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An Improved Mode of Streaming Multidimensional Image Data for Mobile Healthcare Systems

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ABSRACT: Healthcare system is moving from an organization-centered to a process-based care. Process-based healthcare system provides distributed healthcare services based on emerging communication technologies and advanced software architecture, so called Mobile Health Care System. Mobile Health services can be achieved at a lower cost than direct human interactions-based healthcare, in particularly in remote areas. Mobile Health Cloud is a promising new Web technology that allows for an unprecedented level of collaboration between patients, caregivers and physicians. It is an emerging trend of health-centric blogs, wikis, social networks, tags, tag clouds and podcasts that promise to bring about a whole revolution in the way that health care is delivered. This level of collaboration in the world of medicine ensures a higher quality of health care for the world, as well as serving as a catalyst to speed up research that has the potential to cure diseases that incapacitate or take the lives of millions around the world. Mobile Health Care System, on the other hand, can closely link the various medical departments and coordinate among medical institutions in the business. With achieving a strong information technology resources and optimizing patient flow, proposed system improves power consumption and throughput of individual nodes in the use of medical resources. The server is able to concurrently manage multiple clients computing a video stream for each one; resolution and quality of each stream is tailored according to screen resolution and bandwidth of the client. The paper explores in depth issues related to latency time, bit rate and quality of the generated stream, screen resolutions, as well as frames per second displayed.

KEYWORDS: Advanced Encryption Standard, Long Term Evolution, PictureArchiving And Communication Standards, Service Oriented Architecture.

I. INTRODUCTION

The data produced by medical hardware and practitioners is fast beginning to outstrip the ability of hospital software to efficiently utilize, navigate and retain. Telemedicine, the application of telecommunication technology to the medical domain, counterbalances this trend by providing ready access to this data regardless of where and how it is stored. The current generation of mobile, handheld computer devices have reached a level of computing power whereby they are capable of forming the backbone of networked multimedia solutions and studies are being performed that indicate the use of portable devices increases the Efficiency of performing information-dependent tasks both in and outside the medical domain, and lowers the chance of potentially fatal medical errors. Compared to PCs, mobile devices are crippled by screen-space, poor graphical power, and difficulty entering text - but it has been found that their pen-based input, visual manipulation capabilities and peerless portability can almost outweigh these factors - particularly in the hands of users accustomed to manual note-taking, such as medical practitioners.

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Multidimensional graphics on mobile devices is a new and challenging task for researchers and developers. Two approaches are basically adopted to address this issue, namely, local and remote visualization. The former uses local device resources to display the multidimensional image scene, while the latter uses remote hardware(i.e., graphics workstations or specialized clusters) to render the scene to be displayed on the screen of the mobile device; in this case, a network connection between the client (the mobile device) and the remote server has to be established in order to allow the transmission of images (from server to client) and commands (from client to server). Rendering large data sets, which can be required in a wide spectrum of disciplines including scientific simulation, virtual reality, training, and CAD, requires considerable computational power and storage resources; moreover, specialized hardware is often employed in order to allow interactive visualization of such complex scenes (in this context, the term interactive means that the user is able to smoothly navigate a scene).

Use of this data, however, presents its own problems. Hospital information systems for most departments are generally based around PACS, systems far too large and complex to be made portable. Departments such as nuclear medicine use data in the form of 3D datasets spanning gigabytes, for which the only clinically acceptable representations are techniques such as volume rendering, which require dedicated hardware just for usable frame-rates. While building a desktop workstation reasonably well-capable of such visualization can be done at reasonable expense, it is highly impractical to populate a hospital with such high-end workstations.

Although nowadays mobile technologies allow the development of extremely attractive high-quality rendering applications (high resolution displays are available on many handheld devices) and some PDAs equipped with a graphics accelerator have recently appeared (i.e., the Dell Axim x51v),the smooth visualization of highly complex multidimensional objects modeled by millions of textured polygons and of data sets consisting of millions of voxels is still beyond the capabilities of portable devices. Moreover, situations exist in which sharing the data set with remote clients is not advisable for security reasons. Finally, often the possibility of using existing applications without any porting to another platform is a strict constraint. In all these cases, an approach based on an indirect rendering can be used. Here, remote resources are in charge of rendering the scene according to the views elected by the user at the client side; then, resulting images are transmitted to the user via a wireless channel. This solution can be defined as data independent since the data set is not moved from the server side.

Scientists addressing this issue have paired such remote server systems with network-capable desktop PCs to allow rendering and processing of simulations or sets of equations to be done remotely, and ‘funneled’ to the machine the data is to be used from. There is no reason the same principle cannot be applied to the use of handheld devices in medical context, harnessing external systems to make up for abilities that they lack. Indeed, numerous solutions already provide web-based access to another machine’s records and processing power via the web-browsers on mobile hardware ,or stream datasets in small pieces, allowing feats such as the surface-rendering of 3D scenes too large for the handheld’s memory. This suggests the viability of using a direct server connection coupled with an informative preprocessed data type to allow a handheld device to take on the role of its supporting machine in the field. It relies on the transmission of static images to provide control of a three dimensional scene at an interactive frame rate.

An additional advantage of the proposed approach is that it is also application independent, since a software porting of the existing application to the mobile device specific platform is not needed. However, this approach raises a set of issues related to channel bandwidth, manipulation latency, and resources necessary at the client side to decode compressed information. This paper follows the remote rendering approach by proposing a three-tier architecture where a remote server(referred to below as Remote Visualization Server or RVS) is able to manage and render 3D models consisting of millions of polygons by using a cluster of Personal Computers(equipped with accelerated graphics cards managed by the Chromium software). Frames to be computed are split among the graphics adapters, reassembled, and encoded into a video stream that can be simultaneously sent to multiple mobile clients via wireless channels. At the client side, users equipped with an ad hoc application (the Mobile3D Viewer) can interact with the visualization interface in order to analyze the model within a cooperative session also involving the console at the remote server side. The proposed framework is able to

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support the visualization on "tiny" devices such as smart phones and PDAs as well as Tablet PCs and others clients (even not mobile) supporting larger resolutions.

II. RELATED WORK

The paper [1] reports on original results of the Advancing Clinico-Genomic Trials on Cancer integrated project focusing on the design and development of a European biomedical grid infrastructure in support of multicentric, post genomic clinical trials(CTs) on cancer. Post genomic CTs use multilevel clinical and genomic data and advanced computational analysis and visualization tools to test hypothesis in trying to identify the molecular reasons for a disease and the stratification of patients in terms of treatment. Subsequently, the initial architecture specified by the project is presented, and its services are classified and discussed. A key set of such services are those used for wrapping heterogeneous clinical trial management systems and other public biological databases.

The main technological challenge, i.e. the design and development of semantically rich grid services is discussed. In achieving such an objective, extensive use of ontologies and metadata are required. The Master Ontology on Cancer, developed by the project, is presented, and our approach to develop the required metadata registries, which provide semantically rich information about available data and computational services, is provided.

The way how data at different levels of the grid can be effectively acquired, represented, exchanged, integrated, and converted into useful knowledge is an emerging research field known as "grid intelligence". The term indicates the convergence of Web service, grid and semantic Web technologies, and in particular, the use of ontologies and metadata as basic elements through which intelligent grid services can be developed. An example of this convergence is the semantic grid that came into existence as an effort to introduce the semantic Web technologies into the grids, and it is usually defined as "an extension of the current grid, in which information and services are given well-defined meaning, better enabling computers and people to work in cooperation."

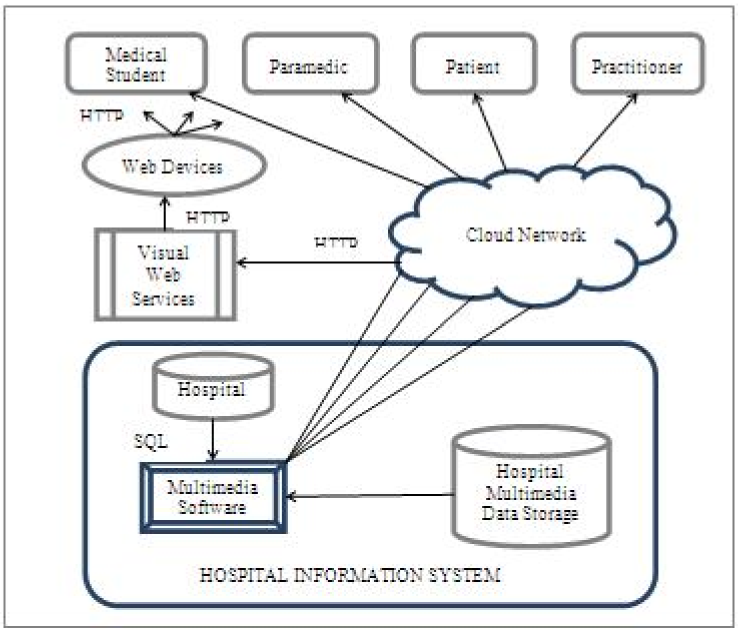
The paper [1] focuses on the systematic adoption of metadata and ontologies to describe grid resources, to enhance and automate service discovery and negotiation, application composition, information extraction, and knowledge discovery, whereas knowledge grids offer high-level tools and techniques for the distributed mining and extraction of knowledge from data repositories available on the Grid, leveraging semantic descriptions of components and data, as provided by the semantic grid, and offering knowledge discovery services. First, they are used for developing a range of postgenomic analytical scenarios for feeding the requirement analysis and elicitation phase of the project, and second, they will be used for the validation of the functionality of the ACGT technologies.

Biomedical software modules and data can be detected and composed to define problem-dependent applications. We wish to provide an environment allowing biomedical researchers to search and compose bioinformatics and other analytical software tools for solving biomedical problems. We focus on semantic modeling of the goals and requirements of such applications using ontologies. The infrastructure that has been developed uses a common set of services and service registrations for the entire CT on cancer community. The shared ACGT semantic services provide biomedical ontologies in common use across clinical trials and cancer research.

III. STREAMING MULTIDIMENSIONAL IMAGE DATA

The network is composed of devices inside and outside of hospitals and medical institutions, both desktop and mobile and a series of when servers that can be either internet or intranet based. The diagram illustrates the hierarchy of networking layers used by our prototype. This hierarchical architecture is similar to some existing proposed middleware systems for remote application control and medical data propagation.

The network architecture is automatically self generated without the need for user input or even network support in the host application. Novel daemon technique is used as an automated process that is a transparent attached process and adapts network input and output. A similar technique is employed by systems that implement autonomic computing techniques Individual mobile and desktop based client nodes are the main components. There is a Sparkmed client node is a standalone daemon program running inside the piece of medical software. This attached medical software may in turn be itself running inside the web browser.



The individual sparkmed daemons use a connectionless zeroconf approach to connect other daemon programs. All daemons are identical but their host applications determine which data items they share or provide and this information is forwarded to other daemons. These individual nodes retain the memory of other available nodes , keeps an index of what each data provides and are able reconfigure their network to recover from service interruptions with the minimal disruption in functionality. Sparkmed node communicate to generate a medical data “cloud”. The centrality of each node is calculated numerically in order to choose a central “server” node, with the criteria for determining the centrality of a node being based on reachability ,network access time, storage and security. The calculation is performed by filtering out all the nodes which do not meet the storage and the security requirements of the active data sources.

Each daemon waits for its host application to start normally, before creating an index of shared data used or created by this application. Once the data have been registered,the daemon seeks out the sparkmed nodes on the network.Those nodes are registered inside the daemon’s internal dispatch center and the state information is exchanged so as to synchronize all these data with remote daemons.

IV. IMPROVED MODES FOR STREAMING

Admin Record Processing The Admin log in is permanent, which uses default user name and password.Admin login name and password will be stored in the MySql Database server. After the successful login of the administrator, he/she will see list of users in the process.(Doctor, Patient)

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Administrator has rights to view the user list and also he/she can create the new user account under the category of above group of users.Admin allows the new registration of the patient under their control and gives them a new password to enter the details and metadata about individual patients. All these details will be updated in the MySql Database. In this module, the new registration of the doctors can also register by themselves and can obtain their new user name and password in the DB.The admin will maintain all the records of the doctors and patients up to date. Middleware creation deals with Middleware that provide services beyond those provided by the operating system to enable the various components of a distributed system to communicate and manage data. Middleware supports and simplifies complex distributed applications. Middleware is especially integral to modern information technology based on basic details, reports and metadata. Middleware often enables interoperability between applications that run on different operating systems, by supplying services so the application can exchange data in a standards-based way. It extracts & maintains the metadata for individual from the database and monitors for the any modification under metadata exists. In this middleware creation module, it renders both the patient data along with the reports which are in the form of image.Then the individual patient information along with the metadata including their image will be compressed together and will be maintained under middleware control.

Secured Cloud framework has Cloud computing is a general term for anything that involves delivering hosted services over the Internet. These services are broadly divided into three categories: Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS) and Software-as-a-Service (SaaS).A cloud can be private or public. A public cloud sells services to anyone on the Internet. A private cloud is a proprietary network or a data center that supplies hosted services to a limited number of people. When a service provider uses public cloud resources to create their private cloud, the result is called a virtual private cloud. All the data are retrieved from the middleware will now loaded in to the DB.Then the metadata about the medial reports and imaging of particular patient will be stored in the cloud storage.Since we used the public cloud storage, the security must be established between the multiple users to download about their reports.Thus the cloud storage must be in a secured way to avoid misusing by any unauthorized user from the storage.So in this module the metadata of every user should be viewed in an intermediate format using the cryptographic methods.The medical records should be converted into the cipher text using encryption and should be uploaded into the cloud storage.

Device dependent service is for A device dependent Service (DDS) contains information that describes a device instance to the device driver. It typically contains information about device-dependent attributes as well as other information the driver needs to communicate with the device. In many cases, information about a device's parent is included. (For instance, a driver needs information about the adapter and the bus the adapter is plugged into to communicate with a device connected to an adapter.)In this module of the device dependent service, the medical service should be provided to the requested user about medical reports. The medical service must provide the service to any type of device like mobile computer and using web services. Thus it should recognize the device and then should retain the metadata from the

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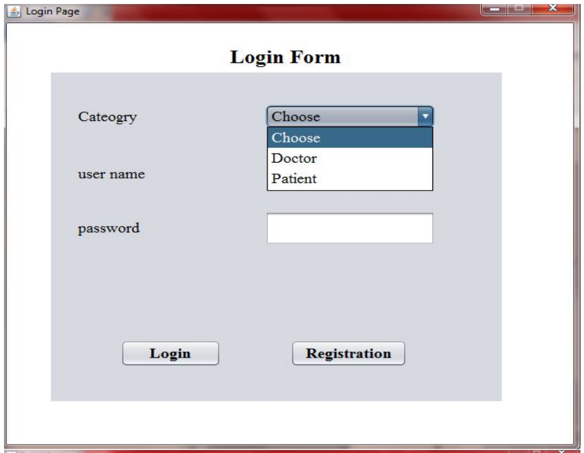
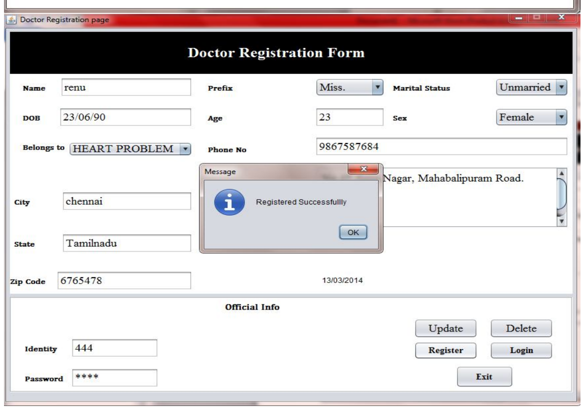
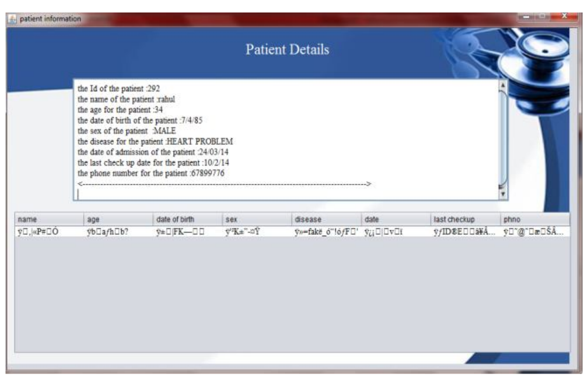
secured cloud storage. When the user or a patient initiates any request from any other devices it should able to recognize whether they are authorized user or not before they retrieve any medical information. If it seems to be unauthorized then it should not allow them to view any medical reports from the cloud storage.





Here the authorized users username and password will be matched with the cloud storage then will be allowed to view the encrypted form of data.Only the authorized user can decrypt the medical metadata using the decryption keys and can obtain the source medical reports.Others cannot able to decrypt the encrypted form using their keys to misuse others medical reports.



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Mobile medical application development For purposes of this guidance, a mobile application or "mobile app" is defined as a software application that can be executed (run) on a mobile platform (i.e., a handheld commercial off-the-shelf computing platform, with or without wireless connectivity), or a web-based software application that is tailored to a mobile platform but is executed on a server.The widespread adoption and use of mobile technologies is opening new and innovative ways to improve health and health care delivery.Mobile applications (apps) can help people manage their own health and wellness, promote healthy living, and gain access to useful information when and where they need it. These tools are being adopted almost as quickly as they can be developed. Mobile apps are software programs that run on smart phones and other mobile communication devices. They can also be accessories that attach to a Smartphone or other mobile communication devices, or a combination of accessories and software. Mobile medical apps are medical devices that are mobile apps, meet the definition of a medical device and are an accessory to a regulated medical device or transform a mobile platform into a regulated medical device.Consumers can use both mobile medical apps and mobile apps to manage their own health and wellness, such as to monitor their caloric intake for healthy weight maintenance.

Performance Evaluation is The performance evaluation is a method by which the job performance of the proposed work is evaluated.A performance evaluation is a systematic and periodic process that assesses an individual process job performance and productivity in relation to certain pre-established criteria and organizational objectives.Other aspects of individual employees are considered as well, such as behavior, accomplishments, potential for future improvement, strengths and weaknesses.The Performance Evaluation System is a process used to assess the performance of classified staff. For this performanceevaluation, we calculated the performance of the enhanced work with respect to the throughput and bandwidth criteria.In this module we compare the throughput of the existing work withthe newly enhanced work and will be shown in a graph using the co-ordinate values which are generated using the calculation ratio.Thus it shows the maximized throughput in the proposed work is achieved in proposed implementation of the secure medical cloud storage.

V. CONCLUSION

Mobile devices have been an important tool in health care for a long time. Our system has the ability to bind to medical applications and transcode and forward the data of mobile use bypasses many of the most intransigent issues associated with medical data. The cloud network created has the potential to extend the reach the hospital infrastructure to allow data access beyond the typical limitationsof proprietary systems. The framework will incorporate the issues which are expected to largely optimize our performance that investigates more advanced modes of streaming multidimensional image data and adapts per to peer networking to reduce power consumption of individual nodes and maximize the throughput.

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