Reinforcing Telemedicine Through an Interactive Voice Response Service for Rural Indians

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Abstract— One of the major socio-economic issues of the rural India is healthcare. This paper is proposed for a system that will provide telemedicine service to the rural India. Interactive Voice Response(IVR) is a developing tool for providing general and detailed telemedicine services. Mobile phones being the primary communication device in developing India, an integrated Interactive Voice Response service provided through mobile phones for telemedicine will be a beneficial act. In India, various providers provide IVR services. One of them is the KOOKOO cloud telephony service. This service can be made available to all the mobile phone users of the country regardless of the model and specification. Implementing an IVR service for telemedicine will carve a new way, as this system can be more effective with reduced cost. Existing use of IVR in telemedicine includes outpatient reviews and doctor's appointment system, which are not more in reach to the patients. But the proposed system can be used by the whole of the population of India by their handheld mobile phones. The major advantage of this system will be the fact that the user of the service (In rural cases farmers and tertiary workers) need not be aware of working model. That is, the user can still be benefited even if they don't have any basic knowledge about the system.

Keyword- Telemedicine, IVR, Cloud telephony, kookoo, Text mining

I. INTRODUCTION

In recent days, telemedicine plays a major role in providing medical service for persons in remote places like rural areas and in places where medical facilities are not available at an instant. Globally, Telemedicine services are provided through various modes including web portals, Interactive Voice Response (IVR), satellite communication, GPRS, wireless sensors, mobile health centers, etc.

Various telemedicine services include tele-cardiology, tele-radiology, tele-pathology, tele-dermatology, tele-ophthalmology, tele-oncology, and tele-psychiatry. In India, only some of the above services are provided through web portals [2], wireless sensors and satellite communication [1].

In India, primarily telemedicine is used in places where a mobile medical centre in a remote/rural place is connected to a specialist doctor in an urban multi-speciality hospital through satellite communication.

Interactive Voice Response (IVR) is one of such technology that can be used for providing effective telemedicine service. IVR technology [3] allows a user to interact with a computer through speech or DTMF(Dual Tone Multi Frequency) signals as inputs.

At present IVR is used in other countries by doctors for providing appointments, this helps the patient in saving the waiting time for doctors in hospitals and clinics. The second type of service is the regular patient care for discharged patients from the hospitals [4]. The IVR calls the patients registered mobile number in periodic intervals and notifies them for upcoming reports, appointments, etc. The proposed system is another kind of service in which the user calls the IVR.

II. PROPOSED SYSTEM

The proposed telemedicine service model can be used in providing special care services like first-aid service, mother and childcare antenatal service, diabetic care and so on. It works on the following mechanism:

The patient who is the user of the telemedicine service calls the cloud telephony number, which provides the IVR service and gives the queries. The system retrieves are the corresponding data from the databases based on the user's query and returns as the output to the user. The called system consists of various components that include the cloud telephony, storage databases, external IVR system and http pages.
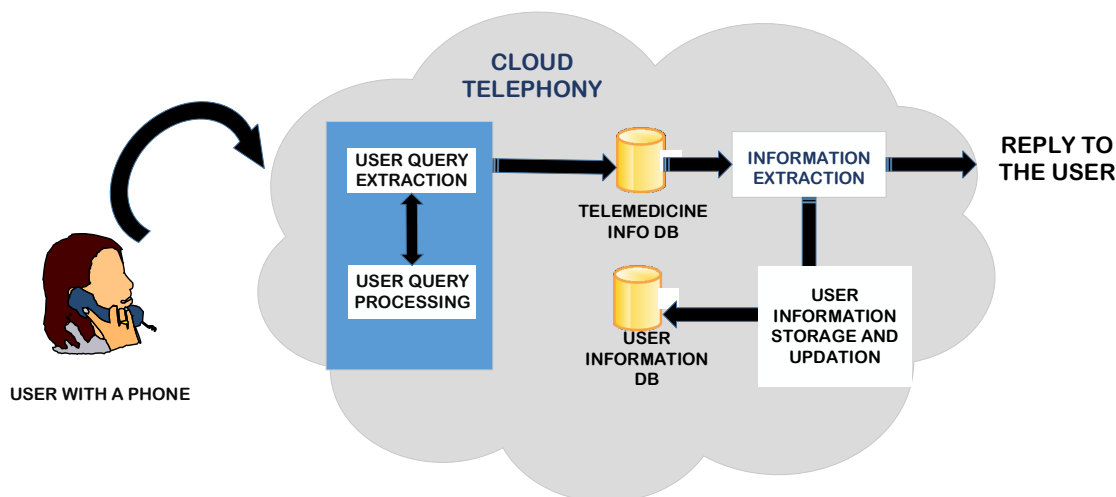
Fig.1. Architecture of the IVR System

A. Cloud Telephony

Cloud telephony is an on-demand voice service that provides infrastructure for deploying telephony applications. It provides the interface for deploying third party IVR applications. This service paves the way for developing numerous applications. Telemedicine is one of such services that can be deployed in cloud telephony.

Generally, Cloud telephony or IVR works on Voice Over Internet Protocol (VOIP). This protocol provides necessary communication channels that are required to transmit voice and data signals as itself over the telephone channels and internet. This kind of channels and facilities are available in standard countries where the channel handles limited number of services per cable.

In India, the available telephony channels handle services at the rate of 30 per cable. This over loads the cable resulting in a state where efficient service is interrupted. To overcome this drawback Indian cloud telephony service providers provide services based on on-demand. It takes the responsibilities of handling and processing all call forwarding functionalities. This assures that any third party application created and deployed in cloud can provide a more efficient and effective service to the user except in some conditions.

Deploying a telemedicine application in cloud will help numerous users to rely on the service and will make the service reachable to the major crowd of the people. It provides consistent service to the people regardless to their perimeters of socio-economic status and place of habitat.

B. Query Extraction and Query Processing

The query extraction and query processing involves mechanism for handling the user queries, processing those queries and presume what necessary steps has to be taken for the corresponding queries. When the user calls the service, initially the service gives a welcoming note to the user in the first block. The second block deals with accepting the user queries. The user query can be in any regional language or English based on the language in which the actual service is provided. The system receives the input queries, stores it along with the user information and processes the query to find the resulting response to be given in the next block.

C. Storage Databases

Two separate databases are used in the system. One is for storing the user information and the other one is a semantic database that contains all possible medical info query from the user and their corresponding remedies for the query. When the processed info of the query in the second block is matched with the semantic database [5], the resulting data collected from the database is given as the output to the user. The output is generally given as voice.

III. CALL FLOW MECHANISM

The proposed system works on the following flow mechanism:

1. Step 1: The user calls the available service number
2. Step 2: After the welcoming note, the user registers his/her query to the system.
3. Step 3: The system processes the queries and extracts the keywords/medical terminologies and other terminologies of notable value

   (For instance: If the user query is as follows, " I Need An Emergency Care For Skin Burn". Then, Emergency and Skin burn are the key words in the query)

4. Step 4: When the key word emergency is found, Execute an out bound call to the specialized doctor.

(In our case skin burn for instance, The out bound call is executed for Dr.XXX in the mentioned contact number)

5. Step 5:If the doctor is not available at the moment or if the keyword 'emergency' is not found then The corresponding remedy is retrieved from the database table and is presented as user output. The process flow is given in fig.2.
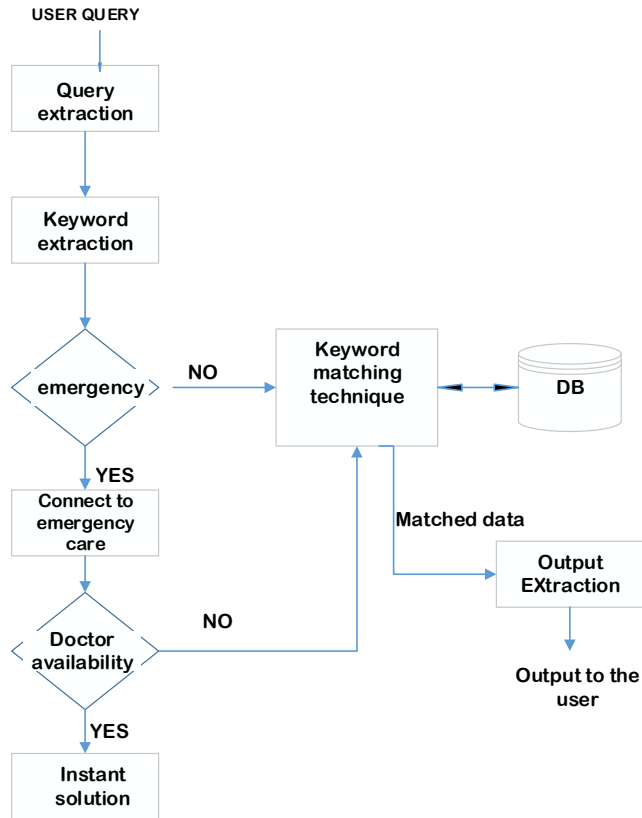

Fig.2. Process Flow Chart

The sample data table referred by the IVR is shown in Table I.

TABLE I
Sample Data Table

NAME OF THE CAUSE	REMEDY	SPECIALIZED DOCTOR	CONTACT
Skin Burn . . .	Prescribe SILVEROL® . . .	Dr. XXX . .	9089****00 . .

IV. RESULTS AND DISCUSSIONS

A group of 100 students were given the sample data and were asked to call the IVR service number on possible occasions for a period of 4 months (Jan-Apr). Based on the number of calls received for each month, the call processing data is collected and plotted in Fig.4 and Table II.
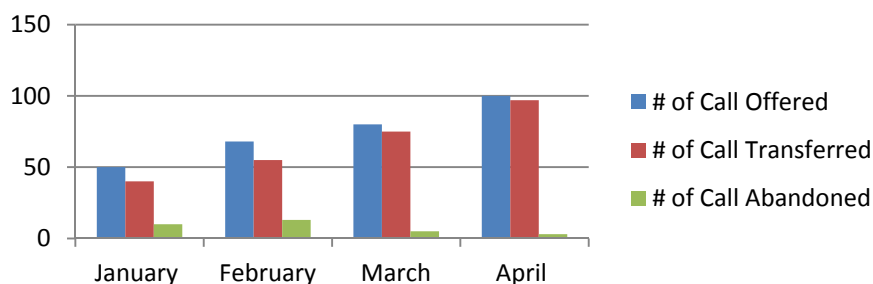
Fig.4. Number of calls processed by IVR

TABLE II
Call List

Month/Calls	# of Call Offered	# of Call Transferred	# of Call Abandoned
January	50	40	10
February	68	55	13
March	80	75	5
April	100	97	3

V. CONCLUSION

This system of telemedicine service could help the greater crowd of Indian population. The effectiveness of the system lies in the knowledge and language independency, which makes it useful for every Indian from urban cities to rural villages. For a developing country like India it is important for the government and researchers to find new ways of mapping existing technologies with available components and new methods for improving the life of an individual and of the nation on the whole. The field of implementation is in process.

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