Supporting the Procurement and Accounting of Areca-nut Farming

Guided By:
Prof Anirudha Joshi

By:
Roopa Narayan Sahoo
126336001
Interaction Design
IDC IIT Bombay

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Declaration

I declare that this written submission represents my ideas in my Own words and where other ideas and words have been included, I have adequately cited and referenced the original sources.

I also declare that I have adhered to all principles of academic Honesty & integrity and have not fabricated, misrepresented or falsified any idea/data/fact/source in my submission.

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Roopa Narayan Sahoo
Roll No: 126336001

Signature: Roopa Narayan Sahoo
Date: 5/8/2015

Place: IDC, IIT Bombay

Approval Sheet

This Interaction Design Project entitled **"Supporting the procurement and accounting of Arecanut farming"**, by Roopa Naraya Sahoo, 126336001 is approved in partial fulfillment of the requirements for Master of Design Degree in Interaction Design.

Project Guide:

Chair Person:

Internal Examiner:

External Examiner:

Date: 5/8/2015

Place: IDC, IIT Bombay

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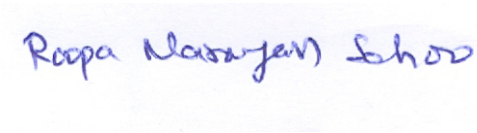
Roopa Narayan Sahoo



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Abstract

The project proposes an interactive voice response (IVR) system for the Areca nut farming community of Alibag Taluka Maharashtra (India). Following extensive discussions with the ATS and the 10 farmers interviewed, it was observed that ATS could benefit with a system that provides adequate and timely information to support scattered, barely literate areca nut farmers. It would help the areca-nut farmer in bridging the digital gap by bringing the benefits of the information technology through a voice driven system over an ordinary phone call. The main goal of this project is improving the interaction between the ATS and the farmers, in the exchange of information in various stages of cultivation, procurement and processing of areca nut so as to improve the collaboration between the farmers and ATS, minimize risk, and to maximize economic and profit driven growth.

The final concept **ATS IVR system** is a voice driven mobile base application where the framers can get essentials information about areca nut farming, marker price as well as sharing of knowledge with other farmers and experts. Also farmer can give information about his location and amount of harvest with submission date ready for submission to cooperative society workers.

Throughout this project we developed concepts that lead to design an interactive voice response (IVR) system which would improve existing practices that are intrinsic to the current areca nut farming production cycle and also some of coherent ideas can be extended for similar kind of farming activities in the agriculture domain and beyond.

Introduction

In the current era, the advancement of information and communication technologies are the key factors of changing various aspects of human life. The ICT revolutions have brought a positive impact in public service delivery and socio-economic structure of communities by minimizing the processing costs, increase in transparency, increase in agricultural production, and improvements in health and education sectors, all of which promote the overall quality of life of rural people.

On the other hand Indian farmers have been poorly informed. Most of our farmers have long relied on a patchy network of local middlemen, a handful of progressive neighbour farmers, and local shop owners to receive decision-critical information, whose reliability, accuracy, and timeliness can have a critical impact on their decision making and therefore, livelihood. Fundamental decisions such as at what price to sell the crop, where to sell, when to harvest, and when to spray pesticides to save the crop, how to choose good quality seed for new plantation require adequate and timely information. Further, a farmer's information needs and sources are varied and change throughout the agricultural production cycle. In short, the farmer requires a comprehensive package of information to make right decisions.

We visited ATS Alibag, an agro-business co-operative society for processing areca nut in the Nagaon area of Alibag Taluka. It procures areca-nut from the farmers and adopts manual methods for processing that match market standards. It has been producing

around 17 types of areca-nut based on size and quality and has gained extensive market popularity in Mumbai. We also interviewed 10 areca-nut farmers in the Nagaon area of Alibag.
In this project, the Areca-nut Farmer is my target user. They are less educated/ low literate and are not technology savvy. Currently they are using basic mobile phones for their communication purpose in local language only. They are not familiar with computer and internet. Therefore, the project will encompass design ICT interventions to help areca nut farmer in Alibag Taluka and improve business management process and planning in ATS. The main focus is towards improving the management of business ecosystem at Alibag Taluka Supari Processing Co-operative Society (ATS). In particular, this project will establish effective mechanisms for sharing information with farmer and ATS and other stakeholders.

Agricultural Cooperatives and ICTs:

Agricultural cooperatives can function more efficiently by using ICTs and also provide various benefits to farmers and its other stake holders such as:

- About market information, Availability of new hybrid plants, seeds, plant medicines and manures, soil health report and other essential agricultural instructions.
- It also improves sharing of knowledge among farmers and with agricultural experts.
- Efficient accounting and administration - farmer cooperatives are often responsible for handling very large amounts of money that may be the cash income of thousands of farmers' families. Efficient record keeping allows a cooperative to serve its members better, and the transparency offered by computerisation and other technologies enhances trust.

Cooperative members' access to and use of technologies should be improved, in order to increase their efficiency. Ultimately, they can help in achieving poverty reduction and fulfill social development goals.

Cultural and social significance of areca nut:

In India, areca nut comprises a significant cultural orientation. It is an important component of the religious, social and cultural celebrations and economic life of people in India. In many parts of India, the chewing and offering of areca nuts fulfills a vital religious and social function. It is a medium of showing love, gratitude, respect and polished lifestyle. Areca nuts are largely included in Indian weddings and ceremonies. Areca nut is an inseparable element of our religious practices, it is offered to the images of gods as part of religious rituals. Arecanut is also used in ayurvedic and veterinary medicines.

Market size:[12][13]

There are mainly two types of processing of arecanut, viz., *chali* (ripe sun dried nuts) and *red boiled type (red supari)* (tender or mature nuts). Arecanut is processed into *pan-masala*, gutka, scented *supari etc*. India is the highest producer of arecanut with a production of around 3.3 lakh tonnes and a total acreage under cultivation of 2.64 lakh hectares, with Karnataka and Kerala accounting for nearly 72 per cent of the total production. Also Tamil Nadu, Maharashtra, A.P., West Bengal and Odisha are the other important producing states which are expanding areca nut cultivation every year.

Over six million people are engaged in areca nut cultivation, processing and trade. More than 85 per cent of the area under cultivation is made up of small and marginal holdings.Among the two varieties white nuts have a share of 60 per cent. India is also the largest consumer with around 3.2 lakh tonnes. Arecanut is a notified commodity in about 32 regulated markets of Karnataka. There are more than 15 co-operative marketing societies handling arecanut in this state. All these co-operatives are functioning as the agencies of CAMPCO (Cocoa and Arecanut Marketing and Processing Co-operative) Ltd., Mangalore. Shimoga a joint venture

of the States of Karnataka and Kerala, has been established in 1973 for procurement of areca nut. The major arecanut trading centres in India are Mumbai, Ahmedabad, Indore, Jaipur, Delhi, Nagpur, Patna, Calcutta, Cuttack, Bangalore, Rajkot, Chennai and Kanpur. In Alibag taluka, the areca nut tender fruits harvest and then boils it while in Murud peta, harvests riped fruit. Alibag Taluka Supari Processing Co-operative Society Ltd. produces around 37.79 tons of Chali supari yearly from which earns Rs. 80.23 lakh per year.

Areca nut Cultivation/Farming [Ref: ATS manager]

Farmer /Farming culture

Areca nut is cultivated as a garden growing crop; Areca nut palm (*Areca catechu*) is cultivated primarily for kernel obtained from the fruit. It is a long-lived garden growing palm plant, the average life span of areca nut plant is about 40 years. It is not a natural growing plant and pre- bearing age of the plant ranges from 5 to 7 years after this period the tree starts pollinating and growing fruits. Annually harvesting season is usually from September till January. Three or four plucking seasons are done during the whole season. An areca nut tree may yield around 300-400 nuts/palms annually. The dried areca nut is non perishable agriculture product and it can be stored for 12 months. Well preserver nuts are stored in bags remain free from insect infestation for up to 12 month.

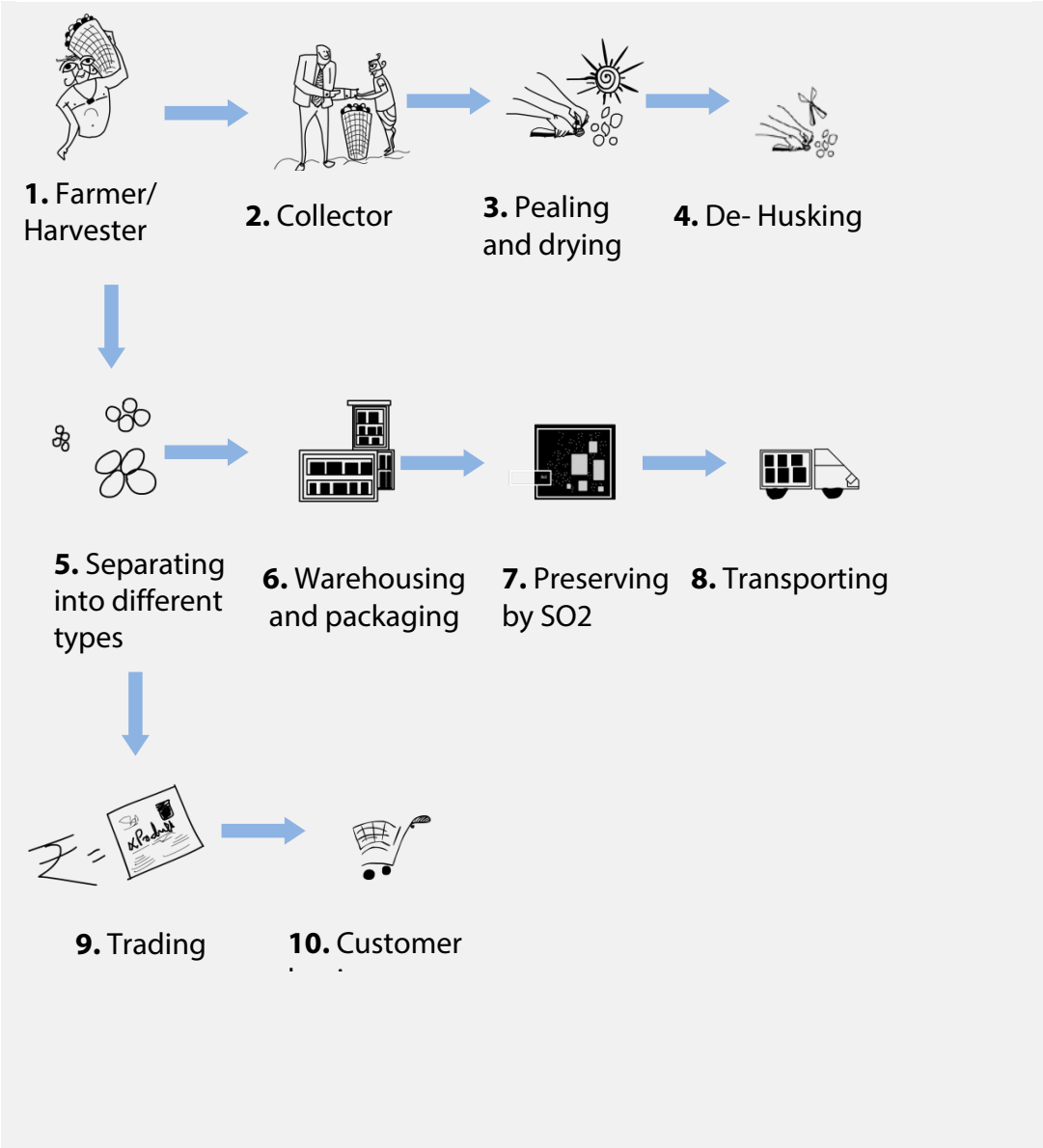
In Alibaug area every farmer has own land and they are not lending any land from others to cultivate areca nut. Each pieces of areca nut cultivated land is close to their residence, planted with 100 to 1000 areca nut trees. As areca nut a garden growing plant, normally farmers plant areca nut palm trees closer to their residence, the same piece of land uses for both the residence and areca nut plantation purposes. In Alibaug area all areca nut farmers do not fall under BPL group. Most of the farms have mobile phones.
Though they are not using smart phones but using mobile phone above entry level.

Diseases

Areca nut tree's health is often found affected by various insects and other micro organisms. Copper Sulfate (CuSO4) thus becomes necessary in Arecanut Plantation maintenance. It is sprayed on the tree tops once or twice in a year.

Production cycle of areca nut

1. Farmer harvests areca nut
2. Collection of harvest by ATS supari collector
3. Pealing and drying under the sun ray by ATS worker
4. De-husking by ATS worker
5. Separating into different types by ATS worker
6. Warehousing and packaging at ATS
7. Preserving by SO2 at ATS
8. Transporting by ATS worker
9. Trading by ATS Manager
10. Customer purchases supari



User Study

I conducted a contextual inquiry in ATS [3] and Nagaon area of Alibag to conducted non-formal interviews with 10 no of areca-nut farmers , 2 no of committee members of ATS and ATS [3] manager. During interviews, a partnership was developed with the user by casual conversation. It was made sure that the interviews were conducted with the users alone with no other people present who could influence the users' statements for the questions asked. Audio Conversations were recorded with the consent of the users. During the interview notes, photography, videos, were taken by me.

Analysis Method:

The voice recorded interviews were analyzed by me in detail as soon as possible after the interview. For analysis, I walked through the audio recordings and noted down interesting user statements, observations, design insights and design ideas. The findings were then sorted as per their relevance to the focus.
Presented in the rest of this report are the findings from the user study and some design ideas that were generated during the process.

Cultivation Process:
Areca nut harvesting and processing is a complete people intensive work. It is difficult to be a one man show for this venture. It is a complete team work. And also it is expensive to purchase processing machine and running a processing unit in part of a single farmer.
Below description is a typical day where the people are starting from the farm owners' place along with the tools.

Step 1: Getting ready for work

Day starts at around 9:00 am in the morning from where all the tools along with the people head to the farmer's home where farm (areca nut garden) identified for harvesting. The preparation step for this is many. The following should have been finished before this day.
1. Fix the day and the farm for harvesting
2. Inform the time and the place where the people have to come.
The most important being the climber, catcher and the transporter along with the ground staff to carry.

Heading towards the farmer's home where farm (areca nut garden)

Step 2: Harvesting the fruits from the tree

During the harvest season, the ripened fruits have to be harvested. Minimum two people with required skills are necessary to accomplish this. One professional tree climber with experience of plucking the fruits and another person who uses gunny bag to catch it when the fruits are falling down. Before the tree climber decides to pluck all the fruits, first he plucks only one/two fruits and indicates the other person to check it. The catcher checks the hardness of nut inside the fruit by pealing its outer membrane and indicates the plucker whether to go ahead or not.

Preparing to climb

Climber leg tools

Climbing to pluck

Catcher

Step 3: Separating the fruits from the bunches

Once the fruit bunches are plucked from the tree, it has to be separated to get the individual fruits. This can be done simultaneously when the plucking process is going on. As the farm will be full of trees, unless there is a big enough space it'll be done on a rather flat place.

Women working at a farm

Separating fruits from the bunches

Step 4: Storing and Transporting

Once the harvesting is completed it has to be transported safely to the processing unit. During one full day of harvesting in a typical farm of about 1 acre, we can get the yield of 14-15 gunny bags. The capacity of each gunny bag is 50-55 kgs. So, depending on the quality of the yield, we may expect around 700-900 kgs of raw areca nut fruits per acre. The normal process in these areas is to use the small carriage lorry vans to transport. If the quantity is more in the range of 30-40 gunny bags then the truck would be used to transport.

Harvested areca nut fruits from farm - Ready for pealing

Step 5: Pealing to get the Kernel

In this step the raw fruit has to be pealed in order to get its kernel. This has to be done within a day or two after harvesting. Otherwise, the cutting will not be easy at all. This is carried out by using either machine or manual laborers. Please remember this work needs highly skilled people who know how to peal areca nut.

Pealing work

Step 6: Sun drying the pealed kernel

After pealing the areca nut kernel for about 12 hrs, another crucial step is to sundry the pealed kernel. This drying process has to be done for minimum of 7-10 days.

Sun drying

Step 7: De-husking the dried areca nut kernel

De-husking of dried of areca nut kernel to get nut is carried out by using either machine or manual laborers. This is the last step of areca nut processing.

De-husking areca nut kernel

Step 8: Grading and Marketing

Once the de-husking is over then grading into different categories accordingly the size and quality of nuts. Finally it can be packed in bags and preserved by sulfur dioxide (SO2) smoke before selling in retail market. After the entire process is over, areca nut customer may get different kinds of areca nuts having.

Problem Identification – Focus points:

These are the potential problem areas were addressed during user study and needed for finding design solutions.

- Small Scale farmer cannot afford the individual cost of transportation and storage
- Farmer cannot process and preserve in house
- Become averse to adopting technology
- Communication Breakdowns at various levels (co-ordination between farmer, ATS Manager, ATS collector and Trader)
- Farmers are isolated in terms of information about new market
- Due to high competition, farmers don't have bargaining power to sale their harvest.

- At the time of harvest selling: ATS collector should inform the offer price, mode of payment. Farmer can compare and decide whom to sell (ATS or Middleman)
- During harvest collection process: ATS collector should inform the farmers about his travel plans in advance , Farmer could collaborate with ATS collector for logistics
- After selling: ATS manager should inform the farmers that the payment is ready then farmer can track his sales payment, asking questions about ATS and loans, advance payments.

Design Considerations:

- Design for low cost basic mobile phone
- No external application Installation
- Use of Audio based interface
- No text Input
- Output display in local language and number

Findings:

1. Market Price Issues (Farmer Level):

It was observed that the farmer is at a disadvantageous position of not knowing the proper price of his harvest. Being an open market, this ecosystem is prone to highly fluctuating prices and market demands leaving the Farmer and Society's Sales Manager vulnerable and clueless as to how to sell their harvest. Further, Improper communication between the co-operative society appointed Collector and the farmer leads to the farmer's selling harvest to the middleman instead of the co-operative society which might give him a better price. Then again, due to being

averse to adopting technology, the farmer is isolated from information about market price and new markets, preventing him from getting proper value of his harvest. There should be some common information portal/ hub to interact between farmer, trader and society, also customer, to fulfill their requirements of trading/ business of areca-nut. Strategic Pricing is currently not possible on part of the farmer since it is difficult to provide/create infrastructure for processing and preservation of areca-nut individually. The small-scale farmer cannot afford transportation expenditure individually to take his harvest to a proper competitive market *Mandi* to bargain and sell at higher competitive market prices. It is also difficult to book a small buffering storage warehouse on rent for a short period of time to store the harvest and trading later to bargain for better selling prices. ICT can help to strategize whom or when to sell to, before harvesting the crop.

2. Produce Supply/Exchange Issues (ATS Level)

Communication Breakdowns at various levels, especially between the co-operative society and the farmer was observed e.g. there is no system in place for the farmer to notify the ATS-appointed Collector regarding his harvest status, collection point, date and time details. Although the ATS sends its workers door-to-door, it is done without pre-scheduling with the farmer. So, if for any reason, the harvest is not ready or the farmer is unavailable, then the effort goes in vain. Hence, the rather proactive middleman, who operates by actively looking out for farmers ready with their harvest, has better chances of reaching out to the interested farmer first.

Unpreparedness at processing point due to lack of statistical data/information about what quantity of raw harvest will reach and at what time it will reach the ATS processing unit, the manager is unable to assess and allocate time and arrange for laborer and other associated infrastructure as per procurement, efficiently. To curb inefficient management, a system that from time to time (esp. at the beginning, during and towards the end of the season) checks upon the state of harvest of the farmer, is in place, then the interested farmers can be better tracked, and approached by the society through its Collector. Further, a tool to record statistics data and forecast for efficient processing management and arrangement of infrastructure such as laborer, other instruments and machinery and forecasting of time required to complete the process can be developed.

3. Knowledge/ Information Dissemination Issues (ATS-Farmer Level)

Except for the yearly book, the ATS manager has no other way to send / broadcast information about price of supari, availability of pesticide, available nursery areca nut plants for new plantation in ATS Office, etc. Loans and advance payment, ATS's rules regulations/ announcements done by ATS, and bill payments

information should also be made available to the farmer. All this and more, such as information on workshops conducted by experts about upgraded techniques for farming can be broadcasted by the ATS manager through a communication system.

4. Social Exchange Platform (Farmer-ATS Level)

A common platform where all parties (farmer, expert and ATS) can speak up and mutually decide upon reforms that can help both the society and the farmer is necessary. Sound interactions through discussions with peers, Q&A sessions and experience sharing among the areca-nut farmers can only help organize and systematize this community. Through this, a useful user-generated knowledge bank will also be created.

Information needed by farmer

From My Contextual enquiry I found that these are the crucial information need by famer throughout the areca nut production cycle

1. Before Plantation
- Details about variety of nursery plants and making them understand the qualities."
- Availability of pesticide and fertilizer and their usages.
- Method of farming has to provide by ATS - sometimes arrangement of specialist from ATS site
- About loans and advance payments

2. During Growth period
- Precautions for pest control.
- Harvesting time and techniques
- Communication with the ATS for the crop selling and Logistics
- Communication with the experts /agro doctors

3. Selling Period
- Check for monthly supari Price
- Alternative market channels/sources
- Understanding of mode of payment.
- Keeping track of payment bills/getting checks

Current Research works on Supporting Rural Farmers [5][6][7][8]

Warana Wired Village Project in the rural areas of Maharashtra: (operating since 1998)

The primary objective of the Wired Village project is to demonstrate the effective contribution of an ICT infrastructure to the socioeconomic development of a cluster of 70 contiguous villages around Warana Nagar in the Kolhapur and Sangli Districts of Maharashtra
The project aims to:

- To increase efficiency and productivity of the existing Cooperative societies by providing state-of-the-art information and communication network and the latest database technology.
- Provide computerized facilitation booths in 70 villages, which are linked up to the central computer network at Warana Nagar.
- Establish a Geographic Information System (GIS) of the surrounding
70 villages leading to greater transparency in administration especially in matters related to land.
- Provide tele-education at primary and higher educational institutions.
- Create a database of villagers on various socio-economic aspects.
- Provide agricultural, medical, and educational information to villagers at Facilitation Booths in their villages.
- Provide communication facilities at the booths to link villages to the Warana cooperative complex.
- Bring the world's knowledge at the doorstep of villagers through the Internet via the National Informatics Centre Network.

How the model works:
The IT Kiosk booths are established in 70 villages, which are linked to the central computer network at Warana Nagar.

- Each farmer gets information by punching code provided by the computer network.
- This information is accessible in the local language and is on topics like new agriculture scheme and new cropping techniques, improved implements, Crop varieties, Integrated pest management techniques and so on.

Benefits:

- Harvest time: the easy information through the system has put up an end to a major reason for anxiety at harvest time. Farmers know the exact time of Harvesting (start of cropping season to harvesting date).
- Easy identification: By punching the allocated code, given by government, farmers can identify when his crop was planted and

when it is due for harvesting. This gives the farmers sufficient time to organize workers to cut and transport the harvest.

- Transaction: The network also gives details of their transaction with the local sugar and milk cooperatives and helps them compare sugar prices in different part of country.

- Bank information: The computer kiosk gives the information about several tasks for instance, after sugarcane was weighed at the factory it took four days for them to know how much money they would get. Now by visiting kiosk he understands everything in minutes.

Problems with the existing System:

- The kiosk was not running perfectly due to lack of proper maintenance and maintenance costs.

- Power is a huge issue in these rural places, and they had UPS backups that would help with it, which adds to the maintenance costs.

- The complex interface is not useful for illiterate users.

- Unavailability of operating staff in major harvesting season.

- Lesser penetration to the actual sugarcane farmers, cutters and landless and homeless labor

- This system is not use full for the less technology savvy farmers.

Warana Unwired: Microsoft Research, India: [5]

The government of India in 1998 started a pilot experiment with Microsoft research to bridge the digital divide by setting up this project referred to as the Warana Wired Village project.
Microsoft research replaced the client PCs with SMS enabled phones. Through a smart phone attached to their PC server through USB, the server has an SMS gateway that receives incoming SMS messages and converts into database calls. Similarly response is also converted to an SMS message and the result sent back to the phone that sent it. The authentication is through the SIM card (essentially the phone number).
The system is now available 24 hours, and the farmers are using the data at time they like. The solution is truly mobile and the farmers are using it in places like the tea shops, front of the farmer fields and in the kiosks.

ITC – eChoupal [3]

e-Choupal[3] is an initiative of ITC Limited. E-Choupal have been developed to tackle the challenges faced by Indian agriculture industry, characterized by fragmented farms, weak infrastructure and the involvement of numerous intermediaries.
Traditionally, the agro-commodities are procured in “mandis” where the middlemen make most of the profit. These middlemen judge the quality of product and set the prices by using unscientific and sometimes outright unfair means. Difference in price for good quality and inferior quality are usually very less, and

hence there is no scope for the farmers to invest and produce good quality output. With e-Choupal, the farmers have a choice of various mandis and the exploiting power of the middleman is restricted.
In this project computers and Internet access in rural areas have been established across several agricultural regions of the country, where the farmers can directly negotiate the sale of their produce with ITC Limited. The PCs and Internet access at these centers enable the farmers to obtain information on Mandi prices, good farming practices and place orders for agricultural inputs like seeds and fertilizers. This helps farmers in improving the quality of produce, and also helps in realizing a better price.

The Model

Each kiosk having an access to Internet is run by a sanchalak - a trained farmer. The computer housed in the sanchalak's house is linked to the Internet via phone lines or by a VSAT connection and serves an average of 600 farmers in the surrounding ten villages within about a 5 km radius.
Every sanchalak bears some operating cost but in return earns service fee for the e-transactions done through his e Choupal. The middlemen called "Samyojak" make up for the lack of infrastructure and fulfill critical jobs like cash disbursement, quantity aggregation and transportation.

Benefits:

1. E-Choupal delivers real time information and customized knowledge to improve farmer's decision making ability. the profit in turn is farm output meets market demands; secures better quality, discovery of productivity and Improved price.
2. This initiative also creates a direct marketing channel, eliminating wasteful intermediations and multiple handling. This reduces transaction costs and makes logistic efficient.
3. The village internet kiosk is managed by farmers, called sanchalak who enables the agriculture Community access ready information in their local language on weather & market price, disseminate knowledge on scientific farm practices and risk management etc.
4. it also has a provisions for farmers to log on to site through internet kiosks in their villages to order high quality agro-inputs, get information on best farming practices, prevailing market price for their crops at home.

It is a highly successful project helping farmer to sell their product in Mandi at best price without intervention of Middle man.

Digital Mandi Project [14]

This Project is based on Agricultural Marketing Information System Network sponsored by BSNL (Bharat Sanchar Nigam Limited) and is implemented by IIT Kanpur. The project is aimed at networking all the Mandis located throughout the country, for spreading effective information. It facilitates in the spreading effective information, over web, of the daily arrivals and prices of commodities in the agricultural produce markets spread across the country. The aim of this project is helping the farmers in decision

making and strengthening of their bargaining power. Farmer can access DigitalMandi by visiting the BSNL Live home page, Scroll the page and click on "DigitalMandi for Kisan" link. Also farmer can Download and install the mobile app for accessing digitalMandi trough his mobile phone.
Though this project for smart phone application using farmers can bargain by using DigitalMandi application. It is an eye opener for me, that farmer can bargain his commodity by using his mobile phone which feeds him information about different market price of commodity.

Fasal Project: [1]

Fasal[1] is SMS based platform to provide information on price, potential buyer info, weather**,** would be invaluable to farming community while also helping bridge the gap for large organizations to reach out with relevant offerings and advisory services to the farming community in India. Fasal with a single objective - help farmers make more money or save more money. This project helps me to observe farmers can get information about offerings and advisory service through sms in their mobile phone.

Mandi Project: [2]

Mandi Project is a Speech-Based Automated
Commodity Price Helpline in Six Indian Languages. It helps farmers stay updated with the latest price of agricultural commodities by dialing a (soon to be) toll free number and enquiring in their native language. This automated system is powered by an interactive speech recognition engine that has been developed by a consortium of seven institutions (IIT-M, IIT-K, IIT-B, IIT-G, IIIT-Hyd, TIFR & CDAC-Kol) and is coordinated by IIT-Madras. The project is funded by TDIL & DeitY, India. The main objective of this project is to use state-of-the-art Automatic Speech Recognition (ASR) technology to provide the latest agricultural commodity prices around-the-clock to farmers, over telephone. This prevents the buyers from exploiting farmers and procuring the produce at lower than the standard rates.
It is a good project for low literate/ illiterate farmers can interact with voice base databank to get information about various agricultural commodities.

mKrishi: [15]

mKrishi is an Interactive Voice Response (IVR) – based system Developed by TCS Innovation labs, Mumbai. The farmers dial a published number (called the IVR Service number) to avail this service. They listen to it and select the appropriate audio prompts (in the local language of the region). They record their questions and get a question id for each question.
Experts analyze the queries and provide the appropriate audio advice. An SMS is sent to the each farmer indicating that his/her question has been replied to. When the advice is available, the farmers enter the query id on the phone to listen to the expert's advice. Experts can also send out various alerts like the weather forecast market prices etc. in either English or the local languages

to the farmers**.** From This project I found farmer can get information about harvest disease and other information without help of actual expert.

Limitations and Advantages of IVR system:

From the above research, we found that all the above projects are IT KIOSK, SMS or web base portals. If we take consideration of IT KIOSK and web base portals for rural or semirural farmer community, it will be too difficult to maintenance of hardware and software form finance as well as technical expertise point of view. Also SMS based system is not useful for barely literate or low literate farmers. Even in India literate peoples are not willing for texting to communicate through SMS technology. So that IVR systems seeking over the no of IT technology described above. As we know IVR systems are based on oral communications and no need to worry about texting or any kind of technical expertise for operations. And also it is cost effective, required very less maintenances. In the current project we are using IVR system effectively to proved information about supari prices offered by co –operatives, availability of pesticides as well as new type hybrid seeds / plants, farmer can take appointment for submission of his crops to cooperatives without physically moving to cooperative office place, and also can collaborate with other fellow farmers as well as experts for sharing of knowledge about farming or marketing.

Though it is difficult to handle by any IVR system if the no of items per menu increase. In the current project we covered, how the IVR systems can handle potentially areca nut farmers' requirements. The objective of the current project is to evaluate the design in a real-life setting by testing through a high fidelity prototype with areca nut framers in Alibaug Taluka.

Project Brief

For my target user group the most natural mode of interaction with mobile phones is that of voice.
They have only digit literacy and know how to answer an incoming call and make an outgoing call from ubiquitous basic mobile phones. Interactive Voice Response (IVR) systems are more usable than text and can offer an intuitive interface for providing information to and collecting data from them. The idea is to build an Interactive Voice Response (IVR) system that can be accessible via a phone call. A framer can place a phone call and gets information by listening information on topics like price of supari offered by ATS, availability of pesticide and new variety seeds and posts a voice message to ask question on particular topic. Also farmer provides his name, address, collection date to ATS harvest collection team for selling their harvest that helps in effective logistic management of supari collection.
A content moderator can optionally review the question answer messages posted by farmer on various topics before that the messages become public.
In my design I have tried to use the existing method of business communication and enhance it by adding several other applications and factors that help them in proper management of their business, hence guiding them to prosperity.
Design of a system that helps ATS to improve its management of business ecosystem. In particularly it would establish effective mechanisms for sharing information with farmer, ATS [3] and other stakeholders. The system should help areca nut farmer to get information on topics like price of supari offered by ATS, availability of pesticide and new variety seeds. The system should also help ATS harvest collection team to be connected with the farmer for logistic management in harvest collection process.
The system should fulfill social exchange of the knowledge as well the methods of farming among the farmers. And finally it would help ATS manager to communicate any information to areca nut farmer effectively and quickly.

The system should also be adaptable to non perishable garden agriculture farming (such as cashew nut, coconut, cocoa) and processing organization and accustomed to latest customer social behaviors.
For the above, the project is to ideate a speech based IVR voice Portal which would cater the needs of the Areca nut farmers of Alibag Taluka Maharashtra.

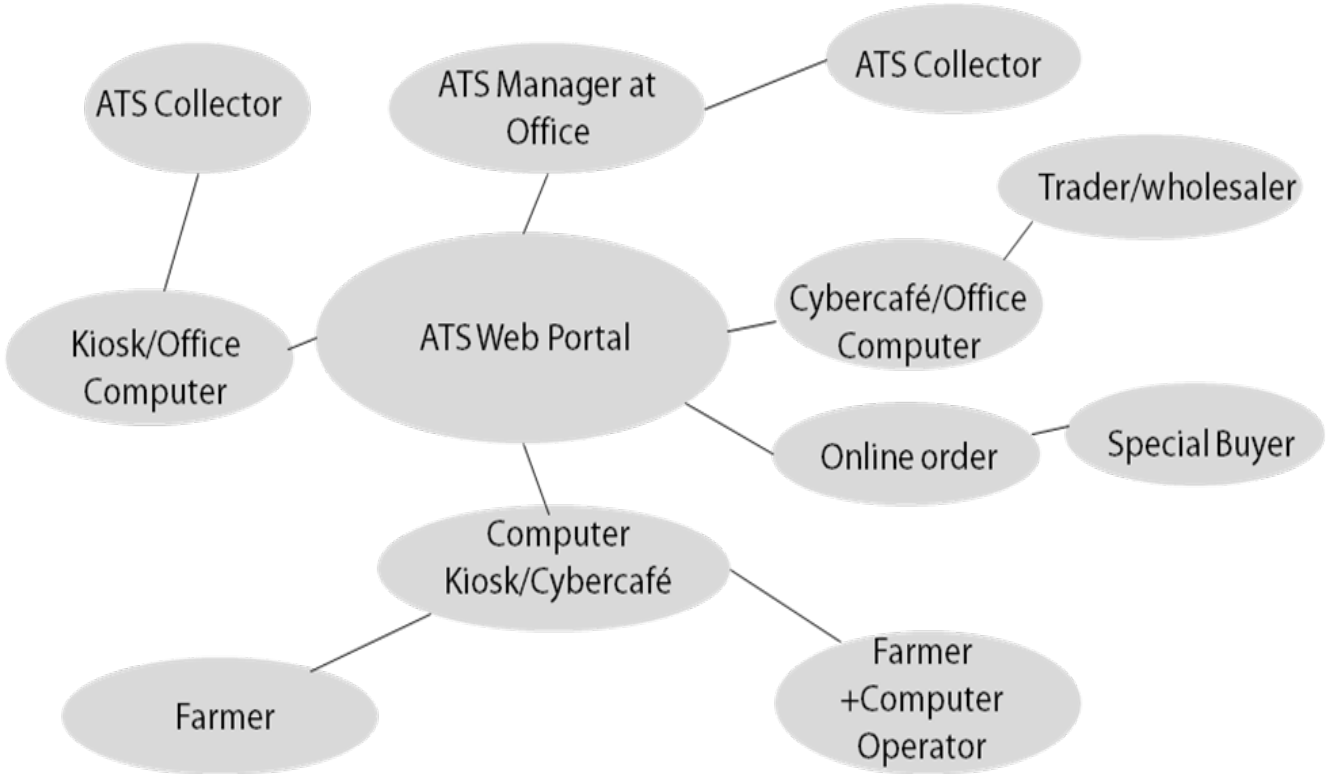
Project Goals/Scopes

- **ATS IVR system** is a mobile based IVR application where the framers can get information about supari farming, marker price as well as sharing of knowledge with other farmers and experts.
- In the first menu by pressing key no 1 farmer gets information about supari prices current year as well as last three years also.
- In the second menu by pressing key no 2 farmer gives information about his location and amount of harvest ready for submission to cooperative society worker and also same time confirming the submission date to cooperative society workers.
- In the third menu by pressing key no 3 farmer gets information about availability of new hybrid plants and pesticides in cooperative society office.
- In the fourth menu by pressing key no 4 farmer can ask his query to forum and as well as listen other framers' answers/onions related to his query.

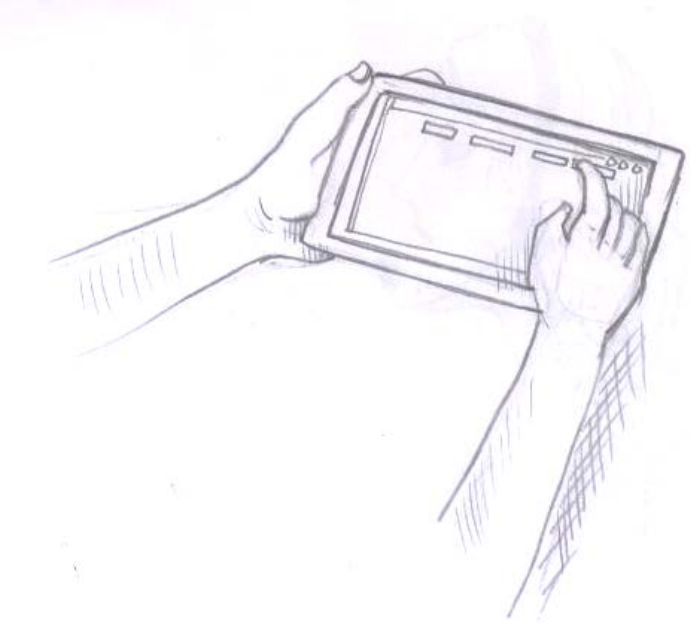
Concepts

Based on problem areas & insights identified, several concepts were generated. Finally focus was established on a single solution to full fill the requirements of areca nut farmers in Alibaug Taluka. Project brief was established for the final concept and few explorations were carried out before reaching it to the final concept.

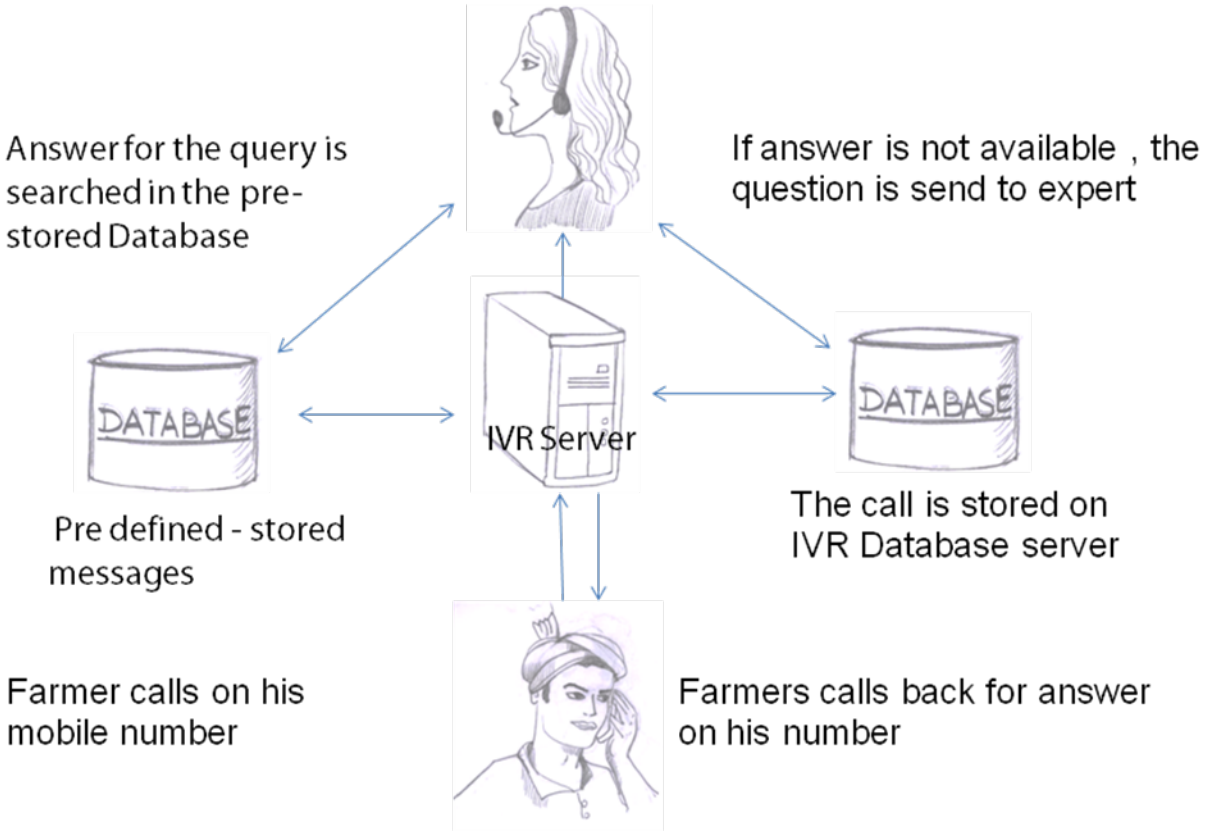
Initial Concepts



The idea is to design a web portal, through which all stake holders of this system can interact, to full fill their requirements. Apart from farmer other stake holders are can comfortable to interact with this system. But farmers can not because they are less technology savvy , low literate and inaccessible to internet. As my main aim to establish an effective communication mechanism between ATS society and farmer. So that this idea is not suitable for current scenario.

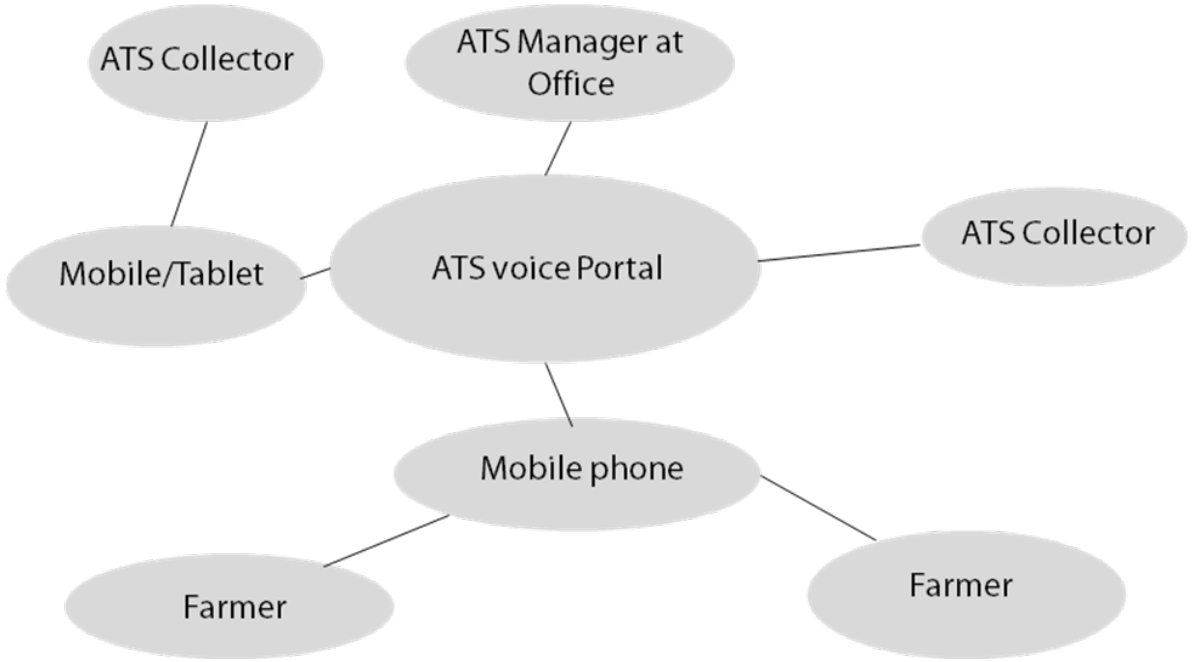


This idea is to design an application for ATS collector to keep framers data into his tablet - Harvest collection Date, Collection point.
It will help ATS collector and manager in logistic and operation management.



This is the idea of designing of an IVR system for low literate and less technology savvy areca nut framer to establish a communication system between ATS and farmer. By using this system farmer can communicate with ATS by help of mobile phone in local language.

Final Concept



After ideation and relooking at the user problems, I found that the concepts were not solving the problem as a whole and were addressing the problems partly. However I cannot address all the problems, but a coherent design solution can solve most of the problems. Hence the final concept is evolved from the initial concepts. The final design is called ATS Voice portal, which is a combination of interactive voice menu base IVR application target to mobile phone with an admin back end web interface.

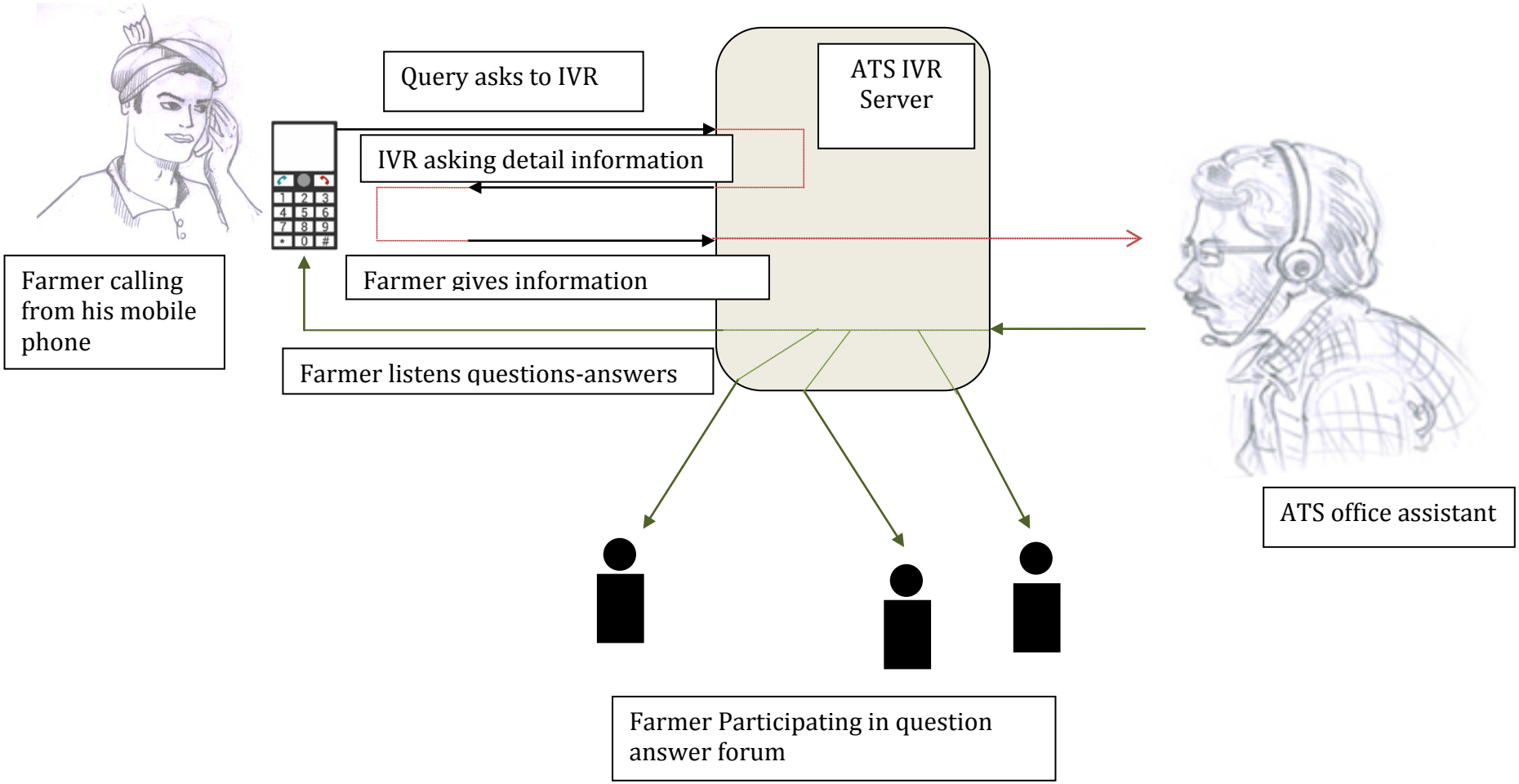
The IVR portals will be divided into four parts:

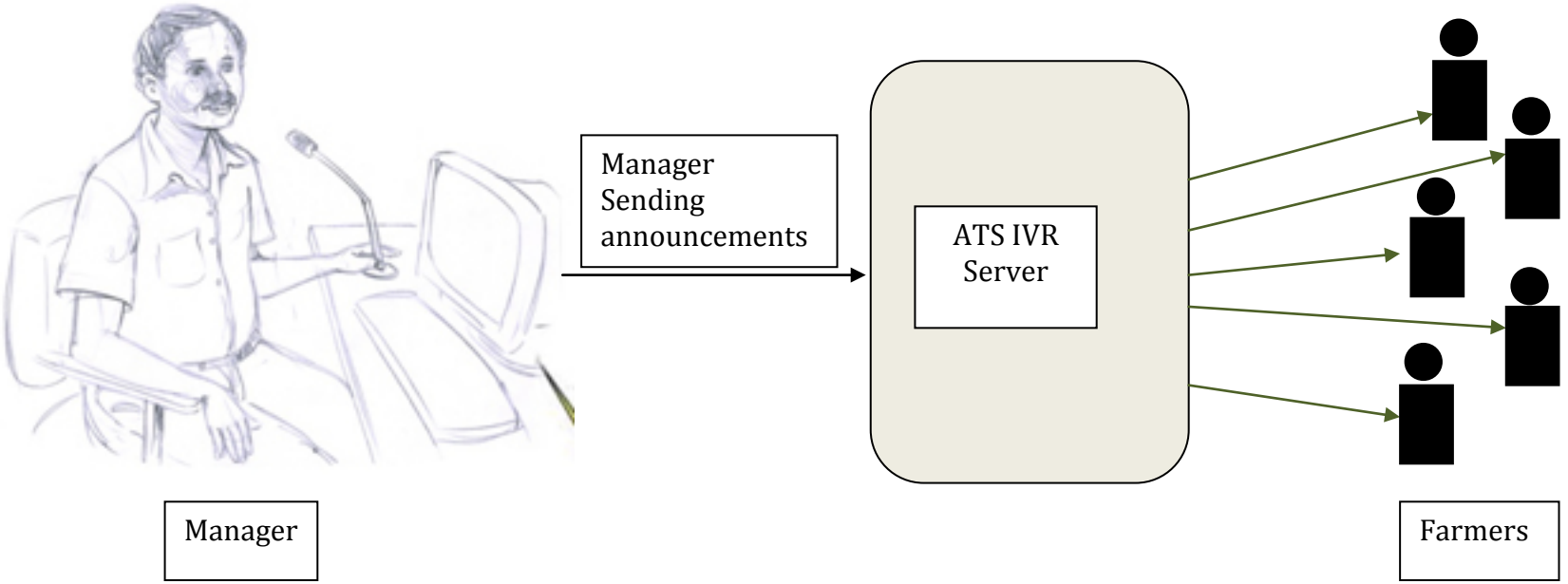
1. Supari Price announcement: By calling ATS voice portal IVR framer can get information about supari prices of current month, previous months and also price of previous years.
2. Availability of pesticide and nursery plants: framer can get information about availability and price of pesticide and variety of areca nut nursery plants at ATS in early rainy season for new plantation.
3. Providing farmer's information to ATS for harvest collection: Farmer provides his information's, name, address, and collection date and harvest amount to ATS harvest collection Team
4. Question- answer section: farmer listens questions-answers on particular topic given by other farmers and also can ask question on particular topic.

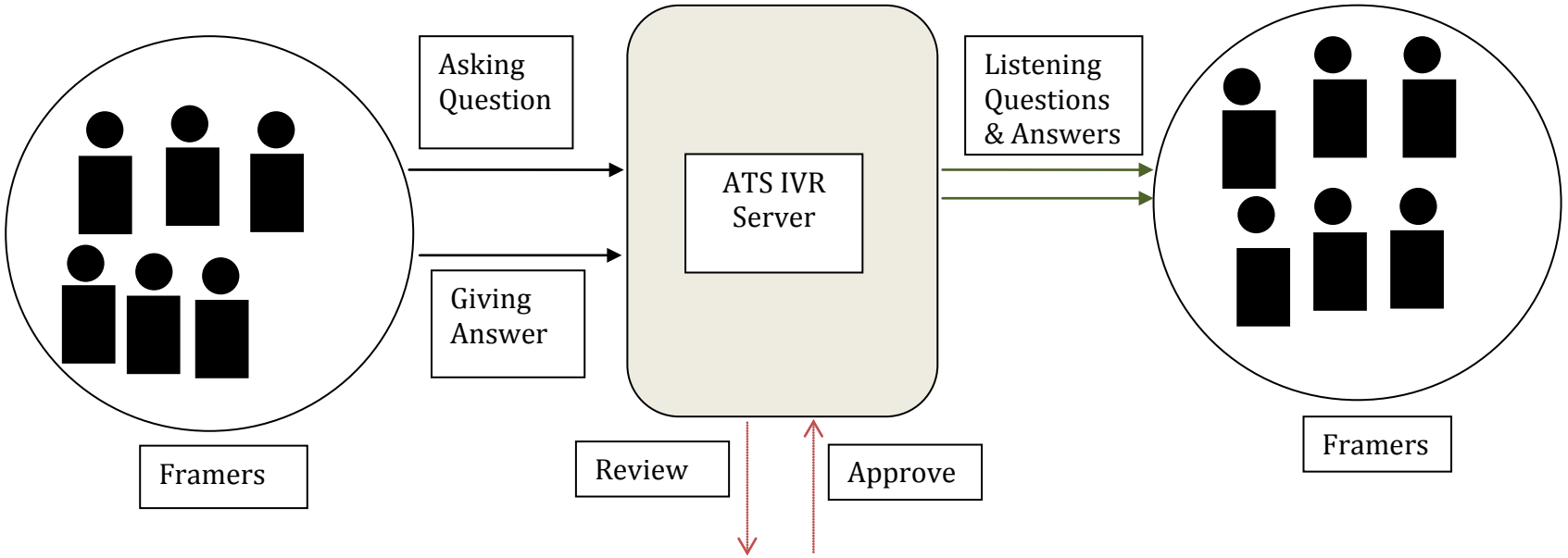
Apart from this, there is an admin interface for moderator; a content moderator can optionally review the question answer messages posted by farmer on various topics before they become public.

All the information details and queries sent by the farmers are saved in a database. The IVR system Processes the queries and gives the required answer to farmer, those are previously stored in server otherwise the queries will pass to ATS person.

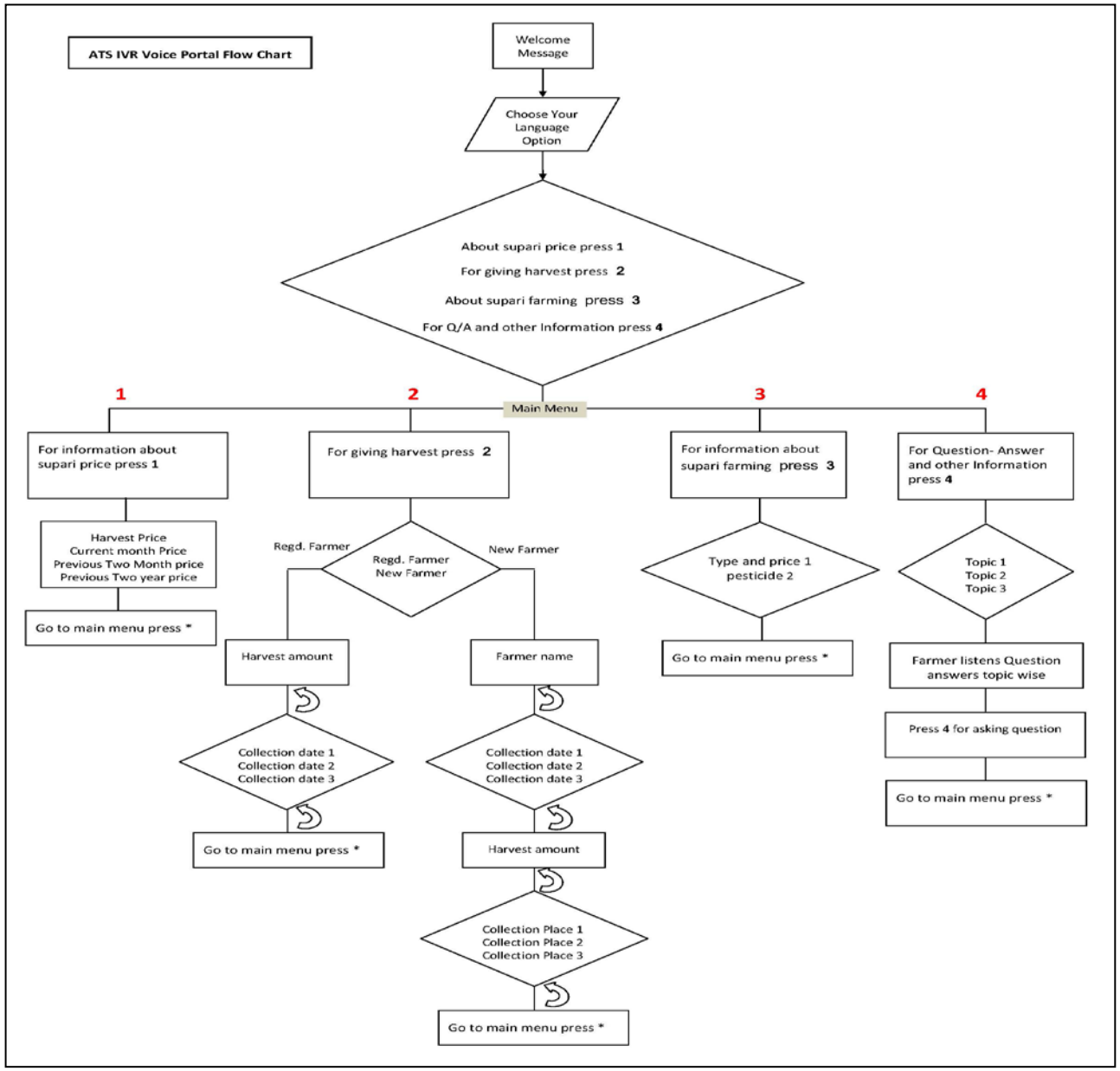
Overview


Query asks to IVR
ATS IVR Server
IVR asking detail information
Farmer gives information
Farmer calling from his mobile phone
Farmer listens questions-answers
ATS office assistant
Farmer Participating in question answer forum

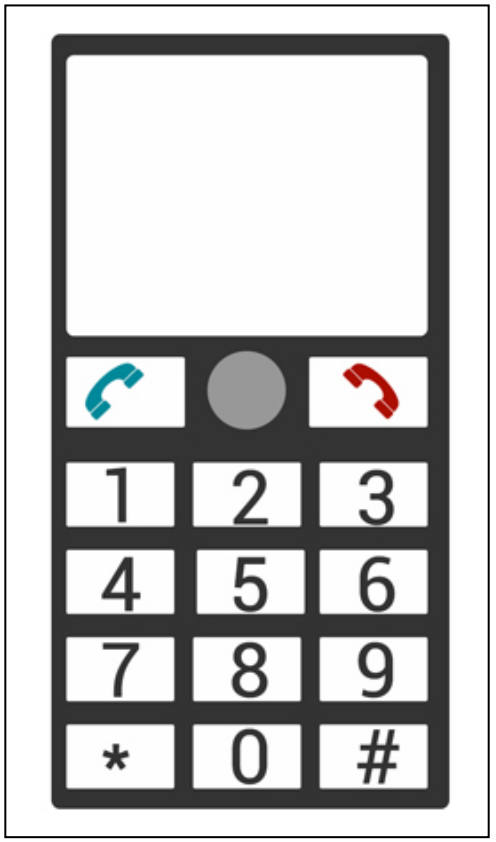

Manager
Sending
announcements
ATS IVR
Server
Manager
Farmers

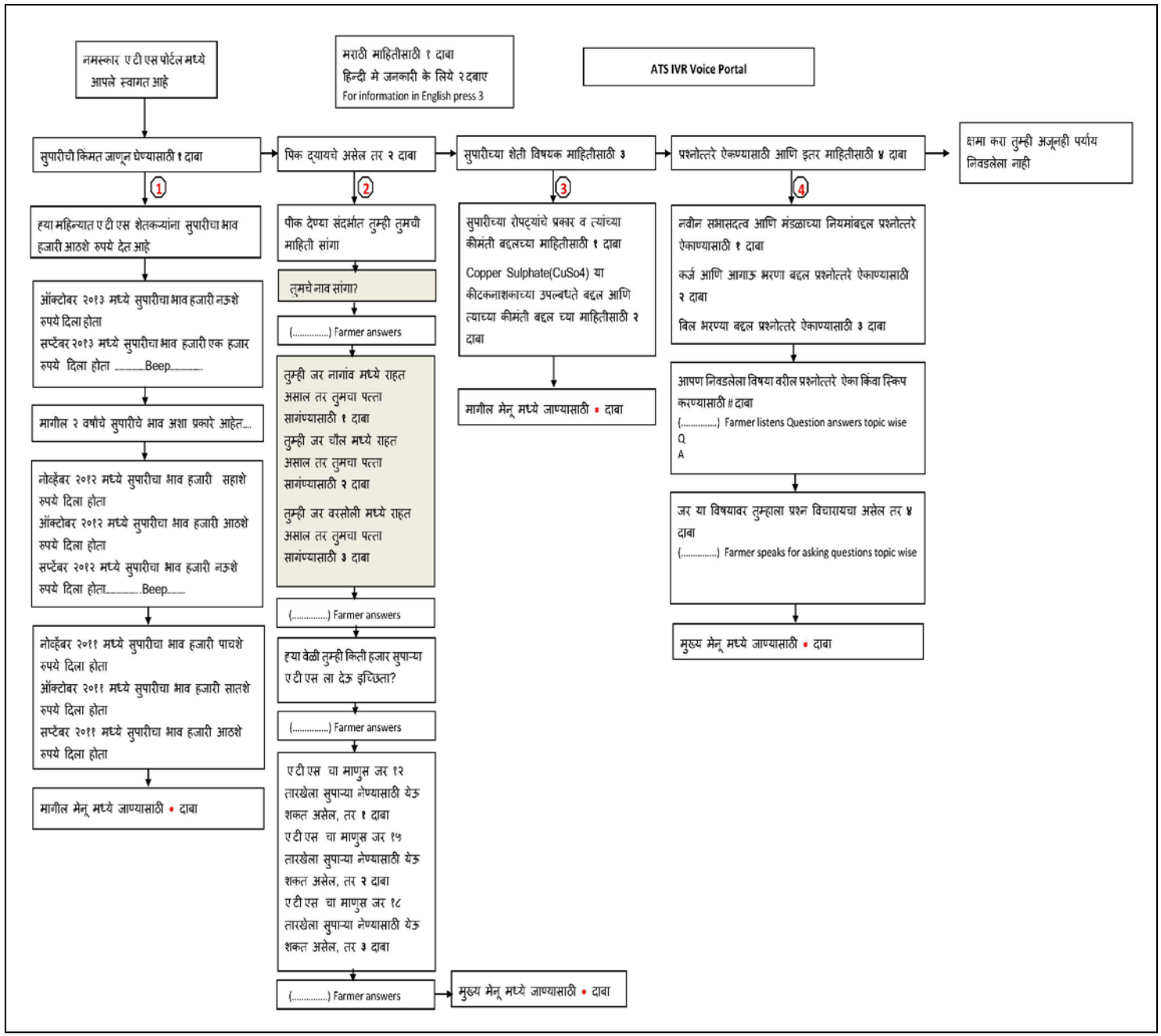


Moderator checking and approving farmers voice Posts

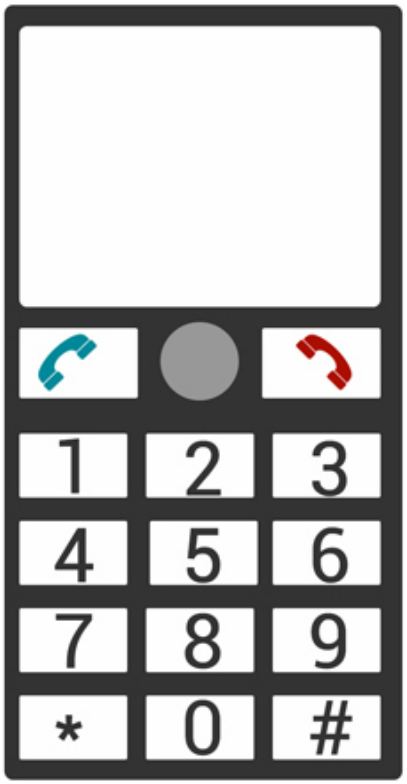


Flow Chart of ATS voice portal IVR System



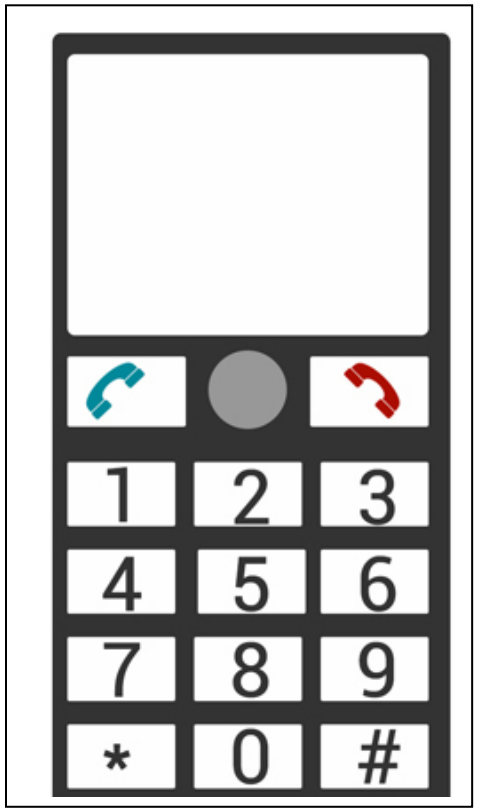


Voice (menus) interface of ATS voice portal IVR System

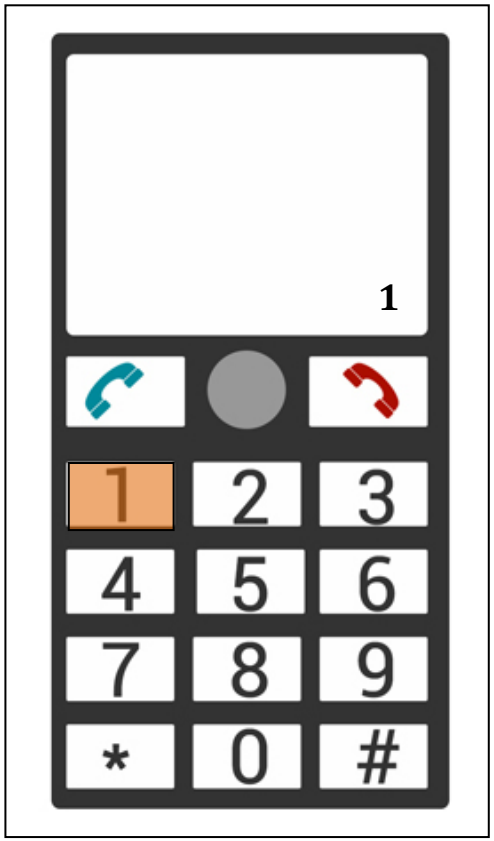


Scenario1:

Mr Amit Kumar bargains his harvest with Middleman and ATS using his mobile phone



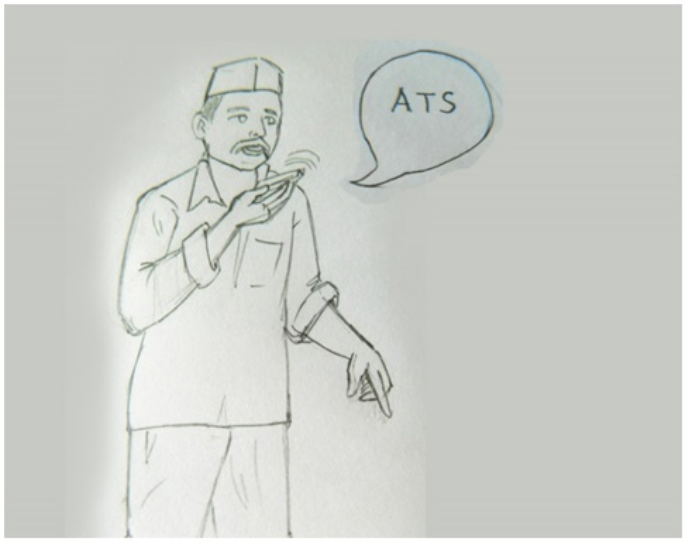
Scenario 2:

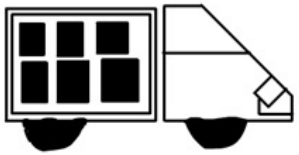


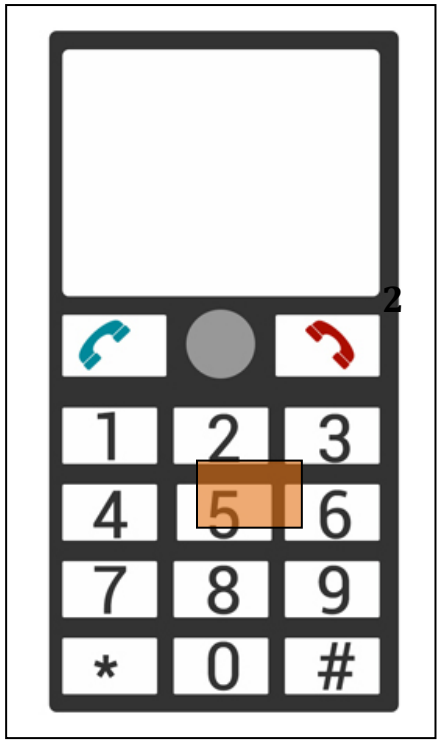
Mr Amit Kumar dials ATS, and presses 1 for Enquires about supari prices offered by ATS

[IVR Script in Marathi]- सुपारीची किंमत जाणून घेण्यासाठी १ दाबा - ह्या महिन्यात ए टी एस शेतकऱ्यांना सुपारीचा भाव हजारी आठशे रुपये देत आहे - ऑक्टोबर २०१३ मध्ये सुपारीचा भाव हजारी नऊशे रुपये दिला होता, सप्टेंबर २०१३ मध्ये सुपारीचा भाव हजारी एक हजार रुपये दिला होता | मागील २ वर्षांचे सुपारीचे भाव अशा प्रकारे आहेत.... नोव्हेंबर २०१२ मध्ये सुपारीचा भाव हजारी सहाशे रुपये दिला होता, ऑक्टोबर २०१२ मध्ये सुपारीचा भाव हजारी आठशे रुपये दिला होता, सप्टेंबर २०१२ मध्ये सुपारीचा भाव हजारी नऊशे रुपये दिला होता

Scenario 3:



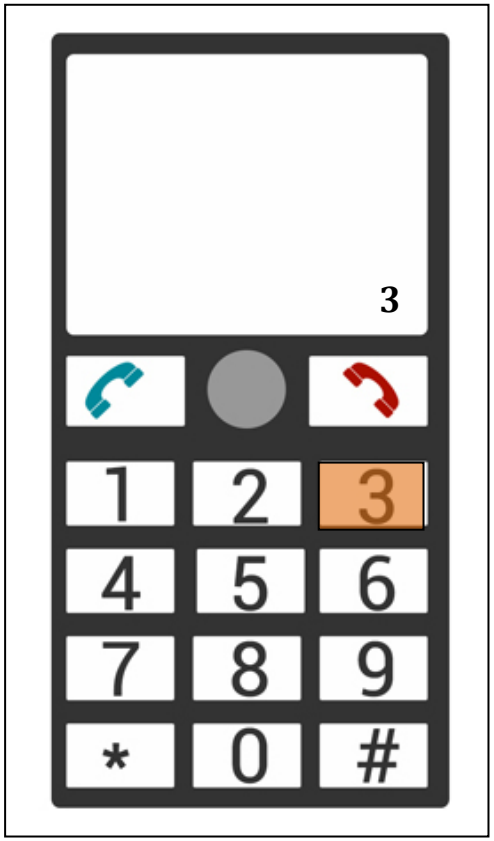




Mr Amit Kumar dials ATS, and presses 2 asking to sell his harvest to ATS and Fixes collection date and collection place address, harvest amount with ATS people

[IVR Script in Marathi]- पिक द्यायचे असेल तर २ दाबा - पीक देण्या संदर्भात तुम्ही तुमची माहिती सांगा - तुमचे नाव सांगा - तुम्ही जर नागांव मध्ये राहत असाल तर तुमचा पत्ता सागंण्यासाठी १ दाबा, तुम्ही जर चौल मध्ये राहत असाल तर तुमचा पत्ता सागंण्यासाठी २ दाबा, तुम्ही जर वरसोली मध्ये राहत असाल तर तुमचा पत्ता सागंण्यासाठी ३ दाबा - ह्या वेळी तुम्ही किती हजार सुपाऱ्या ए टी एस ला देऊ इच्छिता? - ए टी एस चा माणुस जर १२ तारखेला सुपाऱ्या नेण्यासाठी येऊ शकत असेल, तर १ दाबा, ए टी एस चा माणुस जर १५ तारखेला सुपाऱ्या नेण्यासाठी येऊ शकत असेल, तर २ दाबा, ए टी एस चा माणुस जर १८ तारखेला सुपाऱ्या नेण्यासाठी येऊ शकत असेल, तर ३ दाबा

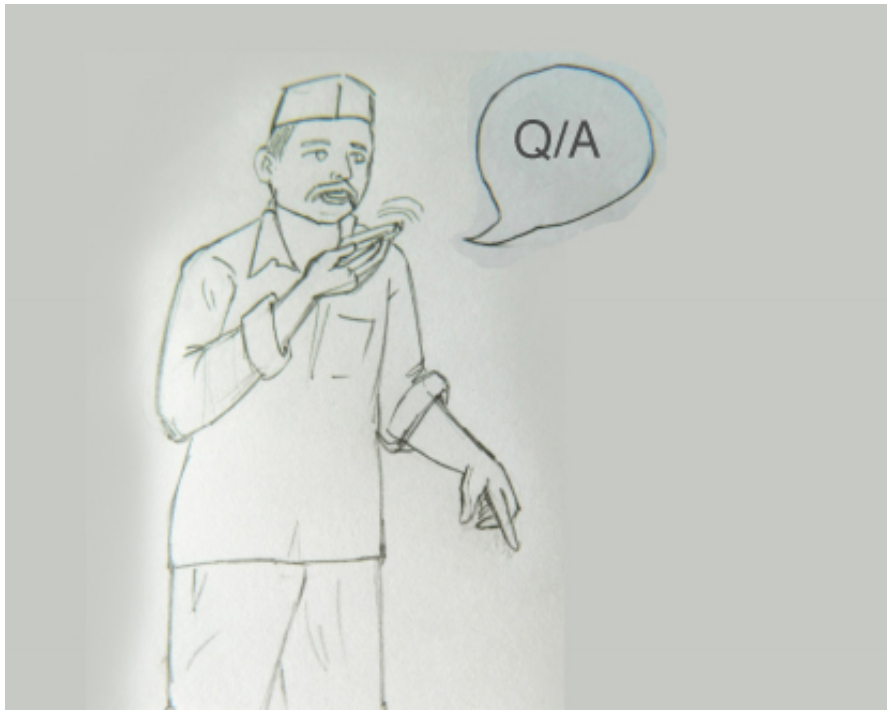
Scenario 4:

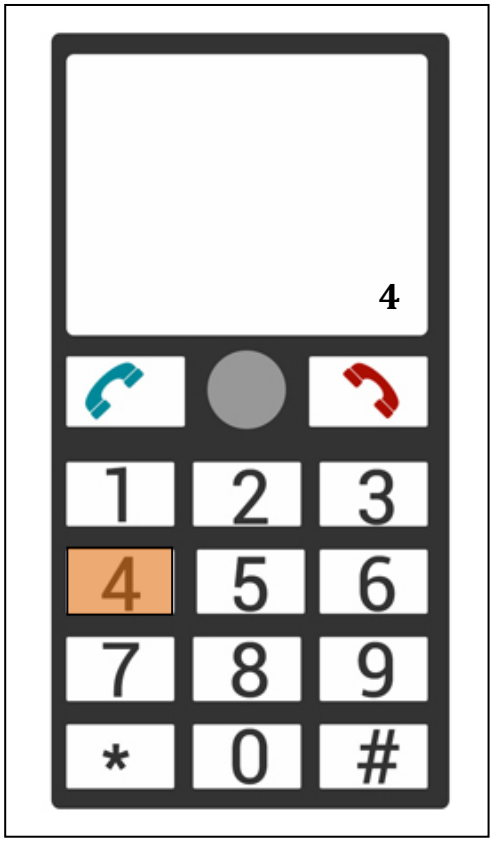


Mr Amit Kumar dials ATS, and presses 3 enquires about availability and price of CuSo4 pesticide and new variety of supari nursery plants

[IVR Script in Marathi]- सुपारीच्या शेती विषयक माहितीसाठी ३ दाबा - सुपारीच्या रोपट्यांचे प्रकार व त्यांच्या कीमंती बद्दलच्या माहितीसाठी १ दाबा, Copper Sulphate(CuSo4) या कीटकनाशकाच्या उपल्बधते बद्दल आणि त्याच्या कीमंती बद्दल च्या माहितीसाठी २ दाबा

Scenario 5:





Mr Amit Kumar participates in ATS Voice forum by pressing 4 - listens questions and answers given by different farmers on particular issue and also asks questions by using ATS IVR system.

[IVR Script in Marathi]- प्रश्नोत्तरे ऐकण्यासाठी आणि इतर माहितीसाठी ४ दाबा - नवीन सभासदत्व आणि मंडळाच्या नियमांबद्दल प्रश्नोत्तरे ऐकाण्यासाठी १ दाबा, कर्ज आणि आगाऊ भरणा बद्दल प्रश्नोत्तरे ऐकाण्यासाठी २ दाबा, बिल भरण्या बद्दल प्रश्नोत्तरे ऐकाण्यासाठी ३ दाबा - आपण निवडलेला विषया वरील प्रश्नोत्तरे ऐका किंवा स्किप करण्यासाठी # दाबा ,(.....) Farmer listens Question answers topic wise Q –A- जर या विषयावर तुम्हाला प्रश्न विचारायचा असेल तर ४ दाबा (.....) Farmer speaks for asking questions topic wise

User Testing and Usability Evaluation

The main objective of the user test and usability evaluation is to evaluate the IVR Interface designed and developed high fidelity prototype. During the User test the silently observations were taken and recorded for further design development.

Method:

The user test was conducted through a simulation of high-fidelity prototype of proposed IVR system. Which includes pre-recorded voice messages for fed into the IVR system and user was asked to navigate the speech portal to access the information.

Goals:

The user must be able to:

1) Understand different navigations.
2) Understand the structure of voice portal
3) Get relevant information from each section of the speech portal.
4) Locate within the site structure.

User Group:

All users were chosen from areca nut growing farmers who own a mobile phone but haven't used any agricultural helpline services.

Demography and mobile usages data: Screener questions.

1) What is your age?
2) Have you ever grown the Areca nut framing? And how long?
3) Do you own a mobile phone?
4) For how much long you are using your mobile phone?
5) Have you ever been using any mobile helpline to get information about farming?

Tasks:

A performance test was conducted by giving specific tasks to the users and then the results was evaluated with quantitative parameters of Time, No of steps and qualitative parameters of user interest & satisfaction.

Task 1 (Know about price of areca nuts)

By pressing 1 numeric button farmer gets information about different market prices of areca-nut in current year and also in previous years. And also navigate to return main menu

Task 2 (submission of areca nuts to co-operative society)

By pressing different numeric buttons, farmer feeds his submission quantity with location details information to IVR system and also getting appointments to keep ready for collecting crops in different dates in his location by co-operative society people.

Task 3 (Know about availability and prices of different types of areca-nut plants and medicines)

By pressing different numeric buttons farmer gets information about availability and price of different types of plants suitable for new plantation and also availability of medicines need for areca nut farming.

Task 4 (interaction with other members of society and asking about rules regulations of society.)

By pressing different numeric buttons farmer can exchange information with other members of society and also get information about rule regulations of society.

Task-1	User-1	User-2	User-3	User-4	User-5	User-6	User-7	User-8
Did the links take you to your expected place	A	A	A	A	A	B	A	C
Did you find the information you were looking for, in a timely manner	A	A	A	A	A	B	C	C
Did you always know where you were within the site structure	A	A	A	A	A	C	C	C

Task-2	User-1	User-2	User-3	User-4	User-5	User-6	User-7	User-8
Did the links take you to your expected place	A	A	A	A	B	B	C	C
Did you find the information you were looking for, in a timely manner	A	A	B	B	B	B	C	C
Did you always know where you were within the site structure	A	A	A	A	C	C	C	C

Task-3	User-1	User-2	User-3	User-4	User-5	User-6	User-7	User-8
Did the links take you to your expected place	A	A	A	A	A	A	A	B
Did you find the information you were looking for, in a timely manner	A	A	A	A	A	A	A	A
Did you always know where you were within the site structure	A	A	A	A	A	C	C	C

Task- 4	User-1	User-2	User-3	User-4	User-5	User-6	User-7	User-8
Did the links take you to your expected place	A	A	A	A	B	B	B	C
Did you find the information you were looking for, in a timely manner	A	A	A	A	A	A	C	C
Did you always know where you were within the site structure	A	A	A	A	A	A	C	C

A- Yes, B- Yes, with taking help, C- Not successful

Usability Evaluation: Design Suggestions

1) Instead of giving different month Price, give only yearly price of last two years with current year offer price.

2) Price offered by different merchants /societies should be available, because farmers can compare and sell his harvest in best price.

3) Instead of IVR giving the supari collection date the frame can also take appointments accordingly his convenience.

5) The quality of voice should improve to listen for easy navigations

6) The content of information should be perfect and as much as possible descriptive for easy and quick understanding

7) The timing of both key press and menu prompts should increase

8) Only First two menus are useful other two are not so important.

Conclusion

Over the entire product is an Enterprise solution. Here demand was to develop a high quality product with low operation cost and stipulated time. It was a big challenge for an experienced professional like me. I enjoyed a lot in the 'learn and do' and 'do and learn 'process followed here. Really it was a great learning experience for me. I can tell it was the stepping stone of my carrier.

Once again thanks to all the people who helped me finish this project.

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[7] http://www.e-agriculture.org/sites/default/files/uploads/media/WaranaVillage.pdf
[8] http://link.springer.com/article/10.1007%2Fs11300-009-0092-z
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