Paper

Cost-effective health services for interactive lifestyle management: the PANACEIA-iTV and the e-Vital concepts

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Abstract—Information technology applications in medicine are rapidly expanding, and new methods and solutions are evolving since they are considered pivotal in the success of preventive medicine. In this paper two different concepts will be presented, the PANACEIA-iTV and the e-Vital concept. PANACEIA-iTV is a home care service provision system based on interactive TV technology and supported by the IST programme of the European Commission. The e-Vital service, supported by the eTEN programme of the European Commission, regards an integrated home care and telemonitoring service chain aimed at large sensitive parts of the European population, the "at-risk" citizens, who are usually patients with a stable medical condition that allow a near normal life but may suddenly deteriorate and put life at risk.

Keywords— telemedicine, telemonitoring, homecare, health information.

1. Introduction

European health care systems are facing a period of unprecedented changes prompted by a confluence of events. From the patients' side, the health care demands are in continuous evolution since the demographics structure is evolving. Europe is the area of the world, which faces the fastest ageing of the population, considerably higher than in the United States. This fact, together with a high prevalence of concurrent chronic disorders is generating an extensive use of health care and social services. The advances in information and communication technologies are foreseen to have substantial impact on health care.

Information technology (IT) applications in medicine are rapidly expanding, and new methods and solutions are evolving since they are considered pivotal in the success of preventive medicine [1]. In the past days, IT applications were mainly applied at the secondary health delivery level, and even at specialised hospital departments. These applications were difficult to use, maintain, and they were quite expensive. Today, due to the fast growing and penetration of the Internet and mobile telephone technology, the IT applications in the health care environment are focused at e-consultation [2] and home care delivery [3] and the use of triage systems [4]. Home care delivery is a very important issue, covering the management of chronic diseases, wellness, education and information delivery on-demand and addressing socially delicate targeted problems such as infertility. Thus, there is a demand for continuous monitoring of basic parameters of the patient, as well as timely delivery of educational material, so as to avoid complications and to prevent the advent of serious diseases. IT-based applications for home care delivery are important media to increase health care quality, increase quality of life and create a better educational platform with carefully designed and customisable patient prompting which in turn is expected to be instrumental in increasing the collaboration degree between the patient and the physician, something which is beneficial to both [5, 6].

New models are being proposed that promote patient's active participation, redefine physician's tasks and enhance nurses' roles. For the first time, the health care sector is becoming a significant driving force in the technology evolution process. In this new scenario, integrated delivery systems based on patient-centred care, supported by an intensive use of information technologies, will facilitate the most efficient use of the existing resources in the health care system.

Several points are very important in the definition of this new health model. First, it must be noted that the different patient's conditions should be treated from a holistic approach, not each one of them separately. Secondly, the patient must be active in the control and treatment of the illness. Thirdly, the co-ordination among the different health actors must be enhanced to ensure a better decision making process.

In this paper two different and at the same time very similar concepts will be presented, the PANACEIA-iTV and the e-Vital concept.

The use of interactive TV for citizen centred health and lifestyle management system is considered by use of the PANACEiA-iTV paradigm. The main concept is to exploit the digital iTV advantages for home care services and for increasing health care quality and safety. The technological innovation of the proposed platform resides in the use of DVB-MHP technology for the development of iTV applications and the communication of the set-top-box (STB) with the monitoring medical microdevices using infrared (IR) communication.

On the other side, the e-Vital project [7] focuses on the implementation and exploitation of a modular and ambulatory secure telemedicine platform, which is using easily wearable vital signs monitoring devices, causing minimal

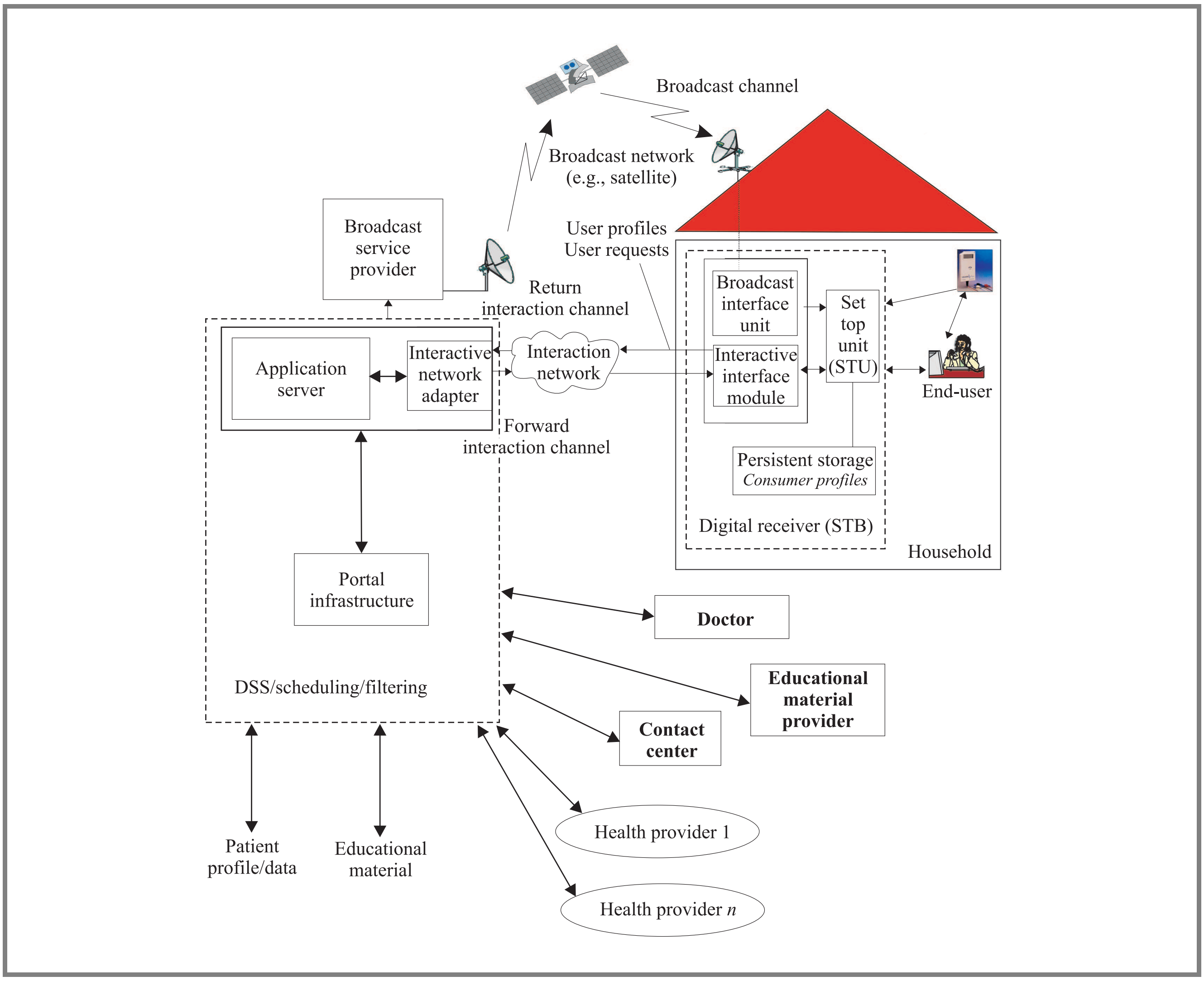

Fig. 1. The PANACEIA-iTV system overview.

discomfort to patients, and which transfer in real time and on-line critical vital parameters to doctors and/or medical experts/consultants, regardless of their location, while getting feedback to increase their feeling of comfort or in case of alarm. It also helps physicians to determine a better care strategy, collecting data previously only available in intensive care units (ICU). The interactive continuous monitoring, as proposed, promises cost effective health services, more active involvement of patients in their own care, and a new sense of realism in making a diagnosis.

The tests and validation tasks of both projects are taking place in a wide geographical area, namely: Greece (PANACEIA, e-Vital), UK (PANACEIA, e-Vital), Spain (e-Vital), Belgium (PANACEIA) and Italy (e-Vital). These countries constitute samples of different cultures and healthcare systems, and this will help to assess the validity of the chosen market approach. The benefits of both services are being assessed both for patients and physicians. Assessment includes reliability, usability, effectiveness, conformance with requirements and specifications, and user acceptance and satisfaction.

2. Methods

2.1. The provided services

2.1.1. The PANACEIA-iTV service

An overview of PANACEIA-iTV system is presented in Fig. 1. The basic communication means used in the current work are satellite TV for the patient and Internet for the clinician. The patient needs a very simple interface that will guide him through the different services provided and will be handled with the remote control. The clinician needs a more sophisticated interface for the monitoring of patients' condition.

At the end users' environment, the patient's interface is managed through the STB, which communicates via an IR link with the medical microdevices. The patient is able to interact with the PANACEIA-iTV service provider receiving educational videos, messages and other patient related info, either over satellite transmission or via the return channel. Patient data, entered with a remote control

unit and by the medical microdevices, are submitted to the PANACEIA-iTV server via the return channel.
The application server of the architecture is mainly responsible for adapting PANACEIA-iTV to the broadcaster's environment and to handle interactive applications.
The portal is the principal access point to the system functionalities for all actors. It provides the interfaces needed by those actors in order to perform their tasks. Web interfaces are provided to the contact center, the clinicians and the educational material providers.
Databases exist for storing patients' profiles and clinical data, educational material related info and also profile info of the rest of the PANACEIA-iTV actors.

2.1.2. The e-Vital service

The e-Vital concept is based on the supply of homecare and telemonitoring. The elements, the integrated homecare and telemonitoring service chain (see Fig. 2) consists of, are the following:

- devices and/or sensors connected to the patient (external hardware),
- service enabling applications at the e-Vital patient module (e-Vital and/or external software),
- service management applications at the e-Vital server module (e-Vital software),
- service facilities and operations (combination of processes/services/personnel),
- technical and organisational support (services),
- organisational models (consultancy).

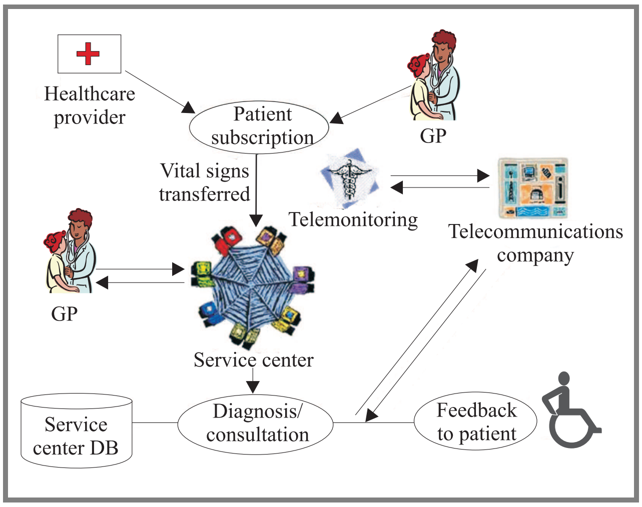

Fig. 2. The e-Vital service chain.

The e-Vital service consists of the following subsystems:

- The patient's module consists of the monitoring devices and the patient's phone. The patient or a nurse, following the care protocol created by the physician, takes the measurements. The data are then sent to the e-Vital server via the phone. In case of emergency and supplemental to the program, measurements can be taken and sent to the server.
- The e-Vital server is the core of the e-Vital service. Here the physician is able to design the personalised care protocol of each patient, to monitor the application of the protocol and the measurements already taken by the patient. In case of emergency, when the measurements are out of limits, an alarm message is generated and is sent to the physician, who in turn is able to inform the patient and rearrange the schedule of the programmed measurements. The e-Vital server collects the data from the monitoring devices, compares the measurements with the given limits and if there is a problem sends the appropriate messages.
- The hospital module consists of the hospital server and the hospital database. The interconnection with the hospital module is used to retrieve patient's medical record, when it is necessary.

Each monitoring device is connected to the phone, which sends the collected data to the e-Vital server. The e-Vital server establishes a communication with the phone, in an emergency or non-emergency situation, and the data are sent to the e-Vital server via GPRS and TCP/IP. The received data are then transformed in an XML file in order to be compatible to the format of the DB and are forwarded to the database centre.
Since the monitoring devices are different due to the various manufactures, the formats of the data files that are sent to the e-Vital server are different from each other. For that reason different applications run in the e-Vital server, to transform the incoming data files to the format compatible to the DB.
Physicians and patients have access to the service from PC, PDAs or mobile phones connected to the Internet.

2.2. Scenarios of use

2.2.1. The PANACEIA-iTV scenario of use

Four different scenarios of use have been defined for PANACEIA-iTV including diabetes II patients (chronic condition), congenital heart disease patients (chronic condition), prenatal group-high risk pregnancy (general population), and infertility couples (sub acute condition).
The users and stakeholders have been defined as following for the system. The users are the citizens/patients, the clinicians and the contact centre personnel. The stakeholders are the technology providers, e.g., broadcaster, medical device manufacturers, educational material providers. In the following, each role is described in more detail.

Citizens/patients. Users who want to manage their own health and/or need specialized healthcare services. Users at home may be either patients or healthy people who use the PANACEIA-iTV services such as data exchange, prompting and querying for communicating with the medical professionals through their TV sets and STBs. An important aspect is that users at home are able to receive educational material in the form of tips, digital videos or interactive hypertext.

Clinicians. Doctors and nurses. The clinicians are responsible for monitoring their patients' condition by checking the transmitted measurements and scheduling the patient's activities and communication protocol via the PANACEIA-iTV system. Using a customized web interface they are able to view the values of the measurements that the patients perform at home, as well as to check whether the patients follow their schedule. Finally, medical staff is responsible for reviewing any educational material submitted for broadcasting.

Contact centre. Provide the communication between the clinicians and the patients/citizens. The main role of the contact centre staff is to administrate the PANACEIA-iTV application and specifically all the patients that are registered with the PANACEIA-iTV service, as well as to register new patients and train them. In addition, the contact centre personnel receives the educational multimedia material from the educational material provider, defines its scheduling and finally delivers it to the broadcaster.

Educational material providers. This entity provides the educational material to the PANACEIA-iTV system. This material is in the form of tips, hypertext/images or videos and it is associated with specific patient groups and group categories. This association is defined by the educational material provider.

Broadcaster. This is the owner of the digital broadcasting platform and its role is to receive the content and the digital TV applications and to broadcast them to the households that are registered with the PANACEIA-iTV service.

Besides the aforementioned functional specifications, there are some general system requirements, including security, multilingual support and possibility for integration with existing systems. The system offers user customization and has event logging capabilities.

2.2.2. The e-Vital scenario of use

Two different scenarios are provided by the e-Vital service.

Routine operation. The first scenario is the programmed one where the measurements are made according to the specific care protocol of the patient. After the completion of the measurements the patient or an accompanying person (nurse, relative of the patient, etc.) is calling the e-Vital server in order to send the data. Then, after a connection is established, the appropriate application runs. The task of this application is to validate if the patient is registered in the system, to identify the type of the monitoring device, which sends the data and to collect the data. This information will be available either in the header of the data message, which will be sent to the e-Vital server or will be sent in an individual message after the establishment of the connection. After that the input data are transformed to an XML file that is compatible to the DB of the database server, and the data are stored in the DB.

In the application server the data are processed and checked if they are out of range. In the DB existing medical information about alarming parameter combinations are stored. It has also access to patients' medical records, which are stored in the hospital module. It then combines these two sources of information with the received patient's data and defined decision flowcharts, it appreciates the patient's condition (excellent, good, average, warning/reason, alarming/reason, or death/reason). If the condition is warning or alarming the notification services will be activated to send an alarm message to the patient, to the physician who attends the patient and to the associated people (that is personal GP, relatives, special requested experts in their respective language) of the patient. These messages maybe SMS or e-mail messages and are also stored in the DB.

Emergency operation. The second scenario concerns the emergency or alarm events. In this scenario in case of emergency, where the patient doesn't feel well, he/she takes some measurements, supplemental to the programmed ones, and sends them to the web server. After the validation and transformation of the data, the web server sends the data to the DB of the service centre, which by turn sends the alarm messages to the physician and to the associated people.

The e-Vital server can communicate with the hospital information system (HIS) of the collaborator clinic. In that case the e-Vital web server is able to ask only for some patient data (mainly the patient medical history) in order to present the data in the physician or patient's web page. The web server does not restore data to the hospital DB. The e-Vital server and HIS communicate through web services, which are located in the web server. The data from the web server are then transferred to the web pages through services centre as an XML file.

The e-Vital can be offered to public health authorities, healthcare providers (hospitals and primary-care units) and physicians.

2.3. System architecture

2.3.1. The PANACEIA-iTV system architecture

The PANACEIA-iTV is a multi-component system (Fig. 3). Much of its innovation lies in the integration of different modules and technologies, which are described in the following section.

The PANACEIA-iTV front-end. Patients' STB receives the broadcasted data (audio/video plus the PANACEIA-iTV application). The STB de-multiplexes the incoming transport stream and sends the audio/video to the decoders

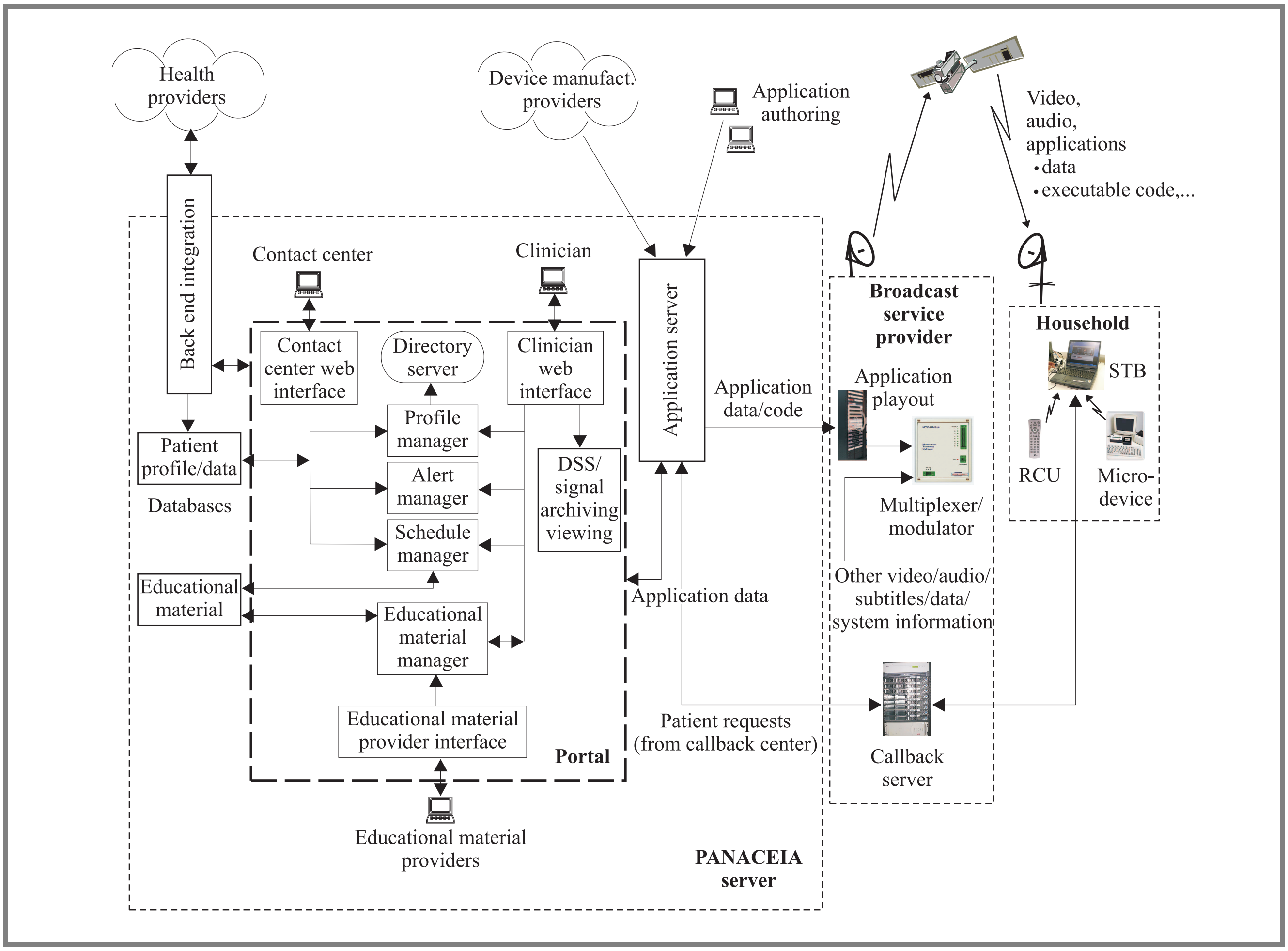

Fig. 3. The PANACEIA-iTV system architecture.

and executes the application according to the user's profile. This scheme allows the user to interact with the application and communicate with the PANACEIA-iTV server (full two-way interaction). Furthermore, it allows IR communication between the STB and the medical microdevices.

The equipment available for the patient is the STB, the microdevices and the remote control. IR communication with the STB is mandatory for signal and vital parameter transmitting microdevices, such as the 12-lead ECG and CTG microdevices.

Broadcaster. The broadcaster owns bandwidth on a broadband network and possesses the infrastructure for broadcasting. This part is assigned the task to schedule events and allocate bandwidth for their transmission. The event's video and audio streams are multiplexed with the PANACEIA-iTV application and broadcasted through a broadband network (like cable, satellite or terrestrial) to the users at home.

The PANACEIA-iTV server. It controls and provides communication links between the different PANACEIA-iTV users. Its basic tasks are:

– to regulate the information and request flow using various purpose software agents;

– to aggregate content and service modules and provide multiple modality access to users;

– to incorporate the potentially distributed databases holding educational material and citizen/patient data and potentially;

– to deliver the same application on different platforms, through the use of different application servers.

Application server. The PANACEIA-iTV application server is the component of the PANACEIA back-end, which is aware of the target platform and the network operator environment. It holds the executables and the data of the target platform and schedules them for delivery to the network operator. It handles HTTP requests coming from the STB (dial-up networking – TCP/IP protocol) related to either data extraction or insertion in the PANACEIA-iTV databases, which are accessed through the portal using XML based schemas. Periodically, it receives content (educational tips, sessions or data) from the portal, converts it to the appropriate format and delivers it to the broadcaster. It checks the delivery status of a particular content to a particular patient, through the return channel. It converts the data into the appropriate format that is understood by the target application (DVB-MHP compliance).

Portal. The portal provides membership management, i.e., the creation and management of users, groups, roles and domains. It also provides integration services allowing deployment of HTML and non HTML applications via the portal. It has mechanisms for reporting/accounting/logging, as well as for handling of all data requests.

Multi-agent system. Additional intelligence and advanced functionalities are provided to the medical personnel by Java-based software agents [8]. Three multi-agent systems are proposed: the alert manager, the schedule manager and the educational material manager. These systems are proposed for the facilitation of patient monitoring.

The alert manager triggers alert messages to the clinicians, when patients' measurements fall beyond predefined limits or their schedule is not followed. Furthermore, it notifies the clinicians for non-scheduled measurement sessions.

The schedule manager controls the frequency of the patient's pre-planned activities (measurements, educational videos, reminders, educational tips). It may provide suggestions to the clinicians by evaluating patient's measurements values.

The educational material manager provides workflow management of the educational content. It notifies the contact center personnel when new educational content is uploaded and automates the selection of educational content.

DSS/signal archiving and processing. Decision support systems (DSS) are interactive computer-based systems that support clinicians in their daily duty and research activities. They provide the means to create and apply complex rules concerning the medical data provided by the patient; helping to identify patients whose data follow specific patterns. Additionally, tools for signal (e.g., ECG) processing and interpretation (denoising, filtering, information extraction) are available.

The signal archiving and processing module includes archiving mechanisms and viewers for ECG and CTG signals.

Databases. The PANACEIA-iTV databases have an expandable and parametric structure. In the patient database, patient's demographic data, medical data and details about the services provided to the patient are stored, while sessions of educational videos, text and short textual tips are stored in the educational material database. The portal resources are used for data exchange between the databases and various applications. The databases and the portal may reside at different platforms using an RDBMS system with network support (Microsoft SQL with ODBC/JDBC drivers).

2.3.2. The e-Vital system architecture

As depicted in Fig. 4, the e-Vital architecture consists of the following modules:

- The patient module, which includes:
  - the monitoring devices, which record, process and send the data at regular time intervals or at alarming situations, when the patient does not feel well, with or without patient intervention;
  - the mobile phone or personal digital assistant (PDA) application; the mobile phone application is software residing into a mobile phone; the application has two basic tasks: to manage the transmission of data to the server and to interact with the service management applications (residing at the e-Vital server) as requested by the protocol; more specifically, after having received the data from the monitoring device, the PDA application converts them to an XML file, compatible with the e-Vital database and connects to the e-Vital server; when the connection is established, the PDA application logs the patient to the server; if the login is successful the application sends the XML file with the measurements and gets the appropriate response from the server; otherwise, an error message is shown on the PDA's monitor; the use of XML technology improves modularity and standardizes the communication between the patient's module and the e-Vital server; the XML document helps to organize the received measurements in a way that is independent of the type of monitoring device and the format of their output;
  - the signal reception and transmission application; this application is necessary when devices communicate only their signals and not to a mobile phone or directly with a server; it also applies in home-based but not mobile monitoring scenarios; the role of the signal reception application is to substitute the specific software implemented by the manufacturer of the monitoring device, which is responsible for its communication with the PDA; the signal reception application is, by all means, device-oriented, and depends on the type of communication supported by the monitoring device; in any case, this application does not interfere to the data transmission to the e-Vital server; it acts as a transparent module.
- The hospital module consists of the hospital server and the hospital database system. The hospital module has been implemented independently to the e-Vital project. It already exists in the hospital or the private clinic that each pilot site cooperates with.

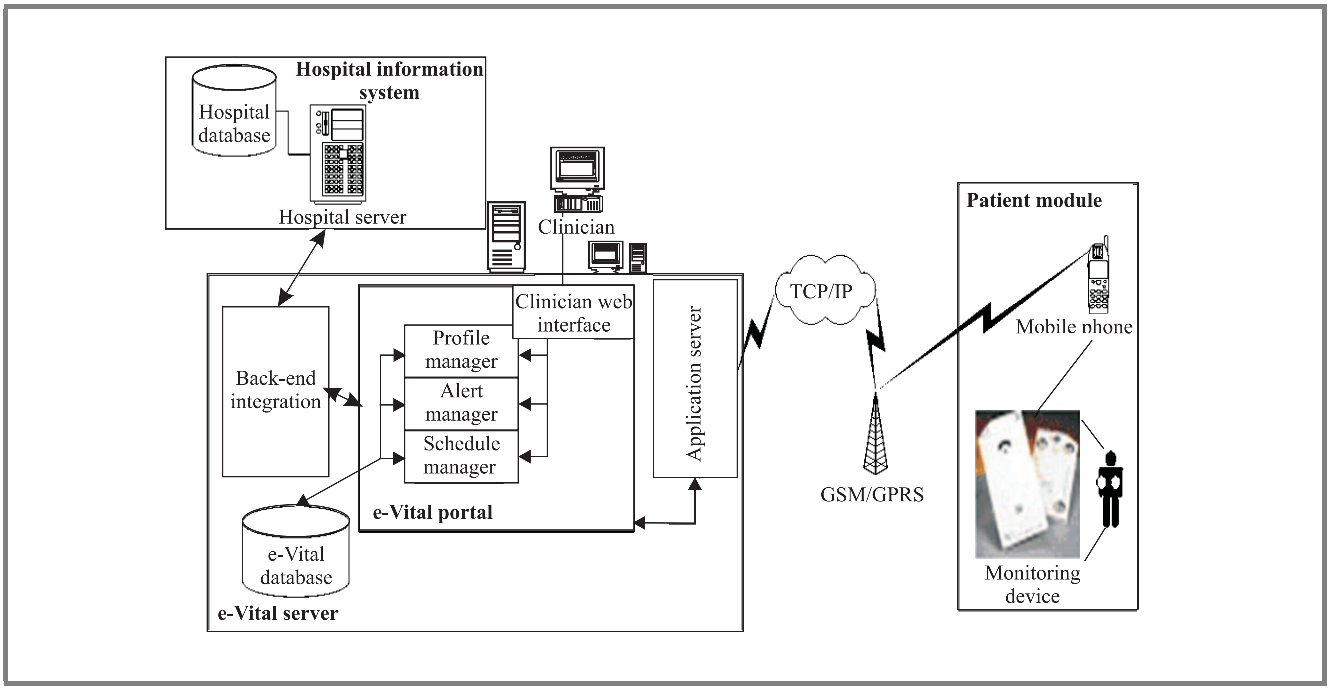

Fig. 4. The e-Vital system architecture.

- The e-Vital server is the core of the e-Vital service and holds the whole functionality of the service. The e-Vital server architecture is based on the PANACEIA-ITV back-end architecture. The e-Vital server consists of:

  – the application server which provides the communication links among the different participants of the e-Vital system (i.e., patient-clinicians), and controls and regulates the data flow among the technical components of the platform;

  – the e-Vital portal which is responsible for the aggregation of content and service modules, for providing multiple modality access to users, for front-end integration for linking to the e-Vital application server and back-end integration;

  – the back-end integration for links to the hospital information system, which access medical records and other data/knowledge repositories;

  – the multi agent system for providing additional intelligence and advanced functionality to the system and guaranteeing a high level of quality of services;

  – the database server which contains information about patients registered with e-Vital service, along with details about the services provided to each patient and the medical data transferred through the system to the contact centre.

3. Discussion

The proposed services provide both the patient population and doctors with complete mobile management of their diseases and a monitoring mechanism and management system that delivers benefits to patients, clinicians and payers. Some of the key features include:

Patient empowering. The services put patients in control of their own healthcare and support them in working with their clinical team. The technology is easy to use, and portable.

Real-time communications. The services will also provide a patient with confidence, knowing that their clinician is reviewing their data and can provide meaningful advice, based on quality data, when it is needed.

Clinical guidelines. The system can help operationalise clinical standards and guidelines so patients are managed in a consistent manner.

Better health outcomes and benefits to patients. Through a strong feedback loop that includes regular reporting, data analysis and clinical intervention, the network provides better compliance to care guidelines. The results are reduced complications, reduced costs, and better data for clinical intervention, research and policy development.

Patient awareness. It has been shown that better patient education and self-management on heart failure and other chronic diseases may increase the mean time to re-admission and decrease the number of days in hospital and the annual health care cost per patient [10].

Financial benefits. A British study indicated that about 15% of home visits could be replaced by telecare because of the absence of hands-on procedures (estimated as high as 45% in the USA) [11]. This implies that the utilisation of the services can significantly reduce the cost of treatment as it is expected that it reduce the number of home visits required for chronically ill patients.

The proposed systems take advantage of recent technological advances in computing, networking and mobile wireless telemedicine to provide an integrated platform for continuous patient monitoring. Further, both systems help patients to be informed about their clinical condition, participate actively, in close collaboration with their health care provider, to their on-going care, and respond to risk factors through lifestyle changes or other appropriate means. Thus, the proposed platforms enhance the effectiveness of health care and improve health standards and in the same time will help patient to continue to some normal and work activities in order to be an "active" citizen.

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References

[1] M. F. Collen, "Historical evolution of preventive medical informatics in the USA", *Meth. Inform. Med.*, vol. 39, no. 3, pp. 204–207, 2000.

[2] S. M. Borowitz and J. C. Wyatt, "The origin, content, and workload of e-mail consultations", *JAMA*, vol. 280, pp. 1321–1324, 1998.

[3] E. A. Balas and I. Iakovidis, "Distance technologies for patient monitoring", *BMJ*, vol. 319, no. 7220, pp. 1309–1311, 1999.

[4] E. Rosenblatt, "Telephone triage. A common sense approach", *RN*, vol. 64, no. 3, suppl., pp. 2–3, 2001.

[5] M. L. Stricklin, S. Jones, and S. A. Niles, "Home talk/healthy talk: improving patient's health status with telephone technology", *Home Healthc Nurse*, vol. 18, no. 1, pp. 53–61, 2000.

[6] J. C. Cherry, T. P. Moffatt, C. Rodriguez, and K. Dryden, "Diabetes disease management program for an indigent population empowered by telemedicine technology", *Diab. Technol. Therap.*, vol. 4, no. 6, pp. 783–791, 2002.

[7] e-Vital Technical Annex, e-Vital Project, Contract number C 27979 project, 2002.

[8] V. Koutkias, I. Chouvarda, and N. Maglaveras, "Agent-based monitoring and alert generation for a home care telemedicine system", in *Proc. AMIA Ann. Conf.*, Washington, USA, 2003.

[9] PANACEIA-iTV Technical Annex, Citizen Centered Health and Lifestyle Management via Interactive TV: The PANACEIA Health System – Contract number IST-2001-33369, 2001.

[10] C. M. J. Cline, B. Y. A. Israelsson, R. B. Willenheimer, K. Broms, and L. R. Erhardt, "Cost effective management programme for heart failure reduces hospitalisation", *Heart*, vol. 80, pp. 442–446, 1998.

[11] Delloite & Touche, "The emerging European health telematics industry", Market analysis. Health Information Society Technology based Industry Study – Reference C13 25533. On assignment of European Commission – Directorate General Information Society, 25/04/2000, Version 1.1.

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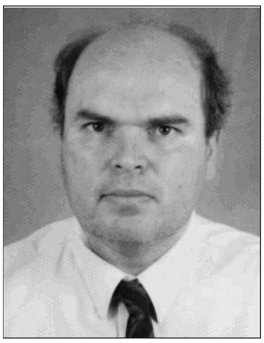

Nicos Maglaveras received the diploma in electrical engineering from the Aristotelian University of Thessaloniki, Greece, in 1982, and the Ph.D. and M.Sc. from Northwestern University, Evanston, USA, in 1988, and 1985, respectively, both in electrical engineering with emphasis in biomedical engineering. He is currently an Associate Professor in the Laboratory of Medical Informatics, Aristotelian University, Thessaloniki, Greece.

He has performed research and development in nonlinear biological systems simulation, cardiac electrophysiology, medical expert systems, ECG analysis, physiological mapping techniques, parallel processing, medical imaging, medical informatics, telematics and neural networks. He has also developed graduate and undergraduate courses in the areas of medical informatics, computer architecture and programming, biomedical signal processing and biological systems simulation. He has more than 120 publications in refereed international journals and conferences in the above areas. He has served as a reviewer in the CEC AIM technical reviews in the past, and in a number of international journals. He was one of the organisers of the MIE97 conference in Greece and he is the chairman of the Computers in Cardiology 2003 Conference. He has finally participated as scientific coordinator or core partner in national research projects, the Health Telematics, the Leonardo da Vinci, IST the TMR and the ESPRIT programmes of the CEC. Finally, he is the Vice Director of the two graduate programs which run at the Medical School of AUTH in medical informatics and medical research technology funded by the Greek ministry of education.

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Andriana Prentza – for biography, see this issue, p. 47.

Pantelis A. Angelidis – for biography, see this issue, p. 4.

Dimitris Koutsouris – for biography, see this issue, p. 25.