

Chapter 78

Ubiquitous Multimedia Data Access in Electronic Health Care Systems

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ABSTRACT

Advances in Information and Communication Technology (ICT) have enabled the provisioning of more cost-efficient means of delivering healthcare services through electronic healthcare systems (e-health). However, these solutions have constrained the mobility of medical professionals as well as patients. Mobile devices have been sought as a potential solution to free medical professionals and patients from mobility constraints. This chapter discusses the literature proposed in multimedia data transfer and retrieval, utilizing mobile devices and a multitude of wireless access technologies. A background section presents the different software technologies utilized by the proposed work, as well as a literature review. Following that, the authors compare these proposed systems and discuss issues and controversies found in these proposed systems, as well as propose means to address some of these issues. They conclude with an overall conclusion and outline future directions in this field.

INTRODUCTION

Telemedicine, literally meaning distant medicine, refers to the provisioning of medical services to distant locations via Information and Communication Technologies (ICT) (Moore, 1999). It includes sharing medical information, including

multimedia data such as image and video, for consultation and diagnosis. Throughout the past two to three decades, countries have been exploiting advances in ICT in order to deploy more complex and resource-demanding telemedicine-based services, such as those requiring high quality multimedia data, to deliver health care services to

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remote and underserved areas. This has enabled governments to deliver health care services to a wider audience in a more cost-effective manner.

ISSUES AND CHALLENGES

The adoption of electronic health care systems (e-health) has given the rise to the use of telemedicine Intensive Care Units (ICU), where intensive care patients are remotely managed from a central monitoring station that houses ICU medical specialists (Berenson, Grossman, & November, 2009). Functions of the central monitoring station include clinical multimedia data viewing, such as viewing diagnostic images and lab results (Cumings, Krsek, Vermoch, Matuszewski, & University HealthSystem Consortium ICU Telemedicine Task Force, 2007). Studies, such as Berenson *et al.* (Berenson *et al.*, 2009), show that central monitoring stations constrain the mobility of the medical specialists, whom tend to perform more than one function and at times have to directly take care of patients.

There are currently mobile applications that have been developed to allow remote access of medical images, such as MRI and CT scans of patients (DigiSoft, n.d.; RemotEye, n.d.). Such applications may help enable medical professionals to remotely diagnose patients, as well as allow for better collaboration between peers, providing the ability to perform image manipulation operations such as cropping and annotating. However, these applications are typically agnostic of the dynamics of the underlying system and network. Wireless networks are in general unreliable with respect to their wired counterparts, and mobile access terminals tend to suffer from intermittent connectivity. In addition, image manipulation operations are known to be among the most resource-intensive tasks. System resources, such as processing (CPU, memory) and communicative power on mobile devices are limited. The speed at which medical images and other data is processed,

sent and received is mainly at the mercy of the system load on the mobile device, as well as the network conditions such as load and variations in network bandwidth.

In some domains, constraining the mobility of the patients themselves can be an issue. With the rise in chronic illnesses worldwide, such as heart disease, the financial burden on long-term care facilities have reached a point to which they have either become unsustainable, or in the near future will become unsustainable (Social Security Advisory Board, 2009). To reduce this burden, some patients may live outside the long-term care facility, and some form of remote monitoring system would enable a medical facility to monitor their health conditions. Such a system would need to allow the patient to be mobile, and facilitate communication and feedback from the patient using multimedia such as sensor data, and perhaps audio and video streams. Most widely-adopted telemedicine solutions tend to be composed of stationary devices and only allow for in-door monitoring of the patient, constraining the patient's freedom of movement.

The cases previously presented mainly talk about issues in two categories of systems, namely *information retrieval systems* and *remote patient health monitoring systems*. It has become apparent that the lack of mobility and the inability to communicate multimedia data effectively has been major contributing factors to the issues and inefficiencies described before. Mobile devices are an increasingly attractive platform that can be used to overcome the mobility constraints described earlier. Coupled with the advancements made in wireless sensors, they have become the basis for a significant portion of the prototype systems and frameworks in the literature that target these issues.

However, just as the adoption of electronic health care systems introduced new issues, the use of wireless sensors, mobile devices and the wireless network environments that they operate in do not come without their issues and challenges. As a result, there has been a significant

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