

Design and Development of APP based on Android Vision Testing and Protection

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Abstract: With the rise of mobile platforms, more and more applications are being developed. With the rise of mobile platforms, more and more traditional PC software has been transplanted to mobile platforms, such as iPad, iPhone, Android and other intelligent terminal devices, among these platforms, Android occupies the largest market share, so the development of software to satisfy the daily use of Android users has become a big hit nowadays. In this design, the popular Android platform is used as the development technology to realize an APP software for vision test and protection. This software will bring convenience to the majority of network users to protect their eyesight, and optimize the vision and color blindness test method, saving people's time to go to the hospital for examination, providing a more convenient and efficient test method for the majority of users, and also providing timely prevention of myopia. Through this software, it is more convenient for people to test their eyesight and color blindness and prevent myopia. In this thesis, we will step by step introduce the vision test and protection APP based on Android. This thesis will step by step introduce the background and significance of the development of vision test and protection APP based on Android platform, then introduce the development, design, function and implementation process of this system in detail, and finally summarize this thesis.

Keywords: Android; Vision Test; Cell Phone.

1. Research Background

With the prevalence of electronic devices and their irreplaceability, the number of myopias in China is increasing and the age group of myopia is getting younger and younger. Myopia is inevitable, and the number of people wearing glasses is increasing, but eye protection as well as daily checkups are still unappreciated. The reasons for this are, firstly, that the examination needs to be carried out in a professional organization, which is time-consuming and laborious; secondly, the protection of the eyes is not in place, and it is thought that everything will be fine if glasses are worn. In many cases, myopic people will be in the current glasses have been insufficient to meet the needs of normal life and learning, only to take measures to check the visual acuity to change to a higher number of glasses. Not being able to keep abreast of the changes in our eyes does not maximize the protection of the windows to our soul. For nearsighted people, it is necessary to have a complete vision checkup about once every three months, and it is even more important to stay informed about your vision in general. Therefore, we will develop a more sophisticated vision test to help myopic people keep an eye on the changes of their eyes, so that myopic people can slow down the increase of myopia.

2. Significance of the Study

After the popularization of smartphone life, people use electronic products time increase, for the deeper degree of cell phone dependence, vision is also affected by it, eye vision health is a lot of people are worried about things, the user wants to detect the health of the eyes, it is necessary to find the right method to detect the health of the eyes is particularly important.

Vision Detection APP development can help users to detect and understand their own vision, eye health conditions, etc. Vision test APP test vision is simple and convenient, but also

can generate care recommendations, you can detect problems in time, to prevent eyesight continue to decline. The vision testing and protection APP development of this project is the prevention of the eye is greater than the treatment, from the tiny details to pay attention to eye health, help users test and monitor their own vision, and at the same time also through exercise and prevention to take care of the eyes.

3. Research Content

1. Based on the study of the optimal distance between the cell phone and the user's eyes

Nowadays, cell phones are an indispensable part of people's normal life, so even though people are well aware of the harm that blue light from cell phones can do to their eyes, they still have to use them, and the frequency is still on the rise. When people play with cell phones, they subconsciously get close to the screen, which over time can lead to soreness in the eyes and sometimes blurred vision. The project team will look at calculating the appropriate distance in any situation where people are playing with their phones, and will provide this data to users so that they can maintain the right distance from their phones.

In addition, when users use the app to take a vision test, they need to be at a certain distance from the phone screen to prevent large errors in the test results. People's cell phone screens vary in size, and the patterns presented on the screen are also different in size.

Therefore, the project team needs to study the optimal distance between different sizes of cell phones and the eyes of the tester, so as to improve the accuracy of the test results.

2. Based on the research on the method of measuring visual acuity by software.

The degree of myopia is related to many aspects, and the vision test in the hospital needs to go through a series of processes in order to accurately derive the degree of myopia of myopic people. This project team needs to study these processes, understand them clearly and find a way to

implement them using software. In addition to a simple visual acuity table to get the rough results, but also to study the test before relaxing the eyes method, the test process of light refraction to the tester's eye regulation method, ball lens, pupil distance pupil height detection method, in order to achieve a more accurate calculation of the tester's myopia through the software.

3. based on the software simulation hardware optometry process research

When we measure visual acuity in the hospital or eyeglasses store, there will be a more cumbersome process, that is, the process of optometry. Optometry is a very important step in vision measurement, which can detect the tester's spherical lens, column lens, pupil distance and so on. This project team will study the method of simulating hardware optometry with software to improve the accuracy of the test. Computerized optometry technology is now available in the market, and we will research the best and most useful ways to experiment with software optometry in conjunction with computerized optometry technology.

After querying the information: computerized optometry working principle is to transmit several infrared rays from the machine to the eye, through the refraction of the eye, reflecting out of the eye, the machine receives these reflected infrared rays and then through the calculation of the degree of your eyes. The human eye to see the image presented in the retina, and optometry is measured by measuring the retina is imaged to the relative position of the light source (i.e., optometry) to determine the degree of myopia in the eye, in other words, is measured by the optometer hit the image just to reach the position of the retina, if the eye axis is long, then measured the distance is long, myopia is deep, but it is not absolutely correct, and need to be manually rechecked.

4. based on the technical research on the relief of eye fatigue

After querying the information: eye fatigue fang is a common ophthalmology disease, it causes 1 eye thousand, eye astringency, eye soreness, blurred vision and even vision loss directly affects people's work and life. Eye fatigue is mainly due to people usually concentrate on watching the computer screen, the eyes blink fewer times, resulting in a corresponding reduction in tear secretion, while flickering screen strongly stimulate the eyes and lead to 1. It will lead to people's neck, shoulder and other corresponding parts of the pain, but also trigger and aggravate a variety of eye diseases.

The cause of eye fatigue is a long time looking at the electronic screen, so in order to alleviate eye fatigue, to protect everyone's body, first, to remind the eyes to rest we will be real-time monitoring of the screen time, discuss with professionals, in a certain period of time to remind the user to rest their eyes. And, for myopic people, we will be based on the degree of eye proximity, when watching the screen whether to wear eyes to set a reasonable length of time, so as to achieve the best results. For people of different ages and at different times of the day, we will adopt different means to achieve effective reminders. (Above myopia degree and age by the user to fill in the data) Second, pay attention to the screen brightness. Adjust the brightness of the cell phone according to the external brightness, as well as blue light eye protection and other measures to provide a relatively protective environment for the use of electronic devices.

5. Based on the production and the user's vision corresponding to the method of eye protection research

Nowadays, the number of myopic people is still on the rise, and the degree of myopia varies from person to person, and

the causes of myopia are also different. The project team will study what kind of protection methods should be used for different eye conditions, and provide users with protection methods corresponding to their eyesight, so as to achieve the most effective protection of the user's eyes.

6. Based on the research of the software can be voice recognition function

Voice control can bring great convenience to the user, the project team will study the software can be voice recognition function, so that the user can directly use language to express their own results in the test process. Since the tester needs to keep a certain distance from the cell phone during the testing process, at this time, the voice recognition function allows the user to directly say what he/she sees back to the cell phone without the need to press it with his/her hand. To take the simplest vision chart as an example, the user holds the phone in his hand, asks for a certain distance, and then changes the size and direction of the letter "E" according to the scale. Starting with the user saying "start testing"; various forms of the letter "E" appear on the screen from small to large, from the user says the direction and then the software automatically checks if it is correct. At the end of the left and right eye inspection, the software automatically says "End of inspection", a pop-up window showing the size of the visual acuity is displayed to end the inspection.

4. The Current State of Research at Home and Abroad

1. Method of detecting eyesight using software and hardware combination

A domestic enterprise has researched a method of detecting eyesight using a combination of software and hardware.

First of all, the method uses a person to move or change the position of the hardware device, so that the screen of the mobile hardware is 1 meter away from the user's face, and then conducts the detection of visual acuity status, the degree of correction of farsightedness and nearsightedness, and astigmatism visual acuity indexes. This method utilizes portable hardware to obtain reliable visual acuity indicators with simple operation.

According to the different needs of users, it can also be used to detect the visual acuity status, the status of correction of hyperopia and myopia, amblyopia and astigmatism and other visual acuity indicators at any time and any place, so as to provide a scientific basis for the correction and rehabilitation of visual acuity.

2. Vision checker with embedded application software

Many hardware devices for vision screening already exist in the country, which are made from embedded software. Domestic attempts have been made to embed application software into hardware to facilitate portable and ready-to-use vision testing.

The size and direction of the visual field is calculated by the computer through a certain algorithm, which makes it very flexible to change. In addition, the software also realizes the functions of medical record information collection, testing, storage and report generation. The application software is no longer limited to the one-to-one vision examination between the doctor and the person to be tested, but realizes the person to be tested to enter information, query, test and view the report, which improves the utilization efficiency of the scarce resource of doctors. At the same time, the portability has been greatly improved compared with the traditional vision

screening equipment, which can be carried around and can meet the screening action of a certain number of people. The embedded vision meter adopts a modularized approach, and it is more convenient to add different vision modules at a later stage. In terms of service life, depending on the embedded hardware and the life of the Pinzgauer screen, which is considerably longer than the background light of the traditional light box. This device is a more humanized equipment that can completely replace the traditional visual acuity meter, its accuracy is not less than the traditional visual acuity meter, the performance is better than the traditional visual acuity meter, the future expandability is stronger than the traditional visual acuity meter.



Fig 1. The embedded vision meters

3. Training vision and testing vision software

Vision tests are usually done in the ophthalmology department of a hospital using paper or electronic vision charts. Normally, we can't always go to the hospital to test our eyesight, and when we find that our eyesight has deteriorated significantly and go to the hospital, it may be a little too late. In fact, we can always use our leisure time to test our vision on our own computers through software. Although this method is not necessarily more accurate than the hospital's method, it will always give you a general idea, and by comparing the before and after situation, you can get a general idea of how your vision is developing. In addition, you can also use software to train your vision, eliminate visual fatigue and slow down the deterioration of your vision.

Eyes relaxing and focusing is a program for visual training and vision testing. You can choose between "Auto Start" and "Manual Start" for visual training. When "Auto Start" is selected, the computer can temporarily set aside the work in progress and automatically start the training program to enter the vision training when the set interval is reached; it can also be selected to start the training when the user is not in operation or start the training when the user is in frequent operation. If you select Enter the size of your current monitor to calibrate the standard, and then the software will prompt the width and height of the current monitor, if it matches, then save the data. Specific test methods with the usual in the hospital to test the same vision, except that the software is only a letter each time instead of the whole table full display. The test also needs to be blocked on one eye first, only one eye for the test. The test is performed by sitting 1 meter away from the monitor and using the four directional arrows on the

keyboard to give the direction of the opening of the test letter. After each letter is tested, the current visual acuity value is displayed in the upper left corner of the test chart. To end the test, use the Esc key and to retest click on the "Reset" button in the lower left corner.

Users with Android phones and tablets can test their eyesight with the "Standard Vision Test 2.2" app. The software is designed according to the international standard near vision chart (test countries 0.05-1.2/3.7-5.1), with simultaneous display of fractional and five-point visual acuity, and 15 levels of E as the visual scale, from large to small. Using the touch-screen sensing feature, the phone can intelligently determine and test the visual acuity by simply swiping left and right on the screen according to the opening direction of the letter E, up, down, 21 Eyes relaxing and focusing for visual training Eyes relaxing and focusing for visual acuity test on the National Eye Care Day. A test result of 1.0 or higher (including 1.0, 5.0 or higher) indicates normal vision. If you need a more graphic visual acuity chart for testing, you can also install the "Vision Check 2.2° Vision and Color Blindness and Color Weakness Test App for Android" on your cell phone, which realizes the "Standard Logarithmic Visual Acuity Chart" (GB 11533-1989), which can be used to test your eyesight.

GB 11533-1989) to simulate an interactive vision test with a doctor. After calling up the visual acuity chart, you can slide the chart up and down to check your visual acuity.

Test how well you can see, with the corresponding level of visual acuity indicated to the right of the symbol. The software integrates eye exercises and a "magic picture collection" to test for color blindness and color deficiency.

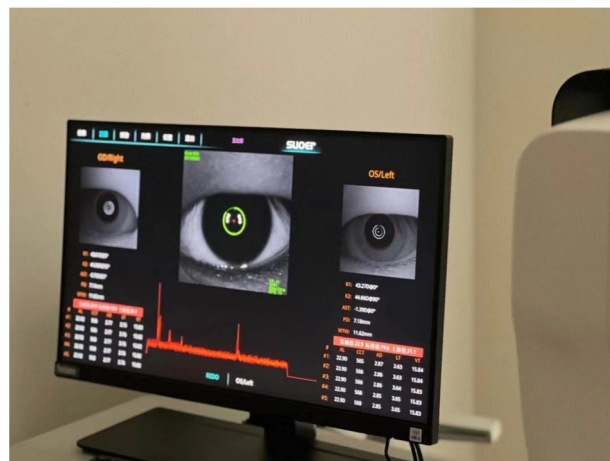


Fig 2. A software that tests your eyesight

4. Color blindness correction system

In order to help people with color blindness, systems have been developed to detect and correct color blindness and to improve the condition of their eyes.

Color blindness is a visual defect caused by abnormalities in the retinal cone cells, which results in the inability of the eye to acquire color information in vision, causing many inconveniences in people's life, study and work. Currently, many fields, including biology, Chinese and Western medicine, physics and informatics, have carried out researches on how to improve the ability of colorblind patients to acquire color information, among which the colorblindness correction method that combines digital image processing and electronic information technology has shown unique advantages in safety and effectiveness. This paper

aims to design a color blindness correction tool that can be used conveniently by people, conducts research on color blindness and its correction from the perspective of image processing, analyzes and improves the color blindness image correction method, and designs and develops a color blindness correction system based on Android system for dichroic color blindness which is more common among color blindness types, and completes the debugging and analysis of the system.

Firstly, two types of image processing methods for color blindness correction based on image processing are analyzed and researched, i.e., the color blindness correction method based on image color value statistics and the color blindness correction method based on H-component rotation. The two algorithms are simulated and analyzed, and the results show that the color blindness image correction method based on image color value statistics has large computation volume, slow operation speed, and poor real-time performance; the color blindness correction method based on H-component rotation takes advantage of the characteristics of l-component, which reduces the computation volume, but occupies a large amount of memory, and is unable to realize real-time processing of video images under the embedded system platform.

Secondly, the color blindness correction algorithm based on l-component rotation is improved, and the improved algorithm takes advantage of the relationship between the values of the R, G, and B color components of the best color blindness corrected image and the corresponding component values of the original image, and adopts the method of replacing the R, G, and B components of the original image to realize the rotation of the day components directly.

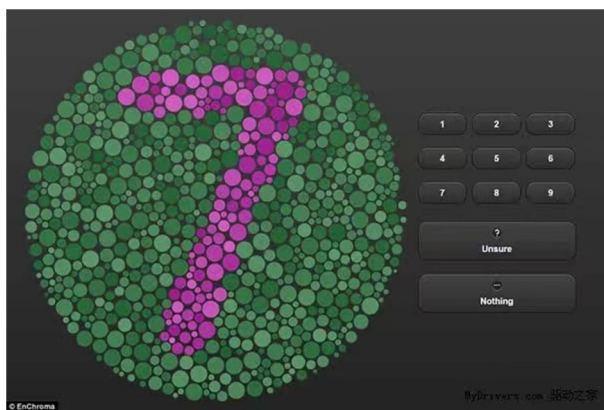


Fig 3. Color blindness correction system interface

5. Current Problems

Nowadays, with the rapid development of the electronic information age, the incidence of myopia in China is on the rise, and myopia has become a major public health problem that affects the eye health of our citizens, especially the youth. Although we have paid attention to myopia, but for the protection of electronic devices, write Yu posture and other issues, there is no systematic and comprehensive knowledge. Lack of awareness, lack of understanding, and lack of concern have largely contributed to the rapid increase in myopia rates. For Vision monitoring and protection APP development for the popularization of the application of the whole society, we still need the joint efforts of the relevant departments and all walks of life.

6. Problems and Suggestions

At present, the state of myopia in China is not optimistic, myopia presents a trend of low age, but the popularity of vision monitoring software is relatively small, especially after the popularization of smart phone life, people use cell phone time to increase the degree of dependence on cell phones, and vision is also affected by it. Eye vision health is something that many people are worried about, so it is especially important to detect eye health conditions. Users who want to detect eye health conditions should find the right method in time.

At the same time, to increase the popularization of vision testing app related knowledge, to help users detect and understand their own vision, eye health conditions. Secondly, the generation of care recommendations, so that myopic patient's timely detection of the problem, to prevent further vision loss. Vision testing app development is the eye of prevention than treatment, but also, from the smallest details to pay attention to eye health, to help users test and monitor their own vision, and most importantly, through exercise and prevention to take care of both eyes.

7. Summary

This project is based on the topic of vision testing and protection, based on a combination of literature research, function development and use, data analysis and other methods. Through the current social needs, in order to understand the impact of vision monitoring apps on myopia patients and then analyze the research direction of the software and its impact factors, to provide effective and accurate research results and reference basis for the general public, myopia patients and other subjects.

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