

Master Thesis
Computer Science
Thesis no: MCS-2009-18
June 2009



Finding Social Location Using Bluetooth

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This thesis is submitted to the Department of Interaction and System Design, School of Computing at Blekinge Institute of Technology in partial fulfillment of the requirements for the degree of Master of Science in Computer Science. The thesis is equivalent to 20 weeks of full time studies.

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ABSTRACT

From the last few years many location based system have been introduced e.g. facebook, orkut, youtube and my-space etc. These networks are specially developed for personal computers. Some location based systems are also introduced for mobile device e.g. Plazes, MamJam, Slam and Jambo. All these type of networks are using the concept of social location, which provides the platform where people can join or make communities according to their interests. Numbers of users on these networks are increasing day by day due to their popularity. This popularity gives the opportunity for researchers to explore the characteristics of these social networks at large scale. This knowledge will be then used to improve the existing networks or to develop new networks. Already developed systems for mobile devices are using different techniques (e.g. Radio Frequency Identification, GPS, GSM, WAP etc.) to determine the location of any person. In this thesis, I am going to develop a prototype of system that will find the social location of an individual using passive Bluetooth scanning of mobile devices. The main idea behind this prototype is that the data obtained should be flexible to target different social needs and as well as different social location applications. The research will explore some more areas of Bluetooth by extending its dimension in social location system. The expected output from this research will help human being to overcome some of their social problems. Social location obtained from the prototype can be used to fulfill different social needs of human being.

Keywords:

Social location, Bluetooth, Physical location, GPRS, Mobile applications.

ACKNOWLEDGEMENT

First of all I would like to thank to almighty Allah who gave me courage and patience during the whole time of this project. I am thankful to Guohua Bai & Yang Liu (Internal Supervisors) for her continuous advice, guidance and help we received throughout our research work. The visions and experience were vital to shape our raw ideas to this dissertation.

I would like to thank my friends Mr. Muhammad Shohaib, Vickey Wadhvani, , Mr. Muhammad Akram and Umer Ghauri, who helped me a lot to complete this mile stone.

Last but not least, I would like to thank my parents, my brothers and my sisters for their support and for making it possible for me to pursue my professional goals.

Umer Hayat

*Dedicated To
My Loving
&
Caring
Family*

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INTRODUCTION

A location based system used the mobile devices and mobile network to provide the information and/or entertainment services. This system uses the geographical position of mobile instrument [6, 7]. In past few years many location based system have been introduced, these location based systems can be divided into two categories (i.e. Physical location based system and social location based system). All applications of physical location systems are based on physical positioning, which allow its user to get the information of other geographical users position [4]. The physical position can be defined as a point by its longitude/latitude or a point plus distance. The other category of location based system does not depend on physical position rather they use Social location.

The main reason for the introduction of these systems is the complexity of human being. Because the social location is more important for a person then its physical location. Social Location is different from physical location; it is not concerned with the geographical or physical position of person. Social location can be defined as a position of human being in a given society and culture. [1]

There are many computer based applications that provides platform where people can join or make communities based on common interests. In these days many online systems are available that have social location on their core concept; e.g. Orkut, Facebook, YouTube and My space (see Section 2.2 for details) are only a few of them. These networks are getting popularity day-by-day, number of users are also increasing continuously. This popularity gives the opportunity for researchers to explore the characteristics of these social networks at large scale. This knowledge will be then used to improve the existing networks or to develop new networks. [14]

Computer is not portable as mobile. In advance countries, most of the people carry mobile with them where ever they go. That is why many researchers and practitioners are making social applications for mobile devices. Seyed Hossein Siadat and Selamat Ali [5] presented a prototype for location-base service in their paper which is using Radio Frequency Identification (RFID) to resolve or determine the location of its users. Also See Section 2.3 for some famous social applications of mobile.

All of these systems were developed using different technologies such as GPS, GSM, Network Operator, WAP etc. but there is not much work has been done in social location by using Bluetooth. The use of Bluetooth in social location applications is very rare as

compared to other technologies. In this thesis I am going to develop a prototype that will find the social location of person using Bluetooth. Further more I will investigate the use of social location determine by Bluetooth in different social application and will also investigate that the social location determine from Bluetooth is good enough to used in different social location application

CHAPTER 1: PROBLEM DEFINITION/GOALS

1.1 Research discipline and application area

This research topic lies in the discipline of Computer Science and is related to design and development of a prototype. In this thesis, I am going to develop a prototype of system that will find the social location of an individual using passive Bluetooth scanning. The main idea behind this prototype is that the data obtained should be flexible to target different social needs and as well as different social location applications. The research will explore some more area of Bluetooth by extending its dimension in social location system.

- Literature review for an overview work that has been done in the area of social location applications.
- To find other technologies except Bluetooth to determining social location of a person.
- To develop a prototype which will determine social location of a person using Bluetooth
- To evaluate the result of developed social location's prototype.
- To find applicability of determine social location in different social location applications.

1.2 Challenge/Problem focus

1.2.1 Problems or Research Questions

I shall try to give the answers of following research questions in this thesis.

1. What literature offers about prototyping and social location?
2. What other alternative technologies are there for developing such application?
3. How to develop a prototype to determine social location of a person?
4. How we can calculate the results of developed prototype?
5. What are the applicability of determine from social location prototype in different social location applications?

1.2.2 Why problem or questions are important

Social location systems [29] have recently gained much importance from the world. In last two decades many social location systems have been developed, the most famous are Facebook and Orkut in computer science, in same way many applications also have been developed for mobiles phone.

Mobile phone is a very common gadget; this gadget is very useful in the area of social location system. In these days almost every mobile equipped with Bluetooth in it. This research problem will focus on the potential use of passive Bluetooth scanning for social location systems.

1.3 Goal/Results

1.3.1 Our Contribution

The expected outcome from the study will be a prototype that will determine the social location of an individual using passive Bluetooth scanning. This prototype will be flexible enough to be used for different social location needs. The study will also result a report that will explain existing work on social location systems till now. The report from the study will also contain the detailed description of the main theme and the developed prototype. In simple our contribution will be as follows;

- A detailed literature overview of social location applications
- A detailed overview of alternative technologies to develop social location prototype.
- A prototype will be developed to determine social location of a person.
- The use of determine social location in different social location applications

The expected output from this research will help human being to overcome some of their social problems. Social location obtained from the prototype can be used to fulfill different social needs of human being.

CHAPTER 2: BACKGROUND

2.1 Social Networks

Social networks have received a lot of attention recently; different researchers already have explored different aspects of social networks (see e.g., [15, 16, 17, 19, 20, and 21]). These networks are some how complex if we compare them with other type of networks. Steve Jones define social network as *“When a computer network connects people or organizations, it is a social network. Just as a computer network is a set of machines connected by a set of cables, a social network is a set of people (or organization or other social entities) connected by a set of social relations, such as friendship, co-working or information exchange”* [13].

As it is discussed in introduction part, a location based social systems used the mobile devices and mobile network to provide the information and/or entertainment services. This system uses the geographical position of mobile instrument [6 and 7]. Inner philosophy of all these online social networks (e.g MySpace, Orkut, Facebook etc) based upon the friendship. This type of friendship is called virtual or online friendship that may be different from real or offline friendship.

In [9] researchers have investigated the major difference between virtual and real friends but not given any quantitative facts of difference between them. Some numerical facts are presented in [10, 11, and 12] to show the relationship between offline and online friends.

2.1.1 Structure of Social Networks

Structure of social networks based on the mesh topology of interrelated nodes. When a human-being or user makes its account in any of these networks or done its registration, then he or she becomes the member of this network, and this member is called the one node of that social network. Now it is also possible that one person can have more then one account to represent different groups or may be for some other reasons [8]. Social networks can be shown in the form of graph. The relationship between nodes is shown by ties. In this graph representation nodes can be shown as points in graph and ties between these points are shown by lines in graph, as shown in fig 1.

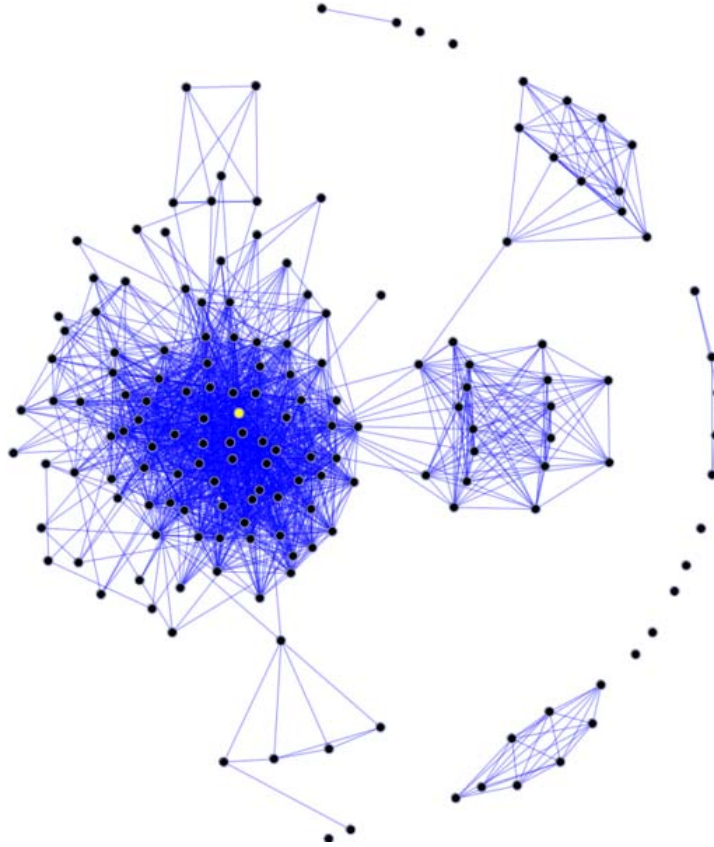


Figure 1: A social network diagram [24]

Structure of social networks is considered as the complex. This type of networks hold common properties like small world, scale free, community structure, and self similarity. This type of networks also has a special property called navigability [18].

Yanqing Hu et al. [18] performed the research on social networks and produced the empirical results on it. According to [18] their study the “*distance distribution between friendship is scale invariant. The distribution is about $Pr(d) \propto d^{-1}$ which is an important and universal property for social network. It not only makes our social network is navigable but most importantly it can benefit individuals for searching information.*”

2.1.2 Types of Social Networks

Social networks are further divided into “*internal social networking (ISN)*” [22] and “*external social networking (ESN)*” [23];

2.1.2.1 Internal Social Network

Internal social networks are based on private or close communities. It consists of the peoples those belong to same company, same society, same university or college etc. These types of networks are not open for every one. Only selected peoples will be the part of that network.

2.1.2.2 External Social Networking

External social networks are not for specific group or for specific company. Any one can join this network. He/she can share his views with other, to find any other existing users, checking the profile of other user etc. Popular examples of ESN are MySpace, Facebook etc.

2.1.3 Social Network Site (SNSs)

Social networks sites are increasing day by day, and these networks are attracting million of users all over the world. Most common example of these networks is Orkut, Facebook, LinkedIn etc. This social networks site provides the facility every member, to share views at any topic with other member of that network, helps to understand the culture of different nationalities. [25]

First social network site SixDegrees.com was published on internet in 1997. In start this first social network provides the facilities like registration and making profile, which was further upgraded in 1998 and provide the facility to list the friends. After this many other social networks sites (e.g. LiveJournal, BlackPlanet, Cyworld etc) have been introduced, as shown in figure 2; [25]

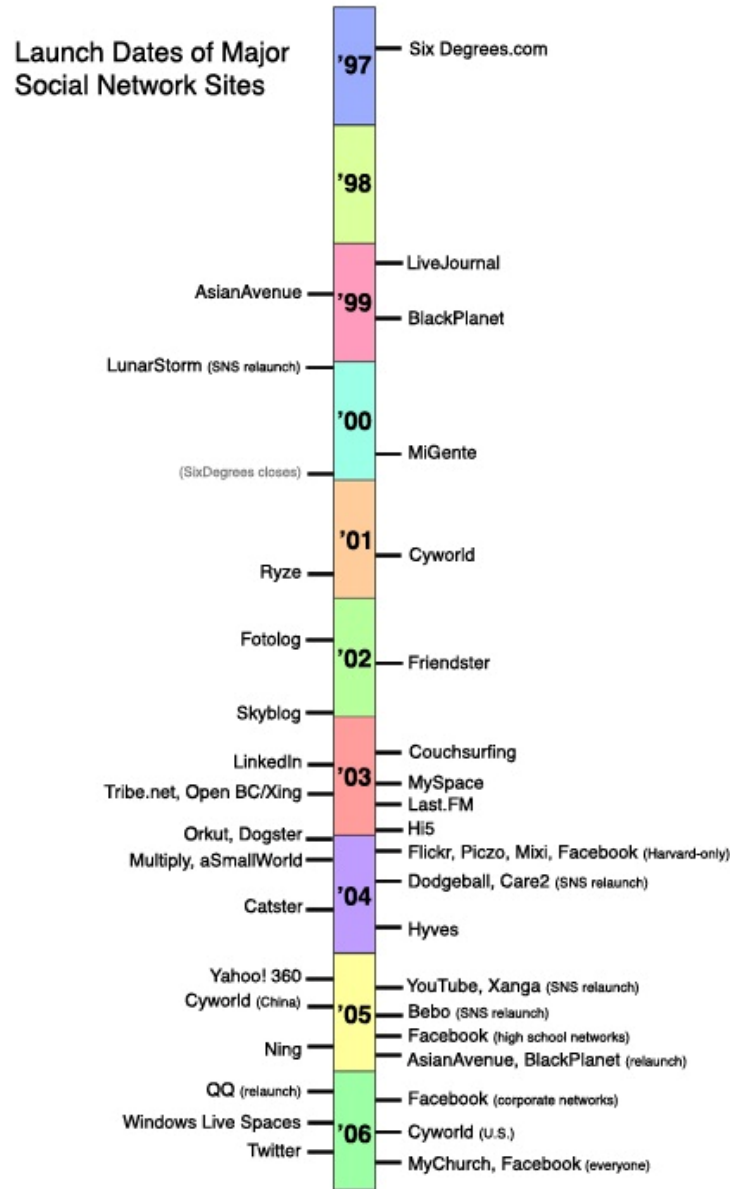


Figure 2: Launch year of major Social Network sites [25]

2.2 Online systems having social location on their core concept

Following are the some popular online systems which have concept of social location in their development.

2.2.1 Face Book

Face Book is one of the prominent site that connects people based on their common interests like music, favorites, game, politics, religion, profession etc. It is very popular among

student. Face Book require school/college email or login id to join the communities of that institution, due to this the communities are more reliable and strong [2]. Popularity of face book is increasing day by day. It has started his journey from U.S in 2004 and now its users are spread all over the world. According to [28] in 2007 it has more then 21 million users all over the world. In 2006 new version of facebook was introduced, which contain support for commercial organization to make communities. Almost 15 million US visitors visit facebook every month [29].

2.2.2 Orkut

Orkut is social application owned by Google. It allows people to make their profile, share videos, pictures, finding people of same interests, business, hobbies, faith location etc. It allows joining via Google account or by making a separate login for Orkut [2]. Its name based on its author Orkut Buyukkokten. Most of its users belong to Brazil and India (i.e. in May 2008 about 49.74% users from Brazil and 17.32% from India).

2.2.3 My Space

It is highly popular social site where people can make friends and stay in touch by messages, blogs, and by leaving comments. It is highly popular in teens and provides an environment to build peer relation [2]. MySpace has more then 47 million US visitor every month. In ranking MySpace is at sixth position in SNSs. [29]

2.2.4 LinkedIn

LinkedIn is a powerful social application to start and maintain relationship. It is also considered as the online business network. This network is especially for high profile peoples from industries or other organizations. Members can share their views on this network to help other members and vice versa. Average age of peoples that join this network is 41 years. LinkedIn is growing regularly, and have more then 40 million users all over the world. It is estimated that in 2008 about 12 million peoples join this network. [31]

There are some very helpful tools to built LinkedIn network quickly. One of them is outlook toolbar which automatically check who is already member of LinkedIn and send the request to his or her existing email contacts [32].

2.3 Social applications of Mobile Devices

“Social location is an emerging concept built on principles that are at the heart of mobile’s DNA. It results from the combination of two key trends: the growing interest in geo-localized

offerings, and the expansion of social networking in the mobile space". Social applications for mobile devices are getting popularity day-by-day. But currently in European countries only 2% mobile users are using these applications. [33]

Following are some available social application for mobile devices;

2.3.1 Plazes

It is a mobile based application and used through web. It shares information in terms of location. It facilitates to announce your location and see the friends in that area or their location across the world. This service also provides the facility to see the location of other peoples those are not your friends. [2]

2.3.2 MamJam

It is used in UK. By using this application the user send the sms to the server and in reply the server sends the id of person in same area for chat [2]

2.3.3 Slam

It is a mobile based application that uses the http messaging service. It facilitates the group messaging and photo sharing. The msg sent to group will be received by every member of that group [2].

2.3.4 Jambo

It helps to meet people of similar interests. Make profile, describe interests, upload picture, chose social groups. When the people of same group will be in the same area Jambo will inform you [2].

2.3.5 TunA

TunA is a peer-to-peer application for mobile devices to share music and other resources without the help of any central server. This application also provides the facility to check what other members are listening on their tunA devices [38]. Member can make their own profile, share their experiences on different music albums, book-marking songs and persons, buying and selling songs. TunA devices communicate with each other using ad-hoc 802.11b wireless connections [34].

There are some other applications that also provide the facility to share music between users. These applications are closely related to tunA e.g Soundpryer [35], Bubbles [36], Sotto Voce [37] etc.

CHAPTER 3: PROTOTYPING AS RESEARCH METHODOLOGY

3.1 Research Strategy

“Research methodology is a process through which we attempt to achieve systematically and with the support of data the answer to a question, the resolution of a problem, or a greater understanding of a phenomenon” [39].

To complete my research report I have chosen prototyping as a research methodology. Purpose of prototype development is to get the proof of concept, to find out the answer of hypothesis or research questions that are designed in research proposal. In recent years this methodology of prototyping is getting popularity in designing information systems [43], decision support systems [40], and expert systems [41]. It provides the framework to evaluate the designed hypothesis or questions. This methodology is best because of many reasons, one of them is that when we have some new idea and want to test that this new idea will be successful or not. We shall loss money, energy and time or we shall earn from this new concept and get the attention of our audience. I have chosen prototyping as research methodology because; this was a new idea that it is possible to build social location application by using Bluetooth scanning. This chapter briefly describes the way, I have achieved my goals.

3.1.1 Preparation for my Research Work

Preparation for research is first step towards the research study, which involves studying the work of other researchers and to judge their research work. This also involves find-out how the research of others will be benefited for me. According to [42], in qualitative research there are six different methods for data collection i.e. Surveys & Questionnaires, Interviews & focus groups, Observations, Document reviews, Tests & Assessments, and Secondary Source & Data Reviews. All these techniques have some advantages and also few challenges.

To complete my thesis report, I have done a detailed literature study. This literature review or study includes the work that is already performed on my chosen topic. I have studied different research articles and books that are written on social location networks and social location applications. After reviewing different data, then I have made selection of most suitable research papers, books and conference data for my research report.

3.1.2 Technology chosen for the development of prototype

Throughout my literature study, I also have done my investigations to find which technology will be the best for the development of prototype for the topic under research. During the selection of technology, I was keen to find a programming language that fulfills all the basic requirements to reach my defined goals.

I have chosen J2ME, J2EE (especially Servlets and JSPs), XML, MySQL to develop the prototype for social location tracking system using passive Bluetooth scanning. I have chosen J2ME & J2EE because it provides the *Ubiquitous, robust, flexible user interface, forceful security and built-in-protocol for network* platform for mobile application development. One other reason to select Java ME was that it provides the portability for many existing devices. The ultimate goal of this application is to enable mobile so that it could behave according to user's location.

Actual development of my location based prototype based on client/server architecture. J2ME is used to develop Client, therefore it will runs on the mobile phone of user and server is developed using J2EE. Basic functionality of server is; to get all the scanees's information via http protocol over the internet and then save it in database. Complete working functionality of client and server is discussed in chapter 4 named "Discussion and Analysis".

Quantitative research is divided into four different parts, like Descriptive, Co-relational, Cause-comparative and Experimental. To fulfill the quantitative part of my research I have done some experiments on my build prototype to check that it is working according to designed hypothesis or there is some mismatch. An experiment is a good technique for scientific study or research. Experiment can be performed to produce data, results, to check validity of underlying theory or to check correction of available data. Also this technique is flexible to use with systems and human beings

3.1.3 Originality, Relevance and Validity of research study

Originality, Relevance, and validity are very important factors in any type of research study. These factors must be fulfilled to write a good quality research report or paper.

To prove the originality, relevance and validity of my research work, I have used the valid, suitable and up-to-dated reference from the work that is already done on my chosen field of computer science. I have taken the help from different books; research papers and conference data published or presented on social location networks, Bluetooth device and

social location applications that currently exist or already developed and those applications are fully functional. To achieve the relevance of all my work, I am completely based upon the already proven research.

3.1.4 Software Prototype

As it is discussed earlier that prototyping strategy is good choice to get the proof of topic which is under research. Prototyping is also provides an excellent way to convert ideas to implementation at the early stage of software development. This technique helps the developers to check or calculate the quality of proposed software system. Planning and execution of development process can be change after checking the results of our prototype at early stage before actual development process starts. [27]

3.1.5 Designing Software for mobile devices

To design software for mobile devices is always a challenging task. During implementation, other than hardware limitations, we also have to keep in mind different restriction like *“interaction modalities, diversity and portability, their pervasiveness and multi purpose functionality”*. [26]

3.2 Proposed Prototype for Mobile devices

I have chosen to develop prototype before implementing the actual software for mobile devices due to following reasons.

- Prototype always helpful for developers at start to enhance the development process.
- It helps to improve the quality of product.
- It's better to find the problem at early stage of development process.
- This can be better to reduce the development cost for system.
- Prototyping is very good technique to involve the users in system and get valuable comments from them.

3.2.1 Mobile Phone Platform

I have chosen mobile phone platform to test my social location prototype. The mobile phone which providing the facility of Bluetooth and 3G can work for this prototype. One needs to connect to internet to check the results by using this prototype.

3.2.2 Location Sensing

Many sources are available to determine the location of mobile phones, like GPS, leverage location technology etc. GPS is not so good because we need some extra hardware to deploy mobile application and also GPS have some coverage problems i.e it may problem indoor. [30] I am going to use Bluetooth and Internet to sense the location of mobile device.

Output from my study will be a prototype for mobile devices that will find the social location of an individual using passive Bluetooth scanning. I have selected the strategy of scanning Bluetooth because these days almost every mobile phone is equipped with Bluetooth. The main idea behind this prototype development is that the data obtained should be flexible to target different social needs and as well as different social location applications.

CHAPTER 4: DISCUSSION AND ANALYSIS

4.1 Social Location Tracking System using Passive Bluetooth Scanning

A Client/Server Application developed using J2ME and J2EE to find the social location of the user. The ultimate goal of this application is to enable mobile so that it could behave according to user's location for example if the user is in office it may behave as silent etc. Basic working of social location prototype is given below.

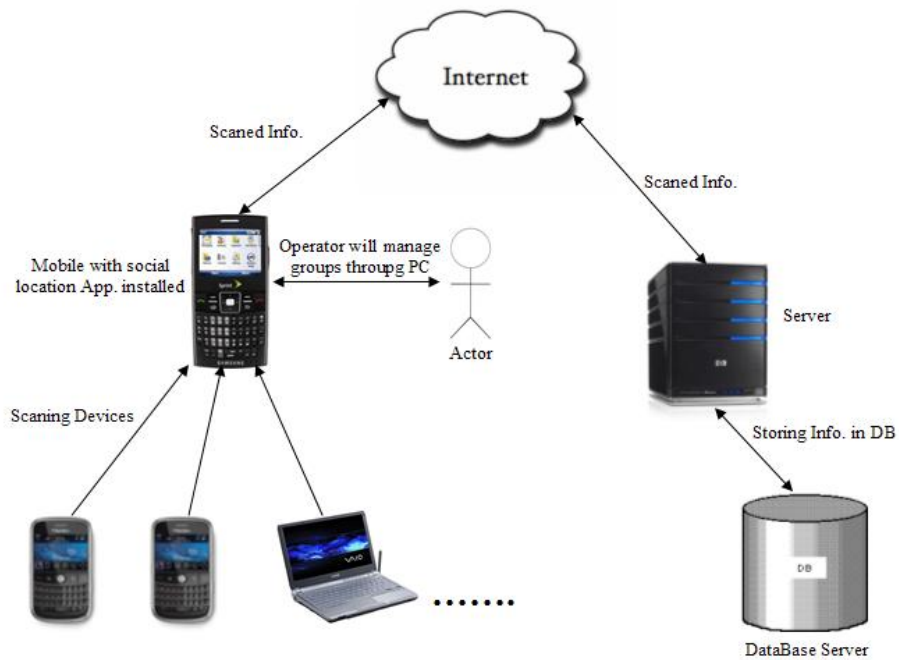


Figure 3: Basic working of prototype

4.2 Client

Client was developed using J2ME and therefore, runs in the mobile phone of the user. Client communicates with server via 3G connection. Server receives data from client sends back its response to client in the form of social location. When user starts the application in his mobile phone; application starts scanning other Bluetooth enabled phones/devices in its range. After the Scan is finished all the scanned devices (Scanees) are sent to the server via http protocol. All the sent scanees by the client are stored in database with its date, time and user information.

4.2.1 Prerequisites for Client

Mobile phone will be used as the client for this prototype, it must fulfill following requirements.

- Mobile phone with supports J2ME, Blue tooth, 3G
- Server : Apache , Tomcat, My SQL
- Internet: server side and client side.

4.3 Server

Server was developed using J2EE specially Servlets and JSPs and MySQL. Server is smart enough to get all the scanees's information via http protocol over the internet and then save it in database. Server also facilitates the user to manage his scanees for example he/she can group its scanees according to its location. Basic login screen is shown in figure 4.

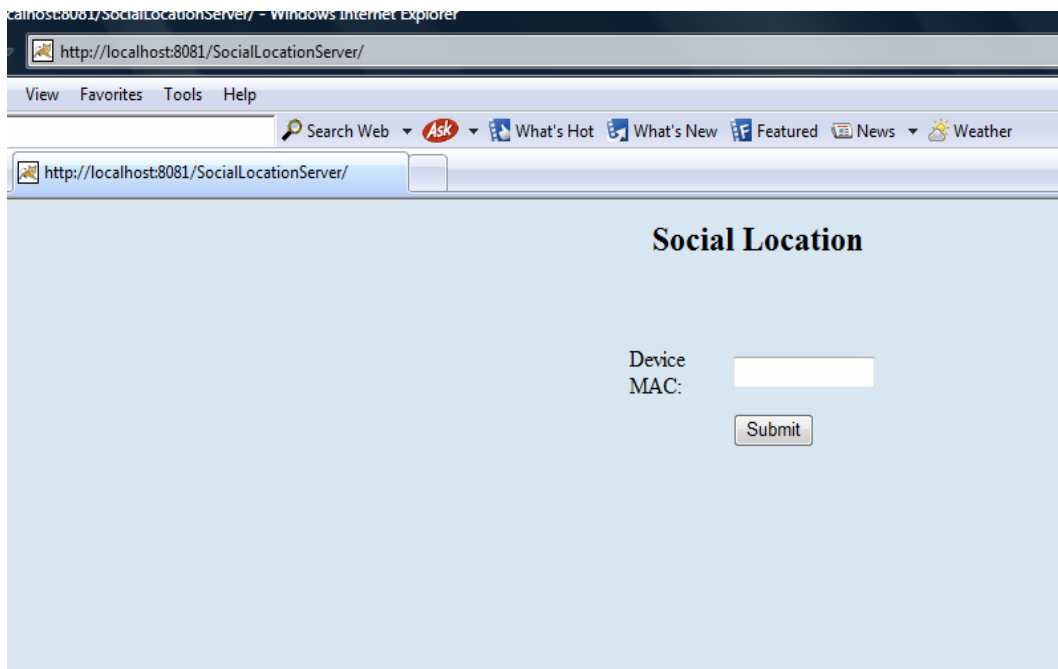


Figure 4: Login Screen

After the user enters his MAC ID displayed on his phone during the application is running and clicks submit button, he will be displayed all the scanees within the selected date by the user. At the first time date is current date that user can change to see its scanees of different dates. User can also set the time by using the time slide bar.

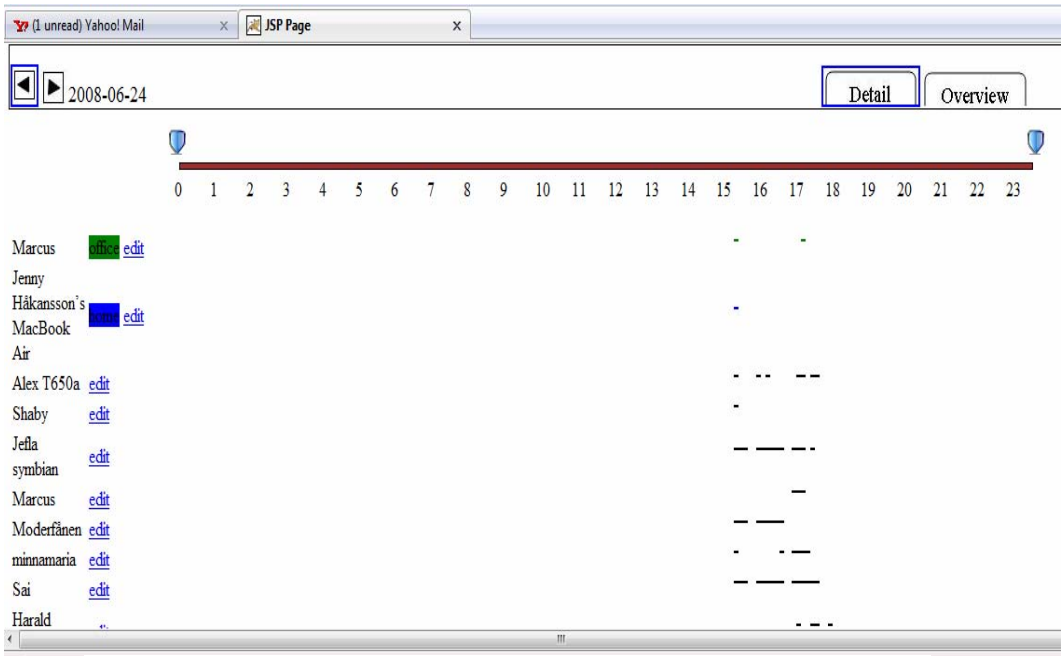


Figure 5: View after the user is logged in by entering his/her MAC ID

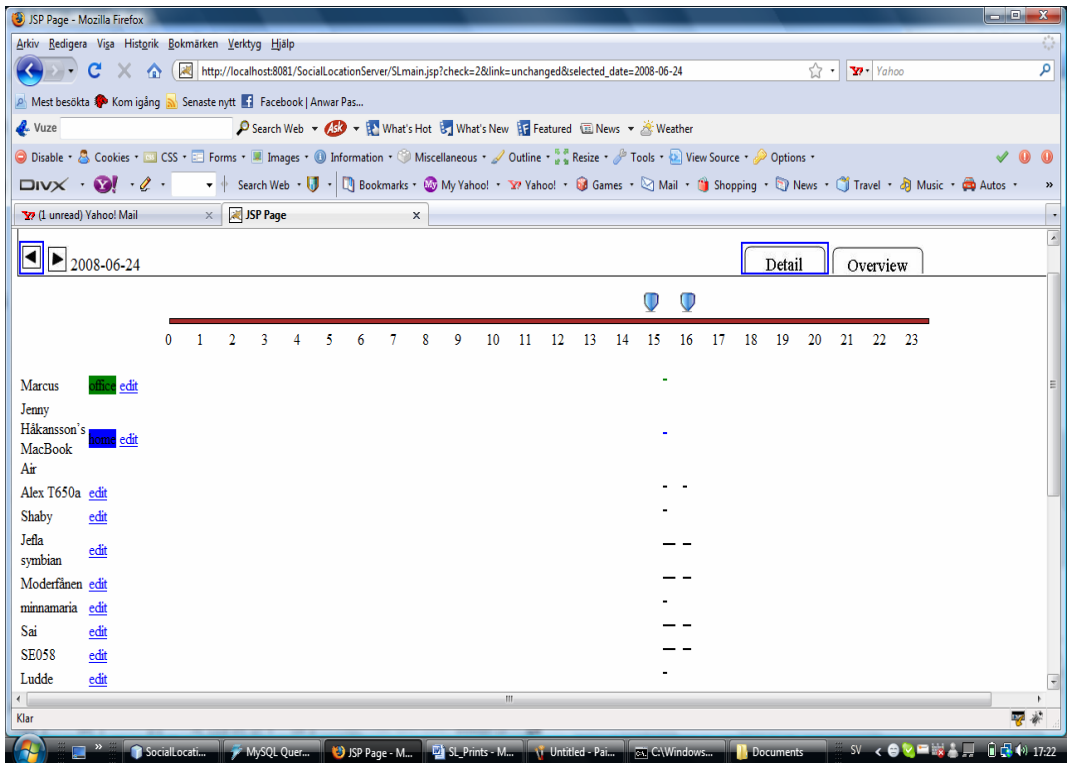


Figure 6: View after the user reduces the time spam using time bar

User can group its scanee by clicking the edit button given after each scanee's name.

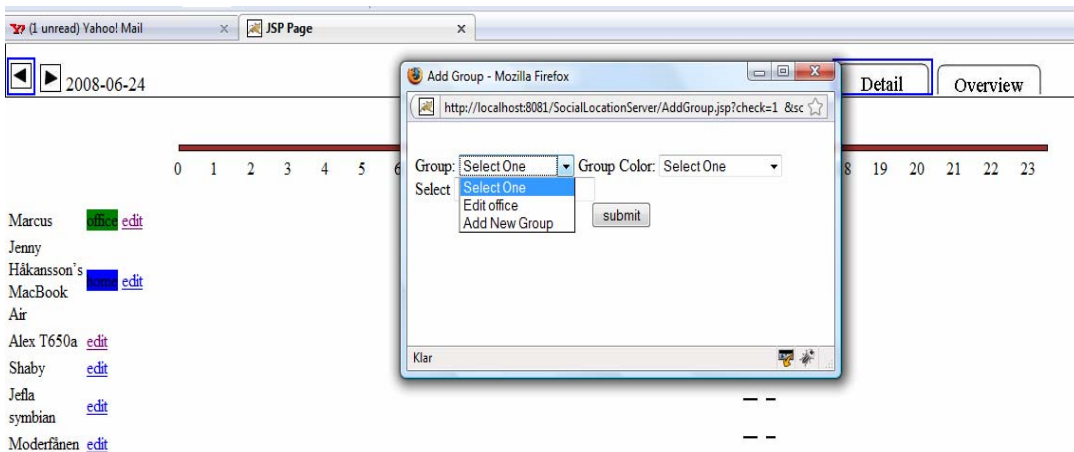


Figure 7: Grouping the Scanees

Server also decides the location of the user according to his grouping of Scanees and sends this location back to the user.

4.4 Architecture of Social Location

4.4.1 Use Case Diagram

There is only one actor in social location application and we named this actor as user. The figure 8 shows all the possible action that a user can perform on social location.

User can send scanned data to server from his/her mobile. He/she can also view and manage this data through web site of social location. He /She can also view his/her social location on his mobile which he/she gets from server.

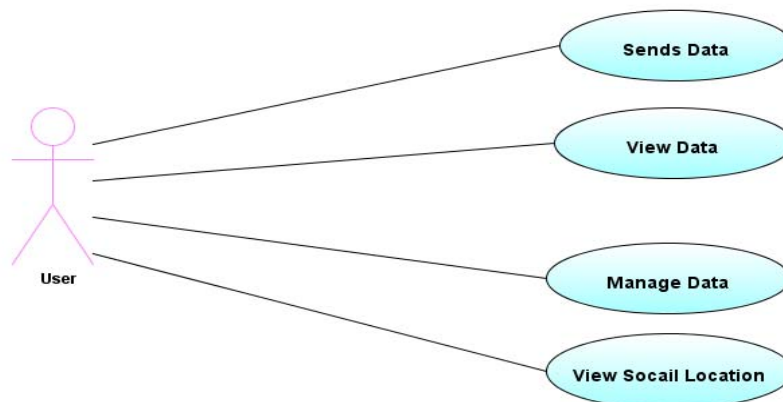


Figure 8: Use case Diagrams

4.4.2 Class Diagram for client

As Social location is based on client / Server architecture that is why here we will present separate class diagram for client and server. First we start with client side.

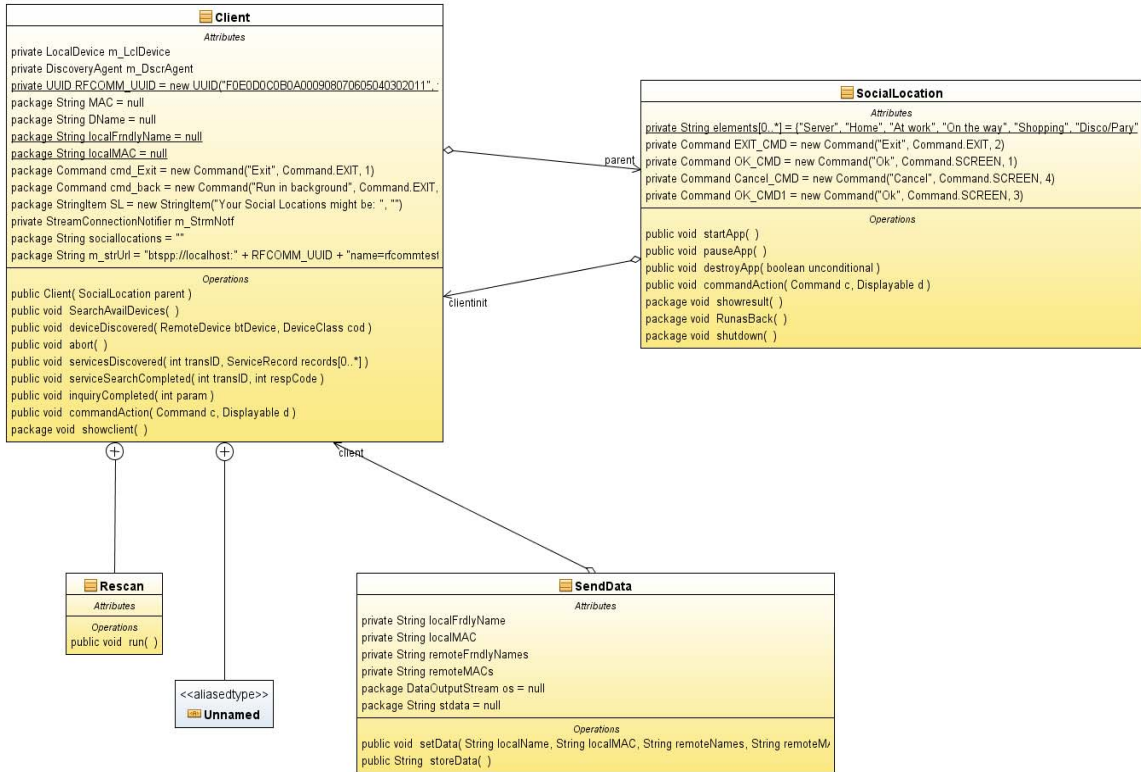


Figure 9: Class Diagram for Client

As we can see from figure 9 there are three main classes of social location client namely Client, Social location and Send Data. The application start with social location and then initialize the client class .The client class is responsible for invoking blue tooth of mobile and after invocation of blue tooth it starts scanning the nearby blue tooth devices. After scanning process client will initiate the object of send data .The send data class communicates with server and send all the scanned data to Get Data servlet which resides on a server . GetData is responsible for storing scanned data into to data base. In addition to that Getdata also sends the social location back to mobile device depending on scanned data.

4.4.3 Class Diagram for Server Side

The are two parts of server in social location. The first one communicates with mobile client

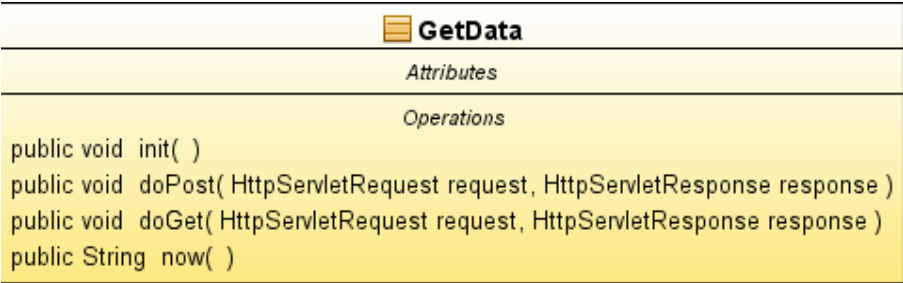
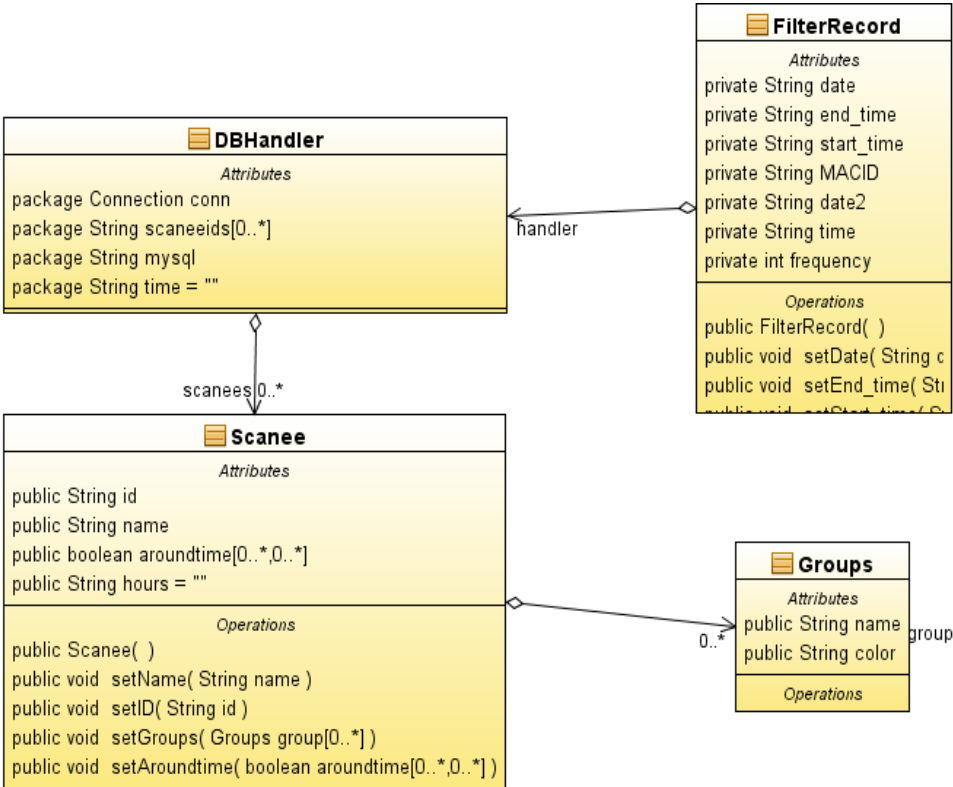


Figure10: Class diagram for Server and client

And second one is used for the web application of social location. Mobile client communicates with GetData which will communicate with DBHandlr for storing scanned data and retrieving the social location.

The other part web application and four classes were used in the development of this part.



The first is DBHandler which is same as we have used for the first part of Server. DBHandler class is mainly responsible for communication of database .It is to for extracting, deleting, inserting, updating from data base.The other class is scanee which is used to store all the information of individual scanee. Scanee class also holds the object of group’s class, which stores the scanees group name and group color.

There is one more class called filter record which filters all the scanee data from database and stores in the class variables.

4.4 .4 Sequence Diagram

Sequence diagram is used to show the interaction of any system. In social location we have identified two kinds of interaction that user can perform on social location. The use can communicate with systems by using mobile and web.

4.4.5 Sequence Diagram for Mobile

Figure 11 shows the possible interaction of user on his/her mobile. Users start this social location client on his mobile and when the application is started it will scan all the nearby Bluetooth devices. After this step mobile connect with server using HTTP protocol and sends the scanned data to the server. The connection with server will remain open until mobile client gets back the social location from server

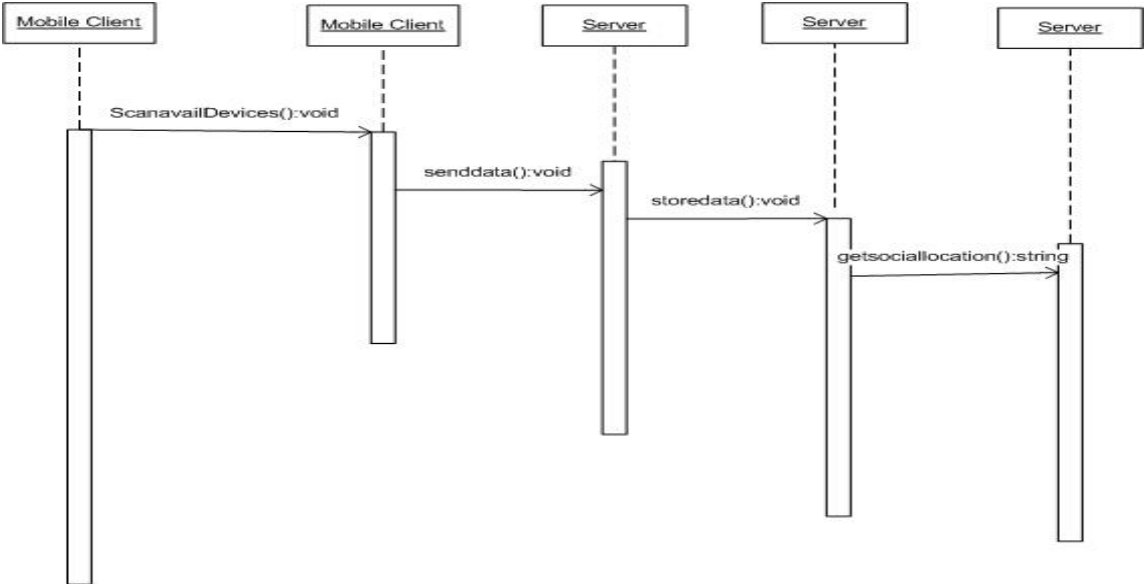


Figure 11. Sequence Diagram

4.4.6 Sequence Diagram for web

The other way to interact with system is through web we have provided separate interface to user where he can view and manage his scanned data.

In the beginning user have to login with his mac address after successful login the user will be redirected to the main page of social location where he can view all the data scanned by him/her .He can also add or edit group of particular scaneer by clicking on scaneer.

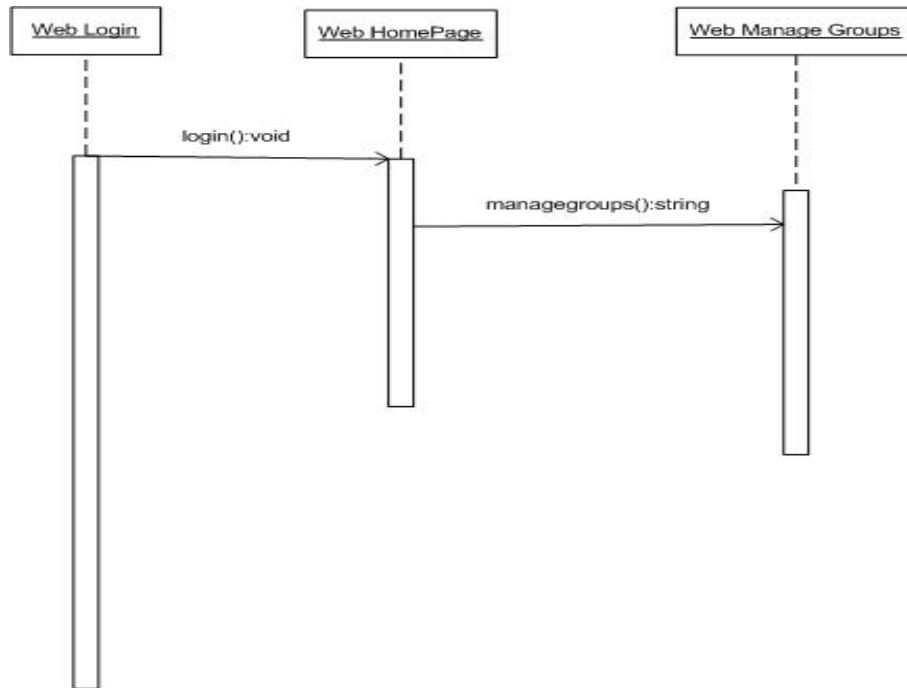


Figure 12: Sequence Diagram for web application

4.5 Different applications of social location prototype

This mobile social location can be used and helpful in different areas of our social life, some are given below;

4.5.1 Finding Friends at Parties/Concert

This application is very helpful to find friends in parties or/and concerts. The main idea behind this feature is t its scan all near by blue tooth devices in parties and concert and send that into the server. Server will start its processing after receiving data from mobile. Based on this data server will select the social location of a users and sends this location back to the

user's mobile. By this information user can determine whether he/she has some friends, relatives or any person from his/her social location in this concert.

4.5.2 Calculate Time Given to Different Social Groups

This possible application of this idea is to calculate time given to different social group. This could be done by adding an extra feature to the server. In this case mobile will sends data on the server and server will store all this data in a database .User can view this data in the form of graph, different web application. X-axis represents the social location and y-axis represents the time. This will help user to calculate his/her time given to different social groups. By doing he/she can prioritize his/her future time.

4.5.3 Automatic Updating of Mobile Profile

This idea could also be integrated with mobile operating system which will help in updating profile of mobile phone. In this prototype user can group different scanees into different social groups. Based on this data server returns social groups on user's mobile. This data could be integrated with mobile which can be used to update profile of a mobile based on the received social groups. The main advantages of this application will be to avoid manual updations of mobile profile

4.5.4 Checking in-out timing

This prototype can be helpful to check one person arriving and out-going timings. E.g. when a person come in office and when he or she has leave the office. This prototype can also be used to check or control how many peoples have visited location in some specific time interval, provided that their mobile Bluetooth is on.

CHAPTER 5: CONCLUSIONS & FUTURE WORK

The basic goal of my study was to develop a prototype for social location system that uses the built-in Bluetooth service in mobile phones. Basic purpose for this development was to get the proof of concept, to find out the answers of my hypothesis. Also I have chosen this method because prototyping is always considered as an excellent way to convert any new ideas to implementation at the early stage of software development. Prototype development is good because it helps the developers to improve the quality of product, to find the problem at early stage of development process, to get valuable comments from its users etc. Because this was a new idea to get the location of any person by scanning its mobile Bluetooth, that's why I have used prototyping as a research methodology.

To complete this thesis report, I have done a detailed literature study on social location systems that are already developed and properly functional. During my study I was keen to find which programming language will be the best that fulfills all the basic requirements to reach my defined goals. So as a result of my literature study I have chosen J2ME, J2EE (especially Servlets and JSPs), XML, MySQL to develop the prototype for social location tracking system using passive Bluetooth scanning.

Mostly location based systems are using the mobile devices and mobile network to provide the information about any individual and/or entertainment services. From last few years many location based systems already have been introduced, there are two broad categories of these systems (i.e. Physical & Social location based system). Physical location systems are based on physical positioning, which allow its user to get the information of other geographical users position [4]. The physical position can be defined as a point by its longitude/latitude or a point plus distance.

Actual development of my Social location Prototype is based upon client/server architecture. Client is developed using J2ME, and this client will runs on the mobile phone of user. J2EE is used for server development. Basic functionality of server is; to get all the scanees's information via http protocol over the internet and then save it in database. This prototype will determine the social location of an individual using passive Bluetooth scanning. This prototype will be flexible enough to be used for different social location needs. Output from this research will help human being to overcome some of their social problems. Social location obtained from the prototype can be used to fulfill different social needs of human being.

As I have discussed earlier that prototyping technique will be the good choice to start the actual development process. Now my next step will be to get comments from its users on this prototype, and in future I have planned to develop full-fledged software for social location tracking system using passive Bluetooth scanning.

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APPENDIX A

This class is responsible to scan all the nearby bluetooth devices and initiates

SendData

```
/**
 * @author Umer Hayat
About this class:
 * This class is responsible to scan all the nearby bluetooth devices and initiates SendData
 * class after the scan is finished.
 */
import javax.microedition.lcdui.*;
import javax.bluetooth.*;
import java.io.*;
import java.util.Timer;
import java.util.TimerTask;
import javax.microedition.io.*;

public class Client extends Form implements DiscoveryListener, CommandListener {
    private SocialLocation parent;
    private LocalDevice m_LclDevice;
    private DiscoveryAgent m_DscrAgent;
    private static final UUID RFCOMM_UUID = new
UUID("F0E0D0C0B0A000908070605040302011", false);
    String MAC = null, DName = null;
    static String localFrndlyName = null, localMAC = null;
    Command cmd_Exit = new Command("Exit", Command.EXIT, 1);
    Command cmd_back = new Command("Run in background", Command.EXIT, 3);
    StringItem SL=new StringItem("Your Social Locations might be: ","");
    private StreamConnectionNotifier m_StrmNotf;
    String sociallocations="",m_strUrl = "btspp://localhost:" + RFCOMM_UUID +
"name=rfcommtest;authorize=true";
    public Client(SocialLocation parent) {
        super("");
        try {
            m_LclDevice = LocalDevice.getLocalDevice();
            localMAC = m_LclDevice.getBluetoothAddress().toString();
        } catch (BluetoothStateException ex) {
            append("BluetoothException" + ex);
        }
        addCommand(cmd_Exit);
        addCommand(cmd_back);
        append("Application Running... \n");
        append("My MAC ID : " + localMAC + "\n");
        append(SL);
        this.parent = parent;
        setCommandListener(this);
    }
// A method to search the nearest devices
    public void SearchAvailDevices() {
        try {

            m_LclDevice = LocalDevice.getLocalDevice();
```

```

        m_DscrAgent = m_LclDevice.getDiscoveryAgent();
        localFrndlyName = m_LclDevice.getFriendlyName().toString();
        localMAC = m_LclDevice.getBluetoothAddress().toString();
        m_DscrAgent.startInquiry(DiscoveryAgent.GIAC, this);
    } catch (BluetoothStateException ex) {
        System.out.println(ex.getMessage() + ex.toString());
    } catch (IOException ex) {
        System.out.println(ex.getMessage() + ex.toString());
    } catch (Exception e) {
        System.out.println("Exception: " + e.getMessage());
    }
}
}
/*A method invoked automatically by discoveryListener when a device is scanned, just adds
the scanned device information a string that will be sent to server */

```

```

public void deviceDiscovered(RemoteDevice btDevice, DeviceClass cod) {
    try {
        if (DName == null) {
            DName = btDevice.getFriendlyName(false).toString();
        } else {
            DName = DName + "|" + btDevice.getFriendlyName(false).toString();
        }
        if (MAC == null) {
            MAC = btDevice.getBluetoothAddress().toString();
        } else {
            MAC = MAC + "|" + btDevice.getBluetoothAddress().toString();
        }
    } catch (Exception e) {
        append("Exception got1");
    }
}

```

```

public void abort() {
}

```

```

public void servicesDiscovered(int transID, ServiceRecord[] records) {
}

```

```

public void serviceSearchCompleted(int transID, int respCode) {
}

```

```

/**
 * This method is invoked automatically by the DiscoveryListener when
 * searching the nearby bluetooth devices is finished,
 * Just invoke the SendData class to send the scanned data to server
 *
 * @param param
 */

```

```

public void inquiryCompleted(int param) {
    SendData send = new SendData();
    send = new SendData();
    send.setData(localFrndlyName, localMAC, DName, MAC);
    sociallocations=send.storeData();
}

```

```

        //append(sociallocations);
        SL.setText(sociallocations);
        send = null;
        Timer t = new Timer();
        Rescan tt = new Rescan();
        //to start the scan process again after one minute
        t.schedule(tt, 60000);
        tt = null;
        t = null;
    }

    public void commandAction(Command c, Displayable d) {
        if (c == cmd_Exit) {
            parent.destroyApp(true);
            parent.notifyDestroyed();
            return;
        } else if (c == cmd_back) {
            parent.RunasBack();
        }
    }

    class Rescan extends TimerTask {
        /* this method is automatically invoked after each one minute when the device searching is
        finished.
        This method initiates the device searching again*/
        public final void run() {
            DName = null;
            MAC = null;
            SearchAvailDevices();
        }
    }
    void showclient() {
        parent.showresult();
    }
}

```

This class is the main midlet that will show Client give option to user to select his/her Social location.

```

/**
 * @author Umer Hayat
 About this class:
 * This class is the main midlet that will show Client give option to user to select his/her
 Social location.
 */
import javax.microedition.midlet.*;
import javax.microedition.lcdui.*;
import javax.microedition.io.*;
import java.io.*;

public class SocialLocation extends MIDlet implements CommandListener {

```

```

private static final String[] elements = {"Server", "Home", "At work", "On the way",
"Shopping", "Disco/Pary", "Fun", "Playing"};
private final Command EXIT_CMD = new Command("Exit", Command.EXIT, 2);
private final Command OK_CMD = new Command("Ok", Command.SCREEN, 1);
private final Command Cancel_CMD = new Command("Cancel", Command.SCREEN,
4);
private final Command OK_CMD1 = new Command("Ok", Command.SCREEN, 3);
private Server serverinit;
private static Client clientinit;

public void startApp() {
//String url = "http://85.227.230.195:8080/SocialLocationServer/GetData";
String url="http://localhost:8080/SocialLocationServer/GetData";
StringBuffer sb = null;
DataInputStream is = null;
HttpConnection hc = null;
DataOutputStream os = null;
try {

    hc = (HttpConnection) Connector.open(url);
    hc.setRequestProperty("User-Agent", "Profile/MIDP-1.0, Configuration/CLDC-
1.0");
    hc.setRequestProperty("Content-Language", "en-US");
    hc.setRequestMethod(HttpConnection.POST);
    os = (DataOutputStream) hc.openDataOutputStream();
    os.writeUTF("hello");
    os.writeUTF("hello");
    os.writeUTF("noAddress");
    os.writeUTF("noMAC");

    is = (DataInputStream) hc.openDataInputStream();
    int ch;
    sb = new StringBuffer();
    while ((ch = is.read()) != -1) {
        sb.append((char) ch);
    }
    String stdata = sb.toString();
    is.close();
    os.close();
    hc.close();
    sb = null;
    is = null;
    hc = null;
    os = null;

} catch (Exception ie) {
    System.out.println("IOexception" + ie);
}

clientinit = new Client(this);
showresult();
clientinit.SearchAvailDevices();

}

```

```

public void pauseApp() {
}

public void destroyApp(boolean unconditional) {
    if (serverinit != null) {
        serverinit.destroy();
    }
    if (clientinit != null) {
    }
}
public void commandAction(Command c, Displayable d) {
}
void showresult() {
    Display.getDisplay(this).setCurrent(clientinit);
}

void RunasBack() {
    Display.getDisplay(this).setCurrent(null);
}

void shutdown() {
    destroyApp(true);
}
}
}

```

Document : index

```

<%-- Document : index
    Author : Umer Hayat
--%>

```

```

<% @ page contentType="text/html; charset=UTF-8" language="java" errorPage="" %>
<% @page import="util.Authenticate" %>

```

```

<html>
<head>
<meta http-equiv="Content-Type" content="text/html; charset=UTF-8" />
<script language="JavaScript" >
function isEmpty(){
    document.form1.scwidth.value=screen.width;
    if(document.form1.macid.value=="") {

        window.alert("Empty Field is not allowed");
        document.form1.username.focus();
        return false;
    }
}
</script>
</head>
<body bgcolor="D7E6F1">
<center>
<H2>Social Location</H2>

```



```

String macid = request.getParameter("macid");
macid=macid.trim();

Authenticate authenticate = new Authenticate();
if (authenticate.validate(macid)){
    session.setAttribute("macid",macid);

    response.sendRedirect("SLmain.jsp?check=1&link=null");

}
else{

    response.sendRedirect("index.jsp?check=false&macid=");

}
%>

</body>
</html>

```

Document : SLmain

```

<%--
    Document : SLmain
    Author : Umer Hayat
--%>

<% @page contentType="text/html" pageEncoding="UTF-8"%>
<% @ page import="java.util.Calendar" %>
<% @ page import="java.text.SimpleDateFormat" %>
<% @page import="util.FilterRecord" %>
<% @page import="util.Scaneer" %>
<% @page import="util.ProcessDate" %>
<!DOCTYPE HTML PUBLIC "-//W3C//DTD HTML 4.01 Transitional//EN"
"http://www.w3.org/TR/html4/loose.dtd">
<html>
<head>
<meta http-equiv="Content-Type" content="text/html; charset=UTF-8">
<title>JSP Page</title>
<STYLE type="text/css">
    TD.borderformat { border: 0px; }
    TD.borderformat1 { border: 1px solid black; }
    Table.borderformat {border-collapse:collapse;
        border:1px solid black;}
    .ace1 {
        width: 18px;
        height: 20px;
        background: url(img/horizontal_scroller.GIF);
        cursor: hand;
        position:realtive;
    }
    .ace {
        width: 18px;

```

```

        height: 10px;
        background: url(img/sldr5v_sl.gif);
        cursor: hand;
        position: relative;
    }
</STYLE>

<script type="text/javascript">
    var DragId = "";
    var OffsetY = 0;
    var OffsetX = 0;
    var MouseX = 0;
    var MouseY = 0;
    var Browser;
    var submitcheck=false;
    var Xwidth = screen.width;
    var Yheight= screen.height;
    var hor_scro1 = 0;
    var hor_scro2 = 0;
    var ver_scro1 = 0;

    var horscrol1="";
    var horscrol2="";
    var actiontag;
    document.write("<input type=hidden name=test value="+Xwidth+">");
    if (navigator.appName == "Microsoft Internet Explorer") {
        Browser = "IE";
    }
    else {
        Browser = "FF";
    }

    function startDrag(id) {

        DragId = id;
        OffsetY          =          MouseY
(document.getElementById(DragId).style.top).replace("px", "");
        OffsetX          =          MouseX
(document.getElementById(DragId).style.left).replace("px", "");

//if((document.getElementById(DragId).style.left).replace("px", "")==document.myform.hrpos1.value.replace("px;","")){
    // window.alert("Operation not allowed");
    //return false;
    // }
    }

    function mouseMoveIE() {
        MouseX = event.clientX;
        MouseY = event.clientY;

        if (DragId == "ace") {
            if(MouseY - OffsetY<=((20*Yheight)/100))
                enddrag1();
            else if(MouseY - OffsetY>=445)

```

```

        enddtag1();
    else
    {
        document.getElementById(DragId).style.top = MouseY - OffsetY + "px";
        ver_scol = MouseY - OffsetY + "px";
        document.myform.hiddverscol.value = MouseY - OffsetY;
        window.getSelection().removeAllRanges();

    }
}
if (DragId == "ace1" || DragId == "ace2") {
    if(MouseX - OffsetX <= ((14 * Xwidth) / 100))
        enddrag1();
    else if(MouseX - OffsetX >= ((86 * Xwidth) / 100))
        enddtag1();
    else {
        if(DragId == "ace1") {

            document.getElementById(DragId).style.left = MouseX - OffsetX +
"px";

            document.myform.hiddhorscol1.value = MouseX - OffsetX + "px";
            document.myform.hiddhorscol2.value
= document.getElementById("ace2").style.left;
            window.getSelection().removeAllRanges();

        }
        else if(DragId == "ace2") {
            document.getElementById(DragId).style.left = MouseX - OffsetX +
"px";

            document.myform.hiddhorscol2.value = MouseX - OffsetX + "px";
            document.myform.hiddhorscol1.value
= document.getElementById("ace1").style.left;
            window.getSelection().removeAllRanges();

        }
    }
}
}

function mouseMoveFF(event) {
    MouseX = event.clientX;
    MouseY = event.clientY;

    if (DragId == "ace") {
        if(MouseY - OffsetY <= ((20 * Yheight) / 100))
            enddrag1();
        else if(MouseY - OffsetY >= (((20 * Yheight) / 100) + 142))
            enddtag1();
        else
        {
            document.getElementById(DragId).style.top = MouseY - OffsetY +
"px";

```

```

        document.myform.hiddverscol.value=MouseY - OffsetY;
        window.getSelection().removeAllRanges();

    }
}
if (DragId == "ace1" || DragId == "ace2") {
    if(MouseX - OffsetX<=((14*Xwidth)/100) )

        enddrag1();
    else if(MouseX - OffsetX>=((86*Xwidth)/100))
        enddtag1();
    else{
        if(DragId=="ace1"){
            document.getElementById(DragId).style.left = MouseX - OffsetX +
"px";
            document.myform.hiddhorscol1.value=MouseX - OffsetX+ "px";
            document.myform.hiddhorscol2.value
=document.getElementById("ace2").style.left;
            window.getSelection().removeAllRanges();

        }
        else if(DragId=="ace2"){
            document.getElementById(DragId).style.left = MouseX - OffsetX +
"px";
            document.myform.hiddhorscol2.value=MouseX - OffsetX+ "px";
            document.myform.hiddhorscol1.value
=document.getElementById("ace1").style.left;
            window.getSelection().removeAllRanges();

        }
    }
}
}
}

function endDrag() {

    if(DragId=="ace" || DragId=="ace1"|| DragId=="ace2"){

        DragId="";

        //document.write("Image="+document.getElementById(DragId).style.left)+"Mouse="+Mou
seX+"Offset="+OffsetX+"Old value="+document.myform.hrpos1.value);

        //document.myform.action="SLmain.jsp?check=2?link=0&selected_date=0";
        document.myform.submit();
    }
    else
        DragId="";
}
function endDrag1() {

```

```

DragId = "";

}
if (Browser == "IE") {
    document.onmousemove = mouseMoveIE;
    document.onmouseup=endDrag;
}
else {
    document.onmousemove = mouseMoveFF;
    document.onmouseup = endDrag;

}

function submitform()
{
    if(submitcheck)
        document.myform.submit();
    else
        return;
}
function setWidth()
{
    var x= screen.width;

    document.getElementById('TT').width=Xwidth;
    document.getElementById('TT1').width=Xwidth;
    document.getElementById('TT2').width=Xwidth;
    document.getElementById('TT3').width=Xwidth;

    document.getElementById('VB').style.position = "absolute";
    document.getElementById('VB').style.left = (92*Xwidth)/100 + "px";
    document.getElementById('VB').style.top = (20*Yheight)/100 + "px";
    document.getElementById('ace').style.position = "absolute";
    document.getElementById('ace').style.left = (92*Xwidth)/100 + "px";
    document.getElementById('ace').style.top = (((20*Yheight)/100) + 142/2) +
"px";
}
function popup(mylink, windowname)
{
    if (! window.focus)return true;
    var href;
    if (typeof(mylink) == 'string')
        href=mylink;
    else
        href=mylink.href;
    window.open(href, windowname,"scrollbars=1,width=450,height=200");
    return false;
}
</script>
</head>

<body onload="setWidth();">
<%

```

```

String gname = "";
int sc_width = (Integer) session.getAttribute("scwidth1");
// out.println(sc_width);
String hor1_scro_pos = ((14 * sc_width) / 100) + "px;";
String hor2_scro_pos = ((86 * sc_width) / 100) + "px;";
//out.println(hor1_scro_pos + hor2_scro_pos);
String ver1_scro_pos = "";

Calendar cal = Calendar.getInstance();
SimpleDateFormat sdf = new SimpleDateFormat("yyyy-MM-dd");
// String current_date = sdf.format(cal.getTime());
String current_date="2008-06-24";
ProcessDate pd = new ProcessDate();
String selected_date = "";

if (request.getParameter("link").toString().trim().equals("back_date")) {

    selected_date                                     =
pd.getBackDate(request.getParameter("selected_date").toString().trim());

} else if (request.getParameter("link").equals("next_date")) {
    try {
        selected_date                                     =
pd.getNextDate(request.getParameter("selected_date").toString().trim(), 1);
    } catch (Exception e) {
        out.print("Exception" + e);
    }
} else if (request.getParameter("link").equals("unchanged")) {
    try {
        selected_date = request.getParameter("selected_date").toString().trim();
    } catch (Exception e) {
        out.print("Exception" + e);
    }
}

else {
    selected_date = current_date;
}

%>
<form
action="SLmain.jsp?check=2&link=unchanged&selected_date=<%=selected_date%>"
method="post" name="myform">

<%

Scanee[] scanees;
FilterRecord filter = new FilterRecord();

if (request.getParameter("check").trim().equals("2")) {

String userid = (String) session.getAttribute("macid");
hor1_scro_pos = request.getParameter("hiddhorscroll1").trim().toString();

```

```

hor2_scro_pos = request.getParameter("hiddhorscrol2").trim().toString();
String scroll1_xpos[] = hor1_scro_pos.split("p");
String scroll2_xpos[] = hor2_scro_pos.split("p");
float hr_scroll_pos1 = Float.parseFloat(scroll1_xpos[0]);
float hr_scroll_pos2 = Float.parseFloat(scroll2_xpos[0]);
float temp = 0;
if (hr_scroll_pos1 > hr_scroll_pos2) {
    temp = hr_scroll_pos1;
    hr_scroll_pos1 = hr_scroll_pos2;
    hr_scroll_pos2 = temp;
}
hr_scroll_pos1 = hr_scroll_pos1 * 100 / sc_width;
hr_scroll_pos2 = hr_scroll_pos2 * 100 / sc_width;
int from_hour = (int) (hr_scroll_pos1 - 14) / 3;
int from_min = (int) (((hr_scroll_pos1 - 14) - (3 * from_hour)) * 20);
int to_hour = (int) (hr_scroll_pos2 - 14) / 3;
int to_min = (int) (((hr_scroll_pos2 - 14) - (3 * to_hour)) * 20);
String from_time = "";
String to_time = "";
int temp1 = 0;

if (from_hour < 10) {
    from_time = "0" + from_hour + ":" + from_min;
} else {
    from_time = "" + from_hour + ":" + from_min;
}
if (to_hour < 10) {
    to_time = "0" + to_hour + ":" + to_min;
} else {
    to_time = "" + to_hour + ":" + to_min;
}

filter.setDate(selected_date);
filter.setMACID(userid);
filter.setStart_time(from_time);
filter.setEnd_time(to_time);
filter.setFrequency(30);
filter.setDetailView();
scanees = filter.getDetailView();
session.setAttribute("macid", userid);
/*out.println("userid=" + userid);
out.println("Scroll1 position = " + hor1_scro_pos + " & Scroll2 positoin = " +
request.getParameter("hiddhorscrol2"));
out.println("Screen Width=" + sc_width);

out.println("Scroller1 value in % = " + hr_scroll_pos1);
out.println("Scroller2 value in % = " + hr_scroll_pos2);
out.println("From Time = " + from_time);
out.println("To Time = " + to_time);*/

} else {
    //String userid = request.getParameter("macid");
    String userid = (String) session.getAttribute("macid");
    //hor1_scro_pos = "400px;";
    //hor2_scro_pos = "850px;";

```

```

        filter.setDate(selected_date);
        filter.setMACID(userid);
        //out.print("userid=" + userid);
        filter.setStart_time("00:00");
        filter.setEnd_time("24:00");
        filter.setFrequency(30);
        filter.setDetailView();
        scanees = filter.getDetailView();
        session.setAttribute("macid", userid);
    }

//scanees=new Scanee[];

// String name1 = scanees[0].name;
    %>

    <input type="hidden" name="hiddhorscol1" value="">
    <input type="hidden" name="hiddhorscol2" value="">
    <input type="hidden" name="hiddverscol" value="">

    <br>
    <br>
    <Table class="borderformat" height="50" id="TT">
        <tbody >
            <tr >
                <td width=2% valign="bottom" class="borderformat">
                    <a
href="SLmain.jsp?check=2&link=back_date&selected_date=<%=selected_date%>&hiddhor
scroll1=<%= hor1_scro_pos%>&hiddhorscol2=<%= hor2_scro_pos%>"> </a>
                </TD>

                <td width=2% valign="bottom" align="center" class="borderformat">
                    <%
if (!current_date.equals(selected_date)) {
    %>
                    <a
href="SLmain.jsp?check=2&link=next_date&selected_date=<%=selected_date%>&hiddhor
scroll1=<%= hor1_scro_pos%>&hiddhorscol2=<%= hor2_scro_pos%>"></a>
                    <% } else {
    %>
                    
                    <% }%>
                </td>
                <Td width=65% valign="bottom" class="borderformat">

                    <big> <%=selected_date%></big>
                </td>
                <Td width=8% valign="bottom" align="center" class="borderformat">
                    <a href="SLmain.jsp" > </a>
                </td>
                <Td width=8% valign="bottom" align="center" class="borderformat">
                    

```

```

        </td>
        <Td width=15% valign="bottom" class="borderformat">
        </td>
    </tr>
</tbody>
</table>
<br>
<br>
<input type="Hidden" name="hrpos1" value=<%= hor1_scro_pos%> >
<div class=ace1 id="ace1" style="position:absolute;top:115px;left:<%=
hor1_scro_pos%>;" onmousedown="startDrag('ace1')" ></div>
<div class=ace1 id="ace2" style="position:absolute;top:115px;left:<%=
hor2_scro_pos%>;" onmousedown="startDrag('ace2')" ></div>

<table height="10" id="TT1">
<tbody>
<tr>
<td width=14% class="borderformat" >
</td>
<td width=72% class="borderformat1" bgcolor="Brown">
</td>
<td width=14% class="borderformat">
</td>
</tr>

</tbody>
</table>
<table height="20" id="TT2">
<tbody>
<tr>

<td width=14% class="borderformat" >

</td>
<%
for (int i = 0; i < 24; i++) {
    %>
    <td width=3% class="borderformat">
        <%=i%>
    </td>
    <%
}
    %>

    <td width=14% class="borderformat" >

</td>
</tr>

</tbody>
</table>
<br>
<!---->
<!--<div class=ace id="ace" onmousedown="startDrag('ace')"></div>-->

```

```

</form>
<table id="TT3" height=80>
  <%

String gcolor = "";
int gcolors = 1;
session.setAttribute("scanee", scanees);
int hour_index = 0;
// this is the main loop iterating each found scanee
for (int sindex = 0; sindex < scanees.length; sindex++) {
    hour_index = 0;

%>
<tr>
  <td width=6% class="borderformat" height=100%>

    <%= scanees[sindex].name%>

  </td>
  <td width=8% class="borderformat" height=100%>
    <% //out.println(scanees[sindex].group.length);
      // out.println(scanees[sindex].aroundtime.length);

      for (int gindex = 1; gindex < scanees[sindex].group.length; gindex++) {
        //gcolor[gindex]="2px solid "+scanees[sindex].group[gindex].color;
%>
        <font style="color:black; background-color:<%=
scanees[sindex].group[gindex].color%>">
scanees[sindex].group[gindex].name%></font>
        <% }

        int check = 1;%>
        <a href="AddGroup.jsp?check=<%= check%>
&scaneeid=<%=scanees[sindex].id%> &scaneeindex= <%=
sindex%>&edit=true"
onClick="return popup(this, 'notes')">edit</a>
      </td>

  <%

    int count = 0;
    //this loop prints around time of that scanee

    for (int hour = 0; hour < scanees[sindex].aroundtime.length; hour++) {

%>
  <td width=3% class="borderformat" height=100%>
    <%

        int pre_hour=Integer.parseInt(scanees[sindex].hours.substring(hour_index,
hour_index + 2));
        if ( pre_hour == hour) {

            //out.println("Else
Block"+Integer.parseInt(scanees[sindex].hours.substring(hour_index, hour_index + 2)));

```

```

        for (int interval = 0; interval < 6; interval++) {

            for (int interval_limit = 10 * interval; interval_limit < (interval + 1) * 10;
interval_limit++) {

                if (scanees[sindex].aroundtime[hour][interval_limit] == true) {
                    count++;
                }
            }

            if (count == 0) {
                %>
                <div style="border-top: 2px solid white; position:relative; width:5px;
height:5px; left:<%=interval * 5%>px; top:<%=interval * 2) * (-1)%>px;"> </div>
                <%
                } else { //gcolors=0;

                    if (scanees[sindex].group.length == 1) {
                        gcolor = "2px solid Black";
                    } else if (gcolors < scanees[sindex].group.length) {
                        gcolor = "2px solid " + scanees[sindex].group[gcolors].color;
                        gcolors++;
                    } else {

                        gcolors = 1;

                    }

                    %>
                    <div style="border-top:<%=gcolor%> ; position:relative; width:5px; height:5px;
left:<%=interval * 5%>px; top:<%=interval * 2) * (-1)%>px;"> </div>

                    <% }

                    count = 0;

                }
                if(hour_index<=scanees[sindex].hours.length()-4)
                hour_index=hour_index+2;
            }

            else
            continue;
        }
    %>
</td>
<% gcolors = 1;

%>

```

```

        <td width=14%>

        </td>
    </tr>
    <%
    }

    %>
</table>

</body>
</html>

```

Document : AddGroup

```

<%--
    Document : AddGroup
    Author   : ShoaibAhmed
--%>

<% @page contentType="text/html" pageEncoding="UTF-8"%>
<% @page import="util.Scaneer" %>
<% @page import="util.DBHandler" %>
<!DOCTYPE HTML PUBLIC "-//W3C//DTD HTML 4.01 Transitional//EN"
    "http://www.w3.org/TR/html4/loose.dtd">

<html>
    <head>
        <meta http-equiv="Content-Type" content="text/html; charset=UTF-8">
        <title>Add Group</title>

        <script>
            function checkifclicked(){

                if(document.myform.group.value=="Add New Group")
                    document.getElementById('g1b1').innerHTML = "Add new group";
                else
                    document.getElementById('g1b1').innerHTML="Enter new name";
            }

            function isEmpty(){
                if(document.myform.group.value=="Select One") {
                    window.alert("Please select a valid option for group");
                    return false;
                }

                if(document.myform.gcolor.value=="Select One"){
                    window.alert("Please select a valid option for group color");
                    return false;
                }
                if(document.myform.gname.value==""){
                    window.alert("Please specify name of a group");
                    return false;
                }
            }
        </script>
    </head>
    <body>

```

```

    }
    function closeWindow()
    {
        window.close();
    }
</script>
</head>

<body>
<%
    DBHandler handler=new DBHandler();
    String macid=(String)session.getAttribute("macid");
    String scaneeid=request.getParameter("scaneeid").trim();
    int scaneindex=Integer.parseInt(request.getParameter("scaneindex").trim());
    Scanee[] scanee;
    scanee=(Scanee[]) session.getAttribute("scanee");
    String colors[]=handler.getcolors(macid);
    if(request.getParameter("check").equals("2")           &&
request.getParameter("edit").equals("true"))
    {
        if(request.getParameter("group").equals("Add New Group")){

            String
check1=handler.addGroup(request.getParameter("gname").trim(),request.getParameter("gcol
or").trim(), request.getParameter("macid").trim(),request.getParameter("scaneeid").trim());
            if(check1.equals("false"))
                out.println("Group has been added. Close the window and refresh the previous page
to see the changes.");
            else
                out.println("Exception in add Group:" + check1);
        }
        else{
            boolean editcheck=true;

            for(int i=1;i<scanee[scaneindex].group.length;i++)

                if(scanee[scaneindex].group[i].name.equals(request.getParameter("gname"))){
                    editcheck=false;
                }

            if(!editcheck){
                session.setAttribute("macid",macid);
                session.setAttribute("scanee",scanee);
                String
url="AddGroup.jsp?check=2&scaneeid="+scaneeid+"&scaneindex="+scaneindex+"&edit
=false";
                response.sendRedirect(url);

            }
        }
    }
}
else{

```

```

        String
checkkk=handler.editGroup(request.getParameter("group"),request.getParameter("gname").t
rim(),request.getParameter("gcolor").trim(),
request.getParameter("macid").trim(),request.getParameter("scaneeid").trim());
        if(checkkk.equals("false"))
            out.println("Group has been edited sucessfully. Close the window and refresh the
previoes page");
        else
            out.println("Exception in EditGroup: "+checkkk);

    }
}
%>
<br>
<center>
<input type="button" onclick="closeWindow();" value="Close window">
</center>
<%
}
else
{
    if(request.getParameter("edit").trim().equals("false"))
        out.println("Scanee Already exist in the given group: Please give different name to the
group");
        %>
        <br>
        <form name="myform" method="post" action="AddGroup.jsp?check=2&edit=true"
onSubmit="return isEmpty()">

        Group: <select name="group" id="group" onchange="checkifclicked();">
            <option>Select One</option>
            <% try{
for(int i=1;i<scanee[scaneeid].group.length;i++){
        %>
            <option>Edit <%= scanee[scaneeid].group[i].name %></option>
<% }
}catch(Exception exp){
    out.print(exp);
}%>
<option>Add New Group</option>
</select>
        Group Color:
        <select name="gcolor" id="gcolor" >
            <option>Select One</option>
            <% for(int i=0;i<colors.length;i++){
        %>
            <option><%= colors[i] %></option>
<% }%>
</select>
<br>
<label id="gbl" >Select</label>
<input type="text" name="gname" size="20">
<br>
<center>
<input type="submit" value="submit">

```

```
</center>
<input type=hidden name=macid value=<%= macid%>>
<input type=hidden name=scaneeid value=<%= scaneeid%>>
<input type=hidden name=scaneeindex value=<%= scaneeindex%>>

</form>
<% session.setAttribute("scanee", scanee);} %>
</body>
</html>
```