

Left or Right: A Convenient Way Using Cell Phone With One Hand

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Abstract—This article aims to give a simple method to deal with the judgement of the phone is in your left hand or right hand to solve the problem that we couldn't play our phones with one hand if its screen is too large. In this article, I analyze the differences between the phone in the right and in the left hand. Then programming on the android platform to realize the algorithm.

Index Terms—left, right, detection, android.

I. INTRODUCTION

NOWADAYS with the development of mobile phone industry, our lives become more and more inseparable with the phone. To provide better services, the cellular phone trends to have a larger screen. Since we prefer to play our phone with one hand, then here comes the question that what if the phone becomes too large to get all the buttons and controls with the range of our fingers. To solve this, I give a method by determining the phone's position, left or right of your hand, to adjust the layout of controls on the phone. I think this method could solve this problem well through its algorithm need to be improved.

II. ANALYSES OF THE PROBLEM

As described in the introduction part, we could use our phone better if it could change its interface layout according which hand it is in. So the problem above could be how to determine the position of the phone in your hand and how to design the interface layout to get a better experience. So in this section, I give two different ways to indicate the phone position in our hand, which could be used in our problem solution.

A. The Gesture When We Use the Phone

To get the phone's position in our hand, we need to know the difference that the phone can detected between in the left and in right of our hand.

As in figure 1 is a typical gesture when we use the phone in our right hand.

We could see that, if the phone is in our right hand, we prefer to bend our fingers making our phone more stable on our hand. In this case, we could easily find that the left side of the phone could be higher than the left side. As for the phone in our left hand, its right side could be higher than the left side.

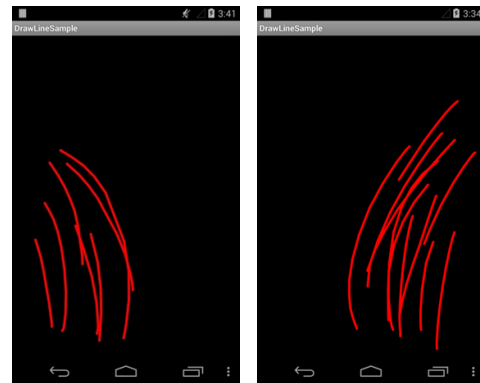
As we have already know that feature that could be detected by the phone, then there should be a way to gather this difference and determine if the phone in your left hand or not. To get this, we could use the orientation sensor in the phone. The orientation sensor



Fig. 1. The Gesture When the Phone Is in Our Right Hand

B. The Finger Movement on the Screen

Another difference about the phone in right or left hand is when we move our fingers to operate the phone, the movement curves could be different. As in figure 2.



(a) The Left Situation (b) The Right Situation

Fig. 2. The Screen Move of the Phone in Left and Right Hand

From the figure we could see that we prefer to use our thumb to slide the screen. Those movements on screen are different causing they tend to bend in different direction.

III. ANDROID PROGRAMMING

Since we have find out two basic differences between the phone in left or right hands, we could use the phone to detect the difference. To achieve our goal, I first introduce some basic knowledge about the android phones.

A. Introduction to Some Android Knowledge

1) *The Orientation Sensor*: There are many sensors in android phones, which make them have powerful ability to realize a huge amount of functions. And orientation sensor

is one of the most common sensors in the phone. It was integrated in the phone and has three different directions as shown in figure 3.

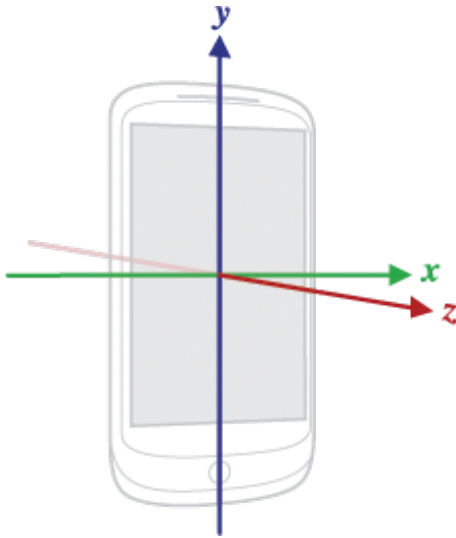


Fig. 3. The Orientation Sensor in Android Phone

When we start the orientation sensor, it will return to us three values that related to x, y and z axis. The value related to x is the angle that x axis rotates with z axis the value related to y is the angle that rotates with x axis, and the value related with z is the angle rotates with y axis. In those three values, the third is import because if the phone's left side is high than the right side, it will be a negative value, and if the right side is high than the left side, it will be a positive number. If we apply the orientation sensor to detect the real-time value, we could use that to decide the phone's position in our hand.

2) *The Event on Screen:* Once we slide the screen, there will be a series of events been triggered. One of them is related with the movement on screen, just as in figure 4.

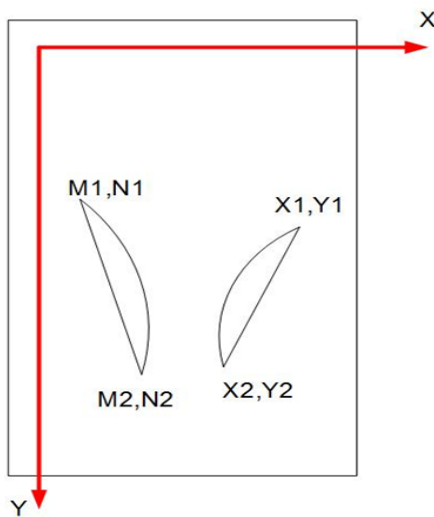


Fig. 4. The Movements on Screen. The left side stands for the situation using our left hand and right side is using our right hand

We could see that for the slide movements using our right

thumb. There will be a curve that bends towards right. In the coordinate system on android phone screen, we could get the following function.

$$(X1 - X2)(Y1 - Y2) < 0$$

Also if we use the left hand, we could get that

$$(M1 - M2)(N1 - N2) > 0$$

By using this kind of detection, we could have larger possibility to confirm if the phone is in our right or left hand.

B. Method Realized on Android Phone

After getting some indexes that can indicate the phone's position, I have program on the android platform to realize the basic function.

1) *The Orientation Part Programming:* In this part, I first initialize the orientation sensor to detect it value changes. If there are changes in the sensor's third value, I will record this value and get the average value every ten times to get more stable results. Then I set two thresholds for the judgement. The one is if the average value is larger than 5, it shall set the flag to left side. And if the average value is smaller than -5, it shall set the flag to right. If the value is within -5 and 5, there should be no change in current situation. The flow chart is shown as in figure 5.

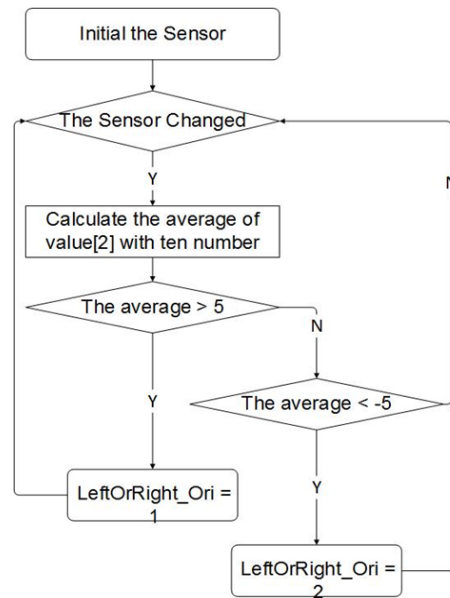


Fig. 5. The Flow Chart of the Orientation Sensor Part

2) *The Screen Movement Part Programming:* In this part, I add a listener on the screen to catch the screen movement event. If there is a move action, it will calculate the adjacent two points' slope and get the average of all the event's related points. If the slope is larger than zero, we should say that the phone in our right hand is true, otherwise it is in our left hand. The corresponding flow chart is shown as in figure 6.

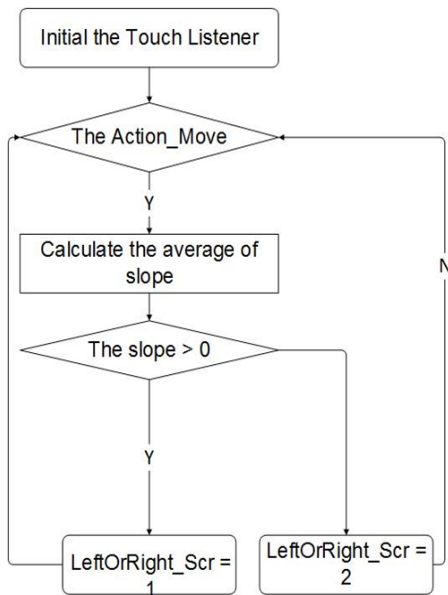


Fig. 6. The Flow Chart of the Screen Movement Part

IV. THE RESULT OF PROGRAMMING

Up to now, the programming have finished the detection part, which could find out the phone is in your left or right hand. But the layout part hasn't finished yet, I think that since the phone has already know its position, it will be easy to accomplish the layout part.

Another problem is this method could be useful in some special situation. For other situations such as lay on bed and so on, it couldn't detect correctly. So there still a lot of to do to improve my thought.

V. CONCLUSION

In this article, I give a simple method to detect if the phone is in your right or left hand. And I have finished most of the parts I have thought of, it worked well if you use the phone in a standard posture. So the algorithm need to be improved to have a better robustness. And I think a better way is we could add some extra sensors such as light sensor on two sides of the phone, it will be convenient to detect what we need. Since the integration of extra parts of sensors couldn't realize quickly. It is still a better way to study the algorithm.

ACKNOWLEDGMENT

After learning about the course of Wireless Communication Principles and Mobile Networks, I have not only known about the basic knowledge about the wireless networks, but also have a better understanding through some experiments that we did during the semester. What was important was that I did some project with the teacher and experienced the whole procedures to do so. Even if I just did something simple, I still think it was important for me. At last, I would like to give my thanks to Prof. Wang and Dr. Tian and the TAs, thank you.