UKM EXPLORER: UKM CAMPUS VIRTUAL TOUR

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Abstract
The virtual tour is a simulation of a reallocation made with media like panoramas, image, text and etc. Virtual tours allow users to experience and see the location without visiting there. For example, instead of physically visiting to a country, user can sit back and virtually explore the country using their electronic devices. Many students not able to visit The National University of Malaysia campus before register themselves due to distance, time and maybe financing problem. There are many universities offer campus virtual tour visits to the students; University of Maryland, Taylor’s University and etc. The National University of Malaysia (UKM), Bangi campus has a huge infrastructure, it is hard for people unfamiliar with the campus to find their way around and they can get lost in the campus. An assistance from a simple tool can help visitors to navigate from one point to another. In this paper, a mobile application – UKM Explorer which used virtual reality technology to provide users with a simple platform for navigating locations prior to or subsequent to entering UKM using GPS technology is proposed. Beside provides a virtual tour of UKM campus through the panorama images of the point of interests. This application also offers the ability to search and pinpoint the exact locations of the point of interest such as the faculties, student accommodations, management buildings and other facilities in the campus.

Keywords: Campus Tour, Mobile Application, Panoramas, Virtual Reality.

I. Introduction
A campus virtual tour is basically a 360° view of campus. It simulates the existing location with the help of 360° image. Virtual tour helps in creating a realistic representation of reality. A campus virtual tour allows visitors to explore and learn about the landmarks of the campus. They able to see the lecture hall, cafe, sport center and all the facilities available in the campus. A virtual tour helps the new
students who do not have the chance to visit the campus before registration day to visualize themselves as a part of campus.

The National University of Malaysia (UKM) main campus is located in Bangi Selangor and it occupies a huge area of 1,096.29 hectare [VII]. It has a huge infrastructure consists of a lot of buildings, faculties and colleges that are connected and scattered around the area. There are no specific maps or navigation applications that cover the large area of UKM main campus to guide visitors to navigate around. Furthermore, it isn’t always possible for students, parents or outsider to visit campus physically due to distance (location and transportation), time and financial restriction.

As mobile technology has become more advanced, smart phones have become a vital technology that we rely on every day. Smartphones today have built-in GPS capabilities making the device a reliable and intuitive tool as an assistive tool for navigation. More sophisticated mobile applications have been designed. Mobile applications serve as platforms for data collection in different formats (images, texts, and video) through wireless networks [I]. Young adults showed good acceptability and compliance in using mobile application to ease their activity [IX].

Hereby, an initiative has been taken to make UKM a digital campus by developing a mobile application that can help in exploring and navigating all the point of interests in UKM. While the public maps may help to facilitate orientation and provide an aid to those who want to look up an unfamiliar place while on the go, UKM Explorer offers user to specifically get information and explore the UKM campus with 360° image view. The virtual tour would be accessible from any mobile device.

The rest of this paper is organized as follows: Section II discusses related work. Section III discusses actual implementation of campus virtual tour. Section IV includes results and discussions and Section V concludes the paper.

II. University of Maryland Campus Tour

University of Maryland mobile application [VIII] taken as comparative related works with UKM Explorer. University of Maryland is located at approximately 4 miles (6.4 km) from the northeast border of Washington, D.C. People, who was thinking of attending University of Maryland, can explore the university by using the application. Prospective students and families can navigate the campus and learn about the university’s unique programs and culture through self-guided tours. Whether at home or on campus, these interactive student guide will accompany users as they can explore the application’s offerings with the GPS-enabled campus map, student videos and photos as shown in Fig 1.
A. **Self-Guided Tour**

A location-based Campus map will highlight important landmarks on campus will allow users to find easily way around. As users approach buildings, the tour guide will provide users with important information regarding University of Maryland programs.

B. **Landmarks and Buildings**

User will have an opportunity to learn more about the programs offered at University of Maryland and explore campus landmarks via descriptions and rich-multimedia.
C. Custom Walking Tour

Enhance users visit by taking a custom tour and get an up-close look at many of the unique majors and programs offered.

D. Multimedia

Explore University of Maryland community by watching videos from campus and browsing through hundreds of photos.

E. Interactive Panoramas

User are able to browse through a list of interactive 360° panoramas of covering various locations and buildings.

III. Implementation

The UKM Explorer mobile app consists of nine categories to group the location in UKM as shown. The main menu is using the recycler view container to show the nine categories. Each item in the recycler view is clickable.

A. Hardware Requirement

The smartphone used as the main device to run the application and it is the platform where it enables the VR view. Users can experience VR and watch video through smartphone clearly. The specification of the devices should be Android 5.0 (Lollipop) and higher was demands for this application. All the 360° images for each point of interest in UKM are captured using Theta Ricoh S. Table I. shows the specification of each hardware.

| Hardware     | Specification                                      |
|--------------|----------------------------------------------------|
| Smartphone   | iOS 8 and higher                                   |
|              | Android 5.0 (Lollipop) and higher                   |
| Theta Ricoh S| Pixels : 2 megapixels (x2)                          |
|              | Still image resolution (max.) : 5376×2688          |
|              | Still image - special features : Noise reduction, DR compensation, HDR Rendering |
|              | Video resolution (max.) : 1920×1080                |
|              | Video frame rate : 30fps                           |
|              | Application : iOS/Android/PC                       |

B. Software Requirement

There are two software used to develop UKM Explorer; Android Studio and Adobe Photoshop as shows in Table II.
Table II: Software Requirement

| Software      | Details                                                                 |
|---------------|-------------------------------------------------------------------------|
| Android Studio| Used as main platform to develop mobile application.                    |
| Version 2.13  |                                                                         |
| Adobe Photoshop| Used to design the background of splash screen.                         |
| Version CS6   |                                                                         |
|               | Used to modify images for:                                              |
|               | Button’s background in Main Menu.                                       |
|               | 360° image                                                              |
|               | Images are stored as jpeg for better compression.                       |
|               | Images are edited to stereo images in 1:1 aspect ratio (5376 x 5376).  |
|               | Example:                                                                |

Library for each function; VR Panorama View, Google Map, Youtube and Card View need to be imported to Android Studio in order to implement the function in mobile application (Table III).

Table III: Library

| Imported Library              |
|------------------------------|
| VR Panorama View             |
| compile                     |
| 'com.google.vr.sdk-panowidget:1.10.0 [V] |
| Google Maps                  |
| compile                      |
| 'com.google.android.gms:play-services-maps:7.8.0' |
| compile [VI]                 |
| 'com.google.android.gms:play-services-location:7.8.0' [VI] |
| compile                     |
| 'com.google.maps.android:android-maps-utils:0.4' [VII] |
| Youtube                      |
| compile files 'libs/YouTubeAndroidPlayerApi.jar' [VIII] |
| CardView                     |
| compile                      |
| 'com.android.support:cardview-v7:24.2.0' [IX] |
IV. Results and Discussion

A. Landmarks and Buildings

User will have an opportunity to learn explore campus landmarks and all the point of interest. All the buildings are categorized in own section for example faculty, college, amenities, administration and services, centre, hall, institute, sports and recreation and other place of interest. (Fig 2). Each landmark has their own point of interest as Fig 3.

Fig.2: Landmark categorization and all buildings.

Fig.3: Point of interest of each landmark.

B. Search Function

User are able to key in any keyword to search for any landmark. User can locate content by searching for specific words or phrases without needing to navigate
through the structure of the application. This function helps the user to find content faster and easier. For example, users only have to type the specific words for example “sains”, the application will search through all the available landmarks which contain the keyword and display all of it to users (Fig 4a). User will able to select the building and check the location (Fig 4b).

![UKM Explorer](image)

**Fig.4:** (a) Search landmarks using keyword, (b) Display the landmark location.

C. **Video**

Corporate videos are ready for each landmark. Users able to explore all the landmark by only watching the video (Fig 5).

![Corporate video](image)

**Fig.5:** Corporate video for each landmark.
D. Interactive Virtual Reality

Interactive virtual reality function is available for each landmark and point of interests in order to allow user to explore them virtually. Before user able to view the full 360° screen view, the application will display the information about the point of interest as Fig 6. User able to select to view the 360° images in two way, it is a recent way to show panoramas in an interactive way using VR devices like VR box and Google Cardboard (Fig 7) or just view it without any device (Fig 8). When user is watching the 360° virtual tour with VR device, it is thus possible to interact with the panorama by rotating view in all direction by moving the head, from the floor to the ceiling.

**Fig.6:** 360° image and information of each landmark

**Fig.7:** Display 360° image view without using a VR device.
E. Navigation

User able to choose any third-party navigation application, after tapping the navigate button, the application will move the user from UKM explorer app to the navigation application of choice. User able to navigate to the landmark through any existing navigation application available in the mobile device (Fig 9).

A simple comparison had been made between the University of Maryland campus map application and UKM Explorer. The results are shown in Table IV.

Fig.8: Display 360° image view using a VR device.

Fig.9: Navigate to the landmark through any navigation application available in the mobile device.
Table IV: Comparison of Campus Map Application

| Functions         | University of Maryland | UKM Explorer          |
|-------------------|------------------------|-----------------------|
| Navigation        | No                     | Yes (Third-party)     |
| Video             | Yes                    | Yes                   |
| VR                | Yes                    | Yes                   |
| Search Function   | No                     | Yes                   |
| Narration         | Yes                    | No                    |

As shown in Table IV, both applications allow users to experience the campus using VR view and video. UKM Explorer give an opportunity to users to explore the campus with more function available like navigation and search landmark. However, UKM explorer doesn’t provide the narration function for the visitor as user can experience the campus through the virtual tour. University of Maryland application do not have the navigation function. Hence, users couldn’t use the application to navigate when they are in the campus.

V. Conclusion

The significance of developing virtual tour of University Kebangsaan Malaysia using 360° image is to enable users to experience prominent entities of UKM campus using mobile device whenever they want. This application enable user to interact with the 360° image by turning around the mobile device (without aid of VR device) or user’s head (with aid of VR device). The completed prototype is proposed to be released by UKM. The recommendation below could be considered to improve the quality and features of the virtual tour; an interactive voice instructor should include to guide and advice user in the virtual environment as offered by University of Maryland application.

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