



Design and Implementation of Telemedicine System

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Abstract: WebRTC is a protocol that extends common browser capabilities, making it hassle-free for browsers to exchange real time media. In this paper, we have developed a Telemedicine System which works using Web RTC protocol. The implementation of this system provides rural areas access to specialised consultations and treatments. In a developing country like India where the rural community is gravely neglected, the use of Telemedicine in healthcare can aid in bridging gaps between urban and rural areas. A simple browser that supports WebRTC like Firefox, Safari, web camera and a stable Internet Connection are sufficient to make it work on any computer.

Keywords: Telemedicine; WebRTC; Rural Healthcare; e-Health.

I. INTRODUCTION

The distribution of healthcare facilities and centres are highly imbalanced in countries like India and other third-world countries. Though the healthcare industry in India has come a long way since its independence, numerous rural and remote areas are under served and continue to face a lack of medical professionals and treatments.

India does not have national health insurance for its citizens, and many of the healthcare costs such as travelling to the super speciality hospitals and staying in the city with their escorts are paid out of their pockets as insurance does not cover these costs.

Telemedicine aims to reduce many of these costs to provide affordable healthcare to people. According to WHO, Telemedicine can be defined as the delivery of healthcare services, where distance is a critical factor, by all healthcare professionals using information and communication technologies. In May 2011, Google released an open source project for browser-based real-time communication known as WebRTC.[6]The whole system makes use of Web Real-Time Communication protocol which is a collection of simple API's that equip many browsers and mobile applications with real time capabilities without any need of plug-ins or extra equipment. The goal of WebRTC is to enable peer-to-peer communication between two browsers. The exchange of audio and video data takes place through a WebRTC data channel which leads to higher performance and lower latency.

For security purposes, it uses secure RTP which encrypts and authenticates voice and video data. This prevents any third-party interference. Even though there are many other solutions available for video conferencing like Skype, the specific application must be installed by both end-users, whereas WebRTC only requires a compatible browser like Chrome, Safari, Opera etc. The user needs to login and a video conference can be established with any other user who happens to be online. Hence the biggest advantage is it's interoperability with the existing systems. It is free of cost and cuts down on charges like subscription fees, specific software and dedicated hardware.

A telemedicine system acts like an intermediary between the local physician and the super-speciality hospital. The Telemedicine Consultation Centre is the site where the patient and the local physician are present. If there is a need for specialised diagnosis, the patient is referred to the Telemedicine System. An appointment is set with a super –speciality doctor at the specified time. The patient reports such as blood tests, X-rays, MRI scans are scanned and uploaded on the Telemedicine Portal. The specialist can communicate with the patient present at the remote site and look up the medical history and reports as well .Using WebRTC; real time annotations can be made on the images that are uploaded. A chat box is available for messaging for offline communication.

Some of the important functionalities provided are:

1. Open an image online during discussion.
2. Mark on the specified regions of the image.
3. Open specialized canvas for displaying skin patches or the different organs of the body.

- 4. Write text for text-based chatting.
- 5. Display the result to other participating doctors.

II. LITERATURE REVIEW

It was first used in the 1950's to send radiologic images via telephone across Eastern Pennsylvania. Based on this, two-way interactive televisions were also used for sending video information communication. E-consults were developed to improve access to specialty expertise for patients without the need for a face-to-face visit. However, the videoconferencing between providers needed specialized equipment and synchronous communication [1]

In Europe, 8 hospitals were connected using broadband networks. A telemedicine environment was established in the frame of EC sponsored TELMED project. The drawback is that a number of requirements associated with it are indispensable such as a remotely adjustable iris of the document camera. [2] A healthcare service was developed especially for burn patients and emergency situations. It is based on client server architecture in contrast to the peer-to-peer network used here which is better in terms of latency.[3]

III.METHODOLOGY

WebRTC communication takes place using three API's-each of these performs a particular function in order to enable the transfer of real time media.

- 1) GetUserMedia - Provides access to the camera and microphone.
- 2) RTCPeerConnection – Initiates the connection and enables sending of real time data between browsers.
- 3) RTCDataChannel – Exchanges data between peer to peer.

A. Working Mechanism

The patient consults the local Doctor for treatment. The Patient is diagnosed at the local health centre and if further specialization is required, he/she is referred to the telemedicine system. If the patient requires specialized treatment, he/she registers into the telemedicine data-entry console.

The details of the patient are entered ex: name, address and each patient is assigned a unique ID. Any relevant information regarding the patient like patient history, medicals reports, previous consultations are uploaded to the database. An appointment for the online session is set with the super-specialist doctor.

When both the parties are online, a video conference takes place between the remote local clinic and the super – specialist doctor at the referral hospital. It also includes additional functionalities like chat and real-time annotation on images.

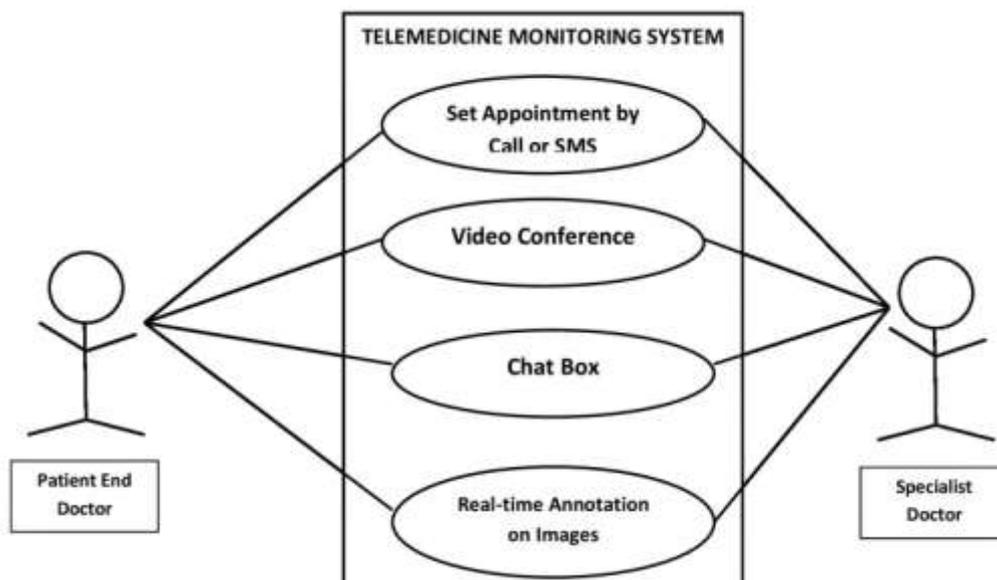


Fig 3.1 Basic Functionalities



B. Flow-Chart

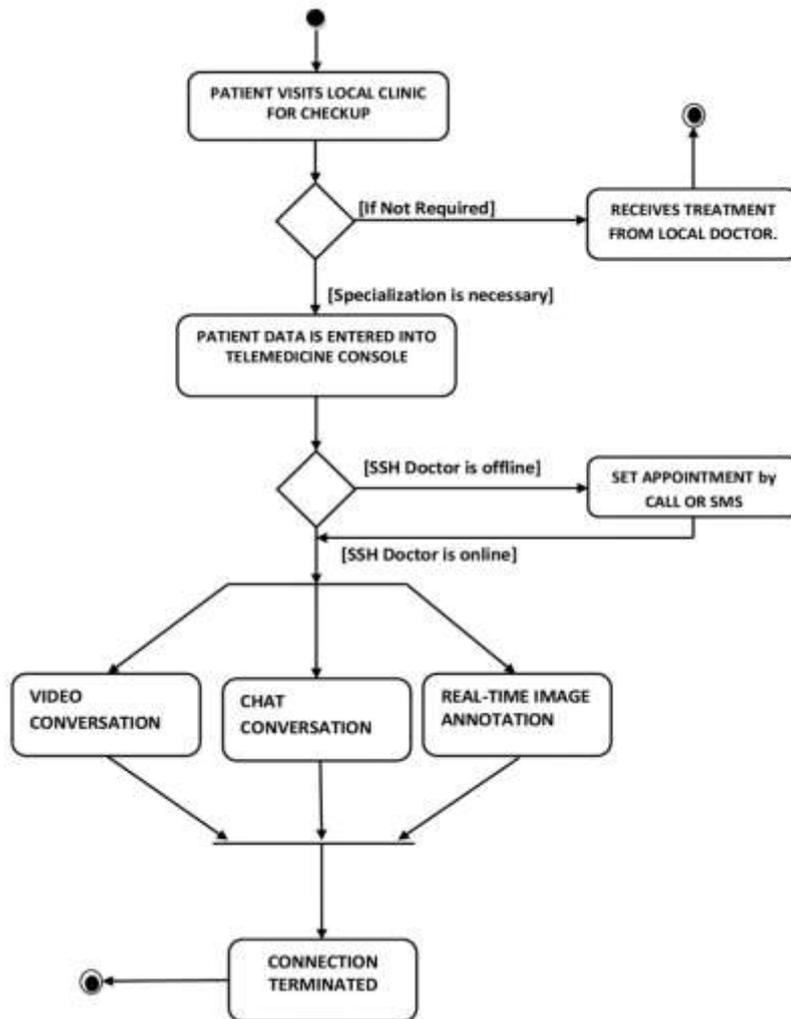
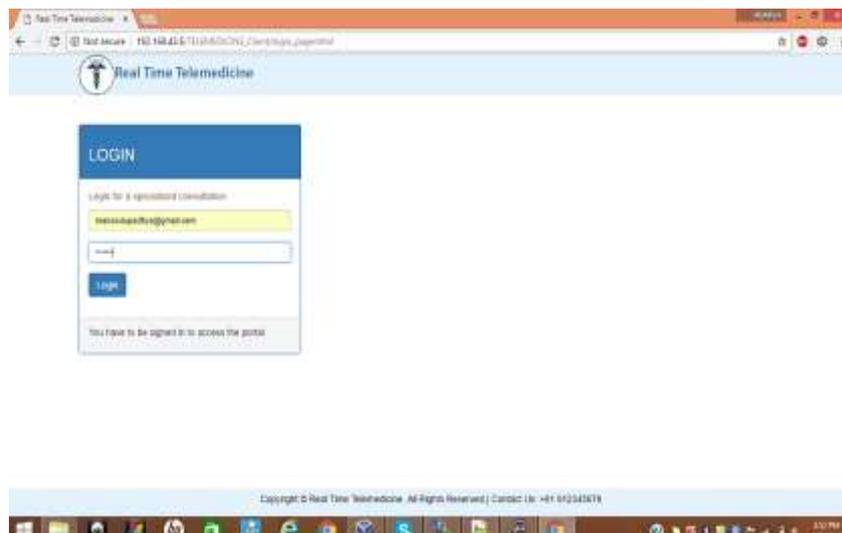


Fig 3.2 Working of Telemedicine System (SSH – Super Speciality Hospital)

IV.IMPLEMENTATION

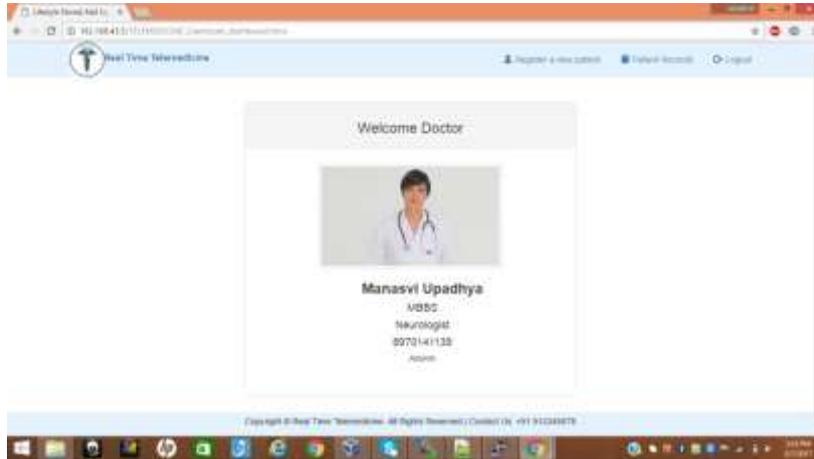
4.1. LOGIN PAGE





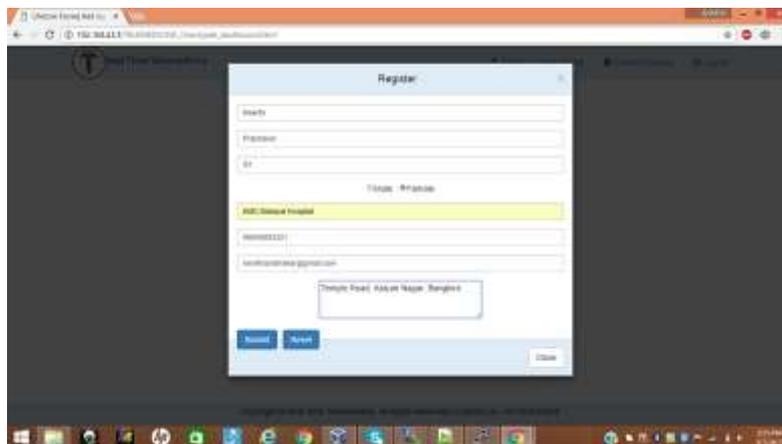
We assume that all details of various doctors are in-built into the system. Each doctor logs in to access the Telemedicine Portal using a username and password.

4.2. DOCTOR’S PROFILE



Once the doctor successfully logs in, his details are shown along with a link to show the patient records.

4.3. PATIENT REGISTRATION PAGE



If a new patient is referred to the Telemedicine system, he has to register first. The patient’s details are entered into the data entry console.

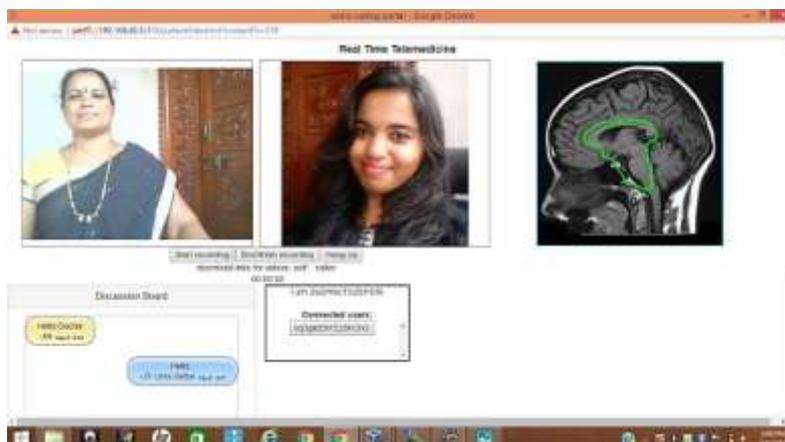
4.4. PATIENT’S PROFILE





The patient's profile with his details, medical history and reports can be retrieved by the local clinic doctor.

4.5. TELEMEDICINE PORTAL



When the concerned doctor is online, a connection is made. Communication takes place through video call, chat along with the annotation of medical images.

V. RESULTS

The purpose of this paper is to present a telemedicine solution that could make the process of remote access to healthcare smoother and easier. We have used WebRTC based solutions to allow the exchange of real time information like establishing a video conference between peers. The application also includes bidirectional document transfer option besides the utilizing the microphone and camera of the computer.

Session recording, audio and video processing for different devices are supported. Diagnosis of the patient is done with the involvement of two health care professionals. The patient can be in his/her comfort zone with the local doctor's involvement. Thus, minimizing the significant charges incurred by transportation and accommodation and timely access to the right treatment.

VI. CONCLUSION

This WebRTC based solution highlights the features of this new protocol, and can be modified and used in other fields as well. Adaptation of the web application to various screen sizes can be improved. Additional features such as integration of body sensors to measure blood pressure, sugar levels, heartbeat can also be implemented.

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