses. It could also be said that telemedicine and information systems enhance transparency.

In addition, some other benefits that can be generated have to do with savings on examination costs, reduction in the geographical and physical isolation of patients and the elimination of the internal migration to urban centers in order to receive better and more effective medical care. The ability to provide expert advice from overseas and improvement of day-to-day research are at the top of the pyramid.

The fact that there is quick and direct access to new information contributes to support of diagnosis and treatment, including rehabilitation. E-health applications can constructively help in the management of health units through the dissemination of best practices. The use of applications of telemedicine (tele-consultation, tele-care or tele-monitoring) and health care at home facilitates and enhances people's stay in decentralized areas, improving the overall provision of health services at each level.

4. Telemedicine

Telemedicine could be defined as: "The use of communication and IT technologies to provide and support healthcare when the parties are separated by great distance". Telemedicine systems were developed to cover these needs and can take one of the following forms:

- ✓ E-consulting, remotely accessing a specialist's knowledge and expertise.
- ✓ E-diagnosis, remotely diagnosing by a specialized physician.
- ✓ E-monitoring, monitoring patients not in the hospital.
- ✓ E-care, using e-monitoring data to provide assistance.
- ✓ E-learning, remotely training patients or healthcare practitioners.

- ✓ Joint diagnosis, where a group of healthcare practitioners from different locations work together towards a conclusion.
- ✓ Remotely accessing a medical database could be considered an telemedicine application.

The main needs covered by telemedicine applications are the following:

- Remote areas with low quality healthcare services
- Navigation
- Home care
- Emergencies
- Health tourism units
- Consulting units to doctors
- Tele-learning
- Rare specialties
- Medical services homogenization

Essentially, telemedicine or e-health aims at providing clinical support by overcoming the geographical obstacles separating the users via IT technologies in order to improve health outcomes. Telemedicine's special properties render it suitable for remote areas (desert, rural, mountain, island regions) where there is a lack of trustworthy and specialized medical presence and knowledge.

4.1. Telemedicine in Greece

The year 1989 is a marking point for telemedicine in Greece. Medical Physics Laboratory of Athens University Medical School, in cooperation with Sismanoglio Hospital presented an telemedicine system to support primary healthcare and created the first network of Health Centers connected to a public Hospital.

Tele-medicine suits Greece especially because of its geographic and demographic peculiarities. At the same time, the constant increase in quality of life, the great number of foreign and Greek visitors per annum, continuously pressure towards improving and upgrading the provided healthcare services by means of modern technology.

The National Healthcare System (ESY) is now compelled to fulfill the reasonable expectations for high quality primary healthcare. Thus, alternative solutions must be found.

On the contrary, positive developments have occurred in the area of modernizing the equipment, indeed to the extreme. The field presenting an excessive delay however compared to the rest of Europe, is the introduction of computers, automations and IT and telematics systems in health and welfare.

While telemedicine is currently portrayed as a novelty, it can be easily incorporated and accepted by all parties of the health and welfare system. Experience so far, both in Greece and abroad, suffices to convince any observant for telemedicine's necessity, while also acknowledging that introducing it at a large scale is a complex and difficult task.

It must be noted that telemedicine is not an alternative healthcare system. More precisely, it is a system which must be introduced in all public and private medical services units or networks to promptly deal with access and quality issues and increase their efficiency and effectiveness.

4.2. Telemedicine in Bulgaria

Telemedicine and e-health are not popular and widely spread specialties in Bulgaria. In fact the only place that educates bachelors and masters in ICT in medicine is New Bulgarian University in Department of Biomedical sciences.

In Bulgarian medical hospitals, clinics and other private institutions have particular projects and implementations, which are not sponsored by the government. There is Leonardo Da Vinci in Pleven city, several solutions for the Military academy and medical hospital. There are different solutions in separate wards and departments, which often even are not popularized and published in the press and special journals.

The main stakeholders in Bulgarian health system are the Parliament, the Ministry of Health, the NHIF and the Higher Medical Council. A number of other ministries own manage and finance their own health care facilities, including the Ministry of Defense, the Ministry of Internal Affairs and the Ministry of Transport. Private practice has expanded significantly, now including dental practices, pharmacies, physicians' surgeries, laboratories and outpatient clinics and polyclinics.

The Health Card is one of the key technologies currently being developed and introduced in Bulgaria for health sector optimization, more efficient transactions between the health care institutions, more secure, flexible and transparent exchange

of information, standardization of services and activities, and ensuring future interoperability with other European countries and health systems. At the time of writing, there is no exact information about the dates for the launch of the system.

5. Aims of eHealth Applications

According to the World Health Organisation, the use of IT technologies in health is a means of achieving a series of desired effects such as:

1) Better treatment decisions by healthcare practitioners

2) Higher quality and safest healthcare by hospitals

3) Conscious choices by the public regarding their health

4) Greater responsibility by the government in health

5) Support effective, efficient and just healthcare systems by national and local IT systems

6) Ever better understanding of the health risks by the public and the policy bodies

7) Better access to knowledge and information necessary for better health

All the above is based on the following properties of e-health:

1. Efficiency
2. Improvement of healthcare quality
3. Scientific documentation
4. Strengthening of citizens and patients
5. Reinforcing interaction
6. Continuous training
7. Extension of healthcare range
8. Safety
9. Equality

6. Description of Equipment

The equipment was created and developed by BioAssist Company. According to the specifications set out in the project, the biosensors selected for the pilot tests are portable non-invasive devices that allow monitoring of the user's health status, providing measurements for the following parameters:

- ✓ Heart Rate
- ✓ Oxygen saturation
- ✓ Blood pressure (systolic and diastolic)
- ✓ Physical activity (recording of steps and sleep)

For measurement collection and storage in the central information system, biosensors communicate with the UMU and the mobile application wirelessly via Bluetooth technology. This process is automated therefore the system is sufficiently user-friendly. In addition, the interface of biosensors with the mobile application presupposes the choice of devices for which the communication protocol or other direct connection and communication mechanism (eg SDK, API) is available.

It has to be underlined that usability was considered to be the top requirement to allow the use of the system and sensors by users with no technical background, such as elderly or patients with chronic diseases. To this end, a non-invasive approach was sought, which does not disturb their habits or the process they are already following to measure their biosciences.

The first step in preparing the equipment for end-user use was to set up the relevant software and in particular to create the required user accounts in the Medical Surveillance System so that end users would not be burdened with this process. In order to protect the privacy of the pilot users, the accounts were created without personal information.

In addition, a corresponding Google Account has been created for each user account on the Medical Surveillance System, which is used to operate the tablet, install updates, and be able to update the required Android services (e.g., Google Play Services) to ensure the smooth operation of the mobile application, but also for receiving emails from the system in the relevant Gmail. Each account has an initial strong password.

The above accounts have been standardized and numbered (001-100) as follows:

Google Account	**eHealth Monitoring Account**	**Name**
ehm###gr@gmail.com	ehm###gr@bioassist.eu	ehm###gr

In this way, those who are responsible for pilot tests can easily match end-users with their system accounts and the devices they receive, without having their personal information from scratch, and each end-user will easily register data through the application and change passwords on first login.

The devices that were selected for the pilot tests are described below:

6.1. Tablet

The proposed type is “Lenovo TAB-4 7 Essential QuadCore 7"”. Its features are WiFi internet connectivity, connectivity to other devices via Bluetooth Low Energy (BLE) and Android Operating System Version 7.0. RAM is 1GB and storage is 8GB.

6.2. Oxymeter

The proposed type is “Jumper JPD-500F”. This is non-invasive, it has an LCD screen to display the results of measurement and it is designed for personal use at home. It is also portable, has CE certification and provides reliable measurements of oxygen saturation and heart rate. The biosensors connect to the UMUs and communicate with the application for transmitting data automatically, without user intervention.

Jumper JPD – 500F performs multiple measurements. This mode is followed by oximeters, which monitor one or more sets of biosimilars for a given time frame (from seconds to hours) and produce chronological monitoring data sets. Connectivity is usually necessary in such cases to promote raw data to the system in real time, especially because the majority of devices have limited internal storage capabilities.

6.3. Blood pressure monitor

The proposed type is “iHealth Track” and is non-invasive, with an LCD screen to display the measurement results. It is also designed for personal use at home and it has CE certification. It provides reliable measurements of heart rate and blood pressure and it sends data via BLE.

iHealth Track also implements separate measurements. Separate metering devices are used only when the user wants to measure the value of a biomass (or the values of discrete biomass in a single measurement). Most of the time, these devices can operate offline and after a measurement they are connected to the system and send or, if requested, synchronize all data.

6.4. Activity Tracker

The suggested type is “Smart Band H10 pro”. It is non-invasive, it has an LCD screen for displaying the measurement results and is designed for personal use at home. It also has CE certification and can be connected to UMUs and application. Finally, Smart Band H10 Pro performs constant supervision.

7. Training Sessions

7.1. Importance of Training

Training is an integral part of human resource development programme in almost all organizations. Training, in fact, is the cornerstone of effective management because it makes employees more efficient and productive. Training presents a prime opportunity to expand the knowledge base of all employees, but many employers find the development opportunities expensive. Employees also miss out on work time while attending training sessions, which may delay the completion of projects. Despite the potential drawbacks, training and development provides both the company as a whole and the individual employees with benefits that make the cost and time a worthwhile investment.

The benefits that are produced through training process are numerous. More specifically, they concern the following:

- **Improved health practitioners performance** – the doctor who receives the necessary training is more able to perform in their job. The training will give the employee a greater understanding of their responsibilities within their role, and in turn build their confidence. This confidence will enhance their overall performance and this can only benefit the company. Employees in healthcare who are competent and on top of changing industry standards help your company hold a position as a leader and strong competitor within the industry.
- **Improved healthcare practitioners satisfaction and morale** – the investment in training that a company makes shows employees that they are valued. The training creates a supportive workplace. Employees in healthcare sector may gain access to training they wouldn't have otherwise known about or sought out themselves. Employees who feel appreciated and challenged through training opportunities may feel more satisfaction toward their jobs.
- **Addressing weaknesses** – Most healthcare practitioners will have some weaknesses in their workplace skills. A training program allows people to strengthen those skills that each employee needs to improve. A development program brings all employees to a higher level so they all have similar skills and knowledge. This helps reduce any weak links within the company who rely heavily on others to complete basic work tasks. Providing the necessary training creates an overall knowledgeable staff with employees who can take

over for one another as needed, work on teams or work independently without constant help and supervision from others.

- **Consistency** – A robust training and development program ensures that employees in healthcare sector have a consistent experience and background knowledge. The consistency is particularly relevant for the company's basic policies and procedures. All employees need to be aware of the expectations and procedures within the company. Increased efficiencies in processes results in financial gain for the company.
- **Increased productivity and adherence to quality standards** – Productivity usually increases when a company implements training courses. Increased efficiency in processes will ensure project success which in turn will improve the company turnover and potential market share.
- **Increased innovation in new strategies and products** – Ongoing training and upskilling of the workforce can encourage creativity. New ideas can be formed as a direct result of training and development.
- **Enhancement of company reputation and profile** – Having a strong and successful training strategy helps to develop your employer brand and make your company a prime consideration for graduates and mid-career changes. Training also makes a company more attractive to potential new recruits who seek to improve their skills and the opportunities associated with those new skills.
- **Reduced accidents at workplace** - Untrained people are bound to commit errors while handling machinery and equipment resulting in incidents at workplace. Training eliminates (reduces) the possibility of incident due to mishandling of equipment, machinery, and other resources of the organisation. Proper training and development programmes ensure safety in handling the organisation's resources which results in reduction in the accident rates.

7.2. Importance of Training in eHealth Sector

Telemedicine is a rapidly-maturing delivery method for health care that relies heavily on technology. As with any other application of technology, users are much more effective and efficient if they are familiar with the equipment and comfortable with the procedures for using it. Health providers are obligated to be competent and confident with the equipment in order to provide patients with the right treatment.

It is difficult to overemphasize the importance of training. The bullet points that follow list some of the principal advantages that come to a network with a well-trained staff:

- Both staff and equipment are ready to go when they are needed. With appropriate training and maintenance, it just takes a few minutes to make a connection and be ready to present a patient. This readiness helps patients trust the process and the technology and promotes a higher level of confidence in the staff
- Program success is driven by accumulating individual successes with telemedicine. Knowledge, professionalism and, most importantly, confidence are enhanced when telemedicine equipment use by the health care staff is second-nature.
- When staff from both sides of the connection train simultaneously, they become familiar with each other and can work much more comfortably with each other. The sense of familiarity can enhance the patient encounter. With a known and practiced encounter routine, network operators can ensure quality of care.

7.3. Execution of Partners' Training

During the final phase of the project implementation, KEDE in cooperation with the EURORADAR Association provided training to the partners on the operation of the system through electronic presentations conducted via skype. The training material was produced by PB2 in Greek and English language, while PB6 provided the Bulgarian version. An installation manual (Appendix I), instructions for use (Appendix II), a presentation (Appendix III) as well as an education scenario (Appendix IV) were presented in order for partners and involved stakeholders to be informed to the highest extent concerning the equipment.

Additionally, the presentation of the project system took place during the second transnational workshop in Komotini. All Greek partners were present and detailed information on the operation of the equipment was provided. The objective of training was for involved partners to gain an in-depth understanding of the system so as to be able to properly inform end users when distributing equipment.

The above documents were designed to familiarize users with the system, in a short and easy to understand manner, so that they can be used primarily as a tool to train a new user in order to use the system. Based on this concept, guides gradually explain the various functions of applications, presenting the corresponding screens.

The presentation informed the trainees about the function of the system and provided meaningful details. More precisely, the core features were described and it became clear that each patient is provided with a tablet and wireless medical sensors. These sensors are connected wirelessly with the mobile app in order to achieve the monitoring of vital signs and in particular they monitor oxygen, pulse rate, blood pressure, physical activity and sleep. With the use of this system, doctors set parameters for patient monitoring and patients use it on a daily basis.

As it was mentioned above, in order for user to be trained, a demonstration scenario of system functions was created, including both the role of the patient, who is the end user of the mobile application, and the doctor, who can monitor the health status of his patients through the web application. The scenario is structured in a story format so that it is comprehensible, presenting the true value of the system and keeping the listener interested.

The structure of the educational presentation is as follows:

1. Log in to the web application as a doctor

a) Web application brief overview

b) Defining Customized Patient Monitoring Parameters (Schedule, Reminders, Normal Measurement Limits)

2. Connect to the mobile application as a patient

a) Mobile application overview

b) Introducing biosensors and performing biosensor measurements

c) Communication through the application with the doctor (video call)

d) Taking measurements during the call

3. Overview of complex application functions

a) Viewing biosignals and searching for historical patient

b) Scheduling automatic patient reports

The training scenario was used in conjunction with user test accounts, which the trainees had access to after the training, with the aim of experimenting and familiarizing themselves with the system in a secure environment. Given the high level of usability of the system, there were no problems in learning and the training procedures were completed in a successful way.

In addition to the training meeting held in Komotini and the use of the KEDE' platform to educate partners on the system developed within the project, Skype calls can be made for further clarifications, information and questions. The purpose is the use of the equipment by all partners so that it can be used by people in need and bring significant benefits to people in the cross-border area.

8. Conclusions

From all the above, it can be concluded that nowadays training in eHealth is of paramount importance. Telemedicine and eHealth produce a wide range of benefits to health professionals and patients and in this way things become easier and more effective. However, it could be said that while in Greece the notions of telemedicine and eHealth are relatively widespread, the same case does not apply to Bulgaria. For this reason, the system which has been developed through this project will make people in both countries aware of eHealth applications and everyone can benefit from it.

In order for partners in the CB area to be able to effectively use the equipment, training was provided by KEDE to Greek and Bulgarian project partners. The first training session was about Greek partners and it was carried out in Komotini. Bulgarian partners were trained through KEDE' s learning platform. Despite that, partners can communicate via Skype, in case they have any queries regarding the function of the system.

Appendix I – Installation Manual

Appendix II – Instructions for Use

Appendix III - Presentation

Appendix IV – Education Scenario