Algorithm Design and Implementation of the User-optimized AI Curation System with AR-based characters

Tae-Yang Kim

Abstract Background/Objectives: ***This study tries to design the algorithm for a basic research to provide AR - based theme travel AI curation system through customized virtual characters that can be modified according to the surrounding situations or issues changing in real time.***

Methods/Statistical analysis: ***This study suggests four modules which are the travel information input, travel preference checking, character generating, and travel information providing modules. Especially, the travel information input module is composed as two parts, which are an information in puta request input unit.***

Findings: ***The AI curation providing system is an automated main system provided in a central server so that the user can utilize it when they are planning a trip. The user can access the system through the user terminal or device connected to the communications to utilize the AI curation system. Furthermore, the system can have a separate administrator or an AI robot inside the system, and it can be configured to perform maintenance and data update through the manager or the bot. On the system environment, the travel preference checking module can be divided as two parts which are a comparative and detailed travel destination derivation parts. As the finding, this study mainly aims to make a design of algorithm for each step for constructing a system that provides a recommendation system of a travel destination recommending a user's preferred travel destination and detailed travel destination.***

Improvements/Applications: ***Based on this algorithm design, it will be expected the appearance of more efficiency travel information sharing service between travel information sharing service server and the way of offering the service server which is the user-optimized AI Curation System with AR-based characters.***

Keywords: Augmented reality (AR), theme travel, Artificial Intelligence (AI), Algorithm Design, Optimized Curation System

I. INTRODUCTION

People who have decided on the places they want to visit usually collect the information they need to travel in various ways and make plans based on them. However, they often fail to experience the features of the destination and fail to travel even though people have gathered and planned information in their own way about their desired destination. If they had the bad experience, they would be able to be financially harmed and not easy to leave. This can be because there is no systematic service even if they want to collect travel know-how and travel-related information to other persons who want to travel the same place or have already visited the same travel destination. Although travel planners who need to more concrete and practical help, accordingly, it is a fact that they have to take care of inefficient aspects wasting their time and energy unnecessarily since there is no one to ask for help. In case of theme trips that travel with specific criteria, especially, they are designed with commercial goals in sightseeing companies or local governments on their own beliefs. In that case, naturally, their general satisfaction for them could be very low.

As an infrastructure research, on the stream, this study tries to design the algorithm for a basic research to provide AR - based theme travel AI curation system through customized virtual characters that can be modified according to the surrounding situations or issues changing in real time.

II. BACKGROUND

2.1. Augmented reality (AR)

In 1997, Azuma [1] explained that augmented reality (AR) is an example of a virtual environment (VE), which means that a virtual reality user is completely immersed in the virtual world, but augmented reality means complementing reality by not replacing but supplementing the reality as allowing virtual objects to be realized it in the real world. In 1968, before the Azuma's definition, Sutherland has already showed off the augmented reality technology, the head mounted display (HMD) through the joint computer conference. The first AR prototypes (Figure1), created by computer graphics pioneer Ivan Sutherland and his students at Harvard University and the University of Utah, appeared in the 1960s and used a see-through to present 3D graphics [2]. This display allows the user to see a simple virtual wireframe cube that overlaps the real world, creating the first Augmented Reality (AR) interface. The term Augmented Reality is often used to refer to interfaces in which two and three-dimensional computer graphics are superimposed over real objects, typically viewed through head-mounted or handheld displays [3].

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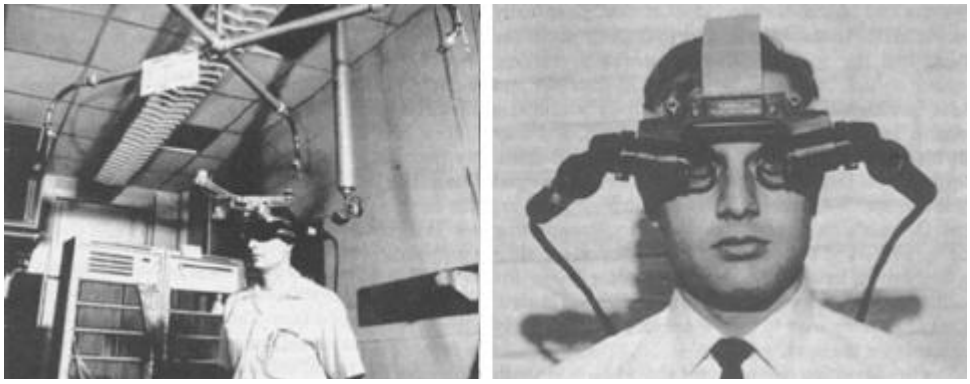

Figure 1: The world's first head-mounted display with the\Sword of Damocles"

According to development of new technologies such as smart phone, the term `augmented reality' has been expanded. Based on his first conceptual definition, both virtual environments (or virtual reality) and augmented virtuality, in which real objects are added to virtual ones, had replaced the surrounding environment by a virtual one.

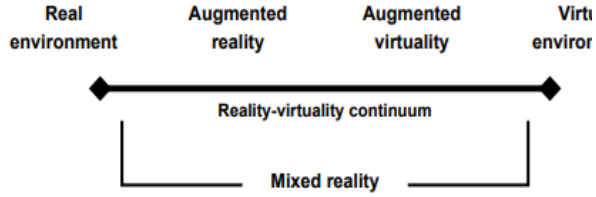

Figure 2.Reality-virtuality continuum

They expanded the definition on the reality-virtuality continuum different from prior conceptual definition(Figure2). Those are that the AR system can combine real and virtual objects in a real environment; registers (aligns) real and virtual objects with each other; and runs interactively, in three dimensions, and in real time. With the definition, they mentioned three characters. Firstly, AR system is not limited to certain display technologies such as the HMD any more. In addition, the category of AR cannot be limited to the sense of sight because it can potentially be applied to all senses including hearing, touch and smell. The category can contain approaches known as mediated or diminished reality which can remove, arbitrate or reduce virtual objects by overlaying.

The concept of AR can be defined as follows. Augmented reality (AR) is an emerging form of experience in which the real world (RW) is enhanced by computer-generated content which is tied to specific locations and/or activities [4]. Collectively, these augmentations can serve to aid and enhance individuals' knowledge and understanding of what is going on around them. Rather than seeming out of place, the digital markups inherent in AR lets users perceive the real world, along with 'added' data, as a single, seamless environment [5].

Syberfeldt, Danielsson, Holm, and Ekblom [6] explained the AR system can be applied to various fields: various types of displays, mobile based application(APP), education, medical industrials, game and so on. Along the line, this study is concerned with an algorithm design of AR in order to apply it to AI curation system.

2.2. Artificial Intelligence (AI)

By developing Artificial intelligence (AI) technology, AI has been treated as very interesting research topics and deal with various areas. Artificial intelligence (AI) is an extensive scientific discipline which enables computer systems to solve problems by emulating complex biological processes such as learning, reasoning and self-correction [7]. The epistemological part of AI studies what kinds of facts about the world are available to an observer with given opportunities to observe, how these facts can be represented in the memory of a computer, and what rules permit legitimate conclusions to be drawn from these facts. [8]. John [8] said that AI is a very difficult scientific problem, so there are great advantages in finding parts of the problem that can be separated out and separately attacked. On the stream, this study tries to make an algorism using the AR contents on the AI curation system that can offer travel information.

III. PROPOSED METHOD

Figure3 shows a conceptual diagram illustrating a schematic configuration of an AR-based theme travel AI curation providing system through customized learning of a virtual character of the present invention. The AI curation providing system is an automated main system provided in a central server so that the user can utilize it when they are planning a trip. The user can access the system through the user terminal or device connected to the communications to utilize the AI curation system. Furthermore, the system can have a separate administrator or an AI robot inside the system, and it can be configured to perform maintenance and data update through the manager or the bot.

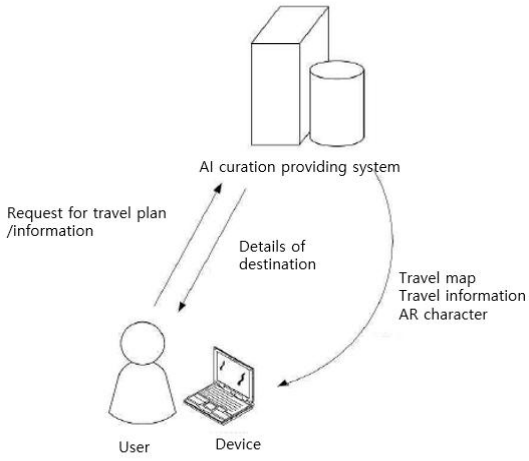

Figure 3. Conceptual configuration diagram

On the conceptual

diagram, this study suggests four modules which are the travel information input, travel preference checking, character generating, and travel information providing modules.

The travel information input module is composed as two parts, which are an information input unit inputting travel information including a travel purpose and a travel destination from a user, and a request input unit receiving a travel plan request written in a sentence related to the travel information from the user.

The travel preference checking module is about determining the user's travel preference based on the travel plan request form and deriving a plurality of detailed travel destinations from the travel destination data;

The character generating module is for generating a virtual character by modifying the appearance of the character according to the progress of the detailed travel destination in the travel preference confirmation module.

Lastly, the travel information providing module is to provide to the user guidance information on the detailed travel destination, the travel destination map showing each of the detailed travel destinations on a map based on Augmented Reality (AR) through the cultivated character.

The detailed configuration with four modules is in shown in Table 1.

Table 1: Block diagram showing the configuration of the travel AI curation system

Travel information input module (100)	Travel information providing module(400)
Travel information input unit(110)	Map receiver section (410)
	Map application section (420)
Prefer travel confirmation module (200)	Path display section (430)
Tourist information database (210)	Location taking section (440)
Travel Preferences Investigating unit (220)	Stop point appointment (450)
Comparisons derived unit (221)	Expansion point appointment (460)
Elaborate trip derived unit (222)	Comparison chart producing unit (470)
Gap interval unit (223)	Complexity determination unit (480)
Deriving extension section (224)	Comparison line producing unit (490)
Extension of travel destination unit (225)	Complexity appointment unit (500)
Character Growing Module (300)	Comparison line synthesis unit (510)
character generation section (310)	Complexity reflecting unit (520)
Character development section (320)	
	Travel Complexity Sensor (530)

With detailed configuration in each module, figure 4 shows algorithm Design of overall process about AR-based theme travel through customization learning of virtual characters,

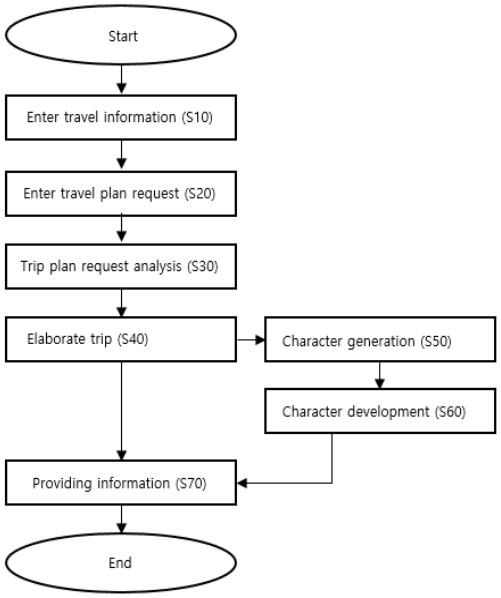

Figure 4. Algorithm design of overall process

IV. EXPERIMENTAL RESULTS

The travel preference checking module can be divided as two parts which are a comparative and detailed travel destination derivation parts.

The comparative derivation part that derives valid terms from the clustering factor that is clustered according to the frequency and proximity of the terms included in the travel plan request. The clustering factor is calculated by the following equation (1).

$$CFab = \frac{Cont(a,b) \times Cont(b,a)}{Cont(a,all) \times Cont(b,all)} \qquad (1)$$

Cont (a, b) is the cumulative sum of the term b close to the term a, Cont (b, a) is the cumulative sum of the term a close to the term b, Cont (a, b) all) is the cumulative sum of all the terms close to the term a, and Cont (b, all) is the cumulative sum of the terms close to the term b.

The detailed travel destination derivation part for deriving the detailed travel destination based on the valid term can provide an AR based theme travel AI curation system. The factor can be calculated by the following equation (2).

$$(CFab)p = \sum_{n=1}^{m} \left(\frac{(CFab)n}{m} \times \frac{Ls}{|Lan - Lbn|}\right) \qquad (2)$$

(CFab) p is an extended valid term, m is the total number of clustering, (CFab) n is the clustering factor of the term b for the term a in the nth

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clustering, Lan-Lbn is the clustering factor of the term b, Ls means the maximum interval between the terms a and b.

The factors of the travel information providing module can be calculated by the following equation (3).

$$Xp = \frac{((Y1\times r)-(Y2\times(1-r)))}{2L^2} \quad (3)$$

XD is the complexity of a particular comparison line, Y1 is the number of objects identified by any one of the complexity detection sensors, Y2 is the number of objects identified in the other distribution sensors forming the comparison line with Y1, r is a significance weight between 0 and 1, which is differentially applied depending on whether the detailed travel destination including the distribution sensor is the duel base point and the expansion base point, and L means the actual distance of the comparison copper line.

In addition, the travel information providing module includes a complexity reflector for controlling the length of the comparison line in proportion to the complexity through equation (4).

$$A(x,y) = Nk\{K0(K1 + K2) - K2(K1)\} \quad (4)$$

A (x, y) is the length of the comparison copper wire, NK is the reference length of the comparison copper wire, K0 is the maximum complexity of the comparison line, K1 is the ratio of the number of objects detected by the complexity sensor included in the selected comparison line among the total number of objects detected by the entire complexity sensor, and K2 is the complexity of the selected comparison line

V. CONCLUSION

In this study, a mathematical expression derivation and an algorithm design which can be customized learning of a virtual character are implemented. This paper mainly aims to make a design of algorithm for each step for constructing a system that provides a recommendation system of a travel destination recommending a user's preferred travel destination and detailed travel destination

Based on this algorithm design, it will be expected the appearance of more efficiency travel information sharing service between travel information sharing service server and the way of offering the service server which is the user-optimized AI Curation System with AR-based characters. On the algorithm design, concretely, the travel information sharing service server will be able to be launched by storing and managing the travel destination information and travel-related information to be visited by each traveler. Also, it will effectively manage the travel-related information for the travel destination that the traveler wants to visit, and shares and views the information of other travelers having the same travel destination. Based on this basic algorithm research, it is necessary to continue research to provide AR-based theme travel AI curation system in the future.

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