Designing an Effective Social Media Platform for Health Care with Synchronous Video Communication

Young Park[1], Mohan Tanniru[1] and Jiban Khuntia[2]
[1]College of Business Administration, Savannah State University, Savannah, GA 31404, U.S.A.
[2]School of Business Administration, Oakland University, Rochester, MI 48309, U.S.A.
[3]Business School, University of Colorado Denver, Denver, CO 80238, U.S.A.

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Abstract: Online social networks are evolving as platforms for health communication among the public, patients, and health professionals. Existing health social network based portals do not provide synchronous -video-based communication features; and are restricted to only text and picture based content sharing. Arguably, healthcare focused online social networks need video based communication for active knowledge sharing between providers and patients, peer-patients, or sharing disease related information through visual media. This study provides a technological framework and design architecture to develop a customizable online healthcare social media network that can incorporate synchronous video communication capability. The design principles and layers that support different types of functionality are described. An evaluation in the context of Rheumatology and back pain patients is underway and will not be discussed in this paper due to page constraints.

1 INTRODUCTION

Use of online social health networks is increasing with the understanding that online communication and support is highly effective to manage own health (Giustini 2006; Heidelberger 2011; Thackeray et al. 2008). In addition, online social media platforms are providing conduits for providers to increase clinical competence of healthcare practitioners through constant monitoring and support mechanisms (Green and Hope 2010; McNab 2009).

The emerging use of social media in healthcare is centered around interactions between individuals and health organizations, and the nature and speed at which these interactions support communication of health related issues (Frost and Massagli 2008; Hawn 2009; Landro 2006). In the United States, 61% of adults search online and 39% use social media such as Facebook for health information (Fox and Jones 2009). Globally, the adoption rate is similar, such as 45% of Norwegian and Swedish hospitals are using LinkedIn, and 22% of Norwegian hospitals use Facebook for health communication, and Facebook is emerging as the fourth popular source of health information in UK (Heidelberger 2011). Moreover, with the focus on decreasing the growing healthcare costs, social media is posited to provide a cost-effective means to support patient-doctor interactions (Hillestad et al. 2005).

Irrespective of the increased use of social media sites in healthcare, design issues pose a significant challenge for effective use of these media in diagnosis, treatment, and intervention. Specifically, the lack of synchronicity among these sites is a major issue for both patients and providers. For example, a patient cannot get an expert opinion, as opposed to unreliable opinions from friends and family, to his current breathing issues (say, due to asthma) just by logging into a social network site given that most of these are designed to access archived information. Several existing healthcare social networking portals use communication methods such as emails, published articles or discussion forums (see Table 1 for a detailed list and features of social networking portals). They lack scalability to support synchronous communication for online consultation, which would greatly contribute to improving communication between health professionals and patients. To our knowledge, no social network portal has the capability to make a doctor available to a patient through a video communication instantly. Furthermore, as healthcare

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Table 1: Sample Healthcare Web Portals and Social Media Sites.

Website Name & URL	Focus	Communication Methods	Content Categories
Steady Health www.steadyhealth.com	How to live healthily under different categories. Covers disease treatments and diets.	Information Center; Articles; Discussions; Videos; Slideshows; Medical Answers; Applications	Categorized by: Well Beings (purposes); Health Conditions (disease types); Family Heath (Sex and Age); Therapies & Treatments; Emotional & Mental Health
Wellness www.wellness.com	How to live healthy under different categories. Covers disease treatments and diets. Also, information about fitness and beauty.	Blogs; Forum; Articles	Popular Topics; Facilities; Fitness & Beauty; Dental Care; Stores; Insurances; Doctors; Mental Health; Counseling; Provider Program; Community
Everyday Health www.everydayhealth.com	Diseases, drug information, living healthily (food & diet).	Articles; Videos; Twitters; Facebook; Blogs; Applications	Conditions (diseases); Drugs; Health Living; Food & Recipes; Advices & Support
Find a doc www.findadoc.com	Devised a unique proprietary rating system that helps patients choose from among the 720,000 practicing physicians in the U.S.	NA	Contact Information Search by Categories
My doc hub www.mydochub.com	Offers doctors' information, hospital information and diseases information.	Articles; Discussions; Blogs; Applications	Doctors; Reviews; Dentists; Blog; Answers; Chiropractors; Hospitals; Vets; Health; News; Health A-Z; Articles
Spark People www.sparkpeople.com	Focused on living healthily depending on food and exercises.	Information Center; Articles; Discussions; Videos; Boards; Applications	Eat Better; Feel Better; Look Better
Physician Data Query www.cancer.gov/cancertopics/pdq	PDQ (Physician Data Query) is NCI's comprehensive cancer database.	Search Engine	NA
Health grades www.healthgrades.com	Doctors' information, hospital information and dentists' information.	NA	Find Doctors; Find Dentists; Find Hospitals
Vitals www.vitals.com	Find and review doctors, make an appointment and prepare for the doctor visit.	NA	Patient Education; Write a Review
RatMD.com www.ratemds.com	Find and review doctors and hospital information.	FAQ; Forums; Tweeters	Find a Doctor; Find a Doctor; Browse Doctors; Hospitals; Top Local Doctors; FAQ; Forums
Drscore.com www.drscore.com	Find doctors information.	Email	Find a doctor; Score your doctor; For Patients
Doctortree.org www.doctortree.org	Find doctors information.	NA	Search Engine by Categories
Suggest a doctor www.suggestadoctor.com	It helps to find doctors information.	Customers' Evaluations	Search Engine by Categories
Healthcare.com www.healthcare.com	Information about health insurances.	NA	NA
Vimo www.vimo.com	Information about health insurances.	NA	NA

depends on the evidence base of a set of visual diagnostics; and plausibly, in this scope, synchronous video communication can be used to establish an effective link that supports service and care delivery in healthcare system.

The study uses the design science approach, which emphasizes that any new information technology artifact, developed to address a key problem, should be evaluated in a real world setting to demonstrate its purposefulness (Hevner et al. 2004). We provide a technological framework and design architecture to develop a customizable online

healthcare social media network that can incorporate synchronous video communication capability. Next section will provide some background and research context and the third section will discuss the features needed to support the video communication portal. The fourth section illustrates the functioning of the portal, along with the design principles and layers that support different types of functionalities. The last section makes some comments on the evaluation underway and provides concluding remarks.

2 PRIOR RESEARCH

Existing literature points out that there are several limitations of social media for health communications. In a recent review, Moorhead et al (2013) point out that quality concerns, lack of reliability of information, and blurred lines between content producer are three major concerns about the reliability of these platforms. However, beyond these concerns, the most important one is the "information overload" and "lack of validity of the information," and this poses a bigger challenge to the use of the social media for meaningful purposes (Adams 2010a; b). Lack of guidelines may misinform the public on how to correctly apply information found online to their personal health situation, thus posing a danger in promulgating adverse health impact or consequences (Freeman and Chapman 2007). These reasons also deter providers not to participate in a social network site, especially when there is a higher likelihood that the text based information may result in a greater risk. Thus, limited evidence on to what extent online communities are effective in positively impacting people's health (Colineau and Paris 2010), and how effective social media is in communicating health related information to patients, are some inhibiting factors for providers from actively participating in online social health networking portals (Kim 2009).

Against these concerns, existing studies have suggested three plausible alternatives for greater provider engagement (Lagu, et al., 2010). First, similar to traditional Internet sites, there is a need for greater interactivity in the social media for patients to upload information regardless of quality. The information posted will be at least more realistic and meaningful to the patients (Adams 2010b) and this might help providers glean useful insights into patients' needs and concerns. Mikki Nasch, the co-founder of AchieveMint recently discussed their use of social medial platform to let patients voluntarily interact with either, so healthcare providers can gain useful information on patient adherence to certain desired behaviour, using Mashup technologies (Polz et al. 2013). Second, reliability concerns can be mitigated if the social media communication and relevant information extraction can be given to third party agencies (Sneha and Varshney 2009), thus allowing healthcare providers to focus on developing appropriate strategies based on this data. In the above example, AchiveMint is the third party used by Sanofi-Aventis, a pharmaceutical firm. The third, and the most important, suggestion is to improve "media richness" by making the information communicated contextually relevant to the situation at hand (Kaplan and Haenlein 2010). In support of the third suggestion, a novel artifact that supports synchronous video communication (SVC) is proposed in this research paper. Table 1 summarizes many social media interaction environments that support health care related interactions and none of these, to our knowledge, have the provision for such synchronous video communication functionality.

Synchronous video communication (SVC) is not new concept in the emerging Web 2.0 context. Indeed there are a number of applications that provide SVC services, albeit not within social media platforms. Applications such as Skype, Voodoo, Google Chat with Video do facilitate multi-party video conferencing features. While it may be argued that, the social media users can always use these "external third party" solutions for synchronous communication. However, in the health care context, knowledge base diagnostic or information sharing approach requires an integrated platform as switching between different applications is cumbersome to users. Both in the patient-physician context as well as patient-patient context, the requirement of a well-integrated system to support secure communication, search capabilities to find topics of interest, connect with others, and to allow for business work-flow integration will facilitate efficient and effective care management. To summarize, although social media applications and use are growing in healthcare, but a significant design gap remains in the existing social media sites. They are not focused on synchronous video based communication, and that perhaps is posing a challenge for a provider-side adoption of the social media to deliver care. We suggest a design and demonstrate implementation of synchronous video communication (SVC) in a social media portal. In this regard, the next section develops design features needed to support the SVC application in a healthcare setting using social media environment.

3 USER REQUIREMENTS

The synchronous video communication (SVC), designed to support health related discussions in a social media context, uses features along three layers: input (front-end), application (middle) and database (back-end layers) (see Figure 1). The front-end layer is designed to support two types of stakeholders: (1) users, consisting of patients, friend and family and (2) providers, consisting of physician, nursing staff, provider organization employees. The goal here is to provide easy and secure access to the video content, and support the associated social media interaction between patients and providers. The middle layer is designed to support the workflow management necessary for the distribution of the content to meet care provider's policy needs and interaction of the content to meet the healthcare needs of the patient. The back-end layer is designed to support the creation, customization and search functionalities of the SVC.

3.1 User Interface Requirements

The user interface requirements of the front-end layer focus on two access related features: *ease of access and secure access*. The ease of access in SVC calls for both *effectiveness of information and mobility for users.* The interface needs to be simple and intuitive, as many healthcare sites are accessed by elderly people. The interface needs to limit the degree of scrolling and allow the patients to preview the content and community they are interacting with before they enter the site. In addition, the system needs to support many typical communication features such as discussion forums, instant messaging and others such as those discussed in physician rating sites (Lagu et al. 2010).

The mobility feature in this context is the user access at any time and from any place to the portal, irrespective of geographical location, technology platform and medium of internet access. Patient access to the system is critical as this is key to the synchronous communication. The focus should be ubiquitous access and patient-centric, so that patient can connect with his/her friends for chat, review health care data, connect with - and engage in - consultation with a physician, etc. In other words, the technology should support access from any platform (desktop to mobile devices), and from any location (work place, home, and outside of home). Secure access to the site should include authentic login features and other controls needed when information is shared with others in public or private interaction mode. There is negative relationship between privacy concerns and willingness to disclose information when requests come from government/public health agencies vis-à-vis hospitals or pharmaceutical companies (Anderson and Agarwal 2011). In addition, patients trust non-profit hospitals more than for-profit organizations. Therefore, it is critical that appropriate privacy/access control features are incorporated and screens/views are limited based on the role the group or an individual user (patient, physician, face book involved in the discussion, etc.) may play. Moreover, social media sites with chatting or blogging capability have to detect and prevent the use of profanity or obscene words. Thus, the proposed system should support a robust set of secure access mechanisms, including password controls, role based access, and administration privileges upon authentication. Finally, Secure Sockets Layer (SSL) technology for encrypted link between a server and a client may be needed, given that the social media platform will operate from different server locations.

3.2 Database Requirement

The back end layer includes a database engine that is designed to support *content creation or development, content customization and content search.* The health care content in healthcare is changing rapidly and physicians and other health care providers may update the content used by patients at a more frequent rate. Thus, ease of update of content becomes critical to maintain the effectiveness of the site. Furthermore, given that the context of patient inquiry will change with time, there should be provisions for customization by patients, so that patients can select the right healthcare domain to share it with others and consult/pose questions to physicians. Finally, as the content stored grows over time, ability to quickly and effectively search and select the content that patients need becomes an important criteria for the design of the system.

3.3 Application Requirements

The application layer is designed to address three needs: (1) alignment/support with organizational workflows, (2) accommodation of domain diversity, and (3) scale up to meet the increase of users.

First, alignment with organizational workflows is crucial since the system should be flexible enough to support the needs of healthcare providers to

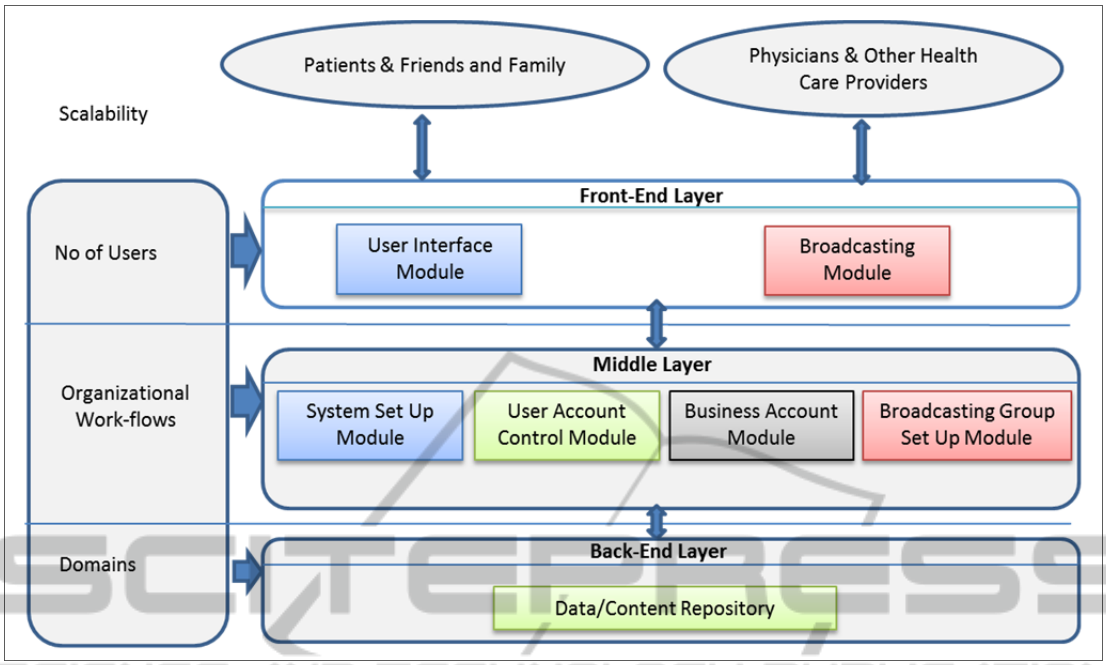

Figure 1: Design Features of the SVC-Social Media Framework.

support care consultation and knowledge dissemination. Providers may want to schedule weekly broadcasting time for certain type of care related communication, or simply make physicians available for consultation at a certain time, for patients to interact with the physicians. The platform should provide flexibility and customizability so that it is used by physicians from differing streams with distinct needs. Apparently, a common theme amongst care delivery is the need of synchronous consultation or synchronous discussion, relying on a repository of evidence based knowledge system. We try to implement the synchronous discussion part, and make use of pre-recorded videos for creation of the knowledge system along with text based repositories.

Second, although the end goal is to develop a synchronous video conference (SVC) portal for health domain, the platform should provide opportunity to support communication for various other domains than healthcare. For example, in addressing pain management issues and related care, the system may support synchronous interaction between patients and physician, while in the case of patients with obesity and diabetes related illnesses, the system may focus on social interaction among patients groups to support behavior modification. Yet, in other cases such as heart patients in a nursing home, the system may provide patient-family interaction with only an asynchronous display of care related information provided by the physician. For smoking cessation management programs, the system may rely on both group and incentive based interventions. While the requirements for these health related issues may be different, but a generalizable application layer that can support dynamically the interface protocol and content changes with minimal programming should be the objective of the system. For example, adding videos and indexing these for easy use, as well providing content-providers the ability to promote these to different groups is useful.

Finally, as demonstrated in many social media sites, the data and the number of users on any social media typically start small but may soon grow exponentially depending on the popularity of the site. In addition, any site that uses videos requires a great deal of bandwidth and storage to handle a large amount of data being transmitted. Although organizations go through a rigorous capacity planning or other pre-estimation process, it is very common to start small and expand as demand increases. In this regard, it is important to design the architecture to support the scalability; that we have accommodated in the design for scalability.

Thus, to summarize, we user interface requirements of a synchronous video communication feature design for a social media platform need to accommodate some salient features in its front-, middle- and back- end layers. While addressing the

design parameters for these features, the next section will provide elements embedded in the system architecture to support the SVC and illustrate its use with some sample screen shots of the implemented design in an alpha-developed social media site.

4 DESIGN ARCHITECTURE

The system design architecture has the objective to support the design features discussed in the previous section. Figure 1 provides, under each layer, specific system design elements to support the synchronous video communication in social media. The architecture consists of several components in the three layers: (1) front-end layer, (2) middle layer and (3) back-end layer.

4.1 Front-end Layer

The front-end layer consists of two major modules: (a) user interface module and (b) broadcasting module. The *user interface module* is responsible for providing easy-to-use interface, user authentication for secured access or search options. The user interface module allows the users to log in and browse, search for friends, or invite a group to join through web browsers. The client's user interface is automatically rendered by the changes made to the system set up module in the middle layer. Through the access control mechanism built in, the user account control module of the middle layer displays different set of menus depending on the type of user account: broadcast owner or broadcast recipient. To build dynamic and interactive user interfaces, a combination of Javascript and AJAX on top of HTML and CSS have been used. The home screen consists of three panels: top menu panel, left menu panel, and outcome display panel in the middle.

The broadcasting module is responsible for creating and customizing the broadcasting contents. This module is only available for the account registered as a broadcast owner. Once the broadcasting feature is set up by the middle layer, the owner - health professional - can customize broadcasting settings. The system is designed to leave zero-foot print on the client site by having the console program download from the back-end server the needed information, wherever it is needed. Once it is downloaded, the console program indicates whether it is on air or not, and displays the same screen users see on their website.

Using the console program in the *broadcasting module,* health professionals can easily set up weekly live video schedules and customize the contents by uploading any recoded video or image materials they want to share with others. Once the broadcast is made to the public, all interested can interact with the health professional and engage in public chat or even private chat. By clicking a user name on the user list, users can see the profile of the person of interest or send a private chat request for a confidential communication. If the person accepts it, they can have a private chat that others cannot see. This feature is extremely critical in healthcare environment that deals with confidential information on many occasions. This broadcasting module uses Adobe's Flash to stream videos and audios at the user site as it uses less bandwidth to stream videos.

4.2 Middle Layer

The middle layer has four major modules: (a) the system set up module, (b) the user account control module, (c) the business account module, and (d) the broadcasting group set up module.

The system set up module is responsible for defining parameters that will be passed to the browser to control the behavior of the application. It also provides a mechanism to set up the interface including the search menu. All the changes made through this module are saved into the data/content repository of the back-end layer.

The user account control module provides a mechanism for users to set up accounts. It also provides a way to block an account that violates established policies set up by the SVC portal. It also communicates with the broadcasting set up module to determine the access control of the broadcaster account.

Business account module helps to implement organizational workflows and business processes. For example, business activities are recorded to track the status of recruiting or contacting potential broadcasters or any issues related to broadcasting, etc.

The broadcasting group set up module interacts with the video streaming service and builds a container that includes all necessary functionalities including live video broadcasting, scheduling, off-line recoded video, and other training material management. Once the broadcasting group is set up through this module, the container is created and stored into data/content repository with a unique identifier. Because this identifier is associated with the broadcaster (owner) account, the broadcaster can

easily retrieve the container from anywhere to broadcast or change parameters through the broadcasting module implemented into the broadcasting console program. This module contains the steps needed to build a chat module and link a chat window to the designated video broadcasted window.

4.3 Back-end Layer

This layer is a repository that stores all the data and the containers made by modules in the front-end layer and the middle layer. This repository is designed and structured so that the stored scripts, templates, or objects can be shared and reused especially by the broadcasting group set up module of the middle layer and the broadcasting module of the front-end layer. When a new broadcasting group is created, a separate container for the group is created in this repository. In addition, when parameters are changed in the front-end layer, these changes are updated into the flash script stored in the corresponding container. Most of the data in this repository are represented by the relational data model and built on MySQL program. The chat content and user list of each group are also stored into the repository, and constantly updated by the broadcasting module of the front-end layer.

5 CONCLUSIONS

An evaluation of this framework in support of pain management is underway. The proposed system provides several key benefits that go beyond one provider or one disease setting. First, the system can provide information sharing platform with real-time interactivity between the parties. Second, the system design is centered around providing flexibility of building communities or targeted markets amongst parties based on their interests, while providing control to the information disseminated. Third, the portal can make expert information available in public or in private, depending on the modalities of operation. Because the information will be provided by expert's live video rather than simple blogging or email communication, the patients or information recipients' satisfaction and trust will increase, as the systems allows for two-way real-time communication between the parties through live chat. Besides evaluation, future work will continue to look at leveraging the benefits of synchronous vide communication system on a broad scale.

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