Journal of Theoretical and Applied Information Technology
15th August 2022. Vol.100. No 15

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

OPENING YOUR EXTENDED REALITY EYE FOR EASY OF USE DURING HOSPITAL SURGERY

H. LIU[1] , P.S. JOSEPHNG [2*], K.Y. PHAN[3], X. GONG[4]

[1] Industrial and Commercial College, Jinan Engineering Polytechnic, Jinan 250100, Shandong, China;
[1] Faculty of International Education, New Era University, 43400 Kajang, Selangor
liuhua_china@163.com, liuhua1103@e.newera.edu.my
[2] Faculty of Data Science and Information Technology, INTI International University. Persiaran Perdana BBN, Nilai 71800, Negeri Sembilan, Malaysia; joseph.ng@newinti.edu.my.
[3]Faculty of Information and Communication Technology, Universiti Tunku Abdul Rahman, Kampar, Perak, Malaysia; phanky@utar.edu.my
[4] Faculty of Computer Science and Information Technology, Universiti Putra Malaysia. 43400 UPM Serdang Selangor Darul Ehsan, Malaysia; gs64174@student.upm.edu.my

ABSTRACT

Extended Reality Smart Glasses is a way to use scientific and technological innovation to introduce a visual atmosphere that connects the physical and virtual worlds. This study investigated the value and possibility of XRSG for clinical surgical services. Data collection is conducted through the experience of medical experts. Combining the "*Technology Acceptance Model*" with the *"Theory of Planned Behavior"*, a new Extended Reality Technology Behavior Model (XRTBM) is constructed through the combination of human-visible social control and data innovation exploration. To improve the accuracy of the review, a triangular mixed research method was used. From the collected information, the SEM survey was used to reflect the relationship between the factors. Reliable positive results demonstrate that the use of XRSG by clinical specialists helps improve the structure, intuition, standardization, and clarity of clinical images, increasing productivity and reducing method time. The significance of this study is that patients can feel the convenience and availability of XRSG through their behavior, which provides a prerequisite for the implementation of XRSG in the medical process.
Keywords: *Extended Reality, Three-dimensional Image, Visualization, Technology Behaviour Model*

1. INTRODUCTION

In recent years, extended reality technology has been used in many fields, especially in the field of medical systems [28]. At present, wearable devices are mainly used in telemedicine, nursing, ophthalmology, and many other environments, but have not yet been used in surgery. Surgeons need to borrow a variety of visualization instruments and physiological monitoring equipment during surgery. Given the multi-monitor observation, the surgeon needs to monitor each display image in conjunction with the limb movement. Secondly, in some operations, it is necessary to borrow a microscope for surgery, which is often cumbersome and has a narrow operating space. And the image is affected by the transmission, and sometimes there is an error. Using extended reality surgery can use 3D stereoscopic images to perform image processing on human structures, converting 2D images of instruments into 3D [4]. Eye-tracking interaction can change the surgeon's control of images and instruments during surgery, freeing hands to better operate instruments to complete the surgery [25]. The hybrid interactive approach also enables telesurgery, as well as multi-specialist online surgical discussions. save more patients.

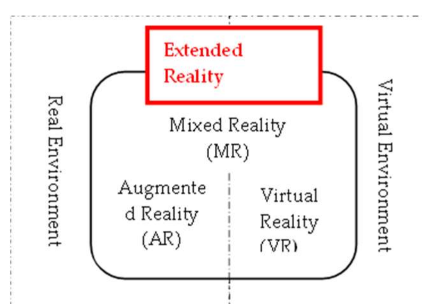

Figure 1. The Distinction Between Smart Glasses In Virtual And Real Environments

Extended reality is a real and virtual all-around three-dimensional image formed by a computer system [3]. It realizes the seamless connection between the virtual environment and the real environment [15][41]. And the visualization is strong, which can bring users a deeply immersive experience. As shown in Figure 1, the Extended Reality is virtual imaging by virtual reality [42]. The augmented reality technology makes the image three-dimensional, and mixed reality is used to superimpose the image so that the graphics tend to be more realistic and the perfect combination of the real environment [16][32]. Scanning with the XR system, the input of instrumental images, and the combination of body structure data can create an overlapping image of the patient's entire body [49]. This makes it convenient for surgeons to calibrate and measure tissues and organs during surgery, as well as locate blood vessels and nerves [30]. Secondly, in the neurovascular anatomy operation, XR can mark blood vessels and nerves in different colors through the system [20], which is also conducive to the rapid separation of doctors and avoids the destruction of tissue fibers.

We found that extended technology could theoretically be used in clinical surgery, but for many reasons, it has not been used in surgery before. This study aimed to investigate the practical use of extended reality technology in surgery, particularly in terms of image, transmission, and tracking enhancements to surgery. Through interviews with experts, the use of XR in surgery was accepted and endorsed. This time, a more appropriate theoretical model, the Technical Behavioural Model, was proposed to avoid the shortcomings of both TAM [10] and TPB [5]. A triangulated mixed research approach was used in this study to avoid the limitations of a single research method. The data were analyzed using CB-PLS SEM statistics. CB-SEM facilitated the certification of the simulation model and PLS was used to analyze data from various models. The details of this paper are as follows. Firstly, the hypotheses and theories are presented through the existing literature. Secondly, the research protocol and data analysis were used. Finally, it is concluded that XRSG improves surgical images, human eye visibility, interactivity, and operational specifications. It ensures that the procedure is completed with high quality and reduces operative time. This study provides technical support for future XR procedures.

2. LITERATURE REVIEW

2.1.1. Technology Acceptance Model (TAM)

Al-Qaysi discovered the *"Technology Acceptance Model"* (TAM) from rational behavior theory to study the rational behavior of users when receiving information or technological systems [1]. TAM is designed to allow users to determine the human impact of technology acceptance through experiential perceptions of *usefulness and ease of use*[43]. Usefulness is how productive people can be by using new technologies or specific systems. Perceived ease of use that people do not spend much time and effort using new technology or a specific system.

2.1.2. Theory of Planned Behavior (TPB)

Ajzen proposed the *"Theory of Planned Behavior"*, which is an internal psychological change that explains behavior changes through people's subjective intentions and attitudes [2]. It is determined by individual behavioral attitudes, subject norms, and perceived behavioral control (PBC), and PBC can also directly affect behavior [7]. TPB believes that the more positive a person's attitude, the stronger the subject norm and the PBC, the stronger the intention to perform a certain behavior, and the more likely it is to eventually perform a certain behavior [44]. The addition of the PBC variable is based on the rationale that PBC does not require complete volitional control to predict behavior, and that PBC may explain why intention does not always predict behavior [50].

2.1.3 Technological Behavior Model (TBM)

When medical professionals use extended-display smart glasses to perform surgical procedures, 3D stereoscopic images of body structures help label and localize patient lesion structures [23]. Doctors can feel the usefulness of the new technology by using it. At the same time, smart glasses have an eye-tracking function to avoid the doctor's head movement during the operation, monitor the doctor's operating specifications, reduce the risk of surgery, and reflect the ease of use of XRSG. Relevant use attitudes, divided into negative and positive effects of individual behavior, are mediating conditions for subjective awareness of TAM [1]. The choice of conscious behavior when using XRSG reflects the positive attitude of users to the technology. This suggests that TAM is suitable for this study. According to TPB, it analyzes PBC, focusing on the influence of human subjective consciousness on the corresponding behavior of actual things cognition, while TAM influences actual actions through

Journal of Theoretical and Applied Information Technology
15th August 2022. Vol.100. No 15

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

experience, namely the external variables Changes in perceived usefulness and ease of use. Neither can be isolated because human behavior responds differently when adopting technology. In this study, technical analysis was applied to SG. By analyzing the influence of external factors of extended reality technology and the subjective internal psychological attitude of users, a more realistic response can be made to the behavior changes of users using extended reality smart glasses. Therefore, this study proposes another hypothetical structure, the *"Technology Behavior Model"*, to exhaustively dissect how human behavior is affected by intrinsic awareness and extrinsic perception factors in actual technology adoption behavior, and to apply the "*Technological Behavior Model"* to technology in behavioral research. Use extended reality technology.

2.3 Extended Really in surgery

2.3.1 Extended Really Usefulness (XRU)

XRU refers to the use of extended reality in surgical procedures by medical professionals to perform better operations. Using the XR system, with the external visual image data instrument, the sensor is transmitted to the computer to construct a three-dimensional human body model, which enhances the user's immersive experience. Human-computer interaction with eye-tracking frees up the hands of medical professionals [18]. Accordingly, the theory is as per the following:

H1: XRU positively affects the goal to embrace SGs (ITASG) careful way of behaving of clinical specialists.

2.3.2 Extended Reality Ease of Use (XREU)

XREU refers to the ability of medical specialists to facilitate surgical operations and reduce operative time through the use of XR procedures. XR systems use complementary head/eye tracking to enhance visual feedback. XR supports participation in the decision-making process, enabling manipulation and psychomotor skills on realistic models [21]. It can address the more complex and diverse common problems of MRI. As a result, surgical specialists using XR can perform more complex procedures, and changes in interaction can better simplify the procedure. Ease of use has a positive effect on the surgical specialist's procedures. In this manner, the theory is as per the following:

H2: XREU positively affects the expectation to embrace SGs (ITASG) careful way of behaving of clinical specialists.

2.3.3 Image Modeling (IM)

IM refers to multispectral fluorescence imaging through XRSG, which is a new technology. It enables real-time contrast imaging with an anatomical view of the human body on existing MR imaging. The module is built using external visualization instrument data such as neuro angiography, MRI, CT, etc. to assist in imaging. Through spectral imaging technology combined with a surgical microscope or internal lens, using different color light source focus display [29]. Form a virtual-realistic 3-dimensional spatial image structure. It overlaps with the lesion during surgery, facilitating the stripping of extraneous tissues and enhancing visualization [6]. At the same time, it can facilitate calibration, focus, and measurement. The improved level of IM allows medical specialists to get rid of the dependence on the human eye and to have a clearer and broader field of vision. Promote the active use and acceptability of XRSG to users. In this manner, the theory is as per the following:

H3: IM positively affects clinical specialists working XRU.

H4: IM positively affects clinical specialists working at XREU.

2.3.4 Interaction Design (ID)

ID refers to XR's interaction technology, which adds eye-tracking methods to existing verbal and gestural interactions. Eye-tracking currently uses scleral coil search, and electrical, optical, and visual imaging techniques [40]. The scleral motion pupil movement, sensing the external light source, generates a voltage difference under the magnetic field, which is used to identify the eye position movement signal source, thus achieving the button control [22]. In human-computer interaction, eye-tracking can be used with related variables for multimedia learning, which can overcome some complex advanced multi-purpose intelligent interactions. It allows for better observation and monitoring of patient physiological indicators and improved visualization during surgery. It has a positive effect on surgical operations. Accordingly, the speculation is as per the following:

H5: ID positively affects clinical specialists working XRU.

H6: ID positively affects clinical specialists working XREU.

2.3.5 Operation Norm (ON)

ON means that XR surgery can help surgical specialists standardize procedures. XR has a zoomable high-definition camera that can monitor the operating table. The equipment usage process can show and guide the expert's usage method through voice interaction and display [46]. The timing of surgery is often more uncertain depending on the patient's condition. High concentration for a long time often results in fixed behavioral reflexes in brain nerves and limbs. Some reflexes are emergency responses of the human body and are completed in an unconscious state [37]. XR's monitoring system is based on computer settings and is not affected by the external environment and time, which is conducive to monitoring people's behavior for a long time. It avoids some operational mistakes in the operation and improves the success rate of the operation. It can effectively enhance the role of XRU and XREU in the surgical process. Accordingly, the theory is as per the following:

H7: ON positively affects clinical specialists working XRU.

H8: ON positively affects clinical specialists working XREU.

2.3.6 Usage Perspicuity (UP)

UP refers to the visual clarity of the image. The visible light wavelength of the human eye is the electromagnetic wave of 390nm-780nm, and the best resolution is 567 million pixels (5.67MEGA) [27]. But from a wide angle, it is relatively narrow, especially in a low-light environment, which the human eye is unable to recognize [48]. The zoom wide-angle camera can better combine the microscope to observe the subtle environment of the lesion. Makes up for the visual ability that the human eye cannot focus on. Enhanced image display clarity. During the operation, it can better observe the fibers inside the tissues and organs, the inner surface cortex, and other structures, which is conducive to the minimally invasive operation of the surgery. Consequently, the theory is as per the following:

H9: UP positively affects clinical specialists working XRU.

H10: UP positively affects clinical specialists working at XREU.

2.4 Theoretical Model

This examination extends the potential outcomes of utilizing practical SG during the medical procedure. The use of broadened reality innovation is accomplished using human social mindfulness. As displayed in Figure 2, considering the proposed new Technology Behaviour Model (TBM).

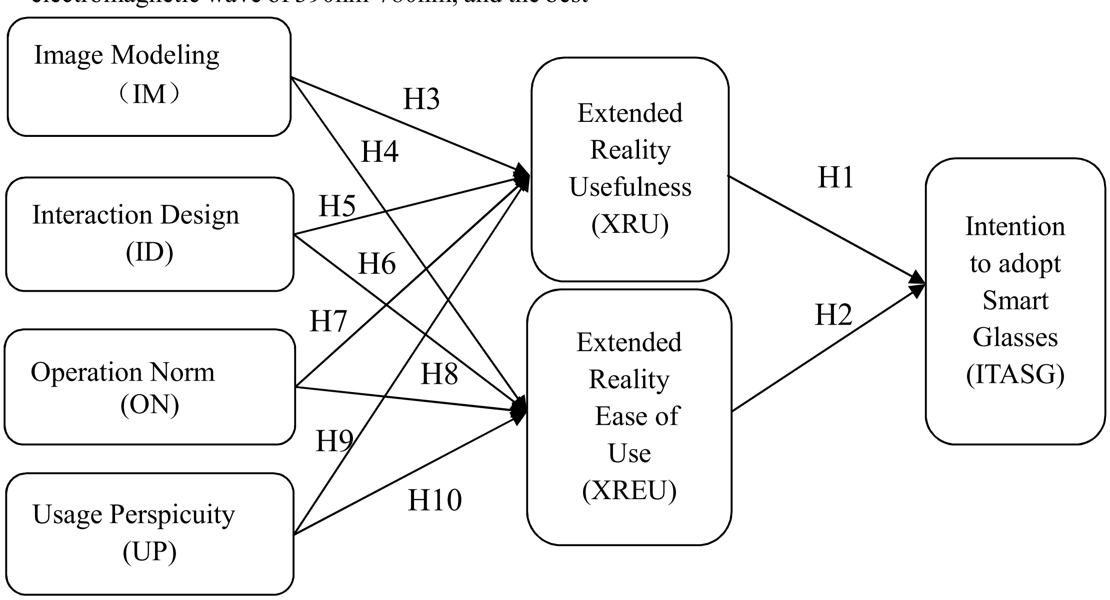

Figure 2. Proposed Relationship Model.

3. METHODOLOGY

Research configuration is an examination technique that consolidates various components of rationale, research objective inquiries [38], and information investigation cycles to test the legitimacy of true theories and acquires research results [8]. To respond to and solve the problems in this review, quantitative test, exploratory exploration, and cross-sectional exploration strategies are adopted. In the first place, quantitative

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

examinations can utilize numerical techniques to break down the gathered information and perform logarithmic activities and factual investigation [31]. This study will gather essential information. A quantitative examination can assist analysts with dissecting the information deliberately. Besides, exploratory examinations are creative and disclosure studies [33]. Although XRSG has been used in the medical system, they are mainly used in teaching and remote consultation. There is no relevant data to prove the daily use in surgery. Due to the lack of relevant reference materials and incomplete research, the study intends to conduct an exploratory review of this review. Third, cross-sectional investigations can work with information assortment by analysts without influencing different factors, save information assortment time, and decide potential connections [19]. This exploration technique is directed at a specific moment or over some time. The information gathered in this study was a one-time occasion and was gathered for more than about fourteen days.

This time, the convenient sampling method is adopted, which is convenient and fast. A visit to a medical specialist in a hospital in Kuala Lumpur, Malaysia. Because they are the performers, the main users. The desire for XR surgery can be reflected through their experience feedback. This time, 300 samples were collected. Due to the lack of data at the time of collection, a total of 298 valid data were collected. The collected data met the requirements of minimum data 273 for the study. Data collection is sent through online mail, Facebook, and other related communication software. Questionnaire questions involve XR image usage, clarity and manipulation, and other related issues, and the questions are derived from relevant peer-to-peer research articles.

4. DATA ANALYSIS

Male respondents represented 57.33% and female respondents represented 42.64%. This study doesn't think about individuals younger than 20. Respondents matured 20-45 represented 85% of the absolute number of individuals in this study. Simultaneously, the respondents have commonly advanced education levels, of which 53.33% have a college degree and 36.67% have a postgraduate certificate. From the pay investigation in Table 1, it very well may be seen that more than 33% of the respondents have earnings between RM5000-8000, and the majority of them are youngsters matured 20-45. They can all the more likely mirror the new age's perspectives on XRSG.

Table 1. Demographic Analysis

Demographic characteristic	Project	Counts	Percentage (%)
Gender	Male	172	57.33%
	Female	128	42.64%
Age	20-35	108	36.00%
	36-45	147	49.00%
	46-55	37	12.33%
	More than 56	8	2.64%
Marital status	Single	105	35.00%
	Married	195	75.00%
Education	Undergraduate	190	53.33%
	Postgraduate	110	36.67%
Income	Less than RM3000	10	3.33%
	RM3000-5000	22	7.33%
	RM5000-8000	117	39.00%
	RM8000-10000	96	32.00%
	More than RM10000	55	18.33%
Industry	Service occupation	192	64.00%
	Non-service occupation	108	36.00%

4.1 Statistical analysis

SmartPLS 3.3.3 is one of the most commonly used software for statistical analysis of SEM [18]. The software was chosen for this study for several reasons. 1. Applicable to unconventional research, this research base is large and suitable for CB-SEM research. 2. This study uses exploratory research, and variance-based PLS can transform exploratory research into experimental research. In the modeling of the causal relationship of variables, it can be better reflected [44]. 3. SEM is mostly used for triangular models, and researchers can use multivariate models such as internal and external models of factor sources, effective intervals, effect sizes, and influencing molecules to systematically analyze the data [34]. It is beneficial to the accuracy and authenticity of the experimental results.

4.1.1 Common method bias

The information in this study was gathered utilizing a survey in particular, and "Common Method Bias" (CMB) needs to be considered [13]. This is because the same person needs to perceive and answer multiple questions during the interview, which is a common bias change caused by the measurement factor. CMB compares actual slave loadings to method factors by measuring variables. The common method bias is added to the model as a latent variable. If the model has a significantly better fit with the method bias latent variable than without the common method bias latent variable, then the common method bias effect is tested, while the inclusion of the common method bias latent variable is tested. A model of the latent variable for common method bias and estimates of the relationship between prediction and criterion variables control

Journal of Theoretical and Applied Information Technology
15th August 2022. Vol.100. No 15

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

Table 2. Common Method Factor

Latent Construct	Indicators	*ubstantive factor loading (Ra)*	*ubstantial variance square Ra²)*	*ethod factor loading (Rb)*	*ethod variance square Rb²)*
ITASG	ITASG1	*.89*	*.7921*	*0.059*	*.003^{NS}*
	ITASG2	*.938*	*.879844*	*0.075*	*.005625^{NS}*
	ITASG3	*.935*	*.874225*	*.05*	*.0025^{NS}*
ID	ID1	*.928*	*.861184*	*.025*	*.000625^{NS}*
	ID2	*.918*	*.842724*	*0.112*	*.012544****
	ID3	*.932*	*.868624*	*.109*	*.011881****
IM	IM1	*.9*	*.81*	*0.002*	*.000004^{NS}*
	IM2	*.941*	*.885481*	*.054*	*.002916^{NS}*
	IM3	*.91*	*.8281*	*.093*	*.008649^{NS}*
ON	ON1	*.935*	*.874225*	*0.148*	*.021904***
	ON2	*.946*	*.894916*	*.06*	*.0036^{NS}*
	ON3	*.925*	*.855625*	*.026*	*.000676^{NS}*
XREU	XREU1	*.9*	*.81*	*0.128*	*.016384****
	XREU2	*.917*	*.840889*	*.069*	*.004761^{NS}*
	XREU3	*.943*	*.889249*	*.032*	*.001024^{NS}*
XRU	XRU1	*.926*	*.857476*	*0.055*	*.003025^{NS}*
	XRU2	*.929*	*.863041*	*.24*	*.0576**
	XRU3	*.895*	*.801025*	*0.189*	*.035721***
UP	UP1	*.928*	*.861184*	*0.002*	*.000004^{NS}*
	UP2	*.925*	*.855625*	*0.031*	*.000961^{NS}*
	UP3	*.903*	*.815409*	*.032*	*.001024^{NS}*

Notes: b. *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$, NS insignificant.

for common method bias [34]. From Table 2, it can be found that the average ratio of Ra2 to Rb2 is 91.6:1, which is higher than the method variance, and the Ra data is greater than 40%, which indicates that CMB does not hold.

4.1.2 Assessing the outer measurement model

When evaluating external models, one usually focuses on reliability, validity, and interval validity [12]. Reliability is expressed by the Roh A value, which in general cannot be lower than 0.7 [33]. The standard threshold of composite reliability is greater than 0.8. The reliability of each variable is higher than the threshold, indicating that the research direction is true and reliable in Table 3. The average variance extraction (AVE) is an important indicator to measure convergent validity. The average variance value is above 0.5, and the threshold is 0.7 [11]. The AVE in the table is all greater than 0.84, and the convergent validity meets the requirements. Three different interval methods including cross-loading, Fornell-Larcker criteria, and Hetero-Trait-Mono-Trait (HTMT) were used in discriminant

validity, and the relevant data corresponded to Tables 4, and 5, and 6. The validity of each table The factors are all in the normal range.

Table 3. Convergent Validity and Construct Reliability.

Latent Construct	Items	Loadings	Standard Deviation	RhoA (ρA)	Composite Reliability	Average Variance Extracted (AVE)
ITASG	ITASG1	0.892	0.385	0.914	0.944	0.849
	ITASG2	0.933				
	ITASG3	0.937				
ID	ID1	0.928	0.377	0.921	0.948	0.857
	ID2	0.923				
	ID3	0.927				
IM	IM1	0.903	0.397	0.908	0.941	0.841
	IM2	0.941				
	IM3	0.906				
ON	ON1	0.933	0.384	0.929	0.954	0.875
	ON2	0.944				
	ON3	0.928				
XREU	XREU1	0.893	0.389	0.917	0.943	0.846
	XREU2	0.923				
	XREU3	0.943				
XRU	XRU1	0.928	0.397	0.907	0.941	0.841
	XRU2	0.927				
	XRU3	0.895				
UP	UP1	0.923	0.395	0.910	0.942	0.844
	UP2	0.922				
	UP3	0.910				

Table 4. Fornell-Larcker Criterion

Latent Construct	ITSSG	ID	IM	ON	XREU	XPU	UP
ITSSG	0.921						
ID	0.594	0.926					
IM	0.594	0.621	0.917				
ON	0.554	0.617	0.495	0.935			
XREU	0.592	0.595	0.525	0.571	0.920		
XPU	0.703	0.681	0.587	0.586	0.603	0.917	
UP	0.623	0.570	0.570	0.401	0.478	0.544	0.918

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

***Table 5.** Hetero-Trait-Mono-Trait (HTMT).*

Latent Construct	ITASG	ID	IM	ON	XREU	XRU	UP
ITASG							
ID	0.642						
IM	0.654	0.678					
ON	0.601	0.665	0.541				
XREU	0.642	0.650	0.570	0.622			
XRU	0.772	0.743	0.649	0.638	0.662		
UP	0.684	0.624	0.625	0.436	0.519	0.597	

Table 6. The outcome of the Structural Model Examination

PLS Paths	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values	2.5%	97.5%	Remarks
UP -> XRU -> BI	0.031	2.790	0.005	0.031	0.153	Yes
IM -> PU -> BI	0.036	2.587	0.010	0.026	0.166	Yes
ON -> PU -> BI	0.032	3.754	0.000	0.064	0.189	Yes
ID -> PEOU -> BI	0.023	2.759	0.006	0.027	0.122	Yes
UP -> PEOU -> BI	0.018	2.044	0.041	0.008	0.079	Yes
ID -> PU -> BI	0.037	5.105	0.000	0.125	0.272	Yes
IM -> PEOU -> BI	0.020	2.008	0.045	0.008	0.088	Yes
ON -> PEOU -> BI	0.026	2.937	0.003	0.035	0.139	Yes

NOTES: ITASG= INTENTION TO ADOPT SMART GLASSES; ID= INTERACTION DESIGN; IM= IMAGE MODELING; ON= OPERATION NORM; XREU= EXTENDED REALITY EASE OF USE; XRU= EXTENDED REALITY USEFULNESS; UP= USAGE PERSPICUITY

Table 7. PLS Predictive Summary.

Endogenous construct	RMSE	MAE	Q2_predict
ITASG	0.722	0.59	0.486
XREU	0.753	0.618	0.442
XRU	0.683	0.506	0.541

Table 8. PLS Predict Results.

	PLS-SEM			Linear model benchmark		
	Q2_predict	RMSE	MAE	Q2_predict	RMSE	MAE
ITASG1	0.402	0.834	0.687	0.523	0.701	0.58
ITASG2	0.384	0.796	0.662	0.57	0.683	0.552
ITASG3	0.442	0.779	0.652	0.448	0.802	0.655
XREU1	0.96	0.763	0.333	0.398	0.912	0.736
XREU2	0.878	0.72	0.407	0.471	0.83	0.683
XREU3	0.882	0.73	0.371	0.38	0.875	0.724
XRU2	0.915	0.704	0.38	0.41	0.892	0.689
XRU3	0.776	0.601	0.47	0.522	0.737	0.578
XRU1	0.888	0.692	0.502	0.535	0.858	0.656

Table 9. PLSc-Effect (f^2).

Predictor Construct/ Dependent Construct	ID	IM	ITASG	ON	UP	XREU	XRU
ID			0.298			0.257	0.385
IM			0.142			0.155	0.171
ON			0.209			0.307	0.221
UP			0.126			0.129	0.155
XREU			0.239				
XRU			0.613				

Table 10. Affirmative coefficient

	R Square	R Square Adjusted
ITASG	0.627	0.625
XREU	0.512	0.505
XRU	0.632	0.627

4.2.3. Inspecting the inner structural model

When examining the internal structure, the standard deviation between the variables was examined in Table 6, and the variances were all close to 0, indicating that the internal structure error was very small [11]. P values were all less than 0.05 and the structure was significant. The maximum and minimum values of the confidence interval are in [1,-1]. There is an interactive relationship between the respective biological variables of the proposed model. The inward construction of the model is laid out.

Q2 is the same important indicator for predicting the dependent variable and structure. When Q2 >0, the prediction of the structural model is the same as the hypothesis. From Tables 7 and 8, it can be seen from both PLS_SEM and linear models that the subdivision variables and the average variable are in line with the threshold. This demonstrates that the hypothetical model is prescient. In the investigation of exogenous factors in PLSc, the effect sizes of dependent variables from weak to strong are 0.02, 0.15, and 0.35 [24]. From Table 9, it can be seen that except for IM, UP has a weak effect on ITASG, and other factors have strong effects on ITASG. The threshold for calculating R for the fit of the model is [0,1]. It can be seen from Table 10 that R is higher than 0.5, and the closer the fitting degree is to 1, the better the fitting degree of the variables and factors in the model.

4.2.5 Importance of performance map analysis

Potential variables and path coefficients are detected using an importance-performance map analysis, which evaluates the mean of the results. It is an important indicator to measure the impact of IM, ID ON, and UP variables ON the average quality of the ITASG. It can be seen from Table 12 that the data are all greater than the threshold value of 60, indicating that each variable has a positive impact on users' use of XRSG.

5. FINDING AND DISCUSSION

XRU and XREU have an appreciable effect on the surgical specialists' operation XRSG The usefulness of extended reality can be reflected in detailed operations such as spinal perforation, brain tumor, and nerve and blood stripping in surgical operations [14]. During the operation, the image 3D function of the XR system can be used to construct three-dimensional images, which is conducive to the identification of various organs and tissues [9][45]. The complex cone fibers are intertwined in the intricate environment to improve stripping and operating efficiency. Dai et al used SG for precise positioning during spinal surgery and avoided nerve damage. In addition, XR can effectively help surgeons to support minimally invasive surgery for cardiac revascularization reconstruction, combine CT images to construct a three-dimensional image of the heart organ, and label different internal tissues with different colors [47]. Provides a high-definition visual map for the implementation of the surgery, and calibrates the size. Therefore, H1 is supported. The ease of use of XR is mainly reflected in the reduction of the operation time. Due to the above-mentioned changes in the view mode, the image recognition time during the operation is reduced, resulting in a shorter operation. That is to say, in the existing same period, XR surgery is significantly faster than conventional surgery when compared with surgery without XR [39]. Hence, H2 is supported. In this study, IM specifically refers to 3D images of human tissues and organs. This imaging principle is very complicated, but the effect is very good [32]. The first is the collection of external data, including visual inspection instruments, CT, MRI, electrocardiogram, etc. The second is the collection of intrinsic data through the connection of endoscopes, microscopes, and some physiological indicators of patients. Image imaging is performed again in combination with the human body structure model diagram. All of them have a positive impact on the search and localization of patient lesions for surgical experts. It can be seen that H3 and H4 are established.

ID is different from the previous single voice interaction, mainly using eye-tracking. The hands of the surgeon are required to operate instruments or instruments during surgery [26]. Not suitable for keyboard and mouse operation. It is easy to cause cross-contamination of the operating table. Eye-tracking is conducive to image switching and viewing, making the original operation more convenient and fast. Therefore, H5 and H6 are supported. From the assumption of ID, it can be seen that the liberation of the hands is beneficial to the operation of the surgical expert, not only that but also the error caused by the human factor in the operation of the instrument [17]. Hence, H7 and H8 are supported. UP focuses on making up for people to regulate and supervise. Pre-judgment prompts for wrong operations. Avoid errors caused by human factors during surgery. Hence, H7 and H8 are supported. UP focuses on making up for the wide angle that cannot be viewed by the human eye and improving the microscopic effect [14]. Surgeons can use PicoLinker smart glasses to efficiently and quickly complete guide wire insertion and pin positioning. This shows that H9 and H10 are established.

It appears that current XR can support surgical procedures, especially in image imaging and visualization. Complete 3D technology data processing can effectively improve the clarity of the surgical guide. The transmission picture is accurate and efficient. The hybrid interaction of eyeglass tracking, gesture, and language can effectively meet the needs of complex surgical environments [16]. And provide technical support for remote surgery. The feasibility of this research theory is confirmed.

6. CONCLUSIONS AND FUTURE

The focus of this study is on the practical impact of the use of XRSG in surgery. Because it is a clinical operation, the target population of the study should be professional. The triangular model was adopted to avoid the errors caused by the limitations of a single research method on the research results. The data analysis of this study was carried out using CB-SEM and PLS-SEM. It not only meets the verification of the theoretical framework of big data but also adopts the multiple regression method. A new theoretical framework-behavioral-technical model is proposed. More in line with research on the effects of human behavior. Emphasis is placed on the influence of 3D image modeling of medical human body structure on surgery. The new modeling method changes the visualization of the original image. But there are still some deficiencies in the research. First, this study was limited by geography and was not

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

collected in other countries in Malaysia. Secondly, the latest 6D stereo image is not used (this idea has been proposed and is currently in the research stage), and the interaction method has not fully realized human-machine integration. Finally, as the world's population ages, the number of patients increases. It will eventually lead to an imbalance in the ratio of doctors to patients. How to use wearable devices to better ensure simplified surgical operations and clear vision. These questions will be addressed in follow-up research. In the future, we will also need to conduct studies on patients, where the full range of views of the two types of people present in surgery is a complete endorsement of the extended technology. The patient's acceptance of the extended reality surgery will be judged by the use of the device in the preoperative period and the changes in their psychological activity after the surgery.

Author Contributions: Conceptualization, H.L, P.S.J, and X.G; methodology, H.L, and X.G.; software, H.L.; validation, H.L, and P.S.J.; formal analysis, H.L.; investigation, X.G.; resources, X.G.; data curation, X.G.; writing—original draft preparation, X.G.; writing—review and editing, K.Y.P and X.G.; visualization, P.S.J.; supervision, P.S.J.; project administration, P.S.J. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: The study did not require ethical approval.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: Data is available inside this article.

Conflicts of Interest: The authors declare no conflict of interest.

REFERENCES:

[1] Al-Qaysi, N., Mohamad-Nordin, N., & Al-Emran, M. Employing the technology acceptance model in social media: A systematic review. *Education and Information Technologies*, 2020,25 (6), 4961–5002. https://doi.org/10.1007/s10639-020-10197-1

[2] Ajzen, I. The theory of planned behavior: Frequently asked questions. *Human Behavior and Emerging Technologies*, 2020,2 (4), 314–324. https://doi.org/10.1002/hbe2.195

[3] Ahn, S., &Lee, G.. Gaze-assisted typing for smart glasses. *UIST 2019 - Proceedings of the 32nd Annual ACM Symposium on User Interface Software and Technology*, 2019, 857–869. https://doi.org/10.1145/3332165.3347883

[4] Boillat, T., Grantcharov, P., & Rivas, H. Increasing completion rate and benefits of checklists: Prospective evaluation of surgical safety checklists with smart glasses. *JMIR MHealth and UHealth*, 2019, *7(4), e13447*. https://doi.org/10.2196/13447

[5] Bosnjak, M., Ajzen, I., & Schmidt, P.. The theory of planned behavior: Selected recent advances and applications. In *Europe's Journal of Psychology*. 2020, Vol. 16, Issue 3, pp. 352–356. PsychOpen. https://doi.org/10.5964/ejop.v16i3.3107

[6] Chang, W. J., Chen, L. B., & Chiou, Y. Z. Design and Implementation of a Drowsiness-Fatigue-Detection System Based on Wearable smart glasses to Increase Road Safety. *IEEE Transactions on Consumer Electronics*, 2018, *64*(4), 461–469. https://doi.org/10.1109/TCE.2018.2872162

[7] Chen, J. R., & Ng, P. S. J. Tweaking Business Planning With Artificial Intelligence. *International Journal of Business Strategy and Automation*, 2021, *2*(4), 1–22. https://doi.org/10.4018/ijbsa.288541

[8] D'Alimonte, R., de Sio, L., & Franklin, M. N. From issues to goals: a novel conceptualisation, measurement and research design for comprehensive analysis of electoral competition. *West European Politics*, 2019, *43*(3), 518–542. https://doi.org/10.1080/01402382.2019.1655958

[9] Danielsson, O., Holm, M., & Syberfeldt, A. Augmented reality smart glasses in industrial assembly: Current status and future challenges. In *Journal of Industrial Information Integration.* 2020, Vol. 20.100175 Elsevier B.V. https://doi.org/10.1016/j.jii.2020.100175

[10] Follmann, A., Ohligs, M., Hochhausen, N., Beckers, S. K., Rossaint, R., & Czaplik, M. Technical support by smart glasses during a mass casualty incident: A randomized controlled simulation trial on technically assisted triage and telemedical app use in disaster medicine. *Journal of Medical Internet Research*, 2019, *21*(1), e11939. https://doi.org/10.2196/11939

[11] Hair, J. F., Howard, M. C., & Nitzl, C. Assessing measurement model quality in PLS-SEM using confirmatory composite analysis. *Journal of Business Research*, 2020, *109*, 101–

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

110. https://doi.org/10.1016/j.jbusres.2019.11.069

[12] Hair, J., Hollingsworth, C. L., Randolph, A. B., & Chong, A. Y. L. An updated and expanded assessment of PLS-SEM in information systems research. *Industrial Management and Data Systems*, 2017, *117*(3), 442–458. https://doi.org/10.1108/IMDS-04-2016-0130

[13] Hair, J. F., Risher, J. J., Sarstedt, M., & Ringle, C. M. When to use and how to report the results of PLS-SEM. In *European Business Review*. 2019, Vol. 31, Issue 1, pp. 2–24. Emerald Group Publishing Ltd. https://doi.org/10.1108/EBR-11-2018-0203

[14] Hasegawa, E., Isoyama, N., Sakata, N., & Kiyokawa, K. Moving Visual Stimuli on Smart Glasses Affects the Performance of Subsequent Tasks. *ACM International Conference Proceeding Series*, 2021, 316–318. https://doi.org/10.1145/3458709.3458973

[15] Heinonen, H., Siltanen, S., & Ahola, P. Information Design for Small Screens: Toward Smart Glass Use in Guidance for Industrial Maintenance. *IEEE Transactions on Professional Communication*. 2021, 14 October. pp1-20. https://doi.org 10.1109/tpc.2021.3110616

[16] Gong. X, Wong A. H., Darobovna. R. K, and JosephNg, P. S., "Smart Glasses Implementation in Hospitals," *International Journal of Business Strategy and Automation,* 2021, vol. 2, no. 4, pp. 1-9, 2021, https://doi: 10.4018/IJBSA.20211001.oa3.

[17] Gong. X, Wong A. H., Darobovna. R. K, and JosephNg, P. S., "Beyond Human Eye in Surgical Smart Glasses," *International Conference on Algorithms, Computing and Systems,* 2021, pp. 135-139, https://doi.org/10.1145/3490700.3490722

[18] Gong. X and JosephNg, P.S, "Technology Behavior Model—Beyond Your Sight with Extended Reality in Surgery," *Applied System Innovation,* 2022, vol. 5, no. 2, 1-21, https://doi: 10.3390/asi5020035.

[19] JosephNg, P.S and Gong. X "Technology Behavior Model – Impact of Extended Reality on Patient Surgery," *Applied Sciences,* 2022, vol. 12, issue. 11, 5607, https://doi.org/10.3390/app12115607

[20] JosephNg, P. S. EaaS Optimization: Available yet hidden information technology infrastructure inside medium size enterprise. *Technological Forecasting and Social Change*, 2018, *132*, 165–173. https://doi.org/10.1016/j.techfore.2018.01.030

[21] Kesmodel, U. S. Cross-sectional studies – what are they good for? In *Acta Obstetricia et Gynecologica Scandinavica*. 2018, 97(4), pp. 388–393. Wiley-Blackwell. https://doi.org/10.1111/aogs.13331

[22] Kim, S. K., Yoon, H., Shin, C., Choi, J., & Lee, Y. Brief Paper: Design and Implementation of a Smart Glass Application for XR Assisted Training of Core Nursing Skills. *Journal of Multimedia Information System*, 2020, *7*(4), 277–280. https://doi.org/10.33851/jmis.2020.7.4.277

[23] Lareyre, F., Chaudhuri, A., Adam, C., Carrier, M., Mialhe, C., & Raffort, J. Applications of Head-Mounted Displays and Smart Glasses in Vascular Surgery. In *Annals of Vascular Surgery* 2021, Vol. 75, pp. 497–512. Elsevier Inc. https://doi.org/10.1016/j.avsg.2021.02.033

[24] Lee, C. K. M., Lui, L., & Tsang, Y. P. Formulation and prioritization of sustainable new product design in smart glasses development. *Sustainability (Switzerland)*, 2021, *13*(18). https://doi.org/10.3390/su131810323

[25] Lee, L. H., & Hui, P. Interaction Methods for Smart Glasses: A Survey. In *IEEE Access*, 2018, Vol. 6, pp. 28712–28732. Institute of Electrical and Electronics Engineers Inc. https://doi.org/10.1109/ACCESS.2018.2831081

[26] Lee, K. J., & Carlin, J. B. Multiple imputation in the presence of non-normal data. *Statistics in Medicine*, 2017, *36*(4), 606–617. https://doi.org/10.1002/sim.7173

[27] Li, R., Lee, J., Woo, W., & Starner, T. KissGlass: Greeting Gesture Recognition using Smart Glasses. *ACM International Conference Proceeding Series*. 2020, March 16, 3(21), 1-15. https://doi.org/10.1145/3384657.3384801

[28] Martínez-Galdámez, M., Fernández, J. G., Arteaga, M. S., Pérez-Sánchez, L., Arenillas, J. F., Rodríguez-Arias, C., Čulo, B., Rotim, A., Rotim, K., & Kalousek, V. Smart glasses evaluation during the COVID-19 pandemic: First-use on Neurointerventional procedures. *Clinical Neurology and Neurosurgery*, 2021, 2, *205*. https://doi.org/10.1016/j.clineuro.2021.106655

[29] Mathew, P. S., & Pillai, A. S. Role of Immersive (XR) Technologies in Improving Healthcare Competencies: A Review. *Virtual and Augmented Reality in Education, Art, and*

Museums, 2020, 3(2),23-46. https://10.4018/978-1-7998-1796-3.ch002

[30] Matsukawa, K., &; Yato, Y. Smart glasses display device for fluoroscopically guided minimally invasive spinal instrumentation surgery: A preliminary study. *Journal of Neurosurgery: Spine*, 2021, 34(1), 150–155. https://doi.org/10.3171/2020.6.SPINE20644

[31] Mulvey, F. B., Mikitovic, M., Sadowski, M., Hou, B., Rasamoel, N. D., Paulin Hansen, J. P., & Bækgaard, P. Gaze Interactive and Attention Aware Low Vision Aids as Future Smart Glasses. *Eye Tracking Research and Applications Symposium (ETRA)*, 2021, *PartF169260*. https://doi.org/10.1145/3450341.3460769

[32] Munusamy, T., Karuppiah, R., Bahuri, N. F. A., Sockalingam, S., Cham, C. Y., & Waran, V. Telemedicine via Smart Glasses in Critical Care of the Neurosurgical Patient—COVID-19 Pandemic Preparedness and Response in Neurosurgery. *World Neurosurgery*, 2021, *145*, e53–e60. https://doi.org/10.1016/j.wneu.2020.09.076

[33] Nasir, H. Modeling the diabetic population in Malaysia using a functional rate of unhealthy lifestyle influence. *Journal of Statistics and Management Systems*, 2021,*24*(4), 755–778. https://doi.org/10.1080/09720510.2020.1850926

[34] Rauschnabel, P. A., He, J., & Ro, Y. K. Antecedents to the adoption of augmented reality smart glasses: A closer look at privacy risks. *Journal of Business Research*, 2018, *92*, 374–384. https://doi.org/10.1016/j.jbusres.2018.08.008

[35] Rigdon, E. E., Sarstedt, M., & Ringle, C. M. On Comparing Results from CB-SEM and PLS-SEM: Five Perspectives and Five Recommendations. *Marketing ZFP*, 2017, *39*(3), 4–16. https://doi.org/10.15358/0344-1369-2017-3-4

[36] Romare, C., & Skär, L. Smart glasses for caring situations in complex care environments: Scoping review. In *JMIR mHealth and uHealth*, 2020, Vol. 8, Issue 4. JMIR Publications Inc. https://doi.org/10.2196/16055

[37] Santos, J., Pham, A., Stasinopoulos, P., & Giustozzi, F. Recycling waste plastics in roads: A life-cycle assessment study using primary data. *Science of The Total Environment*, 2021, *751*, 141842. https://doi.org/10.1016/j.scitotenv.2020.141842

[38] Sarstedt, M., Ringle, C. M., Cheah, J. H., Ting, H., Moisescu, O. I., & Radomir, L. Structural model robustness checks in PLS-SEM. *Tourism Economics*, 2020, *26*(4), 531–554. https://doi.org/10.1177/1354816618823921

[39] Siltanen, S., & Heinonen, H. Scalable and responsive information for industrial maintenance work: Developing XR support on smart glasses for maintenance technicians. *PervasiveHealth: Pervasive Computing Technologies for Healthcare*, 2020, 100–109. https://doi.org/10.1145/3377290.3377296

[40] Song, Y., & Zhang, Q. Quantitative research on gas explosion inhibition by water mist. *Journal of Hazardous Materials*, 2019, *363*, 16–25. https://doi.org/10.1016/j.jhazmat.2018.09.059

[41] Syberfeldt, A., Danielsson, O., & Gustavsson, P. Augmented Reality Smart Glasses in the Smart Factory: Product Evaluation Guidelines and Review of Available Products. In *IEEE Access* 2017, Vol. 5, pp. 9118–9130. Institute of Electrical and Electronics Engineers Inc. https://doi.org/10.1109/ACCESS.2017.2703952

[42] Tai, Y., Gao, B., Li, Q., Yu, Z., Zhu, C., & Chang, V. Trustworthy and Intelligent COVID-19 Diagnostic IoMT through XR and Deep Learning-based Clinic Data Access. *IEEE Internet of Things Journal*. 2021, 21(8), pp.1-11. https://doi.org/10.1109/JIOT.2021.3055804

[43] Taylor, L., Dyer, T., Al-Azzawi, M., Smith, C., Nzeako, O., and Shah Z., "Extended reality anatomy undergraduate teaching: A literature review on an alternative method of learning," *Ann Anat,* 2022, vol. 239, p. 151817, https://doi: 10.1016/j.aanat.2021.151817.

[44] Tesfamikael, H. H., Fray, A., Mengsteab, I., Semere, A., and Amanuel, Z., "Simulation of Eye Tracking Control based Electric Wheelchair Construction by Image Segmentation Algorithm," *Journal of Innovative Image Processing,* 2021, vol. 3, no. 1, pp. 21-35, https://doi: 10.36548/jiip.2021.1.003.

[45] Unal, E. and Uzun, A. M. "Understanding university students' behavioral intention to use Edmodo through the lens of an extended technology acceptance model," *British Journal of Educational Technology,* 2020, vol. 52, no. 2, pp. 619-637, https://doi: 10.1111/bjet.13046.

[46] van Dun, D. H., Hicks, J. N., & Wilderom, C. P. M. Values and behaviors of effective lean managers: Mixed-methods exploratory research. *European Management Journal*, 2017,

35(2), 174–186. https://doi.org/10.1016/j.emj.2016.05.001

[47] Wang, C. S., Huang, W., Chang, Y. F., Yeh, C. M., & Xu, Z. Y. Development of an Assistive Device via AR Smart Glasses. In *2020 IEEE 2nd Eurasia Conference on Biomedical Engineering, Healthcare and Sustainability (ECBIOS)* 2020, pp. 39-43 https://doi.org/10.1109/ECBIOS50299.2020.9203629

[48] Wang, D, Ning, N, Li, G, Zhao, J, Wang, Y. and Rong, L, "3D image reconstruction of terahertz computed tomography at sparse angles by total variation minimization," *Appl Opt,* 2020, vol. 61, no. 5, pp. B1-B7, Feb 10, d https://oi: 10.1364/AO.440847.

[49] Wong, O. L *et al.*, "3D-T2W-TSE radiotherapy treatment planning MRI using compressed sensing acceleration for prostate cancer: Image quality and delineation value," *Asia Pac J Clin Oncol,* 2020, Jan 24, 1-21.https://doi: 10.1111/ajco.13752.

[50] Xi, N., Bampouni, E. and Hamari, J. "How Does Extended Reality Influence Consumer Decision Making? The Empirical Evidence from A Laboratory Experiment," presented at the Proceedings of the 55th Hawaii International Conference on System Sciences, 2022.

[51] Yuen. K. F., Cai L., Qi. G., and Wang X., "Factors influencing autonomous vehicle adoption: an application of the technology acceptance model and innovation diffusion theory," *Technology Analysis & Strategic Management,* vol. 33, no. 5, pp. 505-519, 2020, doi: 10.1080/09537325.2020.1826423.

[52] Yuriev, A., Dahmen, M., Paillé, P., Boiral, O., & Guillaumie, L. Pro-environmental behaviors through the lens of the theory of planned behavior: A scoping review. In *Resources, Conservation and Recycling* 2020, Vol. 155 15-22. Elsevier B.V. https://doi.org/10.1016/j.resconrec.2019.104660