# Efficient Use of Voice as a Channel for Delivering Public Services

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Abstract:     Delivering the information and services to the citizen is a key task of Government. It is the responsibility of the government to keep their citizens informed and deliver public services to them on timely basis. This information required for making critical decisions and forming any opinion. For good governance and transparency, it is very essential that the services and information is delivered timely. Delivering information and services through conventional methods like paper forms, e-Forms have problems in countries having large section of population illiterate. So, more efficient methods need to be employed for the information sharing and data capture. With live human interaction and local language support, an Interactive Voice Response Systems (IVRS) can be an effective method through which data can be captured and information about the services can be shared even to the illiterate population. This paper discusses the issues involved in the implementation of IVR system and making voice as a channel in delivering services to the citizen. This paper is based on the investigation done for finding the potential of an IVRS services and it also discusses the real time IVRS requirements for successful implementation of Govt projects and how IVR systems will increase the acceptability, reduces the query-time of citizen and for making public delivery systems more efficient. We propose a nationwide single number for accessing all Govt. services on user local language. Further, it also includes the case study of Department of Agriculture & Cooperation, Ministry of Agriculture, depicting how IVR system has helped farmers. Such IVRS may be replicated by other Govt. department wherever necessary at customer ease.

## 1 INTRODUCTION

Countries around the world are making full utilization of the ICT tools to deliver the government services electronically and have started offering transactional services. In many developing countries, governments are facing difficulty in delivering public services in rural areas due to lack of literacy. The oldest and most natural means of information exchange between human beings is voice and with recent advancements in the technologies, automated processes and system has made voice channel to be strong enough for reaching out to the citizens. Voice has some advantages over the conventional methods of information capturing and sharing. An IVR system with other support systems such Automated Speech Recognition (ASR), Text to Speech (TTS) can be employed to enable Voice as a new channel of delivering public services. The literacy rate in the rural sections in developing countries is still comparatively very low compared to the urban population and given deep penetration of the mobile subscription, in the rural section; the voice based delivery of services can be very effective. With the support of multiple languages voice can be of great means in countries like India where over 20 languages are spoken. Most of the world's 3.6 billion mobile subscribers (Anne Bouverot, 2012) from the developing nations use their mobile phones primarily for calls. The IVR services can be used in diverse domains, including news and information feeding to citizen, discussion on agricultural (like information about market, weather and crop advisory agents on call, expert system of recommendation for fertilizer), community dialogue (Agarwal 2009) access to health information (Sherwani et al., 2007) group voice calling for information distribution over the citizens of a large geographical region at once, feedback on school meals (Mishra, 2010) ( Grover, 2012), etc.

In this paper, we have outlined the flow of

technical approaches for creating a scalable IVRS platform for delivering the public services anytime anywhere. We have also introduced the combined use of different voice architecture which can be used for creating effective voice platform. Compared to prior solutions, IVR platform offers two key novelties. First, it seamlessly connects Internet based users with phone-based users. Both sets of users can contribute and retrieve audio messages from a repository in the automated IVR system. Departments can connect to IVRS through internet to post audio recordings for automatic broadcast to mobile phones. The second uniqueness of IVR System is that it scales across geographically distributed access points, enabling affordable access via local phone calls (Vashistha, 2012).

## 2 TECHNOLOGIES USED FOR AUTOMATED AND INTELLIGENT IVR SYSTEM

IVR systems may become, primarily, an assistive device for callers and agents during a conversation. IVR will support in making a conversation more meaningful by collecting and conveying information to one or both the parties. In that sense, IVR will be a thin intermediate layer that can amplify the impact of talk by making it more interactive, and by providing context. Some of the technologies used in enhancing IVR systems are listed below.

### 2.1 Text to Speech (TTS) Systems

The goal of TTS is to convert input text to natural sounding speech to transmit information from a machine to a person, for example, citizen dials an IVRS number to check the status of his/her application he / she had been filed, and the IVRS reads out the status fetched from the concerned department server by converting text received into speech using TTS engine. Such systems string the words together to be spoken in isolation and the artefacts of such a scheme are being often perceptible. The methodology used in TTS is to exploit audio representations of speech for synthesis, together with linguistic analyses of text to extract correct pronunciations (what is being said in given context in terms of region, language) and prosody in context (''melody'' of a sentence; how it is being said). Synthesis systems are commonly evaluated in terms of three characteristics: accuracy of rendering the input text (does the TTS system pronounce, e.g., acronyms, names, URLs, email addresses, a knowledgeable human would?), intelligibility of the resulting voice message (measured as a percentage of a test set that is understood), and perceived naturalness of the resulting speech (does the TTS sound like a recording of a live human?). Text to Speech system can be used to broadcast citizen services like weather information, crop details, etc. to farmers, status updates, etc. in addition to banking services, telecom services (Richard,2006).

### 2.2 Automatic Speech Recognition

Automatic Speech recognition which means understanding voice input and performing any required task or the ability to match the voice input against a provided or acquired vocabulary. The task is to get a computer to understand the spoken language. By "understand" we mean to react appropriately and convert the input speech into another medium e.g. text. Speech recognition is therefore sometimes referred to as speech-to-text (STT). The Automatic Speech Recognition system is very important in delivering government services as there are hundreds of services and it is extremely difficult to access these services through a common number without an accurate ASR system.

### 2.3 IP-Telephony

With the introduction of new edge technologies, the Internet Protocol (IP) based networks are increasingly being used as an alternative to the traditional circuit-switched telephone network. The different flavours of IP Telephony provide varying degrees, alternative means of originating, transmitting, and terminating voice and data transmissions which would otherwise be carried by the public switched telephone network (PSTN) (Craig, 2000).

#### 2.3.1 IP based Audio and Video Calling

Audio and Video calling can be done over IP network. Through the use of Session Initiation Protocol (SIP) the point-to-point communications are no longer restricted to voice calls but can now be extended to multimedia technologies such as video. The IVR systems with live video of the caller provide the ability to have true value interaction with the caller. With the introduction of full-duplex video, IVR will allow systems such as the ability to read emotions and facial expressions. This

video calling can be the future of remote biometrics detection such as IRIS scan or other biometric means. Recordings of the caller may be stored to monitor certain transactions, and can be used to reduce identity fraud (lyle-kenya.com).

### 2.3.2 Unified Communications in the SIP Contact Centre

With the introduction of SIP contact centres (automated menu driven SIP systems), traditional barriers to automation are breaking down. As calls are queued in the SIP contact centre, the IVR system can provide treatment or automation, wait for a fixed period, or play music. Inbound calls to a SIP contact centre must be queued or terminated against a SIP end point; SIP IVR systems can be used to replace agents directly by the use of applications deployed using BBUA (Back to Back User Agents).

## 2.4 Automatic Call Distributor (ACD)

In telephony, an automatic call distributor (ACD) or automated call distribution system is a device or system that distributes incoming calls to a specific group of terminals that has agents based on customer's need, type, and agent skill set. It is often being a part of computer telephony integration (CTI) system. An automatic call distributor (ACD) is often the first point of contact when calling many larger businesses. An ACD uses digital storage devices to play greetings or announcements, but typically routes a caller without prompting for input. An IVR can play announcements and request an input from the caller (lyle-kenya.com).

## 3 SERVICES THROUGH IVRS

In nations like India, where there are 22 different official languages and around 25% of population is still illiterate (en.wikipedia.org), development of IVR System can be of powerful medium for delivering public services to citizens.

IVRS application can be used to offer Citizen to Government (C2G) and Government to Citizen (G2C) services his / her local language. There are various government services which are compelling and receiving a lot of enquiries from the citizens. Keeping the magnitude of the population in mind, it is not surprising that these services draw a huge volume of enquiries. These enquiries are nothing but an overhead for the government and such processes if automated can reduce the undue overheads.

## 3.1 Inbound Interactive Voice Response

In an Inbound IVRS service, the citizen can call on the interactive voice response system. The IVR system has predefined menu for users which have the introduction of service and the information gathering menu as well.

IVRS can be accessed as an auto receptionist to attend the call of your customers. It may guide them to the desired department or to the desired person, or may register or respond to their query and complaints (ivrsdevelopment.com).

Menu Options:
- Messages need to be kept short, and should include some prominent key words
- The function need to be announced followed by the key required to activate it
- Provision to the customers for two or three chances to select an option
- The system should transfer a caller to an operator if no option is chosen
- Provision for repeat facility, keeping the best practice for the repeat to occur automatically rather than relying on the customer selecting to hear the options again.

For example, IVRS can be used in the healthcare sector like hospitals, physicians, nursing homes, diagnostic laboratories, pharmacies, medical device manufacturers and other components for efficient workflow. Broadly healthcare sector implement IVRS application for the following workflow (ivrsdevelopment.com) .

- IVRS Auto Attendant
- Patient Information using IVRS
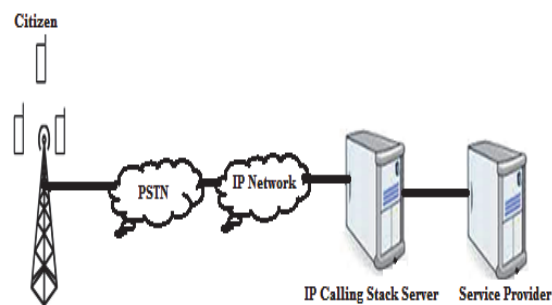- Patient and Other Records Management



Figure 1: Example Flow of Inbound IVR System.

Figure 1 shows the example flow of the Inbound IVR system. Citizen dials a predefined number for accessing the service that he/she wants to avail. Network signal reaches through PSTN network to IP

network and then reaches to IP calling stack server.

This IP calling stack server connected with the different service providers. By identifying DTMF (Dual Tone Multiple Frequency) signal calling server provide the appropriate response to user.

## 3.2 Outbound Call Notification Voice Response

Outbound IVR system is used for generating call for notification and advisory to the users. It is more effective in rural areas where illiteracy is the major problem message with use of local regional language making voice IVR channel as a strong communication mode. Use of TTS at WEB application end makes the use of the services more flexible with cross language Text to Speech message generation and transmission.
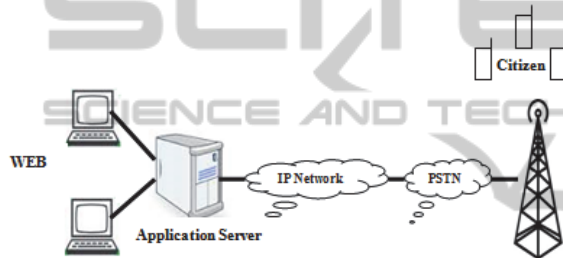


Figure 2: Example Flow of Outbound IVR System.

Figure 2 shows the flow of an IVR system for generating outbound call. A user can generate the single or multiple calls through application server which is connected to IP network. A network interface card converts this IP signal to telecom signal and transfer it to PSTN and a call rings on a requested number.

## 3.3 IVR Systems with Human Agents

The IVR systems with human interaction can add more value for citizen satisfaction. The Government-citizen relationships where the hardships experienced in browsing through IVRS menu by citizens are done away with the introduction of human agents. Call centre with the local language agent can make a call centre available and reachable to the local citizen. User can call over PSTN network or over IP Network to IP Calling stack server which can convert the telephony signalling to IP signalling.

Figure 3 shows the example flow of call centre with human agents. Citizen dials a predefined number, network signal reaches through PSTN

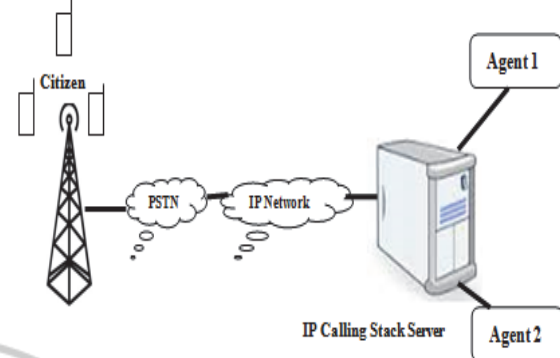network to IP network and then reaches to IP calling



Figure 3: Example flow of Call Centre with human agents.

stack server. This IP calling stack server connected with the different agents directly or with automated call distribution system. By identifying DTMF (Dual Tone Multiple Frequency) signal calling server provide the rings to appropriate and available agent.

Examples of some IVR Systems:
A. IVR system to inform mothers during the pregnancy period about their day care health precautions, about the vaccination of their new born babies, about the upcoming natural diseases and their cure etc.

B. Campaigning for social causes like polio vaccinations, weather forecasting, and disaster management can be done through IVRS.

## 4 ADVANTAGES & CHALLENGES

### 4.1 Advantages

- IVRS can provide government services to the public 24/7.
- IVR frees department staff from repetitive functions (like data entry and monitoring the phones) and enables them to address customers instead as inputs can be recorded automatically.
- IVR can help decrease the amount of paper that a department uses.
- Real time service tracking and grievance handling in local language.

### 4.2 Challenges

- The greatest challenge of IVR systems is that
- many people simply dislike talking to machines.
- Accuracy of ASR and TTS in countries with

multiple languages.
- IVR call quality.
- Good script and menu design.
- Maintain/Improve customer satisfaction

# 5  CASE STUDY - mKISAN

mKisan, Department of Agriculture & Cooperation, Ministry of Agriculture, Government of India initiative, is a mobile based agriculture interactive advisory service consisting of agriculture advisory from experts on crop and livestock such as insects, diseases and nutrition, agro bulletins, market info of crop prices, weather forecast and a farmer helpline. Video based dissemination of agriculture advisory and best practices will also be tested under this project. Mobile based feedback mechanism and farmer knowledge sharing tools has been developed and deployed.

## 5.1  mKisan IVRS Outbound Calls

These are used for obtaining feedback from farmers regarding the advisories which they are receiving from experts about their query and also on the quality of information being given to them by KCC (Kisan Call Centre) agents. A farmer can rate the advisory or answer given by KCC agent on the scale of 1 to 5. This service is available in 12 different Indian Languages (mkisan.gov.in).

## 5.2  mKisan IVRS Inbound Calls

Farmers or all other stakeholders can call on one number for obtaining crop information, weather information, commodity prices from a predefined menu and other also for giving useful feedback on the services or for obtaining any information from a predefined menu (mkisan.gov.in).
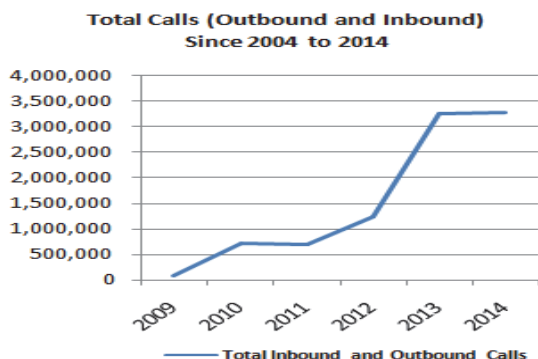


Figure 4: Total Calls by Kisan Call Centre.

Figure 4 shows the remarkable growth of acceptance of government services depicting number of calls both inbound and outbound since 2009 to 2014.

## 5.3  Kisan Call Centres

Aim of the KCC is to answer farmers' queries on a telephone call in their own language and dialect. Call Centres are working in 14 different locations covering all the States of India. A countrywide common eleven digit Toll Free number 1800-180-1551 has been allotted for Kisan Call Centre. This number is accessible through mobile phones and landlines of all telecom networks including private service providers. Replies to the farmers' queries are given in 22 local languages. Kisan Call Centre agents known as Farm Tele Advisor (FTAs), who are graduates or above in Agriculture or allied disciplines with excellent communication skills in respective local language respond to the farmers queries instantly.
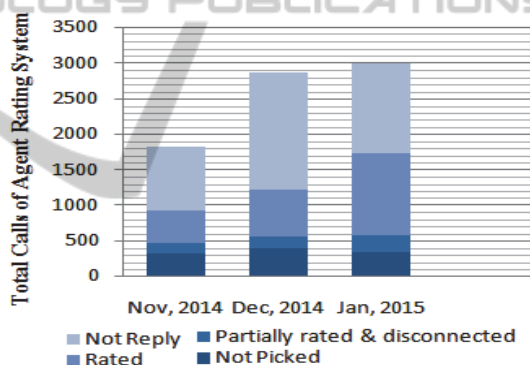


Figure 5: Total Calls IVRS Based Rating System of mKisan.

Figure 5 shows the statistics of mKisan based agent rating system. Figure contains total call generated by the mKisan; how many of them picked, rated by users and not replied. Through the mKisan IVRS system, it has been envisaged that access to agricultural services can be highly useful to the interior of rural areas where penetration of another communication medium is very less and access to internet is very limited.

# 6  CONCLUSIONS

This paper presents a comprehensive study of how the voice can be used as the new channel for delivering the citizen services. Use of new edge

technologies like ASR, TTS, ACD, etc. make the voice channel more efficient and effective, also the introduction of automation reduces the effort. Case study on mKisan shows that the voice can become an effective channel for delivering citizen services.

The high tele-density and penetration of mobile subscription in all parts of the country, IVR Systems can be very useful to citizen, especially those in rural areas where internet accessibility is restricted and literacy rate is very low. IVRS will immensely benefit sections of the society such as senior citizens, poor populace, women, physically challenged populace, etc. as telephone shall provide an easily accessible access channel for Government services.

With the advancement in the technologies, all government services can be made available through a nationwide single number. The lengthy IVRS menus can be reduced through advanced ASR systems and services can be identified directly by recognizing the user voice. TTS systems can be employed to respond to user in human voice.

## ACKNOWLEDGMENTS

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