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# EXPERINN E-LEARNING SYSTEM

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## ABSTRACT

*This paper describes a new e-learning system named "Experience Innovations (ExperInn) e-learning system". ExperInn e-learning system is constructed on the foundation of two important base concepts. They are 1) Image recognition and 2) Augmented reality. It uses web as the major part of communication between learner and ExperInn e-learning service provider. The goal of the proposed system is to increase the learning ability of students and learners with the help of augmented reality audio visual contents. The driving force behind the development of this web-based database delivery mechanism is to provide the benefits of the ExperInn e-learning system to learners all over the world. The proposed e-learning system consists of uploading scanned images of the textbook to the web through service provider's website, database creation by the experts, downloading the database package by the learner, downloading the software and installing the software in the computer, installing the downloaded database files and supporting files (which consist of augmented reality outputs for particular situations), image recognition, color band recognition, displaying audio-visual contents. When the web camera of a PC captures the current page of textbook, the e-learning system first identifies the images on the page, and displays as well as augments some augmented reality contents on the monitor. For interactive learning, the proposed e-learning system can also make use of color-band markers, as this color-band usage mechanism is used by many researchers. The system delivers augmented reality contents for the particular request raised by the learner.*

**Keywords:** ExperInn e-learning system; interactive learning; augmented reality.

## INTRODUCTION

ExperInn e-Learning system makes use of two modern technologies. They are augmented reality and image recognition. It uses web as the communication path between ExperInn e-learning service provider and the learner.

### Augmented Reality

ExperInn e-learning system uses augmented reality [1]. Augmented reality helps in combining real world textbook to computer generated virtual contents.

### Image Recognition

Image recognition is designed for identification of current textbook page or image. When the textbook page or images in the page are identified, the related augmented reality interactive contents are automatically simulated in the PC or it looks as if virtual contents are overlaid on top of the image/textbook page.

## EXPERINN E-LEARNING SYSTEM

### Requirements at learner's side


**Computer** **Webcam** **Scanner** **Text**

**Fig. 1** ExperInn e-learning system hardware requirements at the learner's side.

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**Phases involved in ExperInn e-learning system**

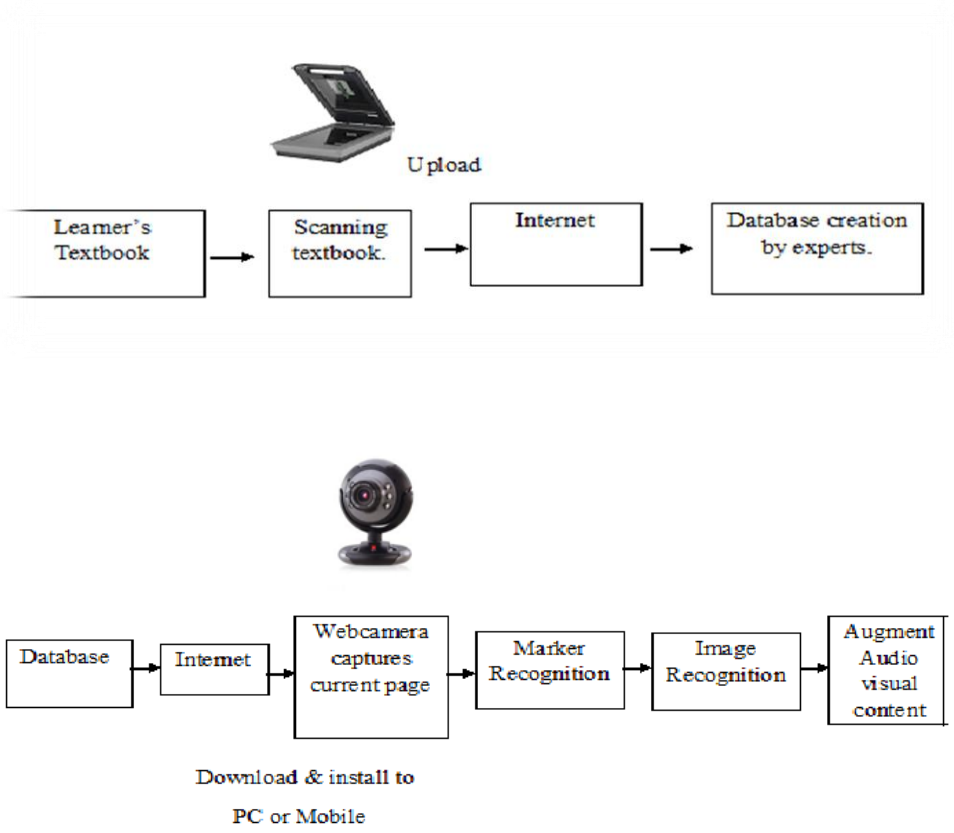


**Fig. 2** Phases of ExperInn e-learning system

The driving force behind the development of this database delivery mechanism is to provide the benefits of the ExperInn e-learning system to learners all over the world. This system is helpful to learners for self-study, as well as to review the material at a later time. It can also be applied to schools and colleges wherein virtual places can be created. Fig. 2 shows the structure of ExperInn e-learning system. Here, in this system, learners provide the contents of the textbook to the ExperInn e-learning service providers. The learner first scans the textbook and uploads it to the ExperInn e-learning service provider's website. These scanned copies will be handed over to experts who in turn create databases that include different images and their corresponding augmented reality audio visual contents.

## EXPLANATION OF PHASES IN EXPERINN E-LEARNING SERVICE PROVIDER'S SIDE

First, the learner has to select the textbook of which he/she requires an explanation. Then the learner has to scan all the pages of the textbook using a color scanner. Consequently, he has to upload those scanned copies to "ExperInn e-learning service provider's website", after which the service provider will collect these scanned copies. These scanned copies get processed through the phases presented below:

1) **Concept Analysis:** Concept analysts are the ones who look at the scanned copies of the textbook which are sent by the learner. They analyze the concepts presented in these textbooks and they find appropriate descriptions and explanations for figures, and objects comprised in these figures. They find diversified means to express those concepts, so that the learner can easily understand them.

2**) Concept to augmented reality audio visual content designing:** In this phase, audio visual contents are designed for a particular figure and a particular object in the textbook. The idea of what has to be designed related to that image/object will be provided by concept analysts. The audio visual

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contents are designed in such a way that the concept is conveyed to all categories of learners. Visual contents should be very effective for the learner. Here the audio visual content is designed according to the concept.

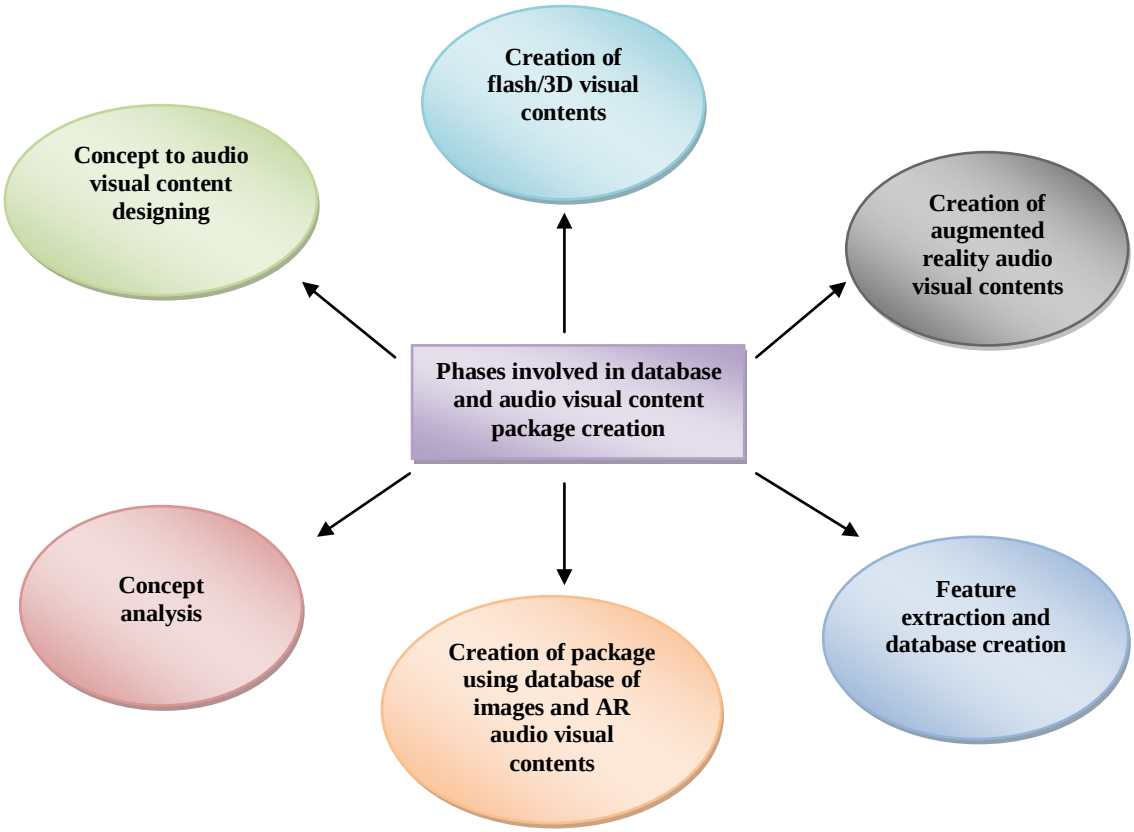


**Fig. 3** Phases involved in creation of packages after uploading scanned copies at ExperInn e-learning service provider's side

3) **Creation of flash/3D visual contents:** In this phase, actual flash/3D visual contents are created according to the design of the concepts. This is done by flash designers/3D creators. They make use of tools like Adobe flash builder, Adobe flash professionals, Adobe photo shops, Expression blend etc.

4) **Creation of augmented reality audio visual contents:** In this phase, suitable audio is prepared and linked with the video synchronously. This is done by audio and video content creators team. They are expected to be creative enough to convey the concepts in terms of augmented reality audio visual contents.

5) **Feature extraction and database creation:** The first step of feature extraction [2] is to detect the distinct points which are also invariant to image variations.

This phase involves creating database of images which contain all the images present in the textbook from which feature points are detected and description ID is assigned to each image. Another database is created in which suitable augmented reality audio visual contents are kept. Augmented reality audio visual contents appear when a suitable match is found.

6) **Creation of packages using database of images and augmented reality audio visual contents:** Finally, created database are made available as a package which the learner can install after installing the software. So indirectly this is an add-on to the software which is already provided by the e-learning service provider. This package or add-on changes from textbook to textbook since the database of images and related augmented reality audio visual contents change from textbook to textbook.

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From the experts, the learner receives the database through the website of the ExperInn e-learning service provider by downloading and installing the downloaded database files and supporting files as a single package or as an add-on to the existing software (which consists of augmented reality outputs for particular situations).

Before installing the package (database files and supporting files), the learner has to download the software which is provided by ExperInn e-learning service provider, and install it in his personal computer. This software contains database maintenance, an updating program and also an interface which gives an option to allow webcam access.

**Learner side software architecture of ExperInn e-learning system**

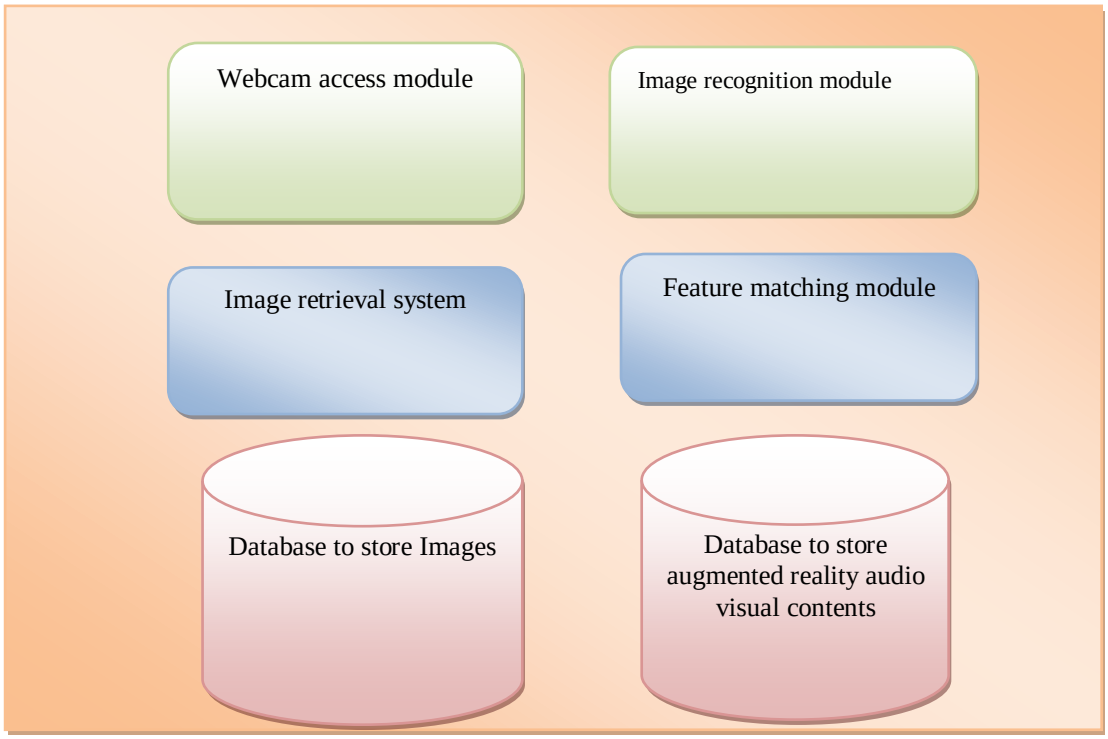


**Fig. 4** Learner side software architecture of ExperInn e-learning system

It consists of several modules, databases and an image retrieval system. Explanations for important modules are given below.

1) **Webcam access module**: It consists of a program to access a webcam in order to take input from it. As soon as the software starts, webcam access program or module starts executing. Then an "Allow webcam access" dialog box is displayed. By clicking "Allow" option, learner can provide input through the webcam.

2) **Image retrieval system**: It helps to retrieve images one after another from the image database which is compared with the image recognized from the textbook. Here, it simply retrieves an image from the database of images each time, and after a failed comparison the next image is retrieved from database. This process is repeated until a suitable match is found.

3) **Feature matching module:** It contains a set of codes for matching features of the recognized image which is pointed out by the learner with the set of images present in the database. The corresponding features are searched for, by reckoning the vector distance between the descriptors. Feature matching is done based on the closest match. ExperInn e-learning service provider can also use homography and RANSAC [4] for the sake of optimization as well as to reduce errors.

4) **Image recognition module**: It contains code for Image recognition. When we have all pairs of matched features, we can recognize the images. The simplest method is to count the number of matched features. As mentioned before, ExperInn e-learning system service providers can also use

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homography to reduce matching errors by removing mismatched features, thus satisfying the matching criterion.

5) **Database to store images:** Learner side software contains database to store images. Images are retrieved one by one. Each Image's descriptor ID which is a 4D vector is compared with that of the image taken as an input from the webcam. This database of images is updated whenever learner downloads the package and installs them.

6) **Database to store augmented reality audio visual contents**: In this database all augmented reality audio visual contents are kept. These audio visual contents are retrieved and appear when certain conditions are matched. This audio visual content database is also updated whenever the learner installs the package which is downloaded from the ExperInn e-learning service provider's website. These augmented reality audio visual contents change from Image to Image matches.

When the learner starts the software, an "Allow webcam" dialog box appears on the interface. As soon as the learner clicks on "Allow" option, the webcam program starts executing and requests for an input. Prior to this step, the learner has to scan the textbook and upload it in ExperInn e-learning system service provider's website and should wait for the download notification from the service provider. Upon download, learner has to install the package. Thereafter, webcam connected to the computer focuses on the textbook. The students study by watching augmented reality audio visual contents. Here service provider can make this e-learning system more interactive by including color-band which acts as a pointer, and can be utilized by the learner to point out particular images from the textbook page.

The advantages of ExperInn e-learning system includes: a) It helps students to understand the concepts clearly. b) The chance of false speculation while learning is reduced. c) After study, learners can perform whatever they desire. d) Less time to learn. e) Recollection of concepts is enhanced. e) Self-learning is made easy. f) It can be used in understanding geometrical puzzles. Ex. Structure of electron, atom etc. g) It can be used to demonstrate lab experiments. h) It leads to innovative thinking. i) It improves the standard of education. j) One can conduct virtual experiments.

## CONCLUSION

With this ExperInn e-learning system, it is easy to provide benefits to learners all over the world. With the help of this, a single package can be shared with other learners after downloading the package for a particular textbook. This system is helpful to learners for self-study purpose, as well as to those who wish to review the material at a later time. By using this e-learning system, it is possible to avoid the use of black and white markers in textbooks. It gives practical knowledge of the textbook concepts with audio visual contents while learning. This e-learning system can be applied to mobile devices like PDAs or mobile phones. Deployment of the proposed e-learning system confirms that if followed, it increases the learners' interest in that concept. It motivates learners to discover new things and to understand concepts in a better way.

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