Program and Application of Cell Counting App Software

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Abstract

Counting of cells is required in clinical diagnostics, laboratory testing, and cell culture related scientific research. Based on mobile technology, the cell counting App Software will be built with Android sdk development environment and developed in Java language, used in conjunction with the microscope, mainly used for counting cells, bacteria or sperm. It changed the handwriting, hand calculation, mental arithmetic method and avoided the situation of missing, multi-recording, mis-recording or miscalculation. The App is simple to install, convenient to use, widely application range, and has calculation and conversion functions, which can greatly improve the convenience and accuracy of the experimental operator, and show a good application prospect.

1. Introduction

Cell counting is an important part of cell experiments. In many fields, such as clinical diagnosis, laboratory departments, and cell culture-related scientific research, cells need to be counted. The development of cell counting tools has attracted the attention of researchers in science and technology, and cell counters have evolved and developed [1-2]. By counting and analyzing the number of living cells, the number of dead cells and the survival rate of cell, the vaccine production enterprises obtained the quantity of the poisonous species to cultivate excellent cells and make the high quality vaccine [3-4].

The principle of cell count experiment is to determine the number of cells in a cell suspension per milliliter by measuring the number of cells in a certain volume of suspension when the cells are evenly distributed in the solution. The early cell count work is generally observed by the magnifying glass under artificial lighting, with the pen on the flat plate, using manual memorization or manual counter counting. Later, cell count work was counted by cell count board: the cells were observed under the microscope with the counting plate added by the sample [1]. The cell count was combined with the microscope, and the cell count was used by the manual counter. With the development of science and technology, the production of automatic cell counter has partly replaced the traditional counting method and applied to clinical and scientific research. But in general experiments and scientific research activities, it is too complicated and cumbersome to use it. It also limits the use of its popularity.

With the wide application of mobile intelligent terminals, mobile terminals are developing in the direction of enhancement, multi-mode, customization and open platform. There are many kinds of APP based on mobile terminals, which are widely used in all aspects of teaching, finance and people's daily life [5-7]. For example, mobile medical App in China has reached over 2000. Part of APP is turning mobile platforms into medical devices. For example, through the

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attachment or the sensor, the mobile device was turned into the APP of the stethoscope, or the APP to measure blood sugar and electrocardiogram and present the results on the APP on the smartphone.

Our cell counter APP will be mainly for the count of cells, bacteria or sperm. The use of the APP changed the working state of manual counting and calculation, mental note and calculation and avoided leakage, miscalculation. It is suitable for teaching and scientific research in blood, laboratory and cell culture counting. This counter has simple installation, easy operation, wide application and convenient use, and has the function of calculation and conversion. It can greatly improve the convenience and accuracy of the laboratory operators.

2. Methods and Steps

2.1. Methods

Android holds almost 50% of the total mobile application market, which is worth billions and if the current trends continue, it is only going to increase.

Java is the official language of Android development and is supported by Android Studio. The number one way to develop Android apps, is to go ahead and download Android Studio. This is a piece of software called an IDE, or Integrated Development Environment. It will come packaged with the Android SDK (a set of tools to facilitate Android development specifically) and basically this will give you everything you need in one place to get up and running.

Android Studio is the official integrated development environment (IDE) for Google's Android operating system, built on Jet Brains' Intelli J IDEA software and designed specifically for Android development [8-9]. Android Studio is used to build cell counter APP.

2.2. Steps

According to the modular idea of software we divide cell counting into two modules, counting cell count and cell viability calculation.

The basic idea of this software design is to carry out the count of cells when the software system enters the counting room module. The researchers input the number of cells in the corresponding square (small square and / middle grid) read out under the microscope. The counter can automatically calculate the standard case (unit body) according to the volume of the grid and the number of the input squares. The number of cells; when switching to the cell viability calculation module, the number of living cells and dead cells in different squares can be directly derived.

3. Results

3.1. Basic Functions of the APP

Click on the logo of the APP and start the counting software. After the program is started, it enters the main interface of the program, the first class menu of the counter is "cell count", and the second class menu consists of two parts: counting room count and cell vitality calculation (Figure 1).
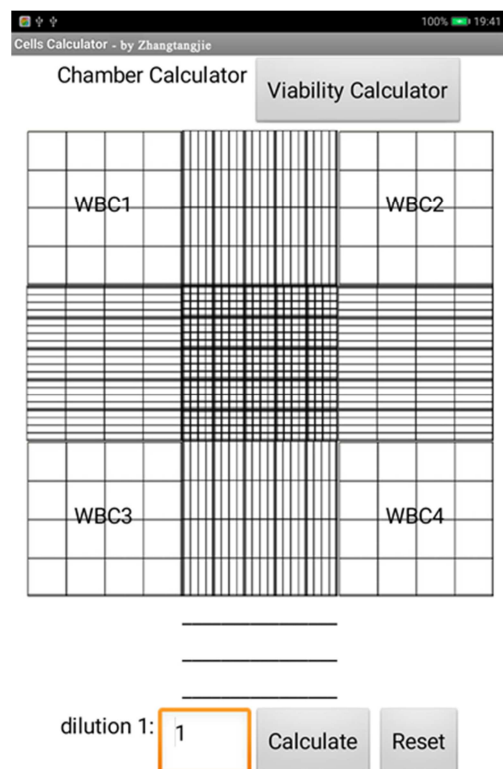

Figure 1. Counting room count and cell vitality count.

The two parts can be switched by clicking the gray button, and the counting room count interface is exactly the same as the square under the microscope, so it is especially good for progressive, accurate counting. When gently sliding up the screen, the main interface will display the remaining contents of the counting chamber, and the dilution multiple is used for dilution of user input. Only one key can calculate the total number of cells.

3.2. Functional Descriptions of Each Region

3.2.1. Input Count Cell Room Number

Clicking on the 5 small squares in the middle of the middle square, the small square becomes blue, and the 5 empty frames appear below the main interface, and the empty frame is seen in the grey number "number", which is used to input the number of the corresponding small square cells or sperm (Figure 2).
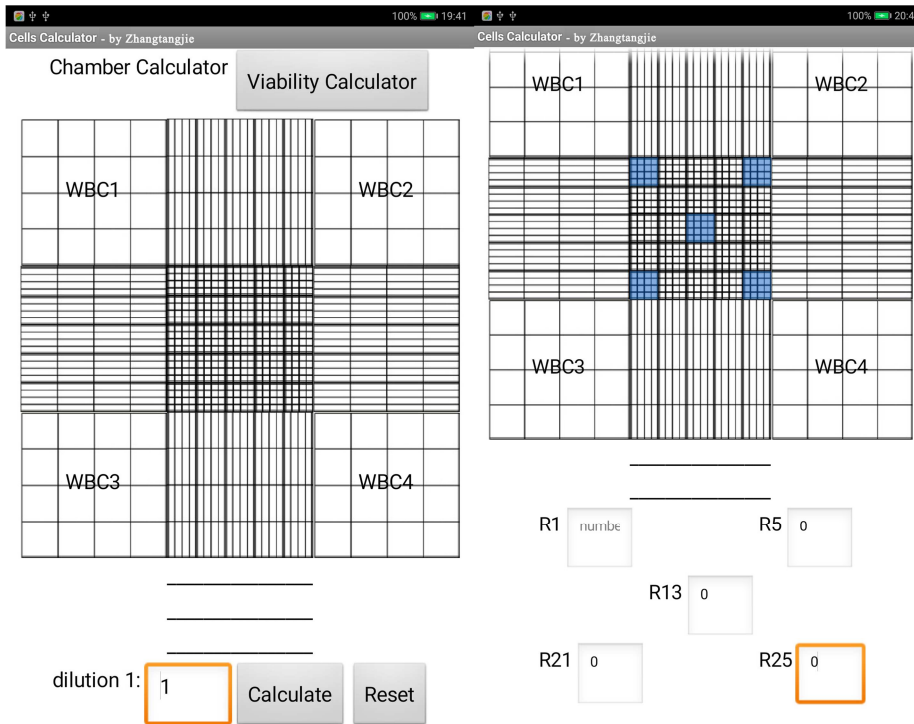
Figure 2. The number of cells entered in the corresponding small squares.

3.2.2. Calculation

When sliding up the screen, clicking to calculate, the results were displayed. In the calculation, the sample dilution multiple was inputted into the empty box according to the actual experiment (1 times in this case), and then click the light grey "calculation" button next to it. If the input error can be reset and reimported by clicking the light grey "reset" next to the "calculation". Click the "calculation" button to display the result, as shown in Figure 3.

Figure 3. Count result.

3.2.3. Count the Number of Cells in the Square

If you want to count the number of grid cells, bacteria, sperm etc., you can click on the upper left, upper right corner, the lower left corner and the bottom right hand corner, four square grid were turned to blue and the input box appeared in the lower part, simply entered the number of the corresponding, calculated after sliding screen as previously.

3.2.4. Cell Viability Calculations

Click on the gray "cell viability calculation" button, the button disappears, enter the cell viability calculation interface, and "count room count" becomes a gray button, you can switch back

The cell viability calculation consists of two virtual counting plates, which can be used for two or repeated calculations. The operator can enter the cell conditions (live and dead cell counts) observed by the under counter microscope into the corresponding squares of the counter plate.

The top left, top right, bottom left, bottom right and middle grids of each counter have 0/0 digital backgrounds. These 5 square boxes are used to count the number of cells. Click on these squares to turn the squares into light blue. Below the two large colored buttons appear, the blue large button is used to enter the cell "survival number" (live cell number), the red big button is used to enter the "cell death number", the input cell number is achieved by clicking the button, click Once the number of cells changes to 1, click again to change
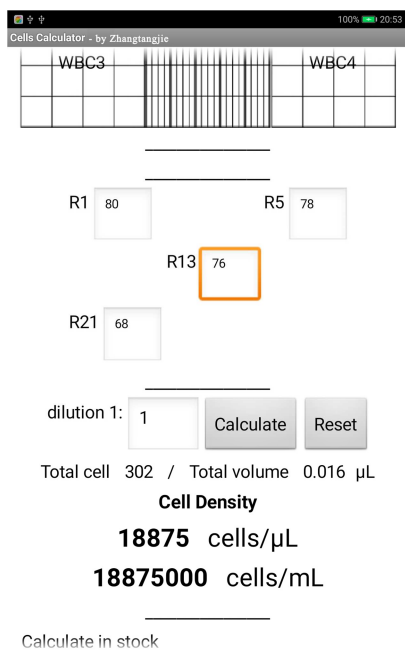
the number of cells to 2. Each time the software is clicked, a sound will be heard. Next to the large button is a gray button containing a "-". Click once to reduce the number of cells. The number of corrections after multiple cell entry was reduced (Figure 4).
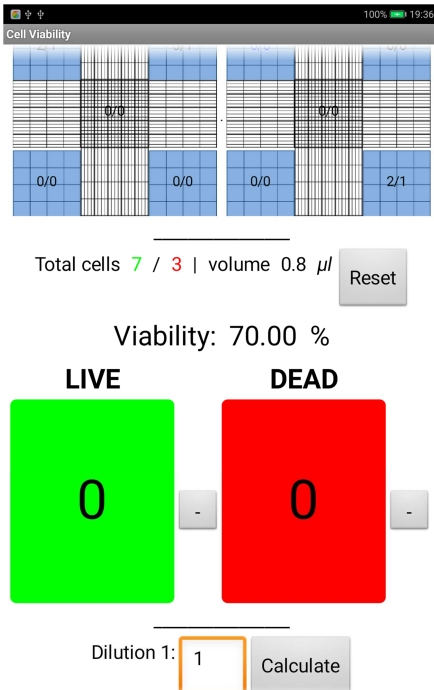

Figure 4. Input the number of live and dead cells.

After entering the number of dead and viable cells in each square grid, the corresponding cell number, cell viability, and volume appear. In Figure 4, we enter the number of cells in each of the 10 medium square cells in all 10 medium squares. Among them, the number of dead and living cells in the 6 medium squares was zero.

Slide up to further calculate the number of cells per unit volume: First select the dilution factor, click the gray "Calculate" button, the total cell number per unit volume, the number of live cells per unit volume, and the number of dead cells per unit volume will be available for further follow-up research.

4. Discussion

4.1. Hemocytometer

For over 100 years the hemocytometer has been used by cell biologists to count cells. It was first developed for the quantitation of blood cells but became a popular and effective tool for counting a variety of other cell types, particles, and even small organisms [10-11]. Hemocytometers equipped with improved Neubauer grids are a mainstay of cell biology labs. Cell counting using a hemocytometer suffers from a variety of shortcomings. These shortcomings include, but are not limited to, a lack of statistical robustness at low sample concentration, poor counts due to device misuse, and subjectivity of counts among users. In addition, cell counting using a hemocytometer is a time consuming and tedious operation.

4.2. Innovation

The development of mobile counting app is practical application of mobile technology in scientific research and clinical testing. It is simple and convenient to use, as long as the phone is nearby, you can use it at any time. "Experimental instruments" certainly carry with you. Its one-click calculation and conversion function, that is, after entering the number of relevant cells, one-click results, greatly improving the convenience of experimental operators.

The mobile counting app is not only suitable for the counting, calculation and conversion of red blood cells and white blood cells, but also applicable to various other cells, sperms and some zooplanktons.

4.3. Application

At present, many universities and clinical testing institutions will use cell counts or bacterial counts or sperm counts, as well as calculations of cell viability, both in teaching and research. Cell counts can also provide data for subsequent clinical and research work, such as by cell counting, the amount of virus seed can be drawn to produce excellent cells and make a good vaccine. Although a fully automatic cell counter has been used, a large number of basic and general molecular biology-related teaching cell counts are still based on the general counting method. In addition, cell counts are also used inbeer brewing (for the preparation of the yeast), phytoplankton cell counting, cell processing for downstream analysis (accurate cell numbers are needed in many tests, such as PCR, flow cytometry, while some others require high cell viability). In a micrograph, the real cell size can be inferred by scaling it to the width of a hemocytometer square, which is known, cell size could be measured. The mobile terminal cell counter is simple, convenient, and widely applicable, and has broad application prospects in basic research and general laboratory calculations.

5. Conclusion

The hemocytometer is a counting-chamber device originally designed and usually used for counting cells, bacteria or sperm. Under the circumstance of the wide application of mobile intelligent terminals, a cell counter APP was programmed, changed the working state of manual counting and calculation and avoided leakage, miscalculation. The cell

counter APP was combined with the microscope, installation simple, operation easy. It can greatly improve the convenience and accuracy of teaching and scientific research in blood, laboratory and cell culture counting.

Acknowledgements

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