Bilkent University

Department of Computer Engineering

CS319 Object-Oriented Software Engineering

Classroom Helper

Design Report

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1. Introduction

1.1 Purpose of the System

The purpose of the Classroom Helper tool is to simplify the group formation, peer review and artefact review processes in classrooms. Our Classroom Helper tool is intended to be a usable, secure, reliable and portable tool. The target audience of our tool is teachers, teaching assistants and students.

1.2 Design Goals

Usability:
Classroom Helper tool must have a user-friendly interface to enable the users to use our tool without facing any difficulties. Also, our tool is planned to be intuitive and basic to increase usability.

Security:
Since the Classroom Helper tool collects sensitive information from the users, it must be secure.

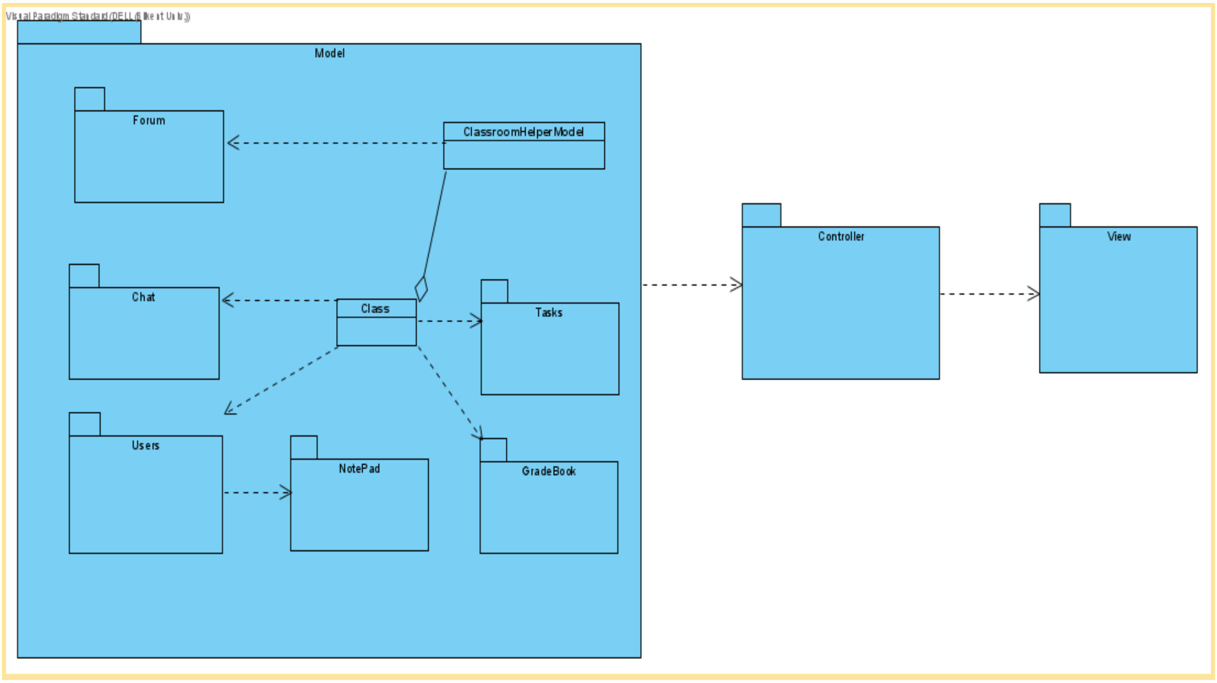
Reliability:
The Classroom Helper tool should be reliable since it collects information and artefacts from the users which are needed to be accessible at any given time.

Cost:
Because of very short time constraints, the program should be cost-efficient.

2. System Architecture

2.1 Subsystem Decomposition

Our system is decomposed into three subsystems by using model-view-controller architecture. “Model” subsystem interacts with the “Controller” subsystem and the “Controller” subsystem interacts with the “View” subsystem. With this decomposition, we reduced the coupling and made our system maintainable and flexible such that a change in a specific subsystem will not affect the whole system. In that way, we increased the coherence of our system and made future changes more applicable.



2.2 Hardware/Software Mapping

We will implement our system using Java and React. To run, our system will require a Java Runtime Environment and React support. Also, our system will require an internet connection and database to operate. The user's browser must be the latest version of Firefox, Safari, or Chrome. Mobile platforms and older versions of these browsers are not supported.

2.3 Persistent Data Management

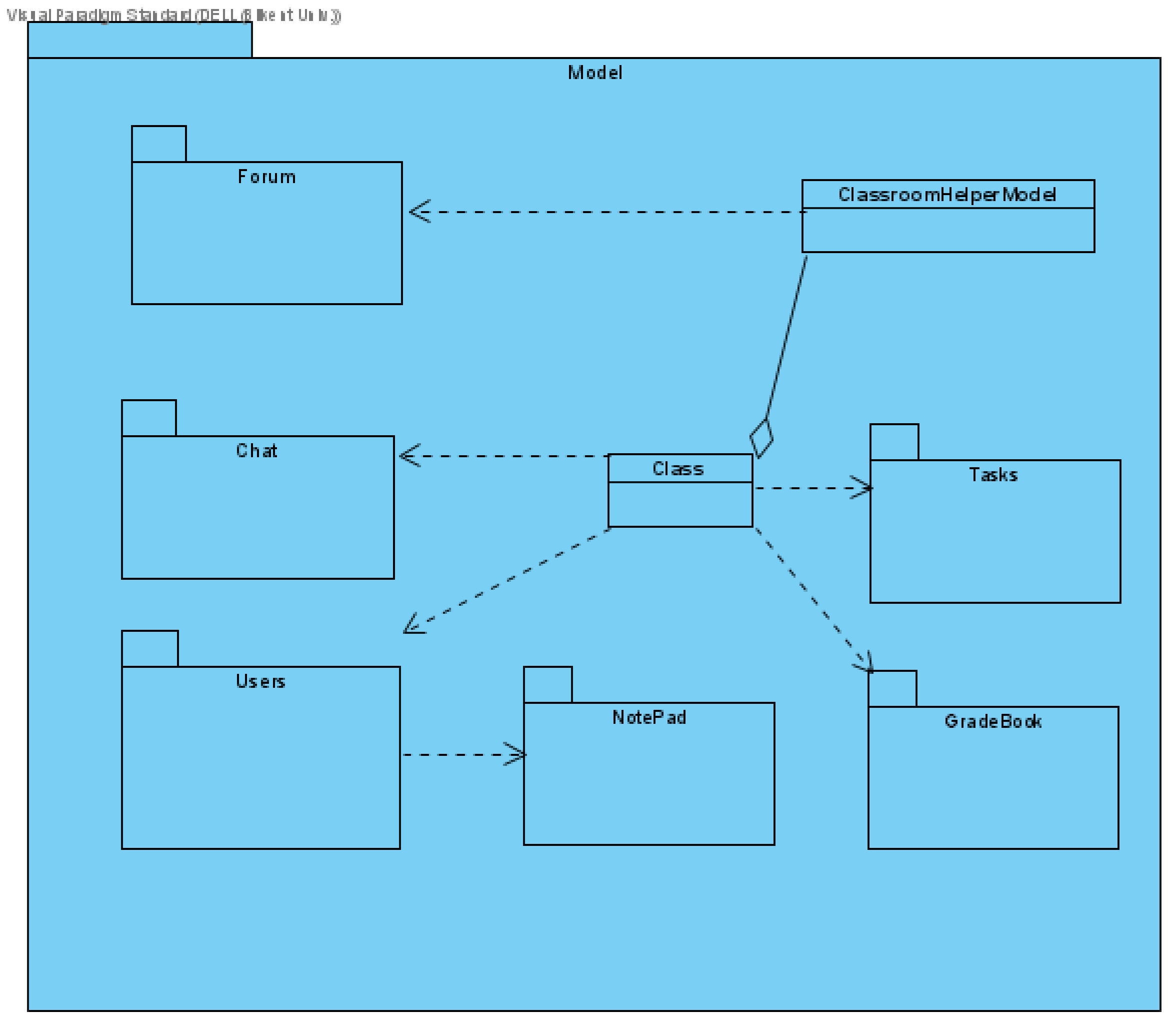
We need to store the user data, usernames and passwords, because of that, we will use a database to maintain the user data. The system will back up once in three days against any power loss.

2.4 Access Control and Security

Our system has three types of users which are “student”, “teacher” and “teaching assistant”. The system will need the usernames and passwords to operate, because of that, our system has a verification process since it has a login sequence. Our system will have a secure connection and use HTTPS protocol.

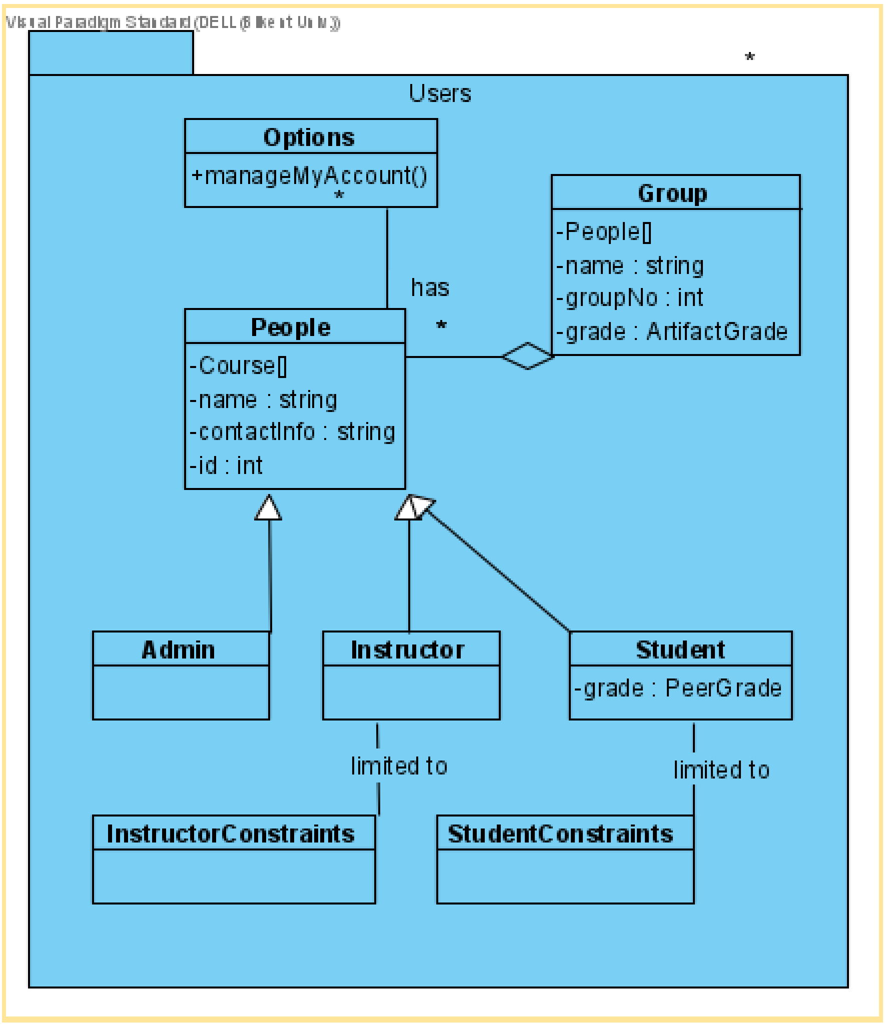
3. Subsystem Services

Model Subsystem



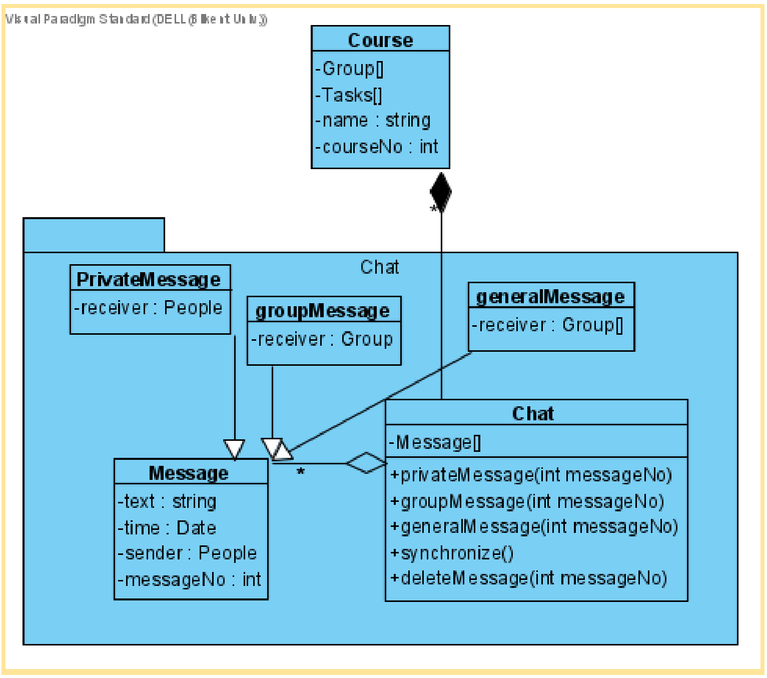
“Model” subsystem has “Forum”, “Chat”, “Users”, “NotePad”, “GradeBook”, “Tasks” and “ClassroomHelperModel” packages and “Class”. “Class” has a “ClassroomHelperModel”. Also, “Class” interacts with “Chat”, “Users”, “GradeBook” and “Tasks” packages. “User” interacts with the “NotePad” package and “ClassroomHelperModel” interacts with the “Forum” package.

Users Subsystem



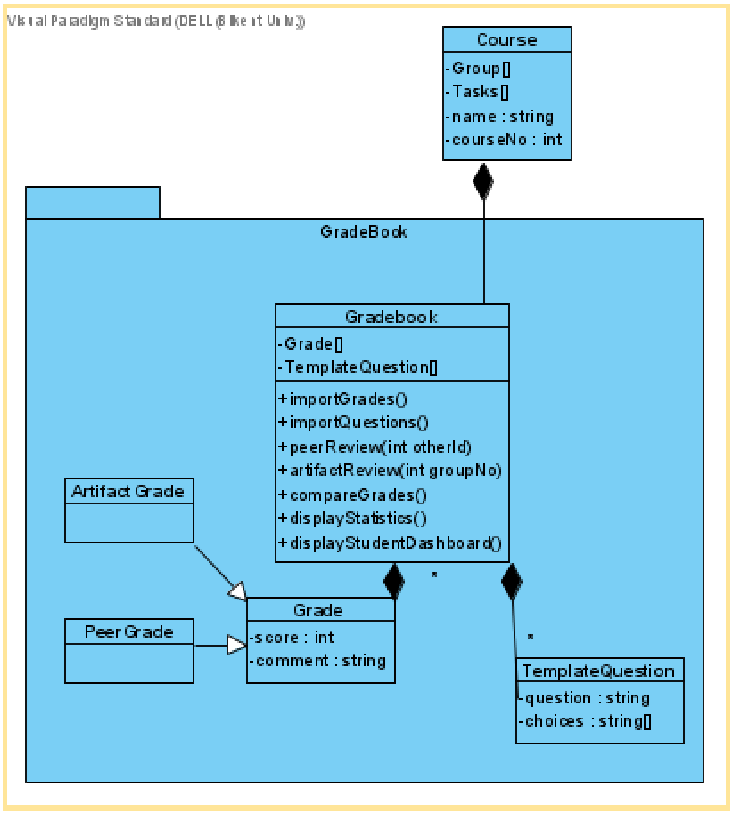
“Users” subsystem consists of “Options”, “People”, “Group”, “Admin”, “Instructor”, “Student”, “InstructorConstraints”, and “StudentConstraints” classes. “Groups” class has a one-to-many relationship with the “People” class, that is, a group may have one or many people. “People” maybe “Admin”, “Instructor” or “Student”. The “People” class has a Course array that stores courses of the given people. Also, the “People” class stores the “name”, “contactInfo” and “id” for that person.

Chat Subsystem



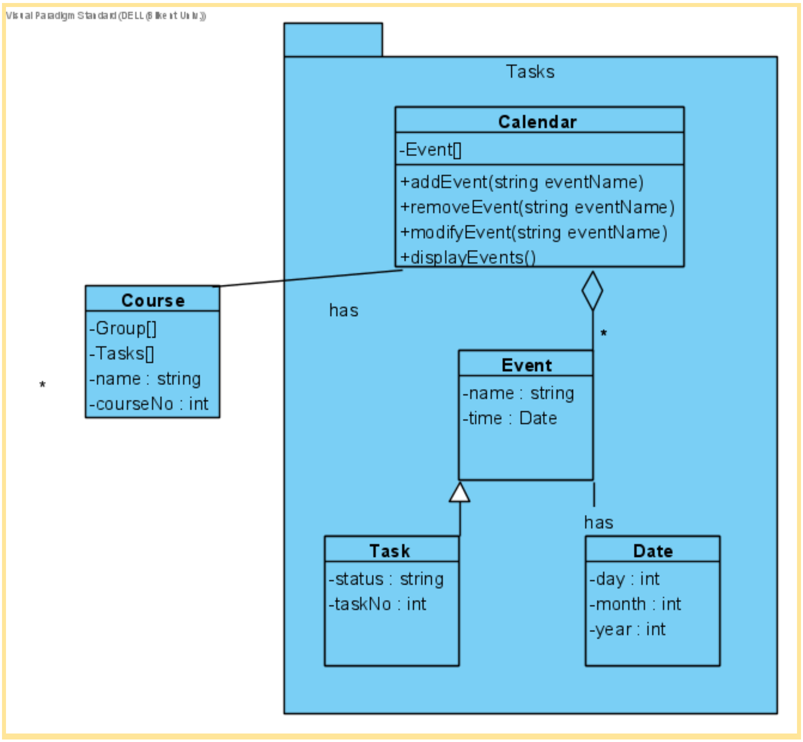
“Chat” subsystem consists of “PrivateMessage”, “groupMessage”, “generalMessage”, “Message”, “Chat”, and “Course” classes. “Chat” has a one-to-many relationship with “Message. Chat may have one or many messages. “Chat” has a Message array to store the messages and methods to maintain the messages provided by the users.

GradeBook Subsystem



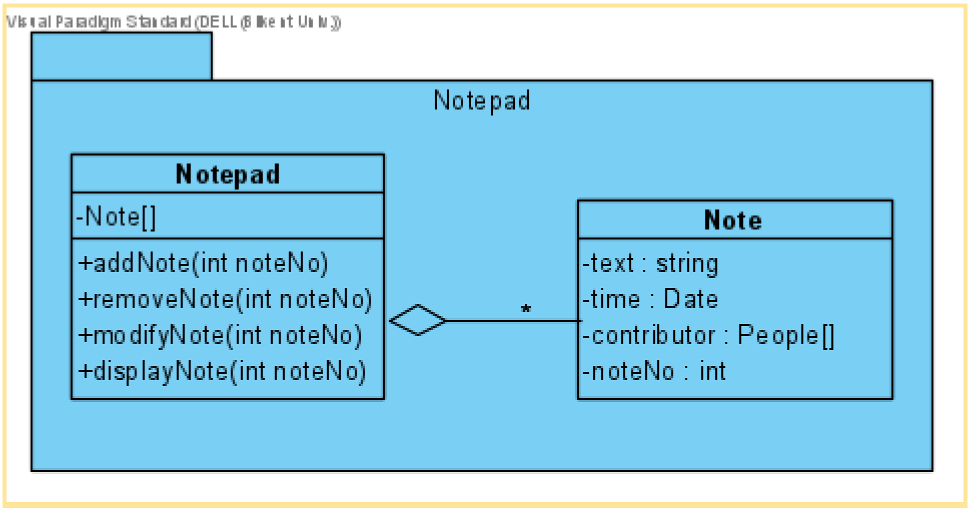
“Gradebook” subsystem consists of “Gradebook”, “ArtifactGrade”, “PeerGrade”, “Grade”, “TemplateQuestion” and “Course”. “GradeBook” has a one-to-many relationship with “Grade” and “TemplateQuestion”. Gradebook may have one or more grades and template questions. “Gradebook” has a Grade array to store the grades and methods to maintain the grades of the students.

Tasks Subsystem



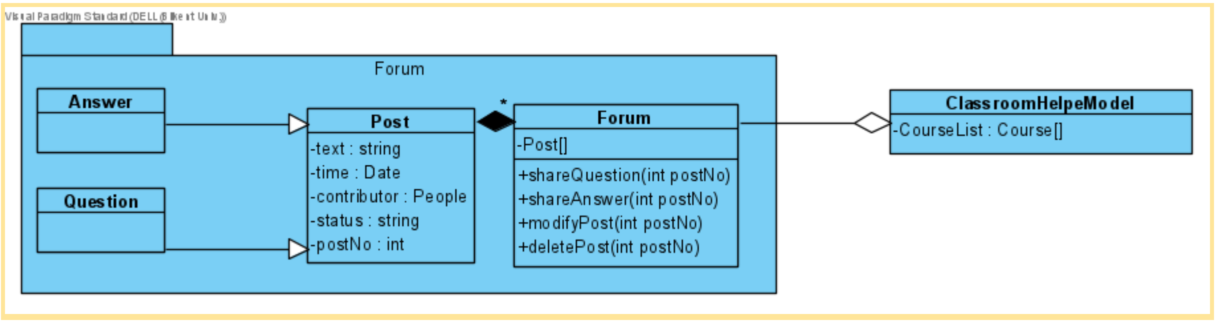
“Tasks” subsystem consists of “Calendar”, “Event”, “Date”, “Tasks” and “Course” classes. There is a one-to-many relationship between “Calendar” and “Event”. The calendar may have one or more events. Also, “Calendar” has an Event array to store arrays and methods to maintain and display the stored events.

Notepad Subsystem



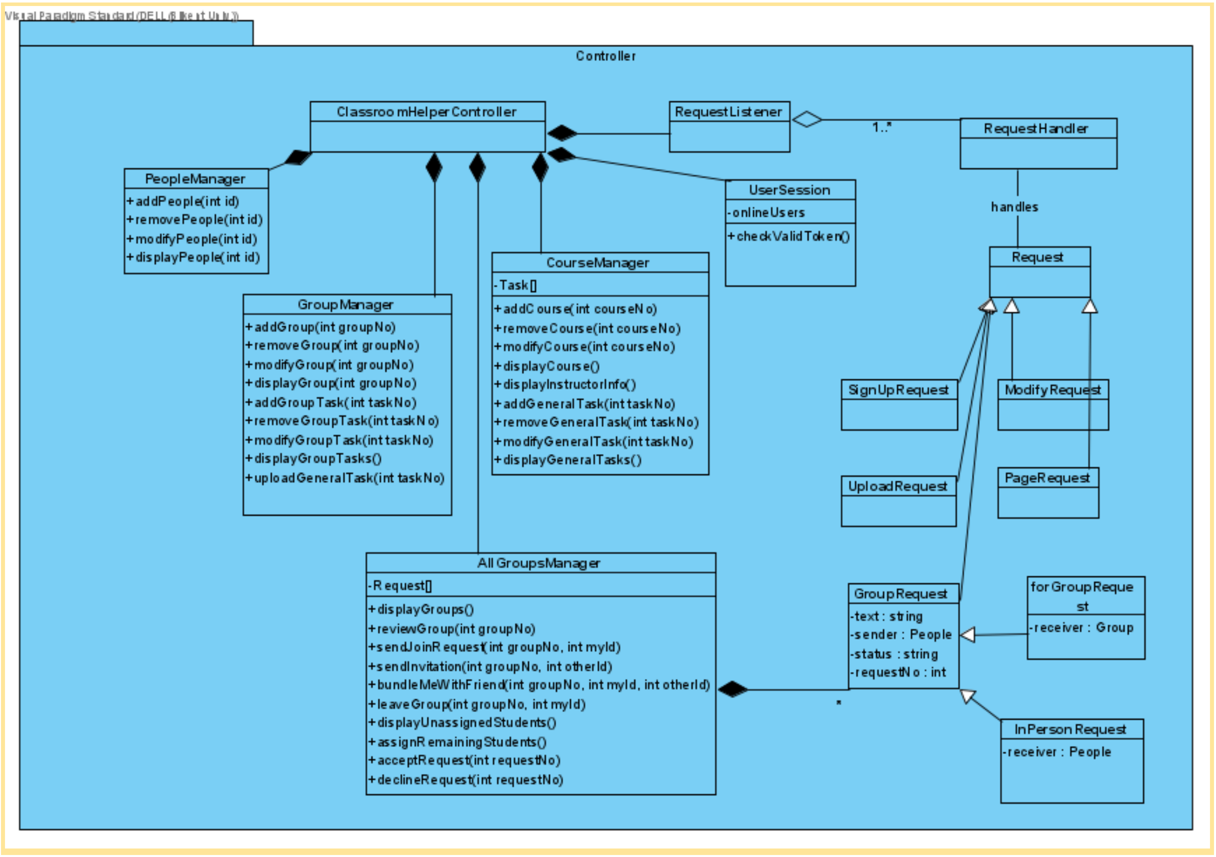
The “Notepad” subsystem consists of “Notepad” and “Note” classes. “Notepad” and “Note” have a one-to-many relationship. Notepad can have one or more notes. “Notepad” has a Note array and methods to maintain the notes.

Forum Subsystem



“Forum” subsystem consists of the “Forum” package and the “ClassroomHelperModel” class. “ClassroomHelperModel” class has an array called CourseList which consists of courses. “Forum” has “Post” and “Post” can be “Answer” or “Question”.

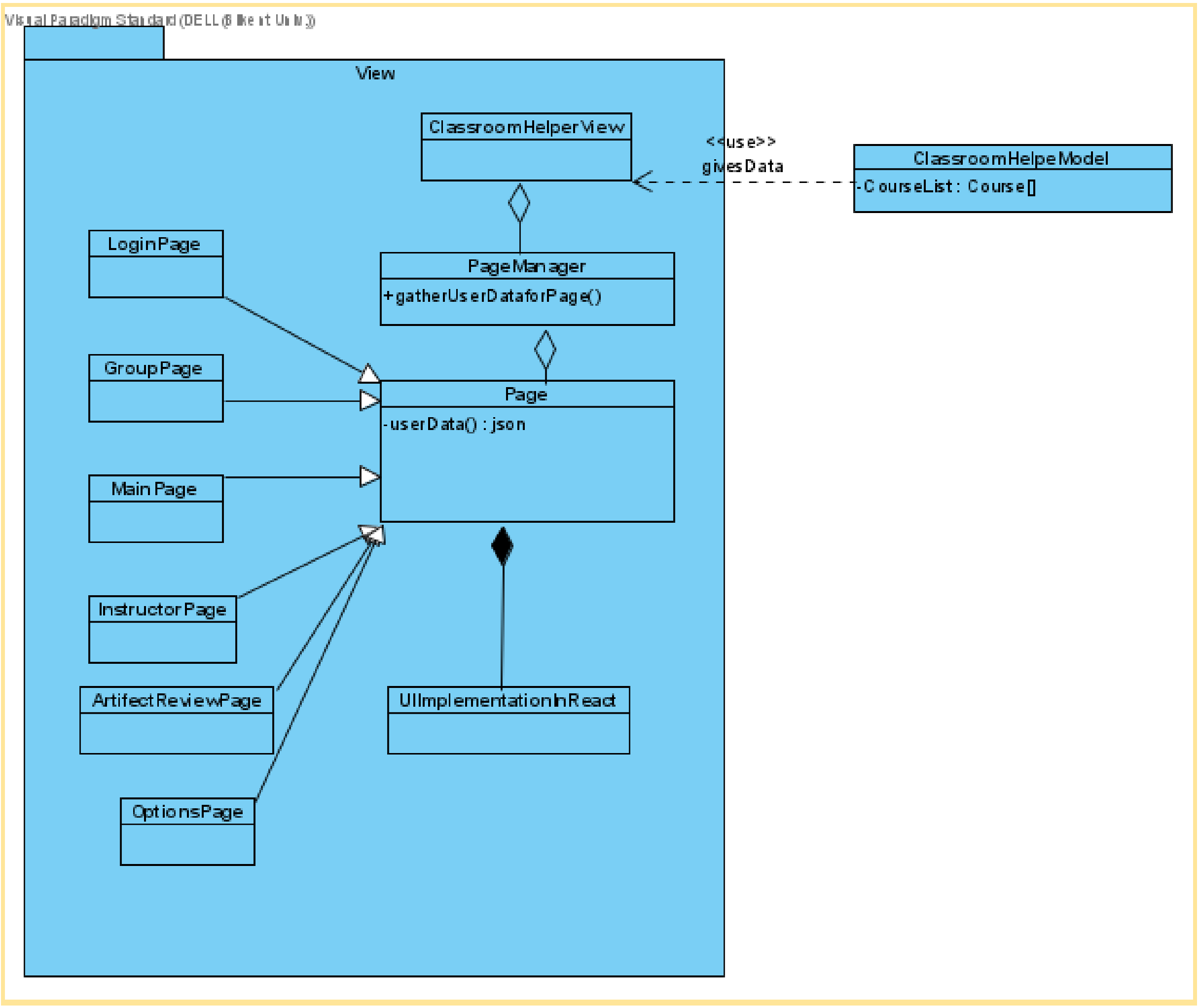
Controller Subsystem


Controller
ClassroomHelperController
RequestListener
1..*
RequestHandler
handles
PeopleManager
+addPeople(int id)
+removePeople(int id)
+modifyPeople(int id)
+displayPeople(int id)
UserSession
-onlineUsers
+checkValidToken()
Request
GroupManager
+addGroup(int groupNo)
+removeGroup(int groupNo)
+modifyGroup(int groupNo)
+displayGroup(int groupNo)
+addGroupTask(int taskNo)
+removeGroupTask(int taskNo)
+modifyGroupTask(int taskNo)
+displayGroupTasks()
+uploadGeneralTask(int taskNo)
CourseManager
-Task[]
+addCourse(int courseNo)
+removeCourse(int courseNo)
+modifyCourse(int courseNo)
+displayCourse()
+displayInstructorInfo()
+addGeneralTask(int taskNo)
+removeGeneralTask(int taskNo)
+modifyGeneralTask(int taskNo)
+displayGeneralTasks()
SignUpRequest
ModifyRequest
UploadRequest
PageRequest
AllGroupsManager
-Request[]
+displayGroups()
+reviewGroup(int groupNo)
+sendJoinRequest(int groupNo, int myId)
+sendInvitation(int groupNo, int otherId)
+bundleMeWithFriend(int groupNo, int myId, int otherId)
+leaveGroup(int groupNo, int myId)
+displayUnassignedStudents()
+assignRemainingStudents()
+acceptRequest(int requestNo)
+declineRequest(int requestNo)
GroupRequest
-text : string
-sender : People
-status : string
-requestNo : int
*
forGroupRequest
-receiver : Group
InPersonRequest
-receiver : People

The “Controller” subsystem has the “ClassroomHelperController” class which has “PeopleManager”, “GroupManager”, “AllGroupsManager”, “CourseManager”, “UserSession” and “RequestListener”. The “RequestListener” class has “RequestHandler” and

“RequestHandler” handles requests. Request can be sign-up request, modify request, upload request, page request, or group request. Two types of “GroupRequest” are the requests sent to groups and requests sent to people to join the group. The “Controller” subsystem interacts with the “View” subsystem.

View Subsystem



The view subsystem consists of “ClassroomHelperView”, “LoginPage”, “GroupPage”, “MainPage”, “InstructorPage”, “ArtifactReviewPage”, “OptionsPage”, “ClassroomHelperView”, “PageManager”, “Page” and “UIImplementationInReact” classes. “ClassroomHelperModel” has a CourseList array and provides the data for the “ClassroomHelperView”.

4. Low-Level Design

4.1. Object Design Trade-Offs

Functionality vs Usability:

Classroom Helper tool will have a simple and user-friendly interface enabling users to quickly grasp the use of the tool. User interface components and verbal interactions will be similar to that of contemporary communication tools. Names, messages, buttons, icons, and graphics will require a basic and intuitive understanding which will contribute to the usability of the product. On the other hand, the functionality of the tool will be kept limited to reduce complexity. By eliminating confusing and complicated operations, the usability of the tool will be optimized.

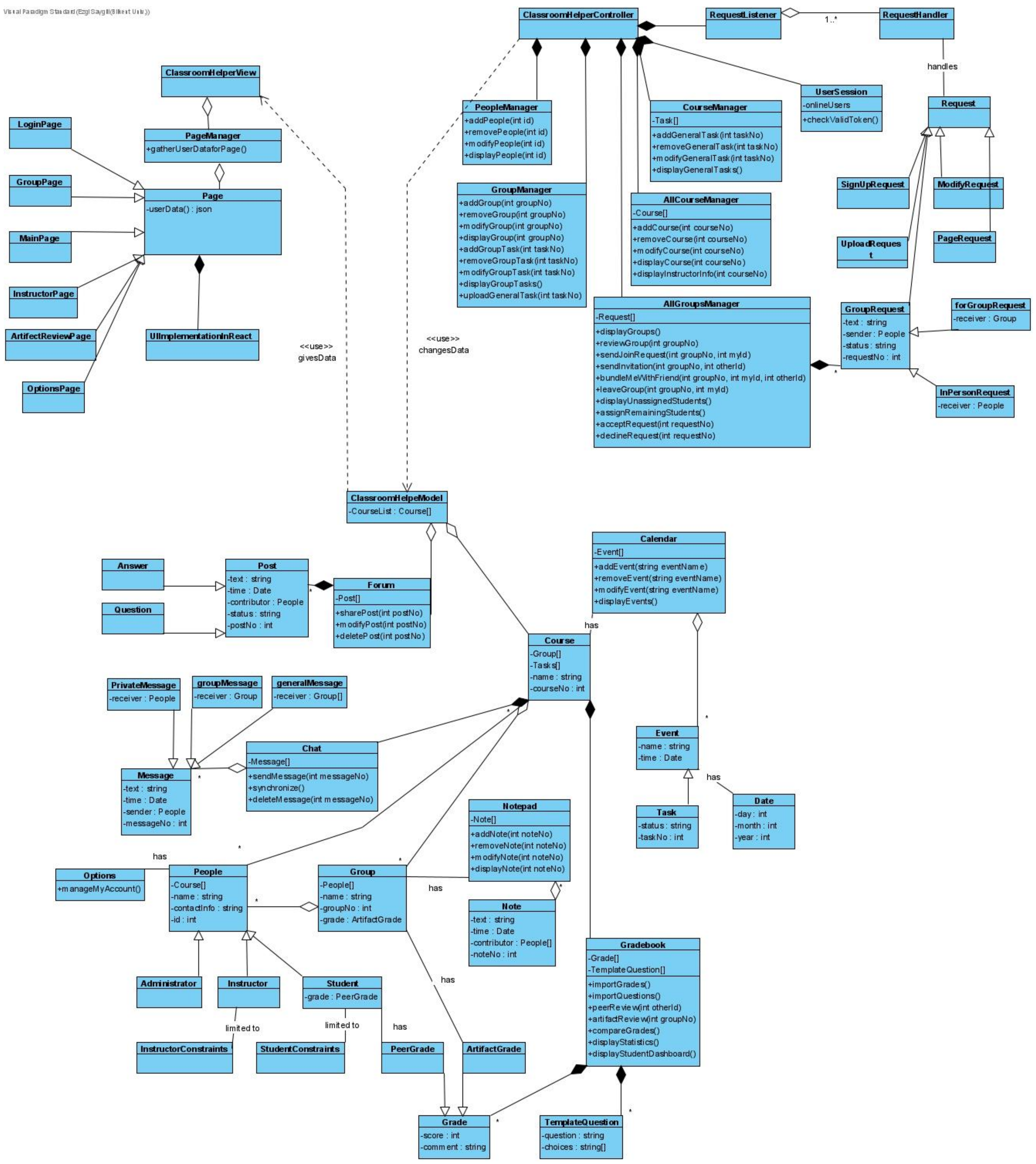
Cost vs Portability:

As a result of the limited time and energy allocated for the project, the Classroom Helper tool will only work on desktop operating systems that run Java and support React. Also, the user’s browser should be the latest of Firefox, Safari, or Chrome. So, users will not be able to use the tool on mobile platforms and older versions of these browsers will not be supported because of time constraints.

Performance vs Reliability:

For security requirements, the tool will have a secure connection and use HTTPS protocol. In the meantime between failure requirements, the tool will have 95% uptime (1 hour in a day might be down). For data loss tolerance, the tool will back up once in 3 days to protect against power loss. All of these will contribute to the reliability of the product while to some extent hindering the overall performance.

4.2. Final Object Design



AllGroupsManager Class:

This class will be used for managing groups in a single course object. This class also has the Request class as an attribute.

Attributes:

- private Request[] requests: array that contains all the requests.

Methods:

- public void displayGroups(): Displays all the groups that are currently in the course.
- public Group reviewGroup(int groupNo): Returns a group object that has a matching group number.
- public int sendJoinRequest(int groupNo, int myId): Send a join request to a group that has a matching group number.
- public int sendInvitation(int groupNo, int otherId): Send an invitation to a student that has a matching id number.
- public int bundleMeWithFriend(int groupNo, int myId, int otherId): Send a join request to a group that contains two students.
- public void displayUnassignedStudents(): Displays the students that have not been assigned to a group.
- public void assignRemainingStudents(): Assigns the students that have not been assigned to a group.
- public void acceptRequest(int requestNo): Makes the request's status as accepted so that the student becomes assigned to the group.
- public void declineRequest(int requestNo): Declines the join request.

Request Class:

This class contains the properties of the request object.

Attributes:

- private string text: Message of the request.
- private People sender: The person who created the request.
- private string status: Indicates that the request is accepted or not.
- private int requestNo: Unique request-id.

Methods:

- public Request(string text, People sender, int requestNo): Constructor of Request class.
- public void setStatus(string status): sets the status of the request.

GroupRequest Subclass:

This subclass was inherited from the Request class.

Attributes:

- private Group receiver: Indicates the receiver group of the request.

Methods:

- public GroupRequest(string text, People sender, int requestNo, Group receiver): Constructor of GroupRequest class.
- public void setStatus(string status): sets the status of the GroupRequest.

InPersonRequest Subclass:

This subclass was inherited from the Request class.

Attributes:

- private People receiver: Indicates the receiver person of the request.

Methods:

- public GroupRequest(string text, People sender, int requestNo, Person receiver): Constructor of InPersonRequest class.
- public void setStatus(string status): sets the status of the InPersonRequest.

Event Class:

This class contains the properties of the event object.

Attributes:

- private string name: Indicates the name of the event.
- private Date time: Indicates the due date of the event.

Methods:

- public Event(string name, int time): Constructor of the Event class.
- public void setTime(Date time): sets the time of the event.

Date Class:

This class contains the properties of the date object.

Attributes:

- private int day: Indicates the day.
- private int month: Indicates the month.
- private int year: Indicates the year.

Methods:

- public Date(int day, int month, int year): Constructor of Date class.

Task Sub-Class:

This subclass was inherited from the Event class.

Attributes:

- private string status: Indicates the status of the task.
- private int taskNo: Unique task id.

Methods:

- public Task(string status, int taskNo): Constructor of Task class.
- public void setStatus(string status): set the status of the Task.

AllCourseManager Class:

This class manipulates all course objects.

Attributes:

- private Course[] courses: array that contains all the courses.

Methods:

- public void addCourse(int courseNo): adds a course.
- public void removeCourse(int courseNo): removes the course that has a matching course number.
- public void modifyCourse(int courseNo): modifies the course that has a matching course number.
- public void displayCourse(int courseNo): displays the course that has a matching course number. Course’s name, number etc.
- public void displayInstructorInfo(int courseNo): displays the instructor information for the course that has a matching course number.

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CourseManager Class:

This class manipulates the single course object’s properties. This class also has the Task class as an attribute.

Attributes:

- private Task[] tasks: array that contains all the tasks. These are mandatory course tasks assigned by the instructors.

Methods:

- public void addGeneralTask(int taskNo): adds a task to the course.
- public void removeGeneralTask(int taskNo): removes the task that has a matching task number from the course.
- public void modifyGeneralTask(int taskNo): modifies the task that has a matching task number.
- public void displayGeneralTasks(): displays tasks in the course.

GroupManager Class:

This class manipulates the single group object's properties. This class also has the Task class as an attribute.

Attributes:

- private Task[] tasks: array that contains all the tasks. These are the in-group tasks assigned by group members.

Methods:

- public void addGroup(int groupNo): creates a group to the course.
- public void removeGroup(int groupNo): removes the group that has a matching group number.
- public void modifyGroup(int groupNo): modifies the group that has a matching group number.
- public void displayGroup(int groupNo): displays the corresponding group's name, number, grade, and students who are assigned to that group.
- public void addGroupTask(int taskNo, int groupNo): add a task to the group.
- public void removeGroupTast(int taskNo, int groupNo): removes the corresponding task from the group.
- public void modifyGroupTask(int taskNo, string status): changes the status of the task
- public void displayGroupTasks(): displays all the tasks of the group.
- public void uploadGeneralTask(int taskNo): add a task to all the groups.

Calendar Class:

This Calendar class contains the properties of the calendar object and its actions. This class also has the Event class as an attribute.

Attributes:

- private Event[] events: array that contains all the events of the course and the group.

Methods:

- public void addEvent(string eventName): Adds an event to its events array.
- public void removeEvents(string eventName): Removes the event from the array if there is a matched event name.
- public void modifyEvent(string eventName, int time): modifies the matched event's time.
- public void displayEvents(): Displays all the events in its list.
- public Calendar(): Constructor of the Calendar class.

PeopleManager Class:

This class manipulates the people who are enrolled in a course.

Attributes:

- private People[] people: An array that contains all the people in the group.
- private string name: Name of the group.
- private int groupNo: Unique group id.
- private ArtifactGrade grade: Grade of the group.

Methods:

- public void addPeople(int id): Adds person to course's person list.
- public void removePeople(int id): Removes the person who has matched id.
- public void modifyPeople(int id):
- public void displayPeople(int id): Displays the matched person's information.

Course Class:

Course class contains the properties of the course and its actions. This class also has the Group class as an attribute.

Attributes:

- private Group[] group: An array that contains all the groups in the course.
- private string name: Name of the course.
- private int courseNo: Unique course id.

Methods:

- public Course(string name): Constructor of the Course class.

Group Class:

Group class contains the properties of the group and its actions. This class also has the People class as an attribute.

Attributes:

- private People[] people: An array that contains all the people in the group.
- private string name: Name of the group.
- private int groupNo: Unique group id.
- private ArtifactGrade grade: Grade of the group.

Methods:

- public Group(string name): Constructor of the Group class.
- public void setGrade(int grade): Sets the artifact grade of the group.

People Class:

People class contains the properties of the people object and its actions. This class also has the Course class as an attribute.

Attributes:

- private Course[] courses: An array that contains all the courses that are enrolled.
- private string name: Name of the person.
- private string contactInfo: contact information of the person.
- private int id: Unique id.

Methods:

- public People(string name): Constructor of the People class.
- public void setContactInfo(string contactInfo): Sets the contact information of the person.

Administrator Sub-Class:

This subclass was inherited from People class.

Methods:

- public Administrator(): Constructor of the Administrator sub-class.

Instructor Sub-Class:

This subclass was inherited from the People class.

Methods:

- public Instructor(string name): Constructor of the Instructor sub-class.

Student Subclass:

This subclass was inherited from the People class.

Attributes:

- private PeerGrade grade: contains the peer grade

Methods:

- public Student(string name): Constructor of the Student subclass.

InstructorConstraints class:

Defines constraints/limits for Instructor users.

StudentConstraints class:

Defines constraints/limits for Student users.

Options class:

Enables People to modify their name, contact information and id.

Methods:

- public void manageMyAccount(): modifies people’s courses, name, contact information and id.
- public Options(): Constructor of the Options class.

Post Class:

This class contains the properties of the post object.

Attributes:

- private string text: Indicates the text of the post.
- private Date time: Indicates the due date of the post.
- private People contributor: Indicates the contributor of the post.
- private string status: Indicates the status of the post.
- private int postNo: Indicates the number of the post.

Methods:

- public Post(): Constructor of the Post subclass.
- public void setPostInfo(string text, Date time, People contributor): Sets information of the post.
- public void setStatus(string status): set the status of the Post.

Answer Subclass:

This subclass was inherited from the Post class.

Methods:

- public Answer(): Constructor of the Answer subclass.

Question Subclass:

This subclass was inherited from the Post class.

Methods:

- public Question(): Constructor of the Question subclass.

Forum Class:

This class manipulates the forum object properties. This class also has the Post class as an attribute.

Attributes:

- private Post[] posts: contains the posts.

Methods:

- public void sharePost(int postNo): adds a post that has a matching post number.
- public void modifyPost(int postNo): modifies a post that has a matching post number.
- public void deletePost(int postNo): displays a post that has a matching post number.
- public Forum(): Constructor of the Forum class.

Note Class:

This class contains the properties of the note object.

Attributes:

- private string text: Indicates the text of the note.
- private Date time: Indicates the due date of the note.
- private People[] contributors: Indicates the contributors of the note.
- private int noteNo: Indicates the number of the note.

Methods:

- public Note(): Constructor of the Note class.
- public void setNoteInfo(string text, Date time, People[] contributor): Sets information of the note.

Notepad Class:

This class manipulates the notepad object properties. This class also has the Note class as an attribute.

Attributes:

- private Note[] notes: contains the notes.

Methods:

- public void addNote(int noteNo): adds a note that has a matching note number.
- public void removeNote(int noteNo): removes a note that has a matching note number.
- public void modifyNote(int noteNo): modifies a note that has a matching note number.
- public void displayNote(int noteNo): displays a note that has a matching note number.
- public Notepad(): Constructor of the Notepad class.

Message Class:

This class contains the properties of the message object.

Attributes:

- private string text: Indicates the text of the message.
- private Date time: Indicates the due date of the message.
- private People sender: Indicates the sender of the message.
- private int messageNo: Indicates the number of the message.

Methods:

- public Message(): Constructor of the Message class.
- public void setMessageInfo(string text, Date time, People sender): Sets information of the message.

PrivateMessage Subclass:

This subclass was inherited from the Message class.

Attributes:

- private People receiver: contains the receiver.

Methods:

- public PrivateMessage(): Constructor of the PrivateMessage class.
- public void setReceiverInfo(People receiver): Sets receiver of the private message.

GroupMessage Subclass:

This subclass was inherited from the Message class.

Attributes:

- private Group receiver: contains the receiver.

Methods:

- public GroupMessage(): Constructor of the GroupMessage class.
- public void setReceiverInfo(People receiver): Sets receiver of the group message.

GeneralMessage Subclass:

This subclass was inherited from the Message class.

Attributes:

- private Group[] receiver: contains the receiver.

Methods:

- public GeneralMessage(): Constructor of the GeneralMessage class.
- public void setReceiverInfo(People receiver): Sets receiver of the general message.

Chat Class:

This class manipulates the chat object properties. This class also has the Message class as an attribute.

Attributes:

- private Message[] messages: contains the sended and received messages.

Methods:

- public void sendMessage(int messageNo): adds a message that has a matching message number.
- private void synchronize(): synchronizes messages.
- public void deleteMessage(int messageNo): removes a message that has a matching message number.
- public Chat(): Constructor of the Chat class.

Grade Class:

This class contains the properties of the grade object.

Attributes:

- private int score: Indicates the score for the grade.
- private string comment: Indicates the comment for the grade.

Methods:

- public Grade(int score): Constructor of the Grade class.
- public void setComment(string comment): Sets comment for the grade.

PeerGrade Subclass:

This subclass was inherited from the Grade class.

Methods:

- public PeerGrade(): Constructor of the PeerGrade class.

ArtifactGrade Subclass:

This subclass was inherited from the Grade class.

Methods:

- public ArtifactGrade(): Constructor of the ArtifactGrade class.

TemplateQuestion Class:

This class contains the properties of the template question object.

Attributes:

- private string question: Indicates the question text for the template question.

- private string[] choices: Indicates the choices for the template question.

Methods:

- public TemplateQuestion(string question): Constructor of the TemplateQuestion class.
- public void setChoices(string[] choices): Sets choices for the template question.

Gradebook Class:

This class manipulates the gradebook object properties. This class also has the TemplateQuestion and Grade classes as attributes.

Attributes:

- private TemplateQuestion[] templateQuestions: contains the template questions.
- private Grade[] grades: contains the grades.

Methods:

- public void importGrades(): imports grades from other platforms.
- private void importQuestions(): imports questions from other platforms.
- public void peerReview(int otherId): enables a student to peer review another student in his/her group that has a matching id number.
- public void artifactReview(int groupNo): enables a group to review another group’s artifact in the course that has a matching group number.
- public void compareGrades(): compares Grades given through artifact review with imported grades given by Instructor.
- public void displayStatistics(): displays statistics for the comparison of grades.
- public void displayStudentDashboard(): displays reviews about students.

Menu Class:

This class contains the properties of the Menu object.

Methods:

- public void backToCourse(): navigates back to the course page.
- public void displayChat(): Switches to chat platform.
- public void displayMyGroup(): Switches to my group page.
- public void displayAllGroups(): Switches to all groups page.
- public void displayGradebook(): Switches to gradebook page.
- public void displayPeople(): Displays people enrolled in the course.
- public void displayOptions(): Display options.

- public void displayForum(): Switches to the forum page.
- public Menu(): Constructor of the Menu class.

4.3. Packages

org.springframework: A framework for building backends with RestApi.[1]

javax.persistence : Java Persistence is the API for the management for persistence and object/relational mapping.

java.io: Reading and writing files to the system such as artifacts etc..

react-doc-viewer: A web browser document viewer for Artifact Reviewing.[2]

react-burger-menu: A burger menu for navigation between pages.[3]

react-widgets: Extended React input options. [4]

[1] https://spring.io/projects/spring-boot
[2] https://www.npmjs.com/package/react-doc-viewer#basic
[3] https://www.npmjs.com/package/react-burger-menu
[4] https://jquense.github.io/react-widgets/

5. Glossary & References

https://spring.io/projects/spring-boot

https://www.npmjs.com/package/react-doc-viewer#basic

https://www.npmjs.com/package/react-burger-menu

https://jquense.github.io/react-widgets/