Title: Smart Filter-A Searching Approach in the e-Me Project

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Abstract

In the past years, the information was kept on the physical medium and people struggle more to get the right information. Everyone tries to search the information in a smart way using different scenarios. With the passage of time as computer became the essential part of daily life and the search engines came into action. When we talk about the search engines, they are also the part of Information Technology (IT) revolution to find the material or information in a simple and easy way in less time span. These search engine help in finding the information instead of the physical media quickly. By the never ending efforts of the researchers, the information which was available only in physical medium or from other resources has been transferred to a single platform using IT artifacts. Now, the efficient accessibility of this information is an issue. There are a number of e-services available on the computer network around the globe from where the users can get the information according to their needs, but some time these e-services do not provide user demanded results because of the improper implementation of IT artifacts.

Our research is focused on the e-Me project i.e. a comprehensive knowledge based Electronic Assistant platform given by Innovation Lab. This project has a number of good e-services to assist the user electronically in course schedules, record of books, planning transportation, course program progress and number of other tasks at one place. This project is also used to co-design approach to initiate the users as a stakeholder. The users create a profile according to the services of the e-Me project and the users can search these services according to their needs. Our research is to provide an efficient smart filter to search information about services according to users needs. We studied the IT Artifacts and adopt the new research methodology called “Action Design Research”. This research is specifically adopted by researchers for the IT based system. In our research we cover the core IT Artifacts i.e. human computer interaction, user centered design, interaction design principles. These artifacts are further verified by the documents in the form of interviews and observation. The results were achieved by taken interviews from three interviewers having expertise in IT fields and they are also aware about the users’ perception. At the end of this research we came up with the design prototype of the smart filter.

Keywords: the e-Me, Smart Filter, Searching Technique, Action Design Research (ADR), Information Retrieval, IT artifacts.
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1 Introduction

The purpose of this chapter is to define the problem statement clearly and divide the problem statement into research question. The need of the research for the smart filter is presented with the background in the field of searching and e-services.

1.1 E-Services

The amount of information over the digital media accessible through network and databases has increased and still increasing rapidly. The effective usage of these resources has become the prominent issue for customers as well as for organizations. The organizations and businesses are coping with dynamics of the digital economy, new technologies and emerging services to integrate and extract the data from appropriate information resources. Traditional assistance is shifting from manual to a new way of electronic assistance by revolution of Information Communication Technology (ICT) in the form of e-services. These e-services are not developed for single user but are able to handle multiple users with multiple tasks at once. E-service provides the services over the electronic networks (Rust and Kannan, 2002).

Today, there have been a number of e-services running around using information technology in the form called “the site”. The Site is said to be a place or homepage over the internet from where the information is accessible using information technology artefacts. Today we have numbers of sites which are increasing day by day to provide more e-services. These e-services are getting good response from the users, but on the other hand, it is very difficult for the users to remember these many websites that provide e-services.

These e-services are growing with the passage of time and making a cloud of e-services according to the increasing demand. The growth of these e-services is pointing towards the Electronic Service Paradox (Albinsson et al, 2006a). This paradox is the force which is different from the “site model”. A closely related paradox is the multi channel challenge for businesses and individuals. As we talk about the individual, he / she wants that the email system, mobile phones, electronic calendars, search engines etc. integrate on one platform in simple, efficient and effective way.
1.2 Background

The e-Me project ([www.the e-Me.se](http://www.the e-Me.se)) gives a new horizon to get more benefits in a smart and efficient way using information technology in the form of personal assistant. The e-Me project is also the reflection of services in the form of e-services. These e-services are embedded in the e-Me project to make the electronic personal assistant possible. The e-Me project initiates to remove this problem caused by a number of e-services.

The e-Me Project is acting as an agent and as a filter in the information technology cloud ([Albinsson et al., 2006b](https://doi.org/10.1016/j.ejins.2006.06.005)). The project, which began formally in 2005, implemented a co-design approach starting from a vision of an electronic assistant as students prepare for self-administration. ([Forsgren et al., 2004](https://doi.org/10.1145/952770.952772)). The e-Me project gives the idea about the simplicity of self-administration for students about daily routine tasks. The main purpose of the e-Me project is to help the students using IT cloud for organizing their tasks i.e. organizing the course schedule, books records, planning transportation, course program progress and number of other tasks. Students have to visit the places physically or virtually to accomplish the above mentioned tasks. The purpose of the e-Me project is to turn these processes around ([Albinsson et al., 2006b](https://doi.org/10.1016/j.ejins.2006.06.005)). The project is a government funded Swedish research group consisting of a representative from University of Boras, Umea University, and Stockholm University as well as private companies like Intel, Microsoft, VISA, Telia, Mecenat, and a smaller student oriented companies ([Lind et al., 2007](https://doi.org/10.1016/j.ejins.2006.06.005)).
One part of the project in the e-Me is to facilitate the students to make all students-related services accessible. To highlight the main student services, the co-design workshops are organized together with the student community of Sweden and Spain in the form of eight different scenarios documented in text as well as in graphical shape in the form of cartoons. (Albinsson et al, 2006a) (c.f. Figure 1). To make the results illustrative, a participant from different ages and different geographical location are indulging for the e-Me project. The age group ranges from 20 to 35 with geographical location is Sweden and Spain. Both types of genders are involved in the e-Me project. These scenarios are based on eight situations to be improved according to students i.e. apply to university and begin studying, Monday morning, email management, change of plan, form filling, searching jobs etc. During the spring and summer of 2006, these scenarios were tested by sending a questionnaire to at most 16000 students in Sweden and get responses from 3200 students (Lind et al, 2006).

After this survey, a pilot version of the e-Me project was designed and built (Lind et al, 2007). A small group of students were involved during this phase of development for testing and evaluation. The students were selected because those were experienced citizens. After three months the first prototype of the e-Me project was deployed in (January 2007) for a group of 120 students at the University of Boras. These students were the future users of the e-Me project. These students were involved in the e-Me project to identify the shortcoming in the application and identify the new situation,
both within and outside of the school, so that the e-Me project is more helpful (Lind et al, 2007).

The e-Me project core components are as follows (Lind et al, 2007).

- **Mail Aggregation**
  This component in the e-Me project takes care of received emails from different sources and manage it according to the mood setting made by the users.

- **Mood Management:**
  This component is used to set the mood of the e-Me. So far, there are three types of mood of the e-Me project i.e. private, meeting and open mood.

- **Calendar Management:**
  In calendar management, one the e-Me user can share his/her calendar with other the e-Me users. Different categories of reservations can be highlighted by using different colors.

- **Archives:**
  This component takes care of different types of stored files and share it with other the e-Me users.

- **Assignment:**
  Using this component, user manages the entire task on one platform assigned to the e-Me. In the pilot version, the four main tasks are managed as follows:
  - The students result records (From Ladok - national reporting system for study results).
  - The schedule system works using, Never Lost (university scheduling system) and get it on the calendar.
  - Get the lunch menu of the week, receives desired offers according to match from different organizations with student discounts (from Mecenat).

- **Community:**
  In this component the stakeholders, developers, and users, the e-Me project management and service providers can discuss with each other about the e-Me project, suggest additional services or improvements and share experiences.

As related to the other student’s e-services, in the e-Me project the students desired life situation has been given a high priority. Our research will try to figure out the information retrieval in an efficient way using the different IT artifacts in the form of smart filter. The different stakeholders are involved in the e-Me project to make this project wealthy with the services they provide and the different registered users will search these services according to their needs. Our research will provide the best way for saving the information from different stakeholders and also the most efficient way
of retrieving desired information by implementing the core IT artifacts using the
Action Design Research Method.

1.3 Problem Statement

In our research, we have studied the e- Me project profile creation form and searching
form. Both of the forms need to be redesigned according to IT artifacts. As we looked
on different searching sites like Google, yahoo, AOL etc, we found that there is a
single search box on the main page and search with an advanced tab to refine the
search according to different criteria.

In the current application, the profile creation form is not satisfying the user’s choice
of information. The current profile creation form is poorly defined. The current search
form is also not satisfying the user’s filtering requirement. Both the current forms are
not fulfilling the IT artifacts i.e. user interface, design principles and performance
against users needs.

1.4 Research Question

Our research question emphasizes on

- What principles are essential to develop an efficient and effective information
  retrieval system in the e- Me project in the form of smart filter?

Following are the key points which we tried to cover in our research.

- How should the profile creation page be designed in order to make information
  retrieval intelligent?

- Which types of the drawbacks are there in the current searching method?

- What would be the social impacts after implementing such e-services?

1.5 Purpose of study & Expected Results

The purpose of our research is to grab the required information from huge collection
of data. In current searching form, the user is bound to search the information using
the appropriate box. In the current application, there is also need of advanced
functionality for better search results according to thesis that will actually lead
towards the induction of smart filter for better search result in the e- Me project. This
research describes the current functionality of the searching scenarios and the solution
in the form of smart filter. This research will also open some new enhanced
functionality of the e- Me project for information retrieval.
Our research work will explain the different scenarios using the new prototype to show the awesome result in different ways. The plan of our research is also to provide an idea that how the user will search and what type of design techniques would be used as there are a number of ways to search the user query. In our research, the existing searching system has been studied and then some propositions have been given for some enhancements to lead the project towards the smart filter. This research also gives an overview of the new system which made user-friendly interface, expected results, efficient time and used by everyone in an easy manner because as the e-Me project is also said to be an electronic personal assistant.

1.6 Target Group

In our research the main focus is about the use of IT artifacts to develop better applications according to user needs and open new horizons for developers, students and researchers. This research will help the development team of the Innovation Lab to study more deeply about the search criteria, as the information retrieval is the key point for the current application module in the e-Me project. Some other groups like Ladlock, Mecenat can also get a good idea about the information retrieval in a smarter way from our research. This research is also leading different students’ communities who are interested in the research field of searching information in a smarter way like a smart filter in our the e-Me project.

1.7 The Authors’ Experience and background

The research is conducted by Asif Iqbal Chaudhry and Mumtaz Ali Chachar. Both authors have different expertise and a background in the computer field.

Asif Iqbal Chaudhry completed a bachelor degree in computer science and now has been enrolled in the University of Boras as an MS student in Informatics. He has vast experience in the field of Computer Science including programming as well as management. In programming, he has also faced some problems regarding searching information while reporting and implementing some intelligent solution e.g. Chart Of Accounts searching algorithm, book keeping algorithm, inventory & stock algorithm etc. Mumtaz Ali Chachar has completed his Master degree in Computer Science. He is currently enrolled in University of Boras as an MS student in Informatics. He has grip in the field of Information Technology and expert in software programming, networking and IT management experience during his tenure.

1.8 Research Method

The research work has been started by defining the research method which has been conducted by theoretical and empirical studies. The research work also examines some scenarios which are based on interviews conducted from different companies, users and developers who are directly involved in the e-Me project or could be the future end-users. The action design research method has been used in this research. Action Design Research (ADR) is also said to be “learning by doing” i.e. A group of
people identify the problem, try to solve the problem, get the expected result if didn't satisfy, and then try again to solve the problem.

Gerald Susman (1983) gives the elaborating research cycle of the said problem in five phases. He has explained initially that the problem is identified and the data is collected for detailed diagnosis. From this collected data, several possible actions of the plan are generated from which a single suitable action of the plan is selected for implementation. After implementation, the results are collected to verify the success or failure. At this point, the problem is re-assessed and the process begins another cycle. This process cycle is continued until the problem is solved.

![Figure 4: Detailed Action Design Research (Adapted from Susman, 1983)](image)

As the action research carried out in real conditions, and requires close and open communication between the involved participants, the researcher should focus more on the ethical consideration during the research work. Following are the main ethical consideration for the Action Design Research, listed by Richard Winter (1996).

- Make sure that the relevant parties, committees and authorities have been consulted, and the principle of guiding the work is accepted prior to discussion.
- All the participants are encouraged to participate in the betterment of work; those who are not wishing to participate must be respected.
• The development of the work must be visible and open to the suggestions.

Permission must be obtained prior to observations or finding to documents produced for other purposes.
2 Research Design

The aim of this chapter is to describe the epistemological position and depicts a scientific approach which is used by the authors to explain what research method and strategies are applied to reach the conclusion. The authors also explain the data collection method and analysis strategy in detail.

2.1 Knowledge Strategy

Everybody agrees that knowledge is valuable, but the consciousness about the knowledge leans to end there. Most of the philosophers disagree that what is knowledge, and what are the ways to fetch it, either even it may be getting. How theory of knowledge approaches to this question? Epistemology deals with theory of knowledge, and metaphysics deals with theory of reality and the main role in philosophical inquiry. "Knowledge is the only meaningful resource today “(Drucker, 1993).

Our aim of current research is to provide a solution for the e-Me project in the form of smart filter and to create a knowledge base system with the aim of comprehension. We have described knowledge as “A dynamic human process of justifying personal belief towards the truth”. From the knowledge, we try to answer hidden questions which are in our minds, supposes what is something instead of why to explain, its only aim is to get or explain knowledge. The main purpose of research on the e-Me project is to create comprehensive knowledge for the users (belongs to the age group of 15 to 80) that will reveal clear concepts and will illuminate as well as produce some meanings. It’s very essential for a researcher to include his/her knowledge (Starrin, 1994, Cited Lind, 2005).

Knowledge is an essential asset of any organization. Knowledge that is created should be comprehended and also should highlight the concept that relates to smart filter perspective view. Knowledge is explicit, which will be collected from different sources like reading books, articles, journals, interviews, questionnaires and discussions.

2.2 Research Method

In a study, you must choose a research method. Mainly two scientific research method positivism and hermeneutics are available to conducting the research. The main purpose of research method is to present comprehensive knowledge regarding research.

First we give brief description of hermeneutics and positivism. According to Capurro and Hjorland (2003) hermeneutics method is used for interpretation about basic component of information system. Language is a source to communicate with world where as hermeneutics method is considered to be a theory of text and related with the human. It also considers philosophy of science. Hermeneutic approach by Patel, R.
and Davidson (cited Callegard, 2011) is a research approach in which researcher study, interpret and understand human action and thinking in the same way as the one interpret and understand the text. Positivism research approach is associated with natural science so we it also said to be scientific approach for physics, chemistry and biology (Oates et al, 2006). In scientific method the world is investigated by assuming it as an object because of world’s regularity.

Different research methods are helpful for different research purposes. It is important to streamline the research objective and select the appropriate research method, as this will help in defining the research strategy. Hermeneutics is defined as theory of action of understandings in relation to the interpretation of text. The text could be in any form of documentation (David L. Rennie, 2006).

The purpose of the hermeneutics analysis is trying to make logic of the relationship between people, organization, and information technology (Michael D. Myers, 1997). “Hermeneutics challenges the positivist view of unmediated observations of ‘objective facts’. Observations are always made on the hermeneutics perspective with the background of theoretical assumptions; they are theory dependent” (Birger Hjørland,2009). Hermeneutics is an idea of dialogical relationship between question and answer brought up by human science.

Using of Hermeneutics approach provide comprehensive knowledge which related to research wok .Main purpose is to lead towards right direction and understanding for better implementation of research work. It’s not easy to follow and learn general pattern from hermeneutics but it is possible for researcher to learn from experience (Benediktsson, 1989, cited Lind, 2005).

The important aspect of Hermeneutics approach is about the thoughts and ideas created in the form of objective (“objectivities of mind”) for other people to inspect. The main objective of this interpretation is to disclose the original intentions of the creator. “Since the idea of the consciousness of efficient history can be used in philosophical hermeneutics to raise doubts concerning the possibility of reaching some of objectivity in interpretation of texts.”(Seebohm, 2004,Cited Lind,2005).

According to the ideas of Schleiermatcher and Dihlty, that hermeneutics is not a consistent science, but evolved from different perspective. In whole process it’s essential that idea of creator must appear in object form and easy spectator to see what is being done. Idea behind the interpretation is to show views of creator. (Benediktsson, 1989 cited lind 2005). Main purpose of hermeneutics is to used philosophy and trying to understand the human world and analyze thorough existing premises (Odman, 1994 cited, Lin 2005).

“The picture of reality that the text creates can be seen as a transformation of the real world to symbolic word (mimesis: imitation) a pseudo-world” (Flick, 2002, cited Lind, 2005).

Text has no boundaries, the writer has ascribed something in their limits but unaware about the limits. One example of interview material that mostly interviewee themselves are unaware about the consequences, there hermeneutics research try to
clear the hidden meaning behind text for which the information is collected. (Nystrom, 2002 cited Lind 2005).

It is the significant challenge for IS (information system) which requires a research method that clearly recognizes IT artifacts as “shaped by the interests, values, and assumptions of a wide variety of communities of developers, investors, users” (Orlikowski and Iacono 2001, p. 131), whereas other has described that the artifacts are developed from organizational context. (Orlikowski, 1996).

Hermeneutic approach gives the researcher to start the research in their own way by understanding the problem. We have clear idea about the problem which will be solve using smart filter. Implementing smart filter consists of different phases. In order to implement it in smarter way and producing best results we need deep understanding of IT artifacts.

In our research, the problem in the e- Me project requires method which is used to build an innovative smart filter on the basis of IT artifacts using the organizational behavior and according to the problematic situation. (Baskerville and Wood-Harper 1998).

This new DR method leads towards ADR which are consisting of stages and principles. In the rest of the chapters we have explained the use of ADR for the compiling of IT artifacts for the best solution in the form of smart filter. The important aspect of ADR is about the thoughts and ideas created in the form of new research, based on others views like developers, users and organizational structures. The main objective of this interpretation is to disclose the origin intentions of the creator. ADR emphasizes the effect of the important aspects of IT which are described in chapter 3.

The purpose of the method is to establish direction for research. There are two types of research methods which are used for the purpose of collecting and analyzing data: qualitative and quantitative. These two methods are used for research work according to the requirement for research.

In information system qualitative research involves the use of qualitative data in the form of interviews, documents, and participants’ observed data to evaluate the problem. The qualitative research method described in depth analysis of the few subjects of data that are organized, but on the contrary to the quantitative research method, describes the proper investigation and constructs application statistics. Qualitative research is exploratory and it’s used to explore topics when theory and the subject are known.

Quantitative method differs from the qualitative model in terms of usage. It relates to the variables or ideas. The term variables relate to the characteristics of an individual or an organization which is measurable or observe through variance among individual or organization that studied. (Creswell, 2002).

Quantitative research based on the ideas of natural science where the result consists of collected materials of quantitative data. (Andersen, H, 1994 cited in Lind 2005). Qualitative research occurs in a natural way where human behavior and events occur.
Qualitative research is based on an assumption which is very different from quantitative design (Creswell, 2002).

The aim of qualitative methods gives the understanding of the human behavior, and the reason to regulate these behaviors. Qualitative research focuses on the question of what, when, where, how and why. Qualitative research will generate knowledge about a specific case study and other more general conclusions are only hypothetical. Therefore we will choose qualitative research methods in the study. The main difference between the qualitative and quantitative method is flexibility. A qualitative research method is a bit more flexible than quantitative. It offers more freedom and adaptation in the interaction between participants and researchers e.g. the “open-end” question gives the participant the freedom to answer freely in their own words.

2.3 Research Strategy

Our research is based on research method called Action Design Research. It is the core of the information system discipline. Action research has been defined as familiar, qualitative, creative, particular, informative, thoughtful and empirical model of inquiry in which all individuals involved in the study knowing and are contributing participants (Hopkins, 1993).

This strategy will lead to defining the missing aspects using the ADR (Action Design Research) for comprehensive solutions in the form of smart filter. The defined strategy is to reconsider the core discipline of IT and artifacts of IT in an organization (Ben- Basset and Zmud 2003).

We propose this method to address the problem in the e-Me project to utilize the IT artifacts using Action Design Research. According to our research, IT artifacts are a much debated issue. The merging of material and organizational feature that represented as a bundle of hardware and/or software in the form of artifacts aggregation (Orlikowski and Iacono, 2001). In our research, the IT artifacts will merge with the existing system to transform it in the form of smart filter. But to transform the smart filter, we need to take a closer look at the existing system design. Designing artifacts are based on the technological features, because these IT artifacts are involved in the interaction design process (Gregor and Jones, 2007). We believe that it is the need for research approaches, which explicitly recognizes objects how the artifacts come out of the structure, function and context of continuous improvement.

ADR is a research method to generate normative conception expertise in the design and the evaluation of the IT based artifacts associated with the organization. It is used to define following problems.

(1) To deal with the problem situation in a specific context of the organization address and evaluate.
(2) Construction and evaluation of IT artifact, which deals with problems that are typical of the class far encountered in this situation.

ADR focuses on aggregated artifacts which deal with critical issues. The ADR method contains several stages and principles to address these issues. We describe these stages which are anchored by these principles that define the assumptions, views and values.
Stage 1: - Problem Formulation
In this stage the researcher identifies the problem in the existing system. It provides the motivation for expressing the research effort. The problem formulation stage identifies and expresses a research opportunity on the basis of existing theories and technologies (Hevner et al. 2004). Once the problem identified, expressed and scoped, then this lead the researcher to put efforts for the scholarly knowledge creation. According to the views of Davision et al (2004) the client consent is same as the AR effort, it is possible to pave the way for the mode of inquiry and mutual understanding of the scope. This stage consists of two principles.

- Practice-Inspired Research
- Theory-Ingrained Artifact

Principle 1: - Practice-Inspired Research
This principle provides a knowledge creation opportunity rather than rambling in theoretical part. The basic idea of this principle is not to give the solution as a programmer or as a consultant. Instead the ADR explains the problem in the form of knowledge which results the researcher to inspire from the problem (Markus et al. 2002).

Principle 2: - Theory-Ingrained Artifact
This principle emphasizes that all items created and evaluated in the ADR will be informed by theories. In this principle it's suggested that the technology design writer must keep in mind the artifacts theories and its reflection on the sociopolitical context of the design. (Hanseth and Monteiro 1997).

Stage 2: - Building, Intervention and Evaluation
In the second phase, ADR frames and use theoretical problems approved in the previous stage. These premises provide reference to the initial design to create a computing platform. This phase also explains locus of innovation which may differ from the reference design or the intervention of the organization to use the other forms depending on the organization and design cycles. This stage consists of three principles.

- Reciprocal Shaping
- Mutual Influential Role
- Authentic and Concurrent Evaluation

Principle 3: - Reciprocal Shaping [as it is stage 2, so the principles should be started from number one rather than from number 3]
The principle stresses not to segregate the effects mutually exerted by the domains that are IT artifacts and organizational context. At this stage the ADR team may go thoroughly the repetitive cycle for details in each domain. The repetitive cycle is same as described by DeGrace and Stahl (1990) as "wicked problems".

Principle 4: - Mutually Influential Roles
This principle points the mutual learning among the different participants of the project. The ADR brings knowledge of theory and technological advances where as the practitioners bring the hypothetical and practical knowledge of organizational work place. These perceptions and assistance may help or contradict (Mathiassen, 2002).
Principle 5: - Authentic and Concurrent Evaluation
This principle highlights the key characteristics of ADR where the evaluation is not the separate stage of the research process that trails the structure. In evaluation cycle, alpha versions are helpful for the refinement of IT artifacts (Remenyi and Sherwood-Smith 1999) and surfacing expected as well as unexpected results. After that evaluation, beta version is used to summarize the expected values and its outcome.

Stage 3: - Reflection & Learning
This stage is used for building a particular solution of an instance to apply for teaching to a broader class of problems. It is a continuous stage and parallel to the first two stages. This stage recognizes that the research process involves more in problem resolution. This stage consists of one principle, i.e. Guided Emergence.

Principle 6: - Guided Emergence
The terms of design and Emergence seem antithetical, because the former implies external, deliberate interference, while the second expresses a sense of organic evolution. Therefore this principle is said to be guided emergence as it gets the important feature of ADR. It not only emphasizes on the aggregated artifact of the preliminary design by researchers but also on the ongoing organizational use, perspective and participants (Iivari, 2003). These refinements not only fix minor problems but also make significant changes to the design and Meta design (Walls et al. 1992). These end changes in the artifacts are like an idea of alteration given by Gregor and Ivari (2007).

Stage 4: - Formalization of Learning
The main purpose of this stage is to formalize the learning in ADR. According to Van Aken (2004), the knowledge achieved from the ADR project should be further developed for a class of problems. These results can be described as design principles which put further reflection to modify the initial design according to theories. This stage consists of one principle i.e. Generalized Outcomes

Principle 7: - Generalized Outcomes
In last principle, generalization is very challenging due to a particular position in nature of ADR outcomes which include organizational changes and the implementation of IT artifacts. The aggregated artifacts are generalized to explain the solution of the said problem. The generalization outcomes consist of three parts (Henfridsson et al, 2011).

- Generalization of the problem
- Generalization of the solution
- Generalization of design principle from design research outcomes

According to the research approach we will use ADR to formulate the issue and how the solution will achieve are shown in below mentioned table.
### ADR Process For smart filter in The e-Me Project

<table>
<thead>
<tr>
<th>Stages &amp; Principles</th>
<th>Artifact</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Stage 1: - Problem Formulation</strong></td>
<td></td>
</tr>
<tr>
<td>Principle 1: - Practice Inspired Research</td>
<td>Research will conduct for better use of IT Artifact in the e-Me project to enhance the information retrieval system in the form of smart filter.</td>
</tr>
<tr>
<td>Principle 2: - Theory Ingrained Artifact</td>
<td>In theory the key subjects will be studied carefully to fulfill the IT Artifacts according to the said problem.</td>
</tr>
</tbody>
</table>

| **Stage 2: - Building, Intervention and Evaluation** | |
| Principle 3: - Reciprocal Shaping | In current design, the efficient and effective information retrieval system are not seen because of the poor management of data storage and information retrieval designs. | In our research we will produce the results in the form of screen prototypes which shows that how should the smart filter look like through the iterative process. |
| Principle 4: - Mutually Influential Roles | In our research we include developers and general users to achieve theoretical and practical perspective about the current design. | |
| Principle 5: - Authentic and Concurrent Evaluation | The smart filter first implements in Innovation Lab and then announced for general users after achieving the research goals. | |

| **Stage 3: - Reflection & Learning** | |
| Principle 6: - Guided Emergence | The ensemble natures of smart filter artifacts are recognized. IT components and additionally identified factors are emerging. | With the feedback, new emerging or revised edition of smart filter design will be needed. |

| **Stage 4: - Formalization Of Learning** | |
| Principle 7: - Generalized Outcomes | For the e-Me project, smart filter screen prototypes will be articulated. | |

Table 1: Action Design Research (Asif et al, 2011)
Research can be used for different purposes and it is also very important to know the main purpose of the research. Usually in research, two types of studies are involved, explorative and evolutionary.

In explorative study, researchers are involved in new subject area which is unexplored. The Explorative study is important when it is moving towards new trends and creates new knowledge of the research area (Babbie, 1995 cited Lind 2005).

An evolutionary study is different from the explorative study, where all results are appearing step by step, in which researcher’s study lead towards the composite results which are based on previous results (Anderser. E1994 cited Lind 2005).

We have chosen an exploratory research strategy because we want to follow a new knowledge. Our research field is unexplored, and a new one. This area needs more exploration for better results. Interviews and observations are well suited for our research which will lead towards the problem findings and will conclude the best results at the end. The exploratory method will help us to give better understanding to make the smart filter interface more effective and efficient.

Once the interviews and observations are finished, we will be able to build a prototype of smart filter profile creation page and redesign the search page according to the new knowledge. Our goal is to get a better idea of how users will observe the interface and how we can make improvements in the interface for effective and efficient working.

### 2.4 The importance of Theoretical Study

The importance of theoretical study of research is very crucial and explores all aspects relevant to thesis work. Theory makes research work easier, simpler to understand and more logical explanation, it also has a tendency of simplifying difficult techniques (make it very simple to understand by everybody), John 2007. Theory can be resulted from the research work done by collected data and by analyzing it (Bryman, 2002 cited, Lind 2005).

The Main purpose of theory is to describe key concepts and utilization of knowledge which is to be proved in empirical data. Theory material has been collected from different sources like literature, scientific articles, journals, magazines, online books. The main source is the search engines like Google, yahoo, etc.

### 2.5 Importance of Empirical Study

In theoretical research all information is collected and then verified through the empirical study, and adopts a new perception of the use of the e-Me project. Usually in theoretical research, only description is given through empirical study to get acquired results (Oates, 2006).

In the empirical study we have implemented interviews for the research work to generate new ideas and new knowledge according to the requirement of the users of
the e-Me project and make it feasible and easy to retrieve information with the help of smart searching. The previous research work of the e-Me project (search engine) illuminates current empirical research work with new enhancements and simplicity.

2.6 Data Collection Method

To conclude, comprehensive research data is needed. There are many ways which can be used to collect data. Some methods are available to acquire related data, such as Text Analysis, interviews, questionnaires and observations. The advantages and disadvantage of these methods are discussed below.

2.6.1 Theoretical Study

Text Analysis

All the written material has been carefully read and analyzed in this method in text analysis (Repstad, 1999 cited Lind, 2005). The advantage of using this method is that, it makes textual research comprehensive to understand different opinions of authors and online website searching techniques to reach the conclusion that what we are looking for. Therefore, we search for search techniques and interfaces used by a number of websites like Google, AltaVista, yahoo etc. to conclude the results of our research.

Finding the correct solution of problems related to research work, one needs to go through scientific textbooks that contain the results of previous research that will provide a base for further research (Kuhn, 1996 cited Lind 2005). Examples of previous results and present findings will make work easier and illuminate comprehensive knowledge. Many ways are available for texts analysis and it is difficult to include every text analysis, so it better for the researcher to use literature samples.

A more useful way of thinking about the sample method for setting criteria is to choose literature and text analysis (Patton, 2002, cited Lind 2005). The e-Me project is implemented in a Western Country, so the researchers prefer the literature of Western Countries to make it easy for users and customers to find a choice of information. Previous findings in studies are also included in the research work, but some of the information has also been collected from the researchers’ region.

Different kinds of sources are also used to collect data for research. We have used literature from the University of Boras library, digital library databases, journals and e-books. In the field of Informatics, we have used online safari tech books, Google search box, Library Information Science (LISA) and ACM Digital Library. The authors’ have also used other electronic media for getting relevant material available on the internet. Google search is also a good resource. We have also contacted with Innovation Lab experts to get an overview about the e- Me project.
2.6.2 Empirical Study

Interview

The interview is an efficient way to collect data. The interview also gives an analysis (Kvale, 1997, Cited Lind, 2005). Some aspects of interviews are positive, others are negative. The positive aspects are finding out user involvement in the whole process and are helpful to identify the problems and explore right answer. The negative aspects are more time consuming process and difficult to find respondents for acquiring proper information. The interview is the suitable way to acquire information about a particular subject. According to the view of Henderson (1991) interviewer is the research instrument and thus must take the responsibility of wrong interview. In this way the interviewer should possess social knowledge rather than technical knowledge (Andrew, Mason, Silk 2005).

Questionnaire:-

This method is also used for collecting qualitative data and easy way to gather related information from a large number of respondents without cumbersome efforts. Information may be collected from individual or groups. Every method has merits and demerits, so same idea has applied here. The main risk of the questionnaire is that, the same question has different answers from different ways (Kylen, 1994, cited Lind, 2005) and the researcher is not aware of this difference until the completion of the questionnaire. The risk of this issue can be reduced by well defined survey. In order to avoid above demerits, the questionnaire is not included in our research project.

Observation:-

Observation involves looking and listening carefully. In our daily life, we all watch each other but some time we didn’t care about the behavior in order to discover the particular information which may occur because of the behavior (Langley, P.1988).

In the process of observation method, the acquired information from a user may be passive or active (Repstad, 199 cited Lind 2005). It may be helpful to interact with different users. It is a lengthy process to check observations and difficult to reach a final conclusion. This research may not provide an effective result, that’s why we will not use this research strategy.

2.7 Data Analysis Procedure

“Thinking without comparison is unthinkable. And, in the absence of comparison, so is all scientific thought and scientific research” (Swanson 1971:145). According to Stake (1995), analysis of data explicitly gives meaning to the first impression as well as final compilation.

Method analysis is a very complex task to identify the problem area and important concepts which are necessary to analyze text. Analysis is a very difficult part of the
qualitative studies (Backman, 1998 cited Lind, 2005). The author needs a deeper understanding of more research rather than quick perception (Davidson, 2007). There are multiple levels of data analysis to improve the quality of the said problem. In data analysis method, the first step is to put the data in order of related subjects. In second step, this data may be categorize into some sort of theme or types, and in last step, this analysis method involve in creating some models, developing theories or deducing inferences (Merriam, 1988).

We will use comparative analysis method for our research. In data analysis, theoretical data is collected from different literature which will utilize the empirical findings in the form of interviews to conclude results. These findings will help us to compare the result with the current application and in finalizing our results in the form of smart filter screen prototypes.

2.8 Presentation Method and Reference Technique

The presentation method describes how to show the research results to the target audience as well as how effectively presented in the research. In our research we will present the result in the form of prototype of smart filter.

We have learned during the study that Harvard reference style is the best one, so we prefer to use this technique in our research pattern, where we have used the author’s last name, years of publication in brackets in alphabetical order to reference the text in our research work. Quotation marks are used in research to identify the wordings borrowed from different authors. Notations are also used in research work to identify the work of other authors.

2.9 Evaluation Method

In research, evaluation method is applied for finding validity of research and should be rich and meaningful from every aspect (Kaplan Maxwell, 2005). The evaluation method in the ADR project is difficult to achieve due to aggregation of different artifacts. As mentioned by Markus (1983) and elaborated by Lee (1989), evaluation should be controlled with a natural possible solution. In research work, reliability and validity concepts are very important to evaluate the quality studies. If these criterias are insufficient for quality of research then adapts other criterias to make it possible for comprehensive research work, there are three types of criteria (Larson, 1994, cited Lind 2005).

- Quality of Text: Perspective consciousness, internal, logic, ethical value
- Criteria for Validity: pragmatic criteria, the heuristic value, discourse criteria, consistency.
- Qualities of Results: structure, richness, theoretical additive.

Above mentioned criteria may help in doing evaluation of quality research work. Controversial ideas are defined on truth; it is the researcher’s responsibility to defend it. Researchers’ first step is to defend the new theory of information and it didn’t mean to attack on past philosophers. According to Davidson (1996), about truth, he
suggested that the truth is a concept, hedged by adding “We are interested in the concept of truth only because there are actual objects and states of the world to which to apply it: utterances, states of belief, inscriptions. If we did not understand what it was for such entities to be true, we would not be able to characterize the contents of such states, objects, and entities” (Davidson, 1996).
3 Theoretical Study

In this chapter, the authors explain different areas which are important from the perspective of research question. This chapter also covers the concept of the current searching way in the e-Me project. The information studied in the theoretical part is enough to give an overview to understand the research objectives.

3.1 Key Concepts

Computer Technology minimizes the expenses in stationary sides, like documentation in a number of files now stored on a single electronic tape which is more efficient and reliable. But there are also some limitations or risk factors involved which are further discussed in this chapter. If we talk about searching by using information technology, the efficiency is in front of us i.e. the information will be retrieved through single click. Now what are searching concepts and how it could be helpful in the e-Me project is described below.

- Design Principle
- System Availability
- Intelligent Search Agent
- User Interaction
- User Satisfaction
- Technical Problem
- Social Consideration
- Implementation Process
- Searching Strategies
- Information Storage

3.1.1 Design Principle

In information system like searching, designing play an important role to interact with the system. The keyword search is not only entering the keyword in the box but also how the design is adopted to enter the search text. The user did not bother while entering the text because they enter the correct text but may be this text lead the query string to display an error message.

3.1.2 System Availability

In computer technology the availability of the system is said to be that users need of some information to update itself, to add new information or to find the information
which already exists using full text search or keywords. If the particular system does not avail the system, it is said to be unavailable (Wikipedia, 2011).

### 3.1.3 Intelligent Search Agent

System intelligence is the term in which the implemented system will behave like humans. When humans interact with the system, the system itself intelligently behaves against the input of the user. The searching of the text using an intelligent search agent, searches the relevant information when a user entered its desired keyword or phrase (G. N. Shined, 2011).

### 3.1.4 User Interface

The user interface is a term in which the user interacts with the system to perform a task. The user interface in computer terms is also related to the term GUI (Graphical User Interface). Simple the GUI, easily the user interacts with the system. In search design the user interface consists of the following patterns which are displayed in the diagram shown below. The intuitive Search Interface is the starting point of the pattern recognition. In the diagram each arrow represents in which direction the patterns lead after initiating the search (Wellhausen, 2004).

![Figure 5: Searching Pattern Interface (Wellhausen, 2004)](image)

### 3.1.5 User Satisfaction

User satisfaction is the term in which user feels satisfied after using any system according to his/her requirement. In a computer system, user satisfaction is the key point for the success of any computer system (Delone, et al., 2002).
3.1.6 Social Consideration

By implementation of these e-services, the physical social interactions between the people are remarkably decreasing. During our research we have also highlighted the issue of social consideration which will not only decrease the physical interaction but also made an impact on computer based application business.

3.1.7 Technical Problem

The technical problem which is faced by information technology system includes the hardware or software malfunctioning. The other aspect of this issue relates to the information retrieval of unavailable data that may lead towards the technical problem.

3.1.8 Implementation Process

In computer application the deployment process is known as the implementation process. The implementation process is involved from the development to the deployment of the application. The process is consisted of development, installation, configuration, testing and then maintenance of the software application.

3.1.9 Search Strategies

The search strategy is applied in various forms around. In computer the search algorithm is also implemented in various forms e.g. Search engines, Microsoft word finding tools etc. In our work, the searching strategy is the main focus for information retrieval.

3.1.10 Information Storage

Information storage is the concept to store the information for future use. Information storage is also the key factor for information retrieval. The proper information storage management leads the information retrieval process faster and more relevant in search.

3.2 Subject Area Relevant for research

The above discussion about the key concepts leads towards several research areas. But these key concepts are not enough to cover our research work. In the light of the above key concepts we will focus on following subject areas to get the answer of our research questions which will be show in the form of smart filter screen prototype.

- System Development
- Artificial Intelligence
- Usability
- Interaction Design
- Human Computer Interaction
- Searching Techniques / Algorithms / Methods
- User-Centered Design
Figure 6: Subject Area and Research Questions Relation
3.2.1 System Development

The system development term is used in the software industry. The system development term can also be called as software development life cycle. The process involves organizing, designing and is used to streamline the development process of information system. There are a number of methodologies developed during the passage of time like the waterfall method, rapid application development, spiral etc. These examples of methodologies are used in a different context with advantages and weaknesses. In our research the e-Me project has a searching module. As we research to make the searching modules smarter that’s why we have used the prototype methodology in our search in system development context.

3.2.2 Artificial Intelligence

Artificial Intelligence is the branch of science which deals with the intelligence in machines as well as computer programs. In our research, the intelligent search agent is an option. Using this intelligent agent, user is able to get required information according to the entered keywords. The agent interacts with the user query and fetches the required data.

3.2.3 Usability

Usability is the quality attribute that accesses how easy the user interfaces are used. The word usability also points out the method for improving the ease of use during the design process. In our research, usability is a major concern regarding the query. The keywords entered in the form of a query which the user may be able to enter in later times to search the data again on these keywords.

3.2.4 Interaction Design

In computer science, the user interacts with the application using the interaction design. Most of the application in information system does not succeed because of the poor design principles. This subject deals with the graphical layout of the screen i.e. How the searching box look like, the width of the box, the physical location of the box etc. Interaction design has been explained through design principles in this chapter later.

3.2.5 Human Computer Interaction

Human Computer Interaction is the subject of the computer which deals with the interaction of the human with the computer. This subject explains the concepts of the interaction using the software or hardware interfaces. In this subject we discuss different aspects and factors about the human interaction with smart filter to retrieve better information.
3.2.6 Searching Method

The information retrieval is a process to find particular information according to need. In computer technology, there are basic searching techniques for information retrieval. These techniques are based on operators, called Boolean operators. The Boolean algebra developed by George Boole in 1854 (Wikipedia, 2011). Searching methods play an important role to build a smarter way for information retrieval.

3.2.7 Literature Resources

The searching techniques and information retrieval are not new in the IT system. Before the revolution in computer technology, the information retrieval caused delay in work. To make information retrieval, the researcher put enough effort on searching techniques to make searching fast. In this section the literature resources are highlighted. The research works are available in books, journals and in article formats. The revolution of IT makes the life easy and most of the literature is available on the internet in the form of a pdf or text files. Most of the important online source of the literature review is ACM computing, IEEE transaction and information system research etc. (OATES, 2006). Besides above mentioned literature review, there are many authors who have written different articles. Interaction Design is the key concept of our research work. We have studied the books About Face 3: the Essential written by Alan Cooper, Robert Reimann and David Cronin. Jonas Löwgren and Erik Stolterman also explained the Interaction Design in detail in their book Thoughtful Interaction Design. Jeremy Lewis has explained the System Development Life Cycle in detail in his book with title System Development Life Cycle. In the field of usability, Jakob Nielsen had done great work in the form of books and articles e.g. designing Web Usability and Web Usability. In the artificial intelligence field, Stuart Russell and Peter Norvig have written many books. There are a number of articles on Human Interaction Design and Usability by Xristine Faulkner and Donald A. Norman described the subject areas in detail. Human Computer Interaction course book “CS408” by the virtual university also helps in studying the computer and human interaction in easy way.

3.2.8 Previous Research

Information retrieval is not a single day work. Researchers have been working for decades to make the information retrieval easy and in a smart way.

The role of the information retrieval is to get distributed information and knowledge in an easy and smart way. To describe our research work, we studied the journals from different publications to get an idea. These journals contain some famous work from different researcher around the world. From these journals, we have discussed some of the below mentioned articles as a future research work.

The ability of information retrieval of people is an easy task using natural language. The librarian in the library is used as reference for the information retrieval. Because the user interacts with the librarian about the particular information retrieval which is in the form of some documents or book. As we examined that the information retrieval is done by the interaction with a librarian. To overcome this interaction the
automated system is needed. The systems are already deployed but in general the natural language processing in computer technology is still an open research problem. More formally, the field of information retrieval (IR) associated with the recovery information as to the information the user needs (Frakes, 1992). Information retrieval is often considered synonymous with document retrieval and text retrieval, the infrared system, but many also download images, audio or other type non-textual information. The word "document" used in the information retrieval not only return document but it may contain any information. There are two types of activities involved in the document retrieval i.e. searching & indexing (Sparck Jones 1997). Indexing is said to be the way in which the document is retrieved. Searching is the way in which the queries create a set of documents relevant to the user query.

By studying and analyzing the articles we decided to give a better idea for searching in the form of smart filter to improve the information retrieval.

### 3.2.9 System Development

The system development process is the cycle that covers all user requirements, organizational objectives and all functional requirements in an information system successfully. The system development process handles analysis, design, development and maintenance of the information system (Kal Toth, 1998).

### 3.2.10 System Development Lifecycle (SDLC)

System development life cycle provides a framework of work sequence to achieve the goal by system developers and system designers. The life cycle consists of steps or phases that are the result of the previous steps in the cycle. Following points gives the overview of the SDLC.

- **Initial Idea**

  The project initiates with the initial idea. Usually this consists of a brief description about what is the project, what’s its purpose and how to achieve the project goal.

- **Feasibility Study**

  The main role of this phase is to analyze the current system at a high level and draw the data flow diagram of current systems to show the working and describe the flaws in the current system. The feasibility study is not carried out on all projects. This stage is omitted for smaller projects.

- **Requirement Analysis**

  Requirement analysis defines a set of possible solutions for the said problem. These solutions may be presented in the forms of technical documents like data flow diagrams, logical data models.
• System Analysis

This phase refines the project goals into defined operations and functions of the proposed application. This phase also analyzes the end-user information requirements.

• System Design

This phase describes that how the requirement of the new system is carried out. The system designer develops a number of designs and then test those designs according to the requirements. The design with the closet result is selected.

• Development

In this stage the actual coding of the system is started and the programmer writes the code against the design and module is tested individually to ensure that the requirements are according to the specification.

• Testing

In this phase all the modules are merged and then test for any errors, bugs and interoperability. There are different types of testing techniques.

  ✓ Unit testing: - Unit testing is performed in development phase.

  ✓ Link Testing: - Link testing ensures that the programs work together e.g. Data processed from one part to another part in the correct format.

  ✓ System Testing: - System testing ensures that the system as a whole works normally according to the design specification. The recovery procedure is also tested along with the normal procedures.

  ✓ User Acceptance Testing: - In this testing phase the user test the system to ensure system usage.

• Implementation

The implementation process begins when the test has been carried out for user satisfaction. There are two main approaches of implementation

  ✓ Phased Process: - In this implementation process, the stand-alone subsets of the system are implemented with the passage of time.

  ✓ Bing Bang Process: - In this process the whole system is implemented at once.

There are some systems that required some special tasks for converting data from old system to the new system. The process of changing old data according to the new system is called conversion.
• Maintenance & Review

Once the system is implemented satisfactory, the maintenance phase is initiated. Maintenance should be on a regular basis to ensure the workflow of the new system and smooth working according to the requirement. Maintenance consists of two approaches.

- Implementation of new features.
- Elimination of errors or bugs.

![System Development Life Cycle](image)

**Figure 7: System Development Life Cycle**

**3.2.11 System Development Methodologies**

The software development is a complex task. There are many types of methodologies used to develop an information system of different nature like technical requirement, organizational structure, project type and team considerations (CMS, 2008). These developed methodologies have advantages and disadvantages. Following is the definition of methodologies by CMS.

- Waterfall Method
- Prototyping Method
- Incremental Method
- Spiral Method
- Rapid Application Development (RAD)

The waterfall model consists of phases. Each phase leads towards the next phase. The next phase does not start until the previous phase do not complete. In prototype method the project is divided into small parts and completed independently while completing the others parts. Incremental method is performed in steps with all requirements defined prior to the evolutionary development of individual growth of the system. The spiral model consists of a circular process. Each cycle progresses in a sequence of steps. The system is assessed and explained through each step. Rapid Application Development (RAD) method is used to develop a system with high quality at fast speed with low overall cost and with respect to other development methods (CMS, 2008).

According to our research, the best suited method for us is prototyping. The prototyping seems to be good because, it’s not an individual development method and the risk level is at a minimum because of the smallest segments of the development techniques. The prototyping is also feasible because the users (an important factor) are involved in the development of the project as well as testing of the prototype. The prototype also helps to identify the deficiency occurred by different users. It also handles the system before time to the user for testing and evaluation (Janson and Smith, 1985). Prototyping schematic representation is mentioned in the below given figure.

![Prototype Model](image)

Figure 8: Prototype Model (Janson & Smith, 1985)

### 3.2.12 Searching Techniques / Algorithms / Methods

Information retrieval is based on some search criteria. These criterias are based on user requirement, but actually some searching methods are involved to retrieve the information. If we find the word from the dictionary, we actually follow some rules. The dictionary is based on the index of the alphabet letters. The searching method mostly works with Boolean operators.
“However, neither mechanism guarantees superior performance for every query”. (Paris & Tibbo, 1998). George Boole in 1854 explained in his book “An Investigation of the Laws of Thought” about the mathematical logic and developed a Boolean algebra which is a modification of ordinary basic algebra differing in its principles, procedures and rules.

The Boolean operators are of following types.

- AND
- NOT
- OR

The Boolean operation can also be explained using a graphical notation using a Venn diagram conceived by John Venn in 1880’s. The result of the Boolean operators is illustrated by using below mentioned diagram called Venn diagram. The diagram shows that how the “AND” operators narrow down the search result, and “OR” operators expand the search result and “NOT” excludes the unwanted keywords from the search.

In our prototype, the advance functionality is based on the Vann Diagram to filter the results according to the user need.

<table>
<thead>
<tr>
<th>Operator</th>
<th>Example</th>
<th>Search Results</th>
<th>Venn diagram results showed in pink</th>
</tr>
</thead>
<tbody>
<tr>
<td>AND</td>
<td>Car and Indian food</td>
<td>Items containing &quot;Car&quot; and &quot;Indian Food.&quot; AND narrows a search, resulting in fewer hits.</td>
<td><img src="image" alt="Venn Diagram Example" /></td>
</tr>
<tr>
<td>OR</td>
<td>Airline or Bus</td>
<td>Items containing either &quot;Air&quot; or &quot;Bus&quot; or both. OR broadens a search, resulting in more hits.</td>
<td><img src="image" alt="Venn Diagram Example" /></td>
</tr>
<tr>
<td>NOT</td>
<td>Italy not Rome</td>
<td>Items containing &quot;Italy&quot; but not &quot;Rome.&quot; Caution! It’s easy to exclude relevant items.</td>
<td><img src="image" alt="Venn Diagram Example" /></td>
</tr>
</tbody>
</table>

Table 2: Vann Diagram Example
3.3 Artificial Intelligence

“Artificial intelligence, also known as man-made intelligence is a branch of science and engineering which is used to study and design intelligent machines, and in particular the intelligent computer programs”. Artificial intelligence is the study and simulation of the human brain. (Liu Xian, 2010). The artificial intelligence is the understanding and the intelligence in human being that is implemented in a computer program or machine to stimulate like a human brain. Now-a-days, artificial intelligence is being used in many aspects like judgements, reasoning, sensing, communicating, searching and many other important aspects.

In our research work, an intelligent agent is the one that answers one of the research questions. As we mentioned above about Vann Diagram, it’s also an artificial concept to filter the data from the huge collection according to the users need.

3.3.1 Application of Artificial Intelligence
The artificial Intelligence embedded in many fields of science i.e. From Kitchen accessories to the space shuttle. Artificial Intelligence is the result of the study of many fields like philosophy, Neuroscience, computer science, logic, economics & probability (Jane Marshall, 2010). Artificial Intelligence uses a number of fields.

- **Computer Games:** Computer games are man-made programs which can play with an opponent (Human) and even can defeat the opponent player e.g. the computer chess is one of the examples in which computers can calculate the 200 million positions in second and can defeat the world champions. (Jane Marshall, 2010)

- **Understanding Natural Language:** Language understanding of the machine is also one of the major steps in artificial intelligence to operate the machine through commands using natural language. In the past, this sort of invention just seemed like a dream, but research made it real. In the future this technology will enhance more and more and machine can understand many languages (Jane Marshall, 2010).

- **Expert System:** It is an artificial intelligence based system which is developed to behave like humans according to the input given by human e.g. Autopilot, heart and lung machine. (Jane Marshall, 2010)

- **GPS:** These systems are unique and use the intelligent search agent to calculate the spatial coordinates. It is used in automobiles, airplanes, missiles etc. to follow the defined path or the trajectory.

3.3.2 Intelligent Agent
An intelligent agent is an autonomous unit that supports the user and performs work on their behalf. Agents are artificial intelligent technique to assists the user in daily computer tasks, such as reading e-mails, maintaining a calendar and filling
information. Agents are able to learn through examples and it enhances their performance with the passage of time (Linda, 1993).

Another definition of an intelligent agent given by Pattie Maes (1995) is that, an intelligent agent is computational systems that consist of complex architecture and perform tasks dynamically according to the environment. These agents respond and act autonomously.

![Figure 9: Agent Interaction with its Environment (Rudowsky, 2004)](image)

As the agents are computational systems and act against the environment. In our research the word environment is the user query. The flexibility of the agent is also said to be an intelligent search agent. The physical existence of this agent is fruitful during the real application. In our screen prototype we will give the intelligent agent name in the form of smart filter. The user will place the query according to the required scenario and the smart filter will retrieve the data in efficient way.

### 3.4 Human Computer Interaction

Human Computer Interaction is not only used to operate a computer but its how the human interact with the computer application. There are a number of definitions about Human Computer Interaction, like, “Human-Computer Interaction is a discipline concerned with the design, evaluation and implementation of interactive computing systems for human use and with the study of major phenomena surrounding them” (HBCCGMPSV, 1992).

The human computer interaction can be defined as the interaction between computer and the human (Paul A. Both, 1989). He further explains at (page 4) that, human computer interaction is also termed as Man Machine Interaction (MMI), Computer and Human Interaction (CHI) and human machine interaction (HMI). If we have user friendly interface, we can easily interact with the computer to perform the said task. In human computer interaction, the interfaces between the users and computers are at software level or hardware level. So during designing [the main focus should be the careful interface designing. (Paul A. Both, 1989). In our research the effective and efficient information retrieval are only possible because of user friendly interface.

The users interact with the computer through the interface. The users adopt the information system because of the ease and effectiveness in work. It is used to perform daily tasks as well as the complex task in easy manners. While developing such computer based systems it is necessary to take care of flexibility, efficient and user friendly computer interface for such application.
The above mentioned figure explains the communication between computer and human through a computer interface. The communication initiated from user side uses some input to a computer, which performs some computation to this input and then display the output to the user. The users then accept or denied the information according his/her perception.

In information technology, the information searching is also the perception of the user because users need the simple and flexible interface for information retrieval. Hayes-Roth and Amor explained that, in the past, the interface design was the machine centre, if the user does not get the proper information or system stops; it is because of the user. With the passage of time this behaviour changed and now the interface is designed according to the user requirement. So during interface design, simple, easy and efficient interface is the main focus.

### 3.4.1 Computer vs. Human

Human and computer are two different categories in this universe, as animal and plant. Humans interact with the computer system through hardware and software level. To understand the interaction between human and computer we have to take a closer look and compare the different aspects to ensure how much they differ from each other and how they act alike (CS408 citied in Inam ul Haq et.al, 2011).

**Human Species:**

Human is one of the intelligent, strange, complex and the shark species on this earth. A human has the ability to think, behave and act freely according to his/her determination. They find the solution of the problems by analyzing the problem from different aspects. Sometimes human also made mistakes with intention or without intention but these mistakes some time gives good results at the end. In humans, the power of decision is based on the emotions and thoughts (ibid).
**Computer Species:**
Computers are the invention of human being. Computer systems are nice-looking boxed but complex inventions in nature of human being. The computer also performs a task by thinking and analyzing capabilities but these capabilities are programmed, that means computer do not think freely as humans can. The processing power of computer for doing any task is much faster than a human being. The computer does not feel tire where as humans are tired of doing continuous work. Human beings are born with the characteristics of feelings, emotions, desire etc., whereas computers do not have feelings, emotions or desires, and hence do not make mistakes (ibid).

Before the invention of computers and computer software, humans have been performing their daily task manually and at some times were not able to complete the tasks on time. Manual record keeping system was in use. For example, store keeper or bankers have to maintain the records of the users in registers, and searching a single record of a person was a time consuming job. With the invention of computer system, the human behaviour has changed. The information technology plays a vital role for mankind to perform simple tasks by clicking. The data is stored on a single machine which is then accessible to a number of users at a single time and this was not possible before the invention of computer system.

### 3.5 Usability

According to International Standard ISO/DIS 9241-11 (cited Ashraf et al, 2010), usability is defined as “The extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use”. The word effectiveness in a system means objectives and efficiency that means how effectively the resources have been utilized in efficient manners to achieve the objectives.

The usability of an online system depends on the user’s need i.e. what are user’s requirements? The user in online system may be surfing, trying to search, online shopping, software downloading. The online system also depends on the organization needs. The organization develops online application for marketing, selling products. The online application also provides information about organization to employees, customers and inventors (Spool et al, 1999).

Usability is the use and learns-ability of man-made objects (Wikipedia, 2011). The object used can be any man-made object with which human can interact to get required results like web application, interactive mobile phone, software application etc. System analyst is more concerned with usability rather than the designer or programmer because system analyst looks the entire major functional requirement which leads towards usability.

According to Nielsen, the usability can be defined in a broader way. There is a difference in online application usability as compared to printed information. Online information gives many advantages like a user with an eyesight problem can view the information by adjusting the text font whereas it is hard to view the printed
information. The usability of the system increases, not only by reading the information but different types of users can use the same system (Jakob Nielsen, 2000).

Nielsen (1993) introduced the term “user friendly”, when developers of information systems first realized that their systems were to be used by users with demands on the products in terms of access, etc. Nielsen worked on the importance of usability of the different interfaces design with respect to the usability. Therefore, in our research, we will focus on the principles of interaction design according to the usability.

To some extent, usability is very limited as compared to the larger issue of system acceptability but the basic question is that, whether the system fulfils all requirements of user and other prospective participants (Nielsen, 1993).

The idea behind the smart filter is to retrieve information in easy and efficient way. The system should be designed in a way that the user easily interacts with the system and minimize the possible issues which may not cause a problem in information retrieval. According to researchers, “We should regard usability as one or more quality attribute for consideration during software construction. Of course, we shouldn’t concentrate on just a single quality attribute when designing systems, also combining software characteristics pose the real challenge” (Juristo, Windl, Constantine, 2003, page 1-2).

As mentioned above, the usability is directly related to the users i.e. User interact with the system and get output from the system. Thus the usability consists of two main points.

- Input
- Output

The input function allows the user to give some instruction to the system, like in our system the user enter keyword or select the specified topic for information retrieval. The output function computes the input information and returns the desired result after computing the input information in the form of search results.

As for the designer’s point of view, usability is really important. They have to make it sure that not only the interaction is simple but also that the user feels comfortable in the physical, mental, and emotional environment of the interaction. The online system interaction context can be as small as a page or as large as the physical, cognitive, social, and emotional surrounds of the user in the act of using the online system (Badre, 2002).

3.6 Interaction Design

The interaction design principle definition needs to split both the words “interaction” and “design” separately as defined by Strijbos, Kirschner and Martens (2004, page 235). Interaction is a constant process in which user action and reaction are done, whereas the design gives the physical structure i.e. how to interact physically with an object. The interaction design is defined as the action of the object and the value of
services using by users to communicate with this object, and the level of quality of experience they (user) have (Strijbos, Kirschner, 2004).

![Simple Interaction Design Model](image)

**Figure 11: Simple Interaction Design Model (Oleh Listia Natadjaja, 2010)**

The design principle made computer and human interaction simple and cause effectiveness in work. (Yusof, Amin & Baker, 2004). The main objective of the human computer interaction design is to create the communication channel between computers and humans to perform their task using a computer in a simple way. To give the high level output using a computer system, it is necessary to build an easy and simple interface. The usability of an application also increases by implementing a good interface design. Shneiderman in 2005 presented in his works some important rules to build an interactive design. These rules are called “Eight Golden Rules of Interface Design” (Shneiderman B., 2008). The rules are

<table>
<thead>
<tr>
<th>Ben Shneiderman’s Eight Golden Rules of Interface Design</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Strive for consistency</td>
</tr>
<tr>
<td>2. Enable frequent users to use shortcuts</td>
</tr>
<tr>
<td>3. Offer informative feedback</td>
</tr>
<tr>
<td>4. Design dialog to yield closure</td>
</tr>
<tr>
<td>5. Offer simple error handling</td>
</tr>
<tr>
<td>6. Permit easy reversal of actions</td>
</tr>
<tr>
<td>7. Support internal focus of control</td>
</tr>
<tr>
<td>8. Reduce short-term memory load</td>
</tr>
</tbody>
</table>

**Table 3: Eight Golden Rules of Interface Design** (Schneiderman cited in Inam et al, 2011)
• **Strive for Consistency**

Must be fixed in the sequence of actions required in similar cases. The same terminology should be used in the instructions, menus and help screens, and should be consistent with commands.

• **Enable frequent use of shortcuts**

As the user interact with the system, the frequency of the usage increases. So the user tries to find the shortest path using function keys, macros facilities and hidden commands to interact with the system.

• **Offer informative feedback**

The action made by a user should be responsive by the application to make the user aware about the consequence of the next action e.g. If the user type some search query the result should be displayed or if the result didn’t get, there should be some proper instructions mentioned instead to generate some error message.

• **Design Dialog to closure**

There should be some proper start, middle and end, in each interaction. This sequence will help the user that what action should be taken to the next step which satisfies the user regarding the action taken.

• **Offer Simple error handling**

While designing a system, there should be an intelligent system which notifies about errors caused by users.

• **Permit easy reversal of actions**

It should be a simple and reliable system designed to remove and undo the action. There must be navigational options when the user wants to go back and also the ability to detect and sort the user actions performed incorrectly.

• **Support Internal Focus Control**

The expert users always consider themselves as the administrator of the system. Design the system in such a way that the user feels they are like a producer, not a consumer.

• **Reduce short-term memory load**

In short-term memory of human, the information is reduced. For this reason, the design of the application should be kept simple and the changing of application interface frequencies should be reduced.

Jonas Lowgren explained the interaction design process as “creative design”. He has explained the interaction design according to engineering approach. In engineering design, developers build the software according to the requirement specification, and
in creative design, designers build the design of the said problem and reframe it constantly by questioning during the design process (Lowgren, 1995). The design is based on user friendliness and guided designs which are mentioned below as described by Julie A Jacko (2007, cited Inam et al, 2011)

**Design Principles**

- **Just One Operation Requires At One Screen**
  The user can perform step by step action. For this, in information system only one action should be placed to make things easy for the users.

- **The Screen Switch Must Be Noticed**
  The user must be notified about changing of the screen, so that the user prepare for the next step.

- **The operation flow must be comprehensible**
  The flow of the operation must be comprehensible, so that the user can interact with the system with confidence.

- **Screen information must be simple as possible**
  Screen information must be kept simple and user friendly, so that the users feel free to use the computer application.

### 3.7 User-Centered Design

User-Centered Design is considered to be the best approach to build the system according to user requirements by gathering information from users (Mao, Vredenburg, Smith, Carey, 2005). User-Centered Design is also a term as pervasive usability defined by Suneet Kheterpal (2003, page 1) that pervasive usability is the application development process in which Usability is verified by examining the design using the application requirement and according to user needs.

In our research, the design principles for smart filter are based on user-centered design. Since the information retrieval is a process for the user to retrieve information from the e-Me project using information technology, therefore the design of the smart filter should be according to the users needs. When an information system is designed, it goes through different phases. (Emi Yano, 2007). The phases are explained below.

- Users Survey
- Analysis of User Requirements
- Prototype
- Assessment of usability
Users Survey
The user survey is used to collect or gather information from different users who will use the system. The user survey gives the overview about how many types of users used the system. Conducting a survey is not to make the communication, but we have to think about many aspects from which Emi Yano (2007) focused on the following questions.

- Identify the types of users
- The action of the user to use the system

Analysis of User Requirements
According to Emi Yano (2007), here arises two important questions i.e.

- Which type of functions and information do the users require in the system?
- Identify the requirement and goals that are required by users to make the system successful.

Prototype
If the system is developed without creating its dummy model or so called prototype, it may cause a problem in the system. The prototype explains whether the proposed system has enough potential to meet the system requirement or it needs more functionality to achieve the goal. There is the possibility that the prototype may or may not work; this is useful instead of creating the real application which will at the end did not give the required result (Wikipedia, 2010).

Types of Prototyping
There are four main types of prototyping. These four types are the basic types which are based on main two types Throw away Prototype & Evolutionary Prototype.

Throw away Prototype
This prototype is used to build the model of different parts of the system after a short research. This prototype is easy to build and is used to build the initial requirement. requirements of users usually come with some new ideas of previous experiences of the user. If the system is according to the needs of the user, then the prototype is finalized to build the real product (Wikipedia, 2009).

Evolutionary Prototype
This type of prototype is used to build a prototype which is more efficient and constantly more addition or refining takes with the passage of time. This technique leads the developers to add features or changes that couldn’t be gathered during the requirement and design phase (Wikipedia, 2009).

Incremental Prototype
In this prototype the final product is split into parts. Each part is combined at the end to give final shape to prototype. The advantage of this prototype is that the customer can test the functionality and can give feedback accordingly (Wikipedia, 2009).
**Extreme Prototype**

This type of prototype is used to improve the overall method or techniques and build systems on advanced level. This prototype has especially been used for web development. The application developed under this technique consists of three phases. The initial stage called static prototyping which consists of HTML pages; the second phase consists of programming of the screen and made a fully functional using stimulated service layers. In the third phase these services are implemented (Wikipedia, 2009).

**Assessment of Usability**

The assessment of usability is done by user’s using prototype. The prototype usability is assessed with the help of following method.

- **Heuristic Evaluation**

  Heuristic evaluation is used to identify the usability problems in the prototype. It evaluates that the prototype fulfill the usability concepts or not which were implemented by the designer in earlier phases. The heuristic evaluation approach helps in the improvement of the design (Emi Yano, 2007).

- **Users Test**

  In users test, the usability of the prototype is assessed by testing. The tests are conducted by users to ensure that the prototype fulfill the requirement. The users test verifies the system efficiency, effectiveness and satisfaction to satisfy that the prototype achieves the required goal in an efficient way (Emi Yano, 2007).

**Getting Feedback from Users**

The assessment of the usability of a system is to get feedback from users. The feedback from users can get after making a test on the prototype. This feedback is used to revise the design of the prototype. The feedback is used to make the project successful (Emi Yano, 2007).

![Figure 12: Steps in User-Centered Design (Emi Yano, 2007)](image-url)
After successful implementation, the prototype of smart filter in the e-Me project will go through the user feedback to make it more efficient and effective.

### 3.8 Summary of Theoretical Findings

The above discussion leads the research work to an idea for the smart filter which will come out by answering the research questions. The subject area relevant to our research question contains a design interface, human computer interaction, system development, artificial intelligence and user-centered design. These key concept areas are enough to achieve our goal and to answer our research questions on theoretical base.

The system should be user friendly and easy to understand. For this reason, the user-centered design principles and human computer interaction must be adopted. For smart filter, the user friendly environment is only possible by keeping in view the principle of human interaction design with main focus on user-centered design. The artificial intelligence is also one of the factors in our research i.e. smart filter will use for information retrieval in a smart way. The intelligent searching agent is only the key factor to made smart filter intelligent using logical operators as discussed earlier in this chapter.

According to the current design pattern, there are a number of things which should need to be redesigned. According to this research work, some of the research questions are highlighted which lead towards the conclusion after comparison between theoretical and empirical finding for the best smart filter.

1) **How the profile creation looks like in the smart filter to make information retrieval intelligent?**

   This sub question can be defined by the action of the user in an easy way to make information retrieval easy. The word easiest means, the system is intelligent and interaction with the application is easy to understand. The intelligence in the system makes information retrieval fast. The profile is the initiator for the first step towards the smart filter. The profile should be intelligent and the interface is also kept easy to understand and navigate e.g. The profile strategy is used to make information retrieval easy and fast because of intelligently saving the input from the different profile creator user for future usage.

2) **What are the drawbacks in the current searching technique which could be needed to redesign for the betterment of information retrieval?**

   The researcher found that, in current design, there are a number of limitations which will affect the information retrieval. From the researcher’s point of view, the user will try to search the information using three text boxes which will cause confusion for the new user. The technique should be changed to single text box which will be then connected with the advanced search method to make the user clear that if the information didn’t find from the main search box then try to use the advanced search.
3) **What are the social impacts of these kinds of e-services on the market?**

As we look around, there are a number of advertising companies who earn by providing advertising services to many businesses. The e-Me project’s aim is to create an electronic personal assistant, i.e. the user will interact with the particular information using the e-Me project. This project takes care of the intended information when changing occurred, and then alerts the user. These sorts of e-services will affect some of the social activities; one of them is an advertisement. The automated alert will neglect the advertisement to view by the user because the electronic assistant only looks for the relevant information.

3.9 **Arguments for Empirical study**

In any business or organization, they have their own information retrieval strategy according to their needs. The information retrieval strategy also depends on the nature of the department works. Information retrieval is not only the process to get the information but the relevant information is also important. Number of search engines tries to overcome these issues to gain their business high marks. Our research work, in the e-Me project is said to be feasible if the users are satisfied by information retrieved using this system, then it is implementable or it may need to redesign for better results. The system satisfaction is only verifiable using the real test of the system or using the general interviews from system users about the current system. In our research, as the system is in the development phase and the results are not covered in theoretical studies, the only way to get the proper answers for our research are the interviews from general users and then observe the gathered data from interview to generate the idea in the form of smart filter screen prototype.
4 Empirical Study

In the empirical study the author gathers the data from different users, using interviews to formalize the information retrieval in a better way using a smart filter. The theoretical facts are then verified using this data.

4.1 Purpose

Theoretical part gives the overview for the information retrieval which relates to the implementation of the smart filter for better results. Different researchers have different views about the same problem. The empirical study will give the new idea by viewing theoretical findings. Theoretical knowledge will add a lot of knowledge from different researchers. All of the knowledge is not fruitful because of the different researchers' perception. To overcome this hurdle and to do the research in a right direction, researchers adopted interviews, surveys and questionnaires to obtain the positive result. These results verified by theoretical finding to give a new knowledge about the research. We used the questionnaires and interviews to collect the empirical data that "which types of changing the current system require for creating the profile method and how to improve the searching method". For this purpose we select the companies, general users and developers. After gathering the information we will analyze the data and then give a new knowledge base system in the form of smart filter.

4.2 Sampling

Empirical data is important for the result of the research work. Theoretical findings compared with the empirical results produce new knowledge based system. The empirical results are based on empirical objects from where we can collect data. If the proper objects are not identified then there may be chances of the wrong data which may cause the researcher to work hard to conclude the better system. In this research work, the target objects for empirical data collection are the companies, students, developers and all users who are involved in using the e-Me project. The advantage of selecting these types of objects is to get the best findings about the current system. By analyzing these empirical finding and studying theoretical finding, we would be able to answer the research questions relevant to this research.

The sampling is also based on showing already developed system for various users and observed that what they think and what is missing to be incorporated. To analyze the current system, we also interviewed some software houses that are working from several years in the informatics field and they can give better views about the smart filter.

4.3 The Interviews

Interviews have leaded us towards some results which used to prove theoretical facts with these empirical findings. In this section we have streamline the interviews. Which type of environment will suitable for the interview, what problem will face
during the interview, what will the interviewer respond? And the way of noting the information will describe.

In interviews, some factors play an important role to get better results. The first factor is to initiate or take interview is the place. The interviewing place always should be noiseless and the strength of interviewer should be between 2 to 3 persons. The more the interviewers, the interviewee feels hesitate and uncomfortable to answer the questions. The predefined interview questions always provide better results.

The interview should initiate by explaining the purpose of the interview, which builds the confidence of the interviewee. The timing is also important as the user should decide that how much time he/she should spend with the interviewer. The interview question is also one of the factors and these questioners should be streamlining according to the interviewee. In our research, we need interviews from expert as well as from user perspective. As if we interview from users then we didn’t able to the question about design principles, user-centered design, intelligent agent etc. as the interviewee didn’t know about these terms.

During the interview, the information gathering also requires some knowhow of technical issues as no one knows which information is right and which is wrong. So during the interview we should note down all the information in the form of points. In the interview there would be some social or technical considerations. Never ask about the so much technical question from ordinary people or very simple question from a technical person because in both cases the results are not fruitful. During the interview if the attitude of the interviewee seems to be boring so give some time or leave to continue on the next day, because the user may give a good answer to the remaining questions.

In preparation of the interviewee we tried to contact with the companies with the help of our supervisor but there was a language barrier. So during interviewee preparation the companies were not participating, so we opt for other objects like students, developers, general users etc.

After selecting the interviewee we will streamline the question which we will ask from the interviewee. Following are the major question on which we focused mostly during the interview.

- What is the opinion about the current interface (regarding profile creation & Searching)?
- Which type of mistakes should users will mostly face during searching and how it will overcome?
- Which type of interface should be and what is lacking in the current system?

From above mentioned questions we almost figure out the main idea about the smart filter and then able to justify the issues in the current system.
4.3.1 The first interview

We had our first interview with a Ph.D. Student and who is currently working in the Innovation Lab on the e-Me project. We discussed about the e-Me project in detail and found very useful information about this project. He briefly explained the current working scenarios of the e-Me project. He highlighted two main issues while searching on the internet. The spelling mistake and keyword search on the basis of synonyms. He further added that the current system is working on the basis of the keywords adding by the scenario creator. While entering the keyword there are chances of spelling mistakes which create problems in information retrieval. He also discussed the current scenario creator that contains the profile name, profile description and keywords for searching. He further explained the type of the profile become public or private. The below mentioned figure is about the profile creation form.

![Profile Creation Form](image)

**Figure 13: Current Profile Design (Current Application Prototype Innovation lab)**

The issue highlighted in the interview was about the smartest way for searching keyword. He explained that in the current situation the searching is based on the very simple way like the searching on profile, searching of description and searching on the defined keywords. He said that this is not smart. He also added that the searching form is also lacking a design rules. As we looked at other searching forms like Google, yahoo, etc., these also contain a single box with a link on advance search. This advanced search caused some smarter type of filtering. The below mentioned figure is about searching in current condition.
4.3.2 The second interview

From the first interview we highlighted some issues from developing side. But this interview was not enough to give a solution. We took another interview with informatics students. First we made some general discussion about our thesis work and explained some ideas about the e-Me project as a personal assistant. He understood the key concepts of the e-Me project carefully. Then we came towards the final thing. We explained the current profile creator and then searching behavior of the system. Then we asked several questions like whether he feels easy to use this kind in the profile form. Was that easy to understand, and what about the searching way and implementation in the current system? The screen shot was available in the Swedish language, so first we translated the words in English. Then the interviewee gave some good suggestion about the system. He first replied that the profile creation is the most important factor for the smart filter. Although the design was simple and feasible for every user but after viewing the searching form he focused more on the searching way. He tried to find the advanced search option but he didn’t. So he came up with the suggestion that the smart filter should not consist of only these three boxes. In smart filter you should come up with some unique more features. He suggested that some of the users don’t care about spellings so these users don’t get the exact results although the results are stored. For such users, the search technique
should be different. He also added that the advanced search would make several combinations for information retrieval which would cause the users to satisfy from the system.

### 4.3.3 The Third Interview

Techleadz is a leading software house in developing web applications. Our interviewee was from this company. We first discussed about some formal searching ways and also got some overview about the value of searching. He explained briefly that information retrieval was always one of the headaches in any web application especially when the results were updated on a daily basis. He told us that the dynamic values are constantly updated and we have to look for the implemented changes. He explained that in SEO (Search Engine Optimization) technique the HTML pages are compared with some rules using one of the intelligent features. If the page, some time ago is ranked 12 but after some time these pages ranked higher using SEO then the rank is automatically updated between 1-11 pages because of the high level SEO intelligence. When we developed the application, we did not only think from the developer end but we also think from the user’s side, that which type of user interaction with the system and which type of design interface or technique we should have to build.

When we discussed about the smart filter, he explained that searching at user created environment is bit different from the general searching scenarios. In user created scenarios the user enters the text according to their perception. Thus we can’t give the information according to the users search. He explained with the example that the user searched for “technology” then result will come up with “bio technology” but the user interested in “computer technology”. So for these sorts of scenarios we try to place a help below the search box about how to search. He also mentioned that there should be some advance level searching mechanism for expert users for retrieval of exact information. These advance level filters also help the expert users to feel relaxed while searching information in fast and easy manner. One of the factors which user may feel annoying is no information retrieval e.g. in web application a user search for the some product, it’s good to show in return the information instead display system error message.

He further added that the social impact for such personal assistance may cause resistance. He explained that an advertising company earns against an Add by hitting the page is reduced as electronic personal assistance look for the changes and update the user for the required information instead of browsing the page which will cause the direct interaction with the webpage and the advertisement company will not be able to get any credit, however the user will get the information. We were trying to contact with companies but due to the language barrier we were unable to contact with them. After finalizing the interview we came up with an idea about how the design should look like for the smart filter.
4.3.4 Observation Procedure

After taking interview we came to know that more interviews we do more complex the system could be, so it’s better to take a view from limited people. In reality, if the interviewee will use our purposed system they would present some different perception because the technology is changing and new technology may give some good results from the previous implemented solutions.

Before the interview, we already have done a deep analysis of the smart filter but we wanted to learn more about the problem during interviews. During the interviews, we noted down all the information and we mostly focused when the interviewee gives some suggestion or views about the current system, more and more they explained, more and more we got answers about a single point.

One of the most important interviewees which we were not able to get was the companies. Because the companies are also a stakeholder of the e-Me project, and they didn’t have much time for the interview and secondly there were mostly Swedish speaking employees. So, for us, it was hard to hire someone who could translate Swedish. At the end we almost finalized our work in the form of a prototype which will be shown in coming chapters.

4.4 Empirical Research Results

This section gives some overview of the empirical results which covers the answer of our research questions. The empirical results give the overview about the current system that how they feel when they use the current system and which type of changes they needed to make it better according to their viewer. As information retrieval is not a minor problem, from decades, researchers are working on it to give better, fast, reliable and easy approach to users. From the interview, we came to know that the user needs simple and relevant information. We also came to know that some times, users don’t bother about the spellings and try to search the information with the wrong spellings. From the interviews, we were able to get the answers of our research questions.

According to 1st research question, the design for the smart filter should be different from the current design. As to the first question, the interviewee showed us scenario by making a profile and then search the information using the search form. During searching, we analysed that the design should be kept simple which is understandable by the general users. We, at the end of the interview explained about the changing of the design for better results and the interviewee expected that this could be one of the solutions. In our purpose solution we planned to manage the user keywords in the categorised format for the smart retrieval of information.

From 2nd and the 3rd interview, we were able to get the answer of intelligence and social impact using the smart filter. By observing the 2nd interviewee’s answer, we were able to think about the different aspects of information retrieval that could help to build the smart filter. The points which will help us in making smart filter
intelligent are the layout of the information retrieved. This was the idea that we picked after interviewing Techleadz software house employee. He further added that the layout also contains advanced search criteria instead of placing text boxes with the current design.

The social aspects are also considered which was highlighted by the 3rd interviewee. This kind of systems makes the community to interact with each other through an electronic system or may cause some economic issues to some of the business community. So during the implementation of such systems, these business entities also merge during the development process to make the system successful.
5 Empirical Study

In this chapter author analyses the theoretical and empirical findings. The comparison of theoretical findings done with the empirical results and then show the results in the form of smart filter screen prototypes.

5.1 Analysis

The result of theoretical and empirical study findings have been analyzed through comparative analysis method. The Analysis chapter is backbone of the research work. In our research, we wanted to create deeper, concise and meaningful knowledge for the users/researchers in the form of smart filter using comparative analysis. Our research sub questions have been used as “Frame of Reference”. Under the frame of reference, we have identified the problem, created an idea using question and observations and studied theory to validate our results in the form of screen prototype. The “Ground of Comparison” in our research relates interaction design principles with focus on user-centered design, usability and as well as intelligent search agent for the efficient way of information retrieval in the e-Me project i.e. smart filter. The “Thesis” includes three sub-questions in our research work to perform comparative analysis to produce meaningful results in the form of smart filter screen prototypes. It has been utilized according to the requirement of comparison analysis method by using theoretical and empirical findings in our research. According to the context of “Organizational Scheme”, our research analysis focused on “point-by-point” in comparative analysis by the debate of theoretical and empirical findings.

How the profile creation looks like in the smart filter to make information retrieval intelligent?

In chapter 3, we have discussed about the artificial intelligence. The intelligent behaviour makes the system more effective and efficient. If we bring the intelligence out of any system then that system is not useful. Information retrieval is working on the basis of intelligent search agent and if we bring out this agent out of the system then this system never retrieves the information because the agent is not present there. But this agent has some requirement to fulfil the work. Sometimes, this agent works and sometimes not. During the interview, we found that this agent simply works on the basis of comparing the keywords with the user input. These keywords are stored in the form of a profile which is created by the user. During the interview, we also found that the profile structure should be in the form of the tree like structure which helps the agent to perform works more efficiently. At the time of profile creation the user should input the keywords in the defined category and these categories are maintained by the administrator.

Artificial intelligence is not defined, it is created. Smart filter is based on the defined rules but if the rules are not created in a defined pattern, then we are unable to create artificial intelligence. In profile creation, simplicity is also considered for every user. In the current system the defined pattern is simple but not intelligent. Using this
pattern, it is unable to create an intelligent system in the form of smart filter. That’s why the profile creation form needs to be redesigned.

**What are the draw backs in the current searching way that could be needed to redesign for the betterment of information retrieval?**

As in chapter 3, we have explained about the user-cantered design, usability and user interaction design. During the interview, we have also observed that the results are restricted around these terminologies. As if we talk about IT system, the system should be user friendly and easy to use. While interviewing the most of interviewees, we also talked about the user design. It means that after viewing the current screen shot of the system, they feel that it needs some better design. During the interview we found that the main focus of the searching way was revolving around the simplicity and advance search. One of the interviewees explained that the three search boxes shifts to advanced search. This advanced search will give much better way of searching.

As we already discussed about the intelligence in the previous question, but in advance search, the intelligence is still the main part. As the pattern of keyword searching is based on the combination of scenarios. These combinations require searching data in efficient and effective way and it is only possible if the data is gathered in an intelligent way. During the interview, the interviewer discussed about the spelling problems which may cause the irrelevant information retrieval. For these sorts of outcomes, the searching technique should base on the selection instead of typing the keyword. The intelligence in smart filter is implemented by taking the initiative of the redesign of the profile form which already has been discussed in the previous chapter. One of the interviewees gave us some help tips of how should be the advance search look likes. By keeping in view, we have tried to give the prototype for the advanced search which will be displayed at the end of this chapter.

**What are the social impacts after implementing such services?**

IT plays an important role to streamline the daily work in effective and efficient way. Where there are advantages of the system, there are also some disadvantages. Compared to disadvantages, advantages of the system are many, so these minor disadvantages are neglected by the society. As we look around, there are a number of social activity sites that are getting popular day by day, but there are disadvantages i.e. the physical interaction. The e-Me project also called electronic personal assistant that will provide the best solution for the user to visit all the required websites to update them. During the interview the interviewee also highlighted the impact of these services on the market. The main impact of these services is directed towards the advertisement companies who earn by placing their ads on the popular site e.g. Google, AltaVista, Yahoo etc. When the user searches for some information and when the user views his/her relevant information, the advertisement on that page is viewed by the user. By implementing such services, the page is then electronically visited by the system and the user gets the information without viewing the page. Advertisement is the main source of any business or product for profit. Interviewees also put focus on this sort of social impact on the market.
5.2 Result summary

The result summary of our research questions is streamlined in the form of screen prototypes. The results are displayed in the form of prototypes which answers all of the questions. For our research, we have consulted from many web interfaces to analyze our empirical and theoretical data to conclude final results. We have tried to redesign the current profile form to make the required information retrieval system more efficient and effective. We have tried to remove the drawbacks in the current searching way by redesigning the form and adding the functionality of user friendly interface as well as the advance search technique to filter the data according to the users needs. The social impact of these services is also kept in mind and thus we have tried to give the newsletter subscription to overcome the impact to some extent.

The entire research question will help to sort out the problem in effective and efficient manner and define the new path to think about the betterment of the smart filter. We have tried to develop these screen prototypes by viewing the number of applications running around and have provided overview after analyzing the interview results. Although these are just screen prototypes as we have not put the real application source code neither we have used their environment to implement our prototype because of security reasons. But these screen prototypes are enough to work as a smart filter in the e-Me project.

We have tried to figure out the main issues about the current application i.e. Profile creation and redesign the form after conducting the interviews to make the application more intelligent. The second question was about the searching technique used in the current application that was also redesigning by analysing the interviewee observation. Mostly, user’s need the filtered information according to their needs which is not possible in current application where as our redesigned searching form will help the user to search the information according to their needs. The social impacts of these services are also kept in mind and will be handled by placing the proposal of electronic newsletter registration about particular services.

5.2.1 Screen Prototype of Profile Creation Form

As in chapter 4, we have already mentioned about the profile creation form which highlighted during interviews. Keeping in view, we have tried to redesign the form which will make the user to search in efficient and effective way. In this prototype, we have added tree like structure which will help to categorize the user keywords and these categorizations will help to search better than free keyword search.
In the above mentioned screen prototype, the addition of category “head” made the profile form different from previous one. As we look that if any user adds the keyword in the head of an automobile and the user enter the keyword “bike” or “heavy bike” for a search, the user search in the head of an automobile and the results will be displayed because both of the keywords belong to the same head.

5.2.2 Screen Prototype for Searching

The research question is more related to smart filter. As in the previous discussion, we also came to know that the information retrieval process should be efficient and effective. If we look at previous design mentioned in chapter 4, it is somehow restricted to search in a general way like search through profile, description and keyword. But if we plan to search on some scenarios like profile name and description then we have to give some different search techniques. In the below mentioned screen, we will first give the general design for the search form which will contain “help” and “advanced” link. This screen prototype retrieves information on the basis of keywords which are entered during profile creation. The advanced tab will then be used to retrieve information by expert users or by making scenarios of different keywords, profile name or description.
Figure 16: Normal Search Box New Design

The above screen prototype is the general form prototype screen which will first display on the user screen when the users click for searching information. The below mentioned prototype screen is for advanced search which will be used by advanced users or general user for information retrieval by making different scenarios. During the interview, we found that the interviewee tries to find the advanced search option and in empirical study we highlighted the need of advanced search.
By using the above screen prototype, the advance type of information retrieval is possible. As compared to previous screen mentioned in chapter 4, this option is not available. By using the advanced search option, the user will be able to retrieve information according to different scenarios e.g. the user wants to search the information in which:

- The profile name is “ABC”.
- Category is “Automobile”, “House” and “Bank”

But the user input the keyword “apartment” instead of “house”, the advanced search will display the information according to the user required criteria as the category will not bother about the keywords.

By using the advanced search the user will be able to have the grip on following functionalities.

1. More control on matching / information retrieval
2. Scoping
3. Managed output control (in the form of paging, sorting aspects)
6 Discussion

This chapter consists of discussions about research work in the form of method and result evolution. This discussion at the end defines some implication in the informatics.

6.1 Conclusion

In the current system, we were unable to retrieve the information in efficient and effective way. At present, the profile creation is not enough to make the data retrieval intelligent. The information retrieval in filtered form is also not possible because of lacking advanced search techniques.

We can reduce the possibility of irrelevant data, but still there are some obstacles which need to be refined. In our research, the main focus revolves around the smarter way of the information retrieval. We started research on how the smartness can be brought into the system, and then we implemented some rules which will make the system smarter and more efficient. The development in technology is also updating the rules day by day. As we look around, there are a number of complex IT systems deployed. These systems work on the basis of some infrastructure.

One of the purposes of these systems is to store data or to retrieve data. But these systems are ranked with others on the basis of efficiency and effectiveness. If we talk about search engine, the answer should be Google because of its efficiency and effectiveness. Google just uses IT rules in a smarter way and makes a smarter system. By keeping in view, we also focused on the core concepts which we observed during interviews to build a smarter way for information retrieval in the form of smart filter. By placing the Venn Diagram, we are able to give the smartest way for information retrieval. The user-centred design, human computer interaction, usability and intelligent search agent, all of these play important role to build a smarter system. If we neglect any one of these aspects, the system wouldn’t work smartly. To keep in view the above mentioned aspects, we have tried to give a smarter design for information retrieval in the form of smart filter.

The research was not possible by only studying theoretical part but the empirical part also plays its role to sort out the best possible solution for the smart filter. Through our findings from theoretical and empirical part, we have been able to come up with a model which will fulfil the required aspects as defined in theoretical part and observed by different interviewee during the empirical study.

6.2 Implication for Informatics

The informatics works a lot for the betterment of mankind and is still adding more by different research work. Our research mainly revolves around the core concepts of IT artifacts i.e. Human computer interaction, design principles, system development process etc. During research we have tried to implement these key concepts mentioned in Chapter 2 with detail to present the prototype of smart filter.
In the discipline of an information system, someone thinks about to search the record from three or four books in seconds, that seems to be impossible, but informatics has made it possible. Informatics has given a new era of utilizing the information system in a better and efficient way. By studying the concepts of informatics, we are able to give a better information retrieval system in the form of smart filter. This research will lead the developers to think about other aspects of the smart filter which is not covered in this research topic.

As we talk about the implication of informatics from user-end, it is defined that the user will now be able to achieve the work using informatics in an efficient and effective way. As decades ago, the organization or business man kept accounting records in the form of bookkeeping and when they tried to find some information, it took them hours, days or even months to find the information on a particular record. With the passage of time, IT revolution changed the mind-set of doing such complex jobs in seconds. Informatics is still in the way and has merged with artificial intelligence to build a better system for mankind. Informatics is not only helping the scientist to explore the earth or the sky but its implications can be seen easily for the betterment of the mankind to serve in a better way.

In our thesis we have also tried to do some betterment in the e-Me project in the form of smart filter. As the e-Me project is one of the information based system which looks after the user required information in an efficient way instead of the user for doing the whole stuff manually. In our research, we have tried to give the best way for information retrieval with regards to the current system. We have tried to give some different perspective for searching data and it was not possible without gathering information from different users. As of today, the human beings are getting benefits from these informatics based systems but these systems are successfully implemented by getting interviews, observations and research work of the respective field. If we talk about the information retrieval system, there are number of examples in front of us like a barcode reader machine, figure print scanning and search engines and these all are the type of information retrieval systems working well in their implemented field.

6.3 Method Evaluation

The evaluation method leads the research work to evaluate the facts and findings of related aspects accordingly. In our research work we have tried to evaluate our finding using theoretical study and through empirical study in the form of an interview. These interviews also give us the way to observe differently, which we can’t do before interviews. In our research work, the problem is to find the best solution for filtering the information in efficient and effective way in the form of smart filter. The information retrieval is not consisting of single aspect. For understanding, we have understood different aspects; we have studied different theories and have done the research work to find out the core aspects which has helped us to streamline our work. As we discussed above that the previous research work and theories were not enough to sort out the problem and just gave an overview, so these aspects should be considered to solve a related problem. Theoretical area helped us to streamline the
research work and to verify theoretical findings we arranged some. To make our research in the top, we conducted several interviews from where we were able to get that what aspects are taken on a priority basis to make our research work in a positive way. During the interview, we noted down these answers and observed them according to theoretical finding. These observations will help us to give answers to our entire research question in easy manners, which will help us to develop an effective and efficient information retrieval system in the form of smart filter.

As we discussed above that we only dig out the major aspects from theoretical finding which will be considered more like user-centered design, human computer interaction and artificial intelligence, but only theoretical study is not enough. For this reason, the empirical study is done in the form of interviews. For the interview, we have tried to fix a meeting with a different group of people including general users, developers, researchers, students etc., and we were only able to conduct the interview from a limited number of people. We tried to conduct the interview from companies, but due to the lack of time from companies and the language barrier issue. So we were unable to conduct any interview with companies.

If we were able to conduct more and more interviews we would be able to come up with better results. However we have tried to cover up the potential outcome through interviewing with developers and from general users. By observing their thoughts, we have streamlined their thinking and summed up together in the form of smart filter screen prototypes.

6.4 Result Evaluation

In our research, we have conducted theoretical and empirical study to come up with a prototype screen that how the smart filter should look like. As we discussed in 2.10 about the evaluation method which was based on
- Validity
- Data quality
- Feedback

6.4.1 Validity

Validity is termed as the evaluation of the results on some predefined patterns as discussed in chapter 2. It is subjective in nature as we have to cross check the results. In our research we figured out the aspects from theoretical findings, and we validated these aspects through empirical study. These aspects need to be validated through empirical finding because theoretical finding is based on logics and during implementations sometimes the logics do not fulfil the requirements because of logical interpretation.

6.4.2 Data Quality

Data quality gives the authenticity of the required action whether it is done in proper manners and results are satisfactory or not. We gathered more and more information about a particular subject and then verified it with empirical study to evaluate our collected data.
6.4.3 Feedback

Feedback plays an important role after implementation of the newly or upgraded task. In our research we have tried to explain the already defined system and got feedback in the form of an interview to produce the best design in the form of smart filter. For evaluation of system there are two types of methods

- Green box evaluation
- Black box evaluation

Green box evaluation is the evaluation method in which the individual component of the system is evaluated. In black box evaluation, the evaluation of system is done as a whole (Michael F. Mctear, 2002).

In our research we didn’t use black box evolution as we haven't yet implemented. We cannot evaluate our research results from a mathematical formula as we didn’t use a quantitative approach to research. The evaluation method is based on the basis of target groups who will give feedback and by implementing these feedbacks we will be able to increase the strength of the system.

During research, we studied the different theories and empirical results from different sources. By implementing or showing the above mentioned screen shots, we do not criticise on the developers of the current application. We have just evaluated according to theories and empirical studies. “It is important that study is guided by good ethical and has high ethical survey”. (Ann Lind, 2005).

6.5 Possible to generalize

The research is done through theoretical and empirical finding, verified by analysis and come up with some solution in the form of a smart filter prototype. The results which we have done during theoretical and empirical finding are from different resources and literature. In information system, the information retrieval is considered to be the main part. As at management level, they want the information in efficient and effective way. If we talk about the other IT systems, they are also able to get an idea to build a smart filter according to their need to boost up the information retrieval. Our thesis work gives benefits for both the business and society by putting some extra effort in our research work for better results.

6.6 Ideas for continued research

In our research, we also mentioned about social impact on the market but we will not be able to touch this issue. The other option which we are unable to streamline in our research work is about the geographical information intelligence filter which will cause more effective and efficient information retrieval process. These two are just the ideas which we observed during the empirical data analysis.

These ideas will initiate another research work which will have a different aspect to think instead of the defined aspects of the current research. In our research, these ideas will lead towards a different path and because of the limited time we were not able to define these kinds of points in our research work.
REFERENCES


63. (Stake, 1995) Stake, R., 1995 : The art of case study research, California: SAGE.


University of Borås is a modern university in the city center. We give courses in business administration and informatics, library and information science, fashion and textiles, behavioral sciences and teacher education, engineering and health sciences.

In the School of Business and Informatics (IDA), we have focused on the students' future needs. Therefore we have created programs in which employability is a key word. Subject integration and contextualization are other important concepts. The department has a closeness, both between students and teachers as well as between industry and education.

Our courses in business administration give students the opportunity to learn more about different businesses and governments and how governance and organization of these activities take place. They may also learn about society development and organizations' adaptation to the outside world. They have the opportunity to improve their ability to analyze, develop and control activities, whether they want to engage in auditing, management or marketing.

Among our IT courses, there's always something for those who want to design the future of IT-based communications, analyze the needs and demands on organizations' information to design their content structures, integrating IT and business development, developing their ability to analyze and design business processes or focus on programming and development of good use of IT in enterprises and organizations.

The research in the school is well recognized and oriented towards professionalism as well as design and development. The overall research profile is Business-IT-Services which combine knowledge and skills in informatics as well as in business administration. The research is profession-oriented, which is reflected in the research, in many cases conducted on action research-based grounds, with businesses and government organizations at local, national and international arenas. The research design and professional orientation is manifested also in InnovationLab, which is the department’s and university's unit for research-supporting system development.