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사용자 프로파일을 이용한 웹 기반 비디오 학습 평가 시스템의 구현

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Implementation of Web Based Video Learning Evaluation System Using User Profiles

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요 약

본 논문에서는 사용자 프로파일을 기반으로 한 정보 필터링을 사용하여 개개인의 학생들에게 맞는 효율적인 웹 기반 비디오 학습 평가 시스템을 제시한다. 비디오 기반 문제들이 주어지면, 키 프레임들은 위치, 크기, 그리고 컬러 정보를 기반으로 추출되고, 문제 출제 구간은 시간 윈도우와 그레이-레벨 히스토그램의 차이에 의해 추출된다. 게다가, 카테고리-기반 시스템과 키워드 기반 시스템을 합성하여 문제 출제가 효율적인 평가를 확실해 하도록 주어진다. 따라서 학생들은 관심 영역을 유지하면서 부족한 영역을 보충함으로서 학업 성취도를 향상시킬 수 있다.

Abstract

In this paper, we propose an efficient web-based video learning evaluation system that is tailored to individual student's characteristics through the use of user profile-based information filtering. As a means of giving video-based questions, keyframes are extracted based on the location, size, and color information, and question-making intervals are extracted by means of differences in gray-level histograms as well as time windows. In addition, through a combination of the category-based system and the keyword-based system, questions for examination are given in order to ensure efficient evaluation. Therefore, students can enhance school achievement by making up for weak areas while continuing to identify their areas of interest.

▸ Keyword : 사용자 프로파일(User Profile), 웹 기반 비디오 학습 평가 시스템(Web-Based Video Learning Evaluation System), 키 프레임 추출(Keyframe Extraction), 카테고리-기반 시스템(Category-Based System), 키워드-기반 시스템(Keyword-Based System)

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I. Introduction

Information processing refers to the active process of acquiring information from which an intended goal can be attained. Web-based information processing can be classified into two functions: information retrieval and information filtering.

Information retrieval, which allows the user to search his/her desired information, is the sequential process of analyzing and properly processing pieces of information or data collected in order to search and locate the information complying with the user's requirements from a database[1].

Information filtering allows for processing and filtering information so that a specific piece of information can meet the user's requirements. It refers to the dynamic filtering of information streams based on users' long-term profiles to be created and maintained by the system. Most dedicated filtering systems automatically create and maintain users' interest profiles using learning techniques[2,3]. Information filtering is an important process of information personalization. It is classified into the following three types, or combinations among them: conventional content-based filtering, social filtering, and economic filtering[4].

Content-based filtering is also referred to as cognitive filtering where objects are selected by the relationship between objects' contents and user priorities. Keyword-based filtering is representative of content-based filtering[3,5].

Social filtering is also referred to as collaborative filtering where objects are filtered from the perspectives of other people with similarity in occupation to the user[6]. Despite the drawback of requiring a number of participators and objects, social filtering is widely used; some of the most representative are as follows. In Tapestry[7], the user directly attaches his/her own annotations and determines his/her interest areas, and the program's composite filter then filters continuously saved documents. In Stanford Information Filtering Tool (SIFT)[8], which is a system for providing web-based filtering services, the user is provided with filtering services by means of one or more profiles that specify keywords where a matching strategy is used. For GroupLens[9], a distributed collaborative filtering system for Usenet News, the user can give weights to his/her desired articles.

Economic filtering is an information filtering technique that is based on cost factors[8]. The cost factor used here includes the relationship between the costs used and the profits or the relationship between network bands and object sizes.

Sometimes, combinations among the above- mentioned three filtering techniques are used; for example, NewsWeeder[10] is a combination of content-based filtering and social filtering, and used mainly for Usenet News.

Over the past few years, much study has been conducted by means of user profiles. Along with the advancement in XML, across-the-board filtering has been performed for of web-based documents, which is both content-based and structure-based. XFilter[11] is a typical filtering system that filters latest web documents. Filtering systems such as Franklin[12] use user profiles for data replenishment. These systems propose automatic data replenishment schemes based on user profiles that are written in semantic profile languages. Filtering systems such as Schwab[13] propose learning schemes that use potential user profiles in which obvious user observations are only used.

With the rapid expansion of the internet, the most remarkable progress in education has been made in the field of web-based distance learning evaluation. The proposed distance learning evaluation system has significantly contributed to addressing many problems posed by existing distance learning evaluation systems: for example, limitations in terms of time and space limitations on the number of evaluations; and inability to ensure evaluation objectivity, transparency and rapidity. Existing learning evaluation systems have some distinctive disadvantages in their inability to take individual student's characteristics and propensities into account. They also have the problem of performing evaluations merely uniformly.

A personalized user profile can be an effective solution to such problems. Through the use of personalized user profiles about students, question filtering is carried out in the question bank(database) in such a way as to reflect individual student's characteristics and propensities. In addition, students are provided with filtered questions yet to be solved so that they can make up for inadequacies in their study while pursuing further efforts towards enhancing academic excellence[14].

This paper proposes an efficient video-based learning evaluation system that uses information filtering, based on personalized user profiles through reflecting individual student's characteristics and propensities. As a means of giving video-based questions for examination, the proposed system uses the program entitled Janhakquiz which aired on EBS. Key-frames are extracted from a question-making shot using a scene change detection scheme that is based on the information such as the location, size, and color of the question number area in a video frame. Question-making intervals are extracted using differences in gray-level histograms as well as time windows. In particular, the question- making scheme featuring a combination of the category-based scheme and the keyword-based scheme is to be applied when using user profiles to allow students to make up for their weak areas and deal with matters of interest.

Hereafter, scene change detection for segmentation of question-making scenes will be described in Chapter 2. In addition, user profile-based learning evaluation, and substantial system implementation and application will be described in Chapter 3 and 4, respectively. Finally, conclusions will be made in Chapter 5.

II. Scene Change Detection

Video scene change detection is a technique using information within each frame that is continuously scanned from a video to search the point at which a video scene changes to another. Performing indexing for different contents is a prerequisite to developing digital video information as a database. In addition to enabling content-based search, this allows the user to make non-sequential access to his/her desired video information by means of scene change detection and indexing. Efficient replacing method and various scene change detection method of a caption in the video is expressed in [15]. Feature point detection and tracking of object in motion image is expressed in [16].

This paper presents a scheme for extracting keyframes and question-making intervals using scene change detection as a means of giving video-based questions for examination.

2.1 Keyframe Extraction

For the purpose of giving video-based questions for examination, we used the program entitled Janghakquiz broadcast on EBS. In this program, three rounds of evaluation is performed. However, in this paper, we used only one round of evaluation to perform a video segmentation. We used a total of five segmented question areas - Language, Mathematics, Society, Science, and Foreign Language in order to give questions for examination.

The following structural characteristics can be obtained as a result of evaluating one round of the program:

(1) When giving a set of questions, each question number and its content always appears.
(2) When each question number and its content appears, the question number flickers.
(3) Each question number and its content has its own fixed size.
(4) Each question number area has a specific color.
(5) Upon completion of giving questions for examination, question numbers and their contents disappear.

Based on the features described above, the keyframes in the question-making scene are extracted by means of similarity measurement during which information such as the location, size, and color of the question number area is used. The similarity measurement scheme can be represented as Equation (1):

$$Similarity = CIi(p,\ s,\ c) - TI(p,\ s,\ c) \quad \text{where } i = 1 \cdots m \qquad (1)$$

In Equation (1), TI(p, s, c) refers to the template having the position(p), size(s), and gray color(c) of the question number area as its values; it is created based on the previous knowledge. In addition, CIi(p, s, c) has each piece of information about the question number area of an input frame.

A keyframe is extracted by performing a comparison between critical values obtained as a result of similarity measurement for the question number area. If the result is within the critical values, the input frame is extracted as a keyframe. Otherwise, the input frame is considered a normal frame.

2.2 Extraction of Question-Making Intervals

The question-making interval(QMI) refers to the interval between the points where each question number and its content appears and disappears. The question-making scene refers to the scene obtained as a result of extracting a question-making interval based on an extracted keyframes. Extracting a question-making interval is preceded by finding a difference in gray-level histograms (Di) for the question number area, as shown in Equation (2):

$$D_i = \sum_{j=1}^{Bins} \left| H_i(j) - H_{i-1}(j) \right| \qquad (2)$$

In Equation (2), Hi(j) refers to the jth bin in the gray-level histogram for the frame i. Di refers to the difference in histogram between the present frame Fi and previous frame Fi-1.

In addition, the time window(Wi) assigned by the keyframe is measured to prevent a question-making interval from being improperly extracted due to flickering initially occurring when giving each question for examination. QMI is extracted only when there exists a difference in gray-level histograms within the critical value(DT). In addition, despite the difference in histograms exceeding the critical value, QMI is extracted if the frame difference(Wf) between the time point of a keyframe(Wk) and the time point of an input frame(Wi) exists within the time window(WT). Otherwise, the input frame is regarded as an NFI(Normal Frame Interval). <Fig 1> shows an algorithm for extracting question-making intervals.

```
For (i = 2; i ≤ n; i++) {
   D_i = gray-level histogram difference;
   W_f = |W_k − W_i|;
   If (D_i ≤ D_T) F_i = QMI;
   Else IF (D_i > D_T AND W_f ≤ W_T)
           F_i = QMI;
   Else F_i = NFI;
}
```

그림 1 QMI 추출 알고리즘
Fig 1. QMI Extraction Algorithm.

Therefore video data is stored continuously each keyframe and its question-making interval.

III. Learning Evaluation Using User Profiles

Conventional learning evaluation systems are substantially the same as the previous evaluation systems they do not consider limitations in terms of time and space, personal characteristics and propensities, and individual differences. Furthermore, they are very consuming and inefficient in terms of evaluation type, method, and processing. They provide very low evaluation productivity and efficiency as well.

In this paper, we aim to solve the problems posed by conventional evaluation systems through the use of user profiles. To do so, we propose a learning evaluation scheme that reflects individual student's characteristics and propensities. First, a question bank(database) will be constructed to allow for the performance of web-based evaluations that go beyond time and space. Second, questions will be filtered by means of user profiles. Finally, evaluation efficiency will be enhanced through giving consideration to students respective differences, and their characteristics and propensities. ⟨Fig 2⟩ shows the overall system architecture.

As shown in ⟨Fig 2⟩, the overall system is composed of three modules: administrator, teacher, and student. The administrator module consists of overall system management functions: teacher (acting as an administrator) registration and management, new course management, student information management, and system management. The teacher module consists of several functions: giving questions by area for examination, examination paper creation, and student school record query. The student module is composed of several functions: information query by students themselves, question solving, and school record query. This module allows relevant information to be saved onto the database through solving questions while enabling user profiles to be applied.

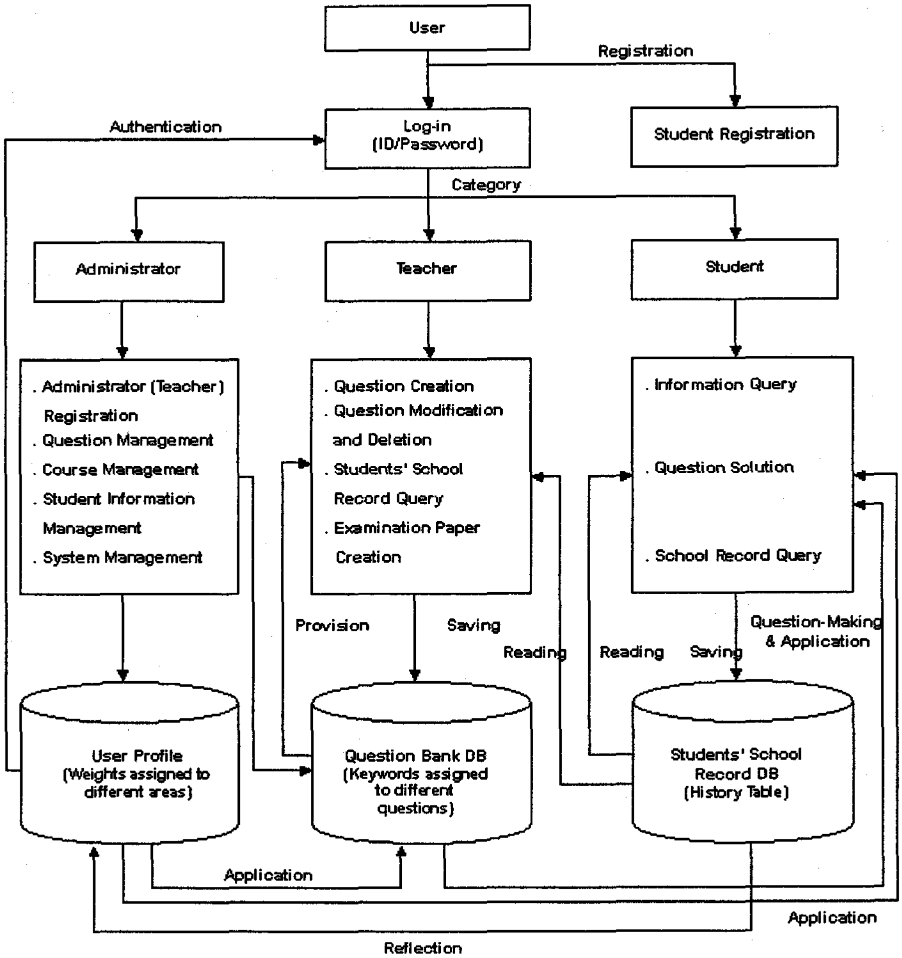


그림 2. 전체적인 시스템 구조
Fig 2. Overall System Architecture

3.1 Detailed System Architecture

The proposed system features a combination of category-based and keyword-based user profiles, focusing on addressing the problems posed by conventional learning evaluation systems. In this paper, an information retrieval agent for question-making purposes[5] allows for retrieval and filtering of suitable questions stored in the question bank by means of user profiles according to users' characteristics and propensities, and individual differences.

3.1.1 User Registration

If a user is logged onto the web page by entering his/her ID and password, the user is categorized by the user profile into the administrator, teacher, or student, and is granted varying levels of authority.

3.1.2 Administrator Module

Administrator has all levels of administrative authority such as user management, course management, and system management.

The User Management module allows for retrieval/query/modification/deletion of user information. The Course Management module performs course additions and deletions. The System Management module manages the entire database and adjusts critical values (Cp(V))for non-applied profiles.

3.1.3 Teacher Module

Teacher has authority to create questions, give questions, and perform queries for student school records. When questions are created, the administrator saves them in the question bank(database). The teacher can help students by creating on-line help guides at the time of giving questions for examination. In addition, the teacher may give questions through utilizing multimedia such as images, music, etc.

When generating a set of questions, the teacher should define keywords that support the keyword-based user profile system. Defining keywords is enabled by entering the most important subject in the corresponding question as a keyword during the question generation.

3.1.4 Student Module

The student module is the most important part in the evaluation system to which the user profile is applied. Students solve optimized questions using the user profile, and a new user profile is reflected in the evaluation system. The student who has logged on is provided with an examination schedule such as the number and frequency of exams, the number of questions by area, and exam duration, prior to taking a full-fledged exam.

A set of questions that are generated for students need to be optimized by means of a user profile such that those questions can reflect individual student's differences and characteristics. In case of an exam that has as many non-applied critical values (Cp(V)) as set by the administrator, no user profile is reflected in any area so that an optimized user profile can be generated. In this case, the user profile is accumulated through solving as many questions as the number of non-applied initialized profile questions (iPq(N)). If Cp(V) is satisfied through this process, the evaluation system obtains both weights by area(weight[i]) and words of user interest(Iu(W)), thereby creating and maintaining the user profile.

3.2 Question Filtering Using User Profile

If a student takes an exam, the system makes reference to the user profile to perform analysis and verification of the user information, filters questions, and provides suitable questions to the student. In addition, the number of questions for different areas is determined by calculating the weights by area. In this paper, question filtering is performed using a combination of the category-based and keyword- based schemes.

3.2.1 Category-based Scheme

Scores by area can be obtained by finding the total score of individual questions for different areas. In addition, the total area score can be obtained by summing up all scores by area.

This evaluation system aims to identify individual student's characteristics and propensities by performing relative evaluations for different areas this system converts scores by area, not the total score, into relative percentages that are then reflected in the system. In the next round of evaluation, the system will give positive integer weights to weak areas with the purpose of assigning the number of questions to the weak areas. Given that it is capable of explicitly representing the number of questions by area, this scheme is also called a category-based system using explicit techniques.

Although this explicit category-based system can perform quantitative analyses, it has difficulty in carrying out qualitative analyses. In this thesis, higher weights are given to users' weak areas. However, this may cause students to lose their interest. Therefore, keeping it in mind, we conducted an integration of a keyword-based system with a category-based system in order to complement the weak points of the category-based system.

3.2.2 Keyword-based Scheme

The keyword-based scheme enables qualitative elements to be incorporated into the evaluation system. The category-based system classifies question areas as a means of performing evaluations and assigning weights by area. On the contrary, the keyword-based system searches the most important subject matter of interest from each question and puts the subject into the corresponding question as a keyword. Afterwards, it selects the most frequently occurring keywords among the questions that the user answered correctly, and inserts the keywords into the queue saved in the existing keyword data to create a new keyword profile. In the next evaluation, the keyword-based system preferentially generates the questions for examination containing the words of user's interest where a new keyword profile is reflected in the number of questions for different areas assigned by the category-based system.

In the category-based system, selection criteria for keywords are subjective. To reflect the subjective nature of such selection criteria, a retrieval function should be used to extract questions from the question bank DB. In this paper, we used "LIKE" statements in the standard SQL convention provided by MySQL.

3.2.3 Question Filtering Process

1) This process determines whether questions should be given through reflecting a user profile. This process is needed to accumulate the user profile, outputted in the form of Yes or No. Through this process, reliability can be given to the user profile that includes some pieces of uncertain, unclear, and implicit information.

   In this paper, a critical value (Cp(V)) for the non-applied profile is set to accumulate the user profile. If the overall user evaluation coefficient (Tt(C)) is smaller than Cp(V), as shown below, the user undergoes normal evaluation rather than profile-applied evaluation, and the result is reflected in the profile.

```
IF (Tt(C) < Cp(V))
THEN FOR(i = 1; i ≤ Ta(N); i++)
Qa(N)[i] = iPq(N)
```

Cp(V) : Critical value for non-applied profiles;
Tt(C) : Overall evaluation coefficient;
Ta(N) : Total number of areas;
Qa(N): Number of questions by area;
iPq(N) : Number of questions for non-applied profiles.

2) In this process, the number of questions by area is calculated. The user profile in the form of the number of questions is read from the database. The category-based system is implemented in the same manner that the user is provided with a set of questions by area complying with relative levels of learning. In this routine, the number of questions by area is determined.

```
FOR(i = 1; i <= Ta(N); i++)
Qa(N)[i] = Query(Select Area[i] From
           User_Profile_DB where ID = userid
```

3) In this process, as many questions as Qa(N) are assigned to the corresponding area. This routine implements the keyword-based system that is created through marking exam papers and reflecting the user profile, and that preferentially selects the questions relevant to the words of users' interest by means of modified Iu(W).

```
FOR(i = 1; i <= Qa(N); i++)
Question_Array += Query(Select Question_No
    From Question_DB
 where Question_Keyword Like %Iu(W)% )
```

Iu(W) : Words of users' interest.

If the value of Iu(W) is null, or if all record sets of questions corresponding to Iu(W) are added, the words of users' interest are randomly selected using the function Random(). In both cases, if all selected record sets are inserted into Question_Array, the questions to be given to the user are selected through undergoing duplicate checks and through application of an array algorithm. In this paper, we used a selective array.

4) The system allows the user to view the passage followed by questions and accepts the user-entered examination paper in array form.

5) The scoring routine performing comparison between the correct answers extracted from the question bank and the user-entered exam paper calculates the total of the user's marks for different areas and the grand total.

6) Weights by area are calculated so that they can be applied to the category-based system. Weights by area are important data that are used to determine individual student's characteristics and propensities. For the scores earned by a student on different areas, strong areas on which the student earned high scores have lower negative values, and weak ones where the student earned low scores have higher positive values. The system gives weights to weak/strong areas in such a way as to reduce the number of questions set for the areas in which students show interest, as well as increase the number of questions set for the areason which they can solve questions. This allows students to make up for their weak areas and hone their abilities.

For(i = 1; i <= Ta(N); i++)

$$weight[i] = \left\{ \left(\frac{T_t(S)}{T_t(N)} - \frac{T_a(S)[i]}{Q_a(S)[i]} \right) \bullet T_a(N) \right\}$$

Tt(N) : Total score as the grand total of full marks;

Tt(S) : Total score earned with respect to Tt(N)as the grand total of full marks;

Qa(S) : Total score as full marks for different areas;

Ta(S) : Scores by area earned with respect to Qa(S) as the grand total of full marks.

These weights are multiplied by the question ratio (converted to decimals) for the preceding exam, along with the number of questions. The result of multiplication is rounded off to the nearest integer, and either added to or subtracted from the number of preceding questions. Then, the number of following questions is calculated.

7) Iu(W) is calculated so that it can be applied to the keyword-based system.

```
For(i = 1; i <= Ta(N); i++)
  Iu(W) = Query(Select Question_Keyword
  From Area(i)
 Where Question_No = Area(i)(right_j))
```

right_j : The question numbers of a corresponding area with a set of correct answers.

8) Weights obtained in the category-based system and Iu(W) obtained in the keyword-based system are updated in the user profile database. The weights are updated in such a way as to perform addition operations on the existing profile data. Iu(W) is updated in such a way as to inserting existing profile data into

Queue, followed by push operations on newly-acquired data.

9) The system allows the user to view the total scores by area as well as the combined total, and saves them onto the history database.

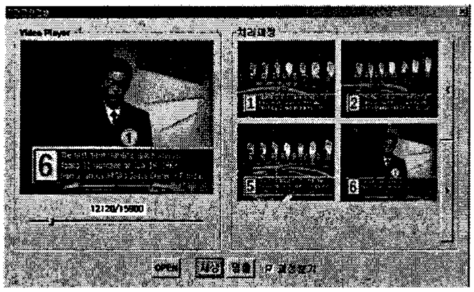


그림 3. 장면전환검출
Fig 3. Scene Change Detection.

Ⅳ. Implementation of Video-based Distance Learning Evaluation System

4.1 Implementation Environments

The proposed video-based distance learning evaluation system featuring the use of user profiles was implemented using an Apache web server to use TCP/IP environments on a Pentium 4-1.4GHZ PC. Scene change detection for the video of the Janghakquiz broadcast on EBS was implemented using Visual C++6.0. In addition, we used MySQL to develop a medium-range database system server on a Windows 2000 Server, together with PHP3 as a tool for making access to the database.

4.2 Implementation of Scene Change Detection

We used the first round of the EBS Janghakquiz to detect our desired scenes from video streams. Keyframes were extracted through the use of the structural features(i.e., location, size, and color information) of a question number area in the video. Question-making intervals were extracted using differences in gray-level histograms, and time windows. 〈Fig 3〉 shows the process of performing scene change detection.

〈Table 1〉 shows the location, size, average gray color and time window of a question number area for scene change detection, as well as reference and critical values for differences in gray-level histograms.

In 〈Table 1〉, the reference value is the standard value for a particular question number region, and the critical value is the value corresponding to the critical region for the reference value. If all features exist within the range of the critical value, it is possible to extract keyframes and questions-making intervals.

표 1. 장면전환검출을 위한 임계값
Table 1. Critical Values for Scene Change Detection

Features	Reference Values(RV)	Critical Values(CV)
Location(x, y)	25, 171	RV±1
Size	1739	RV±83
Average Gray Color	170	RV±10
WT	60	RV±5
Di	100	RV±10

4.3 User Module Implementation

The user can access the system using his/her ID and password authorized by the administrator.

4.4 Administrator Module Implementation

The administrator controls and manages overall matters related to giving questions for examination and to exam areas. In addition, Cp(V) and iPq(N) are set that are necessary for managing and piling up the information about students and teachers. ⟨Fig 4⟩ displays the screen of the administrator module.

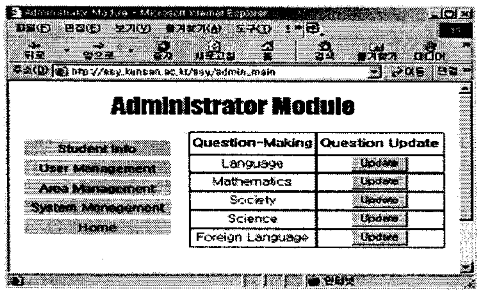


그림 4. 관리자 모듈 화면
Fig 4. Administrator Module Screen

4.5 Teacher Module Implementation

The teacher can manage student information, give questions for examination, and perform modifications with the exception of system management, course management and administrator management among administrator functions. To implement a keyword- based scheme for giving questions, questions(passage) in video format and keywords can be inserted, as shown in ⟨Fig 5⟩.

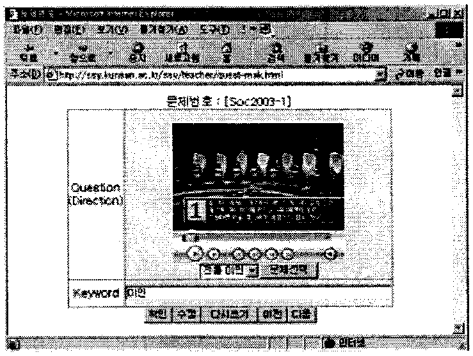


그림 5. 교사 모듈의 문제 출제 화면
Fig 5. The Question-Making Screen of the Teacher Module.

4.6 Student Module Implementation

When a student makes access to the video-based distance learning evaluation system, the main screen displays the number of questions for different areas and question ratios for evaluating learning through analysis of user profiles(See ⟨Fig 6⟩).

As illustrated in ⟨Fig 6⟩, students read exam schedules, and they solve successive questions, as shown in ⟨Fig 7⟩.

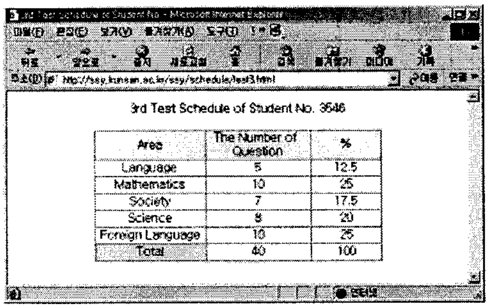


그림 6. 학생 모듈의 시험 일정
Fig 6. Examination Schedule of the Student Module.

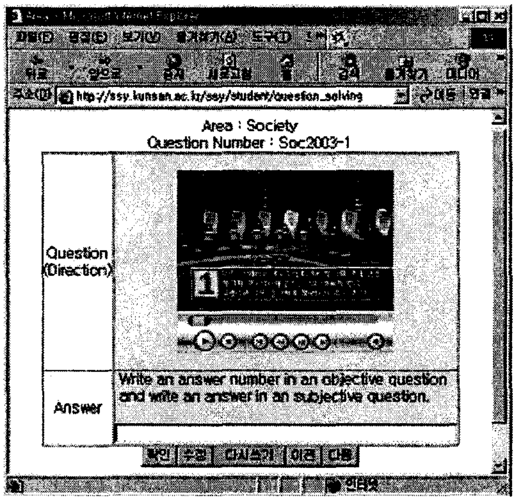
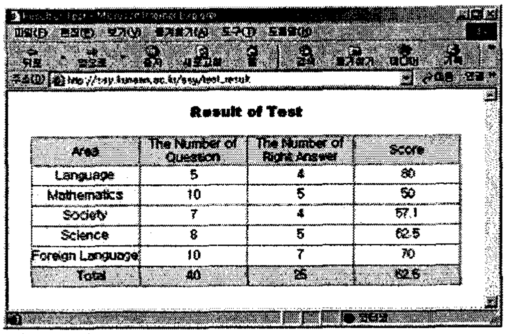


그림 7. 학생 모듈의 문제 풀이 화면
Fig 7. The Question-Making Screen of the Student Module.

The user is provided with the corresponding area by question and question number, and the system receives the user-entered answers. Upon completion of solving the questions, the system allows for automatically moving to the page that lets the user verify his/her exam results.

Exam scoring and results enables the user profile of the category-based system to be updated by means of relative scores for different areas. In the Mathematics area, as illustrated in ⟨Fig 8⟩, Tt(N) has a value of 100 on the basis of 100 points, and Tt(S) has a combined score of 62.5 secured on the basis of Tt(N) as 100 points. While Qa(S) has a value of 100 on the basis of 100 points as combined scores for different areas, Ta(S) has a combined total of 50 obtained on the basis Qa(S) as 100 points. In addition, Ta(N) has a value of 5 that is the number of areas.

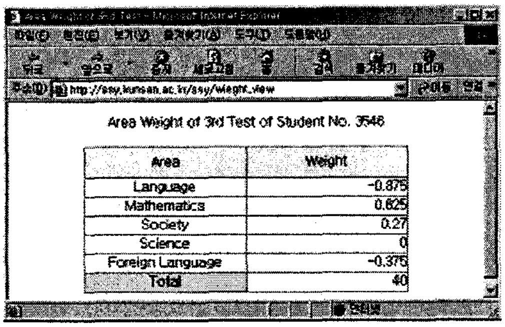
⟨Fig 9⟩ shows the result obtained when weights are assigned to different areas according to the exam result illustrated in ⟨Fig 8⟩.



Result of Test

Area	The Number of Question	The Number of Right Answer	Score
Language	5	4	80
Mathematics	10	5	50
Society	7	4	57.1
Science	8	5	62.5
Foreign Language	10	7	70
Total	40	25	62.5

그림 8. 시험 결과를 보이는 학생 모듈 화면
Fig 8. The Screen of the Student Module Showing Exam Result.

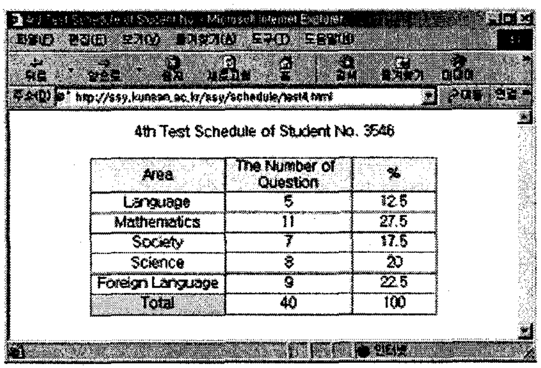


Area Weight of 3rd Test of Student No. 3546

Area	Weight
Language	-0.875
Mathematics	0.625
Society	0.27
Science	0
Foreign Language	-0.375
Total	40

그림 9. 학생 모듈에 대한 영역별 가중치
Fig 9. Weights by Area for the Student Module.

As illustrated in ⟨Fig 10⟩, the user profile updated through the preceding exam is applied to the next exam, and the number of questions is changed.



4th Test Schedule of Student No. 3546

Area	The Number of Question	%
Language	5	12.5
Mathematics	11	27.5
Society	7	17.5
Science	8	20
Foreign Language	9	22.5
Total	40	100

그림 10. 학생 모듈의 다음 시험 일정
Fig 10 Student Module's Next Exam Schedule.

⟨Table 2⟩ shows variations in the number of questions between the third and fourth exams to which the user profile of the student No. 3545 was applied.

표 2. 3번째와 4번째 시험 문제수 변화
Table 2. Variations in the Number of Questions between 3rd and 4th Exams.

Area	3rd Exam		4th Exam	
	Number of Questions	% (Area/ Total)	Number of Questions	% (Area/ Total)
Language	5	12.5	5	12.5
Mathematics	10	25	11	27.5
Society	7	17.5	7	17.5
Science	8	20	8	20
Foreign Language	10	25	9	22.5

As shown in ⟨Table 2⟩, we performed learning evaluations targeted at students in a more effective manner through the use of user profiles and by adjusting the number of questions according to the personalized features for different areas.

⟨Fig 11⟩ shows the screen of the administrator module that displays the exam information of the student No. 3456. As shown in ⟨Fig 11⟩, Iu(W) applies to the keyword-based system, and to the next exam and evaluation.

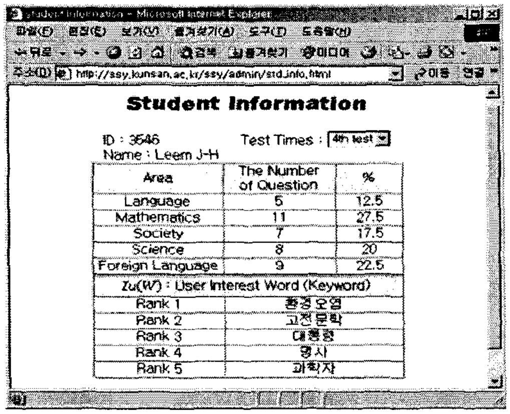


그림 11. 학생 정보를 보이는 관리자 모듈 화면
Fig 11. The Screen of the Administrator Module Displaying Student Information.

4.7 Comparison and Evaluation

Conventional system's question-making is simple and overall, and evaluation type is uniform. Also, question-making is evaluator-centric, wholly identical, and equally non-prioritized manner. And question-making medium is only text, and evaluation purpose is simple evaluation of academic achievement.

⟨Table 3⟩ shows a comparison between the characteristics of a conventional learning evaluation system featuring simplicity and uniformity, and of the proposed learning evaluation system.

As seen in ⟨Table 3⟩ the main objective of the proposed video-based learning evaluation system using user profiles is to allow each individual student to make up for his/her weak areas in consideration of his/her characteristics and interest, as well as to allow students to improve academic achievement by maintaining interest in their strong areas. Therefore, unlike conventional evaluation systems, the proposed evaluation system avoids evaluating students' academic achievements in a simple and uniform manner.

표 3. 기존 시스템과의 비교 평가
Table 3 Comparative Evaluation between the Two Systems.

Items	Conventional System	Proposed System
Question-making and evaluation type	Simple, overall, and uniform	Differ per individual
Number of questions per area	Wholly identical	Differ per individual
Criteria for giving questions and for evaluations	Examiner- and evaluator-centric	Based on individual characteristics and interest
Priority for question-making and evaluation	Equally non-prioritized	Priority placed on weak areas
Medium for giving questions	Text	Video
Purpose of Evaluation	Simple evaluation of academic achievement	Improvement of academic achievement

V. Conclusion

In this paper, we proposed an efficient video-based learning evaluation system that uses user profile-based information filtering, and that is tailored to individual student's characteristics and propensities. To perform evaluation using user profiles, we used a question-making approach featuring a combination of the category-based and keyword-based systems. In addition, as a means of giving video-based questions for examination, we extracted keyframes from question-making scenes by means of structural features such as location, size, and color information. Question-making intervals were extracted by means of differences in gray-level histograms and time windows. The proposed system allowed students to make up for their weak areas and improve academic achievement while maintaining their areas of interest. In particular, the user profile significantly contributed to enhancing efficiency in performing learning evaluation. In addition, the users' words of interest aroused students' interest in learning, and greatly helped teachers guide students.

References

[1] D. Lefkovitz. "File Structure for Online Systems," Rochelle Park : Hayden, 1969.

[2] Feynman, C.. "Nearest neighbor and maximum likelihood methods for social information filtering," International Document, MIT Media Lab. 1993.

[3] Sheth, B. D.. "A Learning Approach to Personalized Information Filtering," SM Thesis, Department of EEVS, MID, 1994.

[4] T. W. Malone, et al.. "Intelligent Information Sharing System," Communications of the ACM, Vol. 30, No. 5, pp. 390-402, 1987.

[5] Salton, G. and McGill, M. J.. "Introduction to Modern Information Retrieval," McGraw-Hill, 1993.

[6] Thomas Kahabka, Mari Korkeaaho and Günther Specht. "GRAS : An Adaptive Personalization Scheme for Hypermedia Databases," Proc. of the 2nd Conf. on Hypertext-Information Retrieval -Multimedia(HIM '97), pp. 279-292, 1993.

[7] Goldberg, D., Nicholas, D., Oki, B., and Terry, D.. "Using Collaborative Filtering to Weave an Information Tapestry," CACM, Vol. 35, No. 12, pp. 61-70, 1992.

[8] Tak Y. Yan and Hector Garcia Molina. "SIFT-A tool for wide-area information dissemination," In Proc. of the 1995 USENIX Technical Conf., pp. 177-186, 1995.

[9] Paul Resnick, Neophytos Iacovou, Mitesh Suchak, Peter Bergstrom and John Riedl, "GroupLens : An open architecture for collaborative filtering of netnews," In Proc. of ACM 1994 Conf. on Computer Supported Cooperative Work, pp. 175-186, 1994.

[10] Lang, K.. "NewsWeeder : An Adaptive Multi-User Text Filter," Research Summary, 1994.

[11] M. Altinel and M. J. Franklin. "Efficient Filtering of XML documents for Selective Dissemination of Information," Proc. VLDB Conf., 2000.

[12] M. Cherniack, M. J. Franklin and S. Zdonik. "Expressing User Profiles for Data Recharging," IEEE Personal Communications, pp. 6-13, 2001.

[13] I. Schwab and A. Kobsa. "Adaptivity through Unobstrusive Learning," KI 3(2003), Special Issue on Adaptivity and User Modeling, pp. 5-9, 2003.

[14] Lee E. B, Kwak D. H and Ryu K. H. "Understanding of Computer," KNOU press center, 1999.
[15] 전병태, 김숙연, "비디오 자막 문자의 효과적인 교환 방법," 한국컴퓨터정보학회논문지, 제 10권, 제 2호, pp. 97-104, 2005.
[16] 임익선, "인터넷 동영상에서 물체의 특징점 탐지 및 추적," 한국컴퓨터정보학회논문지, 제 10권, 제 1호, pp. 149-156, 2005.

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