IVRS based Health care for economically backward

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Abstract*—India is producing about 50,000 doctors every year. Besides that, health care in India is still a question. Some of the best-in-class medical resources, including better consultancy are provided by private hospitals which demand more money that poor cannot afford to. Lack of well-qualified doctors and resources are preventing the poor from getting the best-in-class medical facilities available in the country. Amidst that, there are professional practitioners interested in serving the poor. Hospital@Hand tries to connect these service-minded professional doctors to poor people through an efficient and easily accessible medium. This system allows the doctors and patients to medicate and get medicated at their own places without the need to travel. Doctors can access a sophisticated web app to connect with the patient, which they are comfortable with. On the other hand, the targeted poor patients do not have provision to access the Internet. So, in this project we use their basic featured mobile phones to access simple and toll-free IVR system. Doctors can communicate with the patient through simple SMS and voice calls. Hospital@Hand encourages the patient to monitor their health regularly. Most of us have the tendency to care for our health only after reaching a severe stage. This is more predominant among the economically backward community. Our system engages the patient regularly, reminding them to care for their health.

Index Terms*— Dual Tone Multi-Frequency (DTMF), Speech synthesis, Voice over Internet Protocol, IVR (Interactive Voice Response).

I. INTRODUCTION

In this project, we combine healthcare and IVRS. Today, in modern life everyone is not bothering about their health. According to the survey made medical facilities in rural areas are very poor and insufficient. So, many people are unaware of the latest technologies in medical field and the doctors are far away from their reach. So, our system acts an intermediate between the doctor and the patient through a known simpler technology known as IVRS. Basically IVRS means interactive voice response. It is way of communication in which a programmed computer connected to a telephone number will respond based on our action (key pressing). IVRS is used here effectively between doctor and a patient as an intermediate.

Our system will provide the interface for the doctors and the patients to connect.

The tools used are,

- Twilio
- Bluemix

IVRS is provided by Twilio. Bluemix is a cloud storage which is developed by IBM which is used as backend.

A. IVR

Interactive voice response (IVR) is a technology that allows a computer to interact with humans through the use of voice and DTMF tones input via keypad. In

telecommunications, IVR allows customers to interact with a company's host system via a telephone keypad or by speech recognition, after which services can be inquired about through the IVR dialogue. IVR systems can respond with prerecorded or dynamically generated audio to further direct users on how to proceed. IVR systems deployed in the network are sized to handle large call volumes and also used for outbound calling, as IVR systems are more intelligent than many predictive dialer systems.

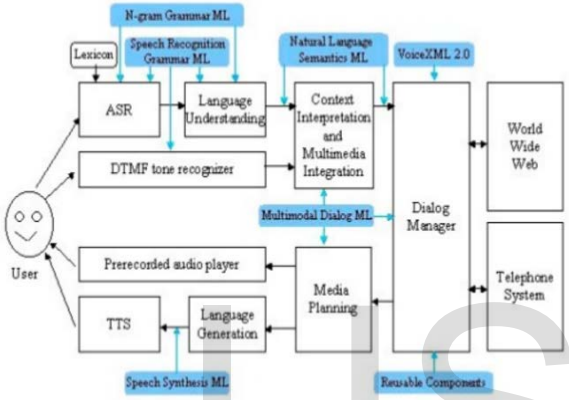

Figure 1: Block diagram of IVRS

DTMF decoding and speech recognition are used to interpret the caller's response to voice prompts. DTMF tones are entered via the keypad. Other technologies include using text-to-speech (TTS) to speak complex and dynamic information, such as e-mails, news reports or weather information. IVR technology is also being introduced into automobile systems for hands-free operation. TTS is computer generated synthesized speech that is no longer the robotic voice traditionally associated with computers. Real voices create the speech in fragments that are spliced together (concatenated) and smoothed before being played to the caller.

IVR speech recognition interactions (call flows) are designed using 3 approaches to prompt for - and recognize - user input: directed dialogue, open-ended, and mixed dialogue.

B. Twilio

Twilio is a cloud communication platform as a service (PaaS) company based in San Francisco, California. Twilio allows software developers to programmatically make and receive phone calls and send and receive text messages using its web service APIs. Twilio's services are accessed over HTTP and are billed based on usage.

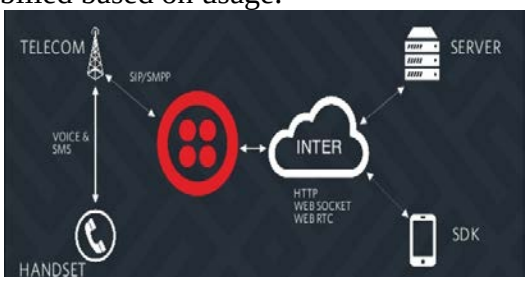

Figure 2: T'wilio's architecture

Twilio is the platform which provides IVRS services.

C. IBM Bluemix

IBM Bluemix is a cloud platform as a service (PaaS) developed by IBM. It supports several programming languages and services as well as integrated DevOps to build, run, deploy and manage applications on the cloud. Bluemix is based on Cloud Foundry open technology and runs on SoftLayer infrastructure.

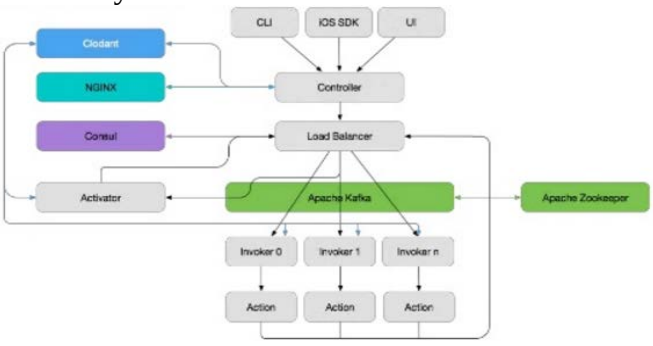

Figure 3: Bluemix structure

It took a team of people located in different places only 18 months to build Bluemix from initial concept to public availability.

II. LITERATURE SURVEY

Prof. Seema V. Kedar has proposed a system, that his paper addresses the advance data mining and feasibility of using IVR approach in medical clinics and hospitals. Using the interactive voice response (IVR) technology the existing hospital phones can be configured to act as automated telephone answering machines, which give instructions to the patients to book appointments, provide guidelines etc. The voice files of data demanded are built and played for response through application, TTS (Text to Speech) and IVR server. System automatically sends alert messages about babies' vaccination schedule dates to the parents of new born babies. It also sends alert messages about upcoming medical camps and appointments to the patients. System is able to provide automatic functioning in hospital by taking decision about scheduling of patient's appointment and medical diagnosis reports by using stored patient's and medical database. In this system, we focus on simple and effective methodology for medical diagnosis. We are using association rules with the Apriori algorithm to decide the diagnostic respective to the disease. To perform effective data mining, system performs classification, clustering and association of data used to identify the symptoms, decision and the respective diagnostics. The association rule is used to select the best solution for the patient.

In this system, the drawbacks are the data are limited to hospital server only. It can send only SMS to the patients. System will focus only communication of patients in particular hospital only.

Server works 24/7 without any human involvement. It is well proven that IVRS controls damages and waste due to careless human error and poor management up to 30%. This adds value in terms of direct cut in cost and better utilization of resources.

Prasad Girish Rashinkar, has proposed a system that the rapid increase in mobile penetration has cut through the literacy barriers even in the developing countries. It has paved a way for technological interventions in healthcare domain, using the mobile platform such as Interactive Voice Response Systems (IVRS). Over the past few years, IVRS have been looked upon as an intervention in frequent and non-frequent but time-critical health support systems for chronic diseases. We present an IVRS based solution for a low-resource setting, to ameliorate the problems of People living with HIV/AIDS (PLHA). We discuss the strategy to deal with frequently and non-frequently used menus. We describe a style of interface added especially to meet the problem of selection of multiple and overlapping options. We highlight the use of flat messages (like health tips) and IRV-based quiz to provide information and shape users' understanding of the disease. We describe and discuss comparative study of usability evaluations of our system conducted with low literate rural users (independent of their HIV/AIDS status) in two villages of Maharashtra (India) in Marathi, the local language. Training provided to the users overcomes the problem of inability of abstract thinking in low literate users.

A Decision Support System is developed which collects disease information from state health workers through Interactive Voice Response System (IVRS), sends Short Messaging System (SMS) to data providers, links the data for mapping the disease information on Geographical Information System (GIS) and publishes the IVRS data on

website.The audio files for a question can be developed in the desired regional languages.

III. OBJECTIVE

To enable educated economically backward class people to access better medical facilities, through simpler technologies and encourage them to continuously monitor their health through IVRS.

IV. SYSTEM DESIGN

Initially, Patients must upload their medical reports at the hospital. Later they can use the IVRS at any time by calling the toll-free number. The Patient data uploaded is shared with the doctor through a web application. Now the doctors can treat the patient either by prescribing through a web application or by communicating with the patients through Voice calls and SMS.

The overall system design consist of two divisions,

- Patient side
- Doctor side

A. Patient side

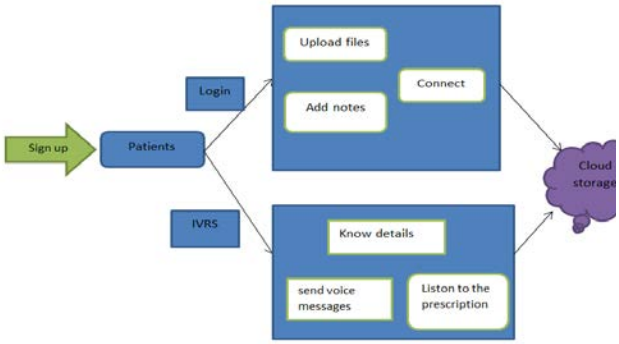

Figure 4: Patient side mechanism

This phase will be done in the hospital side only. The patient will first sign up to enter into his web page. Patient's medical reports are uploaded using a web application. Patient's data, notes about the patient's medical treatment is also added here.

The next phase is the IVRS phase; in this the patients will be communicated and given prescription using the IVRS system. The patients can send voice message to the doctor through IVRS without using internet. In patient side there is no need for internet connection for communication.All the data will be stored in cloud storage. Patients can also call the toll-free IVRS number to use the system at any time.

B. Doctor side:

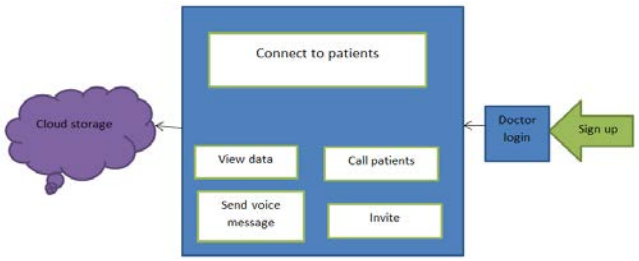

Figure 5: Doctor Side mechanism

In doctor UI, he must use his login to enter into his web application. In doctor side, the doctor can view the data of the patient from the cloud storage. After viewing the records the doctor can call the patient in case any emergency or simply he can record and send voice.

The doctor will add some prescription in the UI that will be sent as voice to the patient.

V. IMPLEMENTATION

Basically the implementation is divided into 4 modules,

- Authentication module
- Data collection module
- IVRS module
- Treatment module

A. Authentication module:

Two sub modules are implemented in authentication module

- Patient side authentication

- Doctor side authentication

Patient side:

In patient side, the authentication will be based on one-time password (OTP). Using Twilio, we can perform the SMS service. The patient will first register his number with the system. Then for every time he can use his mobile number as user name and password will be generated every time in random.

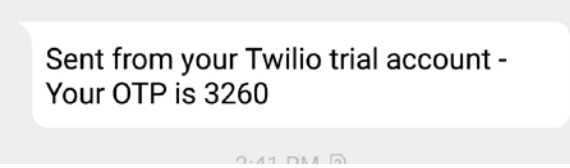

Figure 6: OTP

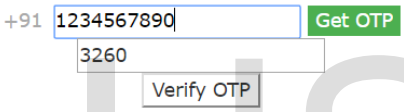

Figure 7:OTP using login

Doctor side:

In doctor side normal username and password mechanism will be followed. Service minded doctors will enroll themselves with the system through a simple sign-up process.

B. Data collection module:

In this module, patients upload medical reports. They can add some notes for extra details.The patients have to mention the disease while they register. Patient's data are added and sent to the doctor in this module. Data are stored in cloud and shared with the doctor.

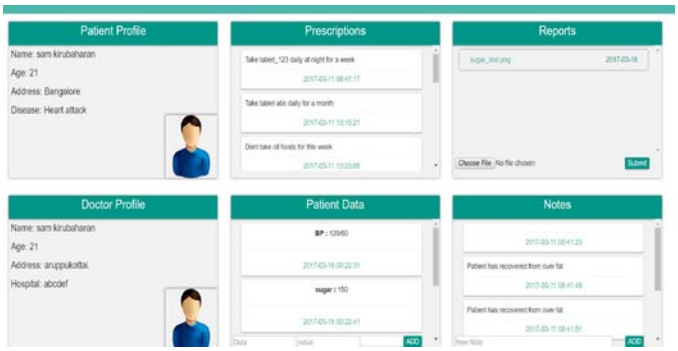

Figure 8: Patient's UI

If there is any small reports like BP, Sugar values the patients can write the value in the patient data column and they can send it to the doctor every week instead of a report. The prescription given by the doctor will be displayed in the patient's login.

C. IVRS MODULE

Interactive voice response system (IVRS) is a technology that allows a computer to interact with humans through the use of voice and DTMF (Dual Tone Multi Frequency) tones input via keypad.DTMF decoding is used to interpret the caller's response to voice prompts. DTMF tones are entered via the telephone keypad.

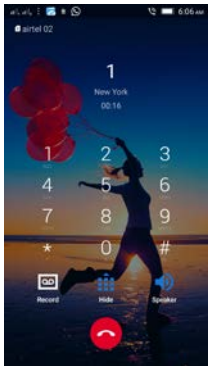

Figure 9: IVRS system

IVRS system is mainly for patient's side, they will act according to the commands given in the IVR system,

- Listening to the doctor's feedback and suggestions.
- Send audio/voice message.

IVRS is fully advantage for patients who have no knowledge about internet. Through, IVRS the patient will be given notification about the treatment. This system will be helpful in rural areas that have no knowledge about technology. Through IVRS the patients can record the voice and send it to the doctor. They can listen to the prescriptions and they can even know their doctors details. The doctors will call the patient through IVRS only or they can record and send voice to the patient.

D. TREATMENT MODULE

This web UI is the doctor side interface, through this interface the doctor can Send prescription, Send audio message, Initiate voice call with the patients, Invite the patients for a visit (special care), Add more notes about treatment.

Figure 10: Doctor's UI

Through message option the doctor can send message to the patient in case of emergency. The doctor can listen to the voice sent by the patient. He can view the reports sent by the doctor. The doctor can give appointment to the patient in case of any emergency by invite option. The prescription written in the prescription column will be sent as voice to the patient through IVRS. By the use of text-to-speech process, the written text will be read to the patient through voice. The doctor can add notes to check history about the patient.

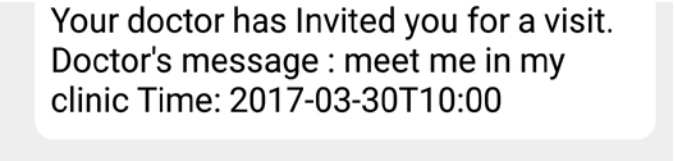

Figure 11: Doctor's invite message

VI. SOCIAL IMPACT

Encourages normal peoples to care for their health regularly. Encourages the use of technologies to be used in our day-to-day lives for better future. Encourages doctors to be more service-minded.

VII. CHALLENGES AND LIMITATIONS

Some of the economically backward people are illiterate. Hence, using IVRS will be a new task for them. Not all service minded doctors might be well experienced.

VIII. CONCLUSION

This project improves healthcare and increases awareness among economically backwards. It enables them to access better medical facilities and also to introduce recent technologies to be used in day-to-day life for better healthcare. It increases awareness about healthcare among the common class people by continuously monitoring their health. It delivers healthcare to the public through simple technology, thereby encourages technologies to be used in healthcare sector.

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