Virtual Space For Virtual Reality Exhibitions With Oculus Quest Devices

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Abstrak: Based on information from the Ministry of Cooperatives and MSMEs, currently the number of MSMEs has reached 64.2 million euros and their share of GDP is 61.07% or 8,573.89 trillion rupiah (Coordinating Ministry for the Economy of the Republic of Indonesia, 2021). The contribution of MSMEs to the Indonesian economy includes the ability to absorb 97 percent of the current total employment and generate 60.4 percent of the total investment. (Ministry of Investment, 2021). VR (Virtual Reality) technology is a technology that allows users to feel in a virtual (virtual) world in visual form and users can interact with a virtual environment simulated by a computer in the form of Android. The focus of this research is a technical way of creating a virtual space or virtual space and 3D objects in displaying products from SMEs to be marketed to consumers with the virtual reality method using the oculus quest device, this research uses the Luther method, a six-stage process for creating multimedia that includes concept, design, material gathering, assembly, testing, and distribution. System testing was carried out using black box testing and usability testing using the SUS Score standardization, with a total of 47 respondents getting an average score of 54%. This average number exceeds 50% of the standard SUS Score Analysis, so the virtual reality exhibition space is categorized as suitable and OK for use by users. And it can also help MSMEs in carrying out virtual reality-based online marketing.

Keywords: Virtual Reality; Software; Usability Testing; UMKM; Blackbox Testing

INTRODUCTION

In the modern era, information media and technology always develop according to the times. Many agencies or companies continue to develop to provide consumers with sophisticated technology to help solve consumer problems, especially in product sales. MSMEs have become an important pillar of the Indonesian economy (Bursa Indonesia, 2022). Based on information from the Ministry of Cooperatives and MSMEs, currently the number of MSMEs has reached 64.2 million euros and their share of GDP is 61.07% or 8,573.89 trillion rupiah (Coordinating Ministry for the Economy of the Republic of Indonesia, 2021). The contribution of MSMEs to the Indonesian economy includes the ability to absorb 97 percent of the current total employment and generate 60.4 percent of the total investment. (Ministry of Investment, 2021)(Aprilia et al., 2015).In developed countries like Hong Kong, an application called eventXtra has been launched. As the name suggests, this application meets the needs of event management, especially online exhibitions(Khairunnisa et al., 2021). Stephenson defines a metaverse as a vast virtual environment. The world of the metaverse was also introduced in the novel and film Ready Player One, defining the metaverse as a virtual environment also known as a MUVE (Multi-user Virtual Environment), whose format originates from MMORPG (Massively Multiplayer Online Role-playing Game) that allows people to find representation in videos 3D games by combining

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virtual reality, augmented reality (AR), virtual reality (VR), and the Internet, Metaverse has a scalable environment that can accommodate many people, this is very important to strengthen the social meaning emphasized by this technology(Indarta et al., 2022).

Some MSMEs and artists still use manual or offline methods to market and introduce their products and work. Of course, this method can be visited or glanced at by people who want to buy the product by coming directly to see and ask about the product being sold, but it can only be visited by consumers who are not far from the business actor's location. Marketing MSMEs products through exhibitions is an effective way to sell MSMEs products in urban areas, several offline marketing alternatives include: E-commerce, electronic markets and virtual exhibitions(Budiyanto et al., n.d.-a). Artists who have work sometimes market their products only by displaying their work at the location, of course people who pass by or visit their place can see their work. In this research we apply sophisticated information technology for exhibitions, both business actors or MSMEs and arts activists in presenting products. One way to increase MSMEs sales is through holding exhibitions where MSMEs players can meet directly with customers and buyers at exhibitions at scheduled times and places.(Hanugrah & Putri, 2021) This method is designed by carrying out 3D modeling, for each product the object can later be viewed using virtual reality technology. Later in virtual reality, consumers can enter one of the rooms to see in more detail the products of each business actor. Virtual reality makes it easier for consumers to get to know the products offered without needing to visit the business location directly. VR (Virtual Reality) technology is a technology that allows users to feel like they are in a virtual world in visual form and users can interact with a virtual environment simulated by a computer in the form of Android.(Marhamah Pratiwi et al., 2020). VR is a computer-synthesized three-dimensional environment in which a number of human participants, with an appropriate interface, can engage and manipulate simulated physical elements in the environment and, in some form, can engage and interact with representations of other humans, past, present or fictional , or with created beings(Okechukwu & Udoka, 2011).

The focus of this research is the technical way of creating virtual space or what is called virtual space and 3D objects in displaying products from MSMEs to be marketed to consumers using the virtual reality method using the Oculus Quest device, using black box testing to test the system and to get results. of respondents using usability testing which will later be seen whether this virtual reality exhibition system can be used by business actors and the public as consumers. where MSME players can interact and communicate virtually, making it easier for sellers and potential consumers to exchange information about products through 3D objects that are created and marketed. Of course, this method also saves consumers more costs in reaching the products being sold because they only have to go online and log in to the virtual space.

LITERATURE REVIEW

Based on previous research, several studies have revealed that virtual reality is a technology that allows users to interact with the environment in a virtual world that is simulated by a computer, so that the user feels like they are in that environment (Prambayun et al., 2022). There are also people who think that virtual reality is a three-dimensional virtual environment that is separate from the real world and is immersive so that users can interact directly with various digital objects in the virtual environment.(Ruangan et al., n.d.). Virtual reality is based on 3D images which are made from several 3D software such as Blender and Sketchup to be combined into a virtual reality creation application, namely Unity. The development of virtual reality has been widely carried out by previous research on tourism marketing, analyzing in depth to understand the concept of virtual reality to increase tourist visits to natural city fences. By using the SWOT analysis method and data from various information sources, the results of the analysis show that virtual technology provides an alternative for the tourism industry to revive itself, especially in the era of the Covid-19 pandemic which has occurred since the beginning of 2020. (Vavensy et al., 2022). Apart from that, there is also the use of virtual reality to sell web-based products using the virtual reality modeling language method or usually called VRML. From the results and conclusions obtained, home objects created using the VRML method are supported in the promotional space via internet media and also applications. The website that has been built meets customers' needs to obtain housing information and its objects and is equipped with home ownership

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credit application facilities(Gunawan & Indarto, 2005). In the form of education using virtual reality in designing and proposing a virtual reality system for college physical education, which consists of cloud platform methods, the Internet of Things, and mobile client applications. Results Through actual case analysis, it shows that virtual reality systems can provide a scientific reference model and basis for modern universities to use virtual reality technology to build distance education information systems(Ding et al., 2020). Development of a virtual reality-based planetarium application with the aim of the research being to help the general public understand basic astronomy, this research uses the ADDIE model. The ADDIE development model is one of several systematic learning design models(Tegeh & Kirna, n.d.). Using white box and black box testing to test the correctness of the application process, we got 100% valid results, and using usability testing, the application attractiveness scale reached 2.167, which is in the very good category.(Gede Turangga et al., 2018).

There is research into making an application called salve consultation for psychology. This research tests the feasibility of an application where anyone who wants to consult but is embarrassed to meet the psychology person in person. Application evaluation and measurement is carried out using usability testing using the System Usability Scale (SUS) questionnaire method(Goncalves & Boas, n.d.). The average result obtained after testing the salve application was 70.13.so it can be said that the Salve application prototype is included in the acceptable category, meaning it is quite good(Hidayat et al., 2022). Creating interactive learning media based on mobile virtual reality technology aims to produce interactive learning materials based on mobile virtual reality technology in DLE subjects. The product creation method applies the waterfall system development model. The results of material validation according to material experts reached a score percentage of 97.8 with a very valid category. According to media experts, the media assessment results reached 97.3, which is very valid. The students' practical assessment results reached 95 in the very practical category(Dwiansyah & Thamrin, n.d.).

METHOD

The research method uses the Luther method, which is a multimedia development method based on six stages, namely Concept, Design, Material Collecting, Assembly, Testing, and Distribution.(Pandhu Dwi Prayogha & Riyan Pratama, 2020). The diagrammatic model of the stages of the research method can be seen in Figure 1.
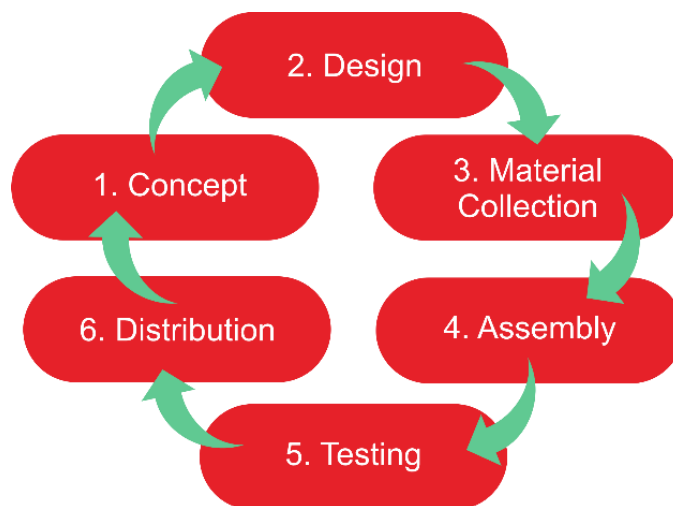

Fig 1. Stages of Luther's Method

Concept

The results of the concept stage are in the form of concept definitions obtained from an analysis of the results of interviews, analysis of the stages of use, problems, and analysis of proposed solutions, the following are concepts as in table 1 below:

Table 1. Concept Description

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Concept Category	Concept Description
Title	Virtual space for virtual reality exhibitions with Oculus Quest devices
Objective	Providing virtual space for MSMEs and art activists so that consumers can easily visit their products
Platform	Android & Desktop
Target user	Starting from 10 – 40 Years of Age

Interactivity:
    a. Touch
    b. Gyroscope
	- Select Room Space
	- Seeing 360 Degrees

Chart	3 Dimensions
Feature	Virtual Reality, Virtual Room Share, Product Info Text,

Design

The second stage is the design, display of features starting from logging in to entering the virtual space on the Simlab VR application and web, online virtual reality software. As shown in figure 2 below:
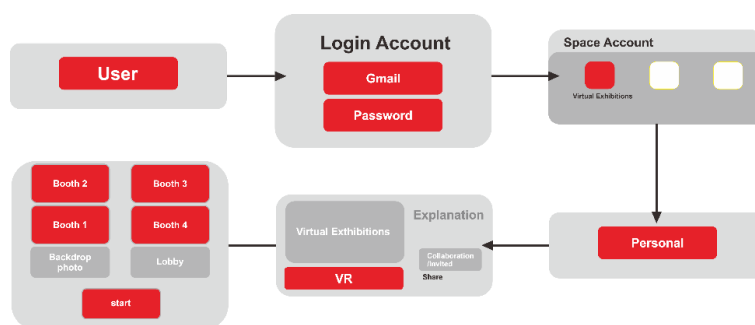

Fig 2. Login and Start VR Exhibition

The virtual reality design scenario, figure 2 explains the design flow steps:
a). The user installs the simlab application or software.
b). Users log in to simlab using a personal email.
c). The user has successfully logged in to Simlab.
d). Users search for accounts or rooms that create virtual reality events.
e). Users can access virtual space with virtual reality using the Oculus Quest tools.
f). Users get product information in the virtual exhibition room.
g). Users can communicate with product owners.
h). Users can move from room to another virtual room.
i). Users can log out at will and log in whenever you want.

Feature Performance in Design:
Based on the analysis of virtual reality development for digitizing virtual reality events, there are several functional requirements, namely:
a) The application can display 3D product objects in virtual reality events.
b) The application can allow users to see information about each product in the virtual reality room space.
c) The application displays information about the application developer.
d) The application can connect several rooms for each product or each MSME.
e). In the application there are sellers and consumers who are connected in one room to get product information.

Material Collection

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At the stage of collecting materials in the form of JPG type files from the product to be used as a texture for the object, which will later be made into a 3D object model so that it can be viewed using an Oculus Quest or smartphone in virtual reality. The process for collecting fig 3 is like this:

Kamera   Painting Product

Fig 3. Collecting Materials Using a Camera

Assembly

a. Photoshop functions to crop images that are used as textures to be inserted into 2D objects. Figure 4 is the stretch texture process.
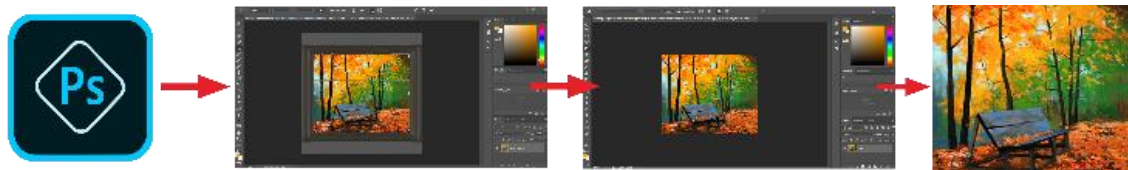

Fig 4. Photoshop Software Process

b. Sketchup software was used to create rooms and products in the virtual space of this research, as well as several objects based on 2D which then became 3D objects when imported into Simlab. As shown in the figure 5:

Fig 5. Creating 2D Sketchup Objects

the object is given a texture from the results of photoshop image editing, to produce an appearance

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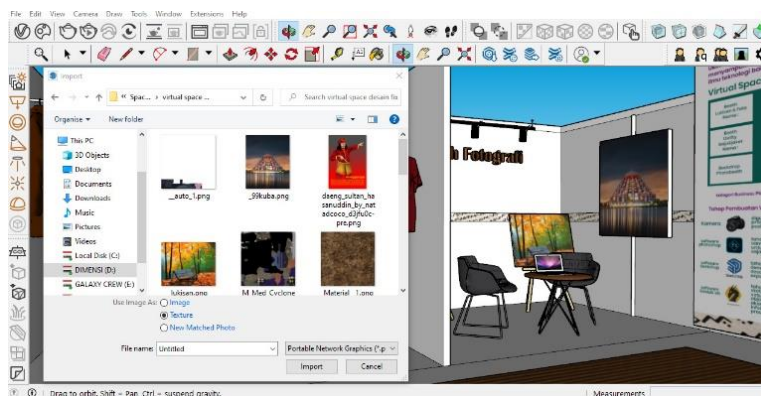according to the reality when in simlab, which will be seen in 3D visualization. As shown in the figure6:

Fig 6. Import Textures in Sketchup

so that objects can be imported into Simlab, the collada format is required. The custom environment feature allows us to upload 3D model files of our own design in collada.fbx, .obj or.glb/gltf format. Thus, 360° rendering and isometrics are no longer needed(Cininta & Wibisono, 2023). Figure 7 is an export process using the Collada format from SketchUp.

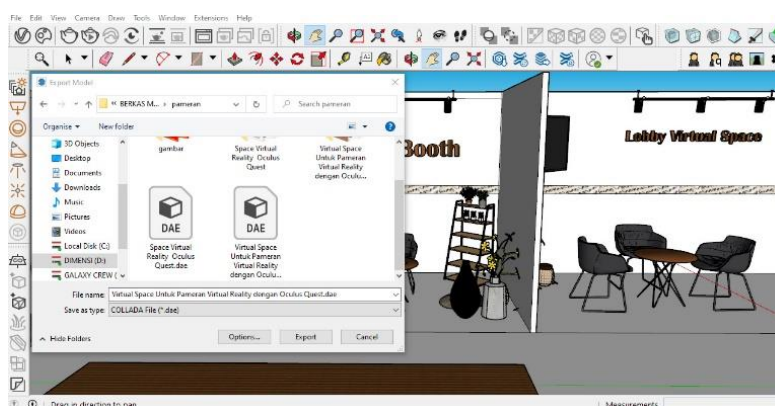Fig 7. Export Collada Format Objects

c. Simlab, after exporting the model in Sketchup, then switch to the Simlab online software to enter or import the model into a 3D object, first log in with your personal or user email then import the virtual exhibition design which has been converted into collada format. As shown in the figure 8:
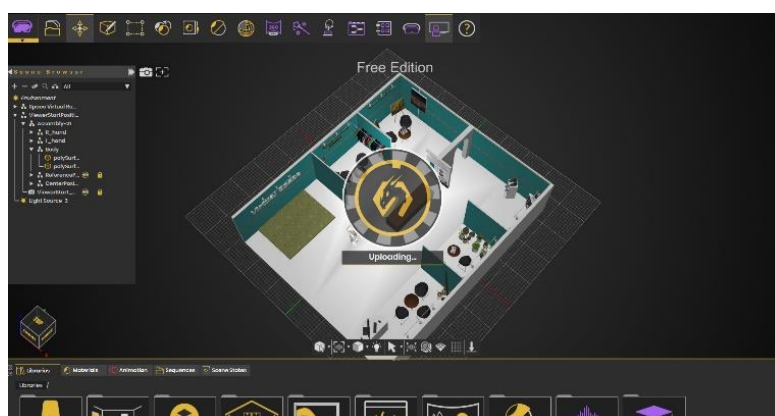

Fig 8. 3D Modeling Objects from SIMLAB

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RESULT

5. Black Box Testing

At this stage testing is carried out using blackbox testing, the blackbox testing method is useful for observing system functionality and knowing whether it is running as expected or not (Mutezar & Umniy Salamah, 2021b). Testing using this method is enough to see the suitability between input and output that occurs during the testing process. If in system testing the feature runs according to input and produces correct output then it is said to be valid or successful by user testing. The following table 2 is the results of black box testing.

Table 2. Black box testing

No.	Testing Activities	Testing	Inputs	Output	Results
1	Going to application	open the Application	login with Gmail	Enter on the main page	Valid
2	Search / Enter the name of the virtual space	The searched space appears	click virtual space exhibition	Show loading, enter the exhibition	Valid
3	Test player	Move to all positions	Cameras point in all directions	The camera sees all directions of the cursor	Valid
4	Product Review	Products appear 3D according to design	Click product information	Product description appears	Valid
5	Share virtual space	virtual space link appears	Send link Another user's kegmail virtual space	The virtual space link goes to the user's Gmail	Valid
6	End virtual space	Exit virtual space	Press the back button	Return to main page	Valid

The results of the blackbox testing above show that all the functionality in the system has successfully run according to the expectations of each user. The feature contained in black box testing is the identification of user stories in accessing virtual space.

The next step in the testing phase involves usability testing, and this is done to reduce the threshold of system efficiency. The effectiveness test results serve as a benchmark for how easily users can operate the system(Mutezar & Umniy Salamah, 2021b). Next, make a scenario table that will be given to the system tester to get an assessment of the results of the virtual reality exhibition space virtual system, there are the number of respondents and the sequence of scenarios that have been made. Table 3 is a table listing scenarios that will later be filled in for user testing and Table 4 is an information scale that becomes the value of each assumption given by the respondent.

Table 3. Usability Testing Scenario

	information code
P1	I find this virtual exhibition easy to use
P2	I think virtual exhibitions can help MSMEs
P3	I think this virtual exhibition will be in great demand
P4	I think there must be a technical person to use the system
P5	I think I still need to learn a lot to use the virtual exhibition system
P6	I think the products from the virtual exhibition have the same similarity to the original
P7	I feel that virtual exhibitions cannot be used with many people yet
P8	I find virtual exhibitions difficult to use
P9	I feel more confident
P10	I think it's better to use this with oculus quest

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Table 4. Information and Value Scale

Information Scale	Value
Strongly Disagree	1
Don't agree	2
Normal	3
Agree	4
Strongly Agree	5

The information scale contains "Strongly Disagree", "Disagree", "Normal", "Agree", and "Strongly agree" on the 10 SUS statement items according to subjective assessment. For items P1, P3, P5, P7, and P9, the contribution score is the scale position minus 1. For items P2, P4, P6, P8, and P10, the contribution score is 5 minus the scale position. Multiply the total contribution score by 2.5 to get the overall system usability score. SUS scores range from 0 to 100(Ruangan et al., n.d.). The following is the formula for calculating the Usability Testing Score :

$$Score\ SUS = ((R1 - 1) + (5 - R2) + (R3 - 1) + (5 - R4) + (R5 - 1) + (5 - R6) + (R7 - 1) + (5 - R8) + (R9 - 1) + (5 - R10)) * 2.5$$

Table 5. SUS Score Calculation Results

Respondent	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Amount	average amount
Respondent 1	4	1	4	1	4	2	3	3	2	3	27	67,5
Respondent 2	3	1	4	0	3	2	2	2	3	2	22	55
Respondent 3	4	1	3	0	4	0	4	0	3	2	21	52,5
Respondent 4	3	0	4	2	4	2	3	1	2	3	24	60
Respondent 5	4	0	4	1	4	1	2	3	3	3	25	62,5
Respondent 6	3	2	4	2	4	1	3	3	2	4	28	70
Respondent 7	3	2	3	0	3	3	2	1	4	3	24	60
Respondent 8	3	1	3	1	3	1	3	1	3	1	20	50
Respondent 9	4	0	4	0	3	1	3	0	4	0	19	47,5
Respondent 10	1	0	1	0	3	2	1	0	4	0	12	30
Respondent 11	4	1	4	1	4	0	3	3	4	3	27	67,5
Respondent 12	3	0	2	0	1	3	2	0	3	1	15	37,5
Respondent 13	2	2	2	2	3	1	2	1	2	2	19	47,5
Respondent 14	3	0	3	0	4	3	4	1	3	2	23	57,5

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Respondent 15	4	0	4	2	4	1	4	4	2	4	29	72,5
Respondent 16	3	3	4	0	3	1	2	1	2	2	21	52,5
Respondent 17	3	1	4	1	4	1	3	1	3	2	23	57,5
Respondent 18	4	0	4	1	4	0	3	3	3	4	26	65
Respondent 19	3	0	3	2	3	1	2	1	4	3	22	55
Respondent 20	3	1	3	1	3	2	1	3	3	2	22	55
Respondent 21	3	1	3	1	3	2	2	2	2	2	21	52,5
Respondent 22	3	0	4	1	4	1	3	1	3	3	23	57,5
Respondent 23	3	0	4	2	3	1	1	1	2	3	20	50
Respondent 24	4	0	4	1	3	1	3	2	4	3	25	62,5
Respondent 25	3	1	3	1	3	1	2	1	3	3	21	52,5
Respondent 26	4	1	4	1	4	0	3	2	3	3	25	62,5
Respondent 27	3	1	2	0	2	2	1	0	2	1	14	35
Respondent 28	3	0	3	0	3	1	4	0	3	0	17	42,5
Respondent 29	4	0	4	0	3	1	3	0	2	1	18	45
Respondent 30	3	1	3	1	3	1	3	1	3	1	20	50
Respondent 31	4	0	4	0	4	0	4	1	4	4	25	62,5
Respondent 32	3	2	3	2	3	1	2	1	2	2	21	52,5
Respondent 33	3	1	3	1	3	1	3	1	3	1	20	50
Respondent 34	4	1	4	1	3	2	3	2	3	2	25	62,5
Respondent 35	3	1	4	1	4	1	4	1	3	1	23	57,5
Respondent 36	4	1	3	0	4	1	3	0	4	1	21	52,5
Respondent 37	4	0	3	0	3	0	2	1	3	2	18	45
Respondent 38	4	0	1	1	2	3	2	0	2	2	17	42,5
Respondent 39	2	2	2	2	2	2	2	2	2	2	20	50

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Respondent 40	4	0	4	0	4	0	4	0	4	0	20	50
Respondent 41	3	1	4	1	2	2	3	2	3	2	23	57,5
Respondent 42	3	1	4	1	3	1	4	2	3	2	24	60
Respondent 43	3	3	4	3	4	3	4	3	3	3	33	82,5
Respondent 44	3	1	3	1	3	1	2	1	2	2	19	47,5
Respondent 45	3	1	3	1	2	2	2	1	2	2	19	47,5
Respondent 46	0	1	3	1	3	1	1	1	3	2	16	40
Respondent 47	3	0	3	1	3	1	4	1	4	3	23	57,5
									Average value			54,25531915

DISCUSSIONS

A total of 47 respondents were obtained in testing the virtual reality exhibition space system. From the answers given by the respondents, then they are calculated to get the calculation results of each statement and then add up the total weight to produce the average value of the entire SUS Score test results. SUS Score Analysis is an assessment of the usability aspect with global (effectiveness, efficiency, and satisfaction) subjectively felt by users. If the average results obtained are below 50%, then the system is categorized as not feasible, but if it is above the average of 50%, it is said to be feasible or Ok from the user, up to a higher percentage level, it can be said that the category is very good for use by the user or users. As shown in table 10 as follows:
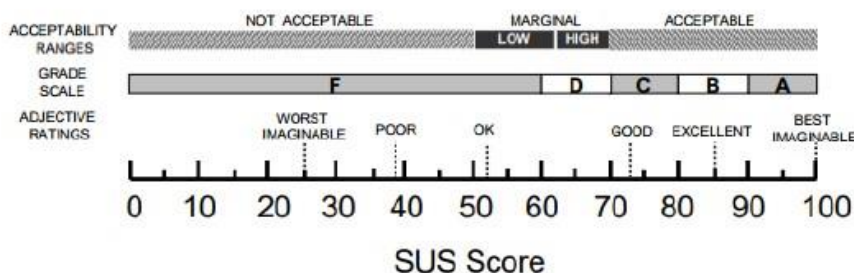

Fig 9. SUS Score assessment

CONCLUSION

After summing up the total respondents' assessments and calculating the number and looking for system testing results, the number obtained for the average value was 54%. This average number exceeds 50% of the standard SUS Score Analysis, so the virtual reality exhibition space is categorized as suitable and OK for use by users. And it can also help MSMEs in carrying out virtual reality-based online marketing.

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