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# UTAUT Model, Smart Exhibition Sorted by Relevance: Word Cloud Visualization Review

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## Abstract

The aim of the paper is to introduce a visualization method with word cloud visualization to illustrate evolution of the smart exhibition, other relevant exhibition modes with virtual presentation and the articles in the application of UTAUT model in a set of documents. The relationship between UTAUT model and smart area, and the smart exhibition and some other smart areas is to be presented rapidly and evidently. This article provides interactive visual analysis of smart exhibition sorted by relevance and the industries or fields in the application of the UTAUT Model by a set of key words, at different time points based on the presentation of D2 or D3 to highlight the core word to make the trend of the smart exhibition clearly understood.

**Key words:** UTAUT model; Word cloud visualization; Smart exhibition; Visual analysis

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## 1. INTRODUCTION

As the evolving COVID-19 is a challenge to economic recovery and a sustainable society rebuilding, the research tries to get deeper insights into the study of smart exhibitions by visual analysis on the basis of word cloud visualization. First, this article reviews the existing research on the implementation of smart exhibition or documents in the application of UTAUT model. Secondly, it also focuses on the exploration of the main industries or fields that apply smart way or smart areas to showcase the actual smart way of life and business in nowadays society. Finally, it studies many and varied ways of virtual mode of organizing an exhibition and clearly separates them into groups of virtual, online, intelligent, cloud and digital exhibition.

This paper takes exhibition attenders' behavioral intention of adopting technology-based smart exhibition as the main direction of the research in an epidemic context utilizing various technology including 5G, the Things of Internet, big data, social networking *etc.*

During the era of big date, word cloud visualization is to be used effectively to demonstrate the representative keywords (Huang, 2019). To facilitate the understanding of temporal content evolution in a set of documents, we propose a visualization method that couples a trend chart with word clouds based on D2 or D3 to visually illustrate the content of the relevant study (Cui, 2010).

## 2. LITERATURE REVIEW

Generally, along with the COVID-19 pandemic, the

widespread use of digital technologies in the economy and the construction of smart city which consists of smart exhibition, community, household and transportation *etc.* has shown the importance of the smart exhibition construction process in the pandemic period. The rapid digital transformations of exhibition industry lead the world to a renewed route of economic recovery after COVID-19 pandemic (Şeker, 2022).

First, the "smart +" dissemination model combines various advanced technologies and in-depth interpretation forms, and comprehensively applies technical means such as the multimedia technology, natural interface interaction, and virtual reality to display the exhibits from pyramid angles (Chen and Chen, 2018).

Besides, "*Smart exhibitions*" is gaining prominence throughout the globe as a solution to timely address the issues of trade or business damages faced by the exhibition industry due to the pandemic. With the evolution of digital economy, smart exhibition is identified as being incorporated into the integrated global digitization of the future economy. It offers attenders multiple choice of doing business. They can visit the real exhibition for the benefit offered with smart service and obtaining smart or virtual experience through technical devices and also visit the exhibition online if the environment is limited. Adaptive and profiled exhibition booths to be evaluated by effectiveness and efficiency is perceived as the smart exhibition (Salem, Alves Lino, and Rauterberg, 2010).

Furthermore, the smart exhibition can be characterized by its virtual, cloud, online, intelligent and digital form. Therefore, the study of these previous study of virtual, cloud, online, intelligent and digital exhibitions is integral to the in-depth exploration of the smart exhibition.

## 3. STRENGTH AND THREATS

In addition to the overall review of the area of smart exhibition and the appropriate choice of using word cloud visualization. Its strength is many and varied as the method is simple, fresh, generous and humane. Weaknesses and threats revolve around five categories: profession, organization and infrastructure (Ángel Alfredo Martínez QuesCésar Hueso MontoroMaría Gálvez González, 2010)

### 3.1 Strength of Word Cloud Visualization

The method of word cloud visualization evidently has quite lot of strengths. Firstly, Word Cloud Script have been widely used in resolving the semantic intelligently and providing render view at one click. Furthermore, it provides the format of text cloud input. Various formats can be saved by JPG/PNG/SVG/PDF/HTML *etc.* Besides, 2D or 3D model cloud image effect can be easily and vividly accessed. As the utilization of this method in language learning has attracted increasing attention, the wide range of research in the application of UTAUT model, word cloud visualization could become a good auxiliary tool in the article data presentation. Therefore, the further study in this paper can lead to a in-depth development in research of smart exhibition using UTAUT model.

Due to a variety of technical and practical factors, there are rich and varied methods of illustrating the connection between the previous research using UTAUT model and the study of exhibition attenders' adoption of smart exhibition utilizing UTAUT model. First, the research is much concerned with the development of smart exhibition visitors' intention of accepting a certain kind of intelligent technology. And the paper also aims to study it in the application of UTAUT model and its impact in the previous research. In addition, there is an evident trend in upgrading of the smart exhibition industry which is also the core component of the paper. Hence, the utilization of word cloud visualization to present different fields highlighting the business world can help to improve efficiency in smart exhibition construction (Huang, 2019).

### 3.2 Threats of Word Cloud Visualization

Although the implementation of word cloud visualization offers users options to customize and interact with the visualization, the autonomous selection of one word or two words can be restricted. There exists imprecision due to the repeats of the layout of the same words.

## 4. ANALYSIS AND EVALUATION

The visual analysis of the smart exhibition and different forms of virtual exhibitions could help academicians and industrial visitors to have a clearer perception of the smart exhibition and review the precise data to meet the latest demand of their customers. Additionally, it makes it possible to help visitors to be more sensitive to the latest changes of the "smart +" area driven by new technologies in a visitor-friendly and technology-based way due to limitations in the smart application.

## 5. IMPLEMENTATION

The method of word cloud visualization in this paper is conducted to extract the evolving utilization of UTAUT model, the smart area and what technology the smart exhibition is adopting in the past a couple of decades. There are five major steps of conducting the process. There are two kinds of routes for this study, the first route is to start the process, divide the titles of articles into words, extract one or two words from the titles and put the final extracted words into the word cloud visualization. The 2D or 3D image is the the basis of analysis of the research. The second route is to divide the articles sorted by the determiner into groups and extract them into words and then put the selected words into the visualization platform for further study and analysis. The flow process of word cloud visualization is as follows:

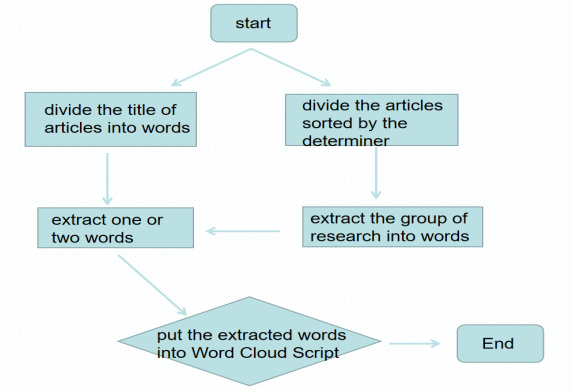


**Figure 1**
**The flow process of word cloud visualization**

### 5.1 Implementation of Research on UTAUT Model

As the UTAUT model is a classic model for technology acceptance, multiple previous research is about the utilization of UTAUT model in various fields. The paper attempts to figure out what technology or devices are studied in the application of UTAUT model as follows:

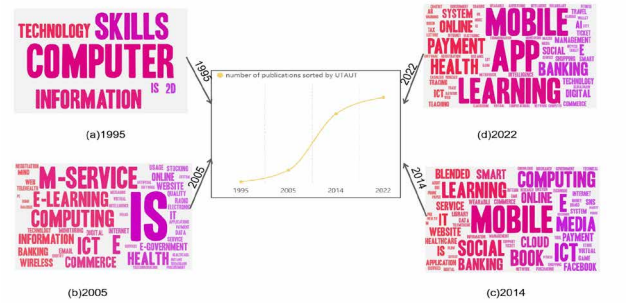


**Figure 2**
**System overview. The center of the figure presents a significance trend chart viewer which shows the curve a collection of documents with different time stamps sorted by Google Scholar database from 1995-2022. Four word clouds ((a)-(d) in the figure) are created using our algorithm for four selected time points where high significance values are observed.**

A systematic review of documents over one thousand articles or books utilizing UTAUT model demonstrates that the documents attaches importance to key words in different period of time. Research of UTAUT model was most connected wit computer skills in 1995. Information system (IS) was the most popular one in 2005. "Mobile + " like mobile service, mobile learning, mobile banking *etc.* was studied connected with UTAUT and electronic devices were highlighted as well in 2014. And all sorts of APPs and e-learning appeared the most frequently in 2022 shown in Fig1. Hence, the trend of documents using UTAUT model focuses on the contemporary technology. Besides, the center of the figure with a upward trend offers a glimpse of the increasing value of UTAUT model.

### 5.2 Implementation of Research on Smart Areas

Fields or areas of "smart +" in this paper refers to a certain space or environment that using smart devices or technology as the key words shown in the following word cloud have much in common with the development of smart exhibition to add the value of the study.

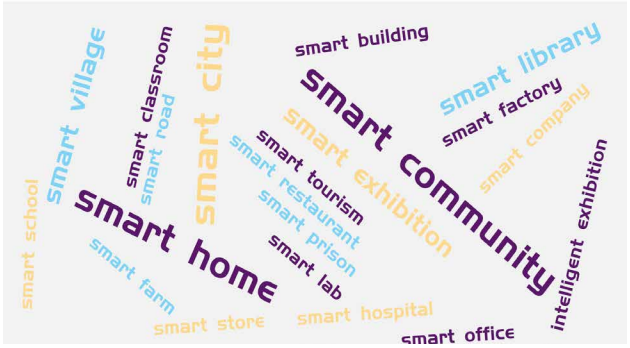


**Figure 3**
**Word cloud visualization of relevant research of "smart + are sorted by Google Scholar database from 1995-2022**

Seen from Fig.3 with the frequency of key words added, "smart +" has a long history and the smart exhibition, which develops on the basis of smart city or smart community, is still in its infancy and has rosy prospect. And smart community, smart city, smart home, smart library rank the first. There is a certain number of researches like smart exhibitions or intelligent exhibitions. Furthermore, smart tourism, smart factory, smart building, smart office, smart school, smart hospital, smart road, smart company and smart restaurant are seldom studied in Google Scholar database.

### 5.3 Implementation of Research on Smart Exhibitions

The exhibition industry has been a part of the "smart tourism" context, and tend to adopt smart information technology (Han, 2014). Smart exhibition is attracting more and more attention around the world. Research themes in this study, which are relational to the smart exhibition, are concerned about a fancy concept that in space where a certain group of people are living, working and learning in the choice of virtual, automated or physical smart mode with the implementation of intelligence, cloud computing, big data. The study focuses on the transformation in ways of life and working.

The word cloud visualization illustrate the key words extracted what technique or technology smart exhibition adopts sorted by title from 26 articles with smart exhibition in the title in Google Scholar base from as follows:

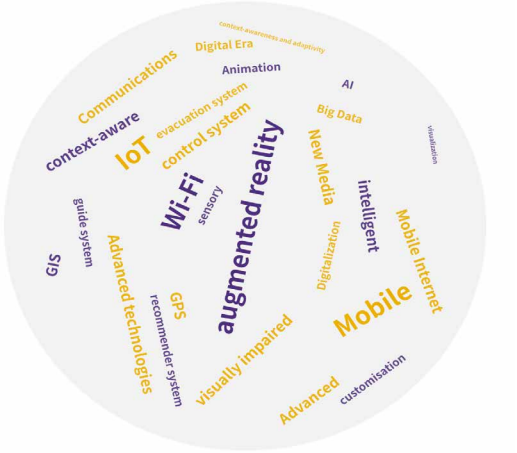


**Figure 4**
**Word cloud visualization of relevant research of smart exhibition by the title from 26 articles sorted by Google Scholar database**

Seen from the Figure 4, augmented reality, which is the center of the figure, is the most frequently used technology in the smart exhibition. And loT is also another kind of technology among these articles.

### 5.4 Implementation of Research on Various Forms of the New Mode Of Exhibitions

The smart exhibition takes on the same characteristics of doing business online. So the virtual form of the exhibition can also be called online exhibition in many occasions, intelligent exhibition and cloud exhibition in some cases, and digital exhibition occasionally. However, the definitions of them are different and each has its emphasis. The existing study of the appellation and content lacks definite classification and connection, it is of significance to implement the research on various forms of the new mode of exhibitions using the visualization. Definitions of virtual, online, intelligent, cloud and digital exhibition are as follows in Table 1:

**Table 1**
**Definitions of virtual, online, intelligent, cloud and digital exhibition**

| Item | Definition | Source |
|---|---|---|
| Virtual exhibition | A virtual exhibition (VE) is an exhibition held in cyberspace It is single- or multi-user realistic 3D representations of exhibits collections, in which visitors navigate, observe the exhibits, learn related information about them presented in various media, and in some cases interact with them. | (Lee-Kelley *et al.*, 2003; Bill Bonis *et al.*, 2013) |
| Online exhibition | Online exhibitions allow visitors to select the level of information they wish to consult, thereby offering something useful to the users of all ages and experience and aims to guide consumption. | (Viralingam, 2008; Li, and Zhang, 2020) |
| Intelligent exhibition | Intelligent exhibitions are exhibitions include customer management, BBS management, document printing, reception resources (hotel, vehicle) management, conference room management, presentation file management, the meeting broadcast live and other online application management system. | (Zhang, Fan and Ni, 2019) |
| Cloud exhibition | Cloud exhibition is a typical presentation of intelligent exhibitions. Its technical framework includes live marketing, 3D display, instant messaging, intelligent translation, video conference, cloud signing, *etc*. It is based on webcast and combined with various exhibition application scenarios to form a variety of operating modes, including webcast+conference, webcast+supply docking, webcast+ exhibition venues, *etc*. | (Li and Zhang, 2020) |
| Digital exhibition | Digital exhibition involves data management, conceptual modelling, geographic information systems and network analysis in which a real-time 3D reconstruction technique is used to superimpose images in exhibition space. | (Romanowska, *et al.*, 2021) |

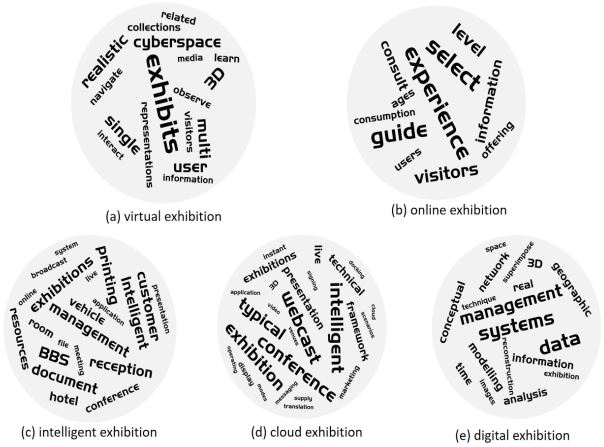


**Figure 5**
**Analysis of definitions of virtual exhibition, online exhibition, intelligent, cloud and digital exhibition using word cloud visualization**
Five word clouds ((a)-(e) in the figure) are created for each definition.

Shown from Fig. 5, the definition of virtual exhibition is much concerned about the presentation technology of the exhibits including 3D, cyberspace, multi-technology *etc*. Furthermore, online exhibition is more characterized by the ways of guiding consumption and information selection. Besides, intelligent exhibition focuses on BBS and intelligent management. Cloud exhibition pays much attention to its webcast and intelligent venue or conference. Finally, digital exhibition emphasizes management, systems and 3D.

As the forms of exhibition are ever-evolving, the boundary between them is to blur in the future and become a fusion product (Ning, 2021). Therefore, the visual analysis relies on the ever-changing forms of them.

## 6. CONCLUSION

In this paper, we are concerned with the current situation of the smart exhibition. And it presents the findings of these identified scholarly works related to smart city, smart home, smart village, smart community and smart

library *etc*. In addition, it also provides the findings of works related to UTAUT model. We present the findings of these identified Google Scholar works related to smart, intelligent and digital exhibitions. Based on our analysis is of our sample articles, we classified the type of documents into three categories: smart exhibition, UTAUT model and literature in relationship with smart mode of life and working which have a tendency of human-centered design for visitors or exhibitors.

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