# GuitarApprentice: A Mobile Application for Acoustic Guitar Learning using Fast Fourier Transform algorithm

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# ABSTRACT

The objective of the project is to create a learning-based mobile application for learning to play an acoustic guitar. The application also aims to select the best algorithm to detect chords and display the chords detection in pictorial form for easier understanding. Beginner guitarists have difficulty to know how well they have learnt or improved in learning to play guitar chords. It is also difficult to detect chords and display the chords detected in pictorial form. The scope of the study is limited to beginner guitarists who are in the age range of teenagers and adults. The methodology uses the prototyping model for rapid building and testing that overlaps until the project ends. The results of the project are the suitable algorithm for chords detection and prototype of the mobile app. The statistics and survey prove that the project is significant for the beginner guitarists with mobile devices.

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# CHAPTER 1

# INTRODUCTION

## 1.1 Background of Study

"Guitar is a musical instrument having a flat-backed rounded body that narrows in the middle, a long fretted neck, and usually six strings, played by strumming or picking"(TheFreeDictionary). Guitar comes in many types such as Bass, Electric, Classical and Acoustic. Each has different playing styles and desired sound outputs. For this project, the Acoustic Guitar will be chosen as the focus instead of all the types of guitars as it is the most common and popular one.

Today, learning how to play a guitar has become so popular worldwide. This is because in general it is not very difficult to master it. It is much easier to master as compared to other instruments like drums or piano which may take many years to play a simple song. The price of an average guitar is also not very expensive. Other instruments like drums or piano cost a lot and not many can afford it. Guitar is also a perfect musical instrument to complement singing. Due to its portability, many singers choose to play guitar while singing when doing a solo performance. Guitar complements singing very well and many people are starting to like this performance which is called Acoustic performance.
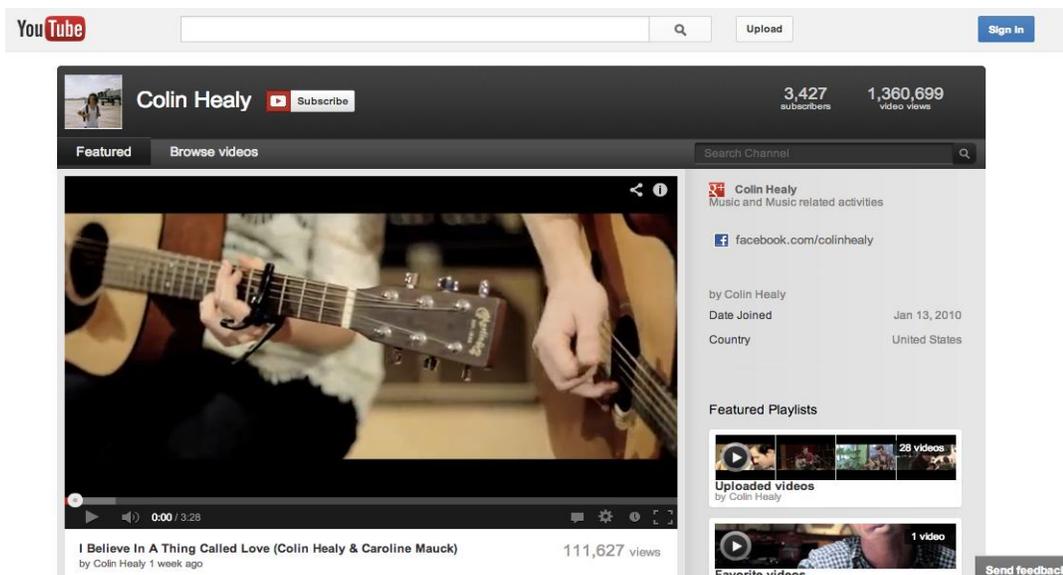


Figure 1: A sample of Youtube Cover

Currently, there is a huge growth in the number of Youtube Covers being uploaded to Youtube, an online platform to share videos. A Youtube Cover is a video that records someone singing a song and usually accompanied by a musical instrument such as a guitar that is uploaded to Youtube for other people to watch, worldwide. It can be observed that most of the Youtube Covers are made with guitar being chosen as the musical instrument.

Some singers became famous after uploading a good Youtube cover music. After being famous, they are employed by music recording companies and they are building a new career in music. As for some, they can tour around the world organizing concerts to earn a living. For people who do not want to make music as a career or for earning a living, they are also interested to make performances at their schools, universities or workplaces. There is also a rise in people playing guitar in their own leisure times as a hobby for releasing stress from school or work.

**1.2 Problem Statement**

**1.2.1 Problem Identification**

The problems can be categorized as follows:

1) <u>Beginner guitarists do not know how well they have improved or learnt when learning to play an acoustic guitar, specifically in playing the right chords</u>
Today, many people who learn how to play a guitar will learn not through actual guitar lessons from music schools or guitar teachers. Most people are learning through online sources such as online video lessons or text-based lessons on websites. The advantage is money saved on fees for guitar lessons. However, there is a problem for beginner guitarists to find out how well they have learnt or improved in the course of time in learning to play the guitar. There are many aspects in learning the guitar, but the specific aspect for this project is learning to play the right chords on the guitar. Beginner guitarists are unsure whether they have learnt to play the chords correctly and the sound of the chords produced is accurate or not.

2) <u>It is difficult to detect the right chords being played from a real acoustic guitar through a microphone of a computer or mobile device</u>
Although technology has advanced drastically today, there are still difficulties in detecting the chords played with a guitar through the help of technology. Through the sound recorded through microphones of a computer or mobile devices, system and mobile applications are lacking in detecting the chords played by an acoustic guitar correctly. System and mobile applications today are more successful in detecting the specific notes played by musical instruments such as guitars.

3) <u>It is difficult to display the chords detection in pictorial form</u>
In addition to that, it is also difficult to display the chords detection in pictorial form. For beginner guitarists, it will be useful if the detection can be shown in pictorial form such as image or graph for easier understanding. It will be useful if the detection can be shown in real time in graphs or saved down as image.

### 1.2.2 Significance of the Project

The project is significant because the mobile application addresses the problems:

1) <u>Beginner guitarists do not know how well they have improved or learnt when learning to play an acoustic guitar, specifically in playing the right chords</u>
   With a guide, it will be useful so as the guitarists know that they have learnt to play guitar chords correctly. Basic chords are essential to be mastered before learning to play more advanced chords. If basic chords were played wrongly, more advanced chords will be played wrongly too. It is good if beginner guitarist can know that they have learnt to play the basic chords correctly before advancing to more advanced chords.

2) <u>It is difficult to detect the right chords being played from a real acoustic guitar through a microphone of a computer or mobile device</u>
   Music notes are one specific sound produced through musical instruments such as guitars. Chords are a collection of a few notes to produce a more well-rounded sound or music. With this, chords are harder to detect as compared to notes. If music notes can be detected, it will be useful to create tuners for guitars or pianos. However, if chords can be detected accurately, it will be useful for beginner guitarists to guide them in learning to play chords correctly. It helps them to keep themselves on track in the learning process.

3) <u>It is difficult to display the chords detection in pictorial form</u>
   In pictorial form, it will be easier to understand about the chords played by the guitarists. They will be able to interpret and understand clearly their performance on learning to play the chords correctly.

## 1.3 Objectives and Scope of Study

The objectives of the project are as follows:

- To develop a learning-based mobile app for beginner guitarists to test themselves on their improvements in playing the right chords
- To analyze the most suitable algorithm to detect the chords from strumming an acoustic guitar
- To display the chord detection results in pictorial form

The product of the project is a mobile application that can be used on both tablets and smartphones. This is because there are no functionalities such as stimulations of a guitar on the screen which requires a bigger screen size like tablets. A smartphone with a bigger screen size is preferable but small screen sizes of a smartphone are still acceptable.

The scope of the project is to limit the user groups of beginner guitarists which are in the age range of teenagers and adults. This is because beginner guitarists are much more prone to face the problems and will benefit the most from the app. Expert guitarists would encounter much more complex problems which might require advices from guitar experts. The users which are within teenagers or older would be able to understand how to use the application. Children might not be able to comprehend how the app functions although they want to learn guitar. As for the elderly, it may be difficult for them to see the tablet or smartphone screen clearly or understand how the app functions.

The number of chords to be considered in the project for detection will be limited to just a small number. The chords to be sampled would be only G, D, Em and C. The sound to be recorded will be strumming of the guitar. One best algorithm will be chosen after analyzing few algorithms for pitch detection to be used in display the chords detection. The pictorial form to be used to display the detection would be in a graph form.

**1.4 Relevancy of Project**

The project is relevant as there is no mobile application in the market that provides a goal-oriented training. The goal is to help guitarists to know they have learnt to play chords to sound correctly. Currently, the applications available may provide virtual guitar playing on the screen but there are no learning objectives to be achieved. There are also a lot of applications of learning guitar which is quite theoretical and does not encourage hands-off practices. Few examples can be found in Chapter 2: Literature Review, Section 2.3.

The application is suitable for musicians as it encourages practices to improve self-performance. It has high usability since it is a mobile app that can be used anytime to increase motivation for practices.

**1.5 Feasibility of the Project within the Scope and Time Frame**

The mobile app runs on Android, which uses Java programming. It is within the scope of the student's capability as the student had gone through the basics of Java in the university.

The timeframe of the project is to be completed within 2 semesters, which is about 8 months long. It is an acceptable timeframe as enough time is allocated from planning, designing, developing and testing altogether. Furthermore, the scope of the project is also defined to limit the scope of the app in terms of functionalities.

# CHAPTER 2

# LITERATURE REVIEW

## 2.1 Acoustic Guitar

To play an acoustic guitar, there has to be enough knowledge in selecting the suitable one. Different types of wood produce different desirable sound output. Different types of bodies produce different sound. Different types of guitars would suit different genres of song such as country song or jazz. In addition, different playing styles of different guitarists would differentiate the types of desired guitar. Some guitars sound more mellow while some bright.

In addition to that, there are proper techniques to learn the basics of guitar accordingly. This is important to allow fast learning for guitars. Beginner guitarists are usually excited and rushed to learn the songs played by their favorite artist. Unfortunately, they are not firm in their basics such as chords and tempo theories. Thus, they will most probably find it hard to master the songs and eventually gave up learning guitar further on. Feldman (1976) thinks that a beginner faces problems like reading chord sheets and knowing how to press them on the guitar frets.

The guitar has to be maintained well for longer years of lifespan. There are many areas which need attention such as humidity, storing and transportation. Storage and transportation places the most major problems (Shaw, 1987). With experiences, one can identify the symptoms to ensure the guitar has no damages. With proper maintenance, the guitar will require less effort to play it. An example would be the tension of the strings brought up to the guitar. It would make the neck to be "lifted up" and thus more strength is needed to press on the strings (Teel, 1999). Strings with lesser tension can be used to solve the problem.

Guitar is thus a subject, a matter which requires a lot of knowledge. Adding to that, there are different categories of knowledge within the subject which each category contains large set of knowledge. A comprehensive guide focuses on a few categories or modules would then be very significant to the users.

## 2.2 Android Platform

The application will run on Android Operating System (OS). It is a free and open-source OS developed by Google. The OS is mainly running in mobile phones and tablets. Android is now one of the two leading OS for mobile phones and tablets worldwide.
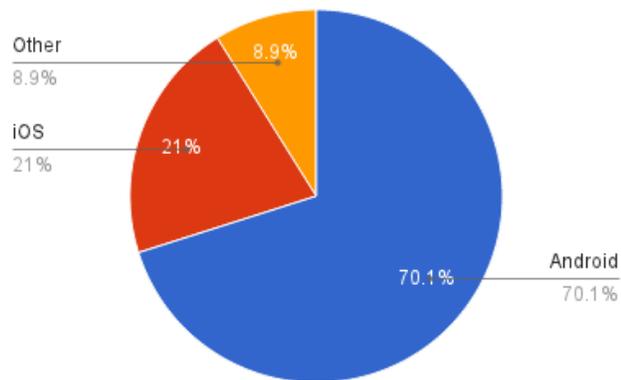


Figure 2: Worldwide usage for smartphones (source: http://techland.time.com)
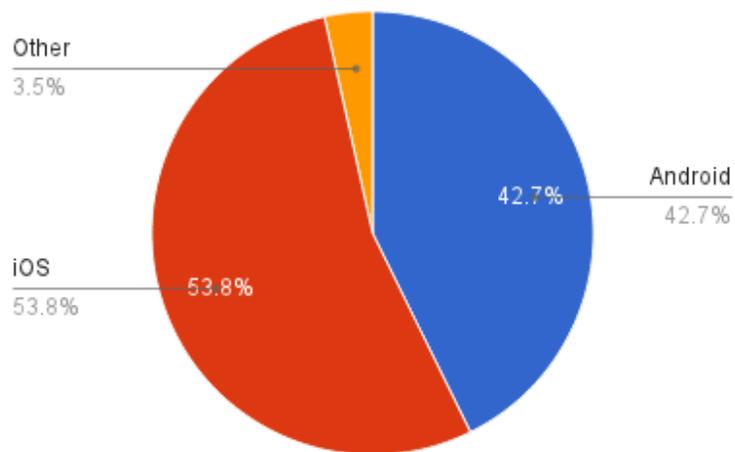


Figure 3: Worldwide usage for tablets (source: http://techland.time.com)

| Version | Codename | API | Distribution |
| --- | --- | --- | --- |
| 1.6 | Donut | 4 | 0.1% |
| 2.1 | Eclair | 7 | 1.5% |
| 2.2 | Froyo | 8 | 3.2% |
| 2.3 - 2.3.2 | Gingerbread | 9 | 0.1% |
| 2.3.3 - 2.3.7 | | 10 | 36.4% |
| 3.2 | Honeycomb | 13 | 0.1% |
| 4.0.3 - 4.0.4 | Ice Cream Sandwich | 15 | 25.6% |
| 4.1.x | Jelly Bean | 16 | 29.0% |
| 4.2.x | | 17 | 4.0% |

Table 1   Android versions usage distribution (source: http://developer.android.com)
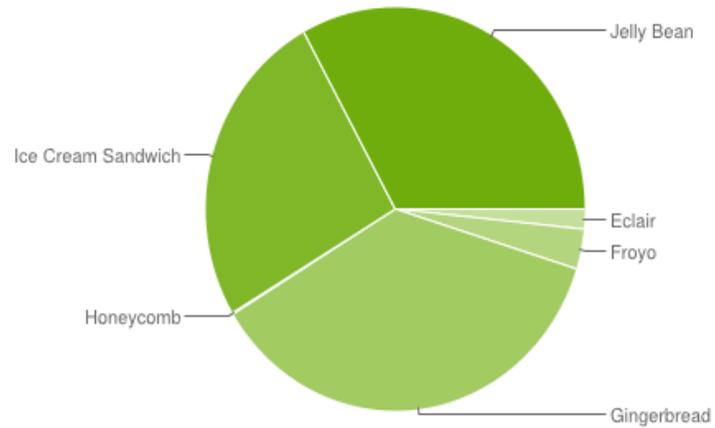
Figure 4: Android versions usage distribution (source: http://developer.android.com)

Many new versions have been added from time to time. The latest version is Android, 4.2.x, also known as Jelly Bean. Table 1 and Figure 5 both show the usage distribution of the Android versions. It can be seen that most users are concentrated for Gingerbread, Ice Cream Sandwich and Jelly Bean. The app should focus to be at least usable for Gingerbread or greater. This will help to reach out and benefit to more users.

## 2.3 Mobile Apps for Guitar

It is not recent news where mobile phone uses app for guitar uses. The functions are impressive and helpful to the users in terms of guitars.

Ahlm & Jeppsson (2002) suggests using the mobile phone as a tuner for guitars. The mobile phone will use microphones to record the sound, do some calculations from an algorithm and output as readings of the tone.

There are a number of Android mobile apps on Google Play for guitar. Few of the top apps for guitar will be highlighted in detail. This is useful to understand what improvements are needed for the project.



Figure 5: gStrings screenshot

gStrings, by cohorter.org, is an Android app for musicians such as guitars and violins to tune their musical instruments. It helps to tune guitars by measuring sound pitch and intensity. It then gives out the reading of the pitch. In addition, it also shows how far is the current pitch to the intended pitch to guide the tuning whether it is to tighten or loosen the guitar string.

It is a very good app for tuning guitars. It shows the reading and help tuning the strings to the intended pitch. However, it would be perfect if the reading is coupled with command to tighten or loosen the string in reaching the intended pitch.
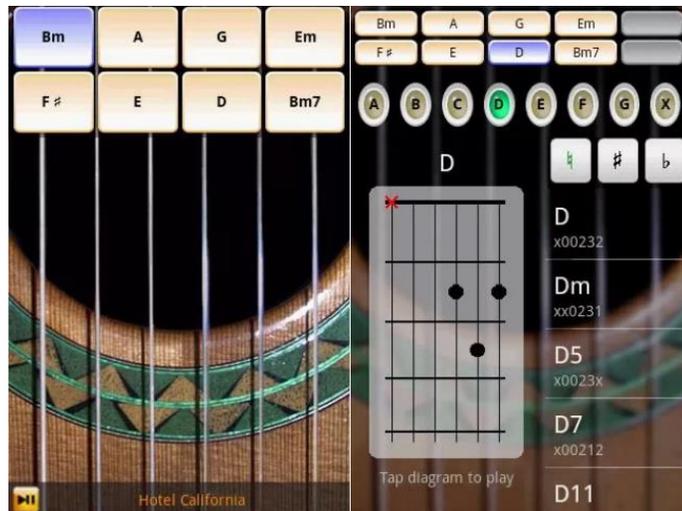


Figure 6: Guitar : Solo Lite screenshots

Guitar : Solo Lite, by Coding Caveman, is an Android app for playing the guitar virtually on the screen of smartphones or tablets. It provides a simulation or a virtual guitar with the strings displayed on the screen. When each string is pressed, the sound produced is same as an actual guitar. The user can choose to pluck the guitar by pressing one string at a time or strumming by swiping the strings from left to right after choosing a chord. There are many chords but up to 8 chords can be chosen to be fitted at the 'shortcut' section at one time. After pressing the desired chord, the user can swipe over the strings to strumming the guitar.

This app is very beneficial for users to practice their guitar when they do not have their guitars with them. The sound produced are correct like an actual guitar. However, the plucking or strumming is different from doing them on an actual guitar. Using the app often does not mean the user can master playing the actual guitar.

Figure 7: AnySong Chord Recognition screenshot

AnySong Chord Recognition, by musprojects, is an Android app that helps users to determine the chords used in a song. It starts by inputting the song through the microphone. It then deciphers the chords based on the frequency or pitch level. Lastly, the chords that appeared throughout the song are displayed.

The app is beneficial in helping beginners to identify the chords used in a song. However, this may demotivate the users to improve their guitar playing and their ear skills to discover the chords manually themselves.
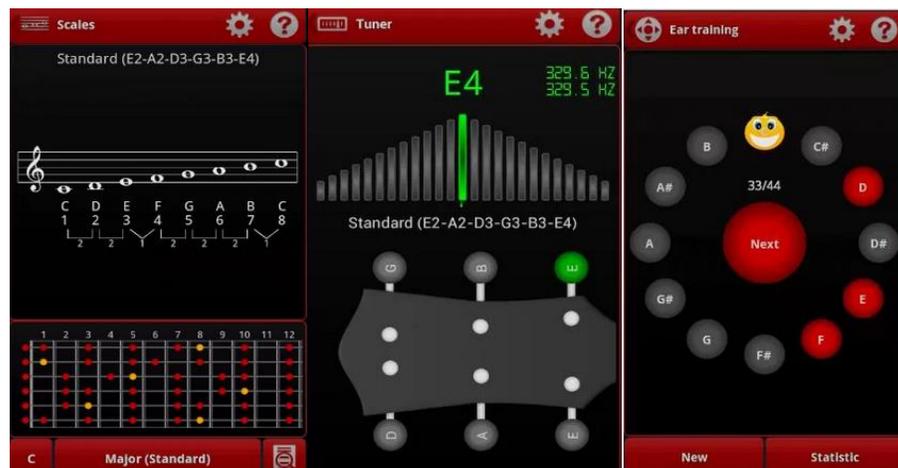


Figure 8: smartChord screenshots

smartChord, by Martin Shule, is an Android app that is comprehensive with a few main functionalities. It can tune the guitar by giving the pitch readings. It provides the scales training by showing the positions of the strings to be pressed on. It also provides ear training by playing a specific note and allowing you to guess among the choices of answers.

This app is comprehensive with much functionality. This is good as one single app combines so many functions. However, the app lacks the test on user's guitar playing.

| App Name | Functions |
|---|---|
| gStrings | Helps you to tune your guitar by giving the readings. |
| Guitar : Solo Lite | Allows you to play a guitar on the device. |
| AnySong Chord Recognition | Tells you to know the chords of a song. |
| smartChord | Helps you to tune your guitar. Provides some scales to practice. Provides ear training. |

Table 2 List of top Android mobile apps for guitar

The name of the top apps and their functions are listed above. These are few of the top apps for guitar. These apps are useful in the use of tuning, knowing chords and some practices. However, there is a lacking in the function of teaching the knowledge of selecting the right guitar, learning how to play the guitar accordingly and taking care of your guitar. Most importantly, the apps lack the grading of the user's guitar playing performance level. An app with these knowledge embedded would be beneficial.

## 2.4 Learning Theories

In learning, there are so many methods to use to master a skill, or knowledge. In mastering different skills, there are a lot of methods but only few which are the most effective to ensure fast and complete learning process. Mangal (2008) has listed many essential learning theories. It is analyzed what kind of theories should be used in learning to play the guitar.

Trial and Error Theories was founded by the famous psychologist Edward L.Thorndike (1874-1949). He suggested that people learn better through trials and errors. His experiment was conducted by putting a cat in a box and putting a fish outside the food. Observations are made whether the cat will be able to come out to get the food. After many trials and methods, the cat is able to get out itself by identifying the best way. There is a drive and goal. This deduces that with the right motivation, the learner can learn a skill after many occurrences of trying to apply the knowledge. A guitarist can be better if he or she keeps playing and practicing to get better in playing as a goal.

Theory of Insightful Learning was founded by Wolfgang Köhler (1887-1967). He suggested that learning is better when there is an interest. His experiment was conducted by placing a chimpanzee in a cage and placing a banana in a short distance from the cage. Few sticks were also placed inside the cage. In the end, the chimpanzee finally combines the few sticks into a long stick to reach the banana from the cage. This shows that with interest and a goal, learners will be motivated. Köhler also commented that learning should be viewed as a whole, as a big picture. Learning can be broken into smaller parts for better learning if it is complicated. A guitarist can break the learning into few parts such as strumming the guitar, plucking and knowing the chords.

Carl Roger's Theory of Experiential Learning was founded by Carl Random Rogers (1902-1987). He proposes that experiential learning is better when there is personal involvement by the learner. The learner has to put his or her hands on the skills by practicing it to learn it. The learner also needs to emphasize on self-evaluation to monitor the progress of the learning. By doing so, it will leave a pervasive effect which is a permanent knowledge on the learner. The learner will not forget what was learned.

Similarly, the guitarist has to try on an actual guitar and always aim to check how well has he or she progressed. This will ensure the mastery of the guitar playing permanently.

In summary, the 3 learning theories highlighted will be embedded in designing the app. The app has to be goal-oriented to ensure the users will keep on practicing and pushing to be better. In addition, the app has to be broken into few sections to ensure a more effective learning in few topics of the guitar playing. Besides that, the app has to impart the user with a sense for self-evaluation to always monitor and grade how they are in the guitar playing progress.

# CHAPTER 3

# METHODOLOGY

## 3.1 System Architecture/Requirement Analysis and Specification
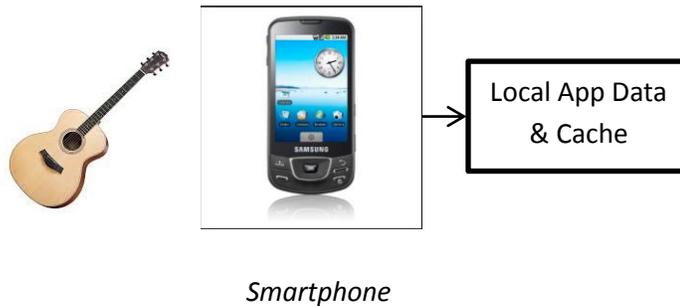


*Smartphone*

Figure 9: System Architecture

The system architecture is as shown in Figure 9. The smartphone will run the app which is installed on the device. Some data and cache of the information from the app will be then stored in the phone. It will be able to use the device's microphone to record the sound coming from the strumming guitar chords on the acoustic guitar. The app does not require internet via cellular data or wireless modem to function.

The requirement analysis is done by collecting data through surveys and generating the requirements from the results. The requirements are then specified as follows:

- The mobile app has to be able to detect sound through recording through the microphone of the device
- The mobile app has to be able to interpret the sound to identify the chords played with the guitar
- The mobile app has to be able to display the detection in a pictorial form for user to understand the detection

The users will be targeted to beginner guitarists to benefit from the app usage. This is because only they can relate to the use and problems addressed by the app. The age range is also targeted towards beginner guitarists of teenagers and adults. This is because children may not understand the function of the app or being able to understand how to

use the app fully. As for the elderly, they might not be familiar in using touch screen devices or being able to see the words on the screen clearly.

There are some limitations for the mobile app. The app guides the user in the aspect of playing the chords to sound correctly on the guitar. The tempos of strumming were also not being considered in this project.

## 3.2 Project Activities

The prototyping model will be used in developing the project. This is because the product will be in the form of mobile app. The second phase to fifth phase is basically repeated throughout the project in completing the mobile app. The app is rapidly build and tested over and over again. The app is quickly tested after a functionality is designed and built. Alternately, the app is quickly redesigned and rebuilt is any improvements are found in testing.
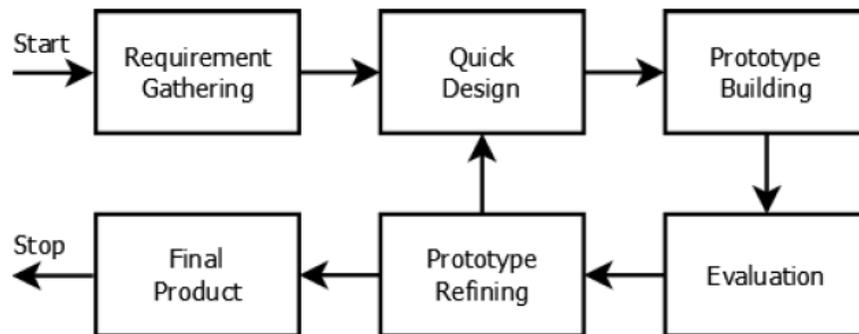
Figure 10: Prototyping Model

1) Requirement Gathering

In researching for the project, two surveys will be done.

The first survey will be done as a mean to collect data for the project. It can also be known as User Perception Study. The data to be collected mainly focuses on what the potential users would require and benefit from the project. The survey questions would then focus more on their problems and what do they expect from the app. It would be more to close-end questions. This survey will help to form the foundation of the app.

2) Quick Design

From the results of the first survey, the interface will be sketched and the basic functions will be drafted. The rough framework will be designed.

3) Prototype Building

The prototype will be built with Prototyper or AppInventor. The mobile app will be done in the Android platform. The interface will be build first. Then, the basic functions will be added as well.

4) Evaluation

The second survey will be done as a mean to further understand the features to be included to the project. It can also be known as Usability Study. The main functions are already included but the survey will help to further understand specifically what to include ensuring the app contributes more to the users and society. It would be more to open-end questions where the respondents can voice out their opinions to specific parts of the app. The users will also be able to have a preview of the app so that proper and valuable feedbacks can be received. The survey will help a lot during the testing stage as bugs can be fixed and additional features can be added if feasible.

5) Prototype Refining

From the results of the second survey, the prototype is refined and improved. Additional functions may be added. Testing will be done and bugs will be fixed.

6) Final Product

The final product will then be tested, demonstrated and presented to the examiners. The project will be evaluated.

## 3.3 Key Milestones

The key milestones are as listed in the Gantt chart. It will determine the deliverables and the suggested dateline. The milestones are highlighted in green.

## 3.4 Gantt Charts

### 3.4.1 Final Year Project 1

| Week | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Project Proposal Submission** | ▨ | ▨ | 🟩 | | | | | | | | | | | |
| **Title Selection/Proposal** | | | | 🟩 | | | | | | | | | | |
| **Literature Review** | | | | | ▨ | | | | | | | | | |
| **Extended Proposal Submission** | | | | | | 🟩 | | | | | | | | |
| **Proposal Defense** | | | | | | | ▨ | ▨ | ▨ | ▨ | 🟩 | | | |
| **Interim Report** | | | | | | | | | | | | ▨ | ▨ | 🟩 |

Table 3 FYP1 Gantt chart

### 3.4.2 Final Year Project 2

| Week | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Programming Research** | ▓ | | | | | | | | | | | | | | |
| **Prototype Development** | | ▓ | ▓ | ▓ | ▓ | ▓ | ▓ | ▓ | ▓ | ▓ | | | | | |
| **Progress Report** | | | | █ | | | | | | | | | | | |
| **Pre-SEDEX** | | | | | | | | | | █ | | | | | |
| **Dissertation First Draft** | | | | | | | | | | | █ | | | | |
| **Technical Report** | | | | | | | | | | | | █ | | | |
| **Dissertation** | | | | | | | | | | | | █ | | | |
| **Viva** | | | | | | | | | | | | | █ | | |
| **Final Dissertation** | | | | | | | | | | | | | | | █ |

Table 4 FYP2 Gantt chart

## 3.5 Tools Required

An Android mobile phone will be used to test the app's function. This is because there is no stimulation of an actual guitar which requires a bigger screen like a tablet. However, it is preferable to have bigger smartphone with bigger screen size.

As for the software part, Android Developing Tools will be used mainly. Java programming will also be used in the programming by using the Eclipse software. Open source codes will also be analyzed and retrieved from Android forums.

# CHAPTER 4

# RESULTS & DISCUSSIONS

## 4.1 Findings

It is found that an algorithm is needed to be used to develop the programming codes to interpret the chords played by a guitar. The algorithm will convert the sound to be in a format where different chords will be having difference in values.

Through research on the Internet, there are a few algorithms that are found to be used in pitch detection. There are Fast Fourier Transform (FFT) and Autocorrelation Method. The two algorithms were analyzed and differentiate in order to know which the better algorithm is.

Fast Fourier Transform is a periodic function, which is formed through the extraction of the series of sines and cosines. The function can be reproduced by superimposed. It is a mathematical method to transform a function of time to a function of frequency. It is suitable for analysis in a time-dependent phenomenon.

Autocorrelation Method is a cross-correlation of a signal with itself. It is a function that transforms a signal to a displaying structure of a waveform. The function also displays frequency value in the waveform.

Fast Fourier Transform is thus chosen to be used as the algorithm as it is more suitable. This is because Fast Fourier Transform is more direct in computing the frequency values and displaying it on the graph. Autocorrelation Method might be more confusing as with the presence of noise, there will be several pitch peaks in the waveform. Fast Fourier Transform is also able to compute the function faster as compared to Autocorrelation Method which requires a high processing rate and thus slower in computing the function. Thus, Fast Fourier Transform will be easier to run the detection in real-time.

**4.2 Data Gathering and Analysis**

It is found through researching that there are many resources for Android programming in the Internet. It is then decided that Eclipse is used as the integrated development environment. There were step-to-step guide on the Internet that guided the installation of Eclipse for Android programming. It is able to develop a prototype which can be stimulated in an Android device emulator provided as an output.

There are many sources in the Internet that can guide in the developing of the mobile app. Due to the student having very little experience in Android Programming, these sources are very helpful.

The official Android Developers website provides full details on the Android API. There were also guides such as running the Android, trainings and tools.

The forum discussions such as Android project page on Google Code and StackOverflow.com provided many help. Questions were posted by users in the forum for unsolved problems or errors in coding. Other users of the same forum were posting solutions to the conceptual programming questions. Similar problems faced during programming were analyzed to benefit from the forums.

**4.3 Experimentation/Modelling**

In order to start developing, the student followed the guides by Android Developers website to learn how to run the sample application. The sample application displayed "Hello World!" It is stimulated to run on the Android device emulator.

After that, the main function and classes were also studied to gain an understanding to start developing the app. User interactions with the app are also studied to build a user friendly app.

**4.4 Prototype**

**4.4.1 First Iteration**

The first stage in developing the prototype would be creating the interface. For Android programming, it is to create the XML of the app. With the help of Android Developing Tools bundled with Eclipse, the interface can be created by developing the XML. Buttons and Texts can be created easily along with minimal coding using Java language.

A few pages were created for the app. There are main page, record sound page and display spectrum page. The main page will display the app name along with buttons that leads to other pages and functions such as record sound page and display spectrum page. The record sound page will display a few buttons to assist recording the sound and saved it as a media file. The display spectrum page will display the spectrum graph and a few buttons to display the spectrum in real-time and able to save the spectrum as an image.
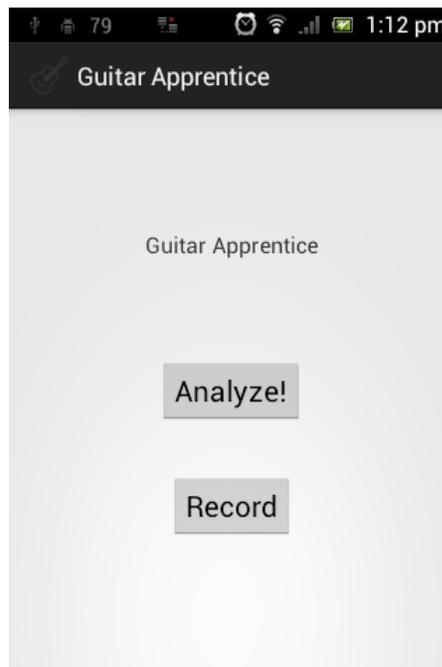


Figure 11: Main Page
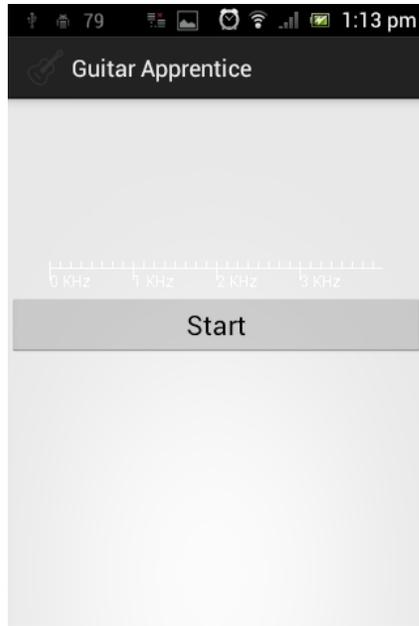
Figure 12: Display Spectrum Page
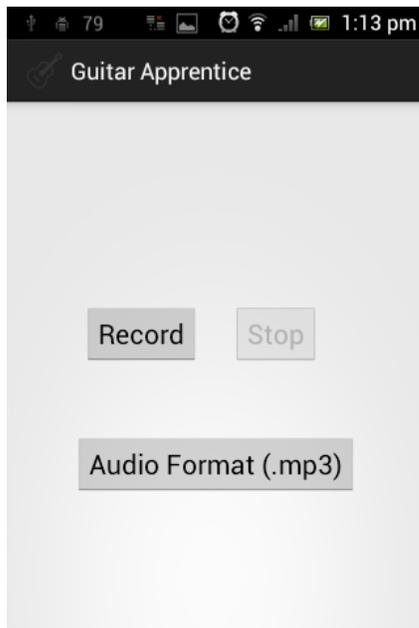


Figure 13: Record Sound Page

### 4.4.2 Second Iteration

The next stage in developing the prototype is to create a sound recording function. Programming in Java is done in Eclipse to accomplish this. Java classes and codes are used. Guidance from the Internet especially StackOverflow helped to complete this function.

The recording sound can be saved into two formats, namely MP3 and 3GPP. Users are able to select which format they would like the recorded sound to be saved as. The recorded sound by default will be saved as "sample.mp3" or sample.3gpp" depending on the user choice and saved at "/sdcard".

There is one button that starts the recording. After the recording starts, the button will not be press-able. Another button that ends the recording is placed right next to the first button. The button will not be press-able when the recording ends or is not started.
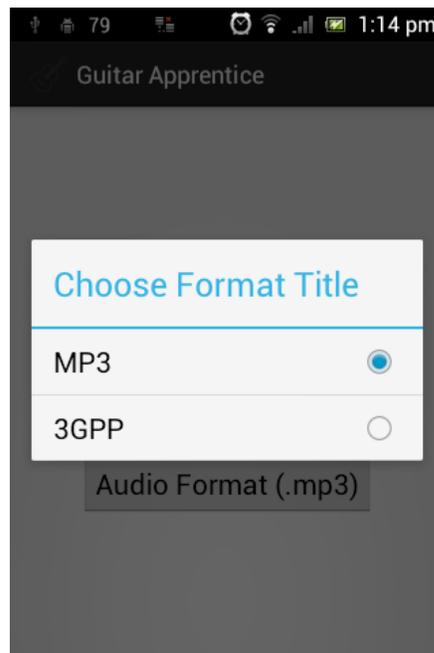


Figure 14: Choose Media File Format To Be Saved To
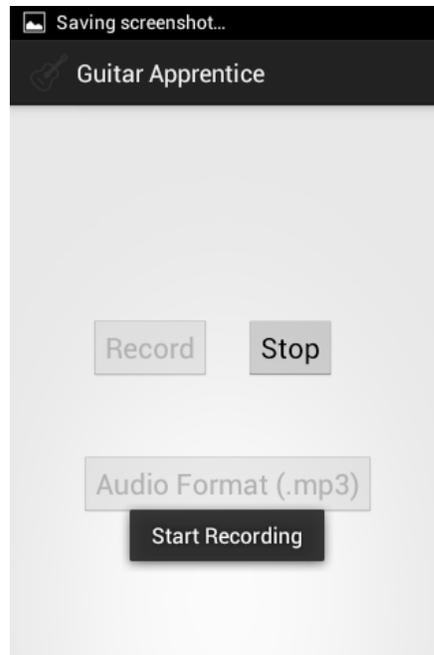
Figure 15: Start Recording
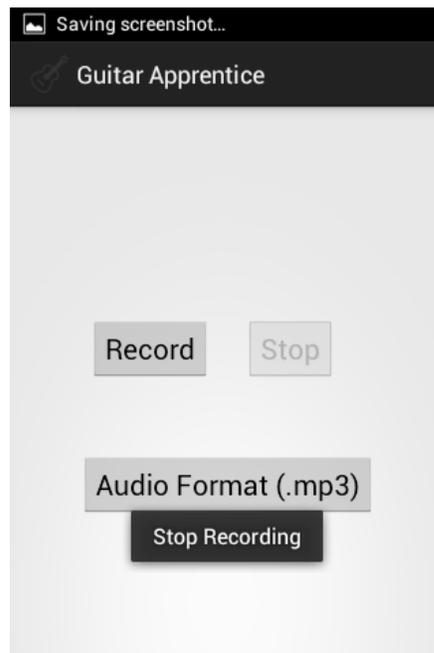


Figure 16: Stop Recording

### 4.4.3 Third Iteration

The last stage in the prototype development is to develop the spectrum graph using the Fast Fourier Transform algorithm. Programming in Java is done in Eclipse to accomplish this. Java classes and codes are used. Guidance from the Internet especially StackOverflow helped to complete this function.

There is a graph that is displayed on the top part of the device screen. A button placed below the graph is to start recording and displaying the spectrum of the sound. The spectrum is displayed on real-time and is ongoing till the button is pressed again to stop the function.
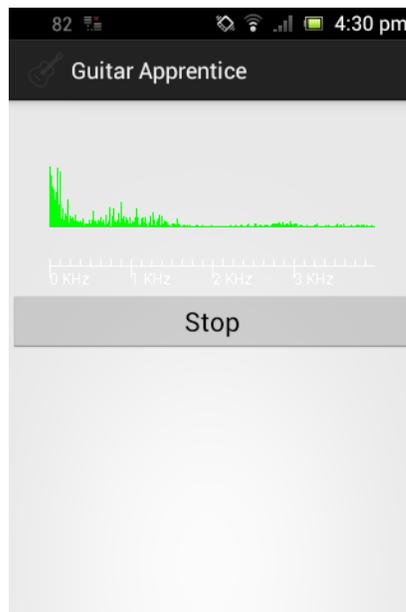


Figure 17: Display Spectrum

## 4.5 User Perception Study

Statistics were found to support the ability of music training through mobile devices. This increases the confidence of the application being able to help beginner guitarist in improving their playing. The statistics are as below:

- If mobile workers could choose only one device, 46% of them would pick a smartphone over a tablet or laptop as their favorite one.

- In final quarter 2010, Fortune reported that Smartphones outsold PC's for the first time.

- Gartner predicted worldwide rollout for mobile devices especially tablets of 103.4 million in 2012 and 154.2 million in 2013.

- By 2015, 80% of people accessing the Internet will do learning with mobile phones.

- Seventy-four percent of mobile owners surveyed said that it is the number one asset they own and 63 percent believed that they could learn through even a basic mobile device.

A User Perception Study was also conducted through survey to find out the user's perception towards the mobile application. Some questions were asked and the results are tabulated and analyzed. A total of 30 respondents with guitar background filled in the survey.

Q1: Do you own an Android device?
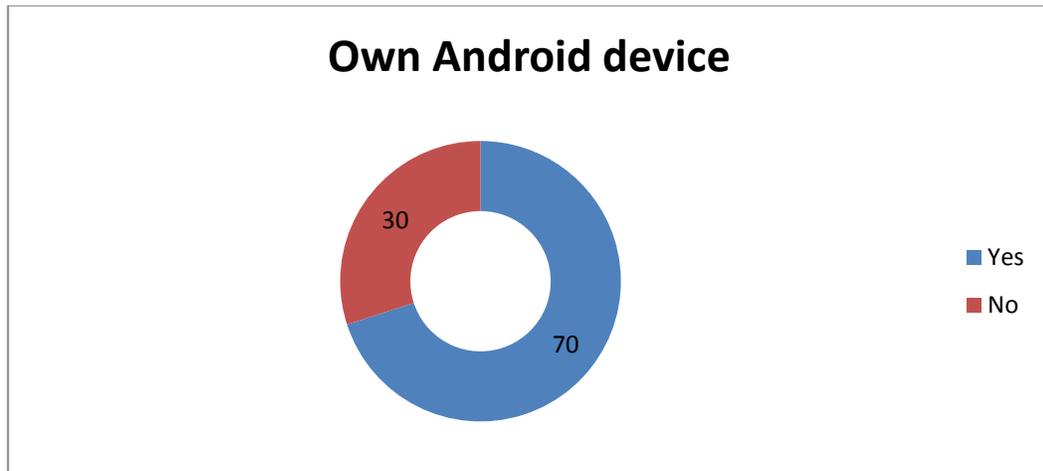


Figure 18: Results of "Own Android Device"

The results in Figure 13 show that a majority of the respondents, 70% do own an android device, either smartphone or tablet. Another 30% do not own an android device most likely they are using another smartphone of another OS or a non-smartphone. This is a promising result as this will increase the likeliness of the respondents to use the application for their guitar learning.

Q2: How long have you played guitar?
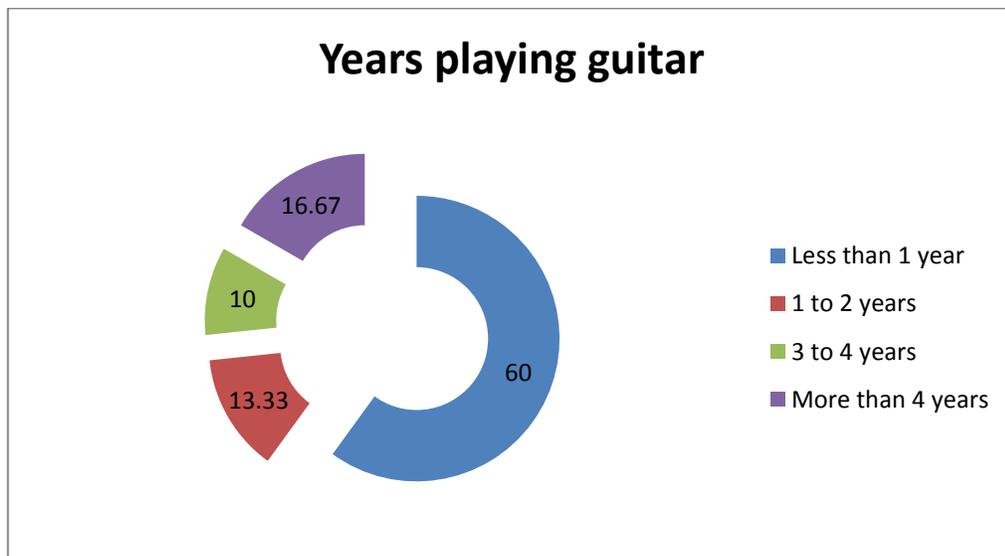


Figure 19: Results of "Years playing guitar"

In Figure 14, when asked about the years of they have been playing the guitar; we can see that the majority, 60% has only been playing guitars for less than a year. Another 13.33%, 10% and 16.67% of the respondents have played guitar for a 1 to 2 years, 3 to 4 years and 4 years and more respectively. The guitarists who have only learnt for less than a year will most probably face difficulties in few aspects especially playing. This shows that a big number of beginner guitarists that will benefit from the usage of the application.

Q3: How did you learn guitar?
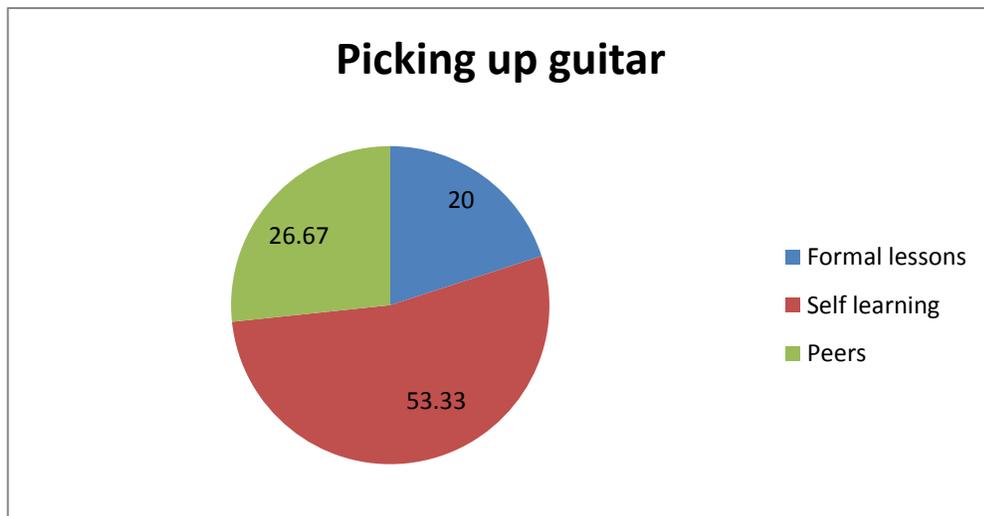


Figure 20: Results of "Picking up guitar"

Figure 15 shows how the respondents learn how to play guitar. 53.33% of the respondents learn guitar by themselves such as looking at guitar books or watching guitar videos online. 26.67% learn from their peers who know how to play guitar while 20% learn from formal lessons from guitar music schools. The 53.33% of respondents who self learns would most likely be interested to learn through the mobile application. This is because it is also a form of self-learning.

Q4: Do you have difficulties in tuning the guitar?
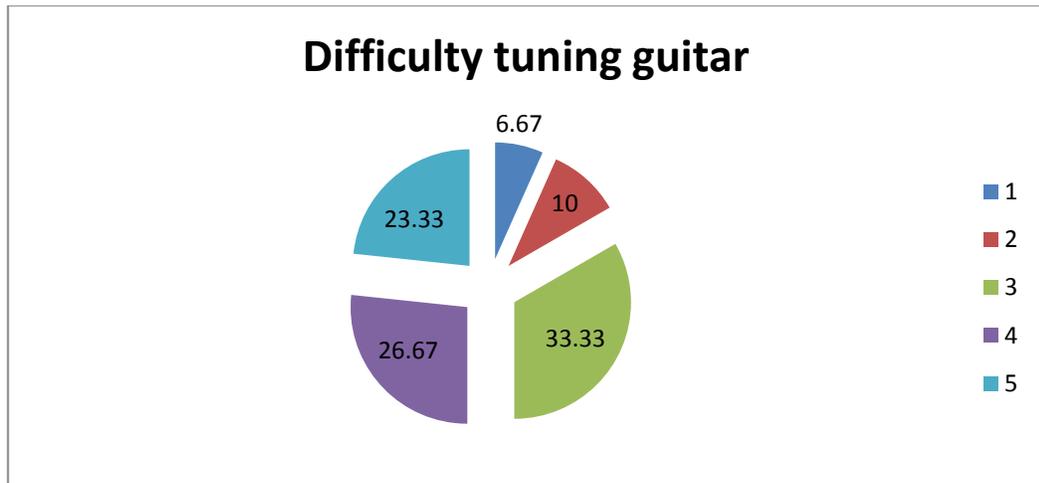


Figure 21: Results of "Difficulty tuning guitar"

In Figure 16, 6.67% of the respondents filled in 1 as they find no difficulty in tuning. 23.33% who filled in 2 have very little difficulty in tuning. 23.33% of the respondents filled in 5 for they find it very difficult to tune the guitar. 26.67% filled in 4 while 33.33% filled in 3 which both also means difficult. Those filled in 3 to 5 are the groups which will benefit from the application. This is most likely due to their short experience in learning guitar, which is less than a year.

Q5: Do you have difficulties grading how well you are in playing?
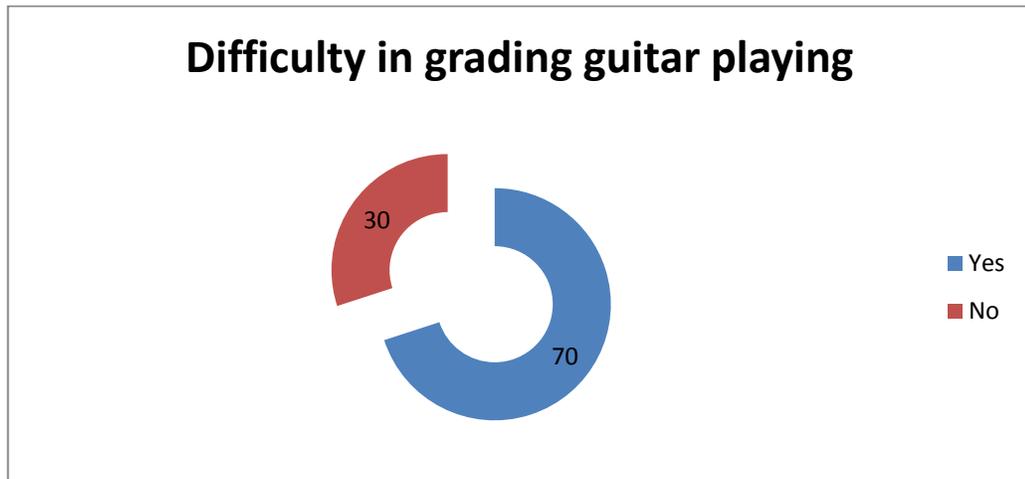


Figure 22: Results of "Difficulty in grading guitar playing"

In Figure 17, 70% of the respondents have difficulty in finding out how well do they progress in their learning process. 30% of the respondents have no problems grading themselves and keep improving. The 70% of respondents will be interested to use the application's grading function to grade them.

Q6: Do you think you have sufficient knowledge in maintaining your guitar lifespan?
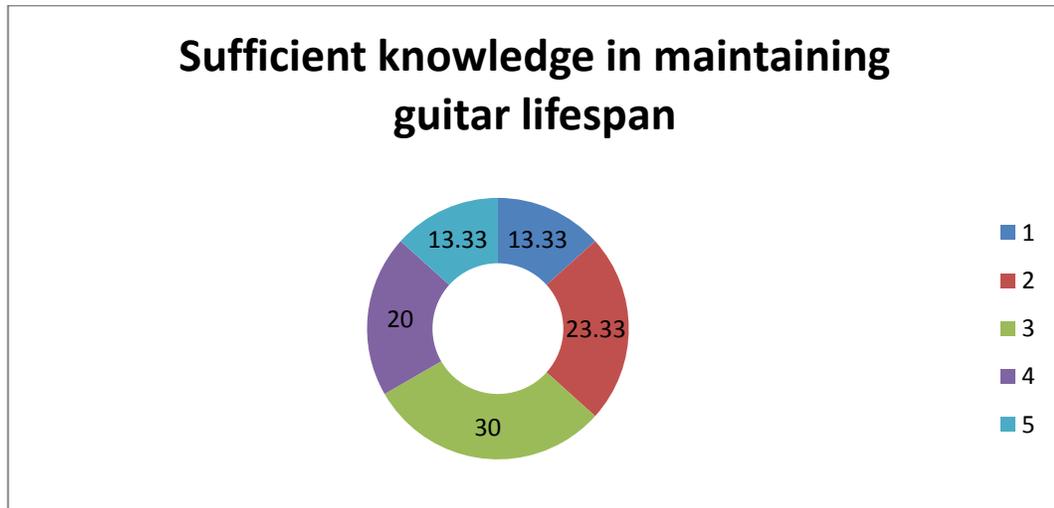


Figure 23: Results of "Sufficient knowledge in maintaining guitar lifespan"

Figure 18 shows how well do the respondents know about methods to take care of their guitar for longer lifespans. 13.33% of respondents filled 5 which signifies them have very sufficient knowledge. 20% filled in 4 which mean they have sufficient knowledge. 30% of respondents thinks they have average knowledge in maintaining. 23.33% of respondents think they do not have sufficient knowledge while 13.33% who filled 1 thinks they do have much knowledge. Those who filled in 1 to 3 will benefit from the application.

Q7: Do you believe in learning guitar with a mobile app?
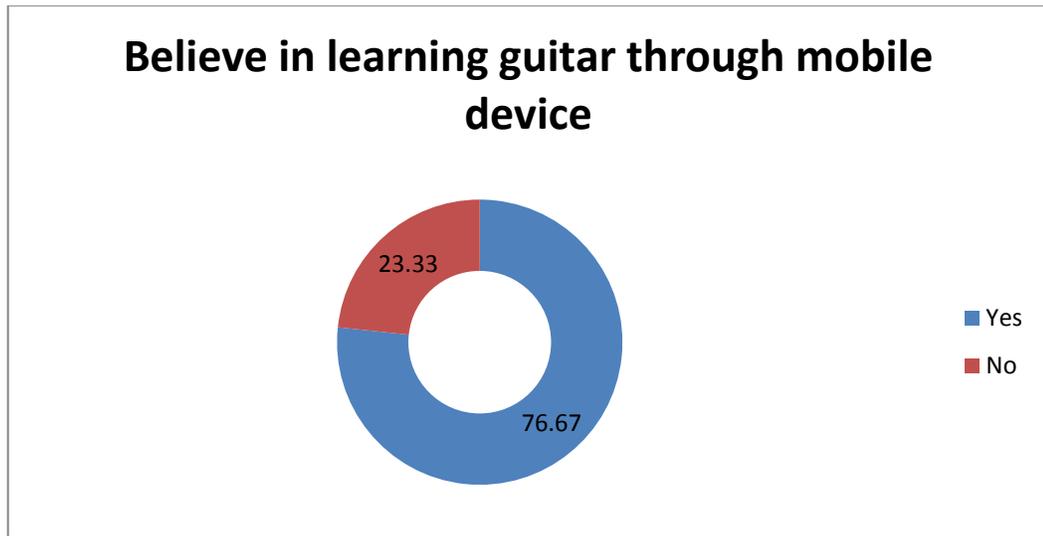


Figure 24: Results of "Believe in learning guitar through mobile device"

76.67% of respondents believe that using mobile application can help them in learning guitar in Figure 19. 23.33% thinks otherwise. The major respondents will most likely use the application when it is completed for user testing.

The statistics and survey has shown that the mobile application is helpful to beginner guitarists in reality. Mobile application has an increasing number of users recently.

# CHAPTER 5

# CONCLUSION

## 5.1 Relevancy to Objectives

Training music through mobile technology is now a trend and is possible today. Musicians like to train music on their own instead of just relying on formal classes or lessons. GuitarApprentice seems to be feasible in helping beginner guitarists to improve their playing especially in playing the right chords.

The objectives of the project are achievable. Beginner guitarists are believed to be able to improve their music training when using GuitarApprentice application. The application promotes a goal-orientated motivation for the beginner guitarists to improve their playing by providing an indication of their chords playing. A User Perception study was conducted towards beginner guitarists. The results were positive towards the mobile application. Beginner guitarists were interested to use the mobile application for their music training.

## 5.2 Suggested Future Works for Continuation

Apart from the specifications listed in Requirement Analysis and Specification, the mobile app can add the functionalities of comparing the chords played by the user and the original song for similarity level. A score or grade can be given to quicken the process of user interpret his or her guitar playing level in terms of playing the right chords.

In addition to the chords, tempos of strumming the guitar can be analyzed. This will increase the standard of the grading and improve the user's playing to a higher level.

**REFERENCES**

*Android.* Extracted on June 25, 2013 from:

http://developer.android.com/about/dashboards/index.html

Coding Caveman (June 11, 2013). Guitar : Solo Lite : Description. In *Google Play*.

Retrieved August 1, 2013 from

https://play.google.com/store/apps/details?id=com.codingcaveman.SoloTrial&hl
=en

cohorter.org (July 21, 2013). gStrings : Description. In *Google Play*.

Retrieved August 1, 2013 from

https://play.google.com/store/apps/details?id=org.cohortor.gstrings&hl=en

Eric D. Shaw (Aug 18, 1987). *Expandible and collapsible acoustic guitar.*

*GSMA & MasterCard Foundation Release Report On M-Learning*. Retrieved July 26,

2013 from Mob21 website:

http://www.mobl21.com/blog/tag/mobile-learning-statistics/

Harry McCraken (April 16, 2013). *Who's Winning, iOS or Android? All the Numbers,*

*All in One Place*. Retrieved July 15, 2013 from
http://techland.time.com/2013/04/16/ios-vs-android/

Henrik Alhm & Mathias Jeppsson (June 5, 2012). *Design and implementation of*

*a guitar tuner for a mobile phone*

Jerome M. Feldman (Sept 7, 1976). *Guitar instruction system.*

Martin Shule (August 9, 2013). smart Chords & tools (guitar.. : Description. In *Google*

*Play*. Retrieved August 1, 2013 from

https://play.google.com/store/apps/details?id=de.smartchord.droid&hl=en

musprojects (December 30, 2012). AnySong Chord Recognition : Description. In

    *Google Play.* Retrieved August 1, 2013 from

    https://play.google.com/store/apps/details?id=com.musprojects.chord&hl=en

Karla Gutierrez (Feb 21, 2013). *20 Eye-Opening Stats You Probably Didn't Know*

    *About Mobile Learning*. Retrieved July 26, 2013 from

    http://info.shiftelearning.com/blog/bid/271043/20-Eye-Opening-Stats-You-
    Probably-Didn-t-Know-About-Mobile-Learning

S.K. Mangal (2008). PHI Learning Private Limited. *Advanced Educational Pyschology*.

    Pg 170-245.

*The Free Dictionary(n.d.).* Guitar. Extracted on June 26, 2013 from:

    http://www.thefreedictionary.com/guitar

Timothy A. Teel (Sept 14, 1999). *Acoustic guitar assembly.*

# APPENDICES

## APPENDIX A

## USER PERCEPTION STUDY QUESTIONAIRE

Q1: Do you have an Android device?

    a. Yes

    b. No

Q2: How long have you played guitar?

    a. Less than a year

    b. 1 to 2 years

    c. 3 to 4 years

    d. More than 4 years

Q3: How did you learn guitar?

    a. Formal lessons

    b. Self-learning

    c. Peers

Q4: Do you have difficulties in tuning the guitar?

    a. 1

    b. 2

    c. 3

    d. 4

    e. 5

Q5: Do you have difficulties grading how well you are in playing?

    a. Yes

    b. No

Q6: Do you think you have sufficient knowledge in maintaining your guitar lifespan?

    a.  1

    b.  2

    c.  3

    d.  4

    e.  5

Q7: Do you believe in learning guitar with a mobile app?

    a.  Yes

    b.  No