Scheduling and decision making system for veterinary services

By
Pranav Mistry
03625008

Guide
Prof. Anirudha Joshi

IDC
IIT Bombay

Approval sheet

The Visual Communication Project - 2 titled '**Scheduling and decision making system for veterinary services**' by **Pranav Mistry**, 03625008 is approved as partial fulfilment of the requirements of the Master's of Design Degree in Visual Communications.

Project Guide

Chairperson

External Examiner

Internal Examiner

Industrial Design Centre
Indian Institute of Technology, Bombay
November, 2004

Abstract

New technologies have created new opportunities to look forward the vision of 'Technology to Masses' from different perspectives. But, still something is lacking. Not technology, technology in 'meaningful manner', only will help solve the current problems. With the help of various design concepts & methods the project aims the successful utilization of ICT to provide efficient veterinary services in rural India. The lack of proper scheduling, decision making support, record keeping, planning, and resource management in current veterinary system seems the driving forces for the inefficiency. The project deals with veterinary services provided by Amul in northern Gujarat region. The inefficiency in existing scheduling system ends in inefficient use of system resources and improper handling of emergencies. As a solution to the problems a new system is suggested based on decentralization of visit request registering. A new map-based interface is suggested to help solve inefficiencies in scheduling task. With the help of a story based design approach throughout the project and evaluations at various stages helped define the efficacy of the suggested sulotion. With the vision, the project aims to make veterinary services in rural India more efficient with proper decision making & scheduling aids.

Contents

Introduction
Process
A visit
Why this project
Understanding user and system
Modeling
Requirement definition: a story based approach
Framework definition and ideation
Form and Behavior design
Refinement
The final solution
References
Acknowledgements

Appendix
A User study notes
B Technical detailing
C Design process
D Other related projects
E Writings during project
F Project website
G Bibliography

Introduction

01

New paradigms always throw up new questions. And in the case of penetration and usage of technology among the Indian masses, it's quite clear that there is no one solution that will solve all problems and neither is anything going to happen overnight. There continues to exist dozens of linked problems (literacy, language, geography, content, access, etc.) but ultimately, it is only an amalgamation of the various ideologies and hypotheses that will throw up a suitable line of action. With this approach and collective initiative, as a part of the theme of bringing 'technology to the masses in India' in a meaningful manner, the project is aimed as a small step towards the same.

Banas dairy is the Amul dairy plant situated in Palanpur, capital of Banaskantha district. Besides the major work of milk production, the dairy works for rural development providing services of education, health, veterinary, etc in rural area of the district.

The dairy operates veterinary health service with a dedicated Dairy Husbandry (DH) department. With a view to provide a sound canopy of good health and sustaining /improving productivity of the animals, emergency veterinary health care, Artificial Insemination, Infertility camp and vaccination camp are the services of DH department, besides providing veterinary first aid services. The DH department operates these services with the help of more than 60 doctors, who travel in the Banaskantha district, daily.

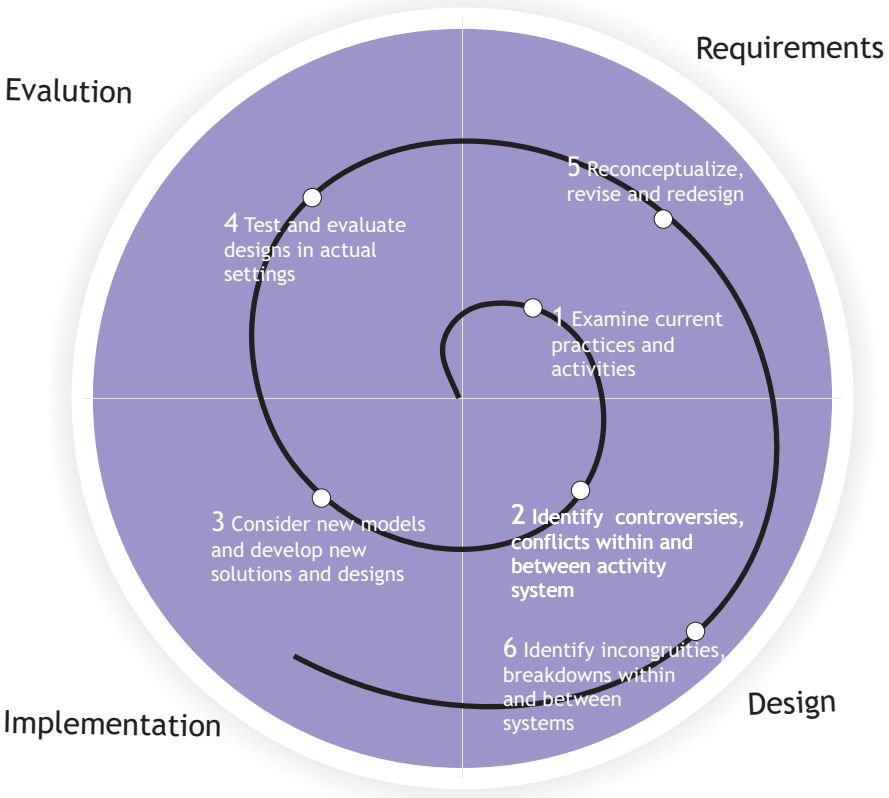
Milch animal owners request for a doctor visit by calling to DH department. Their requests are registered with a list based software system. Doctor visit list are created and doctors visit the place to cure the animal. The major problems of the currents system, which affects overall system efficiency to an extent, are lack of proper scheduling and decision making support. The problems in system of always busy phone line, improper handling of emergency visit request, inefficiency in handling dynamic scheduling, crossover of doctor routs, and all these suggest major scopes for the project to help. The project aims towards better and efficient veterinary services with improving the system with,

- Decision making & resource management system for veterinary health services
- Record keeping & planning at larger level
- Animal-diseases database to help curing
- Better interaction of cattle owner with dairy
- Proper scheduling the doctor visit
- Proper handling of visits by doctors
- Statistical data to help planning for future
- …

A new scheduling system is proposed as an output of the project work to help solve the problems.

Process

02



How to do it? The main goal of the project from personal point of view is to learn 'Design Processes'. The project is taken as an opportunity to apply leanings from the various design courses in the field of interaction design.

A Formative design process is followed throughout the project. Amalgamation of various design concepts and processes constitute to the overall design process followed. The basic process of Define - Design Iterate Refine is without doubt at the core. Various concepts & stages from various design methods constituted in building these main stages. Various methods and process referred throughout the project are,

- User centered design
- Contextual design,
- Activity theory,
- Goal-directed design,
- Scenarios-based design

A story based design approach was at the core of the project. Stories are used as tools in various stages of the process like defining user goals and requirements to framework and user-system interaction. The approach helped in not only ideation stage but also during evaluation of design concepts. Even more these stories are used as a medium to explain the project in terms of problems to solution.

The other design methodologies mentioned above also played import roles at different stages of project. These processes in detail are explained in Appendix[C].

A visit

03

Before finalizing my project topic I decided to have a visit in regions of Banaskantha district, of northern Gujarat. The idea was to take the project as an opportunity to solve a real problem rather than working on a hypothetical ideas. Learning design process with real constraints and having opportunity to proof check the final output to validate the process were the targeted goals.

I went with some prior design project ideas to validate the need for them in the region. The ideas were,

- MIC-multipurpose identification card and deployment of social services based on it
- Resource management systems for rural area
- Community information network for business, health, education, government etc. services
- Surveying system
- Data collection & service deployment techniques for masses

The visit had many faces like discussions with the people working in the same direction; talks with rural people; attempts to understand existing systems and above all a goal of finding problems with current situation that can be taken as a design challenge to solve.

The visit initiated my project, titled as,
'**Scheduling and decision making system for veterinary services**'.

Why this project

04

During my visit to Banaskantha, I came across rural development works done by Banas dairy. Banas dairy is the Amul dairy plant situated in Palanpur, capital of Banaskantha. Besides the major work of milk production, the dairy works for rural development with the help providing services of education, health, veterinary, etc.

The dairy operates veterinary health service with a dedicated Dairy Husbandry (DH) department. With a view to provide a sound canopy of good health and sustaining /improving productivity of the animals, emergency veterinary health care, Artificial Insemination, Infertility camp and vaccination camp are the services of DH department, besides providing veterinary first aid services. The DH department operates these services with the help of more than 60 doctors, who travel in the Banaskantha district, daily. Though a managed system of scheduling is designed, I could see an opportunity there to solve some critical problems of improper emergency case handling, inefficient registering system and all. There were some problems related to decision making also at the DH department end. To solve these problems to improve the efficiency of the system is taken as a project definition by me.

Banas dairy, as a part of Amul is very well established in terms of infrastructure, connectivity, resources. It was awarded the best techno-campus also. Most of the Dudh Mandalis at village end are already connected to dairy via well established network. Most of the system is computerized to handle it efficiently. I seen the project as a great opportunity to do something which has a possibility to be implemented in real, as Amul aims better services in rural area.

The reason for choosing the regions of northern Gujarat was that Palanpur, situated in Banaskantha is my hometown. I wanted language not to act as a problem for me in understanding problems of people. Rather than wasting my time in interpreting their words, I wanted to understand & solve the real difficulties.

The third reason for choosing this as a project was the scope of the project definition. From problem identification to designing form and behavior, even having user feedbacks - the scope of the project definition allows me to work in most of the phases of a standard interaction design project.Thus, I have taken this project as an opportunity to start designing for problem solving.

Understanding user and system

05

The goal was to help solve problems of existing veterinary services with the help of better scheduling & decision making aid. It was without doubt the first step of design process to understand the system & user. To be successful, systems must be designed with their environment and users in mind and evaluated to confirm that they do not disrupt the users' natural workflow. Well-established techniques for understanding users and their environment exist, but are not specifically designed to assess how well the computing and physical task environments blend. During the project understanding user and system has seen taken as pragmatic and qualitative step rather than theoretical approach of user study.

The studies cover a wide range of topics and foci, for example:

Focus on the user investigates users' wants, needs, contexts, motivations, expectations and tasks.

Focus on use investigates what and how a particular information source is actually used for, with the barriers and enablers to its use investigated

Focus on the system or service investigates aspects of technology, design and evaluation.

Focus on the organization concentrates on contextual aspects of the organizational setting, covering both internal and external factors such as resources, internal management procedures, internal and external strategies.

The methods used in user and system research are discussed here. Studies are commonly seen as being either quantitative or qualitative. Quantitative data are seen as being objective, quantifiable, hard, generalisable, based on numbers, whereas qualitative data are seen as being subjective, socially constructed, soft and non generalisable, based on words. The major of study was of qualitative type in the case. The types of studies conducted during project can be listed as

Stakeholder interviews
User interviews
User observation and field study
Literature review
Product/prototype and other similar systems

Stakeholder interviews

Discussion with Niraj Prakash Garg, who is the manager of planning in Banas dairy, helped not only in understanding the system but also getting through the overall vision of the veterinary services provided by DH department of the dairy. The discussion provided a management point of view to the overall services and made me aware of future planning in the direction to improve the services. A talk with Ghemarbhai Bhatol gave an insight to the Banas dairy and its services in northern Gujarat.

Interview with Dr. Z. D. Rathore also can be listed as a stakeholder interview. Dr. Rathore is the head of veterinary department in Banas Dairy. Regular three days visit to DH department and observing & interviewing the work going on without interrupting the flow provided a very clear picture of the system from management point of view. Dr. Rathore also suggested some areas one can help improving the services. Thus, all these interviews helped a lot in understanding existing system. Besides that the interviews helped decide the next step of the study.

User interviews

User interviews were the next step of the formative process of understanding user and system. The veterinary system contains several types of users in its end to end operation.

Milch animal owners, veterinary doctors as well as scheduler and request taker at DH department are main users, interacting with the system. The jeep drivers, Dudh Mandali handlers, clerks at DH department are also involved in the system.Interviewing different users helped understanding the system from various viewpoints and thus understanding the overall system as well as problems in the current system.

User observation and field studies

It was necessary in the case to understand the system and scheduling operation in its pick time of work at DH department end, so, observing the scheduling task as well as overall decision making cycle without interrupting the flow of work was necessary during field study. Various documentation tools like note taking, video recordings and photographs are used to get required data for the later stages of design like modeling. I accompanied Dr. Vikas Kole and Dr. Patel to their visits. A full day spending with them gave me actual picture of problems of doctor as well as animal owner.

A full day accompany to Laljibhai Bhatol and Megrajbhai Bhatol at DH department helped me understanding the existing scheduling and decision making system.

Observing users of the system helped me a lot to understand the unspoken, rather say unattended scopes of the system. Most of these interesting points were not mentioned during the stakeholder and user interviews. User study notes of Dr. Vikas Kole, Laljibhai Patel, Dr. Z. D. Rathore, Pethabhai in detail are there in the appendix [A].

Literature review

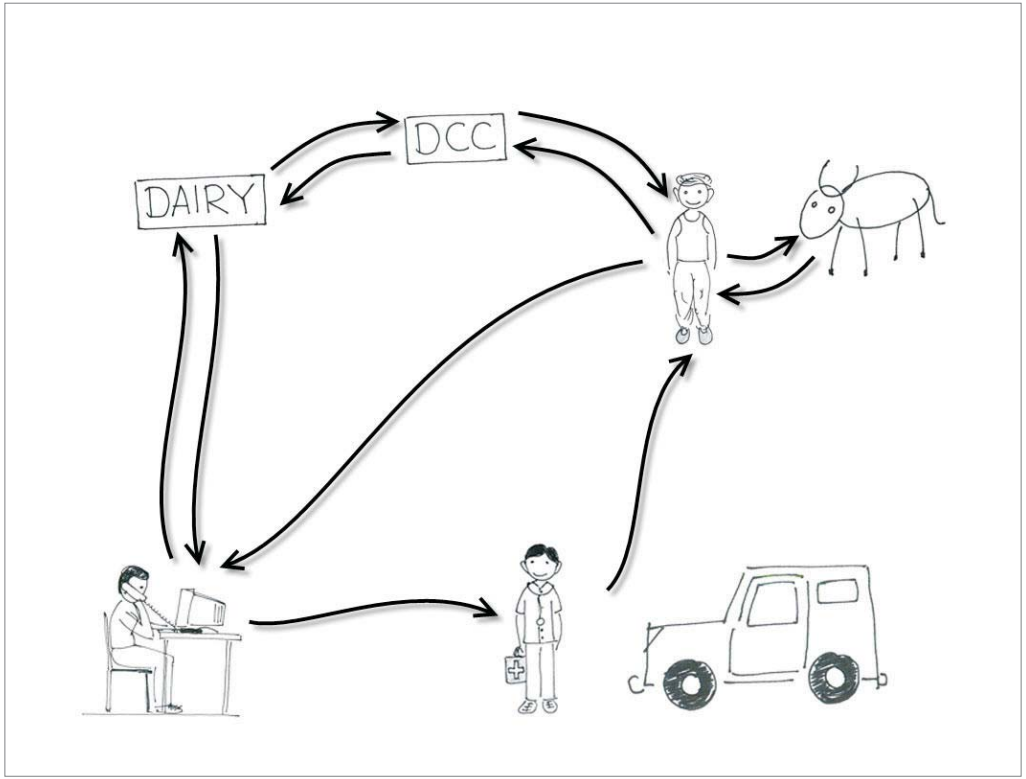
In parallel with stakeholder interviews and user interviews, the study of existing documentation on veterinary services, its history as well as various project proposals and future planning of the department helped a lot to understand the domain well. Documentation provided by Banas dairy on DH department, its working & other statistical data helped understanding the field and its necessity better.

General topics on veterinary services in India by NDDB (National Dairy Development Board), white papers as well as journal papers on veterinary services and other such scheduling systems helped a lot in later stage of process.

Product/prototype and similar projects study

DH department of Banas dairy currently uses a defined system. Examining exiting system parallel with the interviews and field study gave a better opportunity finding flows in it. Studying various other projects in the same direction guided a lot in the design process as well as in system design phase.

Interviewing users helped creating personas and scenarios. As whole design process is taken as a scenario based design approach, this study is very critical for the final outcome. The study leaded to the scenarios at various stages in requirement definition as well as framework definition.



Such a mixed approach of studying user and system gave the clear wholesome picture of the system from a designer's point of view. The system diagram depicted is based on the study. As explained in the diagram the major elements of the system are cow/ buffalo, owners, doctors, milk, scheduler, driver, dairy, DH department and so on. Understanding users and these system elements helped understand the system and its flow better. The clear conceptual model comprehended from the study helped suggest changes in the system in the later stages of project.

Modeling

06

Because, the goal is to design for users, Models are used as tools, which help representing user tasks, goals and relationships in system, for the purpose of better understanding or visualizing them.

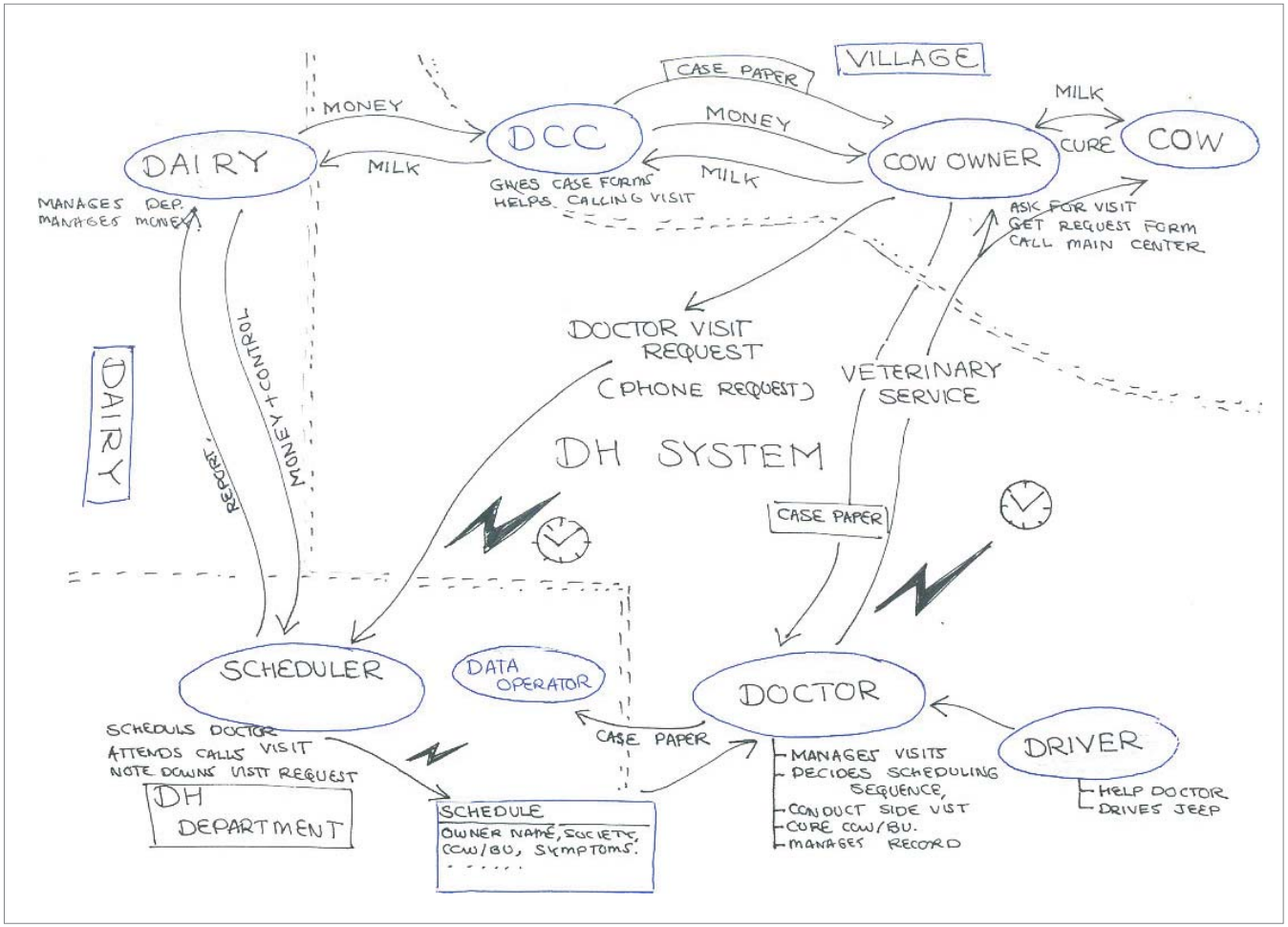
Usage and workflow patterns are synthesized into two types of models.

- Domain models
- User models

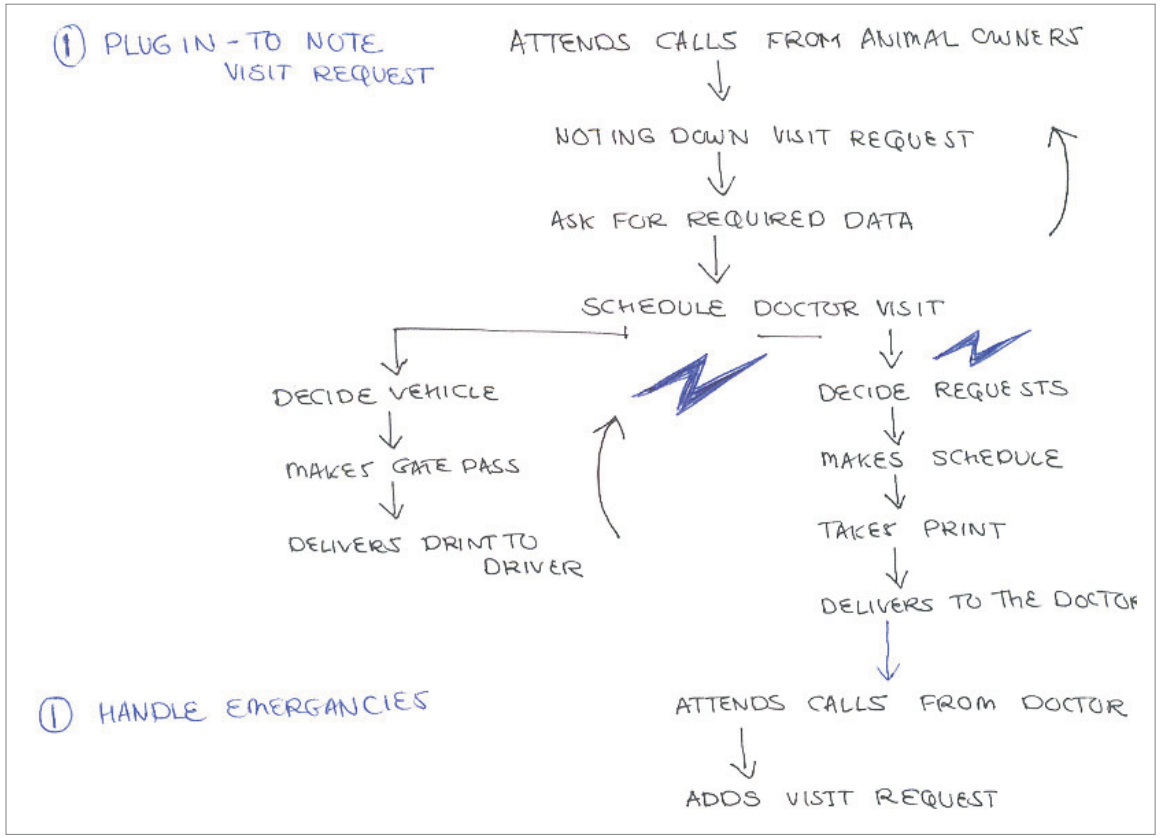
Domain models include information flow and workflow diagrams.
User models are represented as personas that represent distinct groupings of behavior patterns, goals and motivations.

Domain models

Domain models built during interpretation session provided a concrete representation of the work of each user as well as workflow of the system as a whole.



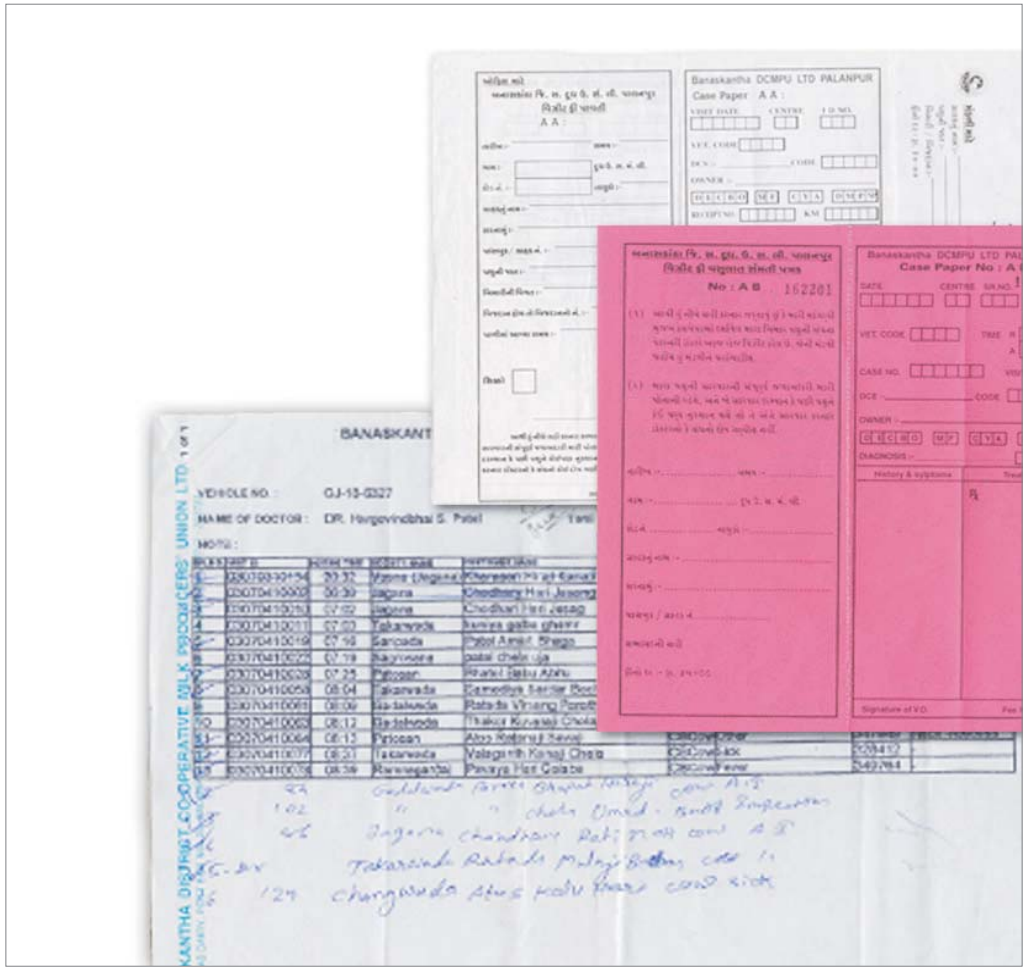
Flow model helped understand the relationship of users in system as well as flow of information, services, and artifacts better. It helped a lot in findind breakdowns of the system as enefficiet scheduling interafce, which later contributed a lot in coming up with design ideas.



Sequence model helped as a tool to visualize sequence of

- Requesting visit form milch owner
- Registering it by DH department person
- Scheduling the visit to doctor
- Conducting the visit by doctor
- Keeping record of the visit in DH department.

Sequence model helped in understanding in between sequential events and thus breakdowns of the system. It acted as a base to visualize the new solution also in later stage.



Artifacts like doctor visit list, gate pass for doctor's vehicle, visit request slip and other such documents acted as one of the design guidelines of the final solution.

The detail study of existing software system interface for scheduling doctor visit helped understanding the user requirements and problems in existing interaction better.

Physical model was very important, as doctors travel place to place for providing veterinary services. Understanding regional area was very critical and the must requirement for optimal doctor visit schedule. The best example of output for modeling is physical model in the project as the final solution of map based interface for scheduling is majorly based on findings of the physical model.

User models

On the basis of user study notes, personas are created to use them in the scenario based requirement definition phase. Personas gave better idea about user goals and requirements. In the system these personas helped understanding scope of the user and its relation to other personas and thus other users. Because these personas are based on actual user study, they could guide defining user goals & motivations.

In the project personas are not taken as only users of system. They are not used directly to define user goals. Hypothetical characters based on the study are created. Later they are used creating in creating stories based on field study and observation. These stories are used in the process of requirement definition and framework definition as the base.

Characters like Khemaji Bhatol, Dr. Kole, Ravajibhai Patel and Jethabhai are at the core. Jitu, Dr. Lalit, Karim Khan and Motiram are also used as supporting characters in stories. The overall goal was to use personas to help support creating stories based on actual situation. These personas are described in detail below.

Requirement definition

07

The requirement definition phase determines the what of the design: what functions the personas need to use and what kind of information they must access to accomplish their goals. What problems they are facing with current system.

Stories can, through its efficacy at engaging and stimulating creative visualization skills, serve as a powerful tools in generating and validating design ideas. Because interaction design is first and foremost the design of behavior that occurs over time, a story combined with the support of visualization tools, is perfectly suited for envisioning and representing interaction concepts. Thus, stories are used here to generate requirement definition.

The stories/scenarios based on user study and field study built around personas created in modeling stages act as the base for defining user goals and requirements as well as help understand real problems of the system.

The scenario narrated below, centered around Khemaji's story will give better idea of the scenario-based design approach followed.

Near border area of northern Gujarat, in Tharad taluka of Banaskantha district, there is a village named 'Rampura'. Rampura is a small village with not more than 1000 people & mainly dependant on agriculture & milk business. Khemaji Bhatol of Rampura is a milk farmer. He has 18 cows & a lot of experience in the field. He daily supplies milk to Dudh Mandali of Rampura, which reaches to main dairy, Banas dairy, situated in Palanpur. Banas dairy is one of the Amul network dairies with very good infrastructure. Dairy works very well & provides milch animal owners other services also besides guidance & training. The dairy DH department provides veterinary health services to animal owners. The department has 60 doctors & uses an established network of Dudh Mandalis with Dairy. Each day all these doctors visit various animals throughout Banaskantha District for curing them.

Today, on Wednesday 22nd September, when Khemaji early morning gets up to get milk from his cows, he finds that one of the cows is not well. For yesterday evening that cow is looking weak. Though, Khemaji had given her good food in evening, she has not taken it. Khemaji cares his cows like his children. On his way to Dudh Mandali, Khemaji decides that he will ask for a doctor visit today.

With his son Jitu he reaches Dudh Mandali of Rampura to deliver his milk. After giving milk there he asks Jethalal for a doctor visit request slip as his cow is not well. Jethalal handles the Dudh Mandali in Rampura. The slip supplied by DH department costs Rs 65 & will be deducted from Khemaji's account. The Mandali has a phone to call to DH department for doctor visit. Khemaji sees that there are 2-3 persons already trying there at phone, they all want to have doctor visit for their cows & buffalos. He waits there and chats with village friends meanwhile about milk, milk quality, prices of food for cows and other village matters.

Khemaji gets his chance to try as none of the three could get connection to register their doctor visit request. As from all over Banaskantha district, from more that 1100 Dudh Mandalis people try to register their requests mainly in the time of morning when they go to deliver the milk, the phone most of the time remains engaged. After trying for more than 1 hour, Khemaji gives up and thinks that he will try to call in noon time.

Khemaji returns to home with Jitu. At home he finds that the cow seems in really a bad condition and need an urgent cure. This is 9:30 in the morning. Now Dudh Mandali is closed so Khemaji goes to a private phone booth situated near Rampura primary school. He tries to call DH department for doctor visit. After almost more than half an hour, Khemaji gets the line to phone at DH department. Ravajibhai Patel handles the task of registering doctor visit requests & scheduling visits for

doctors. He receives calls of visit requests and registers them with a computer based system. The system has a list based registering interface. Ravajibhai asks for customer number, name, village name, type of animal, symptoms and such required fields interface asks for. After giving all required data Khemaji says Ravajibhai that it is an emergency, and requests to send doctor fast.

It is already 10am. All doctors are already on their visits. There is no way to communicate with them. It is not possible to send doctor immediately. After seeing in computer, Ravajibhai suggests Khemaji that Dr. Kole is going to come there for a visit in or near Rampura. So, He can probably find Dr. Kole to get his cow checked and cured.

Khemaji decides to go to the Dudh Mandali & wait for Dr. Kole to pass by. It is 10:30am. Khemaji is waiting there. After waiting for 2-3 hours, at almost 1pm Khemaji returns home when Jitu comes to call him. Now, Khemaji sees that the cow is in the worst condition, with anxiety he immediately goes again to call DH department. Because of noon time he gets line easily. Khemaji asks Ravajibhai the name of the person who has registered a doctor visit from Rampura. After a long Ravajibhai says that it is Motiram who has registers and Dr. Kole is going to visit him. From phone booth Khemaji directly goes to Motiram's farm. Unfortunately doctor has already left almost in the morning only after visiting Motiram's buffalo.

Khemaji is now very sad as well as anxious about cow's health. It is already afternoon and seems that it is not possible to have doctor visit today. With the help of a friend Khemaji tries to give primary cure to the cow.

In the next day early morning, Khemaji leaves for Palanpur to get a confirm doctor visit. After 3 hours Khemaji reaches there to DH department of Banas dairy. He finds so many people like him waiting for doctor visit as they also could not get it yesterday. DH scheduling office is filled with people requesting for doctor visit. Khemaji also confirms his visit today to Ravajibhai there. Almost in the afternoon around 2 pm finally Dr. Jadav visits Khemaji's cow. He cures the cow.

Khemaji feels relaxed as the cow seems in better than before. Around 3pm Khemaji's friend Karim Khan comes to him with a worry on face. He asks Khemaji about Dr. Jadav, as his buffalo was not well from morning and he has faced same problem as Khemaji had faced yesterday. Dr. Jadav has already left. Khemaji goes with him to help him, giving the buffalo some primary cure. Tomorrow early morning Karim Khan will be there on his way to Palanpur.

The mentioned story very efficiently depicts the problems or requirements of the system. Now, based on this the major problems in the existing veterinary services can be briefly listed as below.

- The major problem of visit requesting due to centration of registering system
- The problem of busy line for registering doctor visit request
- Inefficiency of the veterinary services in handling emergency cases
- Lack of proper decision making support in scheduling doctor visits
- Lack of proper clues and support in scheduling visits
- Inefficiency of the system in terms of distance traveled by doctors (problem of crossovers)
- Inefficient dynamic visit request registering
- ...

Besides these some scopes thought during study phase can be listed like below.

- Providing statistical information and patterns in the system variable to help support future planning
- Keeping user of the scheduling interface 'staying in the flow' for better user-system interaction
- Giving location-based clues to scheduling interface
- ...

Framework definition

08

The requirement definition phase sets the stage for the core of the design effort: defining interaction framework of the system. The interaction framework defines not only skeleton of the interaction - its structure but also the flow and behavior of the product in the system.

This phase of the process mainly deals with the designing on the basis of inputs provided from earlier phases like results of user and system studies, requirement definitions, user goals, problems in existing system or product and various design theories and concepts.

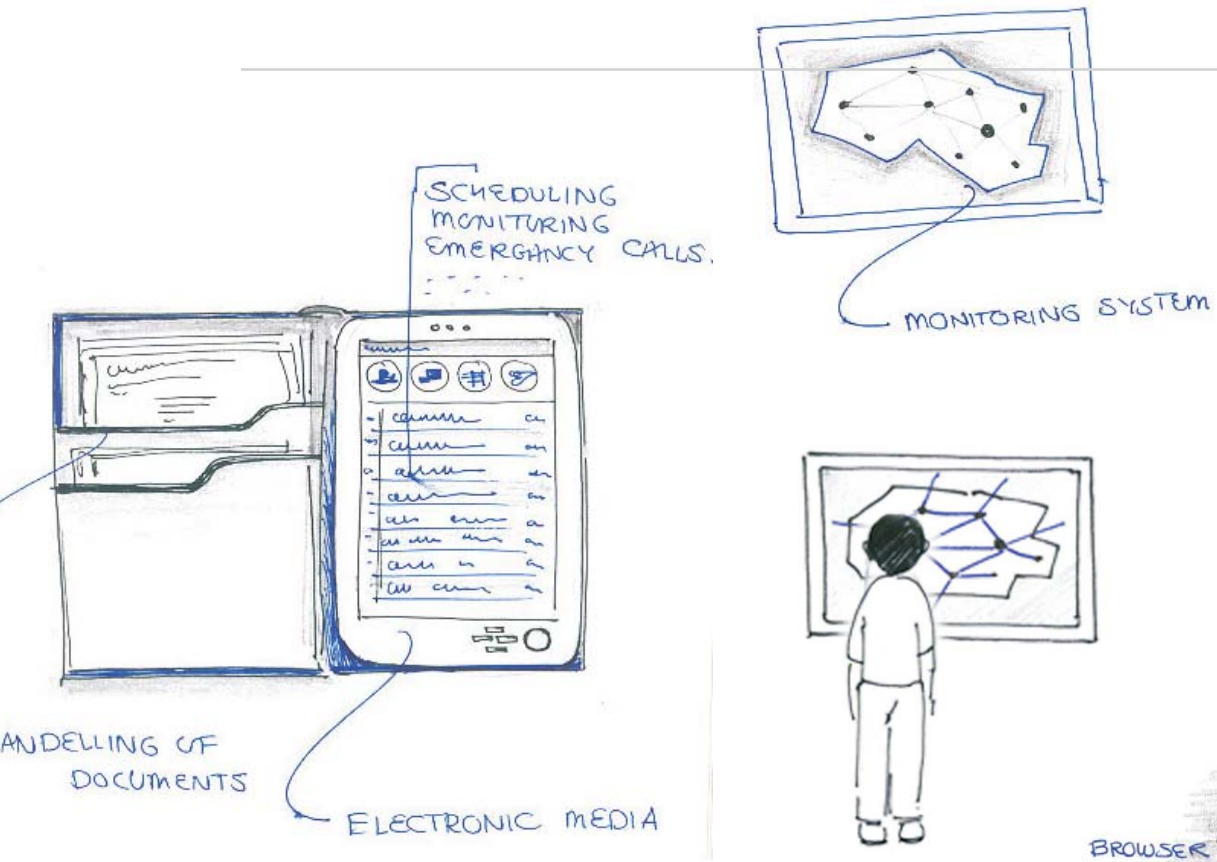
The major steps of framework definition phases are

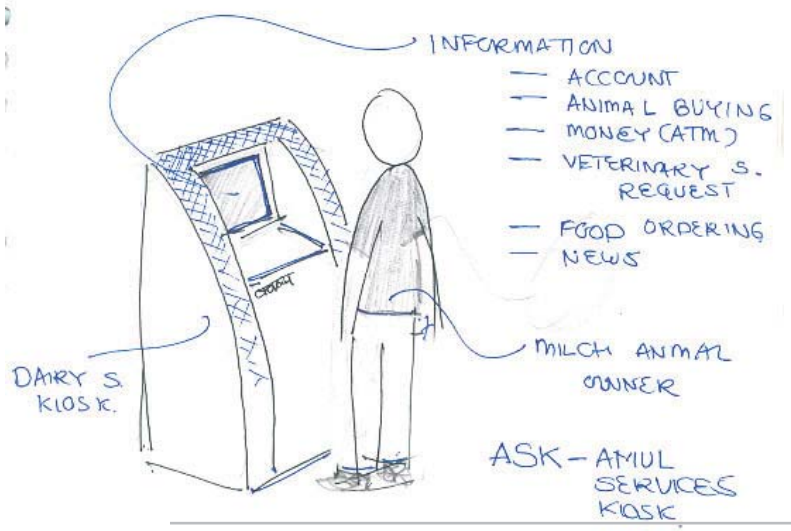
- Defining form factors and input methods
- Defining views
- Defining functional and data elements
- Determining functional groups and hierarchy
- Sketching the interaction framework
- Constructing scenarios

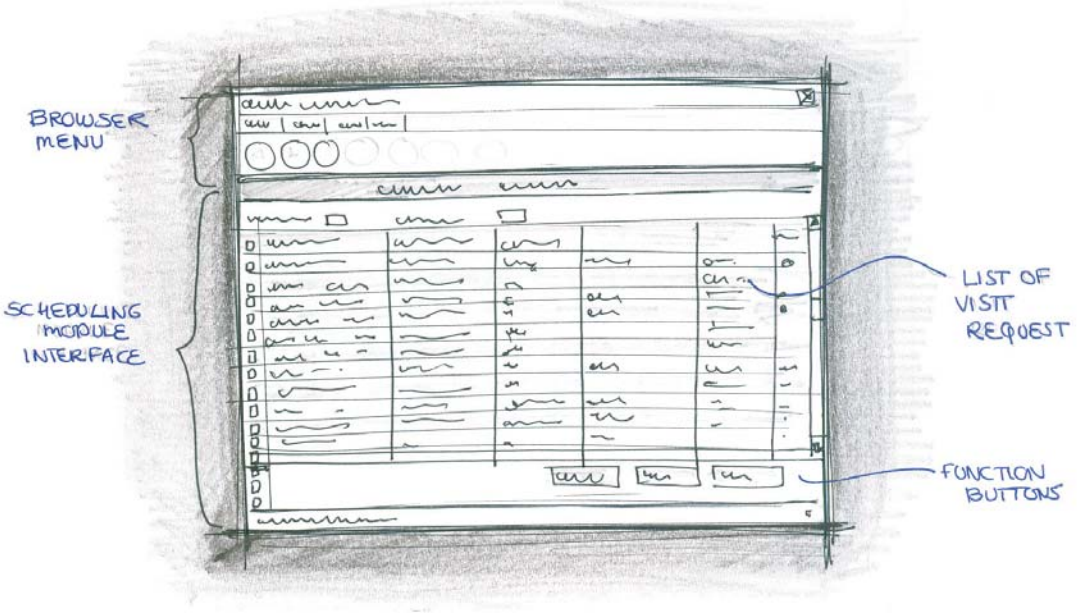
Thus the phase is the core design phase where new concepts are generated to solve problems or to help satisfy user goals.

Ideation

From creating design sketches to generating various paper prototypes of interface and thus designing user interaction is ideation: the process of forming and relating ideas.



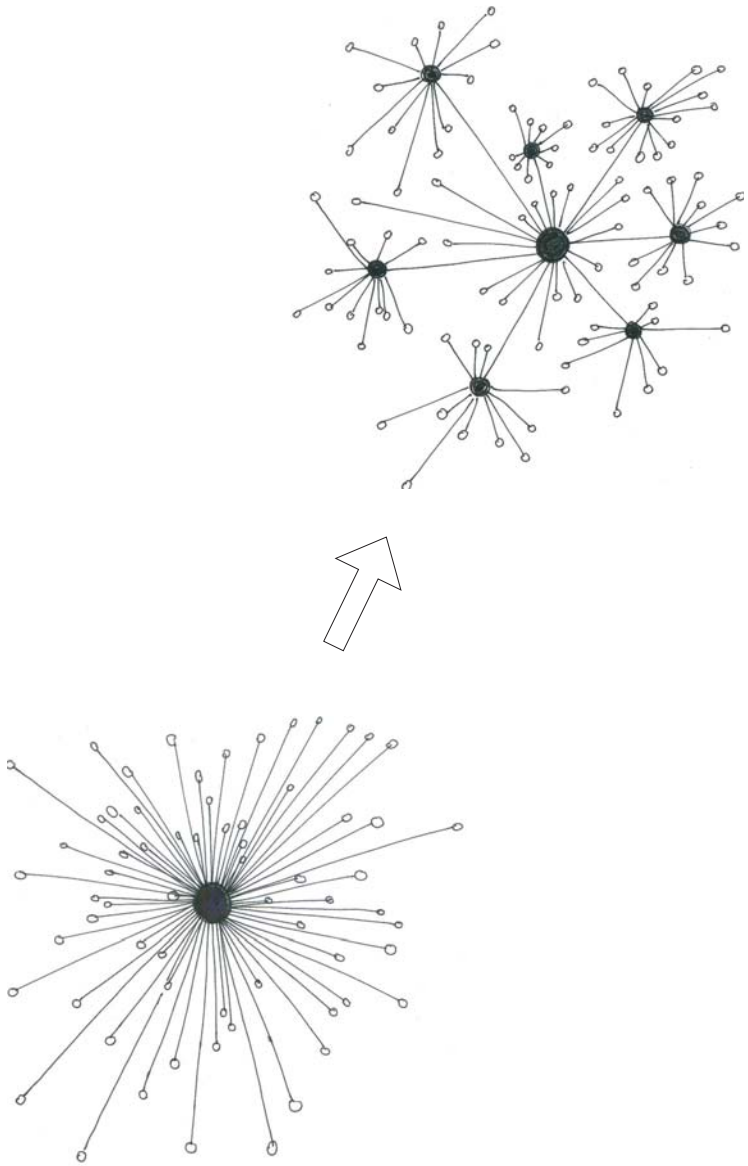




Here are given some of the representatives of the phase to give an overview of the ideation process in the project.

Based on these design concepts and after many evaluations-iterations cycles a new system is proposed with the goal of increasing the efficiency of veterinary services provided by Banas dairy. The concept aims mainly providing better scheduling and decision making support to help serve the same.

Again a story based approach is used during evaluation-iteration phase as well as after that in validating the design concept. The story along with suggested design concepts is as below.



This is mid of November and because of nearby desert of Thar and Kutch, Rampura village is feeling cold. This is early morning and Khemaji is on his way to Dudh Mandali as usual with Jitu. He is worried today as one of his cows is sick again. He is worried because of his experience of mismanaged doctor visit, not more than two months ago. Fortunately, Because of Dr. Jadav's end time treatment, the cow had been saved that time.

Khemaji reaches Dudh Mandali & asks Jethalal for a visit request slip. He is surprised seeing no one at telephone there today at Dudh Mandali. “There is no one today trying to call for requesting doctor visit!” With a smile on face Jethalal says worried and surprised Khemaji “Don't worry, all your problems are now solved with this computer now”. Jethalal points toward something in computer. He asks Khemaji for his customer ID, which dairy provides to each milk suppliers and data like symptoms of cow and all. Khemaji is curious to know what Jethalal is doing. Within some seconds after doing something in the computer, Jethalal acknowledges Khemaji, “doctor will come today itself, to cure your cow.”

“How..?” Khemaji first doesn't believe, but after explaining by Jethalal that how now in new system, we can register request for doctor visit from Rampura Dudh Mandali itself, Khemaji feels good and thanks the 'computer' from heart. On his way to home he explains Jitu to study more. Though Khemaji himself is not educated much, he understands the importance of education and sees new technologies as a boon to humankinds. He wants Jitu to learn computer and all these new things.

Decentration

In actual DH department of dairy has applied the concept of 'decentration' for registering doctor visit requests. The earlier star network is now replaced with one-level tree network, where one can register his request for doctor at selected Dudh Mandali near to him.

In earlier system all need to call to DH department for registering their request for doctor visit. Unlike the earlier system, new concept of 'Decentration' provides a much more feasible option to register visit request from selected Dudh Mandalis.

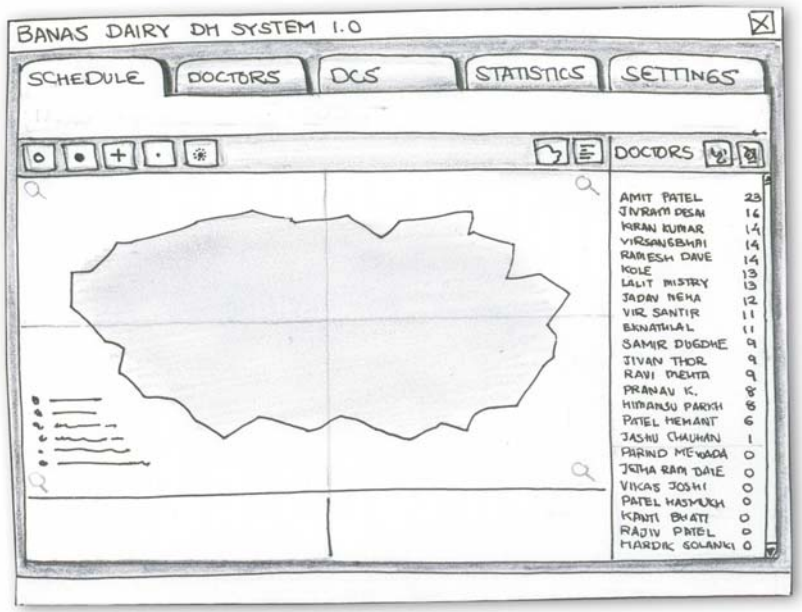
A simple computer based interaction helps register from Dudh Mandalis, which already have a well established connectivity to dairy and thus the problem of engaged calls in morning time because of 'centration' is eliminated. The requests registered at Dudh Mandali are automatically added to DH department scheduling system daily.

Dudh Mandali end interaction for registering doctor visit request

There are more than 1100 Dudh Mandalis in Banaskantha district supplying milk to Banas dairy. Some of them are very small in term of milk productions. Almost 10-11% of these Dudh Mandalis which are bigger in the term of milk collection are which from almost 80% of requests for doctor visit come to DH system. These Mandalis are already connected to main dairy for milk & money accounting. The new DH system provides these Mandalis the facility to register doctor visit request with a simple computer interaction. This creates the tree network for registering visit request. Nearby Mandalis without direct connectivity can register their requests to the Dudh Mandali with registering facility. One can also register their request to DH department also as in earlier system.

A simple interface providing facility to register a request with inputting Customer ID (provided to each milk supplier by Banas Dairy), animal type & basic symptoms is there at Dudh Mandali. The person managing Mandali is the typical user for this interface.

Khemaji's request is now directly registered there to the new scheduling system handled by Ravajibhai. At Banas dairy DH department Ravajibhai handles the work of scheduling doctor visits, monitoring and thus help support in maintaining the veterinary services in best condition. It is almost 8:00am. Ravajibhai has already scheduled more than 300 visit requests up till now. Now there are no engaged lines or people queue at DH department. There, almost 30-40 unscheduled requests Ravajibhai can see on the screen currently. After scheduling visit requests of Danta & nearby villages to Dr. Kole, Ravajibhai schedules Khemaji's request to Dr. Lalit's list as Dr. Lalit has already visit requests from Dudhva, Mandali and nearby regions of Rampura in Vav taluka.



Map based interface for scheduling doctor visits

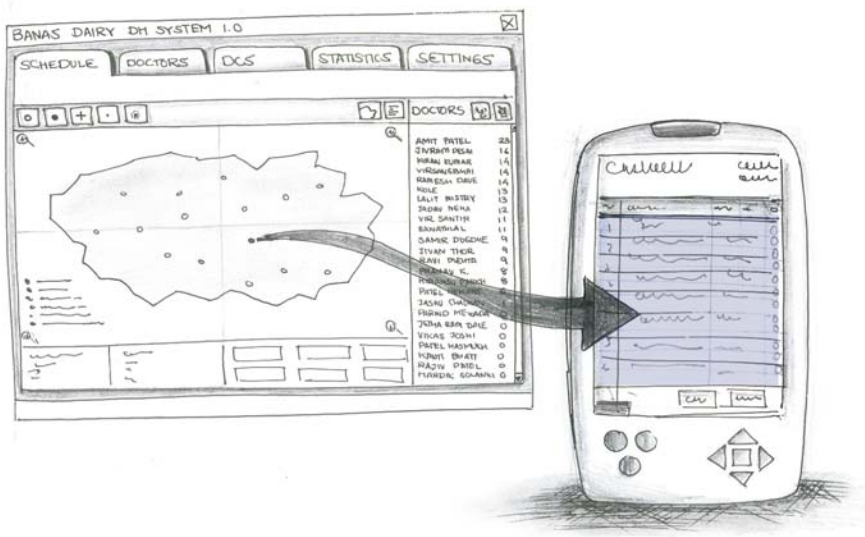
The new system of scheduling works basically on a map based interface which provides visual clues in scheduling visits and decision making. The scheduler can now select any doctor and schedule his visit with better efficiency as the interface is providing visual clues about location of visit request as well as already scheduled visits for the doctor.

The interaction: In the new interface, new requests are represented by an unfilled small circle on the map of Banaskantha by related Dudh Mandali location. Scheduled request are shown by filled circle.
A simple interface providing facility to register a request with inputting Customer ID (provided to each milk supplier by Banas Dairy), animal type & basic symptoms is there at Dudh Mandali. The person managing Mandali is the typical user for this interface.

Visual clues of spatial information of visit requests help decreasing total distance traveled by doctor. Earlier, the scheduler would have to decide it from his experience, field knowledge & visualizing the positions of the requests in his mind. Thus, the cognitive load as well as errors because of that is reduced a lot. For example, as shown in the sketch scheduler can schedule the circled all requests to one doctor.

Adding a new visit to doctors existing list of visits is also efficient with new interface, as interface provides visual clues of new request & doctors with their already scheduled visits. Doctors are represented by a cross symbol. The scheduler can select doctor with scheduled requests from the same region of new request, and assign it to him. The problem of checking each doctor for his already scheduled requests and map in mind to correct doctor for new request was the major problem, which is solved by map based interface.
Besides these, new interface provides the list view with sorting option as well. The newly introduced search option also helps a lot in some cases.

It is 8:30am. The scheduled visit list is added to Dr. Lalit's communicator by Ravajibhai thorough connected DH network. According to his visit list Dr. Lalit decides to move towards Dudhva. He is on his way to Dudhva, where he will visit 3 cow owners who have registered their visit from Dudhva Dudh Mandali.



Doctor's Communicator

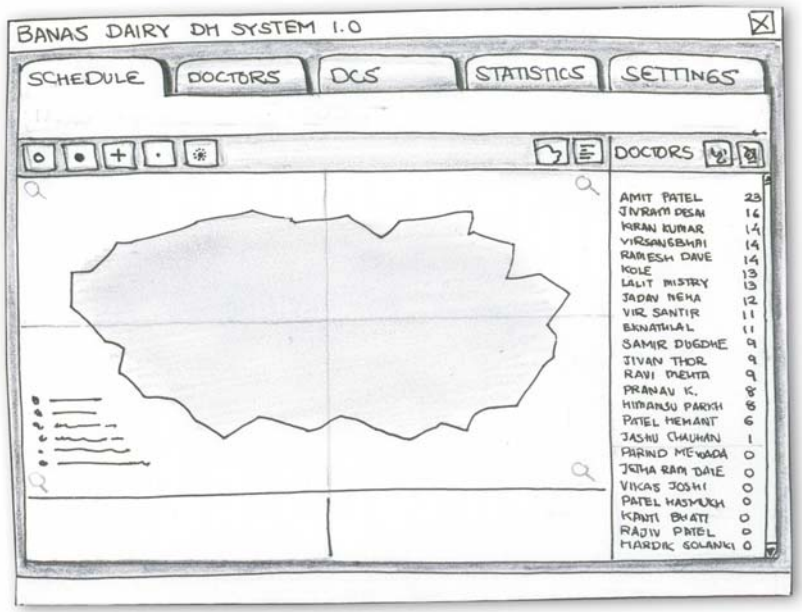
In the new system each doctor is connected by a communicator provided to them by DH department. When scheduler assigns any new visit to doctor, the scheduled request will be added to his list in the communicator. So, doctor can start his visit as soon as he has got even some visit requests scheduled for him. If the doctor has already left for visits, any dynamic scheduling of visit requests will be added to his visit request list by assigning from scheduling interface at DH department. The interface at doctor's communicator will help him manage his visits, notify the status of visits to DH department and even keep record of visit related information for future reference.

Visual clues of spatial information of visit requests help decreasing total distance traveled by doctor. Earlier, the scheduler would have to decide it from his experience, field knowledge & visualizing the positions of the requests in his mind. Thus, the cognitive load as well as errors because of that is reduced a lot. For example, as shown in the sketch scheduler can schedule the circled all requests to one doctor.

Adding a new visit to doctors existing list of visits is also efficient with new interface, as interface provides visual clues of new request & doctors with their already scheduled visits. Doctors are represented by a cross symbol. The scheduler can select doctor with scheduled requests from the same region of new request, and assign it to him. The problem of checking each doctor for his already scheduled requests and map in mind to correct doctor for new request was the major problem, which is solved by map based interface.
Besides these, new interface provides the list view with sorting option as well. The newly introduced search option also helps a lot in some cases.

It is almost 12 in noon now. Dr. Lalit has performed total 7 visits in Dudhva and nearby villages. He in now on his way to Rampura to visit Khemaji's place.

Karim khan also wants to request for a doctor visit today for his one cow, as he want to do insemination to her. He calls to DH department. Ravajibhai notes down his request. With the help of the map based interface with the graphical clue of positions of Karim Khan's request and Dr. Lalit, Ravajibhai decides to assign this request to Dr.



Dynamic Scheduling

The system uses network based methods like Cell of Origin (COO) or Cell Identity (CI) + Timing Advance (TA) for locating doctor's approximate position.

In the new system now it is possible to locate doctors. On the map based interface the positional clue of request and doctors help deciding the doctor to assign newly requested doctor visit.

Scheduler at DH department can monitor the location of doctors by map based interface. He decides new assignment of emergency visits as well as new visits when doctors are on visit, on the basis of these spatial information. As shown in the sketch the emergency requests can be handled efficiently in new system.

After reaching Rampura Dr. Lalit first visits Khemaji's place. After curing Khemaji's cow he notifies the completion of the visit. He also notes down the treatment given in 4-5 words in communicator for future reference. After that he visits Karim Khan and conducts successful insemination of Karim's cow. Dr. Lalit then leaves for Narodi where he will perform 2 visits.

Next day morning at Dudh Mandali both Khemaji as well as Karim Khan are there. They are very happy with this new system. At DH department also from Ravajibhai to Dr. Z. D. Rathore, head of DH Department all are happy with this new system.

This is December month now. Jitu is exited a lot with computer & all these. With the help of Jethalal he has learnt all the work. Nowadays he helps Jethalal in registering visit request & also attending calls from nearby small Dudh Mandalis for doctor visit requests in morning. After that he goes to school. Khemaji wants to make Jitu a Doctor.

Tomorrow also, early morning Karim Khan will be there on his way to Palanpur. No, No, not for requesting a doctor visit. He is going to attend marriage of his friend's daughter. I think this is a happy ending.

Thus, scenario-based design approach is used at various stages from defining user goals, system requirements to defining framework as well as in generating solutions

Form and behavior design

09

The new DH system proposed in earlier steps has three major components.

Decentration: Dudh Mandali end interaction for registering doctor visit request

Map based interface for scheduling doctor visits at DH department

Position awareness and doctor's communicator.

To have an opportunity to apply interface design principles, scheduling interface in proposed system is detailized to a step ahead. Detailed user interaction with the system is designed applying various interaction design concepts.

Scheduling interface

After many iterations and evaluation it has been found that visual clue in scheduling would be the major help improving the overall interface efficiency. Map based scheduling interface, in which map of Banaskantha on the computer screen providing spatial clues of doctors, visit requests, requests for emergency visit, is designed.

User modeling

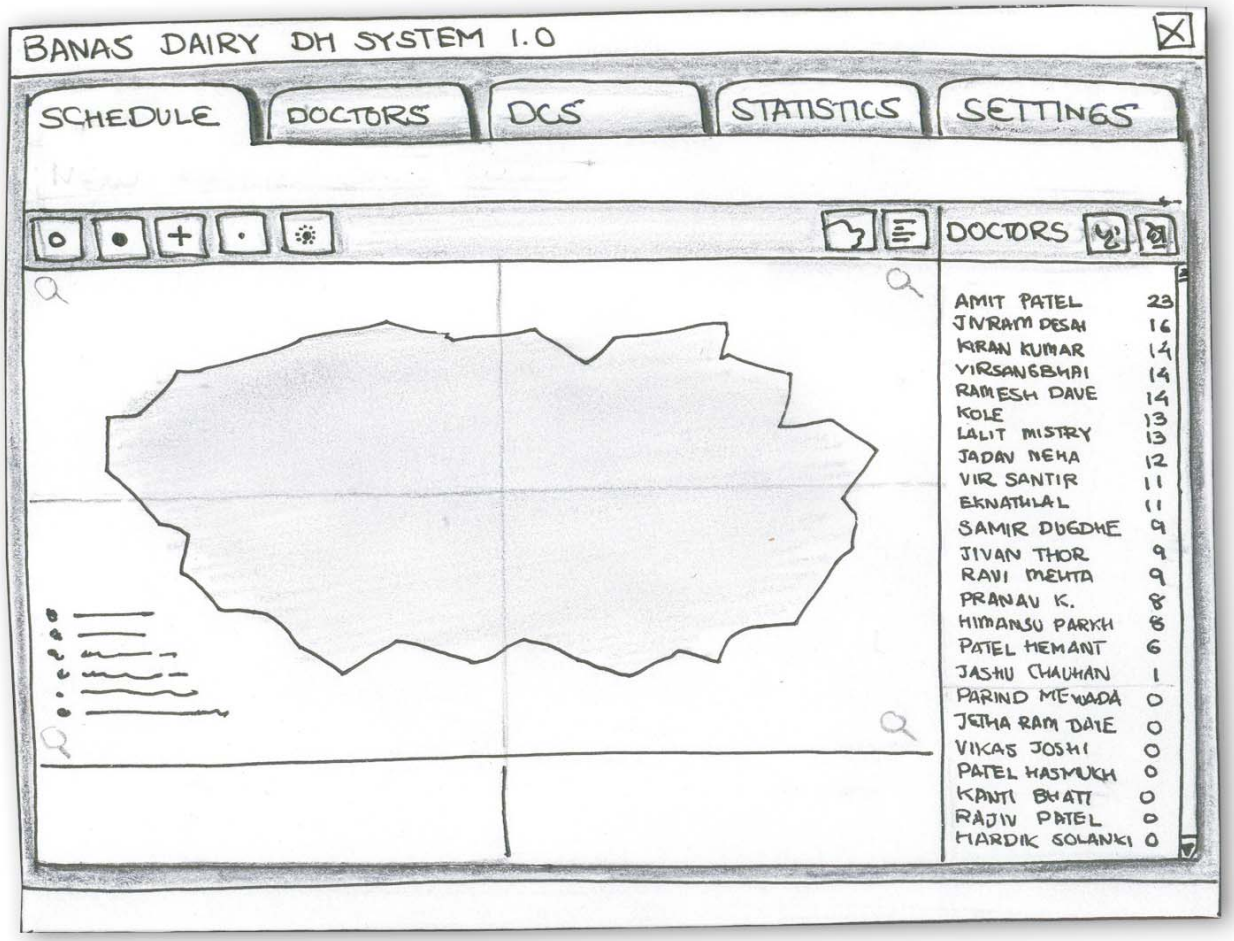
It was must to understand user of the scheduling interface and design the interaction based on these clinical study. User role had been understood by personas and stories.

Interaction design concepts

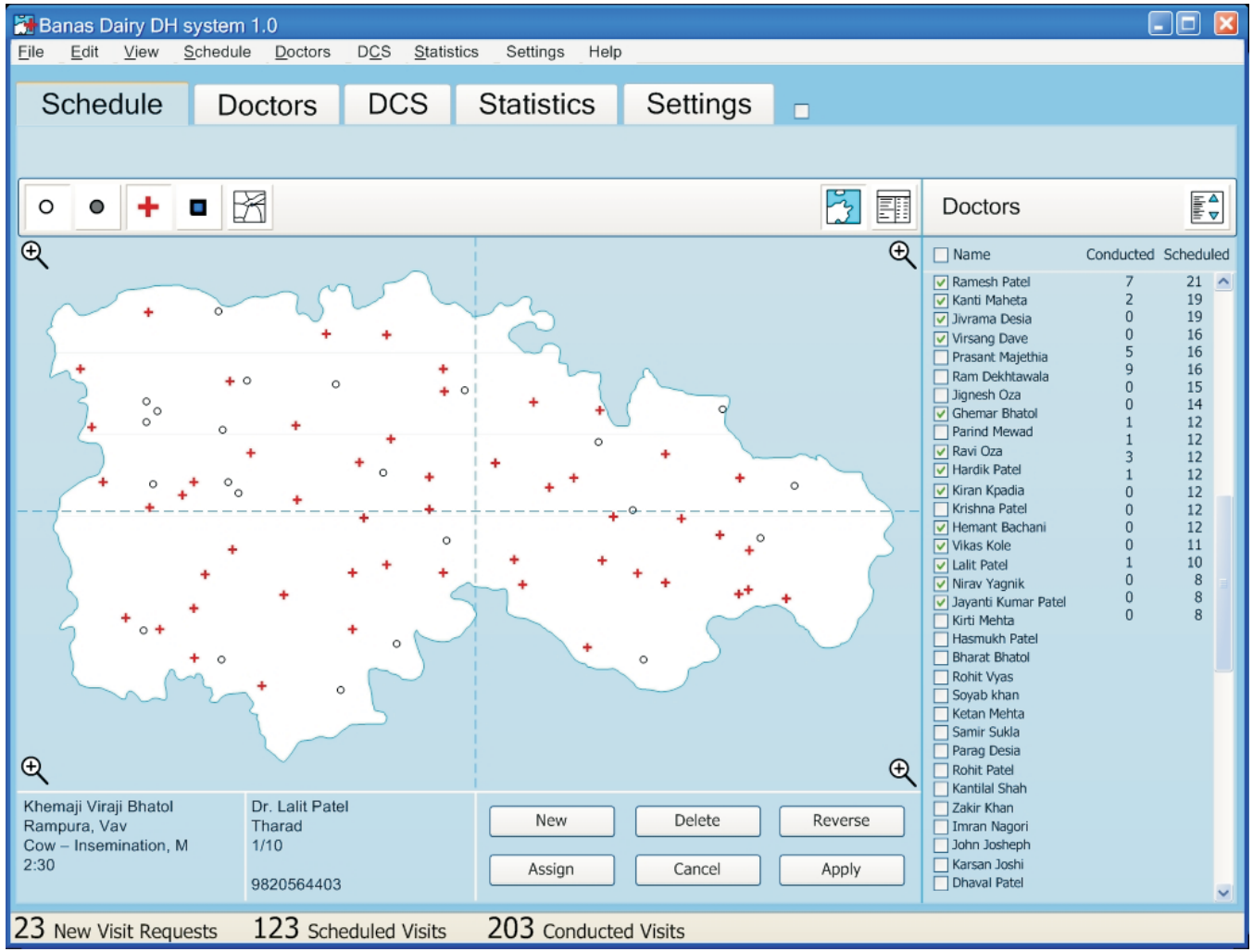
The task of designing behavior has been taken as an opportunity to apply learning of various interaction design concepts. As 'staying in the flow for user interfaces' was my ongoing research field, I seen the interface as a validating project for the same.

Interface design

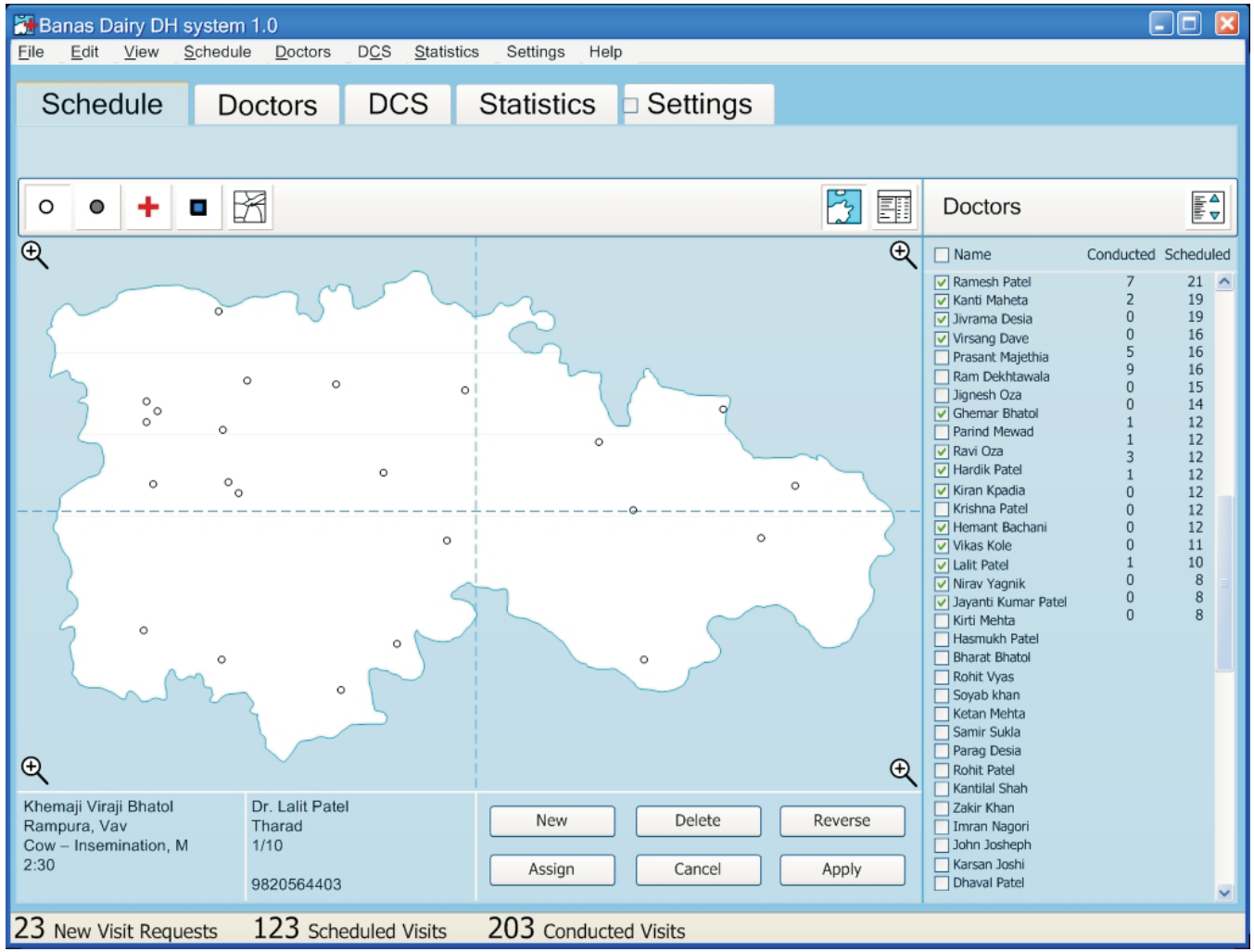
Use of various interface elements and patterns in the interface design helped increase the efficiancy of user interaction wih the system. Various aspects of the suggested map-based interface are explained here with screenshots of the interface and related explanation.



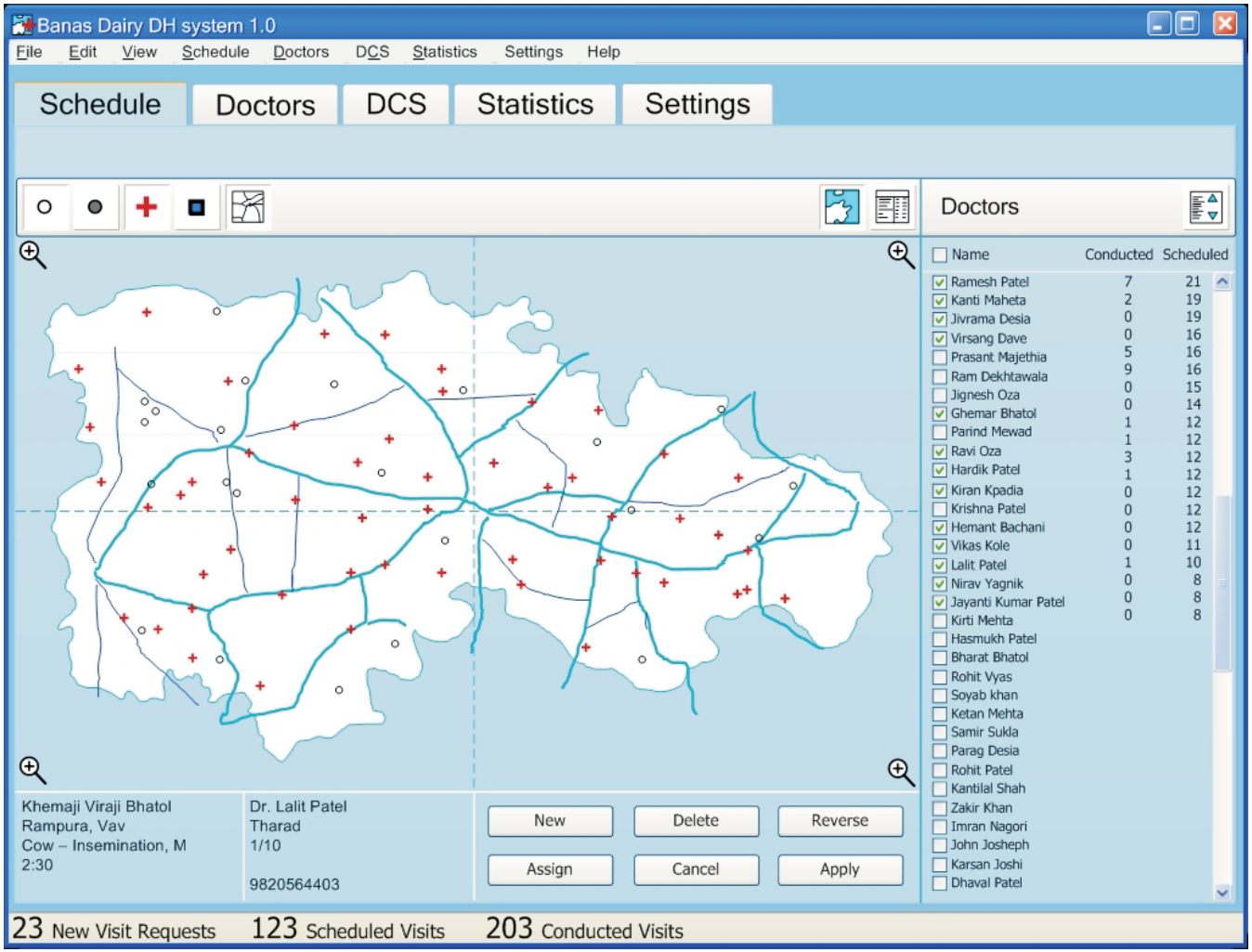
The new system of scheduling works basically on a map based interface which provides visual clues in scheduling visits and decision making. The scheduler can now select any doctor and schedule his visit with better efficiency as the interface is providing visual clues about location of visit request as well as already scheduled visits for the doctor.



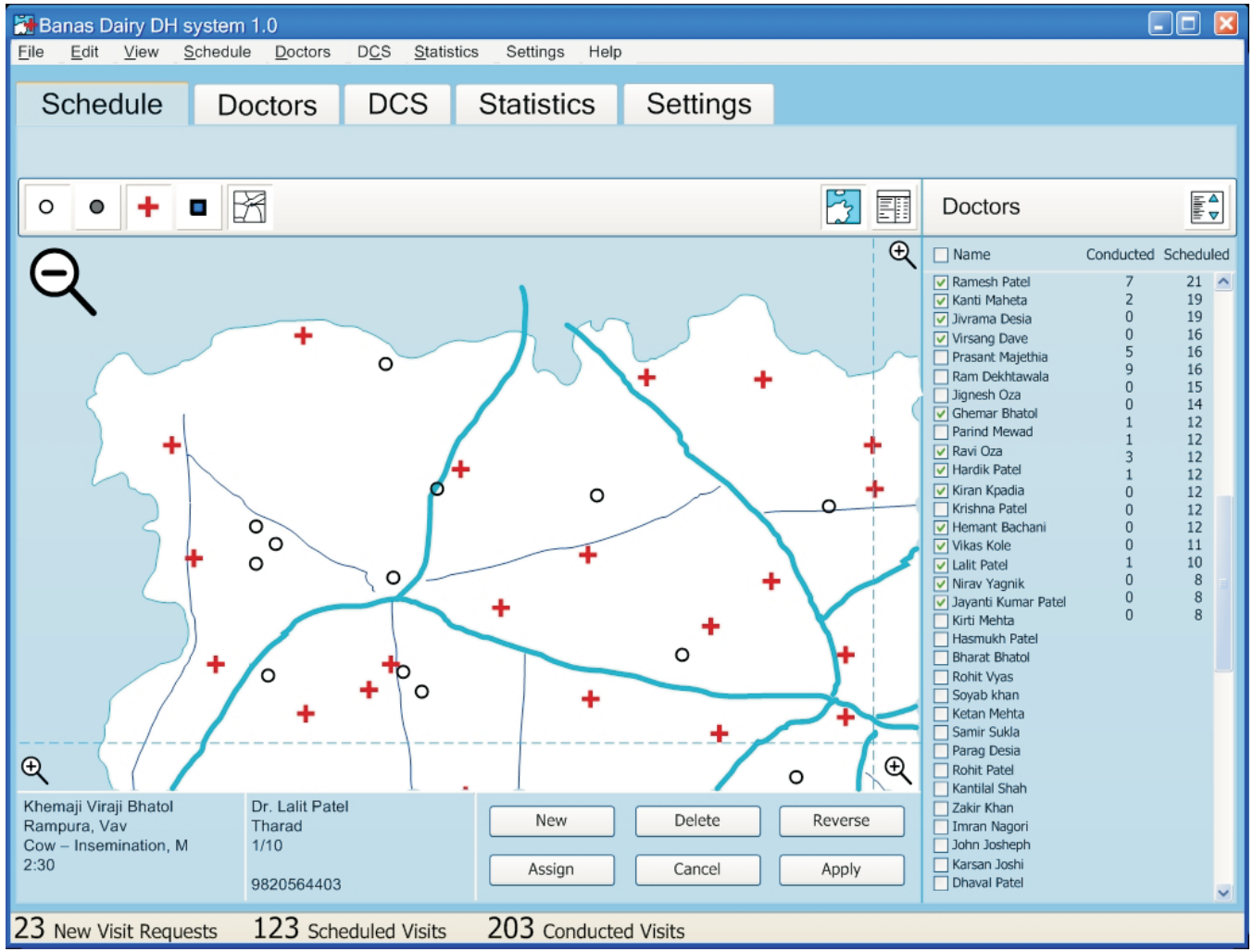
Visual clues of spatial information of visit requests help decreasing total distance traveled by doctor. Earlier, the scheduler would have to decide it from his experience, field knowledge & visualizing the positions of the requests in his mind. Thus, the cognitive load as well as errors because of that is reduced a lot. For example, as shown in the sketch scheduler can schedule the circled all requests to one doctor.



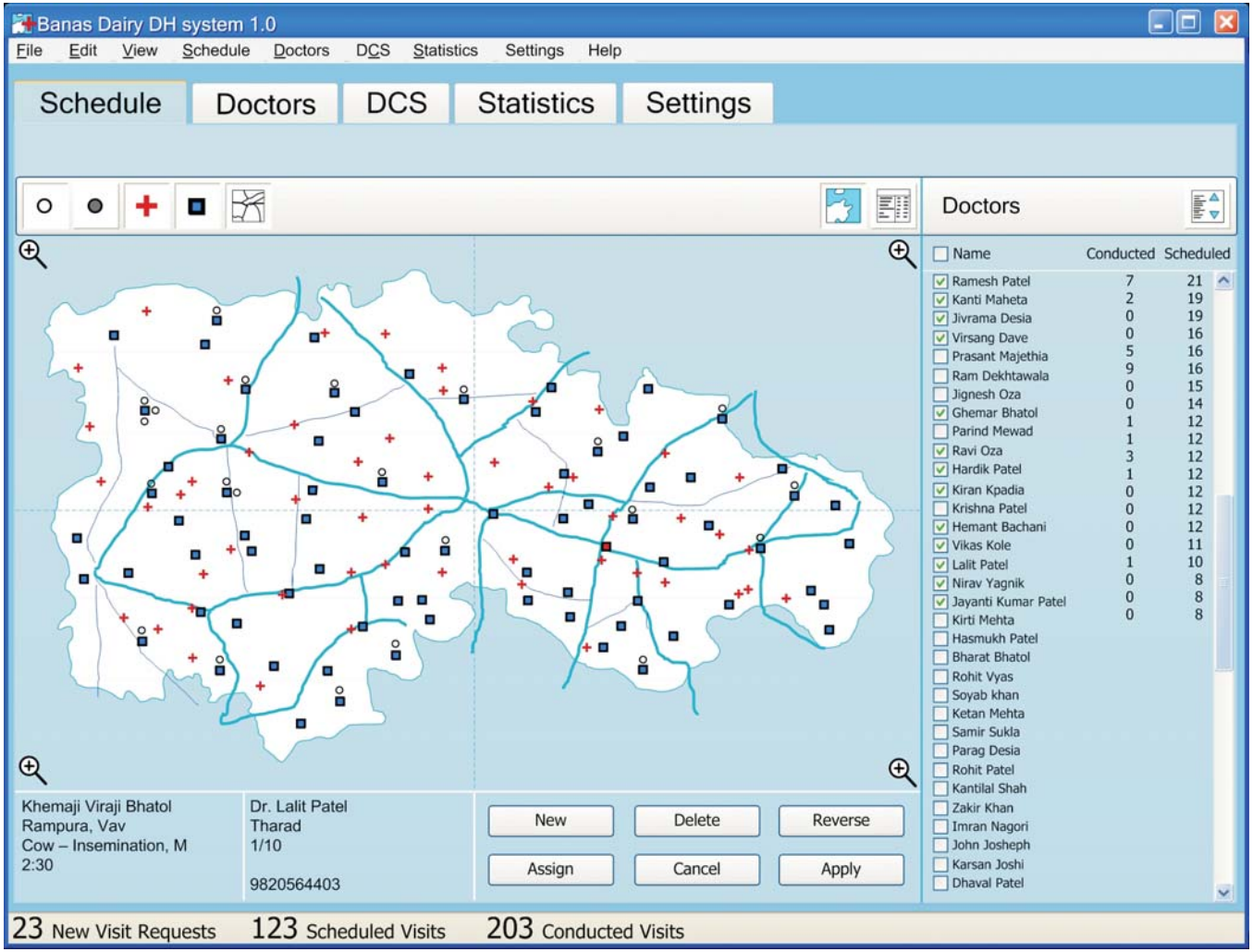
In the new interface, new requests are represented by an unfilled small circle on the map of Banaskantha by related Dudh Mandali location. Scheduled request are shown by filled circle.



Adding a new visit to doctors existing list of visits is also efficient with new interface, as interface provides visual clues of new request & doctors with their already scheduled visits. Doctors are represented by a cross symbol. The scheduler can select doctor with scheduled requests from the same region of new request, and assign it to him. The problem of checking each doctor for his already scheduled requests and map in mind to correct doctor for new request was the major problem, which is solved by map based interface.



With the help of a two level zooming method system provides better clarity in the case of more requests. The map is divided into four parts from which scheduler can select one by clicking on magnifying glass icon. From any status it is possible to be in any new status like zoomed in view of some other part or zoomed out view of full map.



In the new system now it is possible to locate doctors. On the map based interface the positional clue of request and doctors help deciding the doctor to assign newly requested doctor visit.Scheduler at DH department can monitor the location of doctors by map based interface. He decides new assignment of emergency visits as well as new visits when doctors are on visit, on the basis of these spatial information. As shown in the sketch the emergency requests can be handled efficiently in new system.

Refinement

10

During the refinement phase of the project two tasks had been conducted. Getting Feedbacks from users and considering constraints. The phase helped bringing design concept to a implemenatation detailing.

After making the various paper prototypes and semi working computer based simulations are used to get feedbacks from the actual users. The stories also played important roles to help explain the users the new concept during the phase.Some major suggestion came from the phase were related to doctor's connectivity to dairy & implementation of it. Earlier communicator is replaced by a cell based mobile phone. Various positioning methods can give nowadays required spatial information in almost no extra cost.

Besides feedbacks on interaction, consideration of various constraints related to technology, market, organization, strategy, economy, and so on are considered. On the basis of findings of it, related changes had been done to the system and design solution.

The project right now is in it s last stage where I am trying to provide detailing to the solution, so that it can be implemented on the basis of that documentation. Final heuristic evaluation of the solution will help refine it more.

The final solution

11

References

12

National Dairy Development Board www.nddb.org

Amul www.amul.com

DISK, IIM Ahmedabad www.iimahd.ernet.in/egov/disk.htm

Media Lab Asia www.mlasia.iitb.ac.in

Banas dairy www.banasdairy.coop

Banas Chirag www.chirag.banas.com

n-Louge www.n-logue.com

Contextual design: A Customer-Centered Approach to Systems Designs by Hugh Beyer, Karen Holtzblatt

Activity-Centered Design
An Ecological Approach to Designing Smart Tools and Usable Systems
Geri Gay and Helene Hembrooke

Interfaces for Staying in the Flow, Benjamin B. Bederson, UMD

Thoughts on Interface Design. Presented at 'Design Odyssey', held at IDC, IIT Bombay,Poovaiah, R. (1999).

Designing the User Interface: Strategies for Effective Human-Computer Interaction Shneiderman, Ben, & Plaisant,Catherine

Flow: The Psychology of Optimal Experience. Csikszentmihalyi, M. (1991).

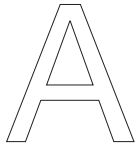
Acknowledgements

13

First of all, I would like to thank Amul and Banas dairy for providing such a great veterinary services in Gujarat. I thank Prof Anirudha Joshi for guiding me throughout the project. I heartily thank Dr. Z. D. Rathore, head of DH department, Banas dairy for his kind and constant support. A thank to Niraj Prakash Garg and Ghemarbhai Bhatol for giving me insight to current real problems as well opportunities to solve them. I would like to acknowledge to Laljibhai Bhatol, Ramesh Patel, Vishal Thakkar, Dr. Vikas Kole, Dr. Patel, Virasangbhai, Pethabhai and Megrajbhai Bhatol for their help during data collection. I would love to thank my friends Ravi, Chirag, Amisha, Abhijeet and Shilpa for their help throughout the project work. At the last & the most, I thank all those cows, buffaloes and their owners.

Appendix A

User study notes



Appendix B

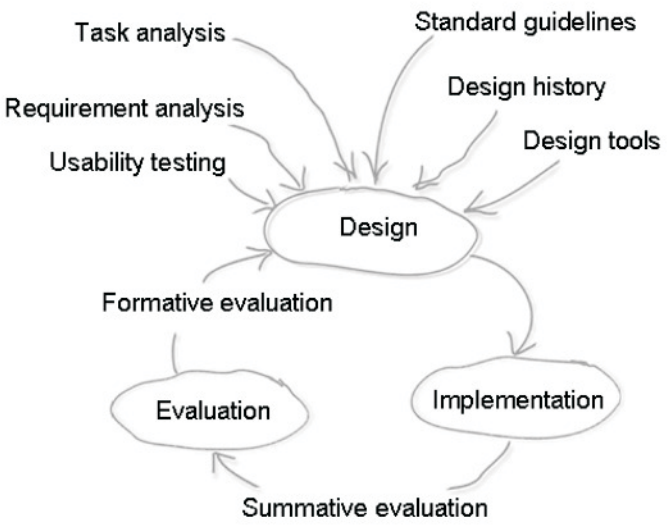
Techinical detailing

B

Appendix C

Design process

C



User-centered Design

As name suggest User-centered design process keeps user at the center of the design process. User-centered design (UCD) is a user interaction design process that focuses on usability goals, user characteristics, environment, tasks, and workflow in the design of an interaction. It follows a series of well-defined methods and techniques for analysis, design, and evaluation. The users are in the center of a double circle. The inner ring contains: context, objectives, environment and goals. The outer ring contains: task detail, task content, task organization and task flow. User-centered design seeks to answer questions about users and their tasks and goals, and then use the findings to drive development and design. Questions like,

- Who are the users of this 'thing'?
- What are the users' tasks and goals?
- What are the users' experience levels with this thing, and things like it?
- What functions do the users need from this thing?
- What information might the users need, and in what form do they need it?
- How do users think this 'thing' should work?
- How can the design of this 'thing' facilitate users' cognitive processes?

The 'thing' can be anything from consumer product to computer based application. The approach can improve the usability and usefulness of everything from everyday things to software to information systems to processes . . . anything with which people interact. As such, User-Centered Design concerns itself with both usefulness and usability, where Usefulness relates to relevance; do the functions, information, etc., It matches 'what the user actually needs?' Usability relates to ease-of-use.

Contextual design

With the central goal of 'Designing user-centered systems', Contexual Design is the state of the art to designing directly from an understanding of how the people work. Karen Holtzblatt and Hugh Beyer, developed the concept of Contextual Design, which started with the invention of Contextual Inquiry. Contextual design is an approach to designing user-centered systems, with forms on being integrated in existing work contexts and practices. The best designs happen when the product's designers are involved in collecting and interpreting user data so they appreciate what real people need. Thus, the combination of the detailed understanding of a user need with the in-depth understanding of technology drives design in Contexual Design. Contextual Design gives designers the tools to do just that. Contextual Design starts with the recognition that any system embodies a way of working. A system's function and structure forces particular strategies, language, and work flow on its users. Successful systems offer a way of working that users want to adopt. Contextual Design is a method which helps designer come to what their users' need and how to design a system for them.Various stages of Contexual Design are,

Contextual Inquiry: uncovers who users really are and how they work on a day-to-day basis to understand the users: their needs, their desires and their approach to the work.
Work Modeling: capture the work of individuals and organizations in diagrams to provide different perspectives on how work is done.
Consolidation: brings data from individual customer interviews together so the designer can see common pattern and structure without losing individual variation.
Work redesign: uses the consolidated data to drive conversations about how to improve work by using technology to support the new work practice.
The User Environment Design: Captures the floor plan of the new system. It shows each part of the system, how it supports the user's work, exactly what function is available in that part, and how the user gets to and from other parts of the system.
Test with users: Paper prototyping develops rough mockups of the system using Post-its to represent windows, dialog boxes, buttons, and menus.
Putting it into practice: Prioritization helps the transition to implementation by planning in system implementation over time. Object-oriented design helps you move from systems design to design of the implementation

Activity Theory

Activity theory draws inspiration from the work of the Russian semiotician and psychologist Lev Semenovich Vygotsky (1962), who argued against artificial separations between mind and behavior and between mind and society. The theory is a philosophical framework that allows the study of different forms of human practice. The practice can be viewed as developmental processes where both individual and social levels are interlinked. Activity Theory can be used to provide a broad conceptual framework that can be used to describe the structure, development and context of tasks that are supported by a computerized system. Activity Theory offers the possible integration of many HCI theories and concepts, thus helping to maintain conceptual integrity in terms of design, evaluation and usage. Activity Theory consists of five basic principles: the hierarchical structure of activity, object-orientedness, internalisation/externalization, mediation and development.

As indicated by Engeström's model, an activity system consists of people, artifacts, an object or motive, sociocultural rules, and roles. Kari Kuutti has characterized activity as “a form of doing directed to an object.” An activity is the highest-level objective where the motivations behind the activity and the ultimate objectives or desired outcomes are the same. Within this activity system, multiple actions are performed to reach the overall objective. Each action is driven by a conscious intentional goal. Finally, operations represent unconscious, often routine actions carried out automatically in the service of other goal-oriented actions. Therefore, the composition of an activity system consists of the activity (the system itself), actions, and operations. Breaking down the system of activity into component parts is useful for identification purposes; however, the system is not reducible to isolated actions or isolated relationships between subjects and tools.

A simple example of the hierarchical structure of activity systems is the activity of "***Khemaji is Requesting for a doctor visit for his cow.***" The motivation and outcome are for Khemaji to end up with a registered doctor visit. To realize this outcome, a number of actions might take place:

Check for the telephone number to call for requesting visit,
Calling veterinary department to register visit,
Asking for doctor availability,
Providing customer ID,
Providing the other end person information like name, address etc,
Note down the confirmation number,
And so on...

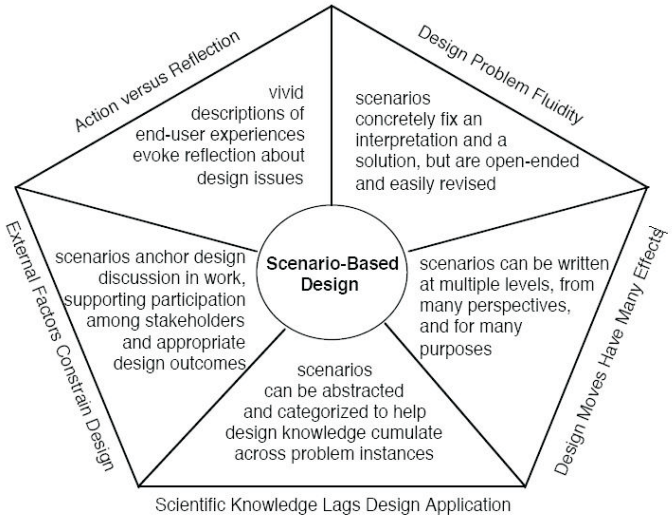
During the call itself, a number of unconscious operations are performed, such as checking for amount of bill the std indicator showing, checking his customer ID from a piece of paper, etc. Collectively the motives and actions add up to the final destination. The hierarchy of actions and the identification of the different components of an activity system provide helpful guideposts for articulating and examining the complexity of context. The multilayered nature of activity theory identifies the actions involved in an activity and assesses how these actions relate to each other.

Goal-directed design

According to the developer of Goal-directed design process, Alan Cooper, Designing from tasks instead of goals is one of the main causes of frustrating and ineffective interaction. Goal-directed design combines techniques of ethnography, stakeholder interviews, market research, product/literature reviews, detailed user models, scenario-based design, and a core set of interaction principles and patterns. It provides solutions that meet the needs and goals of users, while also addressing business/organizational ad technical imperatives. The process emphasizes on goals. A goal is an end condition; a task is an intermediate step that helps to reach a goal. Focusing on goals helps streamline tasks. Design based only on tasks runs the risk of trapping the design in a model imposed by outmoded technology. Goal-directed design process can be divided into five phases,

- **Research.** Use observation and contextual interviews (ethnographic techniques) to develop usage patterns that suggest specific and general desired outcomes of using the product.
- **Modeling.** Usage and workflow patterns are synthesized into domain and user models. Domain models include information flow and workflow diagrams. User models are represented as personas that represent distinct groupings of behavior patterns, goals and motivations.
- **Requirements definition.** Employ scenario-based design methods (among others) explore the design space via a form of role-playing. Includes an analysis of functional needs, prioritized and informed by persona goals and behaviors.
- **Framework definition.** Synthesize an interaction framework by employing interaction design principles and interaction design patterns which encode general solutions to classes of problems.
- **Refinement.** Focus on task coherence, using key path (walkthrough) and validation scenarios. Result is a form and behavior specification, either on paper or interactive media.

These phases follow the five component activities of interaction design identified by Gillian Smith and Philip Tabor- understanding, abstracting, structuring, representing, detailing, with a greater emphasis on modeling user behaviors and defining system behavior.



Scenario-based design

Scenario based design approach describes the use of scenarios during the conceptual design of a system. The role of the scenarios can be compared and contrasted with that of three other design artifacts: the requirements specification, the business model, and the user interface prototype. The distinguishing features of the scenarios are that they are task based and descriptive. By being task based the scenarios string individual events and activities together in purposeful sequences and, thereby, provide an intermediate level of description that is both an instantiation of overall work objectives and a fairly persistent context for the gradual elaboration of subtasks. By being descriptive the scenarios preserve a real-world feel of the contents, flow, and dynamics of the users' work. The scenarios make the users' work recognizable to the designers as a complex but organized human activity. This way the scenarios attain a unifying role as mediator among both the design artifacts and the developers. Scenarios can help remedy the most serious obstacle in the design process that is a chronic lack of knowledge of the application domain. Moreover, scenarios can be employed in analysis and design to serve both illustrating the context of an envisaged usage (user's perspective) and demonstrating the design proposal in terms of the intended usage (analyst's perspective).

Scenarios of human-computer interaction help us to understand and to create computer systems and applications as artifacts of human activity - as things to learn from, as tools to use in one's work, as media for interacting with other people. Scenario-based design of information technology addresses five challenges:

· Scenarios evoke reflection in the content of design work, helping developers coordinate design action and reflection.

· Scenarios are at once concrete and flexible, helping developers manage the fluidity of design situations.

· Scenarios afford multiple views of an interaction, diverse kinds and amounts of detailing, helping developers manage the many consequences entailed by any given design move.

· Scenarios can also be abstracted and categorized, helping designers to recognize, capture, and reuse generalizations, and to address the challenge that technical knowledge often lags the needs of technical design.

· Finally, scenarios promote work-oriented communication among stakeholders, helping to make design activities more accessible to the great variety of expertise that can contribute to design, and addressing the challenge that external constraints designers and clients often distract attention from the needs and concerns of the people who will use the technology.

Scenarios are work-oriented design objects. They describe systems in terms of the work that users will try to do when they use those systems. A design process in which scenarios are employed as a central representation will ipso facto remain focused on the needs and concerns of users.

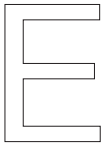
Appendix D

Other related projects

D

Appendix E

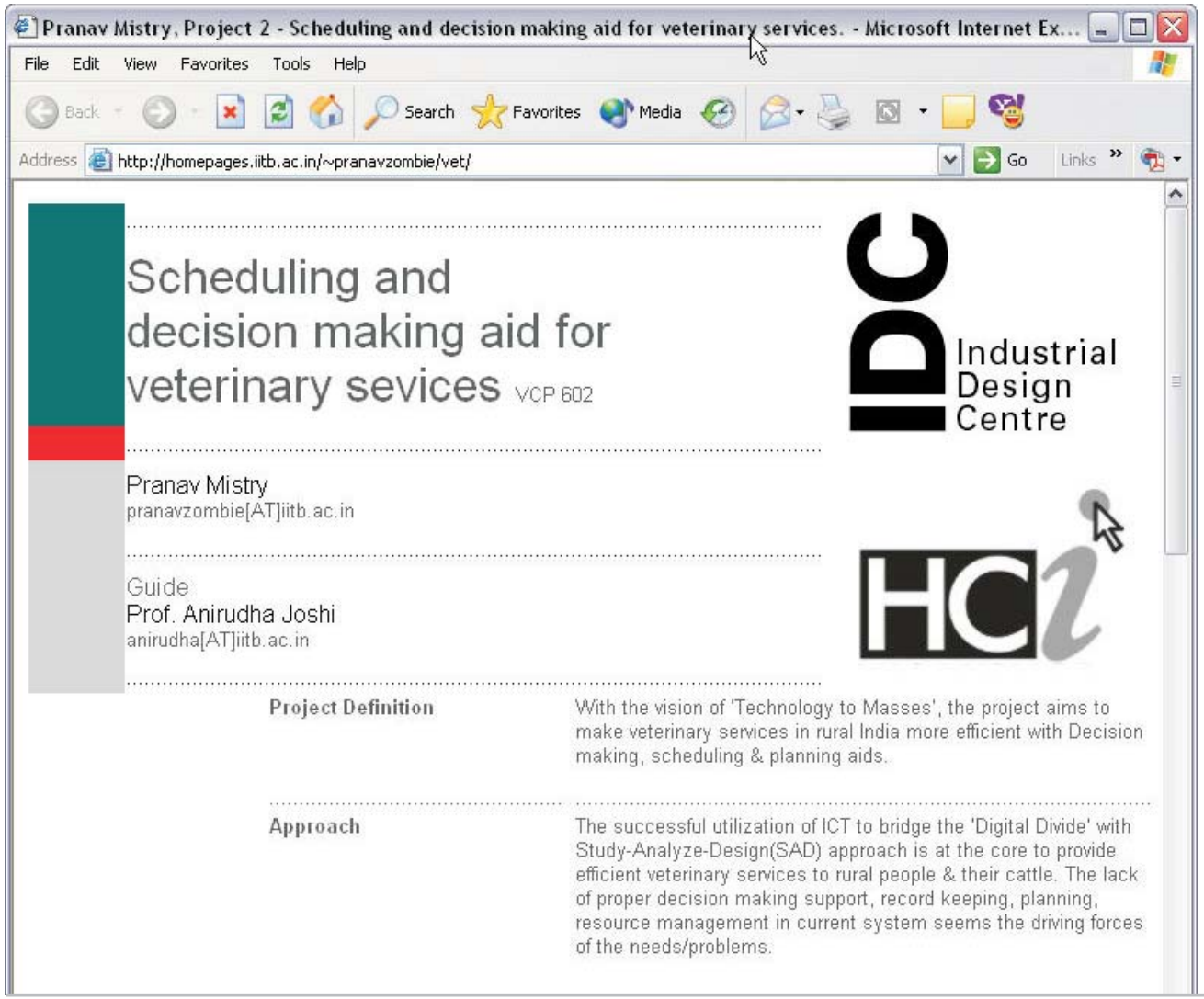
Writings during project



Appendix F

Project website

F



To interact and get inputs from other people involved in the project as well as to keep the status of the project available to other interested people and thus exchanging thoughts, concepts about project a website is created.

The website helped in updating documentation of the project and making Banas dairy people aware about the status of the project.

http://homepages.iitb.ac.in/~pranavzombie/vet

Appendix G

Bibliography