

ForeSee

2020 SIGHT Project

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Introduction

1.1 Background

Noticing that Hong Kong has the highest rate of myopia across the globe for kids at 6 years old. (Yuen, 2019) It intrigues us to further investigate various literature for more information. It shows that there is a rising prevalence of refractive errors among local primary school students. Therefore, we are interested to come up with a solution to ease the worsening trend.

We had the inspiration of building an eye care mobile application after listening to Mr. Dick Lo's sharing on how to keep track on eye data may enable people to notice serious eye disease in advance. Since most of Hong Kong parents and children rely on the booklet provided by health department to record children's health data. However, the booklet only serves as data recording purposes. It doesn't enable parents or children to understand the meaning behind the data and the trend it displays. We considered there's room of improvement such that we can build something for parents to monitor their kids' vision change and equip parents with correct eye care information and habits such that their kids can also be well educated at their very young age. We believe that by building good eye-using habits at early days for the kids can help to relax the growing progression of refractive errors in Hong Kong.

1.2 Problems

Since there are many possibilities to tackle the phenomenon. We have to define problems that is within our reach. Two problems are defined as below:

- Lacking accessibility to their own eye data
- Lacking education on how to take care of their eyes

In Hong Kong, most people won't keep longitudinal records of their eye data. Neither can they interpret and understand the trend of each data point nor its risk behind the progressions. That said, people in Hong Kong are not be able to access their own eye data.

Since children in primary school or kindergarten just start exposing to mobile devices. How they cultivate their habits in using these screen products may affect their eye health throughout along their life. However, lacking sufficient education and awareness on how to use their eyes correctly may pave the way for increasing risk of suffering from refractive errors.

These two problems contribute to our ideas in building an application and how we want to interactive with our users.

1.3 Objectives

Prior to our defined problems, we need some objectives to measure how effective and successful is our solution. Below are the 3 objectives:

- Improve parents' accessibility of their kids' eye data
- Improve parents' intuition of their kids' eye data
- Educate parents and kids about the importance of eye health

Project development

2.1 System's development

As we are developing a mobile application, we decided to go with using React Native which is an open-source cross-platform development framework developed by Facebook. As it is open-source we are also using community-developed libraries to aid our application. The reasons we are using React Native are the prior experiences of our team members and its ability to both create an iOS and an Android application with the same code.

To handle the storage of data generated by the users, we decided to use Amazon Web Services' Relational Database Service (RDS) which stores data in MySQL framework.

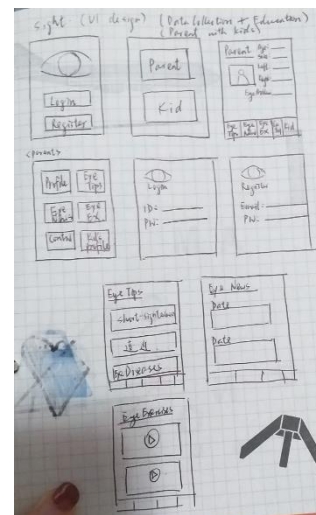
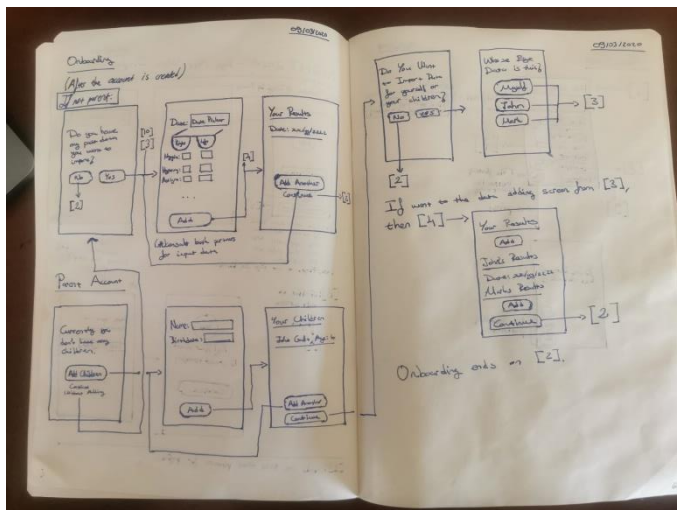
Lastly, to easily implement the connections between our application and the RDS we are using AWS Lambda and microframework Chalice to create REST APIs.

The reasons why we are using AWS is its cost efficiency and its documentation support.

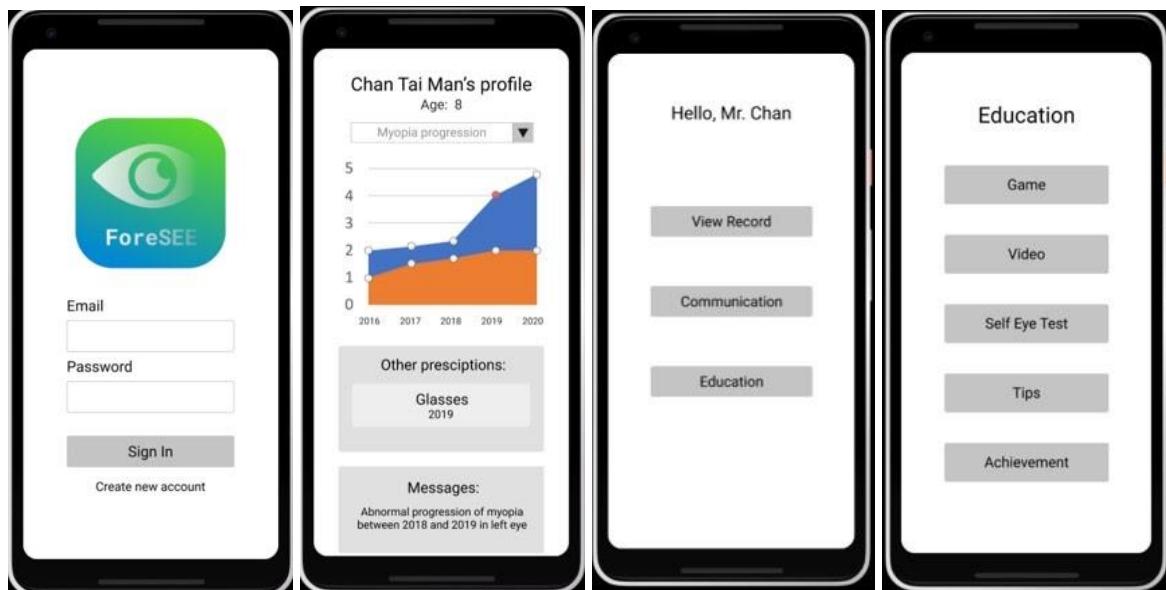
2.2 Design evolution

We first started working on this project in Fall 2019, back then we prepared a design prototype of our core functions (collecting and presenting data, patient-doctor connections, educative advice) using Sketch.

Then after we started this term, we made some basic wire diagrams using hand drawings and PowerPoint which also included the ideas that we have generated at the beginning.



After our ideas started becoming more solid, we put them down in Figma, meanwhile, we also started developing the skeleton of our application.



After having several meetings with our partners, we get a lot of suggestions and then decided to adjust some of the improper part in the figma. For example, our partner points out that in data recording and data visualization part, we have to follow the naming convention used by professionals, and the customer's record is a little messy for both user and professionals. For the education part, our partner would like to have more interaction with users by answering their questions. Our partner commented that the self-eye test can be a game with random test questions. It is advised to use more audio content in order to reduce screen time. We also make our interface more easily for user to use.



Solutions and prototyping

3.1 Data Recording and Visualization (Normal User)

This function help users record their eye check-up record so that they can have a long-term record of their eye health. This function also explains their eye check-up record with text and an area chart.



Components:

1. Tutorial page
2. View control
3. Area chart
4. Explanation
5. Detailed prescription and eyeglasses prescription
6. Data input

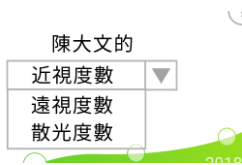
3.1.1 Tutorial page



This tutorial teaches users how to use this function, like how to view record from a different page and how to read the area chart.

3.1.2. View control

- Drop down menu



Users can choose to view record of myopia, hyperopia and astigmatism

- Eyes Button



Users can click on the eyes to view record of another eye. If left eye is open, the screen is currently showing the record of left eye, and vice versa.

- Date switch



Users can either click on the white circle or the arrow sign to view record from a different time. The non-transparent white circle is the currently selected date.

3.1.3. Area chart:

- The colour



Record 2 with myopia -3D

Record 1 with myopia -1D

The colour of the area chart encodes the degree of refractive error with a continuous colour scale (Table 3.1a-c).

The area in between two records is filled with a gradient.

Judging from how rapid the colour change from record to record, users can understand their refractive error progression.

(Table 3.1a)

Condition	Range (Spherical)	Colour range
No to low myopia	-0.00D to -3.00D	#00CA51 to #FFF503
Moderate Myopia	-3.25D to -5.75D	#FFF503 to #FF5D02
High Myopia	Above -6.00D	#FF5D02 to #C40205

(Table 3.1b)

Condition	Range (Spherical)	Colour range
No to low hyperopia	0.00D to +2.00D	#00CA51 to #FFF503
Moderate hyperopia	+2.25D to +5.00D	#FFF503 to #FF5D02
High hyperopia	Above +5.25D	#FF5D02 to #C40205

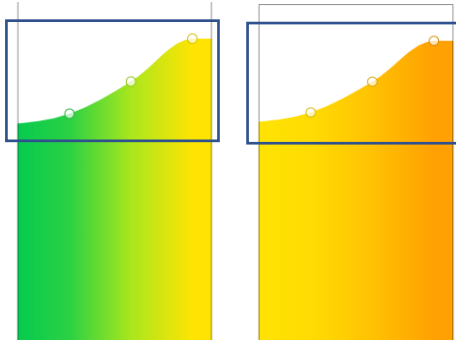
(Table 3.1c)

Condition	Range (Absolute cylinder error)	Colour range
No to low astigmatism	0.00D to 0.75D	#00CA51 to #FFF503
Moderate astigmatism	1.00D to 1.75D	#FFF503 to #FF5D02
High astigmatism	Above 2.00D	#FF5D02 to #C40205

- The slope

This graph is not decided to read exact prescription but to view the overall trend and the change of prescription from record to record. The slope is of relative scale.

The minimum and maximum point depends on the range of user-input records.



The curve on the left has a range from 0 to 2. The curve on the right has a range from 2 to 4.

If the rate of change between every record is the same, the slope and position of the graph will be the same and within a fixed area of the screen.

By combining colour and curve, users can understand the seriousness and the progression rate of their refractive error from this area chart at a glance.

3.1.4. Explanation

右眼近視度數: 25度
您有很淺的近視, 沒有散光和遠視
近視度數增幅正常
您知道嗎?
2小時的戶外時間可以防止近視加深!

The explanation mainly explains the degree, seriousness and progression of refractive error with short sentences.

Based on the current situation, it will provide a link to a related article which encourages users to prevent or slow down refractive error progression or informs the risk of high refractive

error.

3.1.5. Detailed prescription and eyeglasses prescription

- Detailed prescription

21/6/2015		
2/5/2016		
	O.D.	O.S.
SPH:	-0.25	-0.50
CYL:		
AXIS:		
VA:	1.00	1.00
PD: 45		
備註: 沒有		
13/6/2017		

This function is designed for users who want to view the original prescription. They can also use this function if they want professionals to view their record when they are doing eye check-up.

- Eyeglasses prescription

眼鏡 1		
使用期: 2018-2019		
度數:		
	O.D.	O.S.
SPH:	-0.25	-0.50
CYL:		
AXIS:		
備註: 沒有		

Users can view their eyeglasses prescription and the usage time.

3.1.6. Data input

日期

	O.D.	O.S.
SPH:	<input type="text"/>	<input type="text"/>
CYL:	<input type="text"/>	<input type="text"/>
AXIS:	<input type="text"/>	<input type="text"/>
VA:	<input type="text"/>	<input type="text"/>
PD:	<input type="text"/>	<input type="text"/>
備註: <input type="text"/>		

Users can input their prescription data here. A remark field is added to increase the flexibility. It can be used to as a reminder or a comment.

3.2 Data Recording and Visualization (Professional User)

This function helps professionals build a long-term record of their customers. They can then make a more comprehensive analysis of the eye condition of their customers.

1 陳大文
年齡: 9
職業: 學生
家庭病史: 沒有
已知眼疾: 沒有

2
2015 2016 2017 2018
◀ 2/5/2016 ▶

3
O.D. O.S.
SPH: -0.25 -1.25
CYL: -1.00 -0.75
AXIS:
VA: 1.00 1.00
PD: 45
備註: 沒有

4 輸入數據 3 眼鏡度數

Components:

1. Personal information
2. View control
3. Detailed prescription and eyeglasses prescription
4. Data input

3.2.1. Personal information

陳大文
年齡: 9
職業: 學生
家庭病史: 沒有
已知眼疾: 沒有

The information include name, age, occupation, family medical history of eye disease (if any) and known eye disease (if any). This information can help professionals make a more comprehensive analysis. Age and occupation change the interpretation of the

record. There are more than 350 hereditary eye diseases, by listing the family medical history, it can alert professionals to pay attention to early symptoms of the disease, inform customers of the potential risk and the prevention measures.

3.2.2. View control



Users can either click on the white circle or the arrow sign to view record from a different time. The non-transparent white circle is the currently selected date.

3.2.3. Detailed prescription and eyeglasses prescription

- Detailed prescription

	O.D.	O.S.
SPH:	-0.25	-1.25
CYL:	-1.00	-0.75
AXIS:		
VA:	1.00	1.00
PD:	45	
備註:	沒有	

The prescription follows the notation used by professionals.

- Eyeglasses prescription

眼鏡 1		
使用期: 2018-2019		
度數:		
	O.D.	O.S.
SPH:	-0.25	-0.50
CYL:		
AXIS:		
備註:	沒有	

Users can view the eyeglasses prescription and the usage time of their customers.

3.2.4. Data input

日期:

	O.D.	O.S.
SPH:	<input type="text"/>	<input type="text"/>
CYL:	<input type="text"/>	<input type="text"/>
AXIS:	<input type="text"/>	<input type="text"/>
VA:	<input type="text"/>	<input type="text"/>
PD:	<input type="text"/>	<input type="text"/>

備註:

確認

Users can help their customers input data which will be updated to normal users' account. Remarks provide flexibility to professionals to input additional information.

3.3 Ask a professional

"Ask a professional" is a function for normal users to ask professionals questions and get advice from them. They can also view other users' questions and the corresponding response from professionals.

First page

專家解答

小朋友成日擦眼睛

攞到眼皮同眼紅紅地，成日都係咁，已講左好多次吾好擦眼，會有細菌同越整越痕，都吾知做咩，講完都成日係咁，洗吾洗去睇醫生？！如果係細菌感染所致，咁應點做？

兩歲bb成日眨左眼，眼睛有事？

我小朋友一兩星期左眼成日不自覺地眨，右眼又唔係咁，我又睇唔到眼睛有紅腫，只係眨一邊眼睛。原因係咩？thx

BB眼睛有很多黃色分泌物

BB出院後幾天開始左眼有分泌，到健康院睇，醫生話唔係發炎，但3個星期都唔好，於是睇兒科醫生，開了抗生素及眼藥水，一星期到好返，但一星期後又發，今次

找不到你想問的問題？

撰寫問題

View response

專家解答

小朋友成日擦眼睛

攞到眼皮同眼紅紅地，成日都係咁，已講左好多次吾好擦眼，會有細菌同越整越痕，都吾知做咩，講完都成日係咁，洗吾洗去睇醫生？！如果係細菌感染所致，咁應點做？

解答

黃子豪
第1部分註冊視光師

眼痕問題有很多原因：受空氣微塵、乾燥或少量、眼垢分泌（過敏）刺激最多，你可以試下幫BB做熱敷洗眼

早午晚，按需要就可以做：（秘訣係用真乾淨，行動要溫柔）

1. 用微溫的濕毛巾，輕蓋在眼上（閉上眼的），可以當玩小遊戲數一二三，呢個動作係濕潤返及減敏，來回幾次。
2. 用溫水濕過棉花球，沿住BB眼瞼邊緣輕抹一，方向由眼尾走向鼻，每抹一下，注意有沒有穢物跑出。有

Write a question

專家解答

收集問題後，我們的專家會在一星期內回答你的問題

主題: 0/20

問題: 0/200

☐ 我同意專家查看我的歷數記錄

由於我們會在本地式內發佈專家回應，請注意不要留下個人資料

撰寫問題

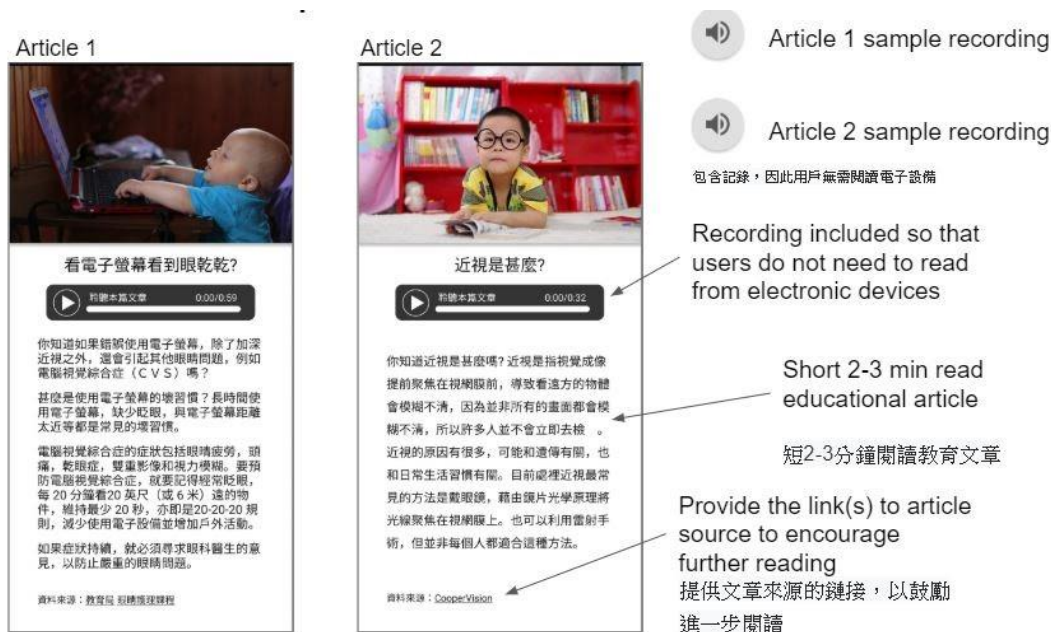
Users can view other users' questions here. They can click on the question to view the response from professionals.

Users can view the profile (name and qualification) of the professionals and their response here.

Users can write their own questions here. They need to fill in the title and the content of their questions here. If the users want, they can disclose their eye check-up record to professionals to provide additional information for them to answer their questions. As the response will be posted publicly in the application, a disclaimer is showed to warn users not to put any sensitive or personal information in their questions.

3.4 Articles and Recipes

The “Articles and Recipes” function aim to make the user learn more about eye-health knowledge. In the articles part, we found some articles and then write some summary of the articles (around 100 to 200 words). After that, we record the voice of the summary so that the user can learn the knowledge of eye-health by playing the audio and reduce the screen time in order to protect their eyes from the blue light. We also provide the sources of those articles so that if some users are interested in the content of the articles, they can just go through it directly.

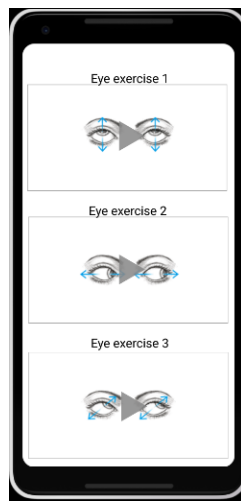


As for the recipe part, we come up with this idea since that it can attract some “mother users”. In the recipe, we not only show the progress of the cuisine, but also point out what ingredient benefits eyes so that the user can cook the meal and the learn some information at the same time. We also put the source of the recipe and we plan to renew the recipe once a week.

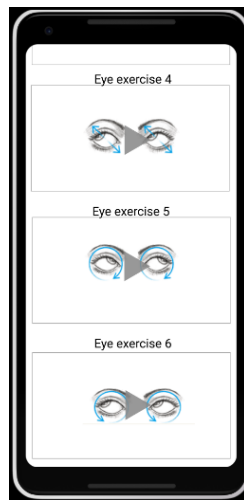
3.5 Eye Exercise

The “Eye Exercise” function aims to let users exercise their eyes by following our audio instruction. It can protect and relax users’ eyes when they feel tired in working and studying. The strength is that it can reduce screen time with 3D audio (8D audio) experience that consists of audio instruction and relaxing music as their eyes can look away from their electronic devices or books for a certain time. While closing their eyes, they can be able to feel the sound with spatial arrangement. For example, they can hear the sound coming from the left when they are told to rotate their eyes to the left and they can hear the sound coming from the right when they are told to rotate their eyes to the right. However, the front and back side effect are not included yet. Its current limitation is that it requires users’ headphone to enjoy the full effect.

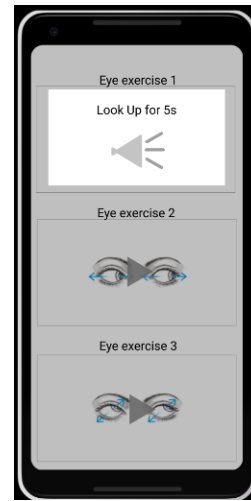
UI design:



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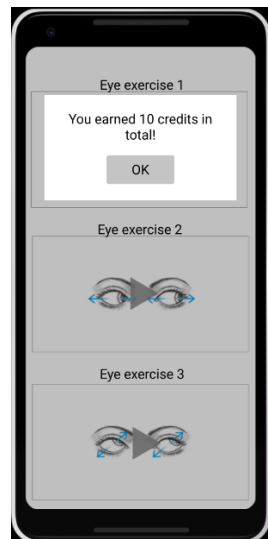
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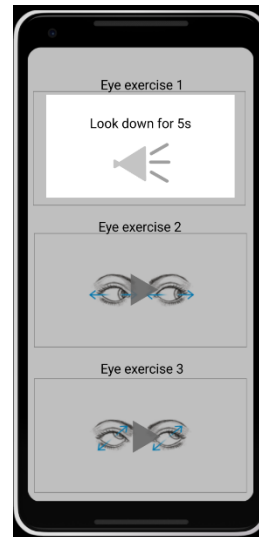
(Page 3)



(Page 4)



(Page 5)



(Page 6)

After pressing the “play” button in the middle of box, it will give audio instruction automatically. For example, in eye exercise 1, users will be told to look up their eyes for 5 seconds by following the counting from the audio instruction. Then, they will be instructed to be ready for the next steps by listening to this “next steps! 1, 2, 3 Go!” instruction. They were told to look down for 5 seconds. After the whole eye exercise, they will be able to gain the credits from our system for earning rewards in the future.

About the detail of the whole eye exercises, the total process is 200 seconds that is around 3.3 minutes. There are 10 steps in total with voice instruction and relaxing music. Here are the steps in detail:

1	Close your eyes (20s)
---	-----------------------

2	Look at the farthest object (at least 20ft 6m) [prefer green object] (20s)
3	Look up (5s), Look down (5s), Look left (5s), Look right (5s)
4	Look top left and down right (5s), Look top right and down left (5s), Look down left and top right (5s), Look down right and top left (5s)
5	Rotate clockwise (10s), Rotate anticlockwise (10s)
6	Look at far object (5s), Look at close object (5s), Look at far object (5s), Look at close object (5s)
7	Close your eyes again (20s)
8	While closing your eyes: Turn your eyeballs up (5s), Turn your eyeballs down (5s), Turn your eyeballs left (5s), Turn your eyeballs right (5s)
9	While closing your eyes: Rotate your eyeballs clockwise (10s), Rotate your eyeballs anticlockwise (10s)
10	Eye Open and close (10s), Close your eyes and Relax (10s)

After this eye exercise, users will feel relaxed and their eyes will be comforted by our soft audio instruction and music. If they do this eye exercises regularly, their eyes can be protected and they can be able to earn some credits and rewards from us such as some coupons of an eye store.

3.6 Achievement

The "Achievement" function aims to be an incentive to encourage users to build up an eye care habit in order to take care of their eyes. The achievement page will provide certain number of tasks for people to complete. Luckily, we have a partnership with an eye glasses shop which gives us some coupons. However, the current limitation is that there is still lack of support from local eye stores. About the achievement page, the item list will be just like a checklist (To-do-lists). The little "certificate" of achievement name such as eye tips expert, eye health chef, book expert will be given to the users who performed the tasks completely. The little "certificate" is the badges which is a visual representation of the achievement gained by users. The method of earning credits is to do tasks (daily & long-term elements) with 3 levels which are easy, moderate and challenging that will be depended on the time

consumption. After finishing some tasks, a coupon will be as a reward to them. The tasks will be modified based on the trend of the society.

Here are some examples of the tasks:

- Listen to 3 articles
- Read a recipe
- Do 3 eye exercises
- Cook 1 meal
- Do outdoor activities
- Record the data from eye-check-up
- Record the eyeglasses prescription
- Invite people to download
- View a question in "Ask a professional"



(page 1)



(page 2)

In page1, users can view the daily tasks and the status (completed/not completed) of the tasks. In page 2, it shows the introduction of the achievement function, and the questionnaires users need to do to fulfil the tasks. After finishing 80 tasks and completing 3 questionnaires, it will generate a digital coupon for users to exchange for prizes in our partners' store.

3.7 Partnership

In order to make sure accuracy of information provide by our application as well as to ensure outreach of our application, we cooperate with an optician and a social worker.

On one hand, Mr. Dick Lo is our optician partner. We have had one meeting with him at the initial stage of application development. His professional advice helps us to tune our app into more professional friendly and accurate. Also, he is willing to support our app by donating 100 free lenses to us such that we can use the free lenses as a gift to attract first group of our users.

On the other hand, connection with Kelly, who is a professional social worker, helps us to reach out to parents' group in Hong Kong. Since we are still at development stage for our

app, Kelly's connection enables us to understand parents' concerns on their kids' eye health before launching of our application.

3.8 Feedback

We have contacted Mr. Dick Lo, an optometrist, with WhatsApp call on April 4th. The feedbacks collected are as follows:

Data recording and presentation:

- Data recording convention for opticians starts from right eye's data. It is advised to follow this convention in both professional and normal users' side.
- The graph is not meaningful to professionals, as they are used to looking at numbers. However, it is useful for normal users to understand.
- Apart from recording and presenting the degree of refractive error in diopter, visual acuity should also be recorded.
- One mistake was pointed out in the Figma prototype where it states that 0.25D means no myopia. It should be explained as mild myopia.
- Threshold on defining abnormality in the rate of increase in refractive error was suggested, >0.75 increase per 6-month for kids under 12, >0.5 increase per 6-month for adults.
- It was advised to control myopia progression within 0.5D per year.

Response:

We agreed to follow the data recording convention and his guidelines. We will correct the error in data explanation. We will advise our users to control myopia progression within 0.5D. We will remove the graph for professional's side, instead, we will display detailed records of users for professionals.

Education:

- Self-eye test minigame: It would be better to randomize the answers which could make it more interesting as a game.
- Eye exercises: It is suggested that we shall include focus shifting exercises as well. To illustrate, it is an exercise to look at distant objects for 20 seconds, followed by repeating the step with nearby objects.
- Professional Articles: Instead of having a direct, real-time inbox function. Mr. Dick would like to have a forum like platform to collect questions from ordinary users and

answer them in a week's time. He also mentioned that totally 3 opticians could help on this part.

- Achievement: In order to motivate our users, Mr. Lo is willing to provide 100 digital coupons which is giving out free lens for each coupon.

Response:

We will try to implement Mr. Lo's suggestions on our apps like randomising the game answers and including focus shifting exercises. For professional articles, we will develop more detailed workflow and prototype to showcase the interaction process between the professional and ordinary users' side. For instance, we shall collect and filter users' questions at the beginning. Then we shall transfer some filtered questions to professional side. We shall be able to post both the questions and answers on the forum in a week's time. For achievement part, since we now have granted the support from Mr. Lo. We shall come up with a detailed achievements list soon to make sure we spend the coupons wisely.

General advice:

- It is suggested to grow our user base before we find more professional users. On finding professional users, it is suggested to approach small glasses shop owners first.

Response:

Our future apps development shall be more user-oriented in order to better promoting our apps in coming future.

We have contacted Ms. Kelly, a social worker from The Hong Kong Federation of Youth Groups, with WhatsApp call on April 24th. The feedbacks collected are as follows:

- We need to specify the content for parents from different age group as they have different needs. (For parents with kids from 3-5-year-old, they are not that aware of their kids' eye health; For 6-8-year-old, most parents start to be aware of their kids' need in glasses or other methods)
- Partnering with only 1 optometrist is not enough, parents would like to have eye doctors to support our application.
- For the "Ask a professional" part, we could include some video featuring some interviews with professionals in which they answer questions from parents.
- For the articles, it would be more relevant to local parents if we could include some information from different universities or some local news.
- Include some warnings (Red flag) after some self-assessment of children's symptoms, and warn them to take action or observe closely.

Response:

We will change our target audience to parents with kids from 6-8-year-old at the first stage, as they care about their children's eyes health and would be easier for them to accept and

try our application. We will then expand our application to also target parents with kids from 3-5-year-old in the future. We will ask more professionals (including eye doctors and optometrist) in the summer to help answer questions in the "Ask a professional" part. We will prepare more local information in the articles. We will discuss the possibility to include a "self-assessment" function in the future version of the application.

Implementation plan

4.1 Short-term Implementation plan

Our main goal in the short term is to launch ForeSee on Google Play Store and reach 100 target users.

To reach this goal, we will promote ForeSee on social media and online forum like Baby-Kingdom in the coming summer. We will recruit social worker, professional optometrists and parents with kids as our target users to test our application. The testing will last for 1 month. After the testing period, we will obtain their feedbacks and evaluate their behaviour change by asking them to fill in three questionnaires which includes two behaviour evaluation questionnaires (before and after) and one on user experience.

4.2 Long-term Implementation plan

In the long-term, we would like to expand our target audience to include elderly. We will keep on maintaining and updating the application. We will find more sponsorships or donation as rewards in the achievement. In order to increase the number of users, we will keep promoting our app online and offline. We will then launch the updates in winter.



4.4 Methods to reach end users

To reach end users, we planned to promote in all Hong Kong eye stores, public eye health clinics by putting posters or booth there. Also, we planned to promote in kindergarten, primary and secondary school by talks and putting booth there in their open days or special dates. We hope to connect with parents more through school. Moreover, we planned to be volunteer to conduct some surveys with our end users on the street or at their home.

4.5 In-line with local customs

Given that we are targeting at local parents who have children age 6-8. We need to adjust our application development as well as promotion strategy in order to attract our targets. For instance, we provide both English and Chinese version of our application. Parents can listen to Cantonese recordings of our eye health-related recipes, articles and eye exercise.

In addition, we apply role play format of presentation during outreach to parents. We make use of Hong Kong lifestyle related conversations to explain how our applications can help local parents.

Future outlook

5.1 Target Market and customers

Our target customers are local parents who have children age 6-8.

5.2 Sustainability

To achieve sustainability, we plan to use the freemium model, in which all users can enjoy all functions in our application. Yet, they can only ask one question to the professional side, all

of their data will only store locally in their cell phones. They can pay to enjoy unlimited chances of submitting their questions to eye professionals as well as to back up their data using our cloud server.

We will also create different decorations using a 3D printer as a gift to motivate and attract our users in the future

Conclusion

'ForeSee' is a healthcare mobile application developed to enhance the accessibility of people's eye data as well as to enable them to visualize the meaning behind those data. As we develop 'ForeSee', we observe a wide variety of needs and requirements from different partners and users. Understanding that 'ForeSee' is desirable to our users motivates us to keep developing and bettering our application. It is hard to change the overall rising trend of refractive errors among kids in Hong Kong. By educating the parents in Hong Kong as a starting point, as the Sight motto goes, a small change can lead to big differences. May our next generation live in a world full of care and love, with healthy eyes and eye using habits.

In the long run, we hope to promote ForeSee to every parent in Hong Kong, making every family in Hong Kong benefit from our application.

Appendix

<https://medlineplus.gov/ency/article/003396.htm> (MedlinePlus, 2020)