Design of Smart Learning System based on AR-APM

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Abstract

New learning method and the need for e-learning technology of the constructivist paradigm which consist the individual experience-centered learning experience, knowledge increased by escaping from the videos and flash-based simple one-side education contents.In this paper, the augmented reality English learning contents for the students to learn through the role and mission in the virtual space as the contents of new forms for the experiential learning through the augmented reality and TOLED(Transparent, Organic Light Emitting Diodes) system by using the vibrating Bluetooth maker cube for themulti maker configuration was designed and the system was designed to service it.

Keywords: *Augmented Reality, Marker Array, g-Learning, TOLED*

1. Introduction

The society·economy · education ·cultures are changing due to the development of IT technology and the rapid penetration of smart phones absolutely differently from the existing state. Especially, the traditional teaching methodology is changing into the smart learning using the smart device from Internet-based PC environment and e-learning, m-learning in the educational area [1].

The e-learning industry is recognized as the killer app of the next-generation in IT and service industry area due to the expansion of the smart learning. E-learning secured the concreteness in the implementation of various functions to inspect the intensity and learning state of the students by delivering the lecture produced by video, however it is different with the existing offline training methods which emphasize the education and communication by the voluntary participation of students, so it has low educational effectiveness.

As the users meet the various contents and the interests about new digital contents increased, the services which provide the various realistic contents based on the digitalization of the multimedia contents such as the various data, voice and video appeared one after another [2].

The realistic contents service is noted, so new learning method and the need for e-learning technology of the constructivist paradigm which consist the individual experience-centered learning experience, knowledge increased by escaping from the videos and flash-based simple one-side education contents.

Therefore the development of the augmented reality based smart learning system which can improve the effect by the learner who learns absorbing himself is needed for one of the alternative about the social needs about the next-generation learning contents and system.

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In this paper, the augmented reality English learning contents for the students to learn through the role and mission in the virtual space as the contents of new forms for the experiential learning through the augmented reality and TOLED (Transparent, Organic Light Emitting Diodes) system by using the vibrating Bluetooth maker cube for the multi maker configuration was designed and the system was designed to service it.

2. Related Works

2.1. Augmented Reality using Array Processing of Multiple-marker

The augmented reality is one of the virtual reality fields and it is called the mixed reality, it is the computer graphics technique which seems to be the real world through one image by composing the object or information in the virtual world based on the real world [3].
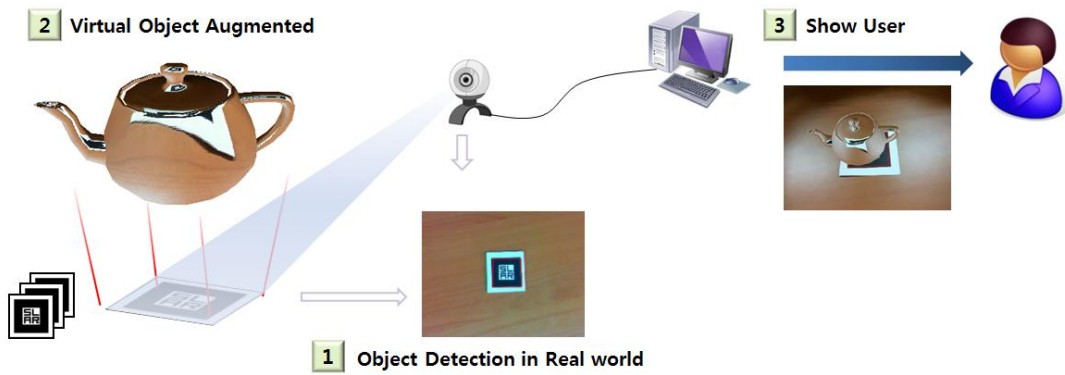

Figure 1. Structure of Augmented Reality

The augmented reality recognizes the object in the real world to augment the object, so it is classified with the location based augmented reality, non-maker-based augmented reality [4, 5], and maker-based augmented reality [6, 7].

The maker-based augmented reality has high recognition rate to augment the numerous virtual objects in real-time. However the maker which can be used is limited for recognizing the similar pattern because of recognizing as same pattern.

In order to solve this problem, the maker array should be created by composing the maker having the pattern with small similarity, and the maker array list technique which augments 256 objects based on ID of the created maker array was studied [8].

In this paper, the various characters, background, tools, and mission were created as equipment by expanding the fragmented maker function infinitely by solving the definiteness problems of the maker after the contents restructure through the array of the maker.

2.2. Education based on Augmented Reality

The augmented reality technique does not provide the simple multimedia learning contents like e-learning in the education areas such as the learning information which is hard to be explained by text and 2D data with difficult direct observation, the contents which are hard to be visualized, the abstract learning concepts, and the experiment with high risk and expenses, however it augments the virtual object in the real world, so the students can experience virtually and the current realistic increased, so many

opportunities can be provided by new teaching-learning medium to maximize the learning effect [9].

The educational characteristics of learning environment and advantages of the augmented reality were determined as follows based on constructionism in the education field.

First, the augmented reality technology show the ability to apply knowledge, understanding and can help improve visualize complex three-dimensional space. Second, it can help you to understand a situation similar to the actual task however can be a problem because of the representation of the situation. Third, you can experience the actual interface to directly manipulate the virtual content and interactive learning experience. Finally, virtual environments allow a user to control the content and learning in augmented reality.

Due to the advantages of the augmented reality, the contents using the augmented reality were developed in the education field, and the cases are as follows.

The 'ARCO-an architecture for digitization, management and presentation of virtual exhibitions' developed by M. White and F. Liarokapis is the research project to provide the reproduced the exhibits of the museum as three-dimensional shapes centered on Europe. This study reproduced information about cultural relics as the augmented reality technique for the user to watch the three-dimensional images which is embodied as the augmented reality with the physical artifacts at the museum [10].

The 'Kanji Tecaching' of D. Wagner in Austria is the augmented reality based system which conducts the studying Chinese through the game by using PDA. After putting the paper cards which the Chinese character is printed on the table, finding the letter cards corresponding on the presented icon through PDA, and then, the picture is presented in three-dimensionally by turning the finding card over [11].

3. Smart Leaning System based on AR-APM

The suggested AR-APM smart learning system in this paper is consisted with the TOLED table, Bluetooth vibrating maker cube, two webcams, smart learning software, and the structure is as Figure 2.
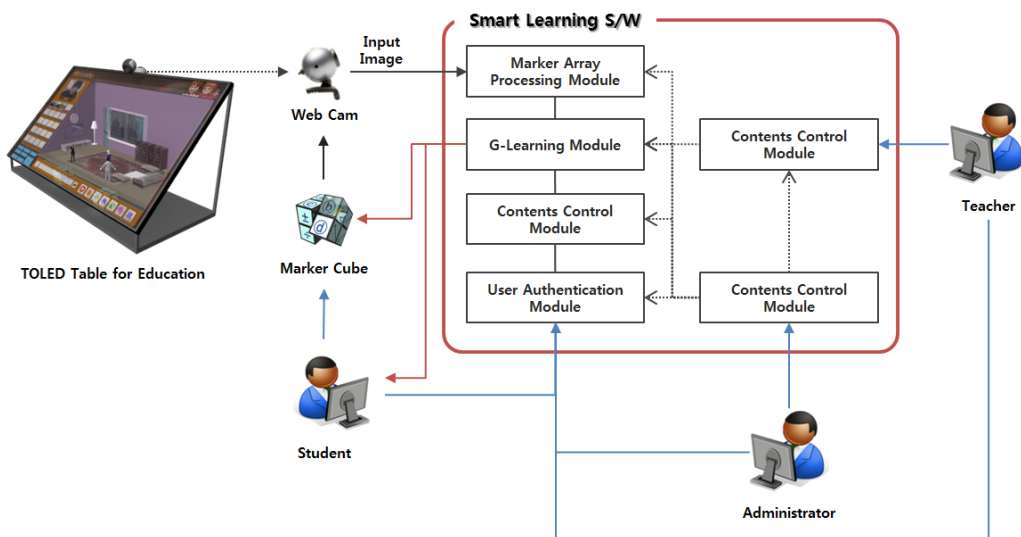

Figure 2.Structure of Smart Learning System

3.1. TOLED Table for Education

The suggested TOLED table in this paper is the device of the form of set-top boxes combining TOLED and Embedded PC for providing the G-Learning contents to user, and the webcam for the video chat and the webcam for the detection of the maker array are attached. Figure 3 is the diagram of the TOLED Table.

The TOLED table is provided to the user through the G-learning contents, and the user controls the contents by touching the TOLED. In addition, if the maker array is combined or the specific event occurs during the user conducts the G-Learning, the Bluetooth signal for creating the vibration which corresponds to the maker cube should be transmitted to the maker cube.

Figure 3. Content Augmentation Using Marker Array

3.2. Marker Cube

The suggested maker cube in this paper is the cube for the user to combine maker array of 2X2 matrix form, so it is composed with the piece cube attaching the maker which is used for the existing augmented reality, the Bluetooth communication signal which is transmitted from TOLED table when the event occurs in the smart learning, the Bluetooth module for receiving S/W, and the vibration module which vibrates based on the signal received from the Bluetooth communication module.
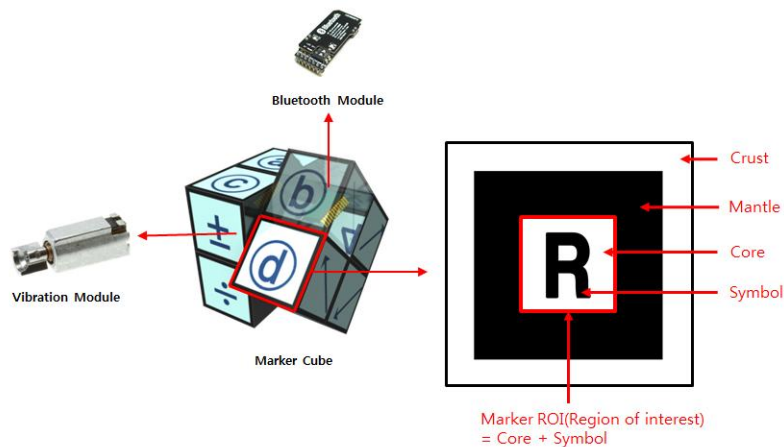

Figure 4.Content Augmentation Using Marker Array

3.3. Smart Learning Software

3.3.1. User Authentication Module: The user certification module is the module which is driven when the system started, it conducts the pre-classification of the users with the students, teachers, administrators through the joining service of the smart learning, and it saves the user's personal information in the database. When the registration of the user completes, then the service can be provided by dividing with g-leaning module, contents provide module, system management module by user based on the registered user information.
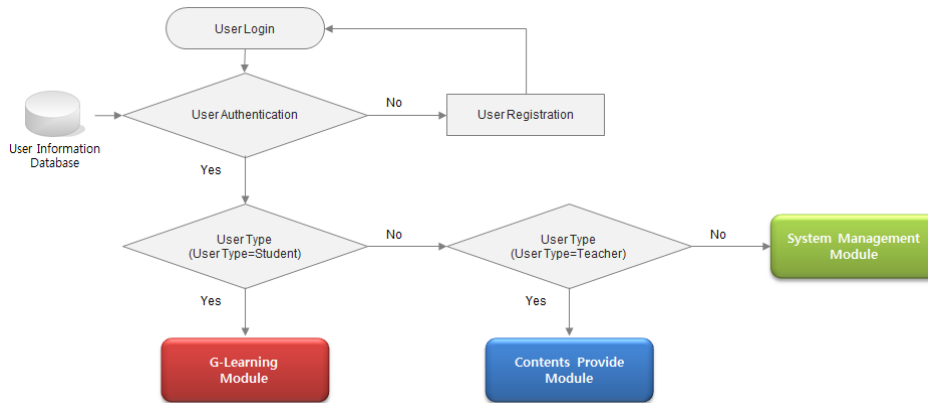

Figure 5. Flowchart of User Authentication

3.3.2. G-Learning Module: The g-Learning module is the module which conducts learning, so it searches the learning information of the user (students) with completed certification so it provides the learning contents to user, and it augments the learning object through the maker array processing module. During the learning process, the user interaction is conducted through the contents control module, and if the event occurs, the maker cube of the user can be vibrated through the Bluetooth communication module. If the learning process completes, the continuous G-learning service is provided to the user by searching the next learning process.
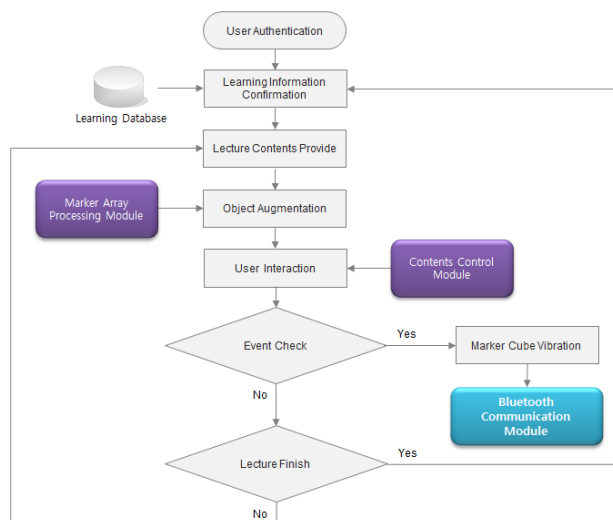

Figure 6. Flowchart of G-Learning Module

123

3.3.3. Contents Provide Module: The Contents Provide Module is the module which sets the G-learning contents, and it confirms the learning contents which are created by the certificated user (teacher), and it sets the G-learning contents by combining the created and up-loaded learning contents.
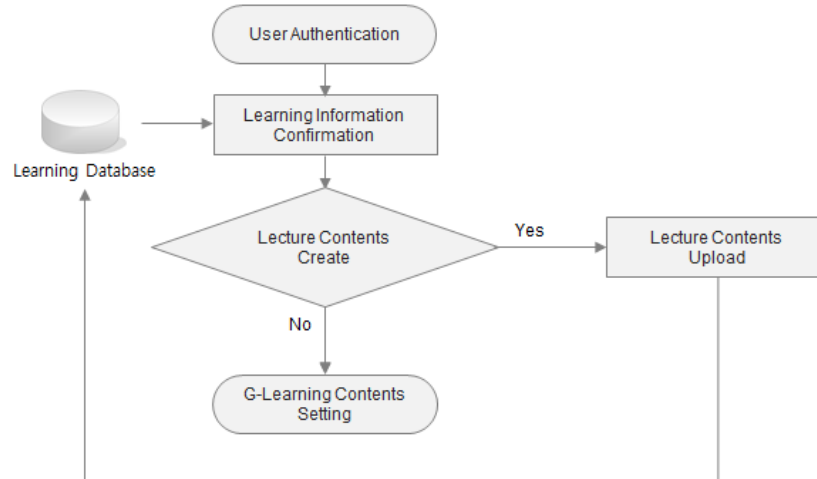

Figure 7. Flowchart of Contents Provide Module

3.3.4. Marker Array Processing Module: The maker array processing module detects the maker array through the existing maker array list method [8]. The order of processing of the maker array module is as follows, and it augments the contents corresponding to the detected maker array ID.

① The pre-procession of the image can be conducted by applying the histogram equalization, Otsu Threshold Determination to the input image.

② The criterion maker can be detected through the labeling work and template matching technique.

③ The maker array domain should be set for detecting the sub maker based on the criterion maker.

④ The sub maker can be conducted through the labeling work and template matching technique.

⑤ The sub maker should be confirmed in the set maker array domain.

⑥ By detecting the criterion maker, sub maker, the maker array ID consisted by the pattern of the detected marker can be recognized.

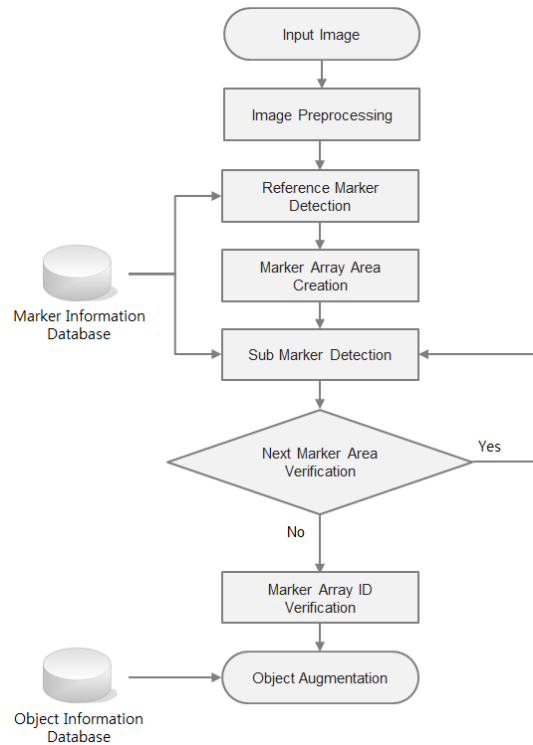⑦ The contents corresponding to the recognized maker array ID is augmented.

Figure 8. Flowchart of Marker Array Processing Module

3.3.5. Content Control Module: It is the module to control the contents which are augmented to conducted the registered learning contents, the user controls the contents by conducting the specific interaction through TOLED. In addition, the additional information which is needed for learning should be confirmed or be used.

4. Conclusion

The suggested system in this paper is the augmented reality system which uses the array processing of the multi maker, it can provide hundreds user interaction by few makers, so there is the distinctiveness with AR using the basic maker technique. In addition, it can make the image of optic angle through TOLED which cannot be implemented with a normal monitor using camera, so the differentiation of teaching methods is possible.

However the maker array list technique creates the maker array by using the criterion maker, Therefore it is difficult to detect the numerous maker arrays. So the maker array detection technology which can be recognized by the area of the screen with the singular webcam should be studied additionally, and the numerous users need to use the system through the various device in the characteristic of the G-Learning, so the system which can conduct the cross-platform using the Cloud service should be researched.

Acknowledgements

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