# The Efficient Web based Low-Bandwidth System for Telemedicine Applications

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**Abstract**
Telemedicine to take a shot at low bandwidth is a website and this application intended to work with portable web association (or) in Offline mode (if there should arise an occurrence of no system availability in remote zones) furnishes an easy to use interface with which the patient and specialist can have a vivacious cooperation. The patient can communicates his manifestations to the specialist and can take proposals from him. With this application the patient can spare his/her time traveling from far separations to the doctor's facilities. Telemedicine has increased enormous prominence in creating nations where rustic populace is denied access to even fundamental medicinal services. Directly telemedicine is demonstrating amazingly reasonable and possible arrangement connecting with rustic populace and crossing over uniqueness in quality and access to social insurance amongst urban and provincial areas. The telemedicine market has seen dynamite development of late for the most part in light of merging Information innovation Communication and Healthcare. This paper looks at the present condition of telemedicine in creating nations. It additionally examines telemedicine execution cases, lessons gained from the cases, and finishes up with potential researchable basic achievement factors that record for the development and unassuming triumphs of telemedicine. The paper likewise quickly examines about the headways in execution of telemedicine in created countries.

**Keywords**
Telemedicine, Telemedicine implementation, e-Health, Health Care Quality, Telemedicine Technologies, Telemedicine Communication, ROI (Region of Interest), DICOM (Digital Imaging and Communication for Medicine).

## I. Introduction

This task is created for the actualizing telemedicine in country regions is the primary objective, rather than utilizing web application here we utilize an application to screen the whole procedure with distributed storage and reinforcement. Once the report of patient is readied, it is sent to referral specialist utilizing an android application with portable web association, if web isn't accessible then it can be sent through an ordinary instant message. In view of that, the specialist contacts to the patient and endorses solution to the individual gnm (general nursing and birthing assistance) of that facility. Every one of the information of the persistence will be safely put away in cloud and it can be went down at whatever point we need to. The specialists who needs to be a piece of telemedicine will be enlisted to the application and nearby gnm can approach the specialists at specific time of specialist's determination. Keeping in mind the end goal to achieve a decent telemedicine benefit, a great nature of administration (QoS) [2] is required in the transmission of ongoing information. Unseemly QoS is normally seen when a remote application does not execute not surprisingly, either by absence of precise criticism or by over the top reaction idleness. With regards to telemedicine applications, the apparent QoS is principally molded by the reaction idleness and additionally by the accomplished synchronization of the dispersed condition, i.e., by the accomplished synchronization of varying media information stations and client activities. The last is of vital significance to accomplish an unambiguous and successful community oriented workplace. It is watched that a specific breaking point of idleness is satisfactory, as long as exact synchronization among basic information channels is accomplished (for example, if two doctors are analyzing some patient information – e.g. a X-beam – so as to abstain from misconception, it is basic that all mouse activities coordinate voice directions amid announcing). Right now, the Internet gives best exertion benefit and is constrained by its bandwidth, deferral and misfortune. Moreover, because of system and frameworks heterogeneity, the trouble to transmit ongoing information in an effective and adaptable way is expanding. This framework additionally extraordinarily eases the burden on the correspondence among specialists and patients the whole procedure of taking is mechanized. Once a patient reached to the specialist is set on the android or site page, it is gone into the database and after that recovered, in practically constant, by an application specialists end. Inside this application, all interchanges in the request are shown, alongside their comparing alternatives and enquiry subtle elements, in a brief and simple to peruse way.

## II. Related Work

Numerous reverting nations like China and India have executed telemedicine systems to associate remote healing facilities with expansive and uncommon doctor's facilities [9]. Out of the three noteworthy telemedicine arranges in China, the IMNC organize depends on phone line and web. It utilizes intense picture pressure calculation to lessen document estimate keeping in mind the end goal to transmit those records over low bandwidth [10]. Pakistan is thickly populated nation where lion's share of individuals are living in towns and residential areas. Because of deficient framework the restorative offices are not palatable in those territories. Because of late progressions in Information and Communication innovation, Pakistan like other creating nations has likewise understood the significance of telemedicine and has begun numerous activities to give better medicinal services offices to the general population of remote zones. Telemedicine developed in Pakistan before 1998, numerous specialists were utilizing email and wire based store and forward advancements to counsel their partners inside the nation and in addition in different nations. Solution innovation ventured out the presentation of telemedicine in Pakistan in 1998 under the program as magnanimous task named TelMEDPAK [11]. An outstanding USA based programming improvement organization led this undertaking. This task finished some little ventures on test bases at Taxila and Gilgit to survey the materialness of telemedicine in Pakistan. The Taxila venture depends on "Store and forward tele-discussion" through email. In this undertaking a model has been grounded at "Ali FAMILY Hospital", which is a private healing facility. This healing facility is outfitted with a PC framework, and scanner having Internet offices. This healing facility is associated with Holy Family doctor's facility

in Rawalpindi. Sentiments are gotten from the master specialists by sending care report of the patients to it. The masters worried to the case answer satisfactory answers in the wake of concentrate those reports: Except some higher specialists, nobody has the privilege to get to the patient's reports and patient records are kept entirely secret. The other task at Gilgit, TelMEDPAK has "voice visit" office. Gilgit having 250 thousand populaces with a couple of wellbeing offices and harsh climatic conditions is the correct territory where telemedicine can assume an indispensable part by lessening. The hardships of the general population confronting medical issues are regarding voyaging and taken a toll. Here additionally telemedicine display has been shown by connecting areas headquarter Gilgit (DHQ) with surgical unit of Holy family doctor's facility Rawalpindi, where restorative authorities identified with specific fields is made accessible. In such manner all the conceivable commonsense modalities of telemedicine is tried and drilled like, sending pictures, X-beams, patients record, Electrocardiography (ECGs), automated tomography (CT filters), voice visit among board of specialists, chilly cases and injury cases are traded. The achievement of this venture, demonstrates that through along these lines we can assume a noteworthy part by utilizing telemedicine which won't just redesign territories yet will bargain those cases which can not be bargain up close and personal because of a few components with respect to the standards and estimations of these regions. In such manner the administration of Pakistan has taken a few activities. The initial phase toward this path is the establishment of telemedicine gathering in September 2001 with the sole reason to recognize telemedicine in the nation by holding courses, meetings and to call attention to and distinguish little test venture which can be additionally extended at national level. In these targets the primary workshop was hung on 22 January 2002, where a live tele-interview between a specialist and expert and a specialist and patient is demonstrated including a tele-surgery activity through fiber-optic innovation. This discussion calls attention to and features numerous undertakings including: the advancement of wellbeing administration data framework (HIMS), the improvement of wellbeing asset focus (HIRC) which goes to the foundation of electronic patient record framework at government doctor's facility and advancing wellbeing exploration and connection investigate separately. HIRC is predominantly committed to therapeutic research exercises and database of healing centers and specialists in Pakistan. It is such a perceived and well-manufactured online asset focus, which empowers the specialists and the general rank individuals to get a ton of valuable data. The space and upper environment commission (SUPARCO) is the space organization of Pakistan, working under the government, executing the space science and innovation programs in the nation. It is a self-governing innovative work association.

## III. Telemedicine System Service

In this paper, we have developed a telemedicine system that supports teleconsultation, telediagnosis, and tele-education. In teleconsultation, rural physicians referred their patients to the medical specialists at a medical center who provide second opinion for them. The patient's medical records will be shared between the rural physicians and the specialists; they will discuss the symptoms of the patient's conditions interactively. The patient's final diagnosis is reached following discussion between the two physicians.

In teleconsultation, we need a synchronous two-way videoconferencing system as well as a document-sharing mechanism to allow rural physicians to send their patient's medical information to specialists and engage in face-to-face conversation. In telediagnosis, it is similar to teleconsultation, but the specialist makes a diagnosis based on the received information. The specialist makes the diagnosis and then forwards the diagnosis report to the rural physician. The major difference between them is that the telediagnosis requires high-quality data and images to achieve an accurate diagnosis, while the teleconsultation requires a synchronously interactive conference environment. Telediagnosis can be performed asynchronously. In tele-education, a rural physician playing a student role obtains advanced medical expertise from the specialists. There are two ways to deliver tele-education to rural physicians. First, knowledge may be delivered in a face-to-face manner through teleconferencing between the rural physician and the specialist. So, a real-time videoconferencing system capability is required for interactive communication. Second, the knowledge may be put in medical teaching materials which can be organized and converted to a digital multimedia textbook presented on the World Wide Web (WWW). A network discussion panel may also be created for exchanging ideas and discussing problems among the rural physician and the specialist. Rural physicians can access these materials and educate themselves via the Internet. So, an authoring tool for compiling the medical teaching materials and a friendly user interface for browsing and discussing the multimedia textbook are required.

In order to meet the requirements of teleconsultation, telediagnosis, and tele-education simultaneously, patient medical records and the associated images must be organized in such a way that a physician can easily access the database based either on a patient's clinical history or on particular cases (clinical problems). This requires that the database must meet different purposes by providing both patient-oriented data folders and problem-oriented data folders. A patient-oriented data folder is used to store all the medical records of a single patient; a problem oriented data folder is used to store all the medical records of one specific case.

### A. Conceptual Databases Models

We know that the physician makes a diagnosis and treatment plan in the clinical practice not only based on the patient's current situation, but also on a review of the patient's history and references

in similar disease symptoms. The current traditional medical databases are constructed according to the type of material in the records. These records may be laboratory data, consultant comments, physicians' notes, and diagnostic medical images from different sources and each of them were managed in separate files. Although this management method is relatively easy to maintain, it is difficult to trace the history of particular problem. To resolve this difficulty, we defined a database as a concise data set containing all of the medical diagnostic information of the patient. Besides, the database package can manage and save any change of status or new information that emerges from the subjective description, objective description, assessment, and plan; these derivations are based on subjective, objective, assessment, and plan (SOAP) medical record methodology [30].

The subjective description (S) refers to the description of a patient's chief complaint and the history of the disease problem. It is interpreted from the patient's point of view, and in this study, includes symptom code, duration, location, severity, description, and chief complaint. The objective description (O) records the results of all measurements during the current visit and factual plan results as noted by the physician during the previous visit concerning the same problem. In this part, physical examination

results, laboratory data, and diagnostic plan conclusions are summarized in the fields of item, location, finding, sign-code, and description. The assessment information, part A, records the physician's diagnosis and a description of the disease problem based on the information in part S and part O It is expressed with the problem ID and an assessment description. The plan information, part Prefers to the diagnostic and therapeutic plans made by the physician specifically addressing the patient's problem.

### B. Database Implementation

It is noteworthy that, as in fig. 1, part of the medical record is a form of multimedia. An important point in system design is how to build a medical information database system to manage heterogeneous data. Although the relational database provides a set of powerful tools to manipulate data, its template of predefined data type limits its ability to manage large objects. In our implementation, the attributes of Video and Images are defined as FILE type. The attributes of Report, Chief Complaint, Description and other attributes are defined as TEXT type. More importantly, they can be uniformly manipulated in SQL queries.

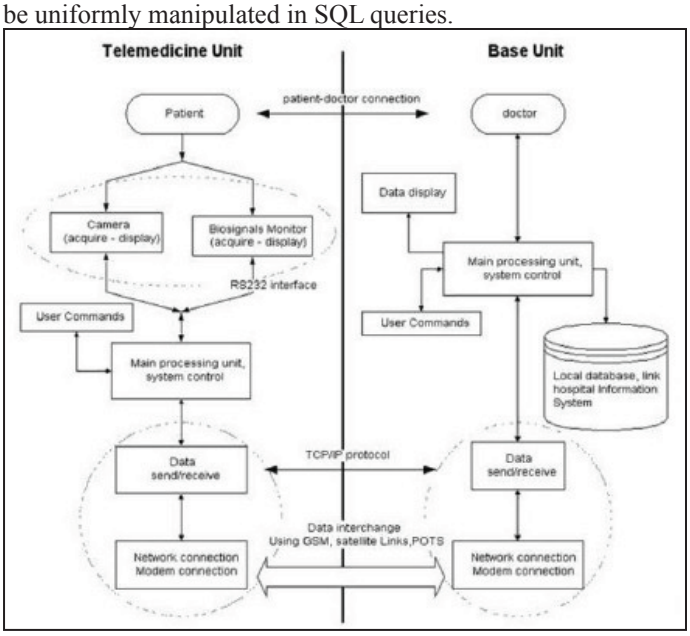


Fig. 1: Web-based Telemedicine System

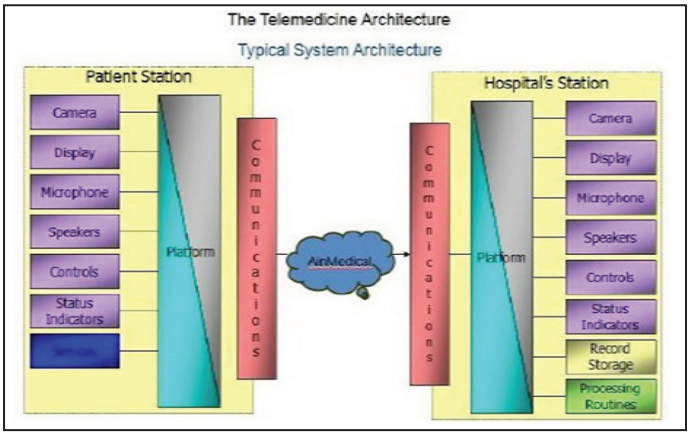


Fig. 2: Ain Medical Telemedicine Architecture

In addition to data integration, speed of data retrieval is also a factor that affects the performance of the telemedicine system. In this paper, a three-layer hierarchical database is created; the three layers consist of main database, long-term database, and local database. The main database stores medical information concerning patients who have visited within recent months. After this period, the data are moved to a long-term database. Then the long-term database server packs the image data according to time of creation and manages it in the DICOM media storage directory (DICOMDIR) format, which is introduced by the American College of Radiology and the National Electrical Manufacturers Association (ACR/NEMA)to store DICOM-formatted medical images in permanent media[31].

The local database provides a short-term storage location forthe medical records of patients currently visiting. It functions to reduce workload of the database server and traffic of the network. In order to prepare the most frequently used data, the PREFETCH mechanism, which works to reduce the data accessing time, is incorporated into the local database installed in the medical center. During teleconsultation, the PREFETCH precedes the diagnosis and accesses medical records according to the schedule. In telediagnosis, the medical records must also be prefetched if the diagnosis report has not yet been completed. Moreover, the REFRESH mechanism is also incorporated in the local database at the rural site to maintain acceptable communication reliability. It stores the medical records of newly visiting patients in the local database and forward these records when the communication channel has been successfully connected. Thus, it can avoid data loss caused by failure of the communication channel.

## IV. DICOM (Digital Imaging and Communication in Medicines)

During the early 1970s computed Tomography was introduced as the first digital modality in the field of digital medical image processing, the importance of which had increased acquired in the due course of time. The evolutionary aspect of PACS and its distribution to a medical Centre or a hospital, electronically, has created the substantiating demand for the exchange of these digital medical images between and among various medical devices from different manufacturers. It was during 1983, both ACR and NEMA forged to create a high-functioning group to develop an image exchange standard. The collective work resulted in ACR-NEMA standard, which was revised several times. Inspite of various revisions, there were certain conceptual weaknesses like no network support for transmission, different proprietary dialects, this standard was however a no success. As a consequence, DICOM standard was developed with an objective to create an open source platform (vendor independent) for the communication of medical images and related data. Since then the DICOM is accepted as a formal standard.

The metrics, data values and theinformation contained in an image of DICOM standard do well above the standard definition, defining the format of commerce for medical images defining;

- Data Structures
- Network Oriented Services
- Formats for Storage Media Exchange
- Requirements for conforming Devices and Programs.

Each tone of medical imaging is squarely defined by and pro-founded by the DICOM standard with a well-established the grid privileges with a perception of the client-server composition. The network services application agree on a common set of parameters, the connection then can be and will be established. In medicine, DICOM has developed into an imperative integral for the assimilation of many digital imaging systems. An overture of solutions, for many grid related pertinences as well as offline services are provided by DICOM. There is however no guarantee

for a "plug and play" integration of all information systems in a hospital.

### A. ROI (Region of Interest)

A subspace of the pixels/pixel values pertaining to the input digital image are refined in most of the image akin undertakings. A capricious sector of selected pixels or only a legitimate of the input image, may be considered depending on the task. Due to certain limitations fencing around the compression algorithms; either lossy or lossless, the basic concept of Region of Interest was introduced. ROI, a glossary pattern often correlated with unequivocal or perceptible information encompassing an image, expressed in a structured format. In a medical image, certain regions are of high importance, the data of these sections are to be maintained. Hence an efficient and a practical methodology is required to be modeled in order to retain the information without any loss in the image data.

## V. Proposed System

As implementing telemedicine in rural areas is the main goal, instead of using web application here we use an android app to monitor the entire process with cloud storage and backup. Once the report of patient is prepared, it is sent to referral doctor using an android application with Mobile internet connection, if internet is not available then it can be sent through a normal text Message. Based on that, the doctor contacts to the patient and prescribes medicine to the Respective gnm (general nursing & midwifery) of that clinic. With this application the patient can save his/her time travelling from far distances to the hospitals. The patient can interact with selected doctors/all doctors and can take suggestions from them.All the data of the patience will be securely stored in cloud and it can be backed up whenever we want to. The doctors who wants to be a part of telemedicine will be registered to the app and local gnm can have access to the doctors at particular time of Doctor's selection.

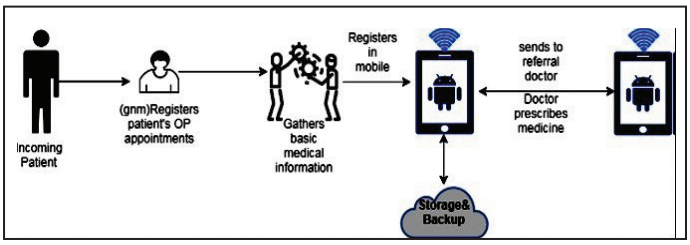


Fig. 3: Proposed Architecture Diagram

## VI. Conclusion

To implement in rural areas, it's better to use a mobile application rather Than the web. So, here by it becomes an easy way to solve primary health issues of the rural people. This application avoids the manual work and the problems concern with it. It is an easy way to obtain the information regarding the various information that are present in the doctors. This is a new application with good user interface. This will provide the user an easy way to communicate with each doctors and patients in the better way. User did not have to face any kind of problems using this application it can be used even by a layman. Finally it's the easiest way to use and saving lot of time.

## VII. Future Enhancement

For any government, ensuring that all citizens have access to quality healthcare is a fundamental responsibility and an essential economic function. Healthcare must be accessible, affordable, and responsive, both to the constantly changing medical and clinical needs of patients as well as to the broader demographic, social, and cultural shifts that typify the modern world. The health status of a country is the complex interplay of a variety of factors like economic growth, per capita income, literacy, education, age at marriage, birth rates, nutrition, access to safe drinking water and healthcare infrastructure. In countries like India rural healthcare IT infrastructure needs to be upgraded and modernized to enable faster, safer and more efficient delivery. IT implementation apart, innovative models of public private partnership and capacity building through technologies like Telemedicine are needed to address the challenges of 'access' to affordable and quality healthcare in rural areas.

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