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Low Cost Virtual Reality Tour: ViTour

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ABSTRACT

The challenges faced in using virtual reality (VR) technology are less flexible VR activities, complex functionality issues in terms of programming expertise and high-cost VR technology involved. ViTour is a virtual tour of the library at a teacher education institute in Sarawak. The VR tour was created based on a low cost and more flexible VEduR Pipeline innovation by Siaw. The pipeline add values to the free apps and digital tools available to create 360° VR content by enabling users to view the content using low cost VR Box and to interact using low cost blue tooth mouse. This innovation provides an alternative for interim teachers to experiencce a VR tour of the campus library before they are physically present at the instiute for face to face interaction. A survey instrument using Technology Acceptance Model (TAM) by Davis enhanced with Perceived Enjoyment (ENJ) by Davis, Bagozzi, and Warshaw was adapted to collect respondents' feedbacks on their experience in using ViTour. Data analysis showed that the respondents agreed (M=3.86) that the use of ViTour would improve performance. The respondents also agreed (M=4.00) that the use of ViTour was free of effort. They also perceived the use of ViTour to be enjoyable (M=4.06) and their intention to use ViTour was high (M=4.00). These findings indicated that users had positive perception on the use of ViTour application.

1. Introduction

Virtual reality (VR) used to be only a science fiction, now it has been realized through the creation of a VR headset. This technology is evolving rapidly and will affect the way people live, socialize and work. It creates a virtual world that resembles the real world through the application of immersive technology. VR headsets enable 360° simulation and made the users feel as if they are in the created virtual environment. The initial use of VR in the gaming and entertainment industries have now vastly extended its application in many other fields like healthcare, education, tourism and the business sectors. VR in education has many advantages like fun and engaging learning. Students can experience VR virtual tour through application like Google Expeditions to places like Mount Everest or to Louvre museum.

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VR tour provides users the ability to interact with the system which enable them to experience the virtual environments in real-time, as if they are actually being there [1-3]. Many industries have ventured into this field such as the military, gaming, automotive, tourism and not least the education [4-6,26]. Many virtual campus tours have been developed to let prospective parents and students to view and explore the campuses virtually at the convenience of their own time and location [5,7-14]. Potential students will have the chance to familiarise themselves with the campus environment before being physically there. Different applications and technologies were used to capture 360° views such as VR 360 camera [11,15], DSLR camera [9], Mi Sphere 360 camera [5] and Google Street View [16]. A commonly used technique to create panaromic 360° view of campus VR tour was photo stitching technique [5,9-11,16]. This technique stitched together the collections of images with overlapping views to provide more effective information at the same time improving photos resolution with lower storage capacity [8]. Stitching could be done using different application like EasyPano and TourWeaver software [9], Insta360 [10] and Google Street View [16]. Some platform was used to create the 3D virtual tour after photo stitching was done. For example CUPIX [5], KRPano Viewer [10], UNITY 3D [14], Story Spheres [12] and Thinglink [16].

Various obstacles [17,20] have hindered the adoption of VR in the various sectors mentioned earlier. Figure 1 showed the main obstacles [17] in descending order as: (1) user experience, (ii) content offering, (iii) reluctance by businesses and consumers, (iv) regulation and risk, (v) financing and investment, (vi) cost, (vii) Government Oversight. The cost for one VR headset can cost up to USD 500 when it was first marketed in 2017. Furthermore, user has to look for a compatible PC which cost about USD1,200 to use with the VR headset. Even though headset price is going down with the introduction of new technology, nevertheless the cost is still considered high. The cheapest headset is the Google Cardboard which cost about USD20. The cost of headset as one of the factors that limit the usage of VR was also reported in researh by Myroslava [20].

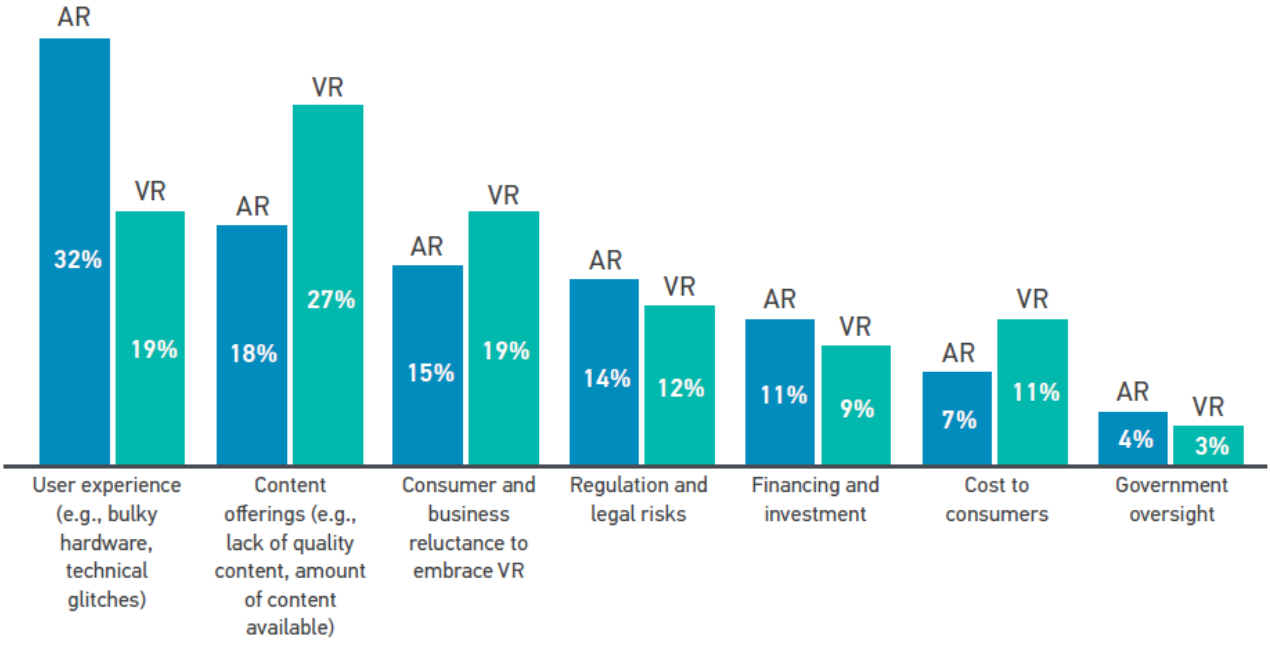


Fig. 1. Obstacles In Augmented Reality (AR) and VR Adoption [17]

Among the challenges of virtual technology that have been shared by [18-21] are the following.

i. Less Flexible- Implemented virtual reality activities have usually been programmed to achieve specific learning objectives. It is not easy to change and thus makes learning less flexible.
ii. Functionality Issues- Virtual reality activities that have been programmed for use with a virtual reality headset (VR Headset) may fail due to damage to the device that requires time to repair. Apart from that, programming virtual reality activities also requires certain expertise. Thus, the functionality of virtual technology is dependent on the expertise available in programming and using the tool.
iii. Expensive Cost- The cost required to use the latest technology is usually high. The same goes for virtual reality technology. Millions of ringgit are needed to buy the necessary equipment. The gap in virtual reality technology between schools that are equipped and schools that are not will become apparent later. As a result of this, inequality in education will become an issue.

In view of the needs to have a more flexible VR activities, less functionality issues in terms of programming expertise and low-cost VR technology involved, VEduR Pipeline [16] is the alternative approach to produce low cost 360^0 VR resources without facing much of the challenges described above [18-21]. ViTour is a localized content created to be viewed using the VR Box. It is an interactive 360^0 content created to replace the 2-dimension only images as displayed in an Institute Pendidikan Guru (IPG) library's website (http://www.ipbl.edu.my/psumber/kemudahan.cfm). VEduR pipeline has enabled low cost localized content like ViTour to be created. This pipeline used the low cost photo stitching technique [22,23] with free Google Street View apps to create the panaromic view of the VR tour. The two objectives of this research are:

i. to produce low cost 360° view virtual tour (ViTour)
ii. to evaluate user perception of ViTour

2. Methodology

In response to the many challenges described above [18-21], VEduR Pipeline [16] is used as a low cost easy to operate process to create 360^0 ViTour application using freely available digital tools. The process of ViTour production using VEduR Pipeline [16] was shown in Figure 2.

Fig. 2. VEduR Pipeline [16]

Input - Capturing 360° View

i. Download Google Street View apps in the handphone.
ii. Launch Google Street View, select the Create tab and choose Photo Sphere to start capturing a 360° view of the surrounding that you want to capture.
iii. Publish the 360° view that you have captured.
iv. Download the 360° images through Google map.
v. Figure 3 shows the steps to capture 360^0 view using Google Street View.

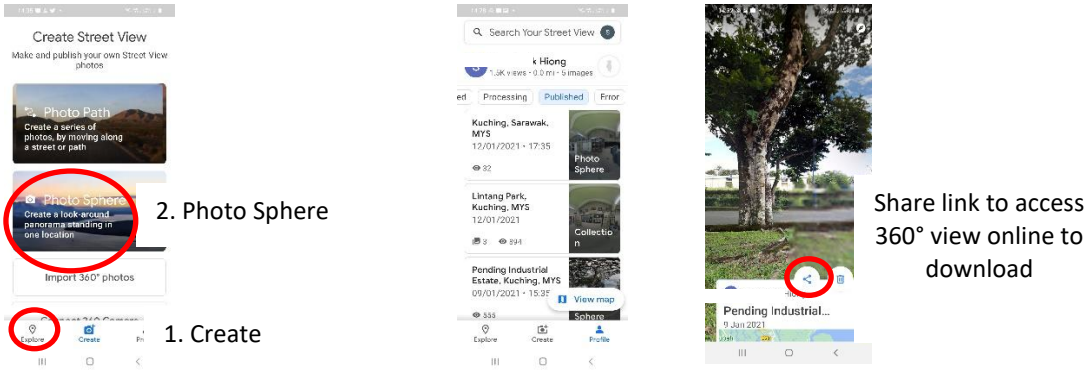
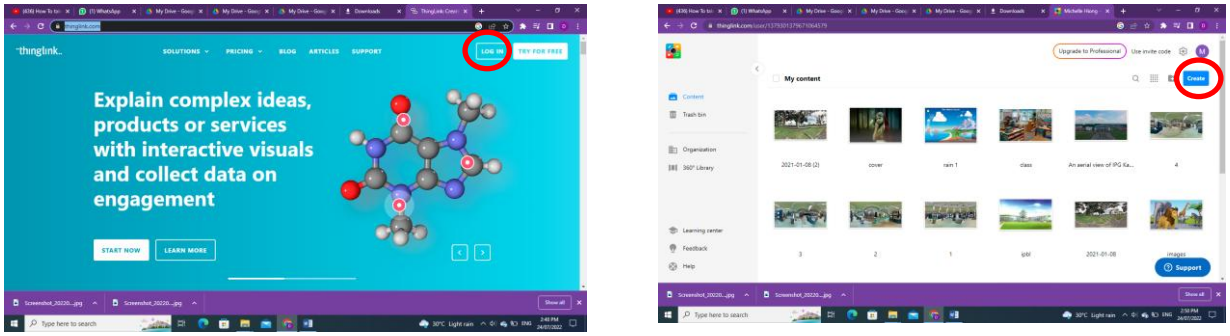


Fig. 3. Capture and download 360° view using Google Street View

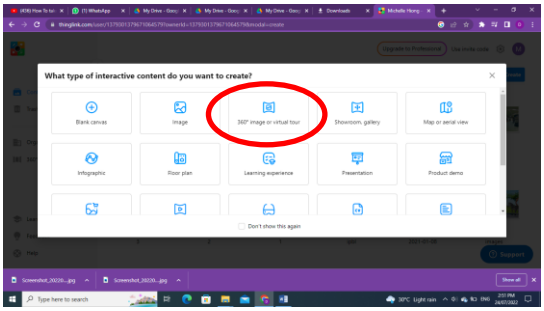
Process – Create VR Content Using Thinglink

i. Create a free Thinglink account at https://www.thinglink.com/
ii. Log in and Create new content.
iii. Select 360° image option to create the VR content.
iv. Upload the 360° images downloaded from Google Street View.
v. Tag VR content with hotspots using Thinglink for content navigation.
vi. Embed or share Thinglink using the share link provided.
vii. Figure 4 shows the steps to create 360° view VR content using Thinglink.

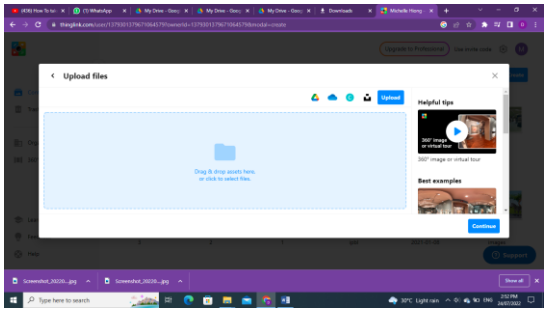


1. Create a Thinglink account

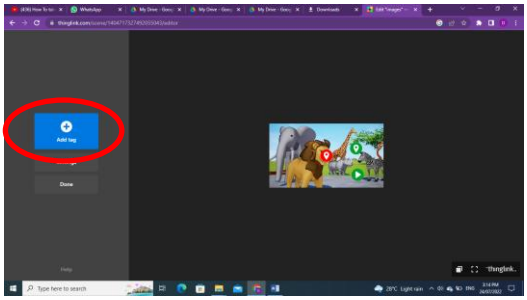
2. Create new content



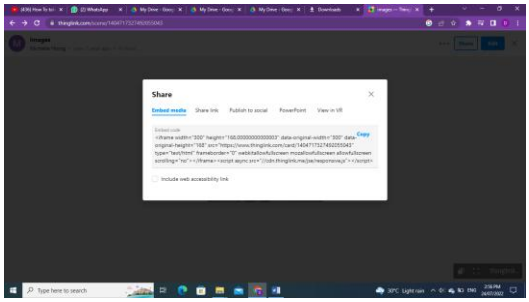
3. Choose 360° image



4. Upload the 360° image downloaded earlier



5. Tagging image with hotspots for content navigation



6. Embed or share Thinglink content

Fig. 4. Create 360° view VR Content using Thinglink

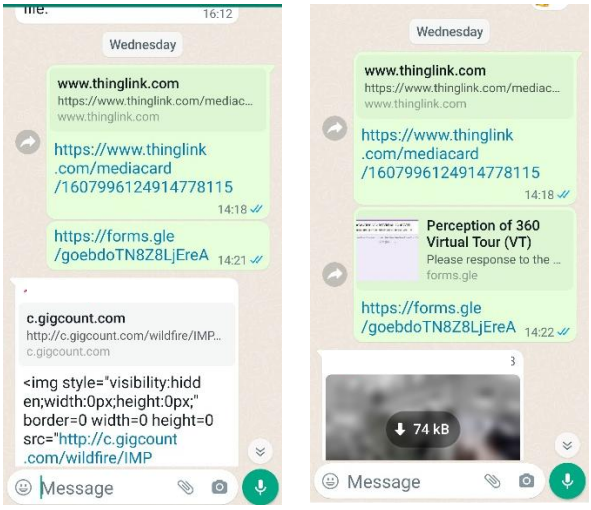
Output VR Content

i. Open the VR content using Thinglink share link provided in the handphone.
ii. Connect Bluetooth mouse to the handphone.
iii. Click VR view for the content.
iv. Place handphone in the VR Box.
v. View and navigate VR content in VR Box using the connected Bluetooth mouse.
vi. Figure 5 shows an example of 360° view ViTour.

Fig. 5. View 360° ViTour in handphone using VR box

The ViTour was shared through Whatsapp with two groups of PDPP interim school teachers (Figure 6) who were taking one and half year diploma course at an IPG in Sarawak. These teachers follow the courses through hybrid learning mode such that they only came to IPG for face to face interactions during the school holidays to complete their lectures, tutorials and practicals. The e-learning components of the courses were their self-learning time using resources available in Google Classroom posted by their respective lecturers. Lecturers gave feedback for e-learning tasks posted by them in Google Classroom. These interim teachers had not visited the institute library physically before they came to the institute for face to face lectures. ViTour link was shared with these interim teachers to let them visit the institute library virtually. They could explore and view the library virtually through ViTour with their handphone as long as there is internet connection. There is no

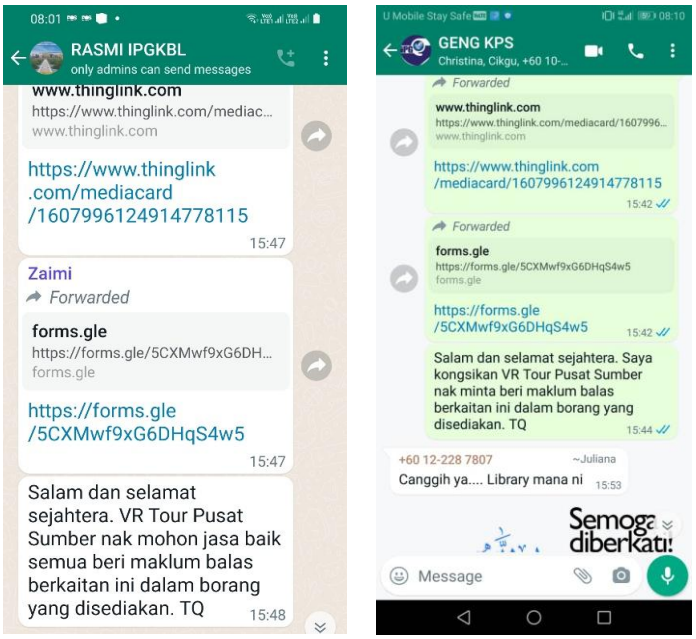
need for them to download any application into their handphone to view ViTour. A survey instrument using Technology Acceptance Model (TAM) by Davis [24] enhanced with Perceived Enjoyment (ENJ) by Davis, Bagozzi, and Warshaw [22] in El-Said and Aziz [23] was adapted to collect their feedbacks on their experience in using ViTour. A total of 24 responses were collected for the survey as a pilot study.



Group 1 Group 2

Fig. 6. Sharing of ViTour Link with PDPP Interim Teachers

Sharing of ViTour was also done with staffs and lecturers of the IPG through the official Whatsapp group and with Ketua Pusat Sumber Whatsapp group (Figure 7). Their feedbacks were collected through Google Form.



Official Whatsapp Group Whatsapp Group of Ketua Pusat Sumber

Fig. 7. Sharing of ViTour with an IPG staffs and Ketua Pusat Sumber IPGKs

3. Results

Technology Acceptance Model (TAM) by Davis [24] enhanced with Perceived Enjoyment (ENJ) by Davis, Bagozzi, and Warshaw [25] in El-Said and Aziz [26] was used to study how users accept or reject ViTour application. The four constructs with the ENJ enhanced TAM models are:

i. Perceived usefulness (PU)- degree to which a person believes that the use of a particular system may improve his performance;
ii. Perceived Ease of Use (PEOU)- degree to which a person believes that the use of an information system will be free of effort
iii. Perceived Enjoyment (ENJ)- the extent to which the activity of using the computer is perceived to be enjoyable in its
own right, apart from any performance consequences that may be anticipated
iv. Intention To Use (INT)- the actual use of a given information system and therefore determines technology acceptance

The survey instrument using agreement on a 5-point Likert scale, namely 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4= Agree, 5= Strongly Agree. was used to collect pilot study data from the respondents of ViTour application. The reliability of the instrument has a Cronbach's Alpha value of .963 (Table 1). Based on the interpretation of the Cronbach Alpha value by Konting [27], the reliabitity of the instrument is excellent (Table 2). Analysis of the data showed the outcomes as in Table 3.

Table 1
Survey Instrument Reliability statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.963	.964	12

Table 2
Cronbach Alpha Value [27]

Cronbach Alpha (α)	Interpretation
0.91 – 1.00	Excellent
0.81 – 0.90	Good
0.71 – 0.80	Good and Acceptable
0.61 – 0.70	Acceptable
0.01 – 0.60	Not Acceptable

Table 3
TAM model evaluation outcomes

TAM Model Constructs	Mean	Standard Deviation
Perceived usefulness (PU)	3.86	0.70
Perceived Ease of Use (PEOU)	4.00	0.67
Perceived Enjoyment (ENJ)	4.06	0.62
Intention To Use (INT)	4.00	0.65

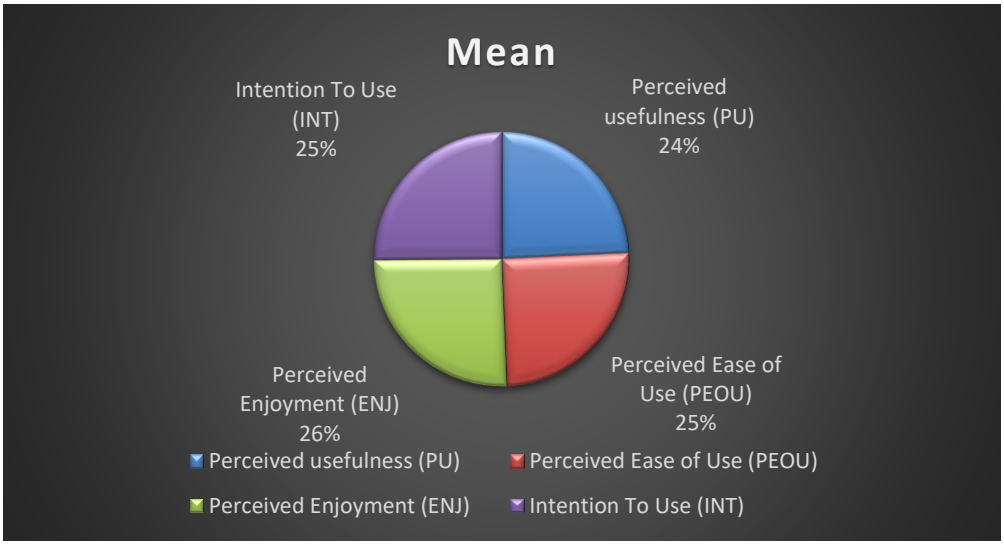


Fig. 8. Means of TAM Evaluation Model Constructs

Findings from the data (Table 3) showed that the respondents agreed (M=3.86) that the use of ViTour would improve performance. They also agreed (M=4.00) that the use of ViTour was free of effort. Respondents also perceived the use of ViTour to be enjoyable (M=4.06). The intention to use ViTour would be high (M=4.00). These findings indicated that the respondents had positive perception on the use of ViTour application. The findings are parallel to the outcomes from research done by various researchers [5,9,11,28]. The overall means of the four constructs for TAM evaluation model were also showed in Figure 8. It indicated that perceived enjoyment construct had a slightly higher mean compared to the other three constructs. This implied that enjoyment was an important element in the development of the virtual tour which was also indicated in research by various researchers [9,20,29].

Below were some of the feedbacks collected from staffs of an IPG after viewing the ViTour.

i. Easy for users to explore the resource center virtually
ii. Interesting tour
iii. Simple and clear, give user new experience
iv. Accurate representation of the library
v. Creative and interactive media

Among some of the suggestions given to improve the ViTour:

i. Display more detail information about the library facilities.
ii. Share more facilities available in the library.
iii. Improve the tagging of information.

4. Conclusions

This research shared the use of an innovation VEduR pipeline [16] to create a low cost virtual ViTour of a library at an IPG in Sarawak. The challenges of less flexible VR activities, complex functionality issues in terms of programming expertise and high-cost VR technology involved in using virtual reality (VR) technology [18-21] are partly being addressed with the use of VEduR pipeline [16] for creating the ViTour. The two objectives of this research have been achieved. Survey data collected indicated that ViTour would improve performance. The use of ViTour was free of effort and to be enjoyable. Furthermore, the intention to use ViTour would be high. It can be concluded these

findings showed that the respondents had positive perception on the use of ViTour application. The contribution of this research is the development of a virtual tour (ViTour) prototype for a campus library using the low cost VEduR pipeline [16]. Future research could develope more low cost VR content other than virtual tour for the purpose of education using the VEduR pipeline [16].

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