Image-based Quiz Evaluation Software

CS 387 Course project

Meet Kathiriya (160050001),
Suraj Bishnoi (160050023),
Phuntsog Wangchuk (160050109),
Simranpreet Singh (160050111)

November 27, 2018

Abstract

We plan to create an image-based exam paper evaluation software which enables students to upload images of their answer sheets after taking an exam and upload them to a database. Following this, the relevant instructor can evaluate the papers with the help of teaching assistants and upload grades, ideal answers and comments on each answer for the students to see.

1 Introduction

We plan to create a system to simplify the exam evaluation process by digitizing it, with support for three major roles: Instructors, teaching assistants (T.A.s) and students. The broad goals of the project involve creating the following :

- **Web Application**
  We are going to implement a web app for T.A.s and instructors to check papers of multiple students for a particular question in the paper. They will be able to give marks to a student on that question and also write comments about mistakes or reason for deduction of marks. The app will also provide some flags for the evaluators to mark a question as checked or unchecked to ease coordination between different T.A.s and the instructor. The instructor also has the authority to create new quizzes, assign questions to particular T.A.s to be checked and announce the grades once all the paper are checked. We will also implement a comment section for T.A.s where they will be able leave comments regarding the reason for deduction of marks etc.

- **Android Application**
  For students, we will implement an Academic Performance Tracker. After the T.A.s have checked the papers uploaded by the students, students will get be able to see their grades on their mobile phones along with comments provided by the evaluator. With this, the students will be able to monitor their academic performance by keeping track of their quiz-wise and even question-wise grades. Apart from this, users will also be able to submit answers for ongoing quizzes.

The uploading of the answers sheet images is to be performed by the students through the Android app. A small time window can be provided by the instructor after each test using the web app, in which the students can scan each answer individually and upload them from their ID.

2 Application Interfaces

- **Web App**
  For Instructors :
  The following interface is provided to the course instructors in the web application:

  1. **Log-in page**
     The log-in page provides a simple log-in form which validates the instructor's credentials. It leads to the Home page if the user logs in successfully.
  2. **Home page**
     It presents a list of courses that the user is currently teaching. Clicking on any one of the list entries will direct them to the related Quizzes page.
  3. **Quizzes page**
     It provides links to the Create Exam page, the Quizzes so far page and the Overall Statistics page.
  4. **Overall Statistics page**
     This page provides a table displaying the quiz-wise marks given to each student for the course.
  5. **Create Exam page**
     This page provides the user an interface to create a new quiz/exam by specifying its name, date, maximum marks, weightage in the course grade and timing (including the start time, exam end time and upload end time). The user can then add questions one-by-one to the quiz, specify maximum marks and upload it when everything is done.
  6. **Quizzes so far page**
     This page presents a list of previous quizzes held for the particular course. Clicking on any one of them leads to the relevant Quiz Details page.
  7. **Quiz Details page**
     This page provides links to upload a sample solution sheet with grading details, upload the question paper as well as a list of the questions where the user can choose to check a question themselves or assign to a T.A. Clicking on 'Check' will direct to the Check Question page, whereas clicking on 'Assign T.A.' will direct to the Assign T.A. page.
  8. **Assign T.A. page**
     This page presents a list of T.A.s. Clicking on any of their names will assign the grading duties of the question to the chosen T.A.
  9. **Check Question page**
     This page provides a list of students whose answers you can choose from to grade, which will take you to the Grading page. The list includes the roll no. and name of the student along with current marks, flag (Checked/Unchecked/Revisit later) against each student's name. The overall grading stats for the question are also provided on the page.
  10. **Grading page**
      This page shows the user the uploaded answer sheet image(s), along with forms to update the marks, flag and comments on each submission. An image of the sample solution sheet is also displayed.

For T.A.s :
The following interface is provided to the teaching assistants in the web application:

1. **Log-in page**
   The log-in page provides a simple log-in form which validates the T.A.'s credentials. It leads to the Home page if the user logs in successfully.
2. **Home page**
   This page displays a list of questions (from various quizzes, from different courses they're involved with) that they've been allotted. Clicking on any question will take them to the relevant Check Question page (same as the Check Questions page for the instructors).
3. **Check Questions page**
   This page is the same as the Check Questions page seen by the instructors, leading to the Grading page in the same manner.

- **Android App**

  For Students :
  The following interface is provided to the students in the Android application:

  1. **Log-in page**
     The log-in page provides a simple log-in form which validates the student's credentials. It leads to the Home page if the user logs in successfully.
  2. **Home page**
     This page displays a list of running courses to choose from, which direct them to the Course Details page for each entry on the page.
  3. **Course Details page**
     This page displays a list of previous quizzes and the marks secured in each, which can be tapped on to go to the Quiz Details page. A button is also provided which leads the user to the Available Quizzes page.
  4. **Quiz Details page**
     This page presents a list of all the questions that were in the selected quiz. Each list entry directs the user to the Grading Details page.
  5. **Grading Details page**
     The page displays the marks awarded to the user for a question, the maximum possible marks and any comments left by the evaluator regarding the submitted answer.
  6. **Available Quizzes page**
     The page displays the ongoing quizzes of a particular course that the user is enrolled in. The user may select any of these to visit the corresponding Attemptable Questions page.
  7. **Attemptable Questions page**
     The page displays the questions that the user may attempt, i.e. upload answer images for.
  8. **Image Upload page**
     The page provides an interface to capture and upload multiple answer images for each question.

3 ER Diagram of Stored Data

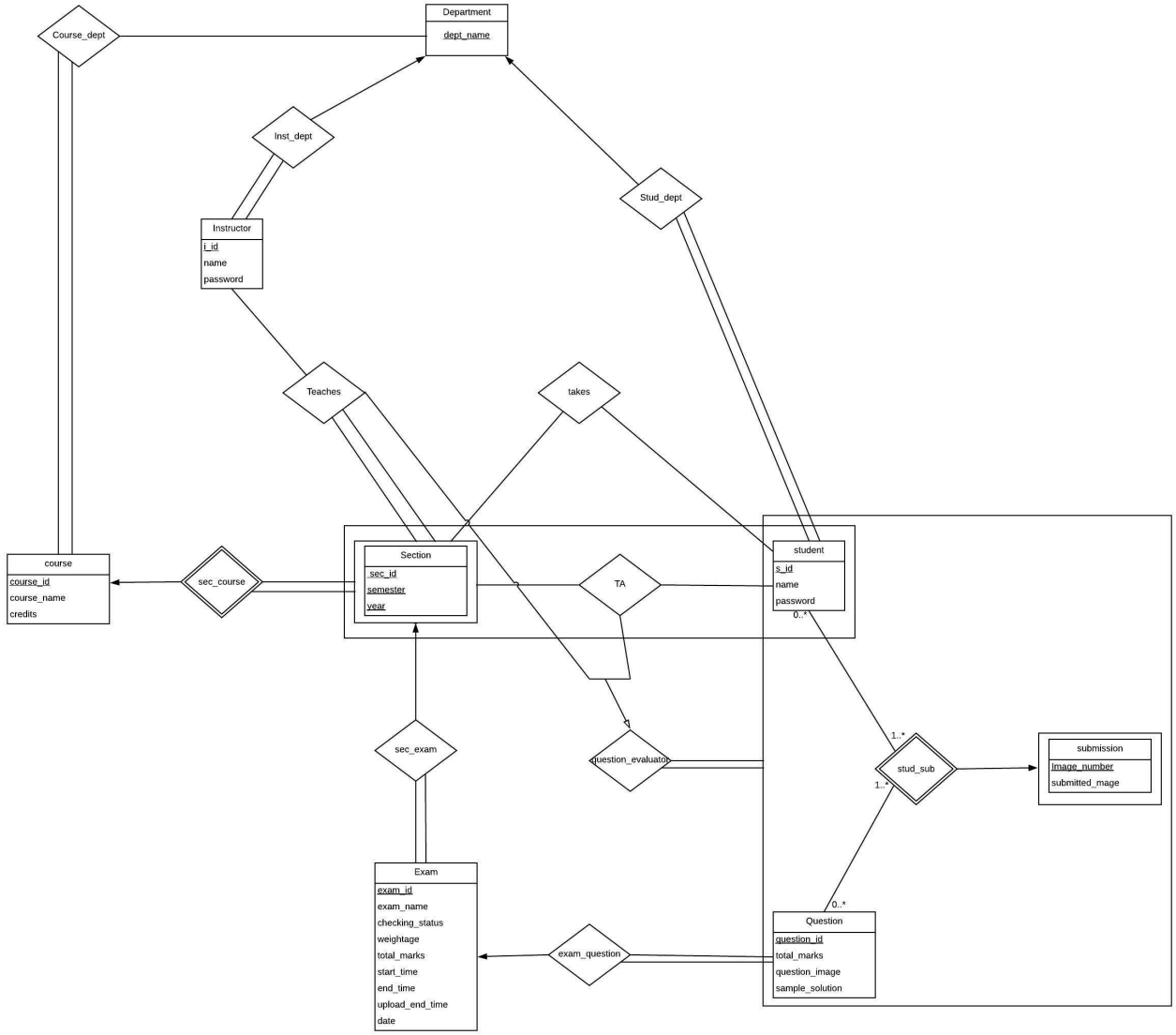

Figure 1: ER diagram

4 Table Design for Stored Data

The major tables required for data storage are as follows:

1. Student (ID, name, dept_name, tot_cred; foreign key (dept_name) references Department)
2. Instructor (ID, name, dept_name; foreign key (dept_name) references Department)
3. Department (dept_name)
4. Course (course_id, title, dept_name, credits; foreign key (dept_name) references Department)
5. Takes (ID, course_id, sec_id, semester, year, grade; foreign key (course_id,sec_id, semester, year) references Section, foreign key (ID) references Student)

6. Teaches (ID, course_id, sec_id, semester, year; foreign key (course_id,sec_id, semester, year) references Section, foreign key (ID) references Instructor)

7. Section (course_id, sec_id, semester, year; foreign key (course_id) references Course)

8. T.A. (ID, course_id, sec_id, semester, year; foreign key (course_id,sec_id, semester, year) references Section, foreign key (ID) references Student)

9. Exam (exam_id, course_id, sec_id, semester, year, exam_name, weightage, total_marks, checking_status, date, start_time, end_time, upload_end_time; foreign key (course_id,sec_id, semester, year) references Section)

10. Question (ques_id, exam_id, total_marks, ques_img, solution_img; foreign key (exam_id) references Exam)

11. Submission (student_id, ques_id, img_no, image; foreign key (student_id) references Student, foreign key (ques_id) references Question)

12. Evaluator (Teaches union T.A.)

13. Evaluation (checker_id, ques_id, student_id, marks, comment; foreign key (checker_id) references Evaluator, foreign key (ques_id) references Question, foreign key (student_id) references Student)

14. Assignment (ques_id, checker_id, checking_status, primary key (checker_id references Evaluator, question_id references Question)

    );

5 Plans for Testing

Prior to the actual tests, we will create suitable sample data to populate the tables. The application is built to function over an existing university schema (similar to the lab assignments), so we will generate a dummy schema with multiple courses, instructors, T.A.s and students for testing purposes.
We plan to test the basic functionality of the system by performing the following operations:

1. **Logging in**
   Performed by everyone: Instructors and T.A.s log in through the web app, and students log into their accounts through the Android app as well.
   Expected results: Each user should be able to access the aforementioned interfaces according to their roles in the course.

2. **Creating a quiz**
   Performed by Instructor: A new quiz is created for a particular course through the web app by adding a question at a time and specifying the maximum marks and overall weightage for each. The time window in which students can upload answers is also to be specified.
   Expected results: The students taking the course should be able to see the currently running quiz and image upload slots, only for the specified duration.

3. **Uploading answers**
   Performed by Students: Each student who can see an active quiz/test uploads images for each question in the time slot and not before or afterwards.

Expected results: The uploads should be visible through the web app to the instructor and course T.A.s.

4. **T.A. allotment**
   Performed by Instructor: Once an upload window for a new quiz closes, the instructor allots different questions to different T.A.s for evaluation. He/she may upload a sample answer sheet with grading criteria to facilitate evaluation
   Expected results: Each T.A. who has been allotted a question should be able to view the answers uploaded by all students for the same.

5. **Answer evaluation**
   Performed by Instructor and T.A.s: Each evaluator provides a grade for each answer to each student, changes the current flag (checked/unchecked) and writes comments against each submission.
   Expected results: The database storing the current grades, flags and comments should be updated accordingly.

6. **Announcement of grades**
   Performed by Instructor: Whenever the the instructor deems fit, the unannounced grades for any quiz are declared to the students. This may even be done prematurely (when all answers haven't been checked yet) at the instructors discretion.
   Expected results: Every student should be able to see their grades (overall and question-wise) for the announced quiz as well as comments about each answer as well.