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GRIN ALARM: MOBILE ALARM CLOCK WITH SMILE DETECTION USING SNAPDRAGON SDK

Hajar Izzati Mohd Ghazalli [1]
Nur Farahin Mohd Johari [1]
Mohammad Hafiz Rosli [2]

Abstract

Most of living things spend nearly one-third of their day by sleeping. Sleep is very important in term of health because it will affect one performance, but if the amount of sleep is not enough or too much, it can cause a very serious medical problem such as diabetes and heart disease. Therefore, one of the technologies, which can ensure to have healthier life is by developing a dependable alarm clock mobile application called Grin Alarm. This paper is focused on the development of an Android mobile application alarm clock that can be disabled by smiling. The prototype is developed by implementing smile detection from Snapdragon SDK library. The library provided facial processing, which include smile detection. Processes involved in getting a smile include the finding face region, eye location and lastly mouth region. This project uses the smile value which is calculated by the right corner mouth and the left corner mouth, to determine if one is smiling or not. Finally, when the prototype recognizes the smile, the alarm will automatically dismiss. In conclusion, this application is capable to disable the alarm clock by using the smile detection technique, provided that it is installed on smartphones with Snapdragon processor.

Keywords: smile, Snapdragon, alarm clock.

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1. Introduction

Most of the living things spend nearly one-third of their day by sleeping, and most of them including mammals such as rat, spend some of their live living time sleep (Saper, Fuller, Pedersen et al., 2010). Sleep does not mean a time when the body and brain shut off. While resting, the brain stays busy, manage a wide variety of biological maintenance tasks that keep the body running in top condition and make a preparation for the day ahead (Smith, Robinson, & Segal, 2016). Moreover, during sleep mode, the growth hormone is secreted. This hormone that is secreted is important for growth in children, but it is also important in rebuilding tissues in adulthood.

A good sleep can positively affect our performance, while an oversleeping has been linked to a very serious medical problem such as diabetes, heart disease and increased the possibility of death (Beihl, Liese, & Haffner, 2009; Kim, Hayek, Awad et al., 2016; Schmidt, Shirazi, & van Laerhoven, 2012). Less sleep is due to a higher caffeine intake which may increase the cortisol levels (Mohlman, 2015).Thus, cortisol alterations may have implications for health (Lovallo, Whitsett, al'Absi et al., 2005).

Some profession requires immediate action after awaking such as emergency services, soldiers, and the doctor, but some of them love hitting the snooze button when the alarm activates in the morning

[1] Lecturer, Faculty of Computer and Mathematical Sciences, Universiti Teknologi MARA Cawangan Melaka Kampus Jasin, 77300 Merlimau, Melaka, Email: hajarizzati@melaka.uitm.edu.my, farahinjohari@melaka.uitm.edu.my
[2] Post Graduate Student, Faculty of Computer and Mathematical Sciences, Universiti Teknologi MARA, 40450 Shah Alam, Selangor, 2015598863@isiswa.uitm.edu.my

providing them an extra minutes to sleep before they really have to get up. It is more preferable for people to stay awake after waking up from hours of their sleep (Hitti, 2006). But experts say that this is the poorest thing to do which may lead to sleep inertia. Sleep inertia is one of the consequences of waking up suddenly, and too early (Lambert, 2011). Moreover, the author suggests snoozing can create a huge impact to the body because after hitting the snooze button, the snoozer will enter back into deep sleep which will make their body feel awful after wake up.

Alarm clocks are normally used for waking users at specified times. By providing a help for the body and mind to wake up after fully rested, it is also providing a help in the demands of daily life that is including going to college or work which are needed for getting up at a specified time (Konnikova, 2013). Normally, alarm clock includes features to set the time of day and also time for the activation of the alarm. There is also another feature called the snooze function which silences the alarm temporarily, allowing a few more minutes of sleep before the alarm activates again. Alarm clocks have multiple ways to wake up user, including tones and vibration.

Traditional alarm clock is built with one or two bells that ring including small hammer between them, which strikes the bells to produce a ringing sound when the alarm is activated. There are no gears and spring inside the digital alarm clock and digital alarm clock rely on electronic rather than mechanical machines to make it function. Digital alarm clock can make other noises and the clock itself uses an LED or LCD face to display the numbers. Most of the mobile phone nowadays has been implemented with alarm clock features (Corpuz, 2016). The alarm clock provides the same function as same as the traditional and digital alarm clock but has the multiple ways to wake up the user including multiple tones and vibration.

The snooze button function that is implemented in each alarm clock application will provide the user an extra minute to sleep before the alarm activates again. But experts say that it is the worst things to do which may lead to sleep inertia (Lambert, 2011). Moreover, becoming a snoozer will create a huge impact towards the body and makes the body feels awful and tired after wake up.

Smile detection techniques used to determine whether a static face image is smiling or not. It is involving up to seven parts of the facial muscles that are Zygomatic Major, Zygomatic Minor, Risorious, Buccinator, Levator Labii Superioris, Levator Anguli Oris, and Orbicularis Oculi (see Figure 1). From Figure 1, it shows that smile involved most of the muscles of the faces.

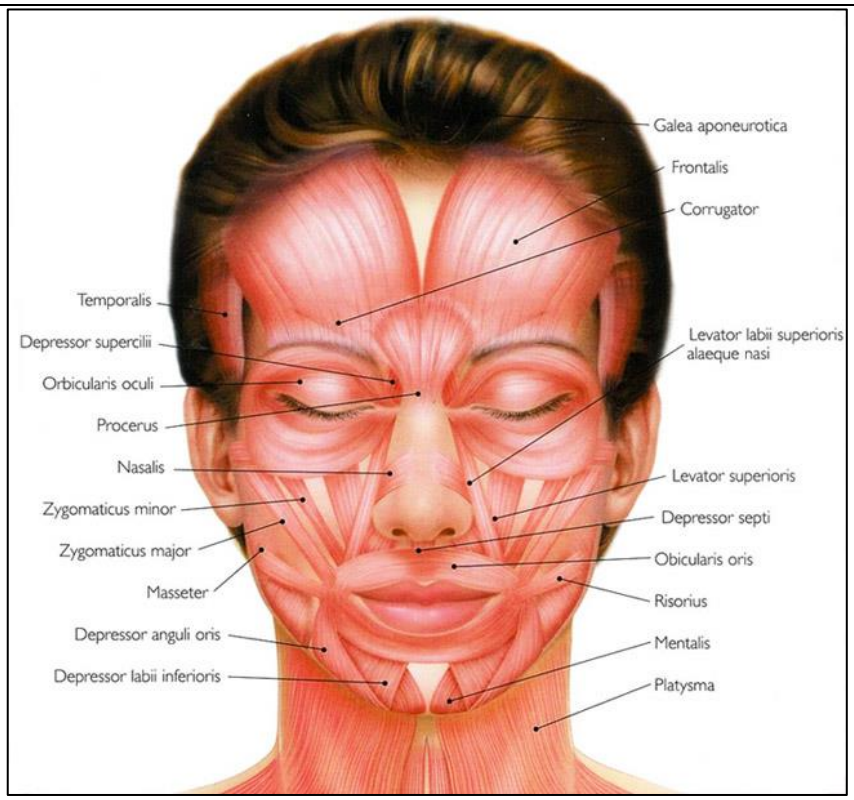

Figure 1. Muscles of the Face (taken from flexeffect.com)

Therefore, by implementing the smile features in the alarm clock mobile application which forces the user to get up and make a movement to turn on the light so the alarm clock can be disabled using smile detection which required the user smile before disabling it. This will increase the possibility for the users to stay awake because each movement can stimulate blood flow, which will make our mind feels more awake and light will stimulate us to wake up (Melgren, 2010).

2. Grin Alarm Clock

Most of mobile phone nowadays has been implemented with alarm clock features (Corpuz, 2016).The alarm clock provides the same function as same as the analog and digital alarm clock but has the multiple ways to wake up the user including multiple tones and vibration. However, most of alarm clocks that are available today are only make sound and are not effective enough in waking up people because some users need an alarm that can react to a specific sense (Døving, Hamdani, Höglund et al., 2005).

Furthermore, most of the smartphone or whatever device with a camera has been implemented with smile detection functions (Tomaselli, Guarnera, Marchisio et al., 2013). Therefore, by implementing a facial expression recognition function which required the users to smile before disabling the alarm, it can help the users by preventing them entering back to their sleeping mode.

Qualcomm has introduced facial processing and facial recognition features in their Snapdragon SDK for Android since 2012 (Munchbach, 2012). Snapdragon SDK makes it possible to detect a smile, determine where the eyes are looking, and detect blinking in Android easily (Yener & Dundar, 2016). According to Qualcomm, there are plenty of mobile phones in the market use Snapdragon processor. Therefore, this application can be used to most smartphones in the market nowadays.

3. Development

Grin Alarm is developed in Java and using library from Snapdragon SDK for the smile detection (Rajapriya, 2016). Based on Figure 2, when the alarm rings, user has to decide whether to get up or just

stay lying in bed. If the user decides to get up, the user has to smile and the system will take a picture and compared whether the picture contain smile or not using the SDK Snapdragon library, so the user will be able to disable the alarm.

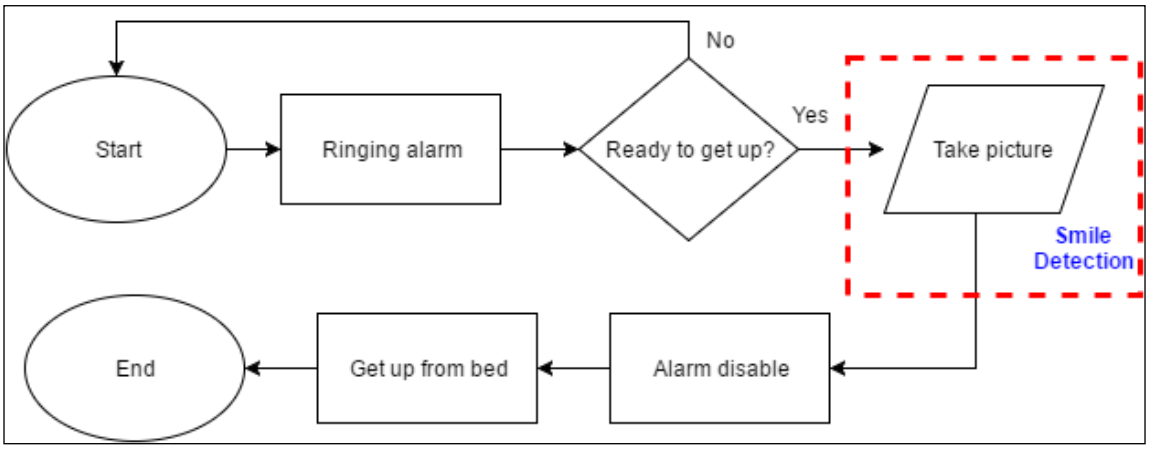

Figure 2. Deactivate Grin Alarm

3.1. System Architecture

The activation of the alarm will trigger the interaction with the user. After that, the prototype will start the camera from the mobile device and the user has to smile where to detect smile required some process and algorithm. The tracking process is started with the face region, then finds the eye location and lastly obtains the mouth region. Finally, when the prototype recognizes the smile, the alarm will automatically dismiss. Figure 3 shows the system architecture of the prototype.

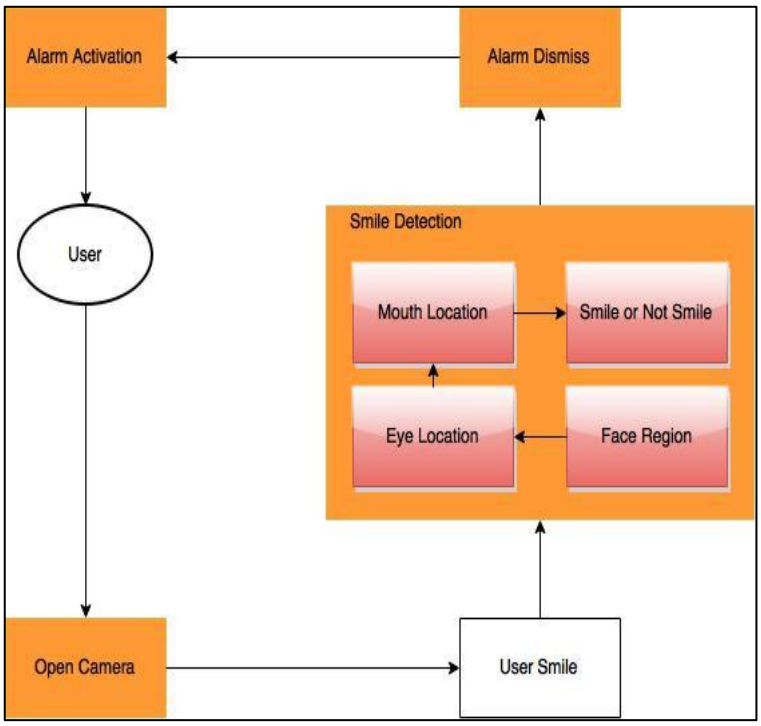

Figure 3. System Architecture

Figure 4 shows how Snapdragon SDK library is used to determine a smile. The figure shows clearly the processes involved to determine a smile. From a picture, the face region is determined. Then, eyes are determined by using Gaze Tracking technique. When eyes are found, the location of mouth can be determined. Finally, degree of smile is calculated to determine whether the user is smiling or not.

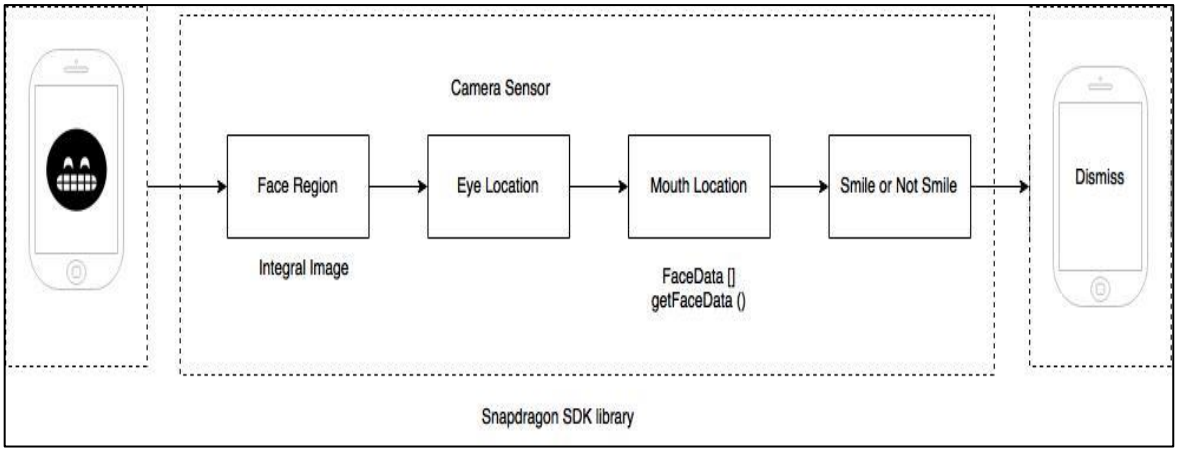

Figure 4. Snapdragon SDK Flow

3.2. Snapdragon SDK

The Snapdragon SDK for Android is a package that includes the software libraries, documentation and sample code. It is free to download at Qualcomm's website. The SDK is generally divided into two categories, facial processing and facial recognition. The facial processing provides features like (Newnham, 2015) :

- blink detection,
- gaze tracking,
- smile value and
- face orientation.

This project uses the smile value to determine if one is smiling or not. The degree of smile can be determined with the left and right mouth corner which is calculated by the Snapdragon SDK library.

3.3. Smile Detection

The Snapdragon SDK for Android is a package that includes the software libraries, documentation and sample code. It is free to download at Qualcomm's website. The SDK is generally divided into two categories, facial processing and facial recognition. The facial processing provides features like blink detection, gaze tracking, smile value and face orientation (Newnham, 2015). This project uses the smile value to determine if one is smiling or not. The degree of smile can be determined with the left and right mouth corner which is calculated by the Snapdragon SDK library.

From the library, eyes were either found by using the camera sensor. Then the mouth region is located by the `FaceData[]` array and `getFaceData[]` array. Lastly, after the mouth has been located, it will determine whether the user is smiling or not based on the degree of smile that is calculated by the right corner mouth and the left corner mouth.

Figure 5 shows `setCircleColor()` function that will set the color of the circle based on the changes of the smile degree. The `setCircleColor()` function will be called on the `onDraw()` method to drawcircle on the mouth region. A red circle will be drawn on the mouth region with 0 degrees of smile, while a green circle will be drawn of the mouth region that has 84 and above degree of the

smile value (Figure 6). When the smile is successfully detected, alarm will automatically disable by calling the `startActivity()` function. Figure 7 shows the disable alarm function.

```
private void setCircleColor(FaceData faceData, Paint rectBrush)
                {
                  if(faceData.getSmileValue()<84)
                  {
                     mouthBrush.setColor(Color.RED);
                     }
                  else
                  {
                       mouthBrush.setColor(Color.GREEN);
                              startActivity(getContext());
                     }
                }
```

Figure 5. The `onDraw` called to `drawcircle` on the mouth region

Figure 6. Left: Image with 0 smile value. Right: Image with 84 and above smile value

```
public void startActivity(Context mContext)
{
    Intent intent = new Intent(mContext,Dismiss.class);
     mContext.startActivity(intent);

}
```

Figure 7. Function to disable alarm

3.4. Interface

Figure 8 shows the interface when the alarm activates. The interface will view the time of the alarm activation. There are two buttons available, Smile and Dismiss button.

When the alarm is activated, the user needs to touch the Smile button (as shown in Figure 5) to disable the alarm. The smile button will call the“MainActivity” class. The function call is shown in the Figure 9 below.

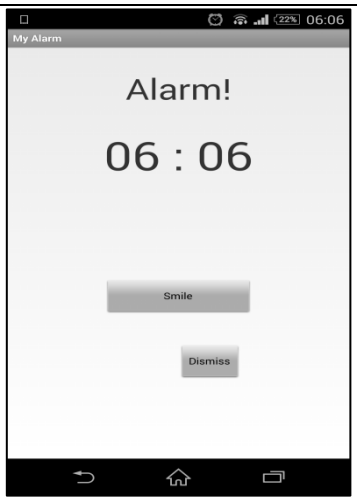

Figure 8. Alarm Activation

```
Button camera = (Button) findViewById(R.id.camera);
      camera.setOnClickListener(new OnClickListener() {

            @Override
            publicvoid onClick(View view) {


Intent intent=new Intent(getApplicationContext(), MainActivity.class);
            intent.addFlags(Intent.FLAG_ACTIVITY_CLEAR_TOP);
                  startActivity(intent);
            }
      });
```

Figure 9. Smile Button on activity_alarm_screen.xml layout

Figure 10 shows the camera is activated and ready to detect smile. If the prototype recognizes a smile, the color of the circle will change from red to green if there are any changes toward the degree of smile value.The prototype requires user to smile more than 80 degrees of the smiling to disable the alarm when the alarm is activated. The degree of smile can be determined with the left and right mouth corner which is calculated by the Snapdragon SDK library.

Figure 10. Camera ready to detect smile

4. Testing

Testing is very important while developing a prototype. This section will discuss the testing held in developing the prototype. The most important test is the smile detection.

4.1. Environment Brightness

The smile recognition accuracy of the system is based on the brightness of the environment. Figure 11 below shows the result after the prototype has been tested.

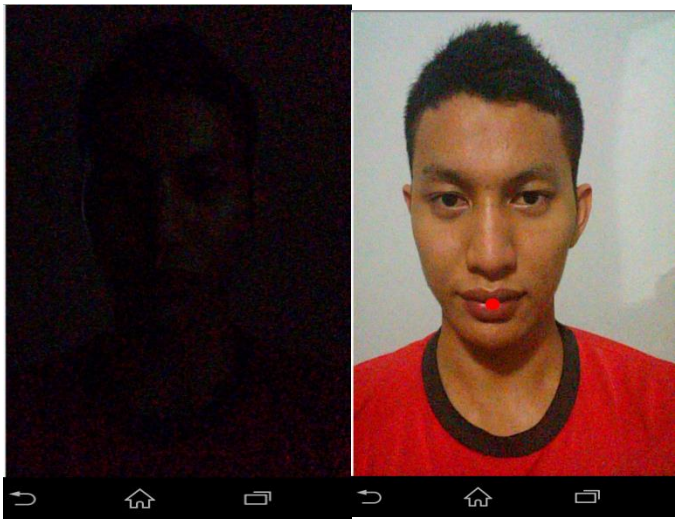

Figure 11. Left: Tested on the darkroom Right: Tested in the bright room

4.2. Degree of Smile

The changes in circle color are based on the degree of smile which is determined by the movement of left and right mouth corner. The degree of smile is calculated by using the Snapdragon SDK. Figure 12 shows how a smile and non smile picture changes the circle color.

Figure 12. Changes in circle color based on the degree of smile

5. Conclusion

This prototype is built to recognize the smile and non-smile by using the smile degree value from Snapdragon SDK library. Before a smile is determined, the location of eyes is determined by using Gaze Tracking technique. After that, mouth location is determined. When mouth is determined, the application will calculate the degree of smile.

This prototype has some weaknesses that can be improvised. Firstly, this prototype can only operate with the Snapdragon chipset devices. Devices that do not built with Snapdragon SDK will not be able to use it. The prototype does a simple checking which is to check whether the device is supported to run this prototype or not. If not supported, the prototype cannot be used. Besides that, this prototype has the difficulty to recognize faces under low light environment because all types of image processing required enough light to do any processing.For future work, the author would like to suggests to enhance the prototype compatibility so the prototype can run on more devices not on the Snapdragon chipset only.

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