

**KEMI-TORNIO UNIVERSITY OF APPLIED SCIENCES  
TECHNOLOGY**

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**Music Player in Qt Framework**

The Bachelor's Thesis Information Technology Programme  
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## **PREFACE**

I would like to thanks my supervisors Mr. Harjuniemi Pekka and Mr. Thai Bui helped me in working on this thesis project.

## ABSTRACT

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The topic of this thesis was developing a Music Player application for mobile devices. The purposes of this application are the user interface is familiar with the user's experiences, and the application could cross-platform. For these purposes, the Qt framework was been chosen. The standard C++ programming language is the main language in Qt programming, so that was the main language in this thesis.

The so called "water fail" programming model and the object-oriented programming (OOP) method was used in design and program the product.

The purpose of this thesis is researching the programming method in Qt framework for mobile devices, and the result was successful for the personality. The product has been tested in Symbian S60 3<sup>rd</sup>, 5<sup>th</sup>, and Symbian 3, Maemo 5 simulators, and the main function worked well, but there were still some errors in details.

Keywords: Music player, Qt framework, C++

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## 1. INTRODUCTION

Qt is a cross-platform framework. It used by Nokia, and used for program the applications for Maemo 5 and Symbian 3 platforms on mobile devices. It will be widely used in next Nokia's platform which called Meego.

Because the Qt framework is cross-platform framework, it is really a code, used everywhere. That was the main reason for choosing this framework for this thesis project.

Music player is one of the most used functions on mobile devices. Not just on mobile phones, also in PDA or walkman. The application was cross-platform, which means one application could work in all devices; it will more market value in the future. Qt phonon media framework is a cross-platform multimedia framework that can be used in Qt applications and play audio and video multimedia content.

### 1.1. Project objectives

This project for mobile devices used C++ language to program a music player in Qt framework. That application should work on the Symbian S60 5th, Mamo5, Linux (PC), platforms also.

Primary target: create the application in Qt framework; realize the basic functions of music player, and successful working on Mobile devices.

Second target: the application realizes the cross-platform function; one source code can be function on almost all mobile devices' platform.

### 1.2. Project scope

This thesis will use the OOP (Object Oriented Programming) technologies to design and develop the application. It used the C++ programming language to implement the design. The application can run in the mobile devices and PC environment, including Symbian 3, Symbian S60 5<sup>th</sup> edition, Maemo 5, Microsoft Windows X86 and X64 operating system, and also with Linux kernel(X86 and X64).

For the mobile devices, the limitation is the need of the touch screen's operation and the platform use the Qt framework. For the PC, the limitation is that the operating system should use the Qt framework. The targeted users are the users who use the smart mobile phones. And the system can be: Symbian S60 5<sup>th</sup> edition, Symbian S60 3<sup>rd</sup> edition, and Maemo 5 operating system. There is not so much limitation in the hardware suppose, so most of the devices which use the platforms are in list before.

### **1.3. Structure of the thesis**

In first part, some interdictions for this thesis's background, few mobile application overview, some information and comparison with the popular platform will be given. In additional part will be explained a cross-platform application and UI framework of Qt.

Next development part is the motivation and design opinion for the music player system.

After that in implementation part is explained the application implements way, and some cold distinct illustrations are given.

At the end part, there will be given a summary for the whole thesis research of this music player system.

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## **2. BACKGROUND**

This chapter will be given some information for mobile application overview and QT Cross-platform application.

Introduction for QT, the new QT SDK enables a faster, smoother user experiences, and explains QT phonon media framework.

Qt framework is a cross-platform framework. It is the most used developing framework for Nokia until now, it was used in Maemo and Symbian 3 applications' developing, and it will be widely used in next main platform for Nokia – Meego. The Qt framework is cross-platform framework, so it could be really be a code, everywhere used.

Music player is one of the most used functions on mobile devices. Not only on mobile phones, but also on PDA or walkman. If the application cross-platform, that means one application could work in all platforms, it will be more market value in the future.

Qt phonon media framework is a cross-platform multimedia framework that can be used in Qt applications and play audio and video multimedia content.

### **2.1. Mobile application overview**

In nowadays, mobile phone is one of the most necessities devices of the people's life. Every kind of applications have their special editions made for different kinds of mobile platforms, there are plenty of worthwhile places for you to use. The mobile phone is not only to be a simple communication tool between people, it can used for reading the

documents or working online with 3G and WIFI network; the user can play games and listen to the music or watch the video with media applications. In order to realize much more different functions, mobile phone's hardware has also been developed.

### **Windows Mobile**

Windows Mobile is the Microsoft Software for Pocket PC and Smartphone platform. It extended to individuals familiar Windows desktop device. Windows Mobile is a Microsoft Windows platform for handheld devices introduces "mobile version of Windows ", use this operating system facilities mainly in the smart phone and PDA, with the music player. There are three kinds of operating systems: Windows Mobile Standard, Windows Mobile Professional, and Windows Mobile Classic. The current version is Windows Mobile 6.5, the latest version is Windows mobile 7.

### **Android**

Android is a software stack for mobile devices include an operating system, middleware, and key applications. Android operating system is base on the Linux kernel. The open-sources software stack of Android consists of Java application running on a Java-based, object-oriented application framework on top of Java core libraries running on a Dalvik virtual machine featuring JIT compilation. Libraries written in C language include the surface manager, OpenCore media framework, SQLite relational database management system, OpenGL ES2.0 3Dgraphics API, Webkit layout engine, SGL graphic engine, and SSL and Bionic libc.

Android platform is used in several types of mobile devices which from almost all mobile companies. Samsun, HTC, Sony Ericsson, and Huawei have their own mobile devices used Android platform. So it is the world's best-selling Smartphone platform. But in this case, the applications which developed for Android platform, the limitation are different. That lead the application might not use on all Android devices. Before use the application, the user must chuck the hardware limitation first, if not, the application might not work smoothly even never work.

### **Symbian**

Symbian operating system is mainly composed of several hardware, central processor, ROM, RAM, IO devices and power. The hardware composition carries out their duties to ensure the operation of the system. It works in 32 bits processor in normally.

Symbian system is an open source operating system, that means every user can make own application by themselves. The application of Symbian made in C++ language, and Java programming language. It makes more widely applications to run on the Symbian platform. The hardware limitation for Symbian system is not so high like other mobile platforms, that makes more and more mobile company choose it for their products.

In nowadays, Symbian operating system works with the Qt cross-platform framework, except the hardware difference, that make more applications which developed for Maemo or Meego could be run in Symbian 3 devices, also in Symbian S60 devices.

But there are also some problems of disadvantages, like: Symbian models used in the hardware configuration of the lower and various models with low CPU Clock, although the system makes it a higher efficiency. But in such areas the multimedia performance is still not satisfactory. In multimedia part, Symbian OS can work with the mainstream media format. Even though Symbian OS uses multiple platforms, to meet the needs of different groups and various, but it also brought a restricted to the Symbian OS development obstacles. The third - part software compatibility between the platform and software developers to concentrate on one platform, this make less various from third - part software platforms cannot be available to use. This problem brings some inconvenience to the users. Version Compatibility difference between the Symbian OS need to be improved one place, when new versions the Symbian OS releases and products available. Compatibility of the system has become another impede for its development.

### **Maemo**

Maemo is built on a desktop computer platform of Open Source components; The objective is to provide a mobile handheld terminal application and innovation of technology. Maemo was launched the first time in 2005 is one of the core platforms of high - level products of Nokia.

The platform based on GNU/Linux operating system and GNOME desktop technology. Maemo gives the developers possible to provide a convenient and practical development environment. It's the new platform, and evolves Hildon UI designed to touch screen handheld terminal screen size and typical uses for optimization.

It provides a powerful platform and developers facilitates development, build and test environment. The platform provides you with the desktop environment similar functions. Maemo is widely deployed in some of the most popular Linux distributions of the mainstream composed of open source software; therefore, necessary skills, tools, and community support are ready. Because maemo platform is a standard development environment, transplant existing application is very convenient.

Development of hand - held terminal is simplified, so as to enhance the efficiency and reduce the study of developers. Application of test and debug is convenient, because the software development environment running and target terminal is the same.

In fact, in the development of host target hardware emulation is not much to demand. This provides an accurate test environment. Maemo based on ARM architecture of terminal operations and software development kit at present provided for Desktop Linux distributions, like, Debian and Ubuntu.



## 2.2. Qt Platform

Qt framework is widely used in anywhere for the electronic products



Fig. 1.

Qt use place /3/

Qt framework is a cross-platform framework which is used to develop the C++ application using graphic user interface. It provides application developers to build-the-art graphical user interface used for the required functions. Qt is fully object-oriented, easily extensible, and allows true component programming manner. Since early 1996 when Qt introduced into the business world, it has become a worldwide success of thousands of applications that base. Qt is also the popular Linux desktop environment KDE foundation. Basically, Qt with the X Window on the Motif, OpenWin, GTK and other libraries and the graphical interface on Windows platform, MFC, OWL, VCL, ATL is the same type of thing, but Qt has excellent cross-platform, object-oriented, many kind the of API, many development documents and so on.

QT is a cross platform development framework written in C++.it use Python, Ruby, C languages and so on, to built the C++ framework use Databases, XML, Web Kit, multimedia, networking, OpenGL...make the original for user interfaces. API design ideas and C++ language programming and most function are the same.

One-time code programming can be used in different application platforms to adapt to different user interface platforms, open source code to facilitate learning and program. PC mobile client now under increasing QT cross-platform software development resources and more convenient to use because it easy software, developers programming code only once to allow the application of the software in different platforms Is compatible with the application platform:

Desktop target platforms: Windows, Mac OS X, Linux / UNIX X11.

Embedded target platforms: Windows CE, Symbian, Maemo, Embedded Linux.

### 2.2.1. Open Source

The QT framework is free for the developers. The application developing could choose LGPL, GPL, Commercial license. LGPL (Lesser General Public License): the application available to open or closed, the developer change the application to QT must be fed back to the community. GPL (General Public License): the application must be open. Commercial: the application can be closed.

### 2.2.2. Short History

1991: Haavard Nord and Eirik Chambe-Eng begin to develop what will be QT supporting X11 and windows.

1994: The Company Trolltech was formed.

1996: The KDE project starts by Matthias Ettrich.

2001: Added support for Mac OS X.

2005: All platforms released under GPL.

2008: Nokia acquires Trolltech.

2009: Support for S60. March 3, 2009 Qt SDK 4.5; December 1, 2009 Qt SDK 4.6.

2010: Qt SDK 4.7, QML and Quick

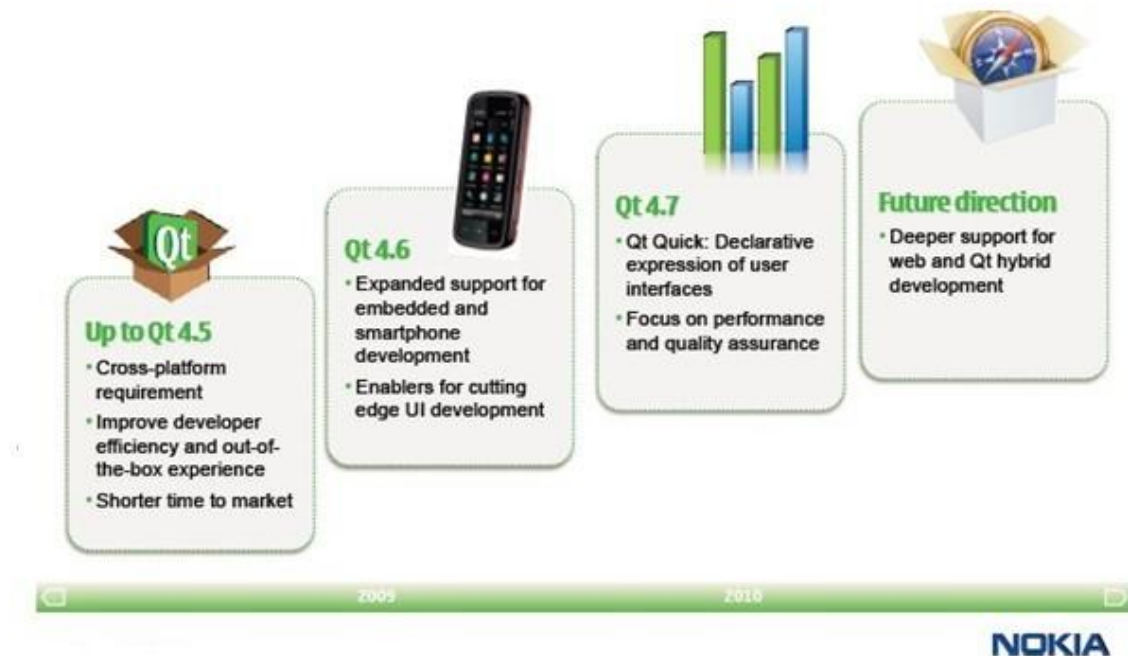


Fig. 2. Qt history /3/

### 2.2.3. Qt SDK

Nokia Qt SDK is developed specifically for the Qt cross-platform mobile application development tools introduced, compared to the previous SDK, it has the following characteristics:

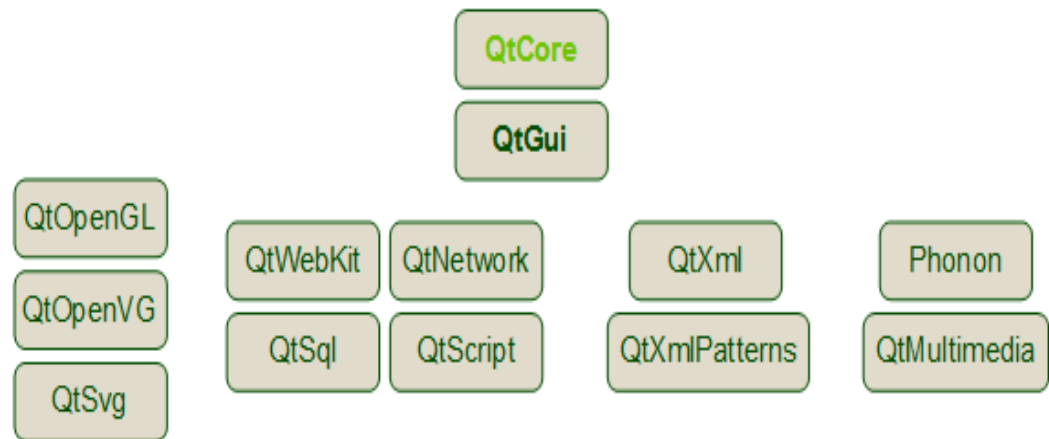


**Fig. 3. Qt history /6/**

- Easier to install: only need to download an installation package.
- Simulator starts up faster: Qt simulator process and memory only use very small space in memory.
- Truly cross-platform: use a development tool can be developed in Symbian, maemo, and the application of the simulator.
- Hardware debugs support.
- Development platform can be extended: by extension, you can develop applications on other platforms such as Windows, Mac and other platforms application.

### 2.2.4. Phonon

After years of development, Qt not only has the perfect C graphic library, and gradually integrated version database in recent years, OpenGL library, multimedia library, internet, script library, XML, Web Kit libraries, and so on. The core of dam have joined the Inter - process communication, multithreaded module, which greatly make more Qt ability to develop large - scale complex cross - platform application, in the true sense to realize its development aims " Code Less ; Create More ; Deploy Anywhere.



**Fig. 4. Model using for Qt /4/**

Phonon is a cross-platform multimedia framework which can use in Qt applications and play audio and video multimedia content.

Starting from the 4.4 version of Qt provides a multimedia framework that provides multimedia playback capabilities. Currently implemented in Qt 4.6 GUI multimedia player depends on the phonon framework, to achieve the underlying media player, under normal circumstances the upper interface phonon module is more suitable for these functions. Initially a phonon from the KDE project, for the use of audio and video application development provides a framework. Application does not need to manage what is achieved through the multimedia player (such as gstreamer, xine), simply call the corresponding interface on the line, but it needs a transit center, known as the backend. It is also achieved by phonon boost platform multimedia player.

Playback of multimedia files, including the main process: file read, streaming, decoding, output.

### **Phonon structure:**

Overall, Phonon structure need only remember the following three things:  
Phonon is using to control multi-media sources. Sources may be audio and video files, etc., and can provide basic playback control, such as starting, pausing or ending. To provide multimedia information to the media object compared to media source, in a media object is usually before the raw data, and then converted by the media object. Compile Phonon Library: normally, Qt default is not compiled, you only need to configure adding parameters, and then enter the phonon alone can be a folder is compiled

Compile your Phonon back - end cards: Qt 3 large platform to provide a back - end plug - INS, srcpluginsphonon directory. Enter the directory compiled, Qt will automatically

choose your back - end of the current system plug - Ins. Phonon backend not appear Plug-in could not be loaded. Output media, such as playing video or widget output to sound card (playing music). Usually a play sink device (such as sound cards, etc.). The sink only accept media object to the data, control playback from the media object; and from the sink to handle these multimedia

Make sure that your back - end normal operation for Qt provide a default provides a plug - in back - end, there will be no problem. Qt embedded player or QProcess Mplayer slave mode. Phonon objects used to connect, which means that media object and the connection between the play devices.

### **3. DEVELOPMENT**

The motivation and background information, music player's functionalities were explained in this part.

#### **3.1. Requirement**

The main target of this thesis project is to study the application programs in mobile phone. There are numerous applications with different functions like entertainments, working tools to be used on mobile phone; these applications make the phone more usefully for people's communication and entertainment. And more functions will be added to the phone in the future.

Nowadays, the mobile phone is not simply a communication tool for people's daily life. With the development of the mobile devices, mobile phone can achieve more and more applications with different purposes and people's life has been changed by the mobile phone. It helps people not only with communication but also with the convenience that improves people's life. Applications which make entertaining and help working become the necessary functions for mobile phone. In this case those simple and practical applications of software becoming more and more popular.

As mobile multimedia functions of music player appears in many phones, it becomes an important part of the applications. A simple and easy - to - use mobile music players will bring more joy to the users.

But today, every operating system has its own applications. And the same function needs to be implemented by using different program languages or tapes. This problem brings more inconvenience to developers. So the idea that to chose and research the Qt platform is great. Because it can build the same application running in different system, it makes programming easier and also saving time and resources.

The reason for choosing the QT as a development platform, is that it is a new development for Cross - Platform Application of NOKIA, it makes mobile phone applications applied successfully in different platforms without the need of modifying the program's code. QT cross - platform performance will be widely used in nowadays mobile devices and PCs; it will have more space for development in the future.

## **3.2. Design**

The analysis of application of the project work, analysis of the application design and the system design diagrams will be explained in this part.

### **3.2.1. Analysis of application needs**

The main target of this thesis project is to build a music player. The application can be worked in the mobile devices, and it should achieved functions including:

- System can load the music from the external memory (such as SD card, Memory stick).
- User can create, delete play list, and run music with all the audio formats, build the play list in ways like: recent played songs, favourite list.
- There are several buttons for skipping to the previous or the next song, and also start or pause the playing. The time bar can show the played time of the current song.
- User interface is friendly and easy to operate.
- The application is cross-platform, which means it can be run in different platforms including Symbian S60 5th, Maemo, and also in Linux (PC Ubuntu 10.10).

### **3.2.2. Considerations during design**

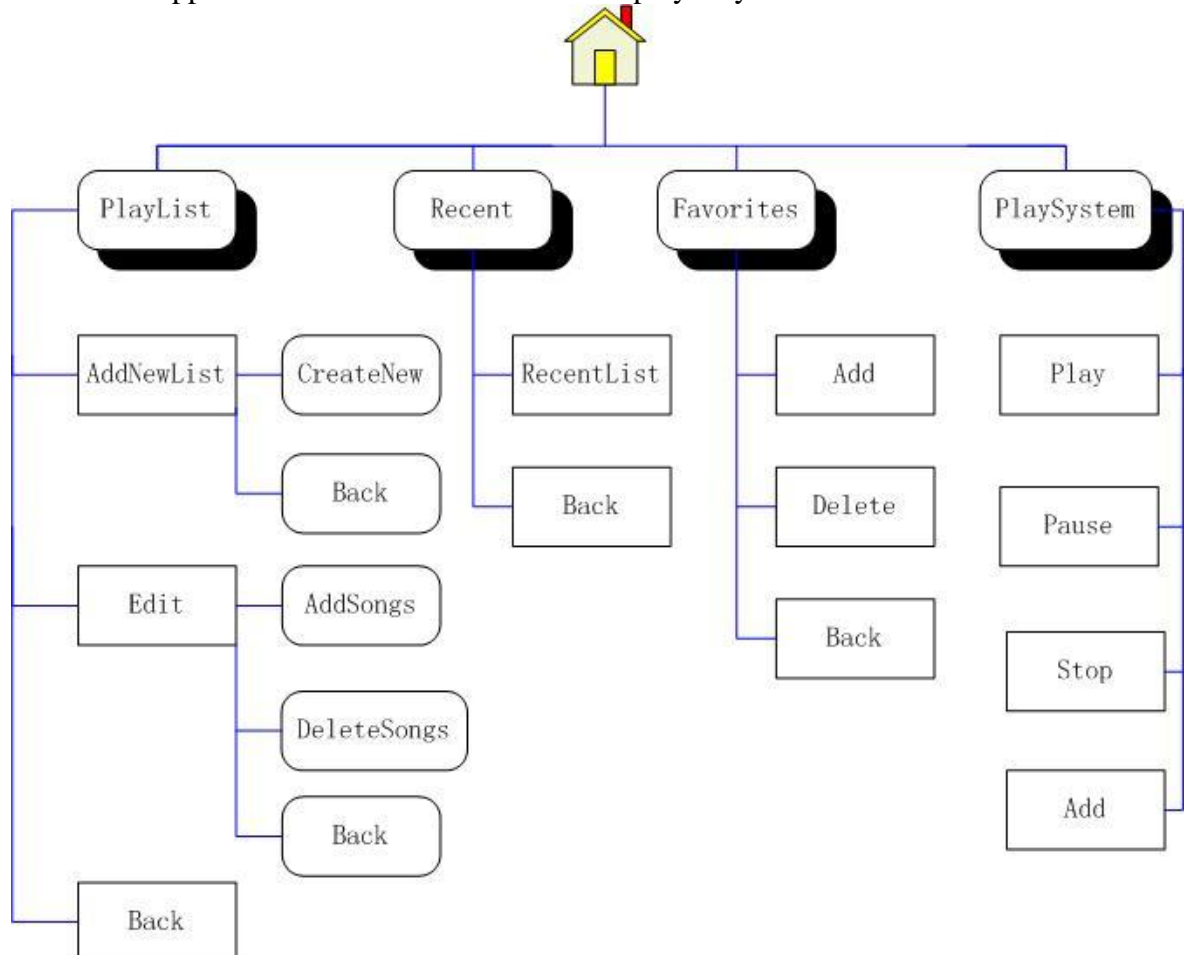
The development for mobile phone product and technology related mobile phone application is fast today. If a platform wants to be chosen, it must have a vast number of applications and resources for users than other platforms. As we know that in the new investigation report, most mobile phones and other terminal manufacturers use the Android platform, the reason that why Android is popular is that it is implemented with an Open Handset Alliance to expand its scale. The more users and manufacturers choosing android, the more the shared information and applications resources will appeared in the Android platform. However, Qt also provides developers the same advantages; the cross-platform feature can gather a large shared market of applications and resources for itself.

The main point of considerations in the design phase can be concluded in three tips.

1. When the cross platform application works in different mobile, the operation was different because of the difference between keyboard and the touch screen.
2. The application needs to be developed as Low-Level API, so that it won't have too much hardware limit. This ensures most mobile phones can run this music player.
3. The database needs to be built in small size. When processing too many processes and saving operations, it will affect the working of phone's CPU and memory hardware.

### 3.2.3. Application framework

Here is the application framework for the music player system.



**Fig. 5 Application Framework for music player system**

There are four parts in the home window: play system, play list, favourites list and recent list.

The playing system includes functions like adding songs from memory, starting play music. There is a time bar to show the timing processes. Pause and stop functions are also implemented as the control function.

In play list window, there are three parts:

- Open the Add New List window could create new list, input the new list name. And back to play list window.
- The admin of the play list in edit window is to add songs to play list and delete them.
- Back button can make the current window jump to the home window.

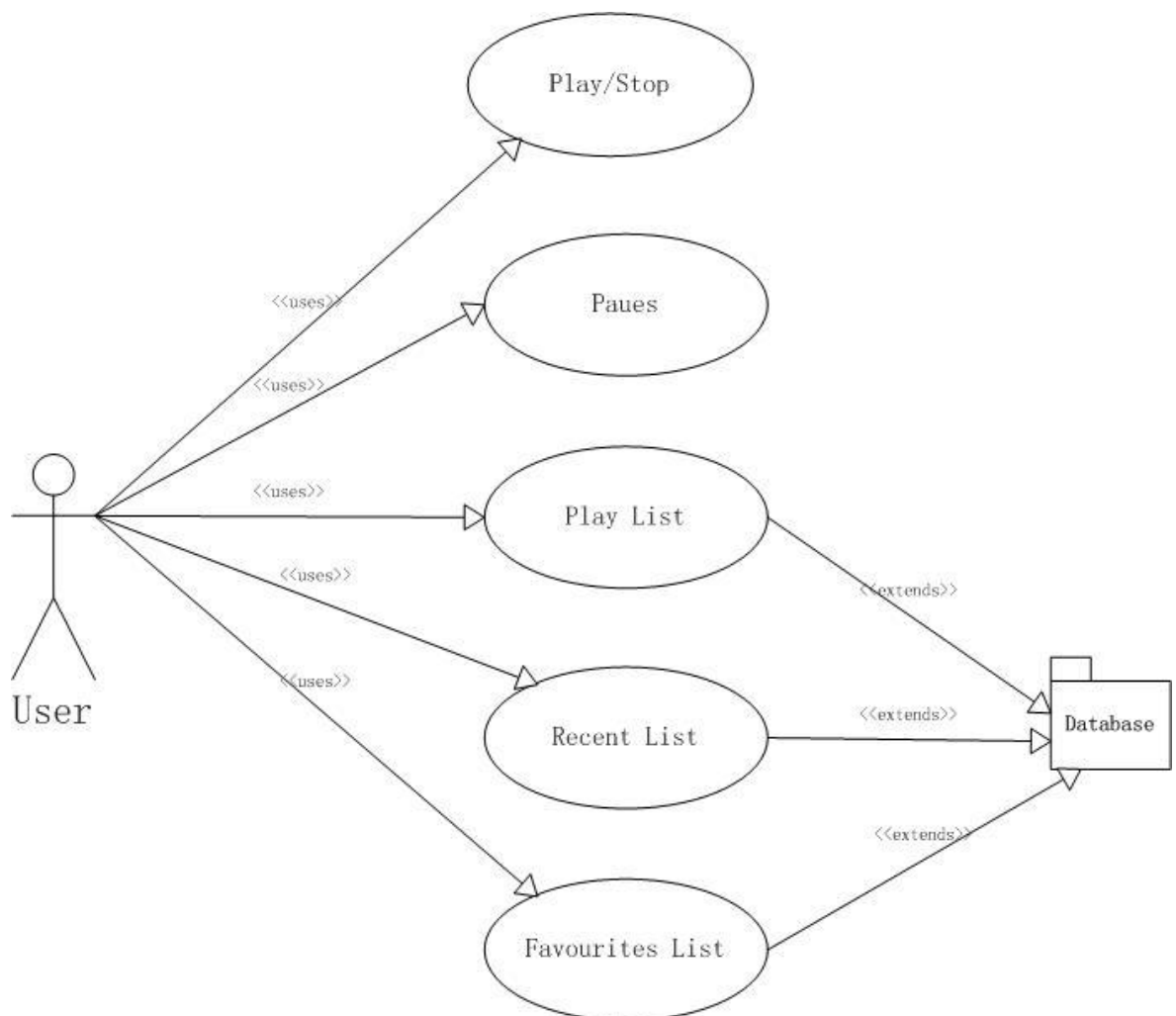


In recent list window has the table to show the songs play history and back to home window.

Choosing the favour songs to add to the favourite list or delete from favourites list window are possible operations in this music player program.

### 3.2.4. Use case diagram

This use case diagram describes the relationship between user and application's functions. User can use play the songs through selecting the music player and playlist information will be saved in database to implementation the creator function.



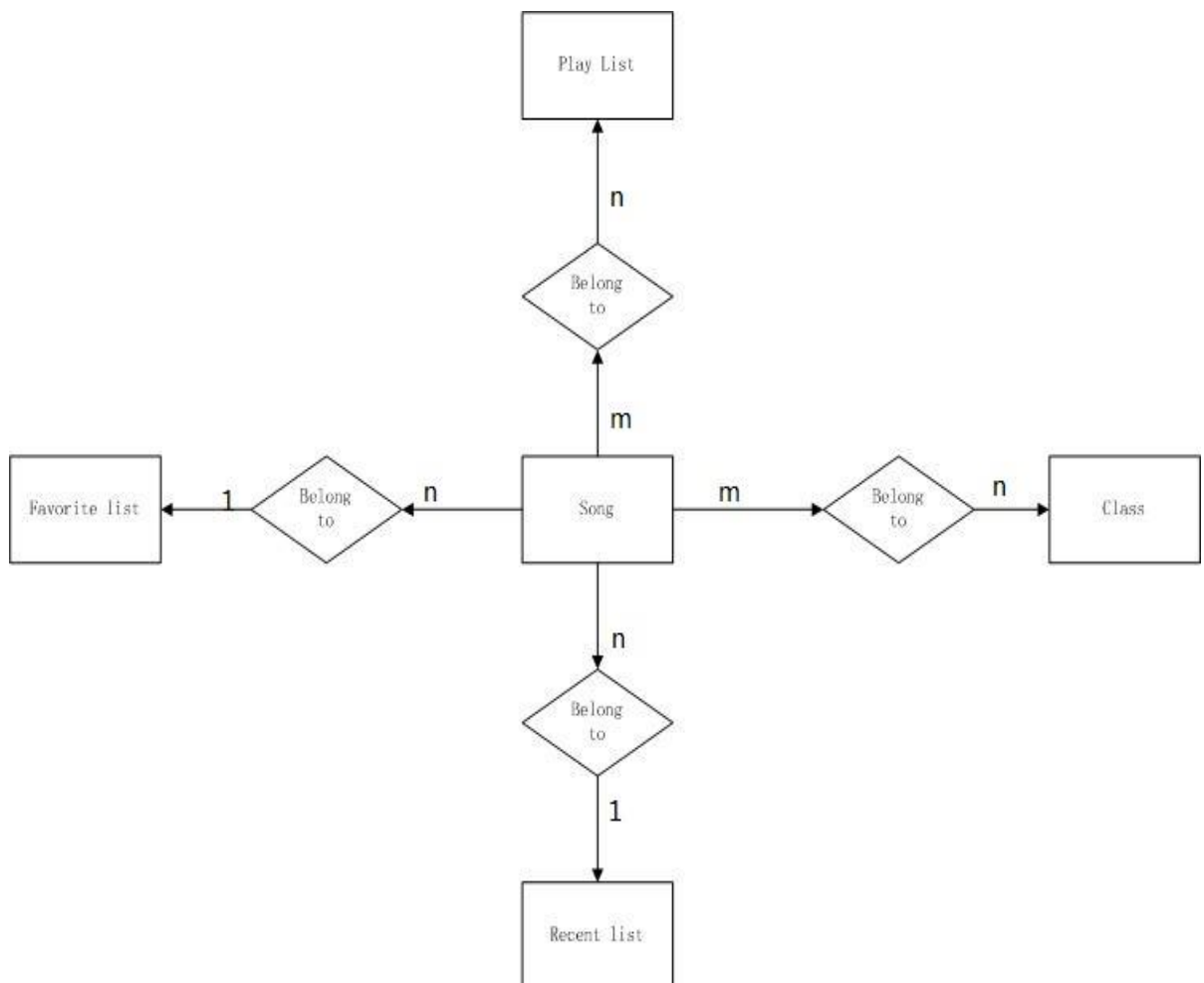
**Fig.6. Use Case diagram**

The music-playing system is the basic functionality of the music player, user can use different buttons to make operations such as adding songs in play list, playing the songs, pause, stop and check the played time.

There also has a function to create the new play list for users by themselves so that they can define the songs in the play list by themselves. Additionally it is possible to manage the list like deleting songs or add new songs. The play list is designed user-friendly and convenient. If there is a song which is preferred, then it is possible to mark it so that it is easier to find it and to be added to favourites play list. The recent list will collect and show the history for played songs previously.

### 3.2.5. Database Entity Relationship

Because of the play list functions, the system needs to work with designed database. The connection between the data in the database and the selected songs can store the selected songs to the specific play lists, and make the whole system work smoothly. Here is the entity relationship diagram that shows the application's database connection.



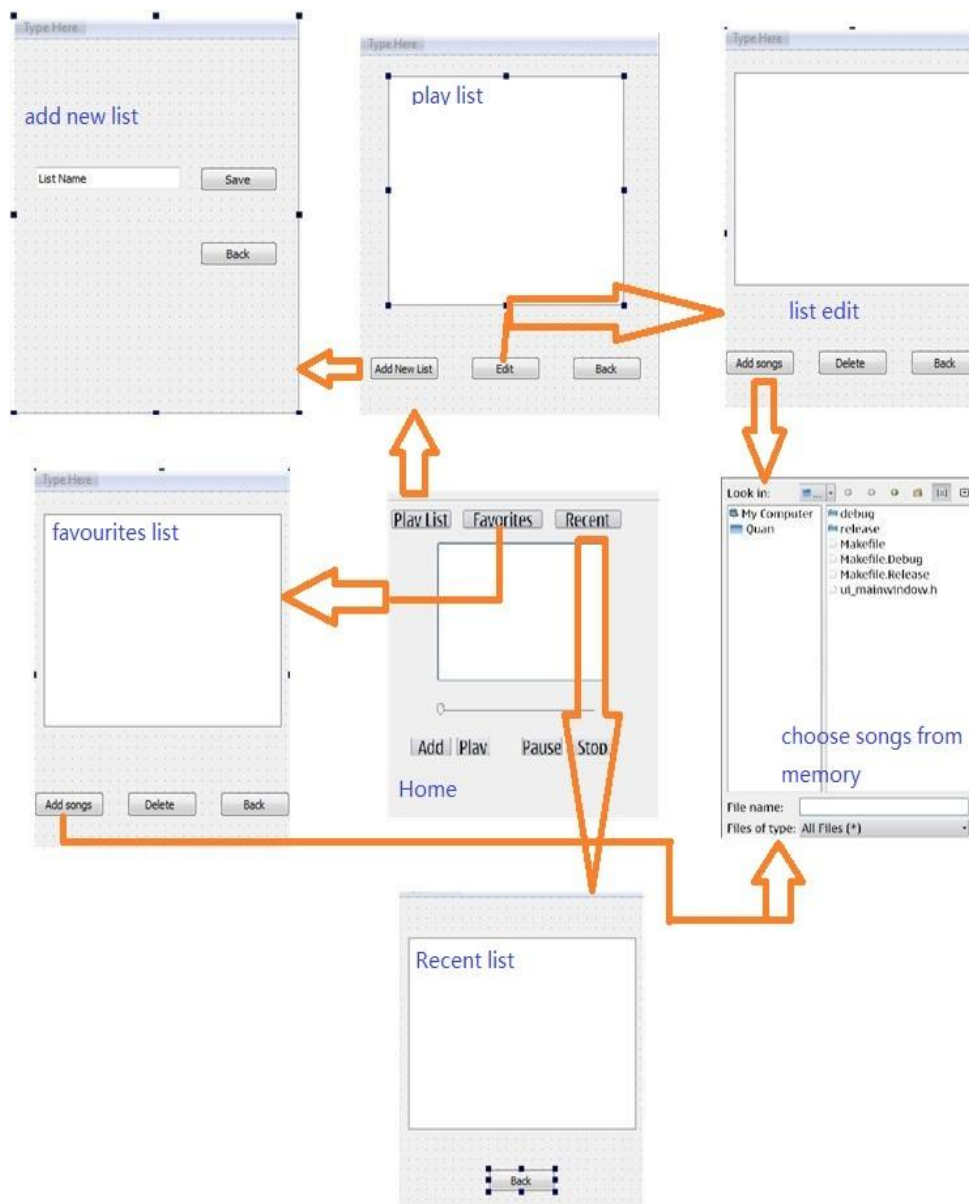
**Fig. 7 Database Entity Relationship diagram for music player system**

The databases can be regarded as the media inventory. When the songs are added to the media inventory, then there will appear song-ids in the database, these id will be used when the songs are added to playlist or music class. In the table which called "song".

The Song's ID is the primary key. This key can belong to several classes, and several Playlists, but only one in favourite list and recent list. That means, if one song loads to this database, this song can be counted in more than one class and added several times in different classes, but it can only be added one time in favourite list and recent list. In the design like this, the application could achieve the working purpose by the lowest hardware requirement.

## 4. IMPLEMENTATION

For the application design purpose, the user interface's framework can be shown below:



**Fig.8. User interface**

The site which is called as “Home” is the main window for this application. And there are 6 dialog windows to implement the full functions of the application.

First of all, the application should connect to the database and create the tables in the database.

```

    QSqlDatabase db = QSqlDatabase::addDatabase("QSQLITE");
    #ifdef Q_OS_LINUX
        QString path(QDir::home().path());
        path.append(QDir::separator()).append("my.db.sqlite");
        path = QDir::toNativeSeparators(path);
        db.setDatabaseName(path);
    #else
        db.setDatabaseName("my.db.sqlite");
        QSqlQuery query;
        query.exec("create table songs(s_id int primary key AUTOINCREMENT, songlocation
varchar(50), sc_id int, pl_id int)");
        query.exec("create table songclass(sc_id int primary key AUTOINCREMENT, s_id int,
c_id int)");
        query.exec("create table class(c_id int primary key AUTOINCREMENT, c_name
varchar(50), sc_id int)");
        query.exec("create table recent_songs(rs_id int primary key AUTOINCREMENT, s_id
int)");
        query.exec("create table favourite_song(fs_id int primary key AUTOINCREMENT, s_id
int)");
        query.exec("create table playlist(pl_id int primary key AUTOINCREMENT, pl_name
varchar(20))");

```

For every code file which was used connection to the database, it should define in the header as shown below:

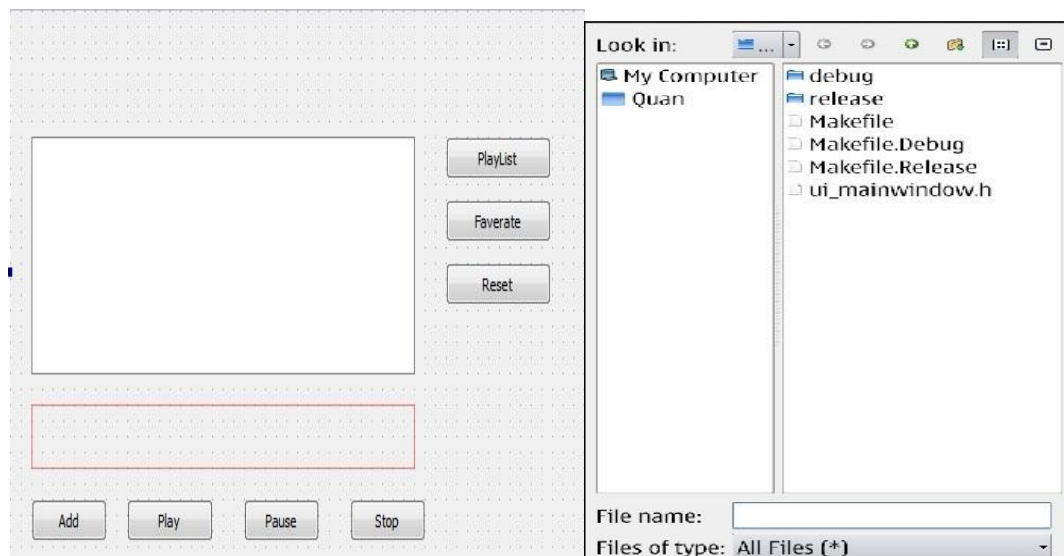
```

#include <QtSql>
#include <QSqlQuery>

```

#### 4.1. Home:

The main functions of the music player are working based on this window. All the buttons have been placed as following image for the logical requirements.



**Fig.9. User interface -Home window**

The main list is using the ListWidget to show the playing list, such as the list detail including the play list which is playing currently. The function should be:

```
void MainWindow::changeEvent(QEvent *e)
{
    QMainWindow::changeEvent(e);
    switch (e->type()) {
        case QEvent::LanguageChange:
            ui->retranslateUi(this);
            break;
        default:
            break;
    }
}
```

**Add button:** this button is used for adding songs from the hard disk to play list. For this function, it could ask the field controller to add the items which have been selected to the list and play .

```
void MainWindow::addFiles()
{
    QStringList files = QFileDialog::getOpenFileNames(this, tr("Selec Files to play"));
    QString file;
    foreach(file, files){
        this->ui->listWidget->addItem(file);
        sourceList.append(file);
    }
}
```

**Play Button:** this button is used to start to play of the music, this function is used the functions from phonon. Before the play button press, the pause button can't be pressed, and during playing process, the play button is disabled.

```
void MainWindow::playFile()
{
```

```

    if(sourceList.isEmpty()){
        QMessageBox::information(this, tr("no music files"), tr("no files to play"));
        return ;
    }
    mediaObject->setQueue(sourceList);
    mediaObject->play();
    this->ui->playBtn->setEnabled(false);
    this->ui->pauseBtn->setEnabled(true);
}

```

**Pause/Stop button:** These functions should be coding in similar way. Ask the function from phonon, the media object is the really working part in this project.

```

void MainWindow::pauseFile(){
    mediaObject->pause();
    this->ui->pauseBtn->setEnabled(false);
    this->ui->playBtn->setEnabled(true);
}
void MainWindow::stopFile(){
    mediaObject->stop();
    this->ui->pauseBtn->setEnabled(true);
    this->ui->playBtn->setEnabled(true);
}

```

For these functions, the application has to ask the functions from phonon, so in the header file, there should add

```
#include <Phonon>
```

**Other buttons:** Playlist button, Favourite button, and Recent button are link with their own pages. In this project, the link between pages can be implemented by the method of windows dialog.

## 4.2. Play List:

In this page, the main list fram will list all list names that from the database.

```

QString playlist = "select pl_name from playlist";
 QSqlQuery query;
 query.exec(playlist);
 while(query.next())
 {
     ui->listWidget->addItem(query.value(0).toStringList());
 }

```



**Fig.10. User interface –Play List window**

All the buttons in this window is linked to their own control windows. But in edit button, the application could get the data from the list which is selected, and the data can be sent to the edit window.

```
void PlayListDlg::on_EditBtn_clicked()
{
    QString s;
    foreach(QListWidgetItem *listname, ui->listWidget->selectedItems())
        s = listname->text();
    edD.show(s);
}
```

### 4.3. Favourite List:

This function should be similar to the play list window. But it can be linked to favourite table in the database.

### 4.4. List edition:

The text label displays the name of the play list which is selected from the play list window. In this window, the playlist could be edited, the operation including adding or deleting songs. When the add button is pressed, it will load the file controller, after add button is pressed, it will update the PlaylistID section in the songs table, the updated data is searched from the playlist table.



**Fig.11. User interface -Edit window**

When the delete button is pressed, the selecting item's PlayListID section will be return to empty in the table of songs.

#### **4.5. Testing:**

The application has been tested in Nokia Qt Simulator. It can run successfully in Maemo, Symbian3, and Symbian S60 5<sup>th</sup> edition's devices. Because S60 3<sup>rd</sup> edition platform does not support the touch screen, even this application can be loaded, but it cannot be operated well.



**Fig.12. Simulator Testing on Nokia N900 (Maemo)**

The music player system works on Maemo platform simulator well.





**Fig.13. Simulator Testing on Nokia N8 (Symbian 3)**

The application ran on Symbian 3 simulator.



**Fig.14. Simulator Testing on Nokia N97 (Symbian S60 5<sup>th</sup>)**

The application worked on Symbian S60 5<sup>th</sup> testing simulator.



**Fig.15. Simulator Testing on Nokia N95 (Symbian S60 3<sup>rd</sup>)**

The application can run on mobile phone with keyboard but operate has a little inconvenience.

The main functions can work successfully, like playing music, pausing and stopping the process. The play list function works not very well. New play list can be created and successful saved in the database. But the function of editing play list is not works, which means, the user can't add songs to playlist.

## 5. CONCLUSIONS

### 5.1. Problems during codeing.

When I implemented the music player system, many difficulties were met. I tried to find the problems and solve them through the study and supervisor's help.

First is installation of Qt SDK. When I downloaded the package from the Nokia's WebPages and installed it, but the Qt Creator could not work, the test example project did not work. I tried install it lots of time and change the different operating system, but it still not work. After that my supervise give me the advise to download one more library, because the problem is there has some function models missing. Though update the Qt library the Qt Creator can work well.

Second problem is that creator new project could not find the KDE phonon model. The Qt could make application cross-platform need many kinds of function models, and Phonon is the model necessary part with media function. So if there miss the Phonon model the music player cannot work. But I install the all library already, so change the operating system to tried again was my solve way. I choose the Windows 7 to install again, there not find this problem. Maybe the problem is compatibility between the Ubuntu and Qt SDK. After that the Nokia update the new Qt SDK 1.1 Bata, this new application helps me solve the phonon not work problem.

Third problem is application's database design. The music player system had some functions to creator the playlist so there need built database to implementing the playlist work. First there have five tables I built songs, song class, class, recent list, favourites list. This five tables show the collection for useful data to save and connection way. But my supervise to give me advise for two missing tables playlist and song-playlist. After these two tables the database could work well.

More problems were to come from the coding work. From the beginning, I have to design the windows, how to make the user interface familiar with the user experience is a big question again. I have tried several music players from other products. I found that the simple UI design is much better, because the simple UI should familiar with user's experience, never need to read extra introductions is the best. After that, I need solve the problem of the windows switch. I have read the tutoring documents from the Nokia official web pages. I found that, in Qt programming, which called dialog programming. I have made every window to application dialog. In these dialog, I embedded the functions on each button. And there are more problems from the Qt widgets which I have used, like List Widget. I solve this kind of problems also from reading tutoring documents, and some example code from Nokia official website. My supervisor gave really great help in the coding part.

## 5.2. The summary for whole theses

The purpose of this thesis was to build a new mobile application to get some professional skill grown. From the project plan, to learn how to plan the project, to include the professional English writing, time table design. For design process, to learn how to design a software product, to include the UML images graphic, functions analysis. Because I needed to use Linux operating system, I started to learn some basic commands of Linux, like to install programming tools, plugs and encoding models. For the Qt, I learned Qt cross platform framework, and basic information about the Qt framework, C++ language programming Qt application in Qt Creator IDE and GUI designing.

For the final product, the functions of playing or pause the music, stop and create the playlist worked fine. It has been tested in the Nokia SDK simulator, and it worked successfully on the platform of S60 3<sup>rd</sup>, 5<sup>th</sup> edition, and Maemo 5, and also in Linux desktop operating system. That means that the final product's cross-platform design is success. Although without the testing in real mobile devices, but if it could work on simulator, it will work fine on real devices too.

The functions for skipped to the next song, previous music, and recent played song list, favorite list play list show on the home window not successful. The missing function about the player control is might be cause of the phonon decoding. The problem about the play list maybe caused of the database design and the while system analyzing.

I will pay more attention on the beginning application analyzing and coding skill. Because the analyzing it the most important part in while product. And some problems come from the coding skill; my supervisor gave me a lot of helping in the coding part. That is the second point which I will work hard on.

But finally, I do get a lot of professional skill growing. As the project plan writing, I really increase my coding skill, UML design skill, and also the professional English writing.

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## APPENDIX

### Installation Qt SDK

Step 1:

Getting Qt: Download from the Nokia forum, choose the version for the operating system (32- or 64-bit Windows XP SP2, vista, windows7, Mac OS X 10.6 or later).

For Windows:

Step 2: Run the installer.

Step 3: Click through the installer.

Step 4: Start QtCreator from the start menu.

For Mac OS X:

Step 2: Run installer package.

Step 3: Click through the installer.

Step 4: Start QtCreator from the Finder.

For Ubuntu:

Using the commands:

```
$ sudo aptitude install build-essential libqt4-dev libqt4-dev-tools qt4-designer
```

For X11:

Step 2: make the installer executable:

```
chmod u+x qt-sdk.linux-*.bin
```

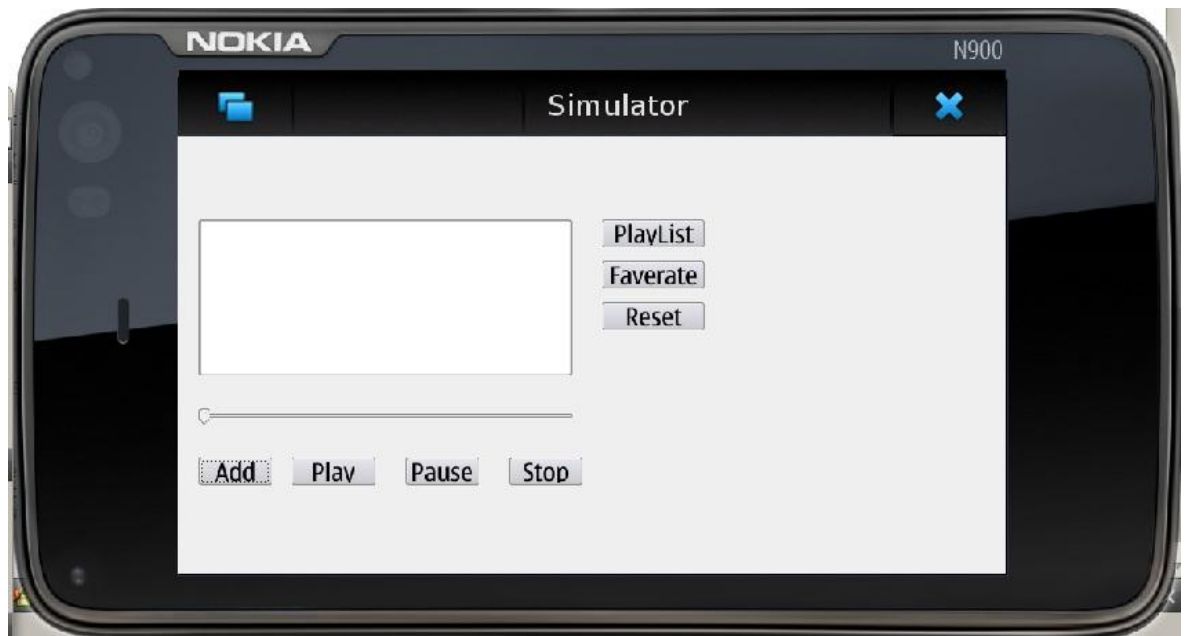
Step 3: run installer.

Step 4: Click through.

Step 5: Start Qt Creator from desktop or menu.

## GUIDE IN PRACTICAL USE

**Step 1.** The music player system interfase.



**Step 2.** Select the songs from mobile phone memory when chick the Add button.

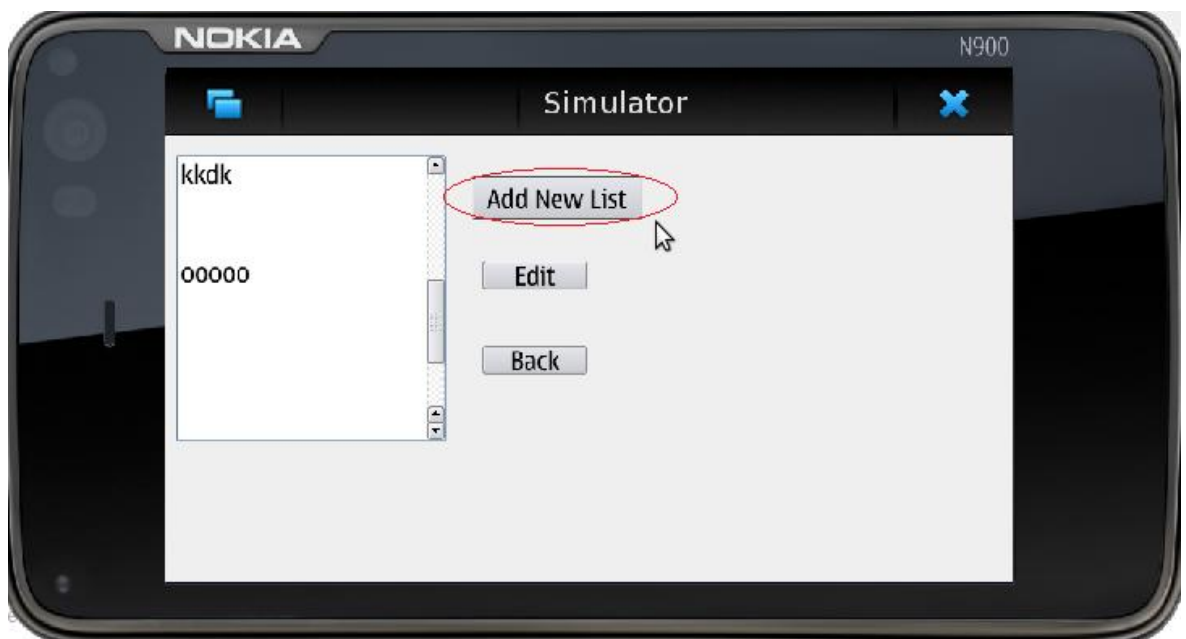


**Step 3.** When the songs chooes already it will show in the list screen, and than can use the play, pauses and stop to control the music play process.

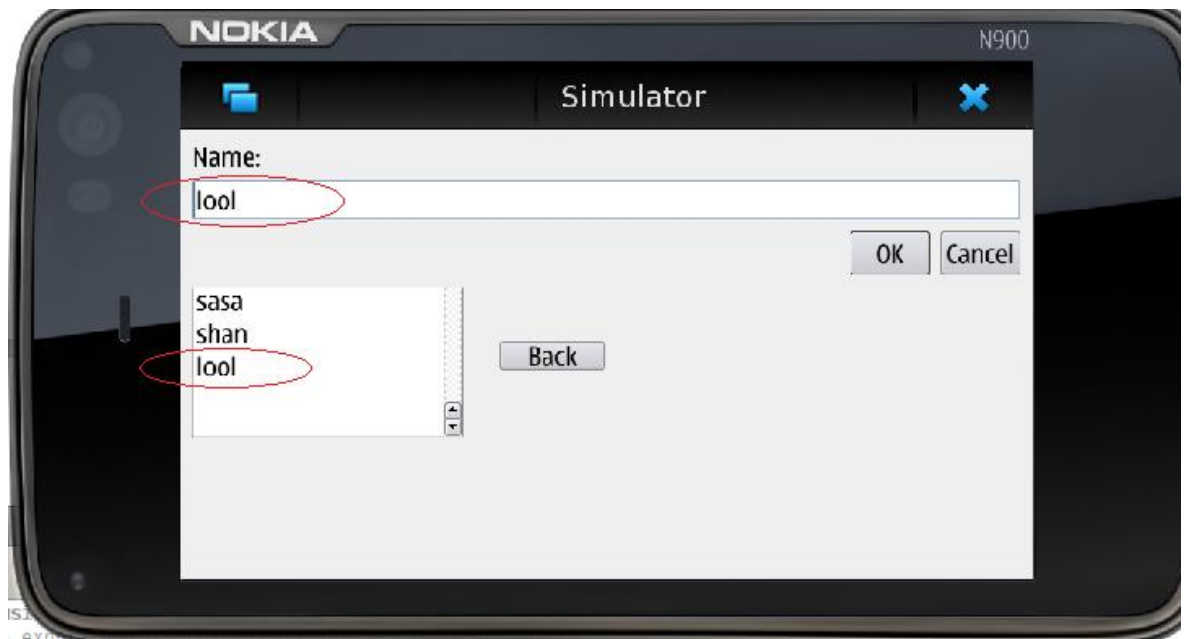




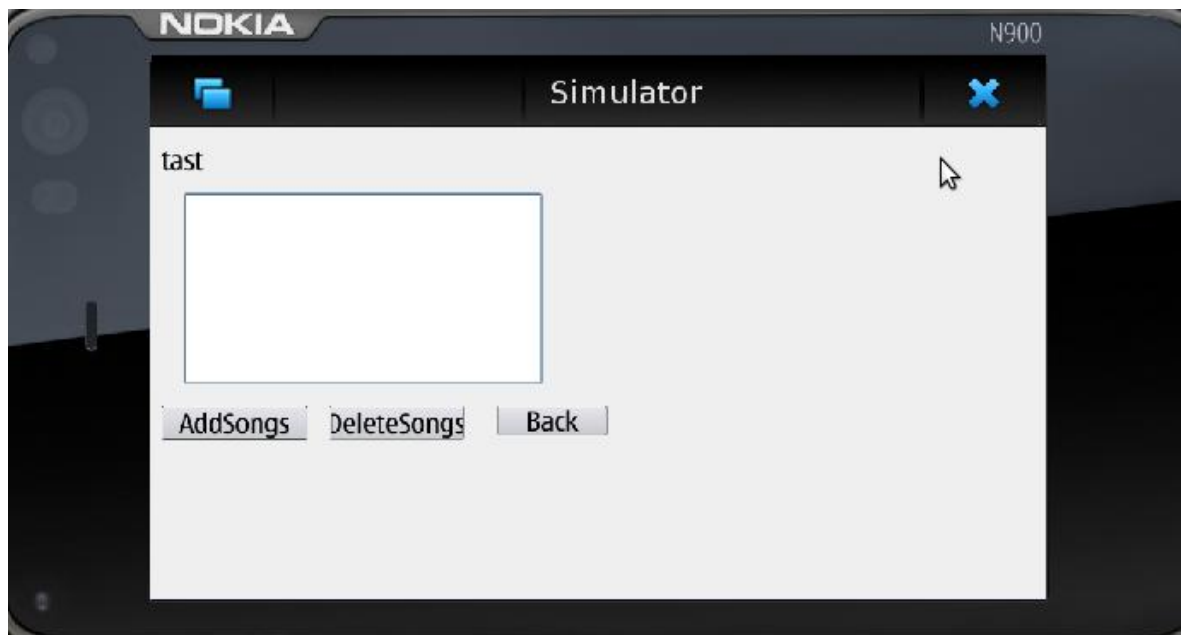
**Step 4** Push the Play List button there will show the new window have list screen for list name and buttons for add new list, edit and back.



**Step 5** Click add new list to open add new window. Input the list name and save it will appear in under list screen, choose chancel button can back to previous window.



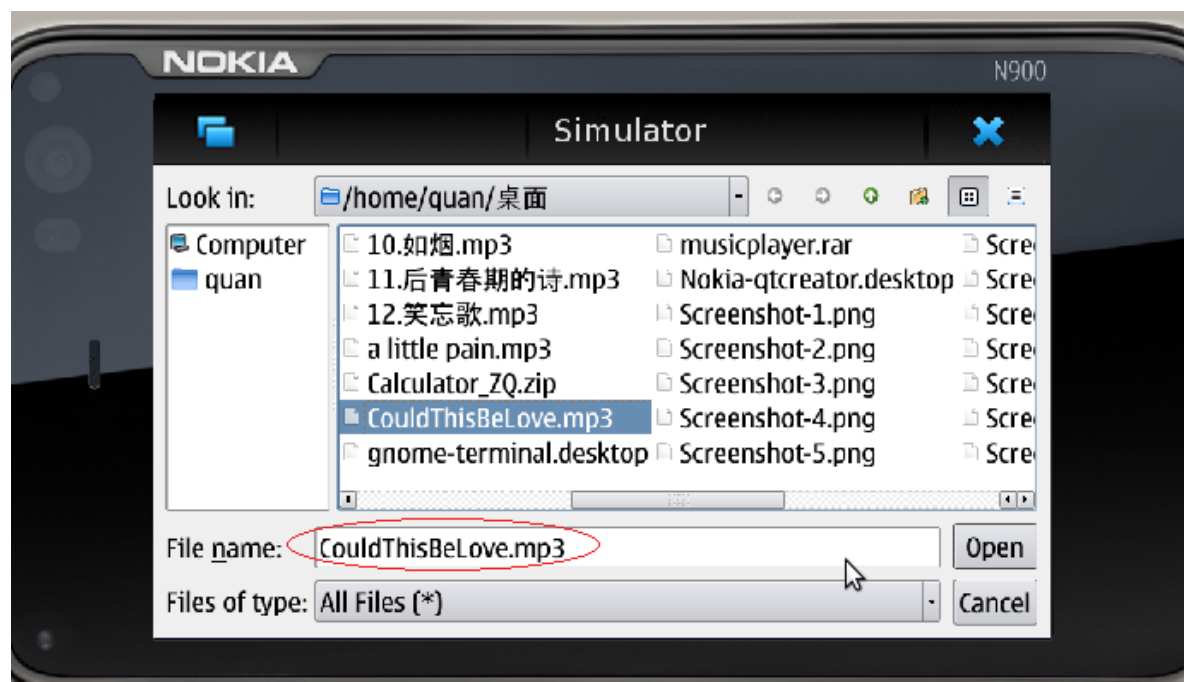
**Step 6** Open the edit window when choose the edit button. Users can admin the play list in this window.



**Step 7** User can select the songs from mobile memory to the list screen when they choose Add songs.



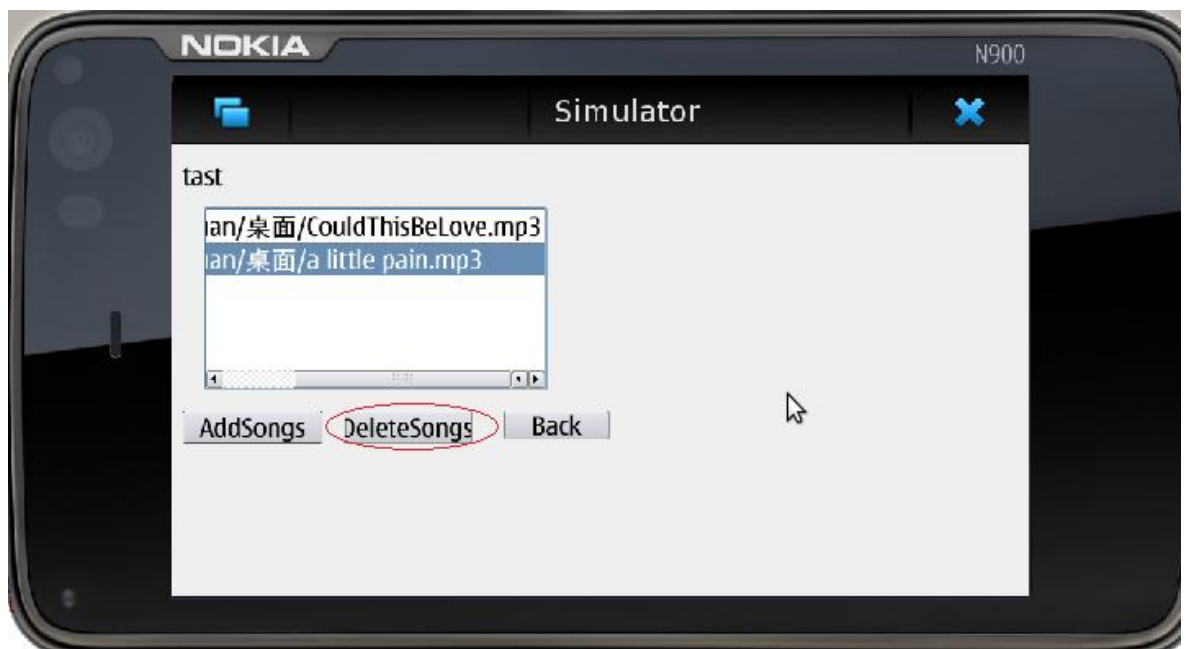
**Step 8** Choose the song and open.



**Step 9** The song will show in list screen.



**Step 10** The admin part also can let user to delete the songs if not need any more. So user could select the songs which one want to delete.



**Step 12** When user chooses the songs already, they can push the Delete Songs button to clean them.



**Step 13** Click the Back button can back to previous window - play list.