The 4th International Conference on Electrical Engineering and Informatics (IC EEI 2013)

Nutritional Information Visualization Using Mobile Augmented Reality Technology

Muhammad Zulfakar Bayu\textsuperscript{a,}\textsuperscript{*}, Haslina Arshad\textsuperscript{a}, Nazlena Mohamad Ali\textsuperscript{b}

\textsuperscript{a}Faculty of Information Science and Technology, Universiti Kebangsaan Malaysia
\textsuperscript{b}nazlena@ivi.ukm.my, Institute of Visual Informatics, Universiti Kebangsaan Malaysia

Abstract

Information visualization with Augmented Reality (AR) technology environments is very effective method in the expansion of information process visually, especially in health-related area by using mobile devices. In this study, Android mobile device is proposed to build and develop AR prototype applications for nutritional information. There are two techniques that are applied in generating nutritional information, which is detection (by scanning image of the object without requiring barcode/AR marker) and tracking (by using Android digital camera). Data from the above techniques were represented in a visual form of a gauge meter utilizing some color coding. The result from this study is to provide user’s understanding in nutritional information visually so that it could potentially improve their health.

© 2013 The Authors. Published by Elsevier B.V.
Selection and peer-review under responsibility of the Faculty of Information Science & Technology, Universiti Kebangsaan Malaysia.

Keywords: Augmented Reality; Information Visualization; Android; Nutritional Information

1. Introduction

Nowadays, awareness of the importance of health is higher. Various attempts were made to improve the health. The use of technology in health area became more widespread. One of the important issues needed is to access nutritional information like calorie and nutrition easily. However, the capabilities of technology in providing this information are limited. Therefore, the development of technology that can provide health information is needed.

\textsuperscript{*} Corresponding author.
E-mail address: jol_fakar@yahoo.co.id

Available online at www.sciencedirect.com

ScienceDirect

Procedia Technology 11 (2013) 396 – 402

 ELSEVIER

© 2013 The Authors. Published by Elsevier Ltd. Open access under CC BY-NC-ND license.
Selection and peer-review under responsibility of the Faculty of Information Science & Technology, Universiti Kebangsaan Malaysia.
Augmented Reality (AR) technology which is part of this study has been developed since forty years ago. It was based on the study that has been done by the researchers recently [1]. Mobile augmented reality running on self-contained smart phones and computers, can leverage an extremely large potential user with an existing devices and most of the users know how to exercise it [2]. Some other researchers found that the implementation of AR technology with mobile application is able to facilitate user’s understanding of the information presented to them visually. According to Schmalstieg [2], mobile phone with embedded camera allows it to use a “magic lens” in running applications based on AR technology. For example, TranslatAR application which is able to translate scanned words into desired language [3] by using its camera.

To improve interactivity and user’s understanding, this study involves a smart phone (Android) as a mobile support for the use of AR technology. The facts that influence the use of android in the work is due to uncomplicated application development and open-sources programming language such as Java, C++ and Javascript. Furthermore, it is the ability of mobile smart phones to generate information in graphic or visual so that the provided information will be clearer and easily understood. The method of providing information is emphasized in this study. One of the techniques is by applying a pre-attentive processing which is part of information visualization. The use of this visualization method can help users to understand data in abstract visual representations [4].

With AR applications concerning nutritional information, hopefully this study can improve health status of the people especially users who needs to regulate their diet plan.

2. Background work

AR technology has been utilized in a number of areas such as in education, industry and health sector. In health for example, the development of medical applications by using AR technology has been introduced. Among others are the visualization of 3D lung [5], orthognathic surgery [6], hepatic therapy [7], breast cancer surgery [8], orthopedic surgery and a number of other surgeries [9]. These studies have added to the list of AR technology innovation to improve work performance effectively and efficiently in solving health problems. In the study conducted by Chen [10] explained the use of the Sensorex tool to measure blood glucose by self-monitoring. The technology has been able to provide benefits of diabetic patient to keep and control glucose level in their blood so as their health will be more manageable. Nevertheless, the Sensorex tool is not a part of the AR technology. However, the process of obtaining information from the use of Sensorex tool can be applied into mobile applications based on AR technology.

AR technology capabilities in its implementation are commonly related with displaying objects visually whether in 2D or 3D shape. Pousman [11] said the use of computer mediated tools to depict personally meaningful information in visual ways that support everyday users in both everyday work and non-work situations so that the available information is easily accessible and understood well.

Based on these studies, technological development in health area provides a lot of positive impact to users. However, the use of AR technology in mobile devices is limited. Thus, this work will create an application that can combine mobile devices and AR technology in generating nutritional information visually in order to facilitate users in improving their health.

3. Methodology

In this work, the framework by [12] has been adopted as illustrated in Fig 1 below.
In determining the success of this study, there are a few techniques that are being realized. These techniques include:

3.1. **Scanning technique without requiring barcode**

The development of this android application is expected to provide information about the number of calories in diet plan by using a mobile phone camera to scan the image of desired object. For example, simply by scanning image of an apple, the nutritional information and 3D object of apple is able to be visualized over android screen so that users can easily understand the generated information. This will help users as their guide in the process of regulating their diet plan especially for diabetes patients who need to control the amount of calories inside their blood.

3.2. **Tracking technique**

Tracking technique is the most important part in building and creating an application which is based on AR technology [1]. Zhou explained, there are three categories of tracking techniques that have been introduced such as sensor-based, vision-based and hybrid tracking. The selection of proper tracking and appropriate technique can increase the speed in generating the desired information. Therefore, vision-based tracking will be proposed in this study since the application development is easier to be implemented and more applicable to our application.

4. **Mobile augmented reality development**

Nutritional information application testing made in this study involves an Android mobile device. Android 2.2 (froyo platform) is one of the minimum platform in carrying out this application. The method performed in this study is displaying the objects in 3D and visualize the information in graphical form. The visualized graph is provided in the form of *gauge meter* and the information content always changes according to the 3D objects displayed.

In the process of displaying information, scanning technique on an image was performed first. The scanning requires an android with embedded camera feature. Once an image is scanned, the 3D objects of the scanned image
will be displayed over the android screen. The 3D objects created contained a lot of information about the image. Therefore, the generated information will be displayed in the form of *gauge meter* to facilitate the user in understanding the information visually.

Several development steps in performing mobile application in this study are demonstrated as below:

### 4.1. Object scanning

During this phase, the process of scanning object is carried out by directing android’s cameras to available image. By using Java program, the information of object will be initialized and analyzed first to get the appropriate data. The java code used is:

```java
private void initApplicationAR(){
    // Do application initialization in native code (e.g. registering, callbacks, etc.):
    initApplicationNative(mScreenWidth, mScreenHeight);

    // Create OpenGL ES view:
    int depthSize = 16;
    int stencilSize = 0;
    boolean translucent = QCAR.requiresAlpha();
    mGlView = new QCARSampleGLView(this);
    mGlView.init(mQCARFlags, translucent, depthSize, stencilSize);
    mRenderer = new ImageTargetsRenderer();
    mRenderer.mActivity = this;
    mGlView.setRenderer(mRenderer);
}
```

After the process of scanning the initial object has been completed, the scanned image will be tracked. The result of image tracking is described in the next phase.

### 4.2. Object id tracking code

Tracking code performed in this phase aims to determine the object id contained in scanned images. Every available image scanned has specific object id and information. It was tracked by using C++ program. Once the object id has been tracked, appropriate 3D objects of the scanned image will be displayed. The following code is used to track the object id from scanned image:

```c
int idObjectName = 0;
int textureIndex;
if (strcmp(trackable.getName(), "greenApple") == 0){
    textureIndex = 0;
    verts = &GreenAppleVerts[0];
    normals = &GreenAppleNormals[0];
    texCoords = &GreenAppleTexCoords[0];
    idObjectName = GreenAppleNumVerts;
    appleRenderId = 1;
}
else if (strcmp(trackable.getName(), "redApple") == 0){
    textureIndex = 1;
    verts = &AppleFruitVerts[0];
    normals = &AppleFruitNormals[0];
    texCoords = &AppleFruitTexCoords[0];
    idObjectName = AppleFruitNumVerts;
    appleRenderId = 2;
}
```

After the process of scanning the initial object has been completed, the scanned image will be tracked. The result of image tracking is described in the next phase.
Referring to [13], the communication between two different codes above for registering 3D object can be described as follows.

- Step 1: Camera scan an available image
- Step 2: Image tracking process
- Step 3: If scanned image detection is:
  - Success: Get object id
  - Fail: Reposition camera or image coordinate
- Step 4: Pose 3D object rendering

In the process of image tracking, object id found in an image can be easily detected only if the camera or image used had the correct position, so that 3D objects contained in the image can be displayed over android's screen.

4.3. 3D visualization objects

Previously, 3D objects are drawn using 3D applications and then exported into .obj files. In this work, 3D object visualization in this phase involves C++ program to draw 3D objects over android screen. Exported file in this phase will facilitate the C++ program in recognizing the information of 3D objects that has been created. The visualization of 3D object example can be seen in Fig 2 below:

![Fig. 2. (a) Scanning image; (b) 3D object visualization.](image)

4.4. Information visualization

Gauge meter is a kind of displaying the information in visual form. It’s classified into analog type category. Analog form is most commonly used in health industry. The example of gauge meter visualization used in this study is as shown in Fig 3:

![Fig.3. Gauge meter visualization](image)
By using this type of visualization, there are some benefits that are contributed in this study, including:

- The ability to see information clearly
- No need for focusing attention
- Reduce time to get important data
- Receive the information instantaneously
- Increase the speed in processing data since data presented is simple

Based on the benefits mentioned above, information display techniques using this type of visualization is very useful way in providing user’s understanding when viewing the data.

4.5. Visual Interface

Information visualization has been recognized over the past twenty years ago. In this work, data were represented using a gauge meter representation. Some pre-attentive processing was used in the representation in this case by using some color coding to represent data. The display of this information result is expected to help user understand the information better.

In addition, some interface design encompasses three distinct, but related constructs such as usability, visualization and functionality [14]. In terms of visualization for example, creating information visualization in attractive form is able to make the useful information more interesting and informative. Hence, there are some visual properties of pre-attentive processing method that need to be considered before display the information in visual way, among them:

- About visuals and icons
- Working with color
- Screen design and layout
- Designing text

The successful of items collaboration above can improve good interface design which makes users easy to understand the information well. Illustration of information visualization can be seen in Fig 4 below:

![Fig. 4. (a) visualization design; (b) visualizing nutritional information.](image)

Testing development that was conducted in this application found that generated nutritional information is concerned with calories contained in food such as carbohydrate, protein and fat. Such information is very important for users who need to manage their diet plan.

As a future work plan in this study is to perform user experiment to measure the capabilities and acceptance of this application. This will be part of the improvement to achieve more useful results.
5. Conclusion

Referring to the previous studies, the use of technology can be easily and quickly adapted due to the AR technology especially when this technology is able to be applied to the mobile smart phone (Android). AR technology capabilities in its implementation on android smart phone can increase enormous potential users largely due to the role of smart phone in providing convenience for users who needed it.

Hence, to achieve the purposes of this study, the combination between android smart phone and AR technology confidently is able to create an application that can provide nutritional information like calorie and nutrition visually so that it will potentially help users to manage their diet better.

References