

Your Cystic Fibrosis App Final Report



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Abstract

The application is aimed at children with cystic fibrosis in Ireland between the ages of 12 to 18 and their doctors. The reason this age range has been selected is because intervention through these years can lead to better outcomes for the patient's overall health.

Now a CF patient between the selected age range will only see their team of doctors every three months. The only exception for this is if they are very ill as there is a shortage of suites that can accommodate patients with CF.

Introduction

The idea for my application came from my sister's condition Cystic Fibrosis. Cystic Fibrosis is an inherited chronic disease that primarily affects the lungs and digestive system. About 25 new cases of cystic fibrosis in Ireland are diagnosed each year. Around 55% of the CF patient population in Ireland is aged 18 or older. The predicted median age of survival for a person with CF is in the early and mid-30's in Ireland. The main function of the application is providing the doctors with more information on their CF patients.

Project Description

Who is it for:

The application is aimed at children with cystic fibrosis in Ireland between the ages of 12 to 18 and their doctors. The reason this age range has been selected is because intervention through these years can lead to better outcomes for the patient's overall health.

Now a CF patient between the selected age range will only see their team of doctors every three months. The only exception for this is if they are very ill as there is a shortage of suites that can accommodate patients with CF.

What is measured:

I will be measuring lung functionality and also, I will be keeping track of food Intake.

Why is it measured:

The reason lung functionality is being measured each week is to give their doctor a better picture of what has been going on over the three-month period rather than only basing it on their previous appointment three months ago. I have experience of this patient's going up every three months and their lung functionality progressively decreasing and the doctor only able to use the patient's previous Pulmonary function tests (PFTs) from three months ago. I believe that the data that could be collected over these three-month periods would be of great benefit for both patient and doctor.

Food is another important aspect of a patient suffering from CF as it can be hard for the patient to maintain or even gain weight and in turn this directly affects how active the patient can be. The dietitian gives a food journal that they are expected to fill in each week. The application could take what a patient eats day by day and then the dietitian could view this information.

How will it be measured:

I will measure the lung functionality by using the mobile's sensors to accurately measure walking patterns. The information that is gathered from this should accurately measure pulmonary function.

I want to keep the food journal as simple as possible so I will break it into the three main meals breakfast, lunch, and dinner. I haven't decided if I will get the patient to input completely what they have ate or if I will create a database of food that they could simply select from the list under the three headings above.

Problems Encountered

Selecting the software to develop my application with

- There are wide range of tools to develop with. It took me longer than I expected to choose what to use in my project.

Android Studio

- Page design is very time consuming
- Keeping track of naming variable over multiple screens

- Learning how to debug when the application crashes on the phone but does not show and code error
- Gradle not automatically updating changes
- Git not saving files important to run in android studio as a result losing work
- Android SDK issues e.g. wrong version

Firestore

- Initial setup
- Firestore rules learning how they work
- Writing and reading from the database
- How to properly structure data within the database
- Using JSON
- Firestore push notifications
- How to run queries

Time Line

- Keeping to each separate iteration's timeline and not having one iteration running into another iteration
- Knowing when to leave on iteration and begin another
- Overall course load

Keeping a Project Log

- I found it hard as the project progressed to keep a straight log outlining the stages I was at during the project. I used bitbucket to store my code as I had an issue with GitHub. It was keeping track of the various stages of my project and the later meeting with my project tutor I found hard to keep track of as I was keeping track of other multiple projects as well.

Goals and Achievements

Goals

1. Login/Register
2. Food Diary
3. Activity
4. Spirometer
5. Doctor Monitoring dashboard
6. Live working application
7. Push notifications

Achievements

1. On the application side I have achieved the following:
 - a. A working login and register system
 - b. A food diary that tracks a patient's food habits each day
 - c. An activity which measures how active a patient is
 - d. A fully functional integrated spirometer
 - e. Live working application
 - f. (In progress) Doctor monitoring dashboard
 - g. (In progress) Push notification
2. I have been in contact with two separate CEO's regarding my application. The first was from Godfrey Fletcher from CRFI (Cystic Fibrosis Registry of Ireland) who was interested and put me in contact with one of his researchers Dr Abaigeal Jackson. I have been in contact with her from the beginning of my project sharing my documents and getting her view on the different aspects pertaining to the different iterations.
3. Dr Abaigeal put me in contact with another company which create mobile medical applications PatientMPower. I was put in contact with their CEO Eamonn Costello who also was interested as they were thinking of expanding their portfolio of medical applications with one for Cystic Fibrosis. After explaining what I hoped to achieve he put me in contact with their VP Scientific Affairs Colin Edwards who has advised me on the different technologies I could use for my project.

Things not Achieved

1. Now while writing this document the doctor dashboard has not been completed. I had hoped it would have been finished but I am hoping that it will be ready for the demo.
2. I had hoped that I could have tested the application with a patient in the selected age range. It would have given me a better perspective on how a patient would interact with the application.
3. Now while writing this document I have not configured Firebase's push notifications to remind the patient to do their spirometer test with in the application but I am hoping that it will be ready for the demo.
4. I would have liked to talk to patients with in the age range to get there view of an application of this type of what they would have liked to see in it. What would attract them to use it.
5. I had planned to integrate a heartrate monitor at the beginning of the project. As I considered the technologies for mobile application it would only work on a specific type of mobile device which had a specific type of sensor for this reason I did not integrate that type of monitor.
6. I had originally intended on creating my own spirometer for my project. As I considered it and talked with Dr Abi I decided not to proceed with making one as it would not have been as accurate as one I could purchase.

7. I hoped to monitor a patient's movement for the activity section of the application but I decided to go in a different direction so I didn't implement the motion detector in the application.

Learning Outcome

Cystic Fibrosis

This project has made me look at Cystic Fibrosis in a completely new light. I looked at the disease from the point of view of a software developer and how I could use my skills to create an application to monitor the disease.

Firebase

At the beginning of the project I was familiar with firebase as I had previously used it in another project but not to the extent that I needed for this project.

The initial setup of firebase is simple and straight forward and it allows you to read and write to the database without a large amount of configuration. This allows for quick development at an early stage.

The catch with firebase is its ability to query the information that is stored in it. Firebase is constantly changing add new features (like a rolling update). Now if you want to query the data it needs to be done app side and then the result will be stored in firebase.

Android Studio

Native mobile application is developed using android studio. Android studio is written in java. I am familiar with java as I have used it in the past but not on such a large project. Android studio has a steep learning curve as the sheer amount of options and tools available to work with. Even with all the options at its core android studio is still basically a complicated java ide and as a result conforms to java standards.

One of the main learning outcomes from this project is how comfortable I am with java and that I would like to increase my knowledge of java and keep it as one of my core languages.

Spirometer

I had originally planned on creating my own spirometer using an Arduino. I spent time researching how they work and the internal mechanics of the device which allow it to record lung function and the different types of measurements. I couldn't build my own one in the end because I could not guarantee the results and as the spirometer is one of the

core elements of the application it relied heavily on the spirometer returning accurate results so I had to purchase one with a high accuracy rating.

Management

I have been talking with different experts when it comes to my project such as my project tutor Dr Joseph Keogh, PatientMPOWER VP scientific affairs Colin Edwards and a Cystic Fibrosis specialist Dr Abigail Jackson. I had to learn how to best access each of the expert's knowledge and then apply that to my project.

YourCF Application

I have learned the amount of work it takes to take the initial idea of an application straight through to a working product. All the different stages and what you initially start out with can be completely different from the product you end up with in the end. Also, I have learned how important it is to stick to deadlines because otherwise you could get lost with in an iteration so having a realistic deadline can help a developer focus.

Things I would do differently

Time Management

When it comes to time management I would have focused more on my main project and less time on other subject projects to a certain degree but I found it hard to strike a perfect balance between my main project and other projects.

Documentation

I should have kept a tighter control on my early project documentation as I found when looking back over them that there was a lot more work updating than I had expected.

Tutor

I feel that I should have met with my project tutor more than once during the week. I know that it wouldn't have been a problem for him to meet up more regularly it was just the work load from other subjects but I do believe that it is important to make a note of this as I think it would have given me a clear picture of where I should be not only that but I should have asked more questions and got my tutors opinion on more aspects of the application.

Added Smart Wear

If I had the time I would have liked to have added smart wear with the application as it would have allowed me to collect more measurements from a patient such as heart rate and so on.

Conclusion

I have achieved what I set out in my project. I found it to be very informative and not only for cystic fibrosis but other diseases as well. I believe that the concept of my application could be built upon and getting the right people involved with it could be great benefits for patients suffering with cystic fibrosis. There is a gap in the market in this sector for medical application with backing from medical professionals. After talking with Dr Abaigeal Jackson at length there has been a massive growth in this area. I hope to conduct further research into this area.

