Augmented Reality for Searching Potential Assets in Medan using GPS based Tracking

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Abstract. Every city is required to introduce its variety of potential assets so that the people know how to utilize or to develop their area. Potential assets include infrastructure, facilities, people, communities, organizations, customs that affects the characteristics and the way of life in Medan. Due to lack of socialization and information, most of people in Medan only know a few parts of the assets. Recently, so many mobile apps provide search and mapping locations used to find the location of potential assets in user's area. However, the available information, such as text and digital maps, sometimes do not much help the user clearly and dynamically. Therefore, Augmented Reality technology able to display information in real world vision is implemented in this research so that the information can be more interactive and easily understood by user. This technology will be implemented in mobile apps using GPS based tracking and define the coordinate of user's smartphone as a marker so that it can help people dynamically and easily find the location of potential assets in the nearest area based on the direction of user's view on camera.

1. Introduction

In order to the development of region, every city is required to introduce its variety of potential assets. Medan, capital of North Sumatera Province, has variety of potential assets which has not been widely known by the public because of lack of socialization and information. Meanwhile, potential assets which includes infrastructure, facilities, people, communities, organizations and customs, can affects the social, economic and cultural aspects in Medan.

Nowadays, development of technology has proved able to help humans in their daily activities, including to get any required information. The most widely used technology is smartphone supported with many features such as GPS, accelerometer sensor and digital compass, which can allow users to get detailed information simpler and easier. Therefore, we need to create a mobile application which can help people easily find any information of potential assets in Medan.

There are so many mobile apps which provide search and mapping locations which can be used to find the location of potential assets in user's nearest area. However, the available information, such as text and digital maps, sometimes do not much help the user clearly and dynamically.

A new technology called Augmented Reality (AR) is technology that combines what is in reality and what is generated from computer by enhancing what we see, hear, smell and feel [1]. This technology is mostly implemented to give users real-time, clearer and more interactive information.

In previous research, AR had been implemented in education [2-3], health [4-5], military [6], advertising [7-8], entertainment [9], and navigation field, such as Layar, Wikitude and Metaio. The most implementation of augmented reality technology is to find and to get information of nearby places from user. In 2012, Shiddiqi and Hendrianto [10] implemented augmented reality technology in android based mobile app and combined the integrated sensors, such as accelerometer, compass and GPS for locating a mosque. The detected nearest mosque will be labelled with some information of the mosque, such as name, description and the distance between the mosque and user. The information retrieved from the server mosque then stored in internal storage media for mobile phones.

AR technology was also implemented for developing cultural heritage sites [11]. They used video images from outdoor as an input by using object panorama, SURF and GPS to augments 3D model visualization system of cultural heritage sites. This research was aimed to ensure efficient management of cultural heritage sites being left in traces and to have public in Korea watch their cultural heritage sites with realistic sense through 3D model visualization system of cultural heritage sites. The 3D model was augmented in cultural sites by using smartphone camera and detailed information of cultural sites would be displayed without difficulty at any outdoor place as well as indoor. In 2014, indoor augmented reality was also conducted for finding any nearby places, users can find a location when being indoor by using QRCode and RFID as markers of augmented reality [12].

An innovation in AR technology done by Sundaram, et al. in 2015. They integrated Cloud, which can act as virtual storage space, with Augmented Reality technology for finding nearby places of interest. The Cloud was used to store and access the location based augmented reality mobile application. This application aimed to help in the field of tourism and navigation [13].

Another research for augmented reality was conducted in 2011 for treating cockroach phobia [14]. They implemented augmented reality technology in a serious game in mobile phone. Experiment was conducted with a 25-year-old woman with cockroach phobia participated in the research. They concluded that based on testing results, the use of mobile game was able to reduce her level of fear effectively.

In this research, we implement augmented reality technology in mobile application that aims to help user easily find the location of potential assets in user's nearest area, especially in Medan, by giving more real, interactive and detail information using GPS based tracking. Section II describes the proposed method. Experimental results and discussion are presented on Section III. Section VI describes the conclusion and suggestions for future research.

2. Research methodology

In this section, we will discuss about our proposed method for building an augmented reality mobile app based location aimed to give user real-time information about the potential assets in his nearest area by displaying virtual 2D/3D content in real world vision. The name of this app is Medan KulinAR which can find the potential assets especially for Medan. Figure 1 shows the architecture of two-tier system implemented in our proposed method. The two-tier system consist of several components, such as mobile application (frontend), web admin, web service, database server (backend).
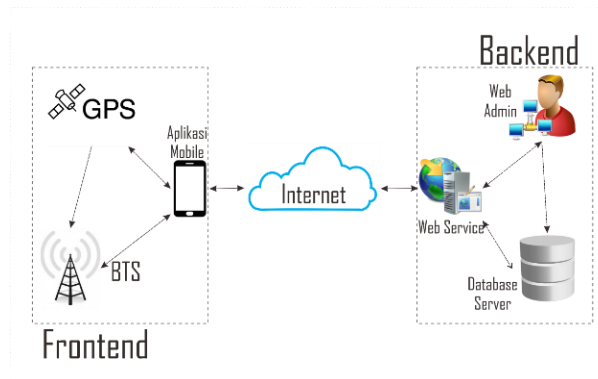
Figure 1. Architecture of Two-Tier System

The installed Medan KulinAR android mobile app is used as an interface between the user and the system in frontend side. The interface is built using Eclipse IDE, Android SDK, Mixare library and Java programming for the augmented reality.

The server side (backend) is the supporting application that serves as data source for the frontend application [15]. This application consists of three main parts, namely web administrator, web service and database server. Web administrator built using PHP programming serves as processor of data resources stored in database server which is managed by admin. Web service built using the combination of REST API and JSON (JavaScript Object Notation) serves as exchange data media between database server and mobile app. MySQL database server stores data resources for the application. The mobile network will connect the frontend application and web service and GPS receiver in mobile device will be connected to GPS satellite that serves to determine user's position, so that the information of potential assets locations will be relevant with user's position. The general architecture of our proposed method for frontend application is shown in figure 2.
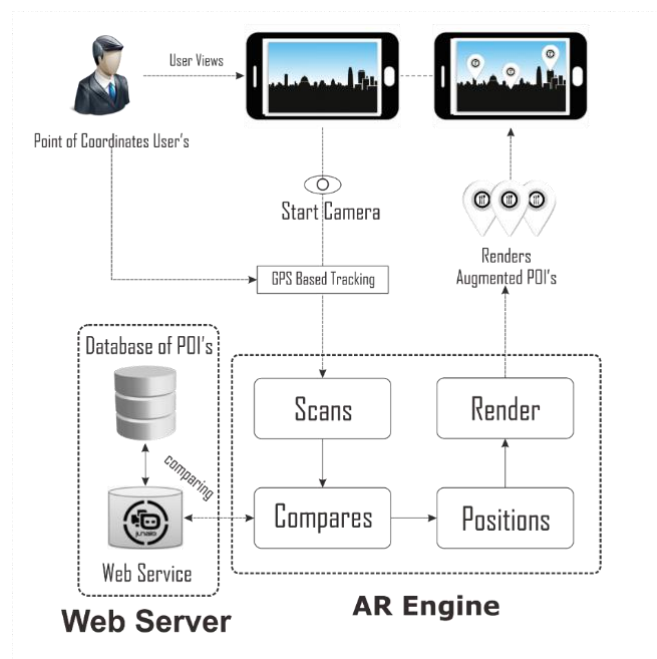
**Figure 2**. General Architecture (Frontend)

Frontend system begins with the camera capturing the real condition which is directed by the user, and then GPS detects coordinates of the user's location used as a target, and the detected coordinates

will be matched with the coordinates of nearest location stored in the database system. The matching process will be repeated until the system finds the coordinates of nearest location. After matching process is completed, the system will proceed positioning and orientation. It aims to determine the location and position of virtual content added to the reality through the camera screen of user's smartphone. While positioning, system calibrates the digital compass with augmented video to match the orientation and position of the camera to the direction of the user's view. Then the last process is rendering to display the virtual content in accordance with the position and orientation set by the system. Virtual content displayed on this application is information of 2D object location which is visible in reality.

3. Result and discussion

The used input data in this application is the coordinate point of location detected by GPS in user's smartphone which is stored in web server and defined as a marker of augmented reality in Medan KulinAR app.

In this research, experiments are conducted based on category of selected marker content and difference in shape of marker that can change according to the distance between user and the location. There are several categories of potential asset able to be selected by user, namely ATM machine, hospital, culinary, supermarket, etc. Figure 3 and figure 4 show the testing results for a few selected categories.
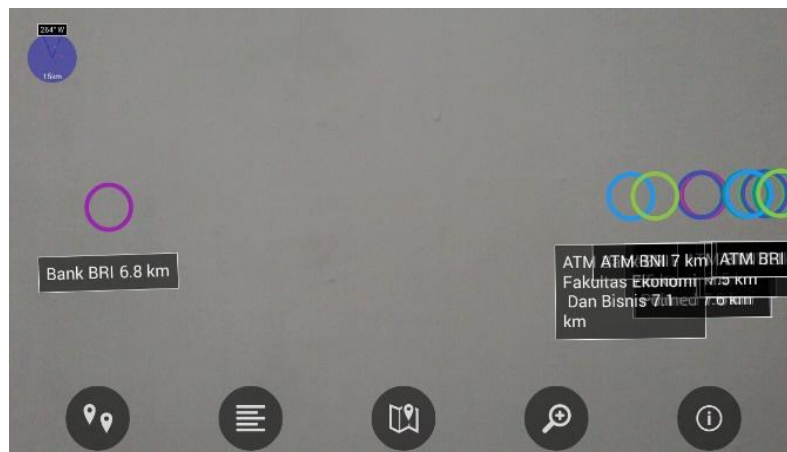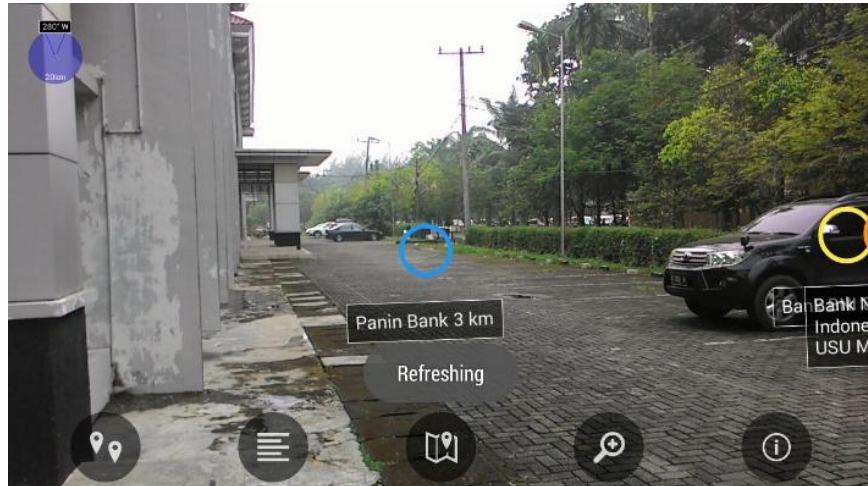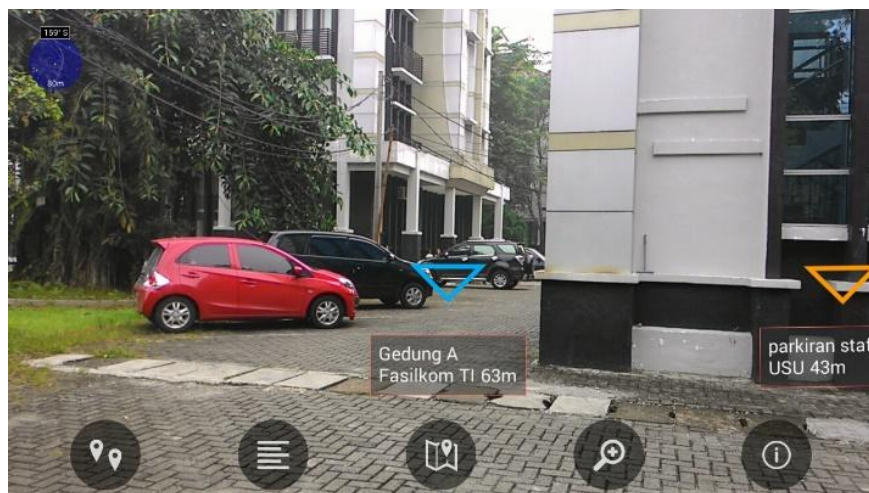

Figure 3. Testing Result for ATM
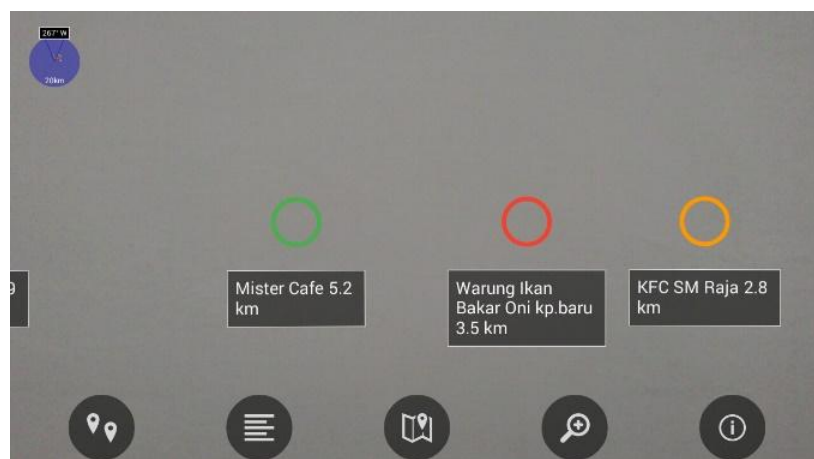
Figure 4. Testing Result for Culinary

For the testing based on distance, the shape of marker can change according to the distance between user and the location. The farther the distance, the smaller the circle and vice versa. If the user is right at the intended position, then the marker will be inverted triangle. Figure 5 and figure 6 show the testing results based on the distance.

Figure 5. Testing Result for Distance > 1 km

Figure 6. Testing Result for Distance < 100 m

4. Conclusion and Future Work

Based on the implementation of our proposed method, GPS based tracking, there are several conclusions obtained in this research. First, the implementation of augmented reality technology can help people easily find the potential assets in their nearest area in Medan. This application can give user detailed information of the potential assets, such as its address or direction, dynamically and more real according to its actual position based on user's view on camera.

Future work for augmented reality research can be done by adding other platforms that support the mobile app. Another experiment possibly done by another researcher is adding the information of locations which is not limited in a city without reducing the performance of the app.

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