

# A content citizen health management system: a tele-health and tele-care prototype portal for the public

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**Abstract** The main inspiration for the implementation of the Content Citizen Health Management System (CCHMS) is to provide a daily, convenient and easily accessible collaborative supportive environment, which will concern social and personal health and welfare matters, to computer literate citizens and those who desire to use information technology. It is a fact that Health services involving prevention and wellness are changing significantly towards a more citizen-centered, home care notion why not also mobile services via WEB and WAP technologies. In other words, the CCHMS as a portal is fundamentally an integration of health content and services in a functional and intelligent WEB environment via the development of communication channels among citizens and the public and private organizations. The design and the development of the CCHMS are based on open source software and follow the appropriate HITSP [1] and ISO/TR 22221 [2] standards along with HON-code principles [3]. In particular, the CCHM system relies on the creation of a customized portal based on the philosophy of the Knowledge Management and Content Management System (CMS). The CMS supports the creation, management, distribution and the publication of corporate information, used to organize and facilitate the collaborative document creation,

and other types of content and powerful tools required to create the infrastructure upon which a dynamic website will be set up. The project's objective is to create a modern, inexpensive, widespread tool to support access to a healthy lifestyle, by means of monitoring and consulting citizens on issues of prevention, diagnosis, treatment, shared information and collaborative education. Also, the development of a voluntary professional health network enables citizens to improve personalized health-related management according to national and European policies.

**Keywords** Health informatics · Health promotion · Social care systems · Tele-health system · Portals · Content management system · Joomla

## 1 Introduction

### 1.1 The portal environment as a content management system

Health services are changing significantly, with the emphasis shifting from patient-centered towards citizen-centered, from hospital to home [4–10] and from treatment of acute and chronic diseases to prevention and wellness via WEB and WAP technologies [11–15].

Subsequently many systems like mobile communication network technology such as Bluetooth [16, 17], mobile communications [18–21] wireless application protocol [22], wireless local area networks [21, 23, 24] or ubiquitous network composed of wireless local area and cable television networks [15] serve as a platform for monitoring physiological signals.

Specifically a portal is fundamentally an integration of content and services in a web environment. It functions as a mean, which works at a higher abstract level, where the user

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is not required to specify too many details to find the information he requires in cases when he needs more functionality and intelligence.

At present from McCallum et. al. [25] who defines the portal as “an information gateway that often includes a search engine plus additional organization and content” we are led to more sophisticated forms of portals like news, information, e-mail, databases and entertainment.

Some services that are frequently found are member registration, personalization, a search engine, an email and forum, organization and an indexing of content, from internal or external sources [26].

## 1.2 Type of portals and their development options

The most prevalent taxonomies of portals are associated with,

1. Means of creation: one-way is an in-house development, a second way is an outsourcing development, and a third is a portal in a box development and an automatic construction [27].
2. Usage: According to a survey [28] the primary intellectual capital of an organization is depicted on the following three functions;
  - The development of knowledge base for organizing and indexing all the documents created by business people using e-mail, Web publishing and office applications.
  - A personalized portal page for integrating e-business services, Internet services and services related to enterprise applications.
  - It is also associated with the Collaboration among employees, partners and customers through a community forum.
3. The type of framework: under this classification is separated into horizontal portals (HoP), vertical portals (VeP) or portals, enterprise information portals and knowledge portals [27] which provide on-line collaboration via forum conversation, lists of announcements, workflows and users' interaction [29].

A horizontal portal is a public Web site that attempts to provide its users with all the services they might need. HoPs do not give the employees access to everything they really need on the Web. A VeP is a portal that delivers specific organization information in a user-centric way and requires confirmation for access [30]. Another context taxonomy characterizes portals as Personal, News, Government web, corporate web, Stock, Health & Medical Web, Search, Tender's, Hosted web and Domain-specific portals [31].

However, there are some different points of the enterprise portals analysis. Roberts-Witt recommends three types of

portals that from a data management perspective. These are Data, Information and Collaborative Portals [32].

At present, Knowledge portals (KwP), as single-point-access software systems, intend to provide knowledge management, which has emerged as a key tool for supporting knowledge work. A basic topic of knowledge management is capturing knowledge and expertise created by knowledge workers and making it available to a larger social group. Many portals intend to provide this topic as an expanding knowledge workplace that supports mobility, collaboration, and an increasingly automated project workflow [33].

## 2 The environment of CCHM system

We mainly articulate this portal as a combination of a Decision support and collaborative Processing portal with knowledge management and enterprise information support [29].

The environment of CCHM system addresses both healthy people and those monitored by a physician or a medical center. However, the system does not intend to replace official medical supervision, since its main aim is to enhance it with new and modern services.

It can also contribute to issues relating to support of public health and preventive medicine, providing useful information and knowledge on health issues, which concern the citizens in a quick, easy and low cost way.

Moreover, the system supports orientation and communication among either citizens and experts or health service providers with reliable and technologically modern means in order to integrate them in existing business procedures.

In addition, the system can assist the promotion of public and individual health of citizens by providing individual support for instance counseling and information services concerning health care. However, we can constantly modernize the proposed system and enriched with new modules.

The CCHMS design complies with a global vision of web metrics [34] and in particular follows ISO/IEC 9126 [35–37], COM (2002) [38], HITSP [1] and ISO/TR 22221 [2] standards along with HONcode principles [39].

Particularly we must declare the principles that follow the proposed system:

*Compatible to the renowned Database Management Systems:* Database technology is essential for the development and maintenance of a portal's content. The usage of a database within a portal is to support the user's profiles, registration and authentication services. It can also support data mining and information extraction.

*Data integrity features:* Any change that occurs is not only audited in the database but it is also verifiable.

*Maintainability features:* The main advantage of developing a system in a web environment that is managed by the server, frees the user from management responsibilities and access can be gained from anywhere anytime with minimum software and hardware. Specifically, it only requires a personal computer and an Internet connection.

This flexible availability of the application and its immediate availability of new versions of web-based applications eliminate any problems related to distribution, management and maintenance.

Where as when an application functions in a stand-alone environment, the overall management of facility operations, the maintenance, and the upgrading of the system with new versions are totally the responsibility of the user. Therefore, it has high operating costs, which refer to not only installation but also to upgrading and maintenance costs.

This often leads to deficient maintenance and operation of the system with inappropriate versions that remain in operation for long periods that consists the modernization of the system impossible.

Finally, the function in a web-based environment consist the system capable of operating without the need of any additional software or equipment.

*Open architecture features:* The term open architecture and open standards mean that the requirements and all the parts of a system are fully documented and publicly available.

A fact, that ensures the transmission system scalability, interoperability and exchangeability of data with other systems.

The open source applications may change and evolve based on the needs of each user providing flexibility.

We have developed the present system using the Joomla CMS as GNU/GPL software, which is an open source system. In addition, the Joomla CMS supports Java language and J2EE technology, which is an open architecture, based on open standards [40].

The implementation of the CCHM system, developed in a Joomla environment has ensured a participating and well-organized constructive process in developing the content based on four categories of users.

This introduces a vital improvement in the current model of health and welfare services that will finally benefit the recipient and user of these services that is potentially every citizen or association.

Furthermore, this fact makes the citizen a partner modulator of the knowledge, the ontological and the technical framework of this awareness, in the domain of medicine, nursing, general health care and welfare.

*Scalability features:* Scalability provides the opportunity to add new or existing modified features without this revision influencing all the other parts of the system neither its operation.

In other words, the system remains stable while continuous modernizations and improvements are taking place. Thus while maintaining the scalability features and adaptation of the system; we secure additional potential interaction between the modules of the system.

*Central management features:* The central management assisted by the server and the Internet ensures the users with timely and accurate notification and general knowledge with continuous renewal and adaptation of the system's content by the developers and the system administrators. Therefore, releases the user from the above responsibilities.

*Searching features:* The portal gives the option to a user to search, select, and aggregate the appropriate results into one page.

*Multilanguage features:* A major advantage of the system is its ability to operate in multiple languages through JoomFish. The language choice is implemented both at presentation and during the application level.

The incorporation of a new language in CCHMS is technically a simple process and this is an important advantage.

*Personalization features:* Personalization is the adaptation of the system to a specific user according to his personal data or to other characteristics that the system has predefined and recognized.

The CCHM system provides a highly personalized environment. Therefore, the users, depending on the category to which they belong to, have different rights and can interact, browse and influence the system in different ways (Fig. 1).

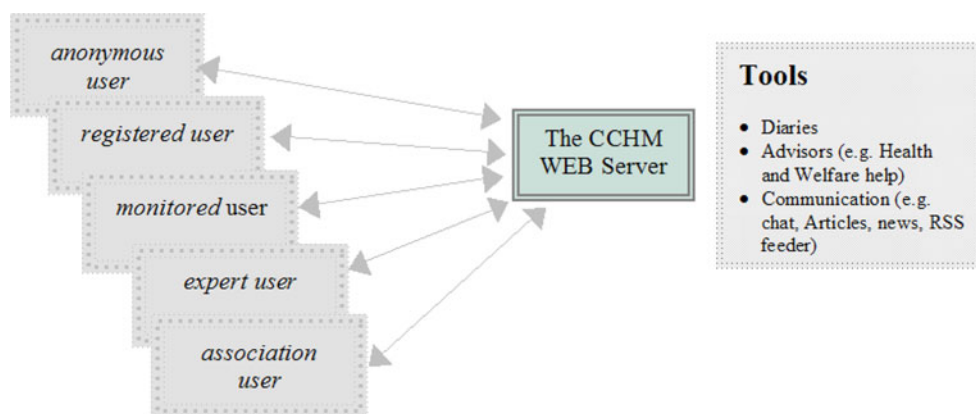
The first level involves the *anonymous* user who has fewer rights and who can only get information on topics that interest him.

The second level involves the *registered* user who can interact with the system in a unique way. He can also have his own area on the website and his own data store, separate from the others.

Another type of a user is the monitored one whose main feature is that the system can provide personalized services on preventive medicine, counseling and support on everyday social hygiene and personal health care matters as he has his personal EHR according to HITSP standards [41].

For instance, it provides counseling on matters such as nutrition, exercise or on implementing a program concerning a home care plan such as medication,

**Fig. 1** The CCHM system web architecture



physical check-ups, and monitoring bio-signals and keeping a health diary, etc.

The system is capable of interacting with the user in order to provide him with information concerning the user, based on the input of data directly from him and the instruments and the monitors. On the other hand, the system is able to transmit signals to the appropriate user in the form of alerts, e-mails, voice mails, etc.

An additional user type named is particularly interesting; the *expert* who acquires shared responsibility to specific domain information for enhancement depending on the area he states and he specializes in.

Once the system certifies the user he can gain access to it and he acquires additional rights like to post useful and specialized data in his domain in the form of general articles, studies, research, counseling, guidelines and care plans.

Finally, the last user type; *association* offers the opportunity to private and public health care providers to be present and interact with the audience in a modern, self-motivated and flexible required mechanism in the form they desire, offering them the possibility of adaptation. Depending on their ever-changing business needs.

They also learn about issues that concern them in order to promote business policies and actions and to interact through multiple and modern forms of communication with service users providing services and information.

All individuals or group profiles of the system take into account either the personal or the professional information of the user or entity, plus the procedures related to the specific case.

In addition, the users can create common issues to inform or to be informed. He can also have discussions; invite other users, experts or organizations involved in these matters either to solve problems, formulate an opinion, or simply to exchange views.

In order to clarify the options provided by CCHM system below we describe the use cases for each user

involved. The following section describes in detail the use cases (scripts) of the user groups, as defined in the CCHM system (Table 1). The specifications are under an ongoing implementation and may be changed in the future.

*Integration features:* Some major issues which the builder of a portal needs to be aware of are permanent availability, up to date content of the portal, intellectual property of the content of the portal [42], security, privacy, different user levels with access to different functionality, and how to apply the security and privacy constraints at each level [28, 43].

We can design the portal from scratch to provide services and data that are specifically constructed for it. Alternatively, we can conceive it as a platform for integrating existing systems and data sources. In the latter case, some major issues in the portal construction complicate the task considerably. These issues are heterogeneity and interoperability, or more generally, system integration. On the other hand building a portal facilitates the system integration [44, 45].

*Security features:* As for sensitive personal health data, potential users will be advised to use a nickname to access the Portal. The pseudonymity ensures the unconditional security of the personal information carried over the Internet.

Nevertheless, this does not rule out the possibility of a citizen to disclose his identity to the expert on a more personal base. In fact, the main policy of the portal includes an optional identity process through immediate contact (patient visit, telephone etc.) between expert and user.

However, according to personal data protection directive, this information will not be included in the CCHMS portal and will not be handled over Internet.

Lowrance W. [46] defines key-coding or pseudonymised as the technique of separating personally identifying data from substantive data but maintaining a

**Table 1** Use cases (scripts) of the user groups of CCHM system

Types of users Modules of CCHM system	Anonymous user	Registered user	Monitored user	Expert user	Association user	System administrator
<b>Information Module</b>						
Sub-section: Library posts on Health subjects						
Informed on health issues (in the modules has expressed interest)	–	X	X	X	X	–
Posts new health issues (in the modules has expressed interest)	–	–	–	X	X	–
Edit add delete records of his list (owner)	–	–	–	X	X	–
Gives/negates permissions for his/her records to other users	–	–	–	X	X	–
Edit add delete records of the list	–	–	–	–	–	X
Full view of any record	–	–	–	–	–	X
Sub-section:-Search content in all or per module						
Search	X	X	X	X	X	X
<b>HealthCare Forum Module</b>						
Sub-section: - Personal blog of the registered user (specific fields)						
Development—maintenance of the personal blog (for registered user)	–	X	–	–	–	–
Sub-section: - Personal blog of the monitored user (specific fields)						
Development—maintenance of the personal blog (for monitored user)	–	–	X	–	–	–
Sub-section: - Personal blog of the expert user (specific fields)						
Development—maintenance of the blog (for expert user)	–	–	–	X	–	–
Sub-section: - Personal blog of the association user (specific fields)						
Development—maintenance of the blog (for association user)	–	–	–	–	X	–
Sub-section: - users' communication						
Shared or private conversations using tools like	–	X	X	–	–	–
-Yahoo messenger						
-MSN messenger						
-skype						
-audio streaming						
-e_mail						
Sub-section:-Discussions—deployments topics concerning the citizens						
Creation of common topic of conversation	–	–	X	X	–	–
Join the discussion	–	X	X	X	–	–
Display topics discussed	X	X	X	X	X	X
Delete discussions by the creator	–	–	X	X	–	X
Sub-section:-Contact for information from experts or associations by using:						
-Yahoo messenger						
-MSN messenger						
-SKYPE						
-audio streaming						
-e_mail						
The registered or monitored user submits the question via text message or e-mail. When the expert or association enters the system then overlooks the question.	–	X	X	X	X	–
The response from this particular expert or association to the registered or monitored user who submit questions via email, audio or image file. Positioned on the home page and seeing just the specified user entering the system.	–	X	X	X	X	–
Sub-section: -Associations and experts posts in health care and public health policies						
Suspensions for workshops, conferences etc.	–	–	–	X	X	–
Update for conferences workshops, etc. depending on the profile of the user (in the section of interest)	–	–	–	X	X	–
Edit add delete records of the list	–	–	–	–	–	X



**Table 1** (continued)

Types of users Modules of CCHM system	Anonymous user	Registered user	Monitored user	Expert user	Association user	System administrator
Full view of any record	–	–	–	–	–	X
Posts to health issues (Key issues, health policies, important links)	–	–	–	X	X	–
Information on health issues (in the section of interest)	–	X	X	X	X	–
Full view of any record	–	–	–	–	–	X
Sub-section: - Search content in all or per module						
Search	X	X	X	X	X	X
HealthCare Journal Module						
Sub-section: - News						
News and hot topics in health.						
Entry of text, directives, links on newspapers or other websites, implants etc. in relation to extraordinary events (epidemics, disasters, etc.)	–	–	–	X	X	X
Facebook module encapsulation	–	–	–	X	X	X
Google module encapsulation	–	–	–	X	X	X
Newsflash module encapsulation	–	–	–	X	X	X
Entry announcements, meetings, seminars, conferences, newsletters, ads, etc. (According to policy the CCHMS)	–	–	–	X	X	X
Entry of a Stream Radio	–	–	–	X	X	X
Entry of a Video emission	–	–	–	X	X	X
Display of text, directives, links on newspapers or other websites, implants etc. in relation to extraordinary events (epidemics, disasters, etc.)	X	X	X	X	X	X
Facebook module view	X	X	X	X	X	X
Google module view	X	X	X	X	X	X
Newsflash module view	X	X	X	X	X	X
Display of announcements, meetings, seminars, conferences, newsletters, ads, etc. (According to the CCHMS policy).	X	X	X	X	X	X
Stream Radio view	X	X	X	X	X	X
Video emission view	X	X	X	X	X	X
Sub-section: - Announcements						
Add RSS	–	–	–	X	X	–
Display RSS	X	X	X	X	X	X
Users communications ie user announcements of emergencies health issues, ads (According to the CCHMS policy).	–	X	X	X	X	–
Sub-section: Useful links						
Creation of links	–	–	–	X	X	X
Links view	–	X	X	X	X	X
Sub-section:-Search content in all or per module						
Search	X	X	X	X	X	X
Health Support System Management Module						
Sub-section: - Personal information for registered users						
New member registration	X	–	–	–	–	–
Login process	–	X	–	–	–	–
Forgotten password	–	X	–	–	–	–
Access to profile	–	X	–	–	–	–
Edit profile	–	X	–	–	–	–
Edit Photo	–	X	–	–	–	–
View Profile	–	X	–	–	–	–
Registered users' Management	–	–	–	–	–	X
Management of the registered user profile elements	–	–	–	–	–	X
View the published texts or whatever (other material like video, audio file etc.) of the registered user.	–	–	–	X	X	X

**Table 1** (continued)

Types of users Modules of CCHM system	Anonymous user	Registered user	Monitored user	Expert user	Association user	System administrator
View is also permitted to experts or associations authorized by registered user.						
View personal information of registered users on tables, searchable by predefined searching keys	–	–	–	–	–	X
Sub-section: - Personal information for monitored users						
New member registration	X	X	–	–	–	–
Login process	–	–	X	–	–	–
Forgotten password	–	–	X	–	–	–
Access to profile	–	–	X	–	–	–
Edit profile	–	–	X	–	–	–
Edit Photo	–	–	X	–	–	–
View Profile	–	–	X	X	X	–
This possibility is given to experts and associations to whom the monitored user has given access.						
Monitored users' Management	–	–	–	–	–	X
Management tab of the monitored user profile. This possibility is also given to experts to whom the monitored user has given access.	–	–	–	X	–	X
View the published files. View is also permitted to experts or associations authorized by the monitored user.	–	–	–	X	X	X
View personal data in the table. It is possible to search based on the Unity of the monitored user asked to join. Access is also permitted to experts or associations authorized by the monitored user.	–	–	–	X	X	X
Sub-section:-Experts' professional data & information						
New member registration as an expert user	X	–	–	–	–	–
Login process	–	–	–	X	–	–
Forgotten password	–	–	–	X	–	–
Access to profile	–	–	–	X	–	–
Edit profile	–	–	–	X	–	–
Edit Photo	–	–	–	X	–	–
View Profile	–	X	X	X	X	X
Expert users' Management	–	–	–	–	–	X
Management tab of the expert profile	–	–	–	–	–	X
View published material	–	X	X	X	X	X
View is permitted to specific users as it has been defined by the expert user.						
View a list of the experts data. It is possible to search based on the Section the expert requested to join .	–	–	–	–	–	X
Sub-section:-Associations data & information						
New member registration as an association user	X	–	–	–	–	–
Login process	–	–	–	–	X	–
Forgotten password	–	–	–	–	X	–
Access to profile	–	–	–	–	X	–
Edit profile	–	–	–	–	X	–
Edit Photo	–	–	–	–	X	–
View Profile	–	X	X	X	X	X
Association users' Management	–	–	–	–	–	X
Management tab of the association profile	–	–	–	–	–	X
View of published material.	–	X	X	X	X	X
View is permitted to specific users as this has been defined by association user.						
View a list of the associations data. It is possible to search based on the Section the association requested to join.	–	–	–	–	–	X
Sub-section: Health Monitoring/Alerts						
Exchanging private messages	–	–	X	X	X	–

**Table 1** (continued)

Types of users Modules of CCHM system	Anonymous user	Registered user	Monitored user	Expert user	Association user	System administrator
The creation of an alert system (such as a calendar for periodical examinations, a reminder for medications, etc.)	–	–	X	–	–	–
Sending messages from the system using the system of reminders	–	–	X	–	–	–
Sub-section: expert health care support system (EHCSS)						
The creation/management of intelligent health monitoring case_based subsystems (guidelenes, home care plans, etc.) according to his/her interest	–	–	–	X	–	–
View of intelligent health monitoring case_based subsystems (guidelenes, home care plans, etc.)	–	–	–	X	X	X
View a list of the expert system data.	–	–	X	X	X	X
Creation of charts of his/her/its interest	–	–	–	X	X	–
Creation of statistics data of his/her/its interest as autonomus information	–	–	–	X	X	–
Data views via charts	–	X	X	X	X	–
View of statistics data as autonomus information	–	X	X	X	X	X
Sub-section—Search content						
Search content in all or by subsection (the criteria options are adaptive to the user type)	–	X	X	X	X	X

(X=Authorized, - =Not authorized)

potential link by assigning an arbitrary code number to each data–identifier pair before splitting them.

Held securely and separately, the key allows re-associating the substantive data with the identifiers, under specified conditions, if that is ever necessary. Consequently, the experts may use these data in crucial matters (e.g. dispatching an ambulance to the patient's home, etc.).

Hence, TRCP operates as an intermediary between the provider and the recipient of health services.

All data, as a Clinical Data Warehouse (CDW), managed by the TRCP is either kept or it's accessible for secondary use purposes in accordance with ISO/TR 22221 business rules and mechanisms previously set by Technical Committee ISO/TC 215 [2].

By definition, Joomla-based CMS implements a Role-Based Access Control and Client Input Filters patterns. It validates the user input and strips any suspicious content with helper functions before saving new user accounts to the system. This is implemented quite similarly and it has predefined roles with predefined permissions [47].

It is however a major issue that, unless someone uses SSL, when a user logs into a Joomla-based CMS sending his password in plain text across the network. A malicious user could take advantage of this vulnerability and can has access to the back-end.

Canavan T. published a book that includes security issues of Joomla based CMS [48]. The book starts out

with the most basic of considerations such as choosing the right hosting sites, and then moves into securing the Joomla! site and servers. He proposes the suitable methods to prevent CSRF, Buffer Overflows, Blind SQL Injection, Denial of Service, and others attacks. This is a security handbook for Joomla! sites, but also for other CMS's, since it covers wider, server-related topics.

The key factor in implementation of security in CMS is well educated personnel who maintains it, regular maintenance, installation of patches, log monitoring and risk analysis according to ISO guidelines [49].

Therefore, the administrator in order make the portal more secure and to protect it from malicious attacks has to do some tasks (e.g. to change the name of the tables in the database to avoid SQL injection, to add code that defines the requests that the site can accept every minute, to avoid attacks Denial Of Service, to change the rights of files, to create a new super administrator with another user name and a strong password, to configure some files adding techniques which enhance the security of the portal, etc.).

Also, in order to enhance the security, some additional Modules and components (jFire Wall Lite Component, jSecure Authentication, JoomlaPack Component and Redirect Failed Login) may be installed.

Especially, for the security of CCHMS portal we also used the *Encryption Component*. This plugin is an alternative solution to SSL. It uses RSA to encrypt



passwords or any other data in the component.

When the Encryption component is installed every time a user tries to login to Joomla (client or admin side) the password will be encrypted on the web browser before it is submitted to the server, where it will be decrypted. Passwords are also encrypted when an administrator changes a user's password, when a user registers and when a registered user changes his own password [50].

The implementation of other signing and cryptographic methods like SSL is considered a future work.

### 3 Description of the CCHM System

The implementation of CCHM System is based on the Model View Controller architectural design applications. We built the whole system using the PHP for managing and the HTML for presentation.

The contents of the site via photos, articles of the site and many more, are stored in a database. When a guest selects a link from the menu on the website, the desired data are retrieved from the exact database and displayed in the front end. However, before they are displayed to the user, different components and modules are applied to filter them so that only the requested information is viewed.

Once the above process is completed and even before the information reaches the user, we select and apply a template to give the content a universal style and an attractive appearance. The template however establishes the whole plan and the structure of the site, because it contains the display location of all modules on the website.

In Health Support System Management Module we used as an example the related ontologies for food [51] and the suitable diet for diabetics [52]. Through JDBC and Protégé we imported the related owl project to MySQL database. Finally, we used the above to construct SQL queries and through PHP and XML the advisory diet system for diabetics.

#### 3.1 The architecture of the system

##### 3.1.1 Operating features

The voluntary research and work of the CCHMS project carried out by the Technological Research Center of Peloponnesus (TRCP).

The participation of experts and associations is voluntary and free of charge. Therefore, the services provided will also be free.

Due to the fact that CCHMS operates like a medium it does not arise any legal or moral responsibilities in connection with the services provided. Since every potential user will be informed of the above matter.

Furthermore, the services offered by the CCHMS do not substitute the personal physician or the official health services. The CCHMS just support them further in an official either un-official way. Besides the support provided in health issues is voluntary and free.

Also, the services offered are not formally associated with public or private health system as well as paid assignments and contributions.

However, we must stress that the certified identities (experts and associations) are held responsible for any legal or moral matters.

All professionals who participate voluntarily have certified identification from the TRCP. With the implementation of the proposed system, anyone will achieve a rational, easy and quick procedure of writing with the ability to renew the content permanently without necessarily being technically literate or skilled in information technology.

It also provides the possibility of continuous development and evolution of the system depending on the authorized users.

Additionally to the contribution of the proposed system to provide information and support on health issues to citizens it can also contribute positively to support the business goals of a private or public entity by streamlining services that can respond adequately to emerging needs of our new social environment.

This is achieved by creating new channels of communication with the citizens and the customer services in a modern, simple, flexible, cheap and fast way by using the existing technological capabilities, like recorded video, RSS, links, messengers, Skype, etc.

##### 3.1.2 Functional features

As we found in Wikipedia [53] Health 3.0 is a health-related extension of the concept of Web 3.0 whereby the users interface with the data and information available on the web is personalized to optimize their experience [54].

Health 3.0 has the goal of increasing patient self-management, preventative care and enhancing health professional expertise [55, 56]. It will foster the creation and maintenance of supportive virtual communities within which individuals can help one another understand, cope with, and manage common health-related issues [56]. In addition, consumers and experts are going to be connected by virtual reasoning tools—an expert system [57].

Personalized social networking resources can also serve as a medium for health professionals to improve individuals' access to healthcare expertise, and to facilitate health professional-to-many-patients communication with the goal of improved acceptance, understanding and adherence to best therapeutic options [56]. Consequently, the society progresses from Patient 2.0 [58] to Patient 3.0 Empowerment or more precisely to Citizen 3.0 Empowerment.

Considering all the above mentioned, the content of the CCHM system is organized into separate sections, which can be divided into four major categories:

These are the static and dynamic information section, the communication section named as forum, the update section named as journal and the health support system section.

We have described the content and the key features of these modules in the subsequent paragraphs (Fig. 2).

**Information module** The system provides static information related to the procedures and daily practices of care for either healthy or other various categories of long-term patients and home care plans. It also provides additional information about health related issues and preventive care in the form of updating using static pages.

We have also taken into consideration the rational need to share files in order to preserve resources while achieving the best organization, since some certain pieces of information are common. Thus we ought to point out that only a specific category of users have the authorization for posts in this section particularly those who belong to specific groups of experts or associations. This ensures the major reliability and validity of the content section.

**HealthCare forum module** An objective in designing the system is to develop a collaborative environment for its users. At this point, therefore an authorized user or association can create his own web server publications, which are of his interest like a blog. He is also able to start a private individual or a public meeting regarding a particular issue or problem that interests him or any other health issue. During a conversation, users are able to exchange messages and upload files.

Moreover, every authorized user is able to communicate with experts and stakeholders to seek information and answers to health related issues.

As long as these experts or association users support the CCHM system, they are able to provide news services,

information services and automatically scheduled appointments with the monitored users through this section, qualities that are achieved through the use of modern means such as mails, video, messengers, Skype, etc.

So as an example if an appropriate user requests a piece of information from an organization it will respond with a mail or a voice mail or it will refer him to a related video or to another link.

This module, as opposed to Information and Healthcare Journal Modules, is not intended to provide reliable scientific information. This section has the priority to encourage and develop friendly and supportive bonds between its members as well as to share ideas and common experiences in health.

**HealthCare journal module** In this section, the experts and associations can post announcements about meetings, conferences, public health issues and applied public and private health policies.

Therefore, everyone will browse these posts but only the authors as authorized users may renew the contents. In addition, the owners of their own region can approve or decline permission to other users to modify or delete their own content area.

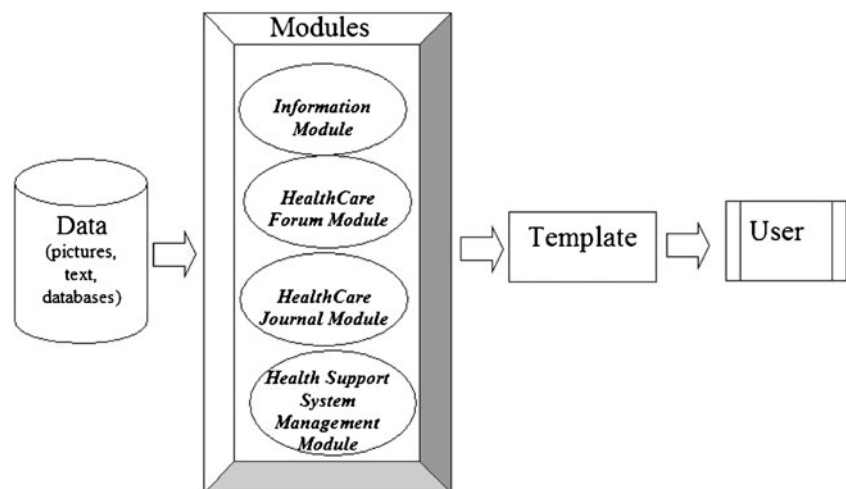
The subsystem is equipped with components such as an RSS feeder, and an email notification subsystem. The communication unit distributes news using RSS feeders and alerts and sends mails to specific user groups.

For example, in case something happens in relation to a specific area, such as an extreme natural phenomenon the citizens of the region will be informed directly via e-mails and alarms.

In a different case, which may involve an epidemic, pandemic or endemic disease the most vulnerable population group will be informed and provided with guidance concerning the specific disease.

Additionally, this framework would send physicians, nurses or other qualified personnel with relative instructions

**Fig. 2** The structure of the portal



where needed. They can use warnings like e-mails either alerts to convey urgent messages directly to users using a standard e-mail server. For this service, the user needs only a valid e-mail address.

*Health support system management module* Using the capabilities of this subsystem with the establishment of collective or individual notifications, the authorized user can be informed and plan activities related to health and daily care.

This subsystem can provide ways to schedule the surveillance and analysis on general health issues and hygiene such as exercise medication and nutrition related problems like dieting, bulimia, anorexia, psychological problems like stress management, etc.

The subsystem can guide the user indicating the next steps through special alerts and reminders. Daily activities and events can be contained in the user's personalized adapted environment.

This section includes suggested tests, reminders and any financial information related service charges.

More specifically, in order for someone to gain, individual support and health information concerning him, he should not only be an authorized user of these services but he should also be registered as a monitored user. Therefore, each monitored user will have obtained his Personal Electronic Health Record (P\_EHR) in the CCHS database system and he will have the individual support according to pre-defined standards. These standards are in the database and function as a middleware to the front-end environment using XML (Fig. 3).

After his personal enrollment in the appropriate category of monitoring, it is clear that the user can have a nickname when registering in the system because the system is supportive to the user and not an official report for paid assignments or public provision.

Moreover, it is clear that such a service does not replace any medical or nursing practice but only supports it. This domain includes services such as keeping a diary, which complies with a testing program or specific medications, etc.

The relevant data is stored and retrieved according to the individual user's information. In addition, the system monitors every individual care plan exchanging notes concerning his necessary treatment and recovery time, etc.

We are also recording and taking into account all the requirements, needs and issues for data analysis, depending on the stage of each procedure, used.

### 3.1.3 Technical features

The CCHM system that is proposed has been implemented as a web-based application based on open source technologies. It supports a modular development and is implemented by using a J2EE (Java 2 Enterprise Edition) platform.

This is a standard platform for extended, reliable and safe development and implementation of distributing applications.

In particular, the system relies on the creation of a custom portal with the philosophy of Content Management Systems (CMS). The CMS supports the creation, the management, the distribution and the publication of corporate information.

We will use it to organize and service collaborative document creation and other types of content and powerful tools for creating the infrastructure upon which a dynamic website is set up.

The Joomla CMS, which is free software (released under the GNU/GPL) and very popular for Web Content Management since it was designed for managing a website at all stages of its life, was chosen to implement the CCHM system.

According to a survey [59] the Joomla environment is the most popular and the most widely used.

In thorough, the CCHMS application is written in PHP and uses MySQL as a database.

There are important and valuable benefits when using a Joomla developing environment. Initially the use of a CSS (Cascading Style Sheets) allows the separation of content from the web design department.

In addition, it includes features such as caching of pages to improve the response, RSS Feeds, News management, blogs, search, multilingual website via JoomFish, while supported by a large community of users who contribute both bug reports, and extensions. The modular development allows easy integration of extensions, which give a new functionality quality to Joomla.

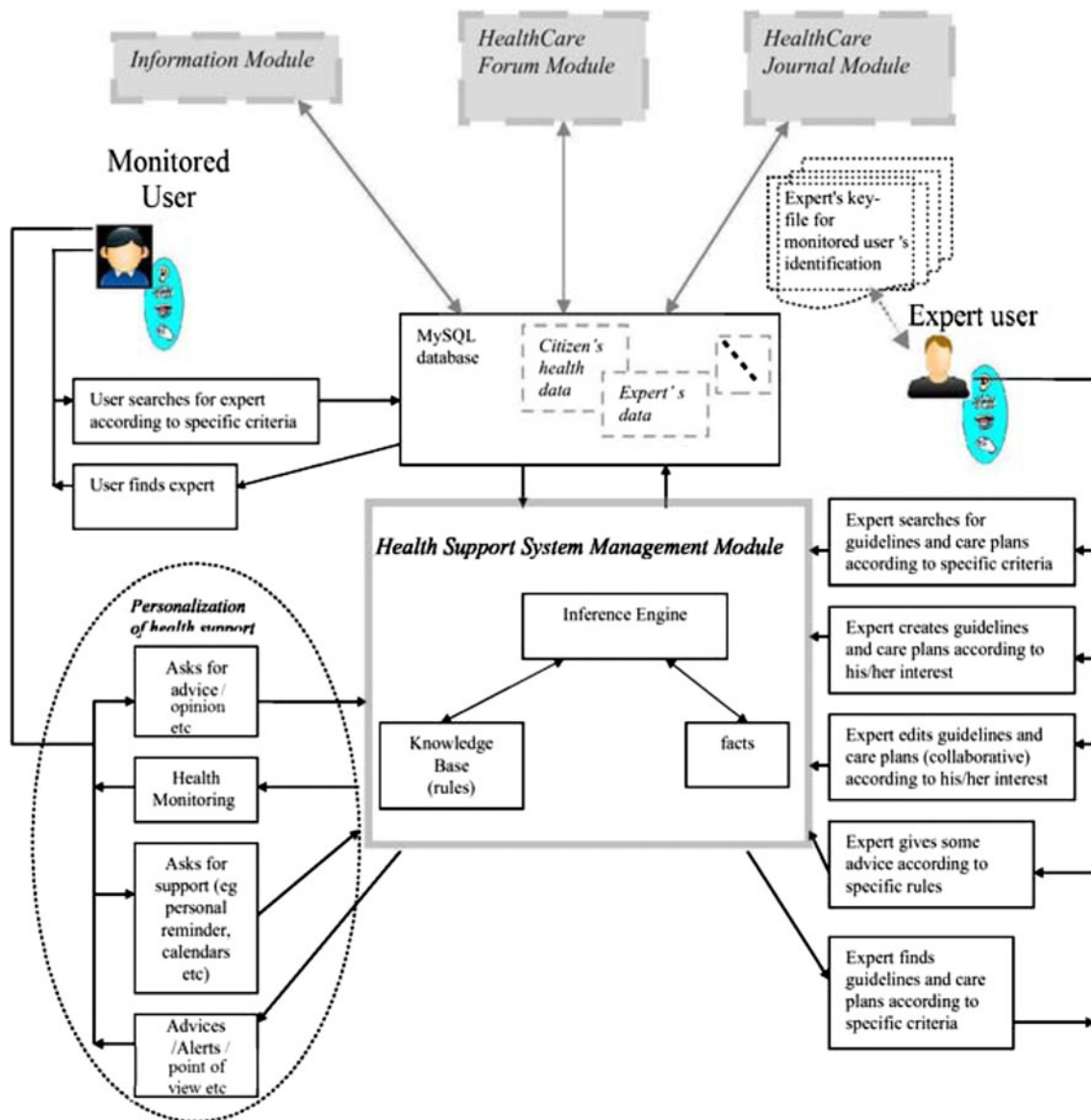
Specifically the Health Support System Management Module is an on going creation.

## 4 Evaluation system

The portal is under a pilot implementation. Thus, a continuous study and evaluation of characteristics demand continuous changes and a further development in connection with the structure and functions of the CCHM System.

In order to validate the system we used an evaluation framework as a guideline (Table 2) based on the work of Slack and the HONcode guidelines which Bomba D. and Land T. proposed [60].

We have modified some items because we used them in a premature phase. For this reason, we did not quantify the results of the assessment because at this stage the evaluation acts as a mean to guide the priorities given to complete the project rather than evaluate its final score. The research team applying the Delphi method [61, 62] assessed the characteristics of the system based on the above guideline. Therefore,



**Fig. 3** The architectural scheme of the health support system management module concerning monitored user. this scheme does not include any registration or validation process

we have received the required information and results in order to integrate them into the existing system and provide advanced services of the portal to the public. Whereas other features are either underway to integrate the existing system and others are under evaluation.

## 5 Related work

The most significant fact is that European researchers have developed a computer system designed to give health care professionals access to a broader range of medical information. The EU-funded Doc@Hand project [63, 64] was put

forward to improve coordination among health professionals by improving their information access. Their aim was to ‘push’ information to health professionals in order to make decisions about patients’ healthcare, rather than expecting those professionals to ‘pull’ out all the relevant data [65].

Also many Governments [66, 67], Universities [68, 69], Institutions [70] and private firms have developed portals in order to preserve, promote, and improve the health and well being of the populations, communities, and individuals. To fulfill this mission, they foster collaborations among public health and the health professions in education, research, and services [71]. These portals are a virtual entrance to

**Table 2** First evaluation of the structure and functions of the CCHMS portal [1–3, 60]

Guidelines	Operationalised sub-items			
		YES	NO	Under evaluation– or-on progress
1. Easy to use	The user able to navigate through the site without problems (i.e. 2–3 clicks to get to desired information)	X		
	Each page useable (i.e. no broken links, images load, no pop-ups)	X		
	The site uses a classification system or categories information into topics	X		
	There is a static frame with key links displayed (i.e. a consistent left, top or bottom bar providing links throughout the site, e.g. home button)	X		
	The site is available in a number of languages	X		
	The language is used understandable (i.e. medical terms simplified to layman's terms)	X		
	A sitemap is link available			Under evaluation
	There is some online user support/help available			On progress
	Are used drop down menus	X		
	The site buttons are clear and visible	X		
	There is a site search function available	X		
2. Immediate benefit to user	The user can finds what they are looking for in less than 4 clicks		X	
	The information is provided on the site up-to-date and regularly reviewed (every 3–4 weeks) and this is stated			Under evaluation
3. Medically sound	There is a Frequently Asked Questions (FAQs) section			On progress
	The (medical) credentials of the content providers and developers are visible			On progress
	There is a statement about how information is evaluated (i.e. is there an approval process)			Under evaluation
4. Confidentiality	There are staff or a senior authority person named as responsible for overview of all articles			Under evaluation
	The organization or content provider is recognizable to the user (e.g. AMA)	X		
	Even if medical credentials are displayed, there is a disclaimer notice on the homepage	X		
	If a non-medically qualified person provides information, this is stated on the site	X		
	The site asks for personal details	X		
	If information is collected is there is a privacy statement or disclosure policy visible			On progress
5. Fast and reliable	Is used any type of encryption	X		
	A user can logon just as a guest to use discussion boards or join a chat session	X		
	A user can edits their own information held by the site	X		
6. Patient in charge	The site indicates the location of the site server plus any mirror sites and the respective privacy laws that apply to that jurisdiction	X		
	It takes less than 3 s to download the homepage and other links			Under evaluation
	Large graphic files are avoided			Under evaluation
	The portal loads correctly every time	X		
7. Interactive	The patient is the primary target of this site	X		
	The user maintains control while navigating the site	X		
	The user always can find home	X		
	The user can get on-line help from the site			On progress
	The user can personalize the website presentation style (e.g. language options)	X		
8. Readily available	The user can does more than just read text on the site	X		
	There are various levels of information delivery (i.e. text, graphics, sound, video, discussion boards, on-line chat forums, patient tools, quiz, etc.)	X		
	The user is required to input some information	X		
	There is a function to allow for user feedback about the site			On progress
8. Readily available	There are some on-line health tests or tools for users (e.g. BMI)			On progress
	The site allow for the user to ask questions or state their opinion			On progress
	The system is available 24 h a day 7 days a week			On progress
8. Readily available	The URL is accessible			On progress
				Under evaluation



**Table 2** (continued)

Guidelines	Operationalised sub-items			
		YES	NO	Under evaluation– or-on progress
9. Subject to formal study	The site is fully open to public scrutiny and evaluation (i.e. no registration, logins, passwords or closed sections requiring fees to access additional features and information)			
	The site indicates how it is judged and accredited			Under evaluation
	The site is associated with some major national academic institution or medical organization	X		
10. Justifiability	Each topic or article has cross-referencing links to other published research results and further supporting articles	X		
	There is balanced presentation of any evidence relating to treatments, products or services (i.e. advantages and disadvantages/side-effects)			Under evaluation
11. Attribution	The content partners for this site are visible/declared (i.e. when clicking on a link that takes you to another site or information on the site itself)	X		
	The content sources are clearly referenced			
	There is a date visible for a clinical page and when it is last updated	X		
12. Complementary	The external sources are evaluated			On progress
	The patients are encouraged to contact a health professional if they are concerning about a health issue			On progress
	There is a contact information for doctors, hospitals and other allied health professionals			On progress
	Patients can consult an online doctor or nurse on the site			Under evaluation
13. Advertising and editorial policy	The information matches that available from other health professional and sources (e.g. books, journals, doctor's advice)			Under evaluation
	There is a visible policy statement about advertising (e.g. banners, logos, products) on the site			On progress
	There is information about who is on the editorial board and their contact details			On progress
	If there is advertising, the advertising is material separate from research/medical content material			On progress
	The contact details (e.g. email, address, phone number) for the site owners and designers are displayed	X		
14. Transparency on authorship	There is a contact email address to the person who maintains the site or webmaster	X		
15. Transparency on sponsorship	The site declare/list some support from private companies or public/government organizations			On progress
	The site owners have some financial interest in the content or running of the site			Under evaluation

interventions related to chronic disease prevention and health promotion, which will further benefit a community and population's health.

Some indicative of these portals are the following.

The Ontario Telemedicine Network is developing an integrated portal, which will bring telemedicine from an institution-to-institution system to a personal telemedicine solution. Personal telemedicine offers healthcare providers the ability to use their own computers and smart phones to get the information and applications they need to serve their patients at a distance [72].

Also the Emedicalpoint Biggest Health & Medical web Portal in Bangladesh [73] is an immense place where health and medical related information is accessible around the world.

Finally, we mention a domain-specific portal, the IFPMA as a Clinical Trials Portal, which is a clinical trial specific portal [74].

## 6 Conclusions and future directions

Currently we have completed the first phase of the system development in relation to the pilot implementation. In this phase, the portal was developed and then implemented as an experimental verification of it with the Delphi method to a small group of researchers [75]. By doing so, we managed to identify the key problems of the system and to find the appropriate methods to improve it.

Directly we extended the application functionality promoting the operation of the portal, incorporating a range of health service agencies, experts and the public.

In the next phase, the testing of the system will take place with a group of students from the Technological Educational Institute of Kalamata to achieve sufficient quantitative outcomes in order to the evaluate the system and make further improvements and integrations.



In the final phase, we will study the possibility of its ratification by HON to advance it to normal operation [3].

For this purpose, we will follow a registration process to HON medical/health non-profit, non-governmental organization, accredited to the Economic and Social Council of the United Nations, in order to receive validation of our health portal and obtain a certification model, the HONcode logo. The HONcode of conduct offers a multi-stakeholder consensus on standards to protect citizens from misleading health information. It is responsible for stipulating guidelines and standards for creation of medical content and issuing a trust mark to websites that comply with specific criteria.

One of the objectives of CCHM system is to make this application well known and valuable to service and information health providers (institutions, companies, experts, doctors, nurses, etc.) even if they lack technical expertise.

The system, will guide the providers to have access to the information they want through a wizard, which will use completed on-line forms by individuals. Then we will also incorporate them into a system of information, interaction and communication with citizens.

After comprehending the data, we will adopt, monitor and verify it to ensure the applicability and reliability of the system via the use of transparent and comprehensible rules.

This paper presents a new model of health portal intended for any acquisition and sharing of knowledge and notification. Through this model, the citizens are able to connect through public or individual services and to use health care and well being plans. The model especially supports the development of communication channels among citizens and the public and private organizations.

Because of the complex nature of social and personal health care matters, their diversity, constraints on response times, strict standardization and regulations and the need for qualified personnel, the penetration of this technology in this area is impeded and discouraged.

Moreover, a particular aspect of this application is the ability to support a Health Support System Management module by parallel and continuous development mainly in providing home-hygiene instructions and healthcare guidelines on specialized topics like continued support for drug, smoking or alcoholic addicts. Support for patients with eating disorders like bulimia or anorexia, diabetics, people with disabilities and ever support concerning fitness exercises and diet guidelines for well being.

One of the system's future aims is to be able to propose the follow-up care plans or instructions, within a specified period and to indicate any problems in the sequence of previous actions. In case of deviation from the specified timeframes, the system will warn the user and suggest possible remedial actions.

This dynamic will ensure the expert user with the possibility to create and automatically install or ever to apply a

new driver-care plan that will operate like a template. This may be a personalized care plan potentially for every monitored user.

A future goal is to develop an integrated system of the suitable guidelines abstractions that will work as a template for home care support.

Moreover, in this area the user will be tracked down not only through continuous interaction with the system. For instance through entry using the keyboard but also using bio-signals which will be initially imported as pictures, video, audio, biosensors, etc. The system will provide all the above for use in a subsystem after suitable handling.

The subsystem will use modeling techniques and statistical techniques for the performance of its duties. Therefore, the main target of the application is to develop new modern business models to support public health and its evaluation either that of the pilot or that of the overall implementation of activities.

We also plan to use the feedback from current implementation for further development.

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