Bilkent University

Department Of Computer Engineering

CS-353 Database Systems

Group 10

Project Proposal

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Table Of Contents

Introduction

Humans are constantly in need of knowledge and improvement. With advancements in technology, they are now capable of using online education and certification platforms to expand their knowledge base. In this report, we will propose an online education and certification system that is reliable and efficient in database management. This system will be described in the following part. Then, the reasons for using the database and its utilization will be discussed. Furthermore, the system requirements and limitations will be stated. Lastly, the E-R diagram will be presented.

Description

This web application is a platform for online education and certification, where several actors can be involved. There are three types of actors: students, instructors, and admins. Firstly, the system will provide myriad functionalities to students, such as exploring and enrolling in various courses, tracking their progress, asking questions to the instructors, giving feedback for the courses, and obtaining certifications for successfully completed courses. Similarly, instructors will be able to create courses with predefined schedules, manage the course content, prepare exams, quizzes, and assignments, and view student evaluations about the course. Finally, the admins will be given the ability to approve the recently created courses, view the statistics, such as the most popular courses or user information of the system, and generate related reports. The system will also have some additional features, including instructor-scheduled online meetings between students and instructors and a financial aid program to grant students free access to paid courses. Lastly, all the users will be notified of the events that require attention.

Why/How a Database is going to be used

Our aim for this project is to provide a database application for the web-based education service. In our database, there will be several user types like student, admin, and instructor, as well as education-related entities such as course content, assignments, and assessments. The instructor can create a course, sections, and content (assignments, assessments, etc.) for these sections. Students can join courses and access course content. These events will create a massive amount of data, and that data will be complex to manage without an automated database system. The database will be used for the following events in our application:

- To determine user permissions(ex. Content access permission difference between student and instructor)
- To get the entity attributes like assignment, assessment content, or user information.
- To create notifications about the system by admin or content-related exam or quiz update
- To store student enrollment, progress, and submission.
- To create a new course and its content for the instructor user type.
- To manage the existing course and section for the instructor user.

This database application will handle the query operations, new data entries, deletion operations, and updates.

Functional Requirements

Student

- Students can register to / log in to the system and maintain their personal profiles with contact information.
- Students can browse all courses, view the course information (including information about its instructor), and enroll for the courses.
- Students can study the course by interacting with various materials like video, audio, images, web-based text, and documents.
- Students must complete the course sections within the course schedule defined by the course instructor to be able to acquire certificates. For instance, if a time period for a section is defined as a week, a student must complete this section one week after his onset.
- Students should take quizzes, assignments, and exams as a course evaluation method.
- Students can join online meetings, which are held by the instructor.
- If students complete the section within the time limit and meet the passing criteria, they will receive a certificate for the successfully completed course.
- Students can view their previous courses with acquired certifications and current courses with their progress rate.
- Students must pay for the courses if the course is not free. However, a student may apply for financial aid to receive free access, which will be evaluated by the course instructor.
- Students can comment on each course's content and ask questions about them, to which the instructor or other students can respond.
- Students can rate the course out of 5 and give feedback about the course content or instructor. In addition, students can view the average rate and feedback for the course.
- Students will receive notifications for events such as assignments, quizzes, exams, section deadlines, financial aid results, replies to posted comments, and upcoming online meetings.

Instructor

- Instructors can register to / login to the system and maintain their personal profiles with contact information.
- Instructors can create courses and define schedules for courses, such as a time period for completing a specific section. Then, register these courses to the system for admin approval.

- The admin-approved courses become available in the system for the students. Then, instructors can manage the course content.
- Instructors can also create exams, quizzes, and assignments, which consist of multiple-choice, open-ended, true-false, checkbox, or document-based questions.
- Instructors can respond to student questions in the comment section of the specific course content.
- Instructors can view the ranking of the students taking the course and can also view information about specific students.
- Instructors can view student feedback and ratings about the course.

Admin

- Admins can view and approve the course creation requests sent by the instructor.
- Admins can view student and instructor profiles.
- Admins can access statistics about the courses or the users of the system. The statistics include the most demanded courses, enrollment trends for the courses, ratings, quiz/exam/assignment analytics, and insights about users.
- Admins can generate reports about these statistics.

Non-Functional Requirements

1. Usability Requirements

Dashboard System

Since this application involves core operations such as creating course content by instructors, enrolling courses by students, completing course materials, accessing assignments, attending scheduled meetings, and tracking student progress (by both students and instructors), a dashboard system will be designed to allow access easily to all these features within at most 3 clicks.

Notification

Notifications will appear to inform users before the deadline for the events discussed above. It performs by alerting all related users within ~3 seconds. In addition, a red dot on the notification icon will catch users' attention and help them keep up with the new updates.

2. Performance Requirements

Responsiveness and Scalability

The application should load all pages within 2 seconds under normal load conditions to ensure no problem occurs related to accessing different parts of the

application. Also, our education platform should initially support at least 1.000 concurrent users without performance degradation.

Data Handling

Since there will be lots of data, course documents, content, videos, images, assignments, etc., on education platforms, accessing and displaying these contents should not affect our system's performance. Application data, such as user profiles, course information, and progress tracking, will be stored in a relational database to ensure data consistency and support complex queries.

3. Reliability Requirements

Data Consistency

All changes to user data, course materials, and other operations must be accurately reflected across the system. To provide that, our database operations will follow ACID principles to ensure data validity despite the errors.

Security

To secure our application, the information accessible to each user will be determined by their role in the system. For example, instructors will see student progress, feedback, and email addresses, whereas students can't view the personal information of other students, while admins can access system-wide statistics and user management tools. The actors' credentials will be encrypted using a hashing algorithm and securely stored in the database.

4. Maintainability

Lastly, our system architecture will follow a modular approach for easier updates and maintenance. The codebase will be modular and divided into entity, service, and controller blocks, ensuring enhanced organization and maintainability and making it easier to update and add new features. Comments and documentation will be provided in the codebase when necessary to improve readability.

Limitations

- Only admins can generate and view reports.
- Only admins can approve or reject course applications made by instructors.
- Only instructors can schedule the course and decide the structure, passing grade, etc.
- Only students and their course instructor can view a student's assignments, quizzes, and exams.
- Students cannot view the profiles of other students.

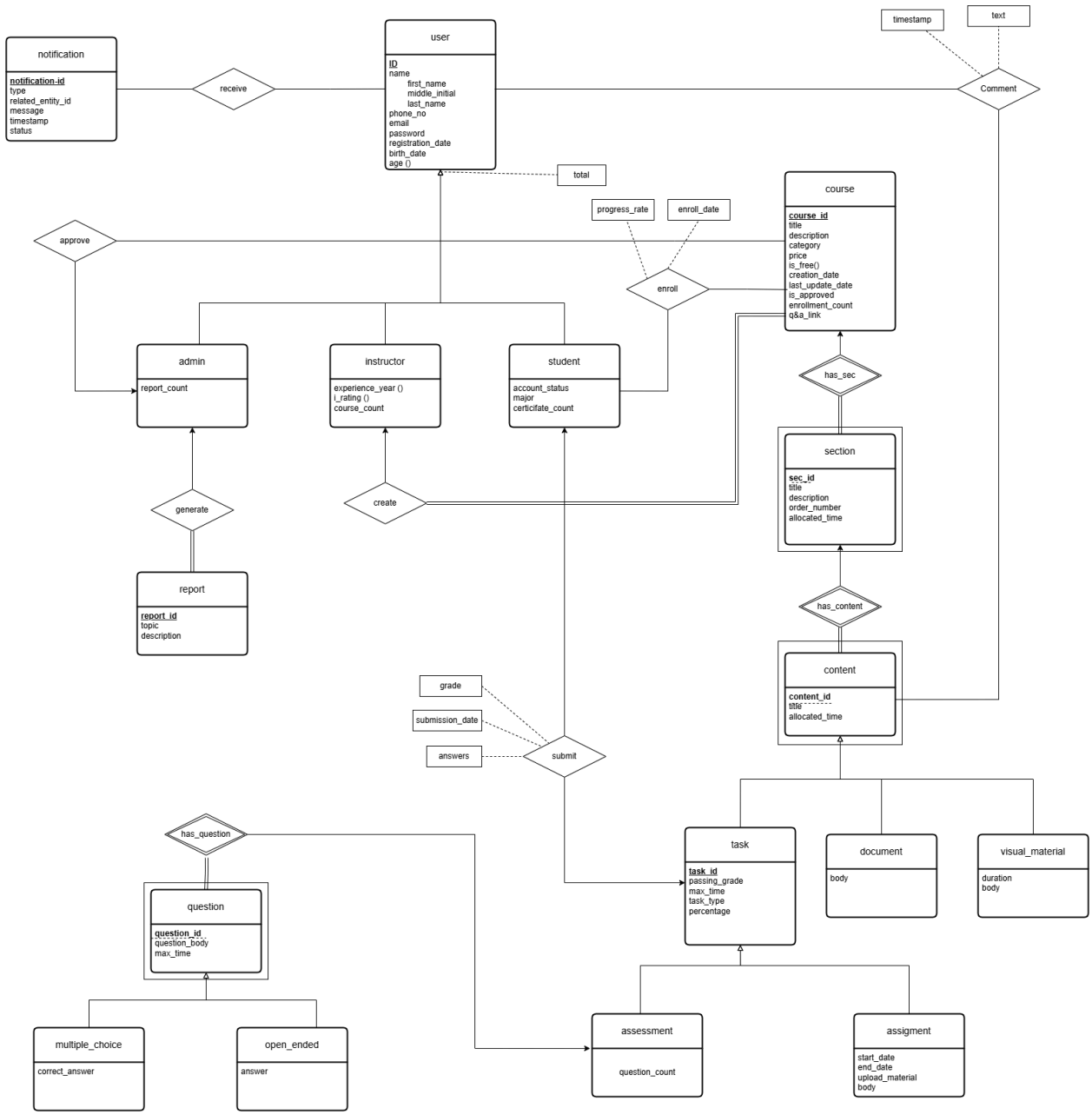
- Instructors can view the profiles of their students, whereas the admin can view every member's profile.
- The rating and questionnaire answers taken from the students will be displayed anonymously to the instructor and admin.
- Instructors can only view the feedback about themselves, whereas the admin can view feedback about every instructor and course.
- A student will only be able to receive a certification if he/she completes the course in the given time slot (decided by the instructor) and completes all assessments with satisfactory grades.
- Only the course instructor and student can view a student’s current scores.

E-R Diagrams

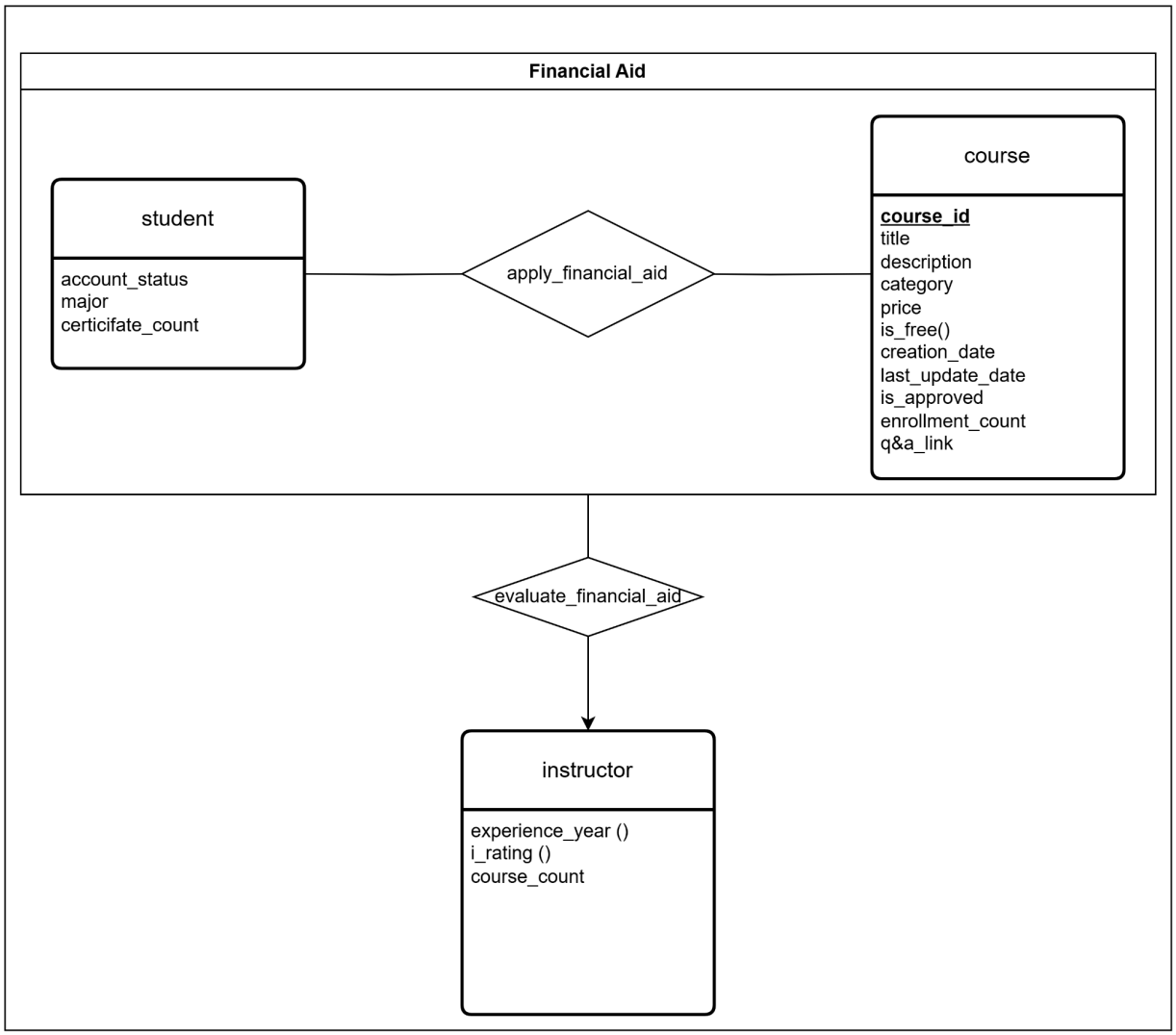
For high-resolution diagrams:

https://drive.google.com/file/d/1OR9GojMzF1jQD1ukdcHCnHi2BblfwLWK/view?usp=sharing

Main E-R Diagram



Financial Aid E-R Diagram



Feedback and Certificate E-R Diagram