# MOBILE APPLICATION: PROJECT PROPOSAL

## MUSIC'S USE & EFFECT ON PATIENTS WITH DEMENTIA

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# 1 - Executive Summary

Our client's objective is for a mobile app to be developed with the purpose of utilising and monitoring the effects of music on those who suffer from patients, and for the resulting data to be accessed by doctors and carers to provide insight and better understanding of the patient's symptoms and treating them accordingly. This document aims to present three different solutions that we believe will achieve our client's objective as well as satisfy the functional and non-functional requirements that were ascertained and explained in our Project Plan. We explored the benefits, constraints, assumptions and expenses of these solutions, and from this we determined the recommended solution and provide reasons for our suggestion.

We investigate our first solution, which suggests the mobile application, database and server are to be developed by our team KS1908. The development team will build the mobile application in Java programming language using the Android Studio integrated development environment, while the database will be written using MySQL and the server will utilise the Express framework for Node. Android Studio, MySQL and Java are familiar environments for the development team, thus the time that would otherwise be spent less on learning new languages and systems will instead be invested in development, resulting in an increase in the overall quality of the application. Furthermore, the use of free, open-source software reduces the cost of developing the application.

Our second solution involves the use of a third-party system to host the surveys, while the mobile app will also be developed using Android Studio. It was determined that Survey Monkey was the best option as it offers customisable features, dynamic collaboration and better branching and logical condition options than Google Forums. This solution requires less time for the server to be created, thus more time can be invested in the mobile application. However, most of the features that Survey Monkey offers are only available for premium members, such as creating private applications that have direct API access to the data.

The final alternative solution is a mobile web application, which acts similarly to a native Android application, with the added benefit of allowing cross-platform support and cross-device accessibility. It will be developed using the ASP .NET Core, which is a product of Microsoft, thus the best path to develop the mobile web application would be by developing through the Visual Studio 2019 integrated development environment, while the server and database will be developed and hosted by Microsoft Azure to allow an easier deployment of the ASP .NET Core application on it. This solution requires a higher financial investment in the technologies required to maintain the server.

After exploring these constraints and benefits, we've found that the first solution is the optimal path that will achieve the client's objective while also being budget-friendly without compromising the overall quality of the products. Following this will be a summary of high-ranking business functions that are essential to the product's ability to fulfil its primary purpose, as well as a detailed schedule explaining the progressive stages of each function as well as the planned completion dates.

# 2 - Introduction

This document will take the contents of the project plan into consideration in order to provide these alternative solutions companied by a detailed overview of the solution, a summary of the technologies and human resources that are required to complete this solution, the constraints and assumptions that have been detected and a cost-benefit analysis. A detailed report on the business functions required for the product is also included in this report.

The following pages will provide an overview of the client's objectives for this product to achieve followed by a detailed analysis of three alternatives solutions. This will provide the client different options that can achieve their objectives, with the recommended solution being the most effective.

We believe that the recommended solution will not only fulfil the needs of the client, but will allow more personalised features that will maximise the product's effectiveness in monitoring the reactions of the users  and displaying the data in a way that will allow carers and doctors to best understand their patients.

# 3 - Company & Client Project Objectives

Our team believes every client is unique in their objectives, and we strive to develop a product that reflects this. Our team is offering to develop a mobile application armed with qualities that will assist the client in achieving their goals in providing a high-quality service for their users, along with a server and database to provide encrypted storage and easy access for administrators.

Our client has expressed their need for a mobile application which monitors the effects of music on patients who suffer from dementia by having them complete surveys through a mobile application; the data must then be stored and accessed by doctors and carers to allow them to analyse the results in order to fine-tune their patient's treatment and prescribe the proper dosage.

What our team proposes will fulfil these objectives and provide features that will also achieve the functional and non-functional requirements and maintains a simple user-friendly interface to allow patients, doctors and carers to navigate through the application efficiently and make the most of its features and abilities. Our proposed solution aligns with the objectives of the client and serves to revolutionise technology in the medical industry.

# 4 - Alternate Solution 1:

## 4.1 - Solution Overview

In this solution, the mobile application, server and database system will be developed in house by KS1908. The mobile application will be developed in Java using the Android Studio integrated development environment (IDE). Android Studio is Google's free and official IDE based on IntelliJ IDEA, created for the sole purpose of developing Android applications. As it is made by Google, support for Android application development is superb and there is a plethora of resources available. This makes it quick and easy to find and fix any bugs or glitches that may come along during the development phase. Java has been chosen as it is the recommended language for development, which we are very comfortable and familiar with. This results in less time wasted learning a new language, therefore faster development times and a better overall mobile application quality. Quicker development times allow for more time to debug the mobile application, so it comes out more polished and complete product for the user.

The server uses the Express framework for Node, which allows us to easily setup a web server without needing to reinvent the wheel. Node is a free and open source runtime environment that allows JavaScript code to be executed without the need of a web browser. It is cross platform, meaning it can be run on many operating systems such as Linux, Apple Mac OS or Microsoft Windows. This means developers can use their preferred operating system, which reduces the costs of purchasing licenses, compared to other solutions that may only run on Windows. Node employs an event driven and asynchronous architecture, which means it is capable of handling a multitude of connections and requests. This design choice allows us to increase throughput and scale the server as the number of users increase. Due to the popularity of Node and Express, they will likely be maintained until the foreseeable future, enhancing the server's security and robustness.

The database uses MySQL, a free and open source relational database management system. It is included in the XAMPP software suite which allows us to view tables, rows and users in the web browser. This makes it easy to see the structure of the database and how data flows in and out of it. The control panel also allows us to easily add, edit or remove rows and users without needing to write some Node code and executing it. MySQL is cross platform and regularly maintained so it can be easily migrated across different platforms. All of the user's

details, answers to questionnaires/surveys and songs will be stored in this database. This will allow our client to analyse the results and draw conclusions from it.

The server communicates directly to the database, by executing SQL queries. The mobile application sends HTTP requests to the server and receives a JSON response from the server. JSON stands for JavaScript Object Notation and is a standard and lightweight method to store data. It's trivial to parse and generate so many languages support it (including Java). The mobile application parses the JSON response and informs the user of any errors. The separation of the web server and the mobile application allows us to independently work on either in parallel. This will speed up development times and allows us to isolate any issues to either the web server or the mobile application. This means we can debug the web server without affecting the development of the mobile application too much and vice-versa.

## 4.2 - Technologies & Human Resources Required

| Type | Cost |
|---|---|
| Software | Android Studio: Free<br>Node: Free<br>Express Framework for Node: Free<br>MySQL: Free<br>XAMPP: Free |

## 4.3 - Constraints & Assumptions

| Constraints | Assumptions |
|---|---|
| Users need internet access to use the mobile application | The client has a web server with all the required software installed |
| Users need an Android device to use the mobile application | After project completion, the client will be able to make changes to the server, |

| | |
|---|---|
| After project completion, server, database and user interface will need to be updated by developers hired by the client | database and user interface as they need to make updates/maintenance, or they will hire developers to do so. |
| Project development will be substantially longer due to the full system development (server, database, user interface) | |

## 4.4 - Cost-Benefit Analysis

| **Benefits** | |
|---|---|
| **Tangible** | **Intangible** |
| Free and open source software | More control over system as we are developing it ourselves |
| Cross platform software allows for easy migration | Many resources/guides for Express/Node |
| Faster Android application development as the team is familiar with Java | Many resources/guides for Android Mobile Application development |
| | Higher overall mobile application quality due to experience |

| Costs | |
|---|---|
| **Tangible** | **Intangible** |
| Software - Android Studio, Node, Express Framework for Node, MySQL, XAMPP | Labour Time - Approximately 10 weeks (3 Developers) |
| Labour - 1 x Back-End Developer (Web Server and Database): $108,402/year | Higher risk of bugs/glitches as we have no experience with Node/Express |
| Labour - 2 x Front-end Developer (Android application UI): $164,760/y | |
| Need to learn how to use Express and Node | |
| Slower development times due to inexperience with Node/Express | |

The use of free and open source software will reduce licensing costs and allow us to focus the budget on more important aspects of the system like the server. A better server means more users will be able to use the mobile application at the same time, better security and protection against attacks and less down time. This will ensure users get the most optimal treatment possible. Similarly, as we are using cross platform software, migration to another system is very simple and won't require any modification of the code. This saves time and money that would otherwise be spent on hiring developers to migrate the code, test that it works on the new system and finally deploy it. This may also introduce bugs or glitches that have not been present in the previous system, further increasing costs and development time.

Furthermore, as we our developing the full system in-house, we have more control over the system. This means we can design and develop the system as the client intended leading to a more efficient and optimal solution. This may mean added complexity and longer development times, but our experience with Android development will offset that and result in a higher quality product.

However, as we have little to no experience with backend/server development, time will need to be spent familiarising ourselves with Node and the Express framework. Due to our inexperience, there may be unexpected bugs or glitches and/or less than optimal server performance, but we will try our best to minimise these issues.

# 5 - Alternate Solution 2:

## 5.1 - Solution Overview

In this solution the database and server of the systems are handled by Survey Monkey, a cloud-based survey tool that helps users create, send and analyse surveys. The surveys will be created by KS1908 on the Survey Monkey app, using the appendix guides provided by the client. These surveys will be embedded in the mobile application where users will login, answer the surveys and then receive their playlist. The application will also be where they answer the post-listening surveys.

The mobile application will be developed in Java using the Android Studio integrated development environment (IDE). Android Studio is Google's free and official IDE based on IntelliJ IDEA, created for the sole purpose of developing Android applications. As it is made by Google, support for Android application development is superb and there is a plethora of resources available. This makes it quick and easy to find and fix any bugs or glitches that may come along during the development phase. Java has been chosen as it is the recommended language for development, which we are very comfortable and familiar with. This results in less time wasted learning a new language, therefore faster development times and a better overall mobile application quality. Quicker development times allow for more time to debug the mobile application, so it comes out more polished and complete product for the user.

## 5.2 - Technologies & Human Resources Required

| Type | Cost |
|---|---|
| Software | Android Studio: Free<br>Survey Monkey: $75/user/month = $900,000 (1000 users for 1 year) |

## 5.3 - Constraints & Assumptions

| Constraints | Assumptions |
|---|---|
| Users need internet access to access Survey Monkey | Client is willing to purchase Survey Monkey accounts for its users |
| Restricted to the functionality of Survey Monkeys database features/ survey features | Survey Monkey has the functionality to implement the types of questions the client needs in the surveys |
| Any maintenance or updates of the Survey Monkey System can't be controlled/delayed | |

## 5.4 - Cost-Benefit Analysis

| Benefits | |
|---|---|
| **Tangible** | **Intangible** |
| Free and open source software (Android Studio) | Many resources/guides for developing Survey Monkey resources |
| Cross platform software allows for easy migration | Higher overall mobile application quality due to experience |
| Faster Android application development as we are familiar with Java | Our team will be able to focus our efforts on app functionality and not on Survey user interface and database aspects |
| Survey design and functionality will be of a high quality coming from an established business | Development would be substantially quicker than developing the full system |

| Costs | |
|---|---|
| **Tangible** | **Intangible** |
| Software - Survey Monkey:<br>$75/user/month = $900,000<br>(1000 users for 1 year) | Labour Time - Approximately 6 weeks<br>(2 Developers) |

The use of free and open source software for application development will reduce licensing costs and allow us to focus the budget on the licensing and account purchasing from Survey Monkey. At a costly price, outside of the project budget, Survey Monkey provides a quality survey system and database which will have high level security for protection against attacks. Survey Monkey has the capability to handle the users the client requires and is already an established business meaning bugs and fixes will be minimal and downtime will be scheduled giving the best user experience.

The biggest advantage of this system is also its biggest downside. While there won't be the hassle of developing and maintaining a server and database for survey results and user details, the client will have to use the survey functionality, user functionality and analysis data that Survey Monkey provides. They wouldn't be able to tailor their surveys or data tracking exactly for their needs. Furthermore, any downtime or maintenance won't be able to be delayed or not implemented, the client will have to use the system as it is.

With our team’s experience with Android development and the backend/server development being handled by Survey Monkey, the overall project development time would dramatically reduce in comparison to a full system development.

# 6 - Alternate Solution 3:

## 6.1 - Solution Overview

In this solution, we'll be developing a mobile web application using ASP .NET Core. A mobile web application is basically a website that acts like a native mobile web application. This makes it relatively easy to develop and even easier when using ASP .NET Core compared to developing a native Android application. Mobile web applications can be run in any web browser, so there is no need to take into account compatibility with devices. Furthermore, any device that has a web browser can access the web application, including laptops, desktops and tablets. This can significantly cut down development costs and reduce redundant code, as we can develop once and deploy anywhere. ASP .NET Core is created by Microsoft and so for best compatibility, we'll be using the Visual Studio 2019 integrated development environment.

Similarly, for the database we'll be using Microsoft SQL Server Management Studio to store user information, answers to questionnaires/surveys and song information. Using Microsoft software ensures development is smooth and has a lower chance of issues, reducing the time spent debugging.

The server and database will be hosted using Microsoft Azure due to the ease of deploying an ASP .NET Core application to it.

## 6.2 - Technologies & Human Resources Required

| Type | Cost |
|---|---|
| Software | ASP .NET Core: Free<br>Microsoft Azure App Service (S1): $126.289/month<br>Microsoft SQL Server Management Studio: Free<br>Microsoft Visual Studio 2019 (Community Edition): Free |

## 6.3 - Constraints & Assumptions

| Constraints | Assumptions |
|---|---|
| Users need internet access to access to access the website | Client has a Microsoft Azure account |
| Locked into Microsoft ecosystem | |
| Restricted to the functionality of Microsoft Azure database features (analytics, reporting, etc.) | |
| Any maintenance or updates of the Microsoft Azure System can't be controlled/delayed | |

## 6.4 - Cost-Benefit Analysis

| Benefits | |
|---|---|
| **Tangible** | **Intangible** |
| Cross platform software allows for easy migration | Microsoft ecosystem ensures software is compatible with each other |
| Develop website once and deploy anywhere | |
| Fast development times thanks to ease of ASP .NET Core | |

| Costs | |
|---|---|
| **Tangible** | **Intangible** |
| Microsoft Azure App Service | Labour Time - Approximately 10 weeks (3 Developers) |

The main advantage of a mobile web application is that any device with a web browser can access it. This allows us to develop the website once and deploy on mobiles, desktops and tablets saving time and money. Furthermore, ASP .NET Core aids immensely in creating a dynamic website that can work across many devices, reducing costs.

# 7 - Recommended Solution

## 7.1 - Justification

Our recommended solution for this project is Alternate Solution 1, the development of the mobile application by our team, as well as the creation of the server and the database. This solution would be the best as the cost for the client is free, for all development and licensing which Alternate Solution 2 and Alternative Solution 3 don't have the advantage of. Whilst the professionalism and convenience of using Survey Monkey to create surveys and having them handle the server and database is preferential, the cost is out of the project budget. Furthermore, being restricted to Survey Monkey's functionality of survey creation, analytics reporting, and maintenance schedule is not ideal. Alternate Solution 3 is also costly to develop, purchasing the Microsoft Azure App Service (S1) for users and each user must have a Microsoft Azure account which is also another inconvenience. Alternate Solution 1, our recommended solution, has the convenience of an application, will have the professionalism in design due to our team's experience with the tools required to create the system and is free of cost to the client.

## 7.2 - Return On Investment Summary

The comparison between the cost of the solutions and their benefits make the best case for our recommended solution. The basic functionality of this app will include surveys and the answers provided will produce a specific playlist for the user. This can be achieved through each of the alternate solutions, but only Alternative Solution 1 can provide this functionality at no cost to the client and with the benefits that a mobile application provides. Alternate solution 2 requires the purchasing of Survey Monkey accounts for users and Alternate Solution 3 requires purchasing of the Microsoft Azure App Service (S1). With the paid solutions costing substantially more money whilst only providing slightly more beneficial results (more secure database, more professional user interface for surveys, etc.) the return on investment of Alternative Solution 1 would be the greatest.

# 8 - Ranked High-Level Business Functions And Use Cases

## 8.1 - Overview of Business Functions

| BF ID | High Level Business Functions | Ranking |
|---|---|---|
| BF01 | Manage Users | Essential |
| BF02 | Manage Songs | Essential |
| BF03 | Collect Answers to Questionnaires/Surveys | Essential |
| BF04 | Process Answers to Questionnaires/Surveys | Essential |
| BF05 | Process Songs | Essential |
| BF06 | View Information/Guides on Dementia | Essential |
| BF07 | User Tracking | Essential |
| BF08 | Play Songs | Optional |

## 8.2 - Business Functions in Detail

| Function | Type |
|---|---|
| **Manage Users**<br>● Manage User Details<br>○ Add User<br>○ Edit User<br>○ Delete User<br>● Manage Password<br>○ Edit Password<br>○ Reset Password | Essential |

| | |
|---|---|
| **Manage Songs**<br>● Manage Playlists<br>○ Add Songs<br>○ Remove Songs<br>○ Recommend Playlist based on survey results | Essential |
| **Collect Answers to Questionnaires/Surveys**<br>● Validate all required inputs are filled out<br>● Validate user input | Essential |
| **Process Answers to Questionnaires/Surveys**<br>● Save answers to database<br>● Map answers to songs that may help<br>● Adjust the mapping to suit the user after listening to a song and answering a questionnaire/survey | Essential |
| **Process Songs**<br>● Get song details (name, link, tempo, mode)<br>● Save song details to database<br>● Recommend a song to user when necessary | Essential |
| **User Tracking**<br>● Time spent listening to song<br>● Time of day listening to music<br>● Type of music listened to | Essential |
| **Play Songs**<br>● Play songs from external app (YouTube) | Optional |

# 9 - Development Release Schedule

| Business Function | Weeks | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** |
| **BF01, BF03** | A | D | C | C | T | I | | | | |
| **BF02, BF04, BF05** | | | A | D | C | C | T | T | I | |
| **BF06** | | | A | D | C | T | I | | | |
| **BF07** | | | | A | D | C | C | T | I | |
| **BF08** | | | | | A | D | C | C | T | I |

**Key Breakdown**

- A - Analysis
- D - Design
- C - Construction
- T - Testing
- I - Implementation

# 10 - Conclusion

To conclude this proposal document, we believe we have a clear understanding of our client's vision for this project and are confident in our ability to deliver a high-quality product that will fulfil this vision.

From the functional and non-functional requirements identified in the project plan, we were able to cultivate three alternative propositions that we believe will capture the vision of the client and meet the requirements that are essential to the success of the application. Each solution is unique in its plan to complete the client's objective, and differs in estimated expenses, the constraints and assumptions that can occur and technologies required to complete the project; each solution also contains a detailed cost-benefit analysis.

After carefully considering such details, we recommend the first solution to be the best course of action to achieve the project completion as it offers a wider range of features while maintaining a lower budget. Our recommendation also utilises an open-source software, which allows more personalised features tailor-made for the client's needs.

Our team KS1908 look forward to working alongside our client to develop a high-quality product; we believe the solution recommended will surpass the initial objectives and expectations of the client.