Studying the Effects of Listening to Quran on Human Mood

Zeeshan K. Shaikh

Master of Science in Information Technology
Faculty of Informatics
The British University in Dubai
2009

Abstract

Many Muslims believe that listening to their holy book Quran, has an effect on their state of mind or mood. Each Surah of Quran emphasizes on a unique topic, warns of wrong doings and provides the correct way of handling a particular situation. A person waiting for a job interview or promotion who often becomes frustrated can listen or read Surahs that may help him feel better. There has been no work done that attempted to study the effects of Quran on the mood of people. Furthermore, when people are in a tough situation or in a bad mood, they seldom think about listening or reading Quran. In these situations if there is a device with them that can detect their mood and suggest a particular surah, it can help them feel better. This dissertation presents a proof-of-concept mobile application that can run on any Java enabled phone, which takes user's feedback on Surahs, stores the feedback for further analysis and provides a simple suggestion mechanism.

Acknowledgement

I would like to first thank God Almighty for bestowing me the strength and motivation to complete this project. I would like to thank Dr. Sherief Abdullah for his continuous academic support, advice and feedback.

I 'm grateful to the faculty and administration of British University in Dubai for providing a unique research based academic environment.

Dedication

I would like to dedicate this dissertation to my family for their continuous encouragement and support.

Declaration

I declare that this thesis was composed by myself, that the work contained herein is my own except where explicitly stated otherwise in the text, and that this work has not been submitted for any other degree or professional qualification except as specified.

(*Zeeshan K. Shaikh*)

Contents

List of Figures

List of Tables

Chapter 1

Overview

1.1 Introduction

Like listening to different kinds of music has different kinds of effect on the listener, Quran also has an effect on the state of mind of the listener. Loud and fast music can energize a person's mood and light and soft music can help in relaxing and focusing. Music is used in nearly all fitness and spa centers. In the work out area, the music played is fast paced whereas in a spa, it is slow paced. A study[19] done on the effects of music in the workplace showed that with different kinds of music played for a period of time, the productivity had increased while music was played, and was least without any music. Likewise, Quran also has effects both in terms of the message being passed in the text as well as the (vocal) recitation. To date, there have not been studies conducted on the effects of listening to Quran on the mood or mental state. The current lifestyle of urban people is such that stress level is very high and the application presented in this dissertation can play a role in promoting stress management by helping the person to improve his mood and state of mind. The goal of this disseration is to study how listening to Quran can help in improving the listener's mood and wellbeing.

It is not easy to study the effects of listening to Quran on mood because user feedback from the listener would be required for the particular Surah listened to. The feedback would require the knowledge of the state of mind before the user listened the Surah and the effect after listening to it; whether it helped in improving the mood or not. Quran is recited at the same speed without any background music so it cannot be categorized as fast paced or slow paced like music. On doing extensive research, I did not find any application regardless of platform either mobile or desktop for Quran that was based on mood. There are numerous Quran applications available that allow the user to listen to Surahs and also read and listen to the translation in various languages, but a Quran application with intelligence and machine learning is not available. The idea of suggesting Surahs to listen to is a new concept and is the main topic of this dissertation.

This dissertation develops and implements the *QuranCompanion*, a proof of concept application, that provides users with a list of Surahs which they can listen to and then collects their feedback which is stored in a file in the mobile phone. These file are then collected, processed and analyzed using data mining[10] techniques. The QuranCompanion also provides simple Surah suggestions to the user based on previous feedback.

Predicting the mood is a complex task as it is dependent on various variables such as location, time, day of the week and touch sensing information on the phone. There are limitations in J2ME[16] platform on which QuranCompanion is developed such as not being able to obtain the touch sensing information on the phone. The application presents the idea of suggesting Surahs to users and shows a basic suggestion mechanism as a proof of concept. It collects the user interaction data which can be used for future studies.

1.2 Research Questions

The dissertation aims to address the following questions:

1. Does listening to Quran affect the listener's mood?
2. If Quran does affect mood, are there factors that contribute to this effect, such as day of the week, or a particular time?
3. Will a mobile application that suggests Surahs to user be helpful?

1.3 Contributions

As a proof of concept, I have developed a mobile application QuranCompanion that can run on any J2ME enabled phone which provides suggestions to the users, stores the user data and once started, keeps running in the background. I also participated in Mobile Application Contest(MAC) 2009[1] that was organized by the local mobile operator Etisalat[2] and Telecom Regulatory Authority[3]. In the contest, judges and participants were extremely interested in this application and they even agreed on using it and providing their feedback. Their feedback was overwhelming and all of them agreed that this application can help them feel better if the application and the handset is fully capable of predicting the mood and suggesting the Surahs at the right time. They also agreed that the touch sensing information is imperative in identifying the mood as only through it, the pulse rate and temperature can be obtained. They even suggested the application should be developed further to cater non-muslims as well. Section 3.1 has details on an online survey done on mobile applications for Quran in which 15 people participated who responded positively on the idea of the application popping up and suggesting Surahs.

The contributions of this dissertation can be summarized as follows:

1. The idea of suggesting Surahs to users on their mobile phones to help them feel better.
2. Developing the QuranCompanion, a proof of concept application that stores data of the user interactions with the application which can be used collectively as well as individually to reveal various interesting patterns. The application suggests Surahs to the user based on previous feedback of the user.
3. Analyzing the data collected through the mobile phone application using data mining techniques, to verify whether listening to Quran improves the listener's mood.

1.4 Scope

The QuranCompanion application shows how a user is provided with a list of Surahs which he can listen to and give his feedback and say whether listening to the Surah helped in changing his mood. The feedback is processed and analyzed using data mining tools and techniques to find out which Surahs were helpful for which states of minds and at what times.

The initial goal was to develop the application so that it would be intelligent enough to predict the mood of the users by their location, their frequency of mobile phone usage, their temperature and pulse rate obtained by the touches on the touch screen mobile phones. However, the current mobile handsets available are limited in terms of capturing the touches and the J2ME platform also does not provide ways to obtain this information, hence prediction of mood is beyond the scope of this study.

[1] http://www.citportal.uaeu.ac.ae/MAC2009/
[2] http://www.etisalat.ae
[3] www.tra.ae

1.5 Organization of the Dissertation

The remainder of this dissertation is organized as follows. Chapter 2 describes the previous related work and discusses the use of mobile applications for health monitoring and music. Chapter 3 describes the mobile application developed as a proof of concept. Chapter 4 describes the analysis of data obtained from a pilot study involving 15 users. Chapter 5 concludes the dissertation and discusses the future work.

Chapter 2

Literature Review

The concept of mood based application for Quran, which is presented in this dissertation, has not been explored before. The idea however is inspired by the current trend of mood based applications that caters to various aspects of daily lives. This chapter reviews some of the work that has been done on mobile devices to conduct studies, offer personalized health monitoring and mood based music. The current mobile phones provide adequate features in terms of personalization and being user friendly when compared to earlier phones. This advancement opens the window for phones to do various things apart from allowing phone calls and sending text messages. Figure 2.1 shows a contrast in the phones that were available in the past and today.

Figure 2.1: Mobile Trend

2.1 Mobile Applications

Mobile applications have been used to study mood, stress and emotions successfully in the past. A mobile application *mobiletype* was developed to study young people's experiences of moods and stress. The application ran four times a day randomly for 7 consecutive days asking questions related to the current activity being performed, mood, responses to negative mood and stresses. Sophie et al.[15] found that "Engagement with the mobiletype program was high

with 76% of 504 possible entries completed and 94% (17/18) of the participants reporting that the program adequately captured their moods, thoughts, and activities. The mobiletype program captured meaningful and analyzable data on the way young people's moods, stresses, coping strategies, and alcohol and cannabis use, vary both between and within individuals."

A study was done on mood monitoring by Mark Matthews et al.[13]which shows that studies and surveys conducted on mobile applications are much more effective and productive than paper based studies. The study was conducted in three schools of Dublin, Ireland involving 73 students out of which 52 students were given paper questionnaires and 21 students had mobile phones to provide feedback on their mood at various times of the day. Upon completion of the feedback phase, the data was collected from the users. Out of 52 students who were to provide feedback on paper, only 18 had completed the questionnaire, rest of them either did not fill it or lost it. Whereas, out of the remaining 21 students who used the mobile application, 17 students provided their complete feedback. On conducting a general survey among the participants, Mark et al. found that 88.7% of the participants prefered to complete such tasks on their mobile phones. Similar to this application and mobiletype mentioned earlier, QuranCompanion also captures meaningful data from the user on the Surahs on the mobile application which can then be processed and analyzed.

2.2 Health Monitoring

Dr. Alison Marshall heads a research team[11] at the University of Leeds, UK that focuses on improving healthcare through mobile and wireless communication devices. Her team is currently developing and testing two applications. The Pulmonary rehabilitation monitor[8] is an application that requires a phone to be connected to a pulse oximeter through Bluetooth connectivity which constantly measures heart rate and blood oxygen levels. It will also automatically update a remote server which will be monitored by a nurse or doctor and in case there is something wrong with the readings, an alarm can be sent to both hospital as well as the user who can then proceed straight to the hospital.

The second application is a mobile food diary[5] health which requires users who suffer from obesity, diabetes or any other illness that requires monitoring on their food intake, to enter details of their meals they are having and get instant feedback based on a database containing nutritional reports approved by dietitians. Dr Alison who is an avid supporter and researcher of health care through mobile devices, predicts that in the next five to ten years, mobile phones will become part of mainstream health care.

According to Australian E-Health Research Center (AEHRC) CEO Dr. Phil Gurney, less than 20 percent of the heart surgery patients complete their six-week rehabilitation program because it requires patients to return to the hospital regularly[2]. The AEHRC and Queensland health are trying to make sure that the heart patients complete their rehabilitation programs after surgery by having nurses monitor them via a mobile phone. The mobile phone is used to collect and send health-related information about patient's activities at home to a central computer. The mobile phones have a built in accelerator that measures physical activity such as the number of steps walked. Currently, this is a trial and once it proves to be effective, it will be used extensively for people living in remote areas. QuranCompanion is a first step in studying Quran, therefore sophisticated technology was not used so that users are not distracted. For future work it is recommended to enhance QuranCompanion to use sensors and devices that monitor heart rate while a user listens to a Surah.

Some of the simple ways in which mobile handsets are being used in different parts of the world to make the healthcare more effective especially for people living in remote areas are SMS reminders of appointments, SMS-based questions-and answer service for HIV/AIDS awareness and prevention and filling out forms on the handset before visiting the hospital to avoid delays. There are various mobile health projects sponsored by universities, government organizations and mobile handset manufacturers that are successfully running in Africa and Latin America. A detailed study done by Inter-American Development Bank[14] shows the different mobile

application projects sponsored by universities, government organizations and mobile handset manufacturers that are aimed at improving healthcare in Africa and Latin America.

With regards to health monitoring, nearly every handset manufacturer has contributed. Nokia's E66 and E71 has the GPS[1] step counter that tells the user the number of calories burned while walking. LG LP4100 has a breath analyzer that tells if the user's alcohol consumption is over limit[6]. It will automatically restrict the user to dial important contacts so that he does not call them and talk inappropriately because of not being fully conscious. O2, a mobile operator in UK has funded the development of mobile devices to monitor the breathing of asthma and cystic fibrosis[2] patients remotely[3]. The asthma patient's symptoms and peak flow are recorded and the mobile device aims to reduce the asthma attacks through increased self-monitoring. QuranCompanion can be fortified by implementing features such as step counter.

2.3 Music

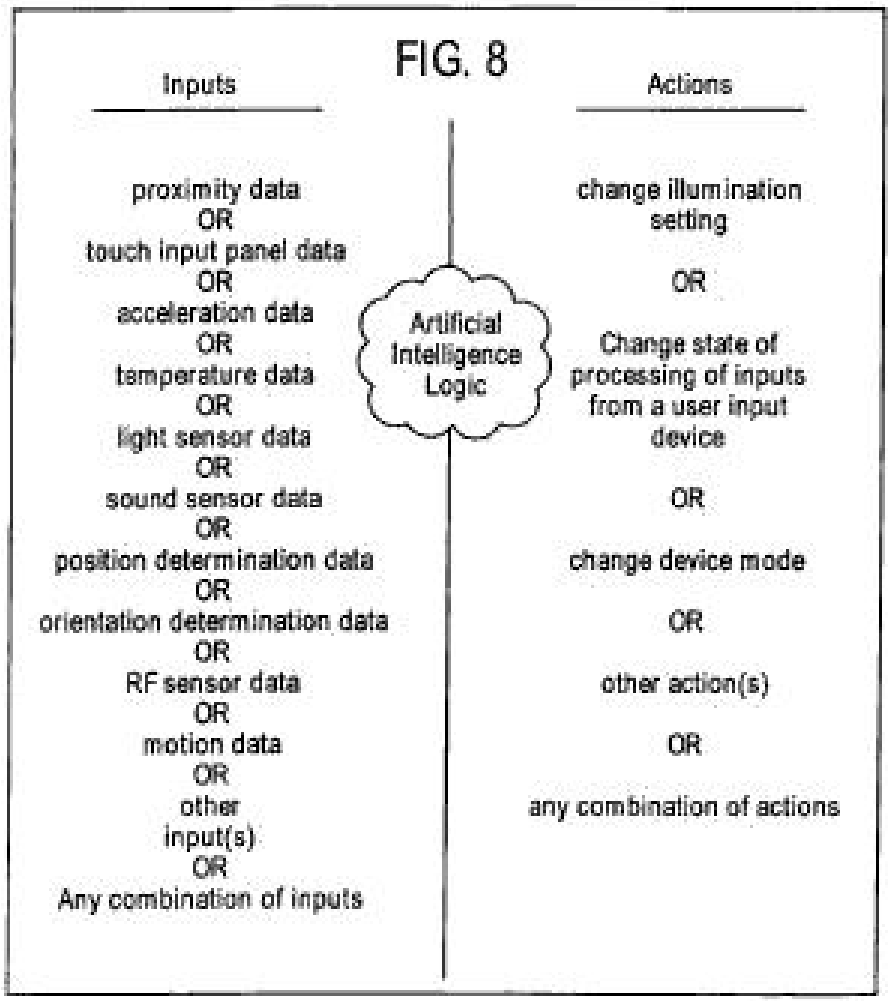
Music is known to have significant effect on physiology and is widely used as an effective tool in stress and pain management. There has been tremendous amount of studies done on the effects of music on human mood and brain. Mobile handset manufacturer Sony Ericsson, specializes in developing phones for music listeners. The SensMe[7] feature in W series handsets of Sony Ericsson classifies each song automatically to a particular mood based on the bit rate and other information that could be obtained from the music file description. The SensMe feature does something similar to what QuranCompanion is trying to achieve. The difference is that instead of analyzing the music as done by SensMe, QuranCompanion depends on the user input. The dependency on the user input could be minimized once the application has learned the patterns after which it would become more personalized and intelligent. The additional inputs such as location of the user, pulse rate and overall handset usage can further help in making accurate suggestions. Access to phone book and text messages is not possible through the J2ME libraries. If access to text messages were available, the application could have sensed the tone of messages sent. For example, in case of use of exclamation marks and uppercase letters, the mood would be predicted to be not good.

2.4 Sensors

The iPhone by Apple is a fairly new device launched in 2007 that has revolutionized the use of handsets by introducing a fully touch screen handset that has Apple's patented smart sensors. Apple's Patent FIG 8[1] below shows various inputs that can be taken by the sensors and based on that appropriate action can be taken. For example, the ambient light sensor automatically brightens the display when in sun light or a bright room and dims it in dark rooms. The proximity sensor turns the display off when the phone is brought closer to the ear to save power and touches.

At present, most of the phones having sensors do not record the touches of the users and work on 'cause and effect' principle. When a particular condition is met, an action is triggered. The data obtained by sensors can be very helpful in determining the state of the user. For example, in a day, if the user hasn't touched his phone many times, it may be the case that either he is very busy or may not be feeling well. To obtain the exact reason of the user for not touching the phone will also require various other inputs such as temperature, pulse rate, location etc. For health monitoring, this data can be very helpful as the mobile phone can send an alarm through either an SMS or email to a close relative if the pulse rate of the user is too high or too low. Touch screen phones are popular these days which are easier to use as compared to phones with keypads. QuranCompanion has been developed for regular keypad phones but it can become interactive and intelligent if it can capture the touches of the users.

[1] Global Position System
[2] Cystic fibrosis is a life shortening disease of the respiratory system



[1]

Figure 2.2: Apple fig 8

Chapter 3

Pilot Application

To support the objectives of this dissertation, I have developed the mobile application QuranCompanion that would collect user inputs and store them so that the data can be analyzed through data mining techniques. By applying data mining techniques to the data, various interesting findings, rules and patterns can be revealed both individually and collectively.

As listening to different Surahs have different kinds of effect on the mood of a person, the data analysis performed on the collected data can reveal information which people may not be aware of. For example, it could be the case that after the data analysis done on data collected from 100 users, it was found that 90 users found Surah Yasin to be helpful in afternoon while fasting. This information might not be known to many people and on coming to know this information, they can try it and most likely benefit from it. For people who listen to Surah's to feel better, this information can be very helpful as they can see which Surahs were helpful to maximum people at a certain time and state of mind.

The next sections explain the technical design and development of QuranCompanion in detail.

3.1 Design Considerations

While developing the mobile application, it was important to ensure that it should be simple to use and people should use it rather than just having it in their mobile phones. On asking 15 users who have Quran applications on their phone, all of them said that they do not use the Quran application on their phone very often as they have to search into their applications folder on their phone and also prefer reading the Quran as a book and listening to it while in a car or in the airplane. However, they agreed that if a suggestion shows up on their phone, they would definitely listen to the Surahs. An online survey was conducted titled *Listening Quran on a mobile device* in which 15 people participated who listen and read Quran frequently. These people were Muslims including both Arabs and Asians. It is imperative to mention that there are many Muslims who do not listen or read Quran so it was important that the survey be completed by users who are interested in listening and reading Quran. 93.3%(14 users) believed that listening to Quran will improve their mood. 66.7%(10 users) of the users admitted that they did had a Quran application on their phone but they never used it. Out of 15 users, 13 of them responded positively on having the application pop up some suggestions of Surah to listen to. Table 3.1 shows the results of the survey.

The important design decisions can be summarized as follows:

- **Using J2ME**: J2ME is a platform that runs on the Symbian Operating System. According to a report by Gartner[4][9], in 2008, Symbian based smart phones had the highest market share of 52.4%. Both applications developed in J2ME and Symbian C++ can run on Symbian based phones. Developing applications on J2ME platform is comparatively

easier than Symbian C++. Before starting the development on J2ME platform, research was also done on other platforms such as Googles Android and Apples iPhone. Both of these are newer platforms and the applications made on these platforms can run on specific phones. However, J2ME platform is more stable and is being used for many years with support from Symbian which has the largest market share. As QuranCompanion was intended to be used by majority of mobile users, J2ME was chosen as the development platform for QuranCompanion.

- **Application Pop-up**: From the survey results, it was clear that the application should be running in the background and should prompt on its own without the user having to start the application everytime he wants to listen a Surah.

- **Simplicity**: Applications that are complicated tend to become unattractive to people. For QuranCompanion, after discussing with my supervisor and asking several people, it was clear that what users want in an application is the simplicity to use it. If the user has to go inside his Applications folder to start the application each time he would like to listen to a Surah, he wouldnt be interested in it. Therefore, the application is created in such a way that it pops up automatically after an interval so that the user in a way is forced to see the suggestions. Then its upto him if he wants to listen to a Surah or not.

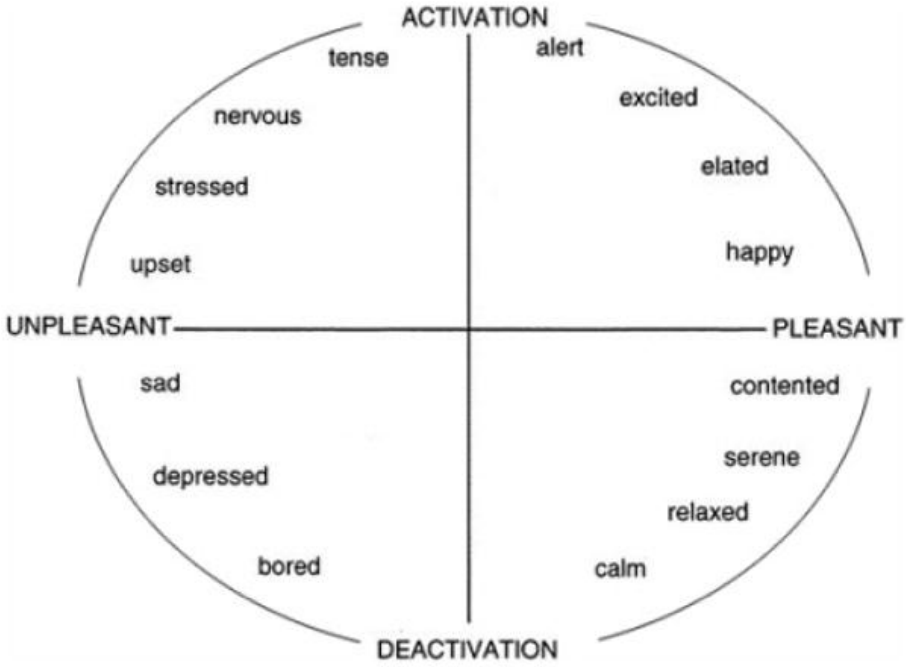
Question	**Response Percent**	**Response Count**
Do you listen to the Quran on a mobile device?		
Yes	40%	6
No	60%	9
Does listening to Quran have an effect on the mood?		
Dont Know	6.7%	1
Yes	93.3%	14
No	0	0
Do you have a Quran application on your mobile phone?		
Yes	66.7%	10
No	33.3%	5
When was the last time you used the Quran application on your phone?		
Yesterday	0%	0
Last Week	6.7%	1
Last Month	26.7%	4
Never	66.7%	10
Will you listen to Quran if the application pops up itself with a list of Surahs?		
Dont Know	13.3%	2
Yes	86.7%	13
No	0%	0

Table 3.1: Survey Results: Listening to Quran on a mobile device

3.2 Application Flow

Capturing user's mood is an essential task of QuranCompanion. Because of limitations in obtaining the mood information automatically, the user has to manually select a state that represents his current mood. Initially, the idea of having the user enter some text to describe his mood was being contemplated but user can get distracted if he has to enter text to describe

his mood every time. Therefore, a list of generalized states are presented to the user which are based on the *circumplex model of affect*[12]. This model proposes that all changes in mood arise from *valence* and *arousal* which are part of the neural system. Valence refers to the range of pleasure and arousal refers to range of alertness. An emotion or state can be a product of some degree of activation in the neural systems associated with valence and arousal. The application had to be simple and as it had been developed for a pilot study, only a subset of moods have been taken from the circumplex model of affect. Ideally, all the moods mentioned in the circumplex model of affect should be taken into consideration but without user having to manually choose one of them. The application should be intelligent enough to identify the mood dynamically based on some parameters. J2ME is not capable yet to fulfill this requirement because of which QuranCompanion expects the user to manually select a mood before listening to the Surah.



[12]

Figure 3.1: Circumplex Model Of Affect Diagram

Following is a summary of steps which QuranCompanion follows to suggest a Surah:

1. First time user selects a Surah and listens to it. Before Surah is played, a generalized list of states is presented such as Depressed, Fasting, Excited, Low, Happy.
2. The user selects the state and then chooses a Surah.
3. The application asks the user if it was helpful or not. If it was, the Surah is associated to the state chosen earlier and is considered to be helpful to the user. If it wasn't helpful it wont be suggested later.
4. The time, date, state, Surah name and the effect wether helpful or not is saved in the database as well as written to a text file on the memory card of the handset.
5. As the Surah is associated to a particular state, the user can also see the Surah list categorically based on the state.
6. After 5 minutes the application pops up and suggests a Surah based on the time and day of the week.
7. In case the user doesn't respond or does not want to listen, 5 minutes are added to the timer and the application will then pop up after 10 minutes.

Figure 3.2 shows the first-time application flow and Figure 3.3 shows the flow of application popup. The blue text on the arrows are the actual menu options in the application.

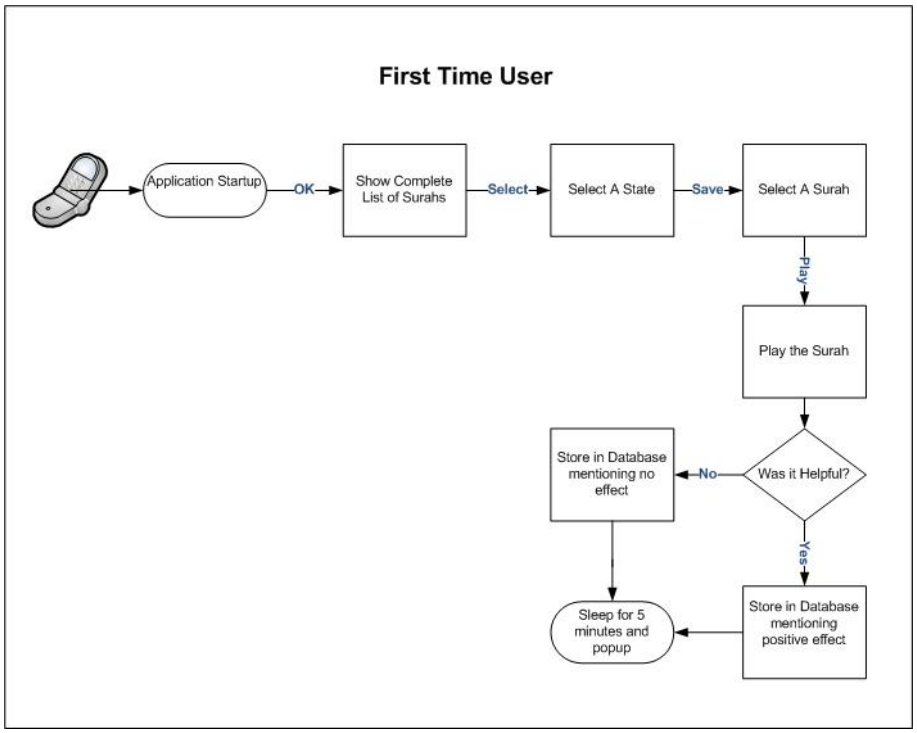


Figure 3.2: QuranCompanion Application Flow

3.3 Components of QuranCompanion

Quran Companion comprises of following components:

- **Graphical User Interface (GUI)**: The user interface provides the user to select different Surahs and provide feedback. The UI is developed in J2ME.
- **Database (Record Management Store)**: This component is responsible for storing all the details of the user input. The input includes state of the person before listening to the Surah and the effects of Surah. See Section 3.4 for more details.
- **J2ME**: J2ME provides a platform for handsets, PDAs and other hand held devices through which applications can be written for these devices. It can be considered a subset of J2SE (Jave 2 Platform, Standard Edition) as handheld devices have limitations in terms of memory, speed and screen size and would not be able to support J2SE completely. Each handset has its own functionality and the J2ME specifications it supports may vary from one handset to the other. Sun Wireless Toolkit Version 2.5.2[1] is the development tool used for compiling and packaging the J2ME code.
- **Data File**: QuranCompanion also stores all the user interactions in a readable format in a text file on the memory card. The text file needs to be parsed and formatted so that it can be processed using Weka.
- **Handset**: QuranCompanion can run on all devices that support Java applications and multi-threading. Multi-threading refers to multiple applications running simultaneously.

Figure 3.4 illustrates the components of QuranCompanion.

[1] http://java.sun.com/javame

3.4 Quran Companion Startup and Shutdown

Once the application has started, it is meant to be running transparently in the background. Upon listening to a Surah, and once the user input has been saved, the application will sleep for a defined interval and then prompt again. If there is no response from user or the user selects not to listen to the Surah at that time, the interval is increased and the application pauses in the background. It will then again popup after the new interval time and the flow will continue the same way. The user inputs are stored in a database so even if the application is closed, on restarting it, the suggestions will still be prompted.

Figure 3.5 shows an example of the screen of QuranCompanion with Surah suggestions.

3.5 Database-Record Management Store

The J2ME platform does not provides JDBC (Java database connectivity) because of which the J2ME application cannot maintain the records in a relational database. The standard option is to store in a record management system (RMS) in which there are no tables. The RMS can have rows and each row is one string object in which the different fields should be separated by a delimited. The text messages (SMS) are also stored in the RMS the same way on each handset. The RMS does not uses structured query language (SQL) so all the fetching and inserting is to be done using manually written code consisting of various string manipulations.

The format in which the data is stored is as follows. The file in which the data is stored is parsed further before it can be processed using data mining techniques.

Date and Time,Surah,RecordId,State,Result,Priority

Example: Mon Apr 13 10:04:57 UTC 2009,Fatiha,15,Fasting,Yes,5

3.6 Evaluation of QuranCompanion

The final version of the application is a result of continuous feedback from the users who had tested the application from the first release and reported all the issues. All of the 15 people who responded to the survey were satisfied with the proof of concept application and wanted to see it turn into a product. See Table 3.2 for full details of the online survey.

Question	**Response Percent**	**Response Count**
What do you think of the overall application? (You can select more than one answer)		
The application sounds to be very interesting and will be very helpful for me	100%	15
The pilot application is not user-friendly	0%	0
The pilot application has bugs	0%	0
The pilot application should be turned into a product	100%	15
How do you rate this pilot application in using it as a proof of concept? (1 being the lowest and 5 being the highest)		
1	0%	0
2	0%	0
3	13.3%	2
4	73.3%	11
5	13.3%	2

Table 3.2: Survey Results: QuranCompanion - Feel better by listening to Quran on mobile phone

3.7 Technical Challenges and Limitations

One of the propositions of this dissertation is to have a mood based application that would intelligently and dynamically suggest Surahs to a user. Because of the limitations in J2ME platform and handsets currently available such as not having touch sensing information, QuranCompanion provides basic Surah suggestions which are based on time and day of the week.

The application developed as part of the dissertation consumed the major amount of time spent on this dissertation. The correct design and development of the application was critical to the completion of dissertation. During this phase, various challenges related to concept and technicalities were faced. The obstacles that were faced were mostly from the technical standpoint as I had not used J2ME prior to this disseration. Previous Java experience was helpful in my being able to code in J2ME. Running the first application took some time as there were various parameters that needed to be configured in the application. On runing the application on the phone for the first couple of times, it would say 'Application not compatible for this phone'. The problem was that the in the Sun Wireless Toolkit, Target Platform in the Settings was selected as *MSA* which should have been *Custom* with profile selected as MIDP 2.0 and Configuration as CLDC 1.1.

For playing audio and video, the standard code available on most of the tutorials and J2ME forums didn't work. After researching various online tutorials and documents, the correct way of playing audio and video was found. Another issue faced while development was with multithreading. As I was also trying to implement some intelligence, I wanted multiple threads to be working and monitoring at the same time but it did not work.

The current application pops up after every 5 minutes and if the user is not interested in listening at that time, another 5 minutes are added to the interval. Ideally the application should popup when there is a change in the mood which should be identified by analysis of mobile phone usage such as motion sensing information, temperature and pulse rate, but since these are not possible to obtain given the platform and handset limitations, QuranCompanion only tries to present the idea in the application by automatically prompting after an interval.

While running the application on various phones, it was found that in some earlier phones only one application could run at a time. In such phones, the purpose for which QuranCompanion was developed would not be served, even though they support Java. For example, on Nokia 6233, when the application was started, it was not possible to perform any other task; either the application was open or if something else needed to be done, the application would have to be closed. However, on running the application on Nokia E90 and Nokia E75, it ran in the background without any problems. Basically, in the newer phones that support multithreading, the application once started can be minimized by pressing the main menu button and the phone can be used to do the usual tasks such as making calls and sending messages. It will popup at its scheduled time.

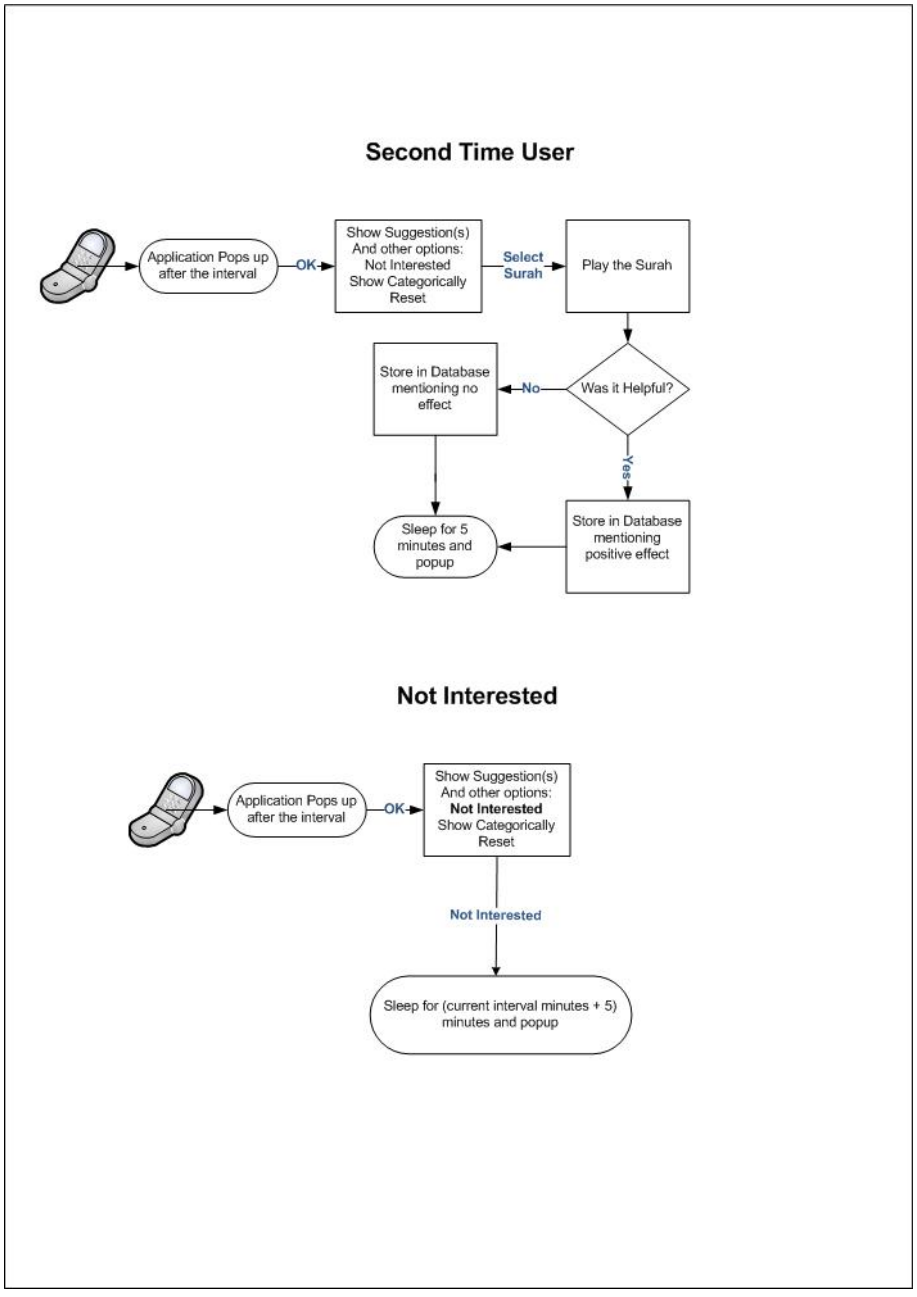


Figure 3.3: QuranCompanion Application Flow - Popup

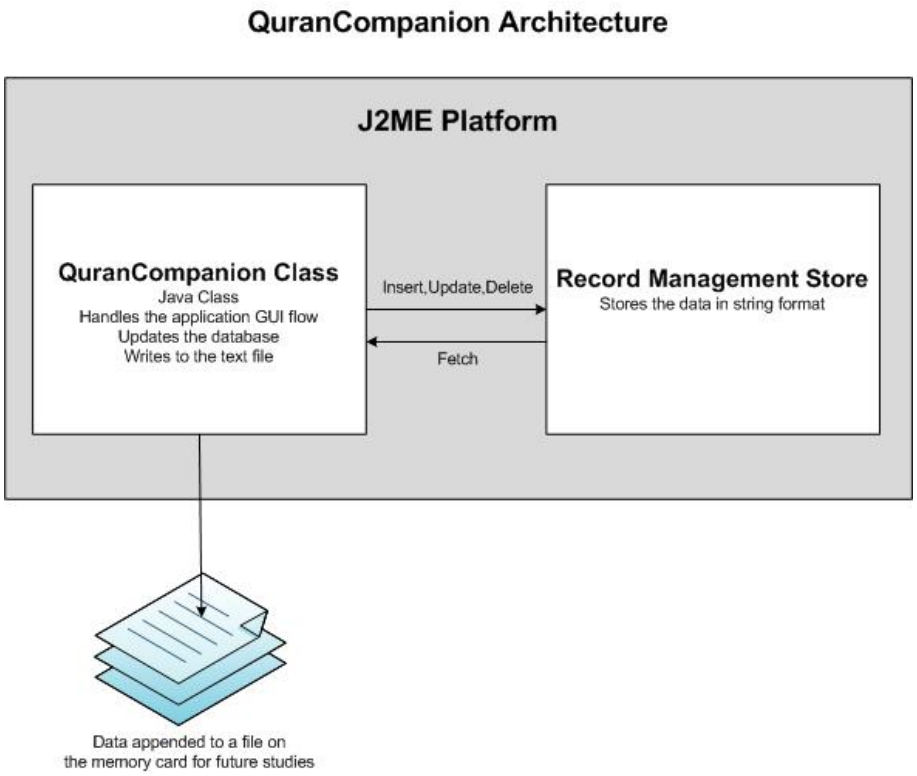


Figure 3.4: QuranCompanion Architecture

Figure 3.5: QuranCompanion GUI

Chapter 4

Data Analysis

The application QuranCompanion was used for capturing all the listening behavior of the users. The application creates a file called 'data.txt' on the memory card and appends the feedback on each Surah. For example, a person listens to Surah Tariq, the application will then prompt to ask if it was helpful or not with options 'Yes' and 'No'. Regardless of the response, the interaction is appended to the file. The data which is saved in the text file on each mobile handset can be used for data mining to find various patterns and useful information. Classification[10], a data mining technique may be used to predict whether on a particular day at a particular time, someone would like to listen to Surah Ikhlas or not.

This chapter explores various classification techniques that were applied both on an individual's data set. Each user's surah preference at a particular time and state of mind can differ from others hence it was appropriate to analyze each data set seperately. However, future studies may want to study the effects of listening particular Surahs on a specific group consisting of users in a particular age group who have similar background and culture. In such studies, the combined data of all users should be analyzed. The data collected in this study from 15 users consisted of 532 rows. Each row indicated a Surah that was listened at a particular time, day of the week and whether it had a positive effect on the mood or not. On analyzing the combined data set in this study, generalized rules and patterns were revealed. Some of the observations are as follows:

- In the month of May, 38 users who were 'Excited' before they listened to a surah, found the Surah to helpful.
- In the month of May, on Saturdays, out of 41 instances of listening Surahs, 39 instances were helpful.
- On all Fridays, out of 89 instances, 81 were helpful.
- The effect on mood upon listening Surah Ikhlas (19 times), Surah Maun (13 times) and Surah Al-Asr(17 times) was always helpful.

From the last observation above, it can be seen that a generalized pattern is revealed. The Surah Ikhlas, Surah Maun and Surah Al-Asr were listened few times out of the 532 intances, and as they were all positive, they were easy to be classified. More specific details could not be obtained.

4.1 Tool Used

Weka[1] is a powerful tool for performing machine learning techniques and data mining tasks using various algorithms. Data can be classified and clustered using different techniques, and

[1] http://www.cs.waikato.ac.nz/ml/weka/

rules can be generated from the data set. In order for data to be evaluated in Weka, it has to be organized in the format Weka can use;ARFF format. Converting from data to ARFF format is tedious as it requires adding @attribute before all the column names. The nominal values need to be added because string values cannot be classified or clustered and blank spaces, special characters need to be removed from the ARFF file. The advantage in Weka is that it will prompt the line in the ARFF file which is incorrect. The *Explorer* feature in Weka was used for classifying the data sets. There are six tabs in the Explorer. The *Preprocess* tab is for opening the file and applying any filters. The second tab is *Classify* which is an essential section where all the classification techniques are applied to the dataset. Clustering can be done in *Cluster* tab and best rules can be found out in the *Associate* tab. Attributes can be selected in *Select Attribute* and the analysis can be observed visually in the *Visualize* tab.

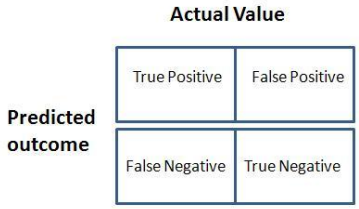


Figure 4.1: Confusion Matrix

4.2 Data Collection

The application was provided to 15 people who volunteered to use the application for a period of time. They were reminded on a frequent basis to use the application so that data can be collected. Once the file was provided by the users, it was parsed and converted into format recognized by Weka. The effect of listening a Surah if positive was added as *Yes* and if there was no effect, it was added as *No*. The outcome of applying various classification and clustering techniques revealed interesting results and patterns. The confusion matrix and the ROC graphs were used for analyzing the different classifiers. The confusion matrix provides the number of instances that were wrongly classified or predicted incorrectly. It shows the total number of attributes that are associated to a particular class and the predicted class of the attributes by the classifier. Figure 4.1 explains the different fields in the confusion matrix. The total of first column is the total positive values and the total of second column is the total negative values. The first row shows the attributes classified as positive ans second row shows the attributes classified as negative. See Appendix A for an individual's data set. In the next sections, an individual user's data set is analyzed in detail.

4.3 Logistic Regression

Logisitic Regression is a popular classification technique that can be easily applied on a data set. Logisitic regression learns only hyperplanes and is good for data can be classified into two classes. On applying this technique on one of the user's feedback with cross validation of 5 folds, Table 4.1 shows the weights that were assigned to various attributes with regards to positive mood.

The negative values indicate that they did not perform well in making the made positive.

The data set for the individual user had total 33 instances out of which 25 were classified as 'a' (Yes), which means the Surahs were helpful and 8 were classified as 'b' (No), which implies that these Surahs were not helpful. From the first row of the confusion matrix, it can be seen that 6 instances were wrongly classified as 'b' and in second row, 4 instances were wrongly classified as 'a'.

Attribute	Class
SurahName=Maun	6.2812
SurahName=Ikhlas	27.0019
SurahName=Ikhlas	27.0019
SurahName=Al-Asr	9.2496
SurahName=Kauthar	9.3543
SurahName=Fatiha	-1.4973
SurahName=Falaq	-16.9236
SurahName=Al-Humazah	24.6293
SurahName=Al-Fil	1.1376
SurahName=Al-Masad	-103.8404
SurahName=Kafirun	-33.2081
SurahName=Nas	32.696
SurahName=Wad-duha	18.7677
SurahName=Wat-tin	15.9314
SurahName=Tariq	-10.1828
SurahName=Al-Qadr	6.6034
state=Depressed	19.3458
state=Fasting	0
state=Excited	25.9189
state=Low	4.8232
state=Happy	-27.6086

Table 4.1: Logistic Regression - Weights of Attributes

a	b	Classified as
21	6	a = Yes
4	2	b = No

Table 4.2: Logistic Regression - Confusion Matrix

The accuracy of this results can be calculated by the formula. Accuracy = number of correctly classified instances/number of total instances

Accuracy = (21 + 2)/(21+6+4+2) = 0.696

4.4 Neural Nets

Neural Nets uses additional layers of perceptrons. For Neural Nets, the classifer in Weka is MultilayerPerceptrion which produces the following confusion matrix:

a	b	Classified as
22	5	a = Yes
4	2	b = No

Table 4.3: Neural Nets - Confusion Matrix

Accuracy = (22+2)/(22+5+4+2) = 0.727

4.5 K-nearest neighbor

In K-nearest neighbor, an attribute is assigned to a class which is most common amongst its k nearest neighbors where k is a positive integer.

Accuracy = (21+1)/(21+6+5+1) = 0.666

a	b	Classified as
21	6	a = Yes
5	1	b = No

Table 4.4: K-nearest neighbor - Confusion Matrix

4.6 Decision Tree

Decision tree is an undirected graph in which the internal node(rectangle) correspond to attributes, the leaf nodes(oval) correspond to classes and branches correspond to attribute values. The data set for QuranCompanion has *Surah Name*, *Day*, *Time* and *State* as attributes and *Yes* and *No* as classes. If the class is Null, it means that there was no response from user at that particular time or state. Classification can be done by traversing the tree.[18]. Decision trees are are easy to understand and implement. However, the issue of overfitting exists which basically means that if the tree grows to a large size it may classify everything correctly. The decision tree for the individual data set presents the effects of Surahs under different conditions visually(See 4.2):

a	b	Classified as
27	0	a = Yes
1	5	b = No

Table 4.5: Decisison Tree - Confusion Matrix

Accuracy = (27+5)/(27+0+1+5) = 0.969

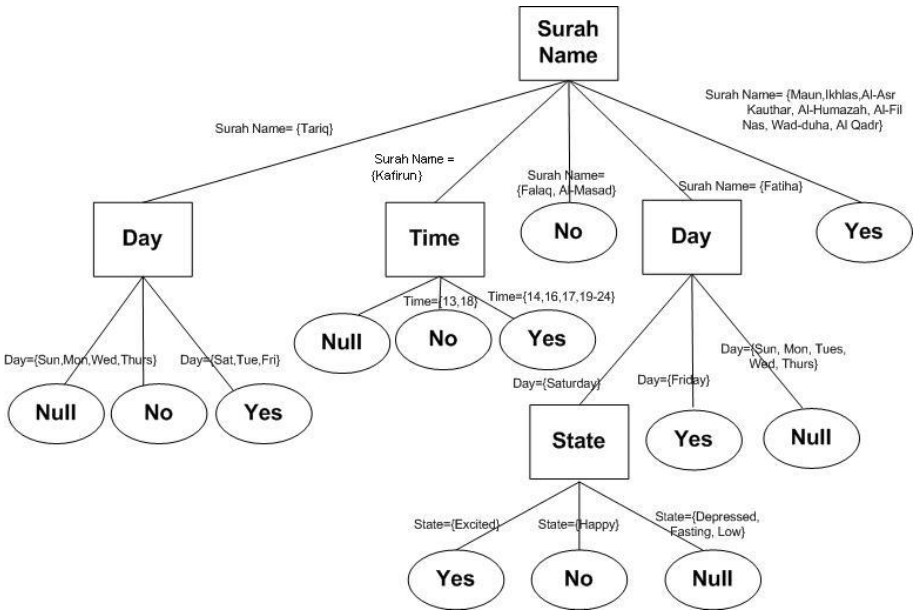


Figure 4.2: Decision Tree - Individual's data set

4.7 Evaluation of Classifers

From Table 4.6, Decision Tree has the highest accuracy hence it is the best classifiers for this data set.

Classifier	Accuracy
Logistic Regression	0.696
Neural Nets	0.727
K-nearest neighbor	0.666
Decision tree	0.969

Table 4.6: Accuracy Summary of Classifiers

4.8 ROC Graphs

ROC graphs are another way of measuring the performance of classsifers. ROC graph is a plot with the false positive rate on the X-axis and the true positive rate on the Y axis. The point (0,1) is the perfect classifer as it classifies all positive cases and negative cases correctly. False positive rate is 0 and the true positive rate is 1. See Table 4.7 for the TPR and FPR values for classifiers mentioned.

- TPR = TP/P = TP/(TP + FN)
- FPR = FP/N = FP/(FP + TN)

Classifier	FPR	TPR
Logistic Regression	0.75	0.807
Neutral	0.714	0.846
K-Nearest	0.857	0.954
Decision Trees	0	0.969

Table 4.7: TPR and FPR

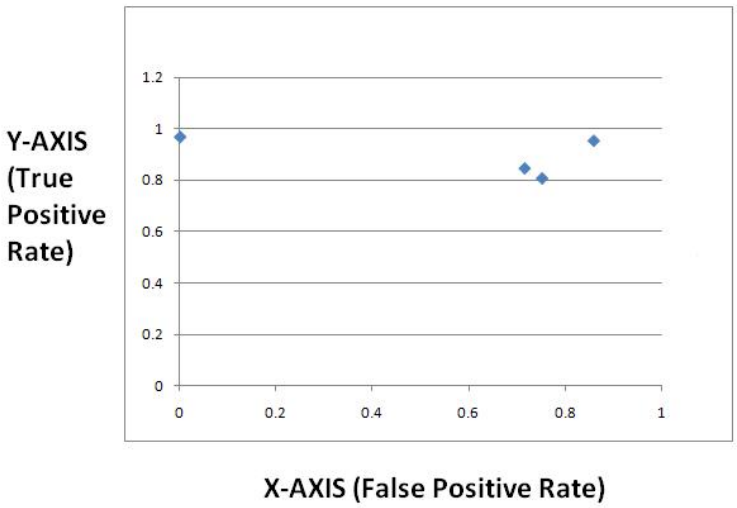


Figure 4.3: ROC Graph

4.9 Rules and Patterns

Table 4.7 shows some interesting rules that were found out from one of the user's feedback. The number in the bracket is the number of instances. The total number of responses from

Day	State	Surah	Result
Friday(9)			Yes(9)
	Excited(6)		Yes(6)
Sunday (5)			Yes(5)
Friday	Happy (5)		Yes(5)
		Kauthar (4)	Yes(4)
Saturday (4)	Happy		No(4)
Friday	Low (4)		Yes(3)
		Al-Fil (3)	Yes(3)
	Low (3)	Wad-duha (3)	
		Wad-duha (3)	Yes(3)

Table 4.8: Individual - Rules and Patterns

this user was 33. As each individual's listening behavior will be different from another user, the associations between different attributes will be different for each user. For example, one user may like to listen to Surahs at night time while another user might want to listen only before prayers.

These rules can be interpreted as follows:

1. On Friday, all Surahs suggested were helpful.
2. When user selected Excited state throughout the testing period, the effect of listening any Surah was positive.
3. On Sunday, all Surahs suggested were helpful.
4. On Friday, when the user's state was happy and he listened to any Surah, the effect was positive.
5. Surah Kauthar's effect was always positive.
6. On Saturday, when the state was happy, the effect was not positive at 4 occurrences.
7. On Friday, when the state was low, the effect was positive at 4 occurrences.
8. Surah Al-Fil had positive effect.
9. Surah Wad-duha was listened thrice in low state.
10. Whenever Surah Wad-duha was listened, it had a positive effect.

Chapter 5

Conclusion and Future Work

In this disseration, the effects of listening to Quran were explored. Pilot software was developed for gathering feedback from users and finding out how helpful listening to a particular Surah was at a particular time. The software also provided suggestions on Surah's depending on previous user feedback. The data collected from users was analyzed using data mining tools. The analysis showed that it is possible to predict which Surahs are helpful for a particular user at particular situation with very high accuracy.

As future work, this study should be extended to specific user groups such as people belonging to same age group and similar background in order to find out common listening patterns. Also, once the handsets are capable of capturing sensing information along with the mobile platforms being able to process it, the existing application can be further improved such that it will dynamically suggest Surahs based on the mood and become more accurate the more it is used. Initially, it can show a list of Surahs and once the user selects a Surah, it will start storing the user feedback. When the application suggests next time, it will consider the previous usage as to whether it was helpful or not.

From the research and material presented in this study, it is evident that a mobile application that would suggest Surahs to users who frequently listen to Quran based on their state of mind will be extremely helpful and compelling. QuranCompanion has been developed to show a prototype and the potential of the application in terms of stress management. Based on my research on various mobile platforms such as iPhone, it is evident that the mobile industry is going in the direction of providing platforms through which intelligent mobile applications can be developed that are personalized and responsive to each user uniquely.

QuranCompanion can be enhanced to become a fully intelligent and mood based application provided it can have access to touch sensing information, pulse rate, temperature and other user interaction details from the mobile phone. All of the 15 volunteers who tested the application agreed that it will be a helpful application and should be further enhanced. The future work I propose to be done on this application should include automatic prediction of the mood based on the variables mentioned earlier, storing all the feedback transparently and instead of popping up after a defined interval, the application should popup dynamically once the state of the user changes. The application can also be extended to studying the effects of Hadith[17]. Hadiths are the sayings of the Prophet and listening to them can also have an effect on the state of mind. Studying the effects of Hadith is another area of research on which no work has been done to date.

Appendix A

Data Set

A.1 Individual

Surahs.arff

```
@relation surahs
@attribute sDay {Saturday, Sunday, Monday, Tuesday, Wednesday, Thursday, Friday}
@attribute sMonth {April, May, June}
@attribute sDate {1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31}
@attribute sTime {1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}
@attribute surahName {Maun, Ikhlas, Al-Asr, Kauthar, Fatiha, Falaq, Al-Humazah, Al-Fil, Al-Masad, Kafirun, Nas, Wad-duha, Wat-tin, Tariq, Al-Qadr}
@attribute sId numeric
@attribute state {Depressed, Fasting, Excited, Low, Happy}
@attribute result  {Yes, No}
@attribute priority numeric

@data

Saturday,May,30,10,Kauthar,1,Depressed,Yes,5
Saturday,May,30,11,Fatiha,2,Excited,Yes,5
Saturday,May,30,11,Falaq,3,Happy,No,5
Saturday,May,30,11,Fatiha,4,Happy,No,4
Saturday,May,30,13,Al-Humazah,5,Happy,Yes,5
Saturday,May,30,13,Al-Fil,6,Excited,Yes,5
Saturday,May,30,15,Al-Masad,7,Low,No,5
Saturday,May,30,15,Al-Fil,8,Low,Yes,4
Saturday,May,30,15,Kafirun,9,Low,Yes,5
Saturday,May,30,16,Tariq,10,Happy,Yes,5
Saturday,May,30,16,Tariq,11,Happy,No,4
Saturday,May,30,18,Kafirun,12,Happy,No,4
Sunday,June,31,15,Al-Humazah,13,Excited,Yes,5
Sunday,June,31,16,Al-Qadr,14,Excited,Yes,4
Sunday,June,31,17,Maun,15,Low,Yes,5
Sunday,June,31,18,Wad-duha,16,Low,Yes,4
Sunday,June,31,20,Kauthar,17,Excited,Yes,5
Tuesday,June,2,13,Wat-tin,18,Low,Yes,5
Tuesday,June,2,13,Wad-duha,19,Low,Yes,5
Tuesday,June,2,13,Kafirun,20,Low,No,4
Tuesday,June,2,13,Nas,21,Depressed,Yes,5
Tuesday,June,2,13,Kauthar,22,Excited,Yes,5
Tuesday,June,2,14,Tariq,23,Low,Yes,5
Tuesday,June,2,16,Kauthar,24,Low,Yes,4
Friday,June,5,11,Fatiha,25,Low,Yes,5
Friday,June,5,11,Ikhlas,26,Low,Yes,5
Friday,June,5,15,Tariq,27,Happy,Yes,5
Friday,June,5,18,Fatiha,28,Happy,Yes,4
Friday,June,5,19,Al-Asr,29,Happy,Yes,5
Friday,June,5,20,Wat-tin,30,Happy,Yes,5
Friday,June,5,21,Al-Qadr,31,Happy,Yes,5
Friday,June,5,22,Wad-duha,32,Low,Yes,5
Friday,June,5,22,Al-Fil,33,Low,Yes,5
```

Figure A.1: Data Set - Individual

Bibliography

[1] macNN, (2007). Apple Patent: proximity, light sensor for iPhone.
Available from:
http://www.macnn.com/blogs/2007/04/19/apple-patent-proximity-light-sensor-for-iphone.html
[Accessed 2nd April 2009].

[2] Dahna McConnachie, (2009). CSIRO breathes new life into E-health. *Technology & Business* [online]
29 April, 2009. Available from:
http://www.technologyandbusiness.com.au/Mobile/News/CSIRO-breathes-new-life-into-E-health.aspx
[Accessed 5th May 2009].

[3] David Nicholas, (2005). *Cystic Fibrosis patients benefit from O2 mobile technology* [online] Available from
http://www.o2.com/media/press_releases/press_release_630.asp [Accessed 5th May 2009].

[4] Gartner, (2009). Gartner Says Worldwide Smartphone Sales Reached Its Lowest Growth Rate With 3.7 Per Cent Increase in Fourth Quarter of 2008. [online]. Available from
http://www.gartner.com/it/page.jsp?id=910112 [Accessed 14th June 2009].

[5] Alison Marshall, (2009). *Mobile food diary*. [online]. Available from
http://www.mobilehealth.leeds.ac.uk/mobile%20food%20diary.html [Accessed 5th May 2009].

[6] Caroline McCarthy, (2006). New cell phone to prevent drunk dialing. *Cnet news* [online] 28 June, 2008
Available from:
http://news.cnet.com/8301-10784_3-6088879-7.html [Accessed 6th May 2009].

[7] Sony Ericsson, (2009). *Playlists for your mood – SensMe* [online]. Available from
http://www.sonyericsson.com/cws/products/mobilephones/overview/w995?lc=en&cc=ae# [Accessed 15th April 2009].

[8] Alison Marshall, (2009). *Pulmonary rehabilitation monitor*. [online]. Available from
http://www.mobilehealth.leeds.ac.uk/pulmonary.html [Accessed 5th May 2009].

[9] Jeremy Kessel (2009). Symbian remains most dominant mobile OS in the world. *MobileCrunch* [online]
13 March, 2009 Available from
http://www.mobilecrunch.com/2009/03/13/symbian-remains-most-dominate-mobile-os-in-the-world/
[Accessed 14th June 2009]

[10] David Hand and Heikki Mannila and Padhraic Smyth. *Principles of Data Mining*. MIT
Press, Cambridge, Massachusetts, 2001.

[11] Esha Nag. How health conscious is your mobile phone? *Gulf News* [online] 3 November,2008. Available from:
http://archive.gulfnews.com/gnfocus/mobile_commu08/more_stories/10257970.html
[Accessed 17 February, 2009]

[12] Jonathan Posner and James A. Russell and Bradley S. Peterson. The circumplex model
of affect: An integrative approach to affective neuroscience, cognitive development, and
psychopathology. *Cambridge Journals*, 17(2-3):715-734, 2005.

[13] Mark Matthews and Gavin Doherty and John Sharry and Carol Fitzpatrick. Mobile Phone
Mood Charting for Adolescents. *British Journal of Guidance and Counselling*, 36, 2008.

[14] Rafael Anta and Shireen El-Wahab and Antonino Giuffrida. Mobile Health: The potential of mobile telephony to bring health care to the majority. 2009.

[15] Sophie C. Reid and Sylvia D. Kauer and Paul Dudgeon and Lena A. Sanci and Lydia A. Shrier and George C. Patton. A mobile phone program to track young peoples experiences of mood, stress and coping - Development and testing of the *mobiletype* program. *Social Psychiatry and Psychiatric Epidemiology*, 44:501-507, 2008.

[16] Sun Microsystems. *Developing Mobile Phone Applications With J2ME™Technology Student Guide.* , Broomfield, CO, USA, 2004.

[17] Syed Irfan Hyder and Syed Ghazanfar Ahmad. Towards a Database Oriented Hadith Research Using Relational, Algorithmic and Data-Warehousing Techniques. *Al Saqafat-ul-Islamia (Islamic Culture), Quarterly Journal of Shaikh Zayed Islamic Center for Islamic and Arabic Studies, University of Karachi*, 19, 2008.

[18] T. Fawcett. Automatic Construction of Decision Trees from Data: A Multi-Disciplinary Survey. 1998.

[19] Teresa Lesiuk. The effect of music listening on work performance. *Psychology of Music*, 33(2):173-191, 2005.