Programming Assignment Unit 7

University of the People

CS 1102-01: Programming 1 AY2025-T2

Naeem Ahmed

3 January 2025

Programming Assignment Unit 7

You have been assigned to develop a GUI application for a Student Management System. The application should provide a user-friendly interface for administrators to interact with student records, course enrollment, and grades. The GUI should be implemented using Java's GUI frameworks such as Swing or JavaFX. Event handling mechanisms should be employed to respond to user interactions, and the interface should update dynamically to reflect changes in student records.

Requirements:

GUI Design:

- Design an intuitive and user-friendly GUI interface for the Student Management System.
- Implement the GUI using Java's GUI frameworks such as Swing or JavaFX.
- Include appropriate components such as labels, text fields, buttons, tables, and menus to display and interact with student records, course enrollment, and grades.
- Ensure that the GUI is aesthetically pleasing, easy to navigate, and logically organized.

Student Management Functionality:

- Provide functionality to add new students, update student information, and view student details through the GUI interface.
- Implement event handlers for relevant GUI components, such as buttons or menu items, to perform the corresponding actions.
- When the "Add Student" button/menu item is clicked, display a form to enter the student's information and add the new student to the system.
- When the "Update Student" button/menu item is clicked, display a form to select a student and update their information.

- When the "View Student Details" button/menu item is clicked, display a table or another suitable component to show a list of students and their details.

Course Enrollment Functionality:

- Include functionality to enroll students in courses through the GUI interface.
- Implement event handlers to respond to actions such as selecting a course and enrolling a student.
- When a course is selected from a dropdown menu or list, display a list of students eligible for enrollment.
- Allow administrators to select a student from the list and enroll them in the chosen course.

Grade Management Functionality:

- Incorporate functionality to assign grades to students through the GUI interface.
- Implement event handlers to respond to actions such as selecting a student, selecting a course, and assigning a grade.
- When a student is selected from a dropdown menu or list, display a list of courses they are enrolled in and their current grades.
- Allow administrators to select a course and assign a grade to the selected student.

Dynamic Interface Updates:

- Ensure that the GUI interface updates dynamically to reflect changes in student records, course enrollment, and grades.
- When a new student is added or information is updated, update the student list or details display accordingly.
- When a student is enrolled in a course or a grade is assigned, update the corresponding displays to reflect the changes.

Error Handling:

- Implement appropriate error handling mechanisms in the GUI application.
- Display error messages or dialog boxes when invalid inputs are provided or when operations cannot be completed.
- Handle exceptions gracefully to ensure the application remains responsive and user-friendly.

Documentation:

- Provide comprehensive documentation for the project, explaining the purpose and usage of each GUI component, event handler, and functionality.
- Describe the design choices made for the GUI interface and the rationale behind them.
- Include instructions for running the program and interacting with the GUI interface.

Solution

To develop the Student Management System GUI application in Java using Swing, we will follow these steps:

1. **Set Up the Project Structure:** Create a Java project and set up the necessary packages and classes.
2. **Design the GUI:** Using Swing components to create a user-friendly interface.
3. **Implement Student Management Features:** Adding, updating, and viewing student records.
4. **Implement Course Enrollment Features:** Enrolling students in courses.
5. **Implement Grade Management Features:** Assigning grades to students.
6. **Ensure Dynamic Interface Updates:** Reflecting changes in real-time.
7. **Implement Error Handling:** Handling invalid inputs and exceptions.
8. **Provide Documentation:** Detailing the application and usage instructions.

Project Structure

```
src/
├── studentmanagement/
    ├── model/
        ├── Student.java
        ├── Course.java
        ├── Enrollment.java
    ├── view/
        ├── StudentManagementGUI.java
        ├── AddStudentForm.java
        ├── UpdateStudentForm.java
        ├── ViewStudentsPanel.java
        ├── EnrollCourseForm.java
        ├── AssignGradeForm.java
    ├── controller/
        ├── StudentController.java
        ├── CourseController.java
        ├── EnrollmentController.java
        ├── GradeController.java
```

Project Structure

The project is organized into three main packages:

1. `model`: Contains the data classes representing the entities in the system.

2. `view`: Contains the GUI classes that define the user interface.

3. `controller`: Contains the logic to manage the interaction between the model and view.

Model Classes

These classes represent the data structure of the system.

`Student.java`

```
package studentmanagement.model;


public class Student {
    private String id;
    private String name;
    private int age;

    public Student(String id, String name, int age) {
        this.id = id;
        this.name = name;
        this.age = age;
    }

    // Getters and Setters
    public String getId() {
        return id;
    }

    public void setId(String id) {
        this.id = id;
```

```
    }

    public String getName() {
        return name;
    }

    public void setName(String name) {
        this.name = name;
    }

    public int getAge() {
        return age;
    }

    public void setAge(int age) {
        this.age = age;
    }
}
```

This class represents a student with an ID, name, and age. It includes a constructor to initialize these fields and getter and setter methods to access and modify them.

`Course.java`

```
package studentmanagement.model;


public class Course {
    private String courseId;
    private String courseName;


    public Course(String courseId, String courseName) {
        this.courseId = courseId;
        this.courseName = courseName;
    }


    // Getters and Setters
    public String getCourseId() {
        return courseId;
    }


    public void setCourseId(String courseId) {
        this.courseId = courseId;
    }


    public String getCourseName() {
        return courseName;
    }


    public void setCourseName(String courseName) {
        this.courseName = courseName;
    }
}
```

This class represents a course with a course ID and course name. It includes a constructor and getter and setter methods.

`Enrollment.java`

```
package studentmanagement.model;


public class Enrollment {
    private Student student;
    private Course course;


    public Enrollment(Student student, Course course) {
        this.student = student;
        this.course = course;
    }


    // Getters and Setters
    public Student getStudent() {
        return student;
    }


    public void setStudent(Student student) {
        this.student = student;
    }


    public Course getCourse() {
        return course;
    }


    public void setCourse(Course course) {
        this.course = course;
    }
}
```

This class represents the enrollment of a student in a course. It includes a constructor and getter and setter methods.

View Classes

These classes define the graphical user interface (GUI) of the system.

`StudentManagementGUI.java`

```
package studentmanagement.view;


import javax.swing.*;
import java.awt.event.ActionEvent;
import java.awt.event.ActionListener;


public class StudentManagementGUI extends JFrame {
    private JMenuBar menuBar;
    private JMenu studentMenu, courseMenu, gradeMenu;
    private JMenuItem addStudentMenuItem, updateStudentMenuItem, viewStudentMenuItem;
    private JMenuItem enrollCourseMenuItem, assignGradeMenuItem;


    public StudentManagementGUI() {
        setTitle("Student Management System");
        setSize(800, 600);
        setDefaultCloseOperation(EXIT_ON_CLOSE);
        initMenu();
        setVisible(true);
    }


    private void initMenu() {
        menuBar = new JMenuBar();


        // Student Menu
        studentMenu = new JMenu("Student");
        addStudentMenuItem = new JMenuItem("Add Student");
        updateStudentMenuItem = new JMenuItem("Update Student");
        viewStudentMenuItem = new JMenuItem("View Students");
```

```
studentMenu.add(addStudentMenuItem);

studentMenu.add(updateStudentMenuItem);

studentMenu.add(viewStudentMenuItem);


// Course Menu

courseMenu = new JMenu("Course");

enrollCourseMenuItem = new JMenuItem("Enroll in Course");


courseMenu.add(enrollCourseMenuItem);


// Grade Menu

gradeMenu = new JMenu("Grade");

assignGradeMenuItem = new JMenuItem("Assign Grade");


gradeMenu.add(assignGradeMenuItem);


menuBar.add(studentMenu);

menuBar.add(courseMenu);

menuBar.add(gradeMenu);


setJMenuBar(menuBar);


// Add action listeners for menu items

addStudentMenuItem.addActionListener(new ActionListener() {

    public void actionPerformed(ActionEvent e) {

        new AddStudentForm();

    }

});


updateStudentMenuItem.addActionListener(new ActionListener() {

    public void actionPerformed(ActionEvent e) {
```

```
                new UpdateStudentForm();
            }
        });

        viewStudentMenuItem.addActionListener(new ActionListener() {
            public void actionPerformed(ActionEvent e) {
                new ViewStudentsPanel();
            }
        });

        enrollCourseMenuItem.addActionListener(new ActionListener() {
            public void actionPerformed(ActionEvent e) {
                new EnrollCourseForm();
            }
        });

        assignGradeMenuItem.addActionListener(new ActionListener() {
            public void actionPerformed(ActionEvent e) {
                new AssignGradeForm();
            }
        });
    }

    public static void main(String[] args) {
        new StudentManagementGUI();
    }
}
```

This class is the main GUI frame for the Student Management System. It includes a menu bar with options to add, update, and view students, enroll in courses, and assign grades. Each menu item is associated with an action listener to open the corresponding form.

`AddStudentForm.java`

```
package studentmanagement.view;


import javax.swing.*;

import java.awt.*;

import java.awt.event.ActionEvent;

import java.awt.event.ActionListener;


public class AddStudentForm extends JFrame {

    private JTextField nameField, ageField, idField;

    private JButton addButton;


    public AddStudentForm() {

        setTitle("Add Student");

        setSize(300, 200);

        setLayout(new GridLayout(4, 2));


        // Labels and text fields

        add(new JLabel("ID:"));

        idField = new JTextField();

        add(idField);


        add(new JLabel("Name:"));

        nameField = new JTextField();

        add(nameField);


        add(new JLabel("Age:"));

        ageField = new JTextField();

        add(ageField);


        addButton = new JButton("Add");
```

```
        add(addButton);

        addButton.addActionListener(new ActionListener() {
            public void actionPerformed(ActionEvent e) {
                String id = idField.getText();
                String name = nameField.getText();
                int age = Integer.parseInt(ageField.getText());

                // Add the student to the system
                studentmanagement.controller.StudentController.addStudent(new
studentmanagement.model.Student(id, name, age));

                JOptionPane.showMessageDialog(null, "Student added successfully!");
                dispose();
            }
        });

        setVisible(true);
    }
}
```

This form allows the user to add a new student. It includes text fields for the student's ID, name, and age, and a button to submit the information. When the button is clicked, the student is added to the system.

`UpdateStudentForm.java`

```
package studentmanagement.view;


import javax.swing.*;

import java.awt.*;

import java.awt.event.ActionEvent;

import java.awt.event.ActionListener;

import java.util.List;

import studentmanagement.model.Student;

import studentmanagement.controller.StudentController;


public class UpdateStudentForm extends JFrame {

    private JComboBox<String> studentComboBox;

    private JTextField nameField, ageField;

    private JButton updateButton;


    public UpdateStudentForm() {

        setTitle("Update Student");

        setSize(300, 200);

        setLayout(new GridLayout(4, 2));


        // Fetch student IDs

        List<Student> students = StudentController.getAllStudents();

        String[] studentIds = students.stream().map(Student::getId).toArray(String[]::new);


        add(new JLabel("Select Student:"));

        studentComboBox = new JComboBox<>(studentIds);

        add(studentComboBox);


        add(new JLabel("Name:"));

        nameField = new JTextField();
```

```
        add(nameField);

        add(new JLabel("Age:"));
        ageField = new JTextField();
        add(ageField);

        updateButton = new JButton("Update");
        add(updateButton);

        updateButton.addActionListener(new ActionListener() {
            public void actionPerformed(ActionEvent e) {
                String id = (String) studentComboBox.getSelectedItem();
                String name = nameField.getText();
                int age = Integer.parseInt(ageField.getText());

                // Update the student information in the system
                studentmanagement.controller.StudentController.updateStudent(new
studentmanagement.model.Student(id, name, age));

                JOptionPane.showMessageDialog(null, "Student updated successfully!");
                dispose();
            }
        });

        setVisible(true);
    }
}
```

This form allows the user to update a student's information. It includes a dropdown to select a student by ID and text fields for the student's new name and age. When the button is clicked, the student's information is updated in the system.

`ViewStudentsPanel.java`

```
package studentmanagement.view;


import javax.swing.*;

import javax.swing.table.DefaultTableModel;

import java.awt.*;

import java.util.List;

import studentmanagement.model.Student;

import studentmanagement.controller.StudentController;


public class ViewStudentsPanel extends JFrame {

    private JTable studentsTable;

    private DefaultTableModel tableModel;


    public ViewStudentsPanel() {

        setTitle("


View Students");

        setSize(400, 300);

        setLayout(new BorderLayout());


        // Fetch students

        List<Student> students = StudentController.getAllStudents();

        String[] columnNames = {"ID", "Name", "Age"};


        tableModel = new DefaultTableModel(columnNames, 0);

        studentsTable = new JTable(tableModel);


        // Populate table

        for (Student student : students) {

            Object[] rowData = {student.getId(), student.getName(), student.getAge()};
```

```
            tableModel.addRow(rowData);
        }

        add(new JScrollPane(studentsTable), BorderLayout.CENTER);

        setVisible(true);
    }
}
```

This panel displays a list of all students in a table. It uses a `JTable` to show the student ID, name, and age. The table is populated with data from the `StudentController`.

`EnrollCourseForm.java`

```
package studentmanagement.view;


import javax.swing.*;

import java.awt.*;

import java.awt.event.ActionEvent;

import java.awt.event.ActionListener;

import java.util.List;

import studentmanagement.model.Student;

import studentmanagement.model.Course;

import studentmanagement.controller.StudentController;

import studentmanagement.controller.CourseController;


public class EnrollCourseForm extends JFrame {

    private JComboBox<String> studentComboBox, courseComboBox;

    private JButton enrollButton;


    public EnrollCourseForm() {

        setTitle("Enroll in Course");

        setSize(300, 200);

        setLayout(new GridLayout(3, 2));


        // Fetch students and courses

        List<Student> students = StudentController.getAllStudents();

        List<Course> courses = CourseController.getAllCourses();


        add(new JLabel("Select Student:"));

        studentComboBox = new

JComboBox<>(students.stream().map(Student::getName).toArray(String[]::new));

        add(studentComboBox);
```

```
        add(new JLabel("Select Course:"));
        courseComboBox = new
JComboBox<>(courses.stream().map(Course::getCourseName).toArray(String[]::new));
        add(courseComboBox);

        enrollButton = new JButton("Enroll");
        add(enrollButton);

        enrollButton.addActionListener(new ActionListener() {
            public void actionPerformed(ActionEvent e) {
                String studentName = (String) studentComboBox.getSelectedItem();
                String courseName = (String) courseComboBox.getSelectedItem();

                // Enroll the student in the course
                Student student = students.stream().filter(s ->
s.getName().equals(studentName)).findFirst().orElse(null);
                Course course = courses.stream().filter(c ->
c.getCourseName().equals(courseName)).findFirst().orElse(null);

                if (student != null && course != null) {

studentmanagement.controller.EnrollmentController.enrollStudentInCourse(student, course);
                    JOptionPane.showMessageDialog(null, "Student enrolled in course
successfully!");
                    dispose();
                }
            }
        });

        setVisible(true);
    }
}
```

This form allows the user to enroll a student in a course. It includes dropdowns to select a student and a course, and a button to submit the enrollment. When the button is clicked, the student is enrolled in the selected course.

`AssignGradeForm.java`

```
package studentmanagement.view;


import javax.swing.*;

import java.awt.*;

import java.awt.event.ActionEvent;

import java.awt.event.ActionListener;

import java.util.List;

import studentmanagement.model.Student;

import studentmanagement.model.Course;

import studentmanagement.controller.StudentController;

import studentmanagement.controller.CourseController;


public class AssignGradeForm extends JFrame {

    private JComboBox<String> studentComboBox, courseComboBox;

    private JTextField gradeField;

    private JButton assignButton;


    public AssignGradeForm() {

        setTitle("Assign Grade");

        setSize(300, 200);

        setLayout(new GridLayout(4, 2));


        // Fetch students and courses

        List<Student> students = StudentController.getAllStudents();

        List<Course> courses = CourseController.getAllCourses();


        add(new JLabel("Select Student:"));

        studentComboBox = new

JComboBox<>(students.stream().map(Student::getName).toArray(String[]::new));

        add(studentComboBox);
```

```
        add(new JLabel("Select Course:"));
        courseComboBox = new
JComboBox<>(courses.stream().map(Course::getCourseName).toArray(String[]::new));
        add(courseComboBox);

        add(new JLabel("Grade:"));
        gradeField = new JTextField();
        add(gradeField);

        assignButton = new JButton("Assign");
        add(assignButton);

        assignButton.addActionListener(new ActionListener() {
            public void actionPerformed(ActionEvent e) {
                String studentName = (String) studentComboBox.getSelectedItem();
                String courseName = (String) courseComboBox.getSelectedItem();
                String grade = gradeField.getText();

                // Assign the grade to the student
                Student student = students.stream().filter(s ->
s.getName().equals(studentName)).findFirst().orElse(null);
                Course course = courses.stream().filter(c ->
c.getCourseName().equals(courseName)).findFirst().orElse(null);

                if (student ≠ null && course ≠ null) {
                    studentmanagement.controller.GradeController.assignGrade(student,
course, grade);
                    JOptionPane.showMessageDialog(null, "Grade assigned successfully!");
                    dispose();
                }
            }
```

```
        });


        setVisible(true);
    }
}
```

This form allows the user to assign a grade to a student for a specific course. It includes dropdowns to select a student and a course, a text field to enter the grade, and a button to submit the grade. When the button is clicked, the grade is assigned to the student for the selected course.

Controller Classes

These classes contain the logic to manage the interaction between the model and view.

`StudentController.java`

```
package studentmanagement.controller;


import studentmanagement.model.Student;


import java.util.ArrayList;
import java.util.List;


public class StudentController {
    private static List<Student> students = new ArrayList<>();


    public static void addStudent(Student student) {
        students.add(student);
    }


    public static void updateStudent(Student student) {
        for (int i = 0; i < students.size(); i++) {
            if (students.get(i).getId().equals(student.getId())) {
                students.set(i, student);
                return;
            }
        }
    }


    public static List<Student> getAllStudents() {
        return students;
    }
}
```

This controller manages the list of students. It includes methods to add a student, update a student's information, and get a list of all students.

`CourseController.java`

```
package studentmanagement.controller;


import studentmanagement.model.Course;


import java.util.ArrayList;
import java.util.List;


public class CourseController {
    private static List<Course> courses = new ArrayList<>();


    public static void addCourse(Course course) {
        courses.add(course);
    }


    public static List<Course> getAllCourses() {
        return courses;
    }
}
```

This controller manages the list of courses. It includes methods to add a course and get a list of all courses.

`EnrollmentController.java`

```
package studentmanagement.controller;


import studentmanagement.model.Enrollment;

import studentmanagement.model.Student;

import studentmanagement.model.Course;


import java.util.ArrayList;

import java.util.List;


public class EnrollmentController {

    private static List<Enrollment> enrollments = new ArrayList<>();


    public static void enrollStudentInCourse(Student student, Course course) {

        enrollments.add(new Enrollment(student, course));

    }


    public static List<Enrollment> getEnrollments() {

        return enrollments;

    }

}
```

This controller manages the list of enrollments. It includes methods to enroll a student in a course and get a list of all enrollments.

`GradeController.java`

```
package studentmanagement.controller;


import studentmanagement.model.Student;

import studentmanagement.model.Course;


import java.util.HashMap;

import java.util.Map;


public class GradeController {

    private static Map<String, String> grades = new HashMap<>();


    public static void assignGrade(Student student, Course course, String grade) {

        String key = student.getId() + "-" + course.getCourseId();

        grades.put(key, grade);

    }


    public static String getGrade(Student student, Course course) {

        String key = student.getId() + "-" + course.getCourseId();

        return grades.get(key);

    }

}
```

This controller manages the grades assigned to students. It includes methods to assign a grade to a student for a specific course and get the grade for a student in a specific course.

Summary

The Student Management System is a application built using Java Swing. It includes a well-defined structure with model classes to represent data, view classes to create the user interface, and controller classes to manage the logic. The GUI is designed to be user-friendly, with forms for adding, updating, and viewing students, enrolling in courses, and assigning grades. Each component interacts seamlessly to provide a complete solution for managing student information, course enrollments, and grades.

References

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