

Self-Sustainable Architecture for Healthcare Social Networking Website

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Abstract: *Today internet is playing a vital role in the life of human beings. People use it to connect and share their resources, ideas and knowledge with each other on single click. This demand open the doors of new concept, named as social networking. Now Facebook, Twitter and many social networking web sites are playing their roles and entreating their users. Currently social networking is being implemented in all fields of life, especially in health sciences. People demanded these social networking features for health related issues so that they can share and know the rapid developments and technological changes in medical science within seconds. They also demanded secrecy of their information, patient file management, conversation handling etc. Many web sites and research papers address few of these issues individually but not collectively. In this paper we propose a Self-Sustainable frame work which addresses all the mentioned issues and also have an ability to handle the information with less space utilization, efficiently and manageably.*

Keywords: *Self-Sustainable architecture, Healthcare social networking, Social networking website.*

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1. Introduction

Social networking plays a vital role in the field of computer science since past few years. The basic purpose behind these applications is to provide a common platform for different people and communities so that they can share their resources among each other [12]. After seeing the growing trends of internet and mobile technology the major focus of different organizations and companies are developing such applications which are one click far from user side. These demands facilitate the social networking concept and make it capable of share resources via internet or any mobile devices. Today many social networking (e.g. Facebook; www.facebook.com, Twitter; www.twitter.com, etc.) web sites are being used by millions or billions of users [9]. They not only share their views but also send and receive files and many more resources among each other. The growing trend of such social networking web sites are now implemented in all fields of mankind (e.g. health [21, 22, 23, 24], entertainment, marketing, etc.) [14].

Social networking regarding entertainment makes tremendous increase from past couple of years. Meanwhile many business organizations switched to marketing social media to promote their businesses and financial management. On the other hand, social networking on healthcare also has growing importance from the last couple of years [6].

There are various health issues which are discussed over Internet. It has been noticed in the past years that people are getting awareness and finding solution to health problems via cyber networks [6].

In this paper we are going to discuss a self-sustainable architecture catering the design issues of social networking websites for healthcare. The proposed architecture presented in this paper not only facilitates the designers and researchers by providing new issues regarding medical sciences but the developers as well to create efficient, secure and reliable health web site.

The development of any web based application (e.g. social networking) is a critical task. The development of these web applications are composed of many phases and the most critical phase during development is designing [19]. Majority designers try their best to impose their domain knowledge as well as latest tools and techniques by adopting best analytical skills so that there design will give successful results [17].

For designing successful web applications the role of viewpoints is considered to be very important. It helps the designers to seeing the system with different perspectives and reduced the occurrences of system failures [11]. In this paper the proposed framework is being described using three different viewpoints: 1) Logical View 2) Physical View and 3) Implementation View (Figure 1) [7]. These viewpoints not only help the designer to check the system with multiple angles but also facilitate them to enhance the efficiency and maintainability of their social networking web applications.

Figure 1 shows how logical, physical and implementation views are associated with design engineering phases [15]. The basic theme behind the logical view is to represent the high level picture of the system to the designers. It helps the designers by

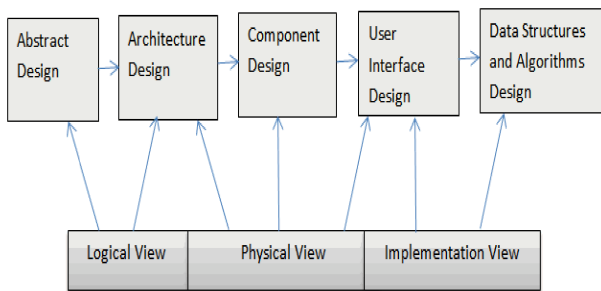


Figure 1. Mapping of views with design engineering phases.

providing the functional and nonfunctional requirements of the system. For designing any health care social networking website basic functional requirements should be that these sites should not be user restricted as many other commercial web sites are [21, 22, 23, 24]. These should be a general for all type of user which might be Patient/ doctor /student of medical sciences, pharmaceutical companies etc. secondly the design of these web sites not only fulfills the basic social networking features e.g. profile handling, wall handling and sharing of resources etc. but also fulfill some additional features related to health care (e.g. Patient history/File Management, doctor/patient appointment handling, sending and receiving of critical reports(e.g. MRI scan, X Rays etc.), management and handling of different health related communities, sending and receiving of notifications regarding new researches related to these communities, Audio / video conversation handling between multiple users for sharing their medical history, attending online health related seminars should also be managed by these sites. The nonfunctional requirements for health care social networking web site should contain secrecy, efficiency, accuracy and management of user personal information related to medical sciences. The logical view is further decomposes into two models 1) analysis model and 2) design model. These models respectively give the functional, nonfunctional requirements of the system from abstract to concrete level. For web applications the information provided by these models helps the designer and developer to understand the whole system behaviors and user expectations with proper coordination. The intentions of the physical view is to provide solid base where final refinements of system behavior is elaborated its coordination with other components (e.g. built in or purchased from 3rd parties) are defined in detail and user interface designing rules are finalized. The implementation view is actually lying in design engineering as well as in coding. It takes rules and regulations (e.g. algorithms etc.) from design engineering and implements them in the form of code in coding phase of SDLC [13].

The remaining sections of this research paper describe the proposed self-sustainable architecture framework through above mentioned viewpoints.

1.1. Logical View

This view provides the abstract vision of the system [9]. The expectations given by the end user regarding such web sites is already described in the previous section and according to these requirements the proposed architecture is divided into three main schemas i.e. internal, external and conceptual [15]. These schemas are considered to be an essential part of the design model. In these schema's modular approach is used which is considered to be more manageable, flexible, reusable and maintainable etc. for developing social networking web sites.

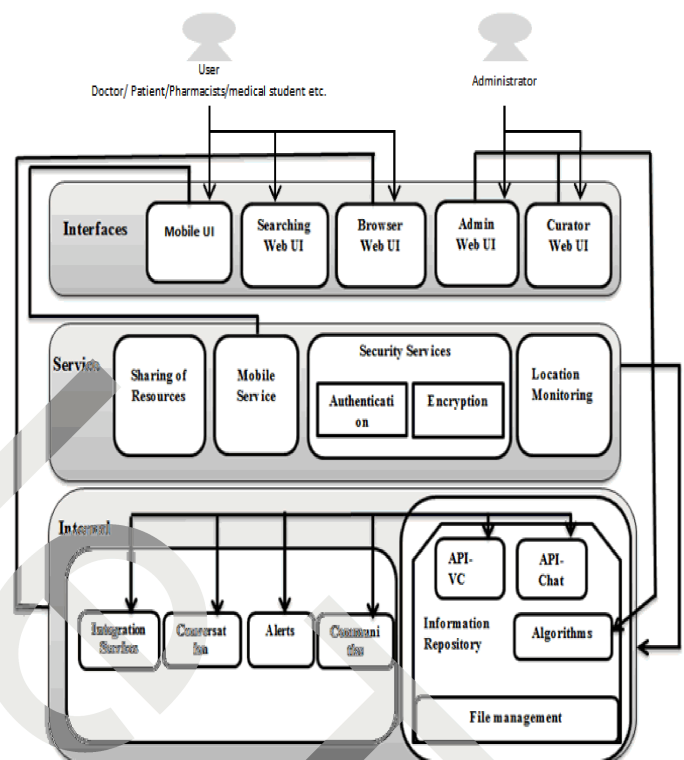


Figure 2. Layered Architecture for Healthcare Social Networking Website.

The architecture is divided into three schemas. According to Figure 2 interface layer lie in external schema which is the front end of the website visible to the user(patient/doctors/pharmacist/medical student), services layer is the part of the conceptual schema consisting on the business logic whereas information repository with file management lie in internal schema. The detail of these schemas and there layers are given in the next section 1.2. The schemas are being chosen keeping in mind the user expectations and market trends. This approach will guide the designers of health care social networking websites about the layout and structure of such websites to fulfill the user requirements and the developers about the essential components that must have to be a part of such websites.

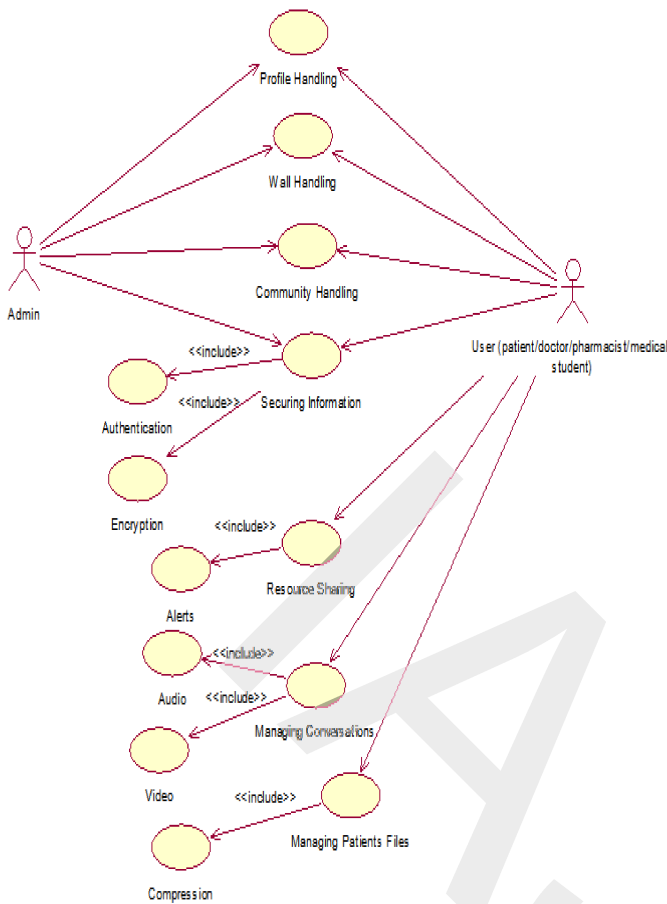


Figure 3. Use case diagram.

In Figure 3 Use Case diagram presents a logical view of users and their interaction with health care social networking website which is being design according to the proposed frame work is described. It will help the designers about who is going to interact with such website so that they could differentiate them according to their intention of interaction. This diagram also facilitates the designers for taking the initial step in designing such type of web sites. In the above diagram two actors have been introduced both of them are connected to almost same use cases expect that *Admin* is interacting for the purpose of the management of healthcare social networking website whereas the user is interacting with multiple use cases for example conversation handing, patient file management etc. Use Case diagrams are widely used to define the essential functional features of any system [2]. Designers and developers could be able to modify it according to the need and nature of system. In the next sections the process of implementation of such website is described.

1.2. Physical View

Physical view deals with the behavior of the components of system in real time environment. In this view we define the components of the system and the interaction between these components. So, in software designing architecture, component and user

interface design phases lie under the category of the physical view (Figure 1). As we described earlier that we are using the layered architecture and in each layer different components are defined according to their role they have to perform individually and collectively (Figure 2). The detailed description of the layers of the architecture is given below.

1.2.1. Interface Layer

The interface layer in Figure 2 is front end of the social networking website and consists of following user interfaces.

- Mobile user interface allows users to use the website in their mobile phones and to receive the alerts (messages) [20].
- Admin interface allows the admin to manage the website.
- A simple browsing web interface that allows users to browse the website features. The major features include communities, conversations, integrated services, searching etc.
- A search web interface that provides access to the standard search and the prototype intelligent search facilities.
- A curator web interface facilitates the admin to edit and manage the content provided to members related to healthcare.

The next layer is the part of the conceptual schema and deals with the business logic of the system. The proposed architecture is representing a social networking website which is dealing with the health related issues. So for such applications the business logic lies on two main things

Market Demands: means user and competitors behaviors and expectations.

Site Policies: These are the provision of resources, services and options provided to the end user according to their access rights. Here development companies not only imposing their rules and regulations but also adopting standardized bodies related to healthcare.

1.2.2. Service Layer

Service layer, the conceptual layer of our architecture where the business logics for the social networking website resides, could also be called as communication layer between the front end and back end of the website and is also responsible for handling user login, authentication, authorization and logout (via the Security Service [18]), and for managing the user login session [17].

- Mobile service layer allows the users to interact the website via their mobile phones.
- All interactions with the back end pass through the security service, which is responsible for enforcing

the access control policy and authorizing user actions.

- Sharing of resources includes files, images, reports, documents, videos, events and messages etc. among the authorized users [16].
- Location monitoring is to be done by the curator who will check various things according to need.
- The interface layer accesses the conversation, integrated services and community subsystems via browser interface. The interface accesses these subsystems via directly invoking remote methods on those subsystems. Website also provides an interface for authorized users to edit/manage items in the community and conversation.

1.2.3. Internal Layer

Internal layer deals with the back end of the social networking website which consists of the information related to users and their data [8]. Structure of the social space utilization, expansion and storage is defined at that layer [1], Algorithms and API's for the services provided to users are also the part of that layer.

- The Information Repository stores and maintains personal information, online activities, shared resources and files of the users and acts as a long term preservation archive for website User gains access to the information in the information repository and invokes required functionality by using one of several Application Programmer Interfaces (APIs). These APIs include:
 - APIs (API-VC, and API-Chat) to browse and retrieve items regarding chatting, audio/video streaming
 - For management purposes, there are various algorithms used that allows the members to add, edit and delete items
 - For searching purposes, algorithms are used that search fastest according to the required query, searching involves various type of searching e.g. search member via name, search community, etc.
- The File management service at the core of the Information repository. As the primary responsibility of the Information Repository is to store and manage the content in a way that ensures the durability and preservation of the data. File management provides a secure and pluggable low-level storage subsystem that interacts with a durable store for patient files [3]. It is also responsible for providing secure interfaces that allow the curatorship and management of data stored in the repository.
- The Community section provides browser interface to access the community and discuss the

information with other community holders. It also provides a major feature of conversation that allows various users to do live streaming of audio/video and chatting between community members e.g. patients, doctors and medical students. It also allows, doing a private chat or conversation with any of the member of respective community.

- The Alerts section provides the functionality of sending messages related to new events and conferences about different health issues to the users.
- The conversation section provides a great functionality to the users. It allows the users to do a private chat with any single user, a community chat by joining a community or to do live streaming of audio/visual between one or more than one users.
- The integration service includes all other functionalities that website has for their users and the access rights regarding these functionalities.

The behavior and user interface of components are defined at the physical view level. In the proposed framework the components of a social networking website are defined according to the essential modules of the websites. These modules are entitled as : a) security services (secrecy of the user information is provided by user authentication and then encryption of the information to be shared according to the sessions), b) Mobile services (handling of sending and receiving the alerts to the users of the website), c)Community handling (handling of the expansion of social space via community based architecture), d) Resource sharing (handled the sharing with the authenticated members and validation of the resource to be shared), e) Conversation handling (audio/ video chat among the users of website) and f) Medical history file management (storage, maintenance and sharing of user files).

1.3. Implementation View

Implementation View is all about the processing of the design we have proposed in in a real time situation or in other words how the user will view the system and how the conceptual and internal layers will respond according to the request of users of the system. As we discussed earlier that healthcare social networking is an incipient concept which helps the users in their online activities related to healthcare but still it's an evolving and emerging concept so need to improve and refine that concept exists [19].

So, here we are going to present a real time application of that design by developing a website which will provide a common platform to the users form different domain and communities so that they can share their resources (files, images, reports, documents, videos, events and messages) [16] and have conversation with each other in a secured

environment without any kind of access restrictions (e.g. [17, 5, and 20]).

For the implementation we use a client/server based architecture (Figure 4).

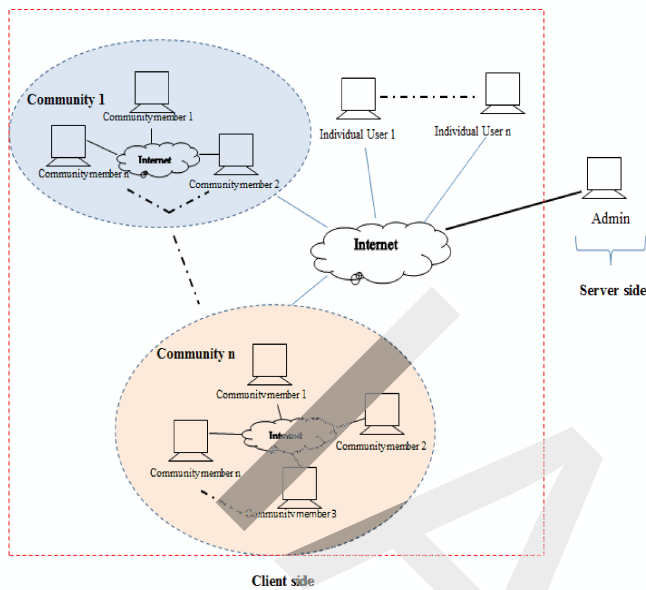


Figure 4. Implementation level system architecture.

At server side business logic resides and from Figure 4 Service and Internal layers are also the parts of server side whereas at client side Interface layer is accessible only.

For development, we used PHP and MySQL (e.g. [4, 8, 16, 10]) and algorithms for searching, storages and sharing [12]. Here are the interfaces of the websites named “Health Care Circle” which is being developed according to the proposed architecture.

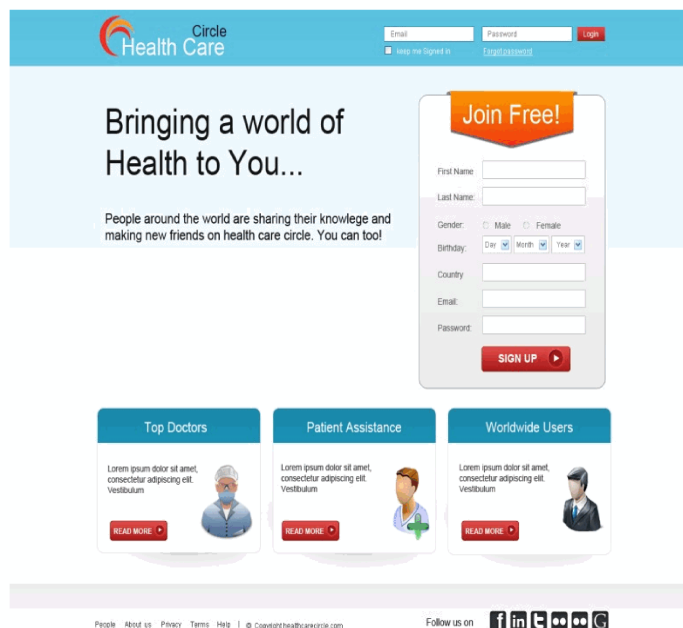


Figure 5. Signup page.

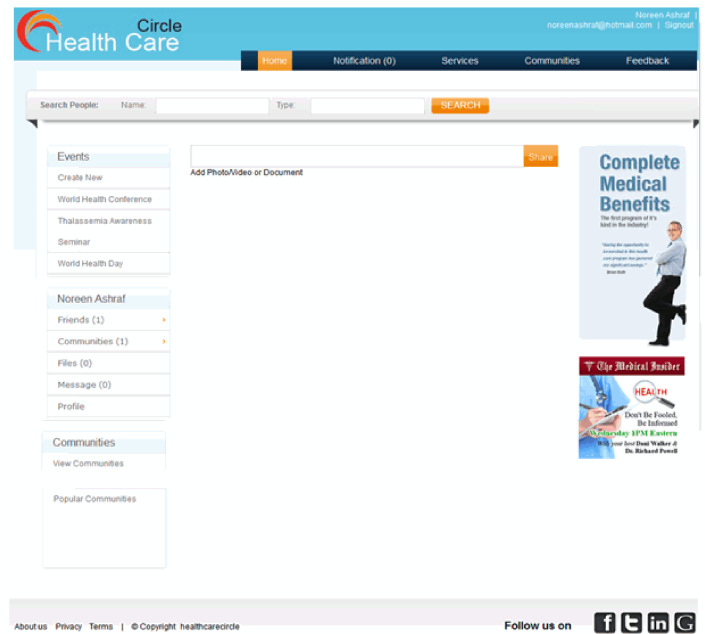


Figure 6. Home page.

2. Experimental Results

Health Care Circle is being implemented in PHP along with MYSQL database.

For testing our system, we have used following hardware components:

- One web server computer
- Three client computers
- Internet Connection (Wireless or wired)
- Webcam, speaker and microphone with each client computer
- Wireless modem with SIM card

Within the defined testing environment, we have performed testing of our healthcare social networking website and have drawn results on the basis of calculated percentages. These results are drawn by testing our website against the following factors:

- Customer service
- Ease of navigation
- Site graphics
- Site usefulness
- Comprehensive text
- Sharing of resources
- Storage of resources
- Secrecy maintained in the website
- Conversation handling in the website

We conduct site satisfaction test not only for our proposed system web site but also for other web sites i.e. Care Connectix, Doctor’s Page, Web MD and Health Central. We take 100 participants and conduct these tests on rotational bases. The results given below in the form of bar chart is taken from the posttest questioner asked and observed by the participants after using these web sites. As the graph show that HCC

provide and handle more user requirements as compare to other sites.

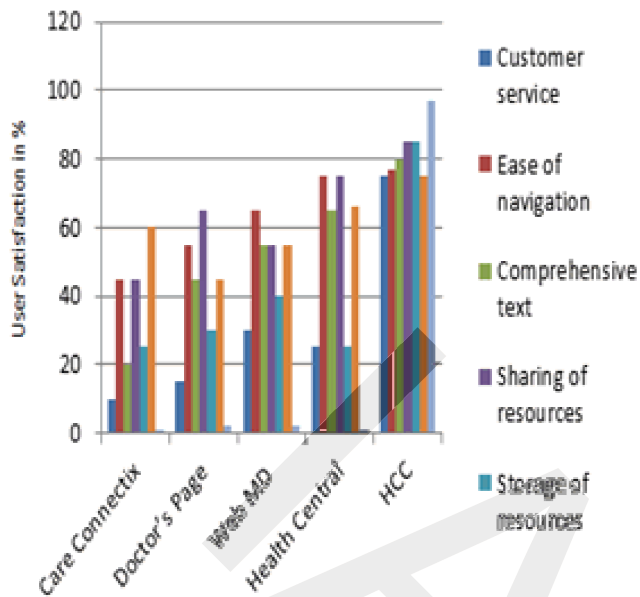


Figure 7. User satisfaction chart.

3. Conclusion and Future Enhancement

Our research work presented in this paper helps the designers of the social networking websites regarding healthcare by providing them a self-sustainable architecture which could be easily modified and adjusted according to the requirements. This research work could be enhanced by comprising following features:

- Authentication of Doctors (whether they are really doctors or not).
- Emergency handling: Sending Alerts to Rescue service in case of any emergency with complete address and location where help is required.

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