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Telemedicine in Transient Phase: Emergence of M-Health Care Services

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Abstract

The fusion of medical science and technology has emerged 'Telemedicine' as a new technological platform, for providing healthcare services to the masses residing in rural and remote areas. The government and non-government bodies are striding hard to implement and promote telemedicine across India. Despite of various initiatives, telemedicine is starving to find the place in healthcare service sector. With the emergence of mobile technology, telemedicine has reached in transient phase. The advancement in mobile technology has improved the accessibility of qualitative healthcare among rural masses. The present research work is an attempt to analyze various telemedicine projects undertaken by the government and to highlight the gaps of low popularity and accessibility among the people. The study also suggests mobile-based model for healthcare. The model demonstrates integration of various healthcare services under the common interface based on mobile applications. It also includes patient-doctor interaction interface system, patient monitoring system, e-payment, online pharmacy and pathology. The use of proposed model will not only reduce the cost of healthcare but also facilitate immediate availability of services. The model-based application provides convenient platform for interaction between doctor and patient. The online payment and monitoring system keep track of patient's economical and health status. The review of various reports and literature reveals that traditional telemedicine practice is passing through transient phase, in which, mobile-based medical applications are replacing traditional practices of healthcare. The findings also reveal the limitations of implementing telemedicine such as delay in response time, low frequency of conducting tele-conferences, lack of infrastructures and lack of awareness among patients. The present study is an attempt to resolve these issues with use of an integrated system for healthcare that can provide low cost, timely and speedy healthcare services. The study concludes that mobile-based applications are real time applications and are more useful as compared to traditional practices in telemedicine services.

Keywords: ehealth, Initiative, Integrated Model, mHealth, Mobile Health, Telemedicine

1. Introduction

India is a geographically diversified and highly populated country where a large share of population dwells in the rural areas. There exists a huge disparity regarding the availability of medical facilitates between rural and urban population[1]. The governments as well as private healthcare stakeholders invest more in urban area for establishment of multi-specialty hospitals and medical research labs, leaving rural masses under served and ignored. Therefore, the rural people have to rush to the urban hospitals for specialized treatment such as heart attack, stroke, sugar attack etc. In such cases, the distance becomes the critical factor for safety of the patient. The telemedicine is an optimal solution to deliver vital and effective healthcare services to such underserved and unprivileged people living in rural areas. The key feature of Telemedicine is the transfer and exchange of medical information through internet by which patients can seek expert advice at the local end. This exchange of information provides an aid in consultation, diagnosis, treatment and management of patient's health problems. As per present telemedicine practice, the patient seeking telemedicine service, visit nearby hospital having facility of telemedicine[2,3]. The doctor on duty examines the patient, and if the doctor finds that the treatment requires expert advice, then

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the case is referred to telemedicine centre. The operator of telemedicine centre digitalizes the patient's records and forwards the information to specialists in the multi-specialty hospital. As soon as the comments and prescription from the specialist is received, the treatment of the patient at the local end is started. If required, video conference session can also be carried out in the presence of doctor at remote sites. The ehealth is an integral part of telemedicine system, which enables the doctors to view patient's records such as X-ray, MRI, pathology reports etc. in the digital form. The patient gets treatment without appearing physically at the doctor's place. On the other hand, virtual visit of patient helps the doctor to examine physical condition of the patient.

Telemedicine, a technical fusion of medical science and information communication technology[4] has emerged with enormous potential to reduce disparity regarding the availability of healthcare services based on geographical diversification in India[5,6]. It is a hope to serve people of India with equality and quality. The telemedicine facilitates the following medical services[7,8].

- Tele-pathology
- Tele-cardiology
- Tele-oncology
- Tele-monitoring
- Tele-radiology
- Tele-education

Telemedicine services are provided into three ways:

Store and Forward: The patient's information is stored and transferred electronically to the specialist at distant locations for reference. There is no necessity for patient and doctor to meet personally or online[9].

Remote monitoring: It is an automatic monitoring system, in which the physicians monitor a patient remotely with the help of various gazettes[10]. This method is useful for managing chronic diseases, such as heart disease, diabetes, asthma.

Real-time interactive services: The patient and physician interact with each other either using mobile phones or video conferencing[11].

2. Telemedicine Initiatives in India

The Government and private health care service providers have taken various initiatives to implement and enhance the performance of Telemedicine services. The major stakeholders leading Telemedicine in India are Ministry of Health and Family Welfare (MOH&FW), Department of Information Technology (DIT), Indian research organization (ISRO), Ministry of External affairs (MEA), etc. Table1 shows various initiatives taken by government agencies[12,13].

Table 1. List of various initiatives taken by government agencies

Sr.No	Agency	Initiatives
1	Ministry of Health and Family Welfare (MOH&FW)	Some of the projects taken up by MOH&FW are establishing Integrated Disease Surveillance Programme, OncoNET for cancer treatment and initiating proposal for National Telemedicine Grid[10,11].
2	Department of Information Technology(DIT)	Various national nodes, task forces, committees and regulating bodies have established by state governments in collaboration with DIT for installation and implementation of Telemedicine Project[12].
3	Indian research organization (ISRO)	Some of the initiatives taken by ISRO include launching of rural satellite GRAMSAT, providing connectivity for consultation and education, connecting remote/ rural and district hospitals with super specialty hospitals etc.
4	Ministry of External affairs (MEA)	The ministry of External Affairs has initiated the Pan-African e-Network Project and the SAARC Telemedicine Projects to provide clinic care at international level[13].
5	Medical Institutes	With the aim to promote, encourage and develop application and research in the field of Telemedicine for clinic care and education Telemedicine Society of India (TSI), Medical Computer Society of India (MCSI) and Indian Medical Informatics Association (IMIA) were also founded[14]. These societies organize regular scientific meetings, workshops and seminars to disseminate knowledge regarding recent advancements in Telemedicine.
6	State Governments:	Various Telemedicine centers have established in sub divisional hospitals and medical institutes. As per reports of Punjab Health system corporation (PHSC), there are 25 telemedicine sites/centers in Punjab, which provide telemedicine services to rural population of Punjab[15].

Table 2. Description of few Mobile applications

Sr.No.	Mobile app	Descriptions
1	National Health Portal India	It is designed especially for rural audience for providing health information services
2	AIIMS-WHO CC ENBC	It is helpful of nursing colleagues and neonatologist for Small Hospitals with limited resources.
3	HealthyYou Card	Search Engine for searching Doctors, Hospitals, Diagnostic Centers and Pharmacies
4	TB Detect	Provides multimedia contents from experts in TB prevention and care.
5	alt12 Apps	Menstrual and fertility tracker, comprehensive pregnancy app for women.
6	Access to health	Access to health information and decision-support tools including WebMD's Symptom Checker, Drugs & Treatments, etc.
6	Lybrate	Provides patients with a one-click emergency support system, search tool for nearby ambulance services, and book appointments with best doctors.
7	NewBornCare	The app contains menu-based information for managing normal, at risk and sick newborn babies.
8	MEDBOX	To store, retrieve and share their personal health record saved electronically and provides searching tool for pharmacy store and diagnostic centers.
9	Mswasthya CDAC	Used in medical emergency, consult a doctor, Diabetes Monitor, Vaccination alert and many other alert

The government of India has launched National Health Portal (NHP) under National Institute of Health and Family Welfare (NIHFW) and the Ministry of Health and Family Welfare (MoHFW)[14]. The portal provides various kind of information related to healthcare and telemedicine. The portal list 42 different Mobile of mobile applications, which provide information and automatic, alter system for patients[15]. Table 2 shows description of few mobile applications.

2.1 Limitations of the Existing System

The present setup of telemedicine services has various limitations. First of all, the average time taken for response from the expert is about 3-4 days which many a times becomes crucial for the patient[16]. The most effective method of treatment under telemedicine is videoconferencing. It has been observed that conducting video conference is difficult task due to lack of infrastructure and non-availability of expert for videoconferencing. Moreover, the available mobile based applications are focused more on providing information rather than providing module for interaction between patient and doctors. Except one or two, the mobile applications are lacking with facilities of video conferencing[17,18].

It has been found that there is no mobile application available, which has integrated online medical store, pathology lab, and hospital health care. The mobile based telemedicine is a good option but most of mobile applications have only aimed to educate and provide necessary information. There is a need to develop platforms, which enables easy to use mobile applications under telemedicine. In the light of demand of integrated platform, we have proposed a system, which is mobile-based interaction module that enables the doctor to communicate with the patient. The model enforces integration of online pathology, online medical store and patient alert system. The payment gateway can be used for making required payments. The proposed model will provide multiple facilities under the common interface.

Telemedicine is an effective method for treatment of disease where delay in treatment is crucial. However, in case of emergency such as heart attack, stroke, chronic disease, patient needs to attend and refer to a specialist. The treatment of chronic diseases requires continue monitoring even after the patient is discharged from the hospital[19,20]. Such situation demands a system that is portable and easy to use in for both the doctor and patient. Moreover, the patient has to visit telemedicine centre number of times to have video conferencing sessions. The major drawback of present system is delay in response time and low rate of video conference. The proposes system is a integrated mobile based model, that enables the patient and doctor to communicate through video conferencing any time anywhere.

3. Proposed Mobile based Telemedicine Model

The proposed model is described in two major modules, which are named as Patient's Module, and Doctor's Module.

Patient's Module: Patient's module is focused on various activities to be performed before availing mobile-based telemedicine treatment by the expert. The major role of this module is to get appointment from the doctor for video conferencing. Figure1 shows various steps to be followed to accomplish the registration and appointment process.

Procedure for Appointment:

1. Patient has to visit telemedicine centre at least once, for registration.
2. Patient has to bring his old prescription along with all the medical reports such as X-ray, MRI,
3. Ultrasound images which will be digitalized by the Telemedicine operator.
4. First of all patient directly consult doctor on duty at local hospital, after examination, if doctor find treatment require expert advice, then case will be referred to the telemedicine centre.
5. Telemedicine operator digitalizes the reference letter, old prescriptions/medical reports
6. Registration interface is used on mobile or system for registration and all digitalized data will be uploaded into the newly created account. After completion of registration, the patient will be allotted a unique registration Id.
7. Appointment Interface is used to locate doctor for expert advice.
8. Select appropriate medical branch (Ortho, Neurology, urology, Pediatrics, etc), search available doctor from the list.
9. After selecting doctor of your choice, check available time slot. Finally, patient will get a unique appointment Id.

The doctor and patient will undergo the telemedicine procedure whenever the doctor is available in the specified time slot. In case of emergency, operator can connect to the doctor on the spot; doctor who is online will receive the call and communicate with operator. The doctor writes the prescription online, which will be made available to the patient.

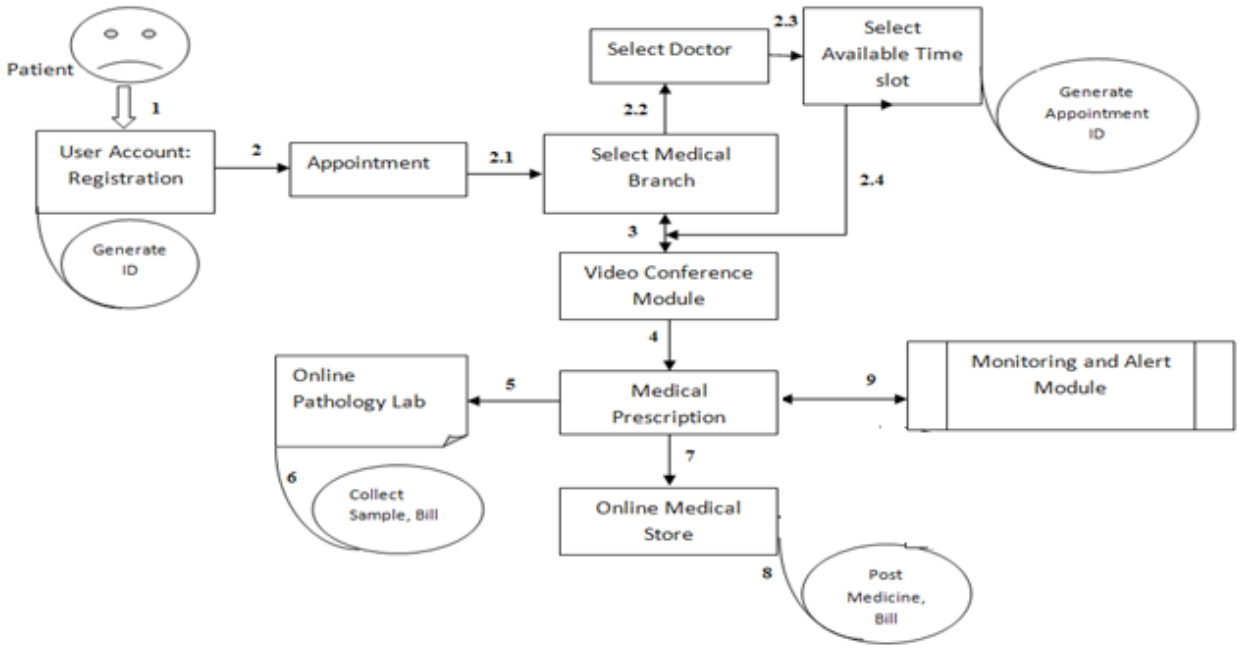

Figure 1. Patient's Interaction Module.
(Source: Developed by the researchers).

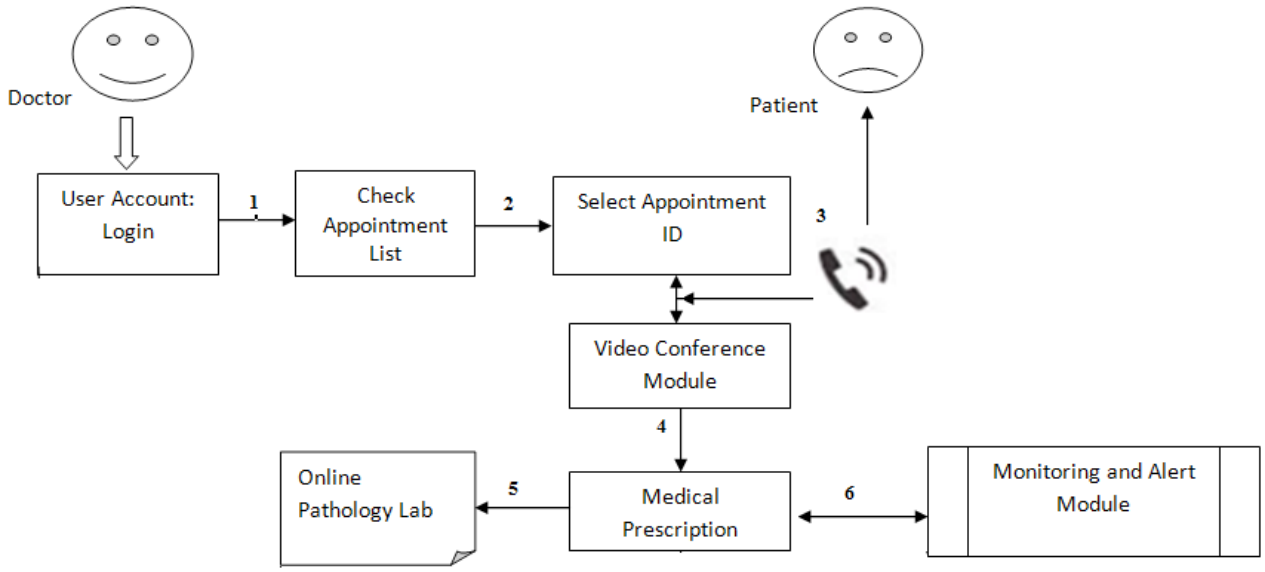

Figure 2. Doctor-Patient Interaction Module
(Source: Developed by the researchers).

Doctor's Module: The doctor's module covers various activities that doctor need to perform during the treatment of patient through telemedicine services. Figure 2 shows various components of the doctor's module. The primary objective of this module is to conduct video conferencing and monitor the performance the patient.

3.1 Procedure for Video Conference and Monitoring the Patient

1. Doctor should registered with the mobile application and login with authorization.
2. Doctor can view list of patient seeking tele-medicine in serial order.
3. Doctor can select any appointment ID and make call for video conference in specified time span.
4. After video conferencing, the doctor can write prescription and pathology tests that will be stored in patient account. The doctor also writes specific prescription in alert system regarding diet and medicine for patient.
5. As per prescriptions, self-monitoring and alert system is updated for routine checkups like blood pressure, sugar, diet chart etc.
6. List of pathology lab test is also updated into patient pathology list. Where, the patient can select pathology online lab.

4. Conclusion

Telemedicine is a new and lucrative concept. Easy accessibility and cost effective treatment under Telemedicine has reduced the gap between demand and supply of health care services. Indian stakeholders have initiated and implemented number of projects successfully across the country to provide medical assistance in far-flung areas. However, providing qualitative Telemedicine services to huge masses is a challenging task for service providers as it includes technical, legal, economical, ethical and clinical issues. Present research work proposes a mobile-based integration model consisting of video conferencing, pathology and alert system. Considering digitalization of records and pathology as an integral part of the system, this model emphasizes on the usage of video conferencing between patient and doctor at any point of time. It will also bring all the facilities under the single mobile-based application, which will definitely resolve the problem of non-availability of experts and the problem of delays in the treatment.

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