CSUN
CALIFORNIA
STATE UNIVERSITY
NORTHRIDGE

COMP 490 Senior Design Project

Topic 6: Project Design

Instructor: Xunfei Jiang

Outline

- Project Design
- Group Discussion: Project Design - Part 1 Goals
- Project Design Example
- Group Discussion: Project Design - Part 2 Visualize your design

Goals of your project

1. What you hope to accomplish ?
2. What are the goals of your project ?
   - List all goals by considering the needs and expectations
   - More details could help to manage your project
3. How to accomplish each goal ?
   - What's the approach to achieve the goal ?
4. What special hardware will be needed ?
   - Hardware that are essential for the project itself
   - Not include computers/laptops to develop programs
5. Software
   - Determine what features are needed
6. Use Stories

Project Design Example - Class Attendance

1. What you hope to accomplish ?
   - Develop a system to take class attendance for instructors in face-to-face lecturing
2. What are the goals of your project ?
   - Use existing RFID reader to record attendance
   - Store the attendance data in a database
   - Develop a web application for data visualization and analysis
3. How to accomplish each goal ?
   - RFID reader read students' ID card info
   - Build a SQL database with tables to store information
     - Students, classrooms, classes, and attendance records
   - The website will be hosted on a server in CS department/university
     - Attendance data will be visualized for users
     - Report could be downloaded for further analysis

Project Design Example - Class Attendance (2)

1. Hardware
   - No need to install additional hardware
2. Software
   - Data Input
   - Attendance Data Storage
   - Data visualization
   - Report generation
3. Use Stories
   - Who are the users of your system?
   - What are the scenarios of use cases?

Activity: Group Discussion (15 mins)

- What are the goals of your project ?
  - List all goals by considering the needs and expectations
  - More details could help to manage your project
- How to accomplish each goal ?
  - What's the approach to achieve the goal ?
- What special hardware will be needed ?
  - Hardware that are essential for the project itself
  - Not include computers/laptops to develop programs
- Software
  - Determine what features are needed
- User Stories
  - Use cases

Day 12 - Class Attendance: Reply with your full name

Project Design Document

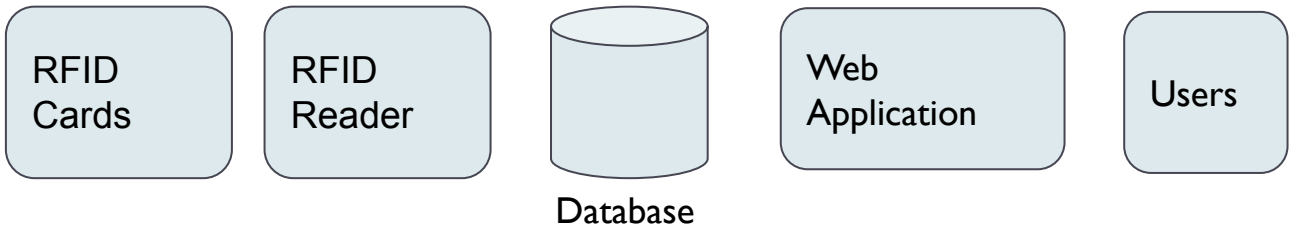
Use UML diagrams to visualize the architecture

- User interface
  - Any part of your project enables a user to interact with it.
- Inputs
  - Information that needs to be entered into the application and/or its modules by the programmers.
- Functional requirements
  - Specific functions, tasks, or behaviors
- Configuration
  - If the project will need any special configuration
- Milestones
  - Milestones may coincide with the completion of certain functionality, modules, or applications.
- Data model and storage
  - How and where information is stored in the system

Source: https://www.smartsheet.com/project-design-any-industry#project-design-for-the-software-development-industry

Project Design Example - Class Attendance (3)

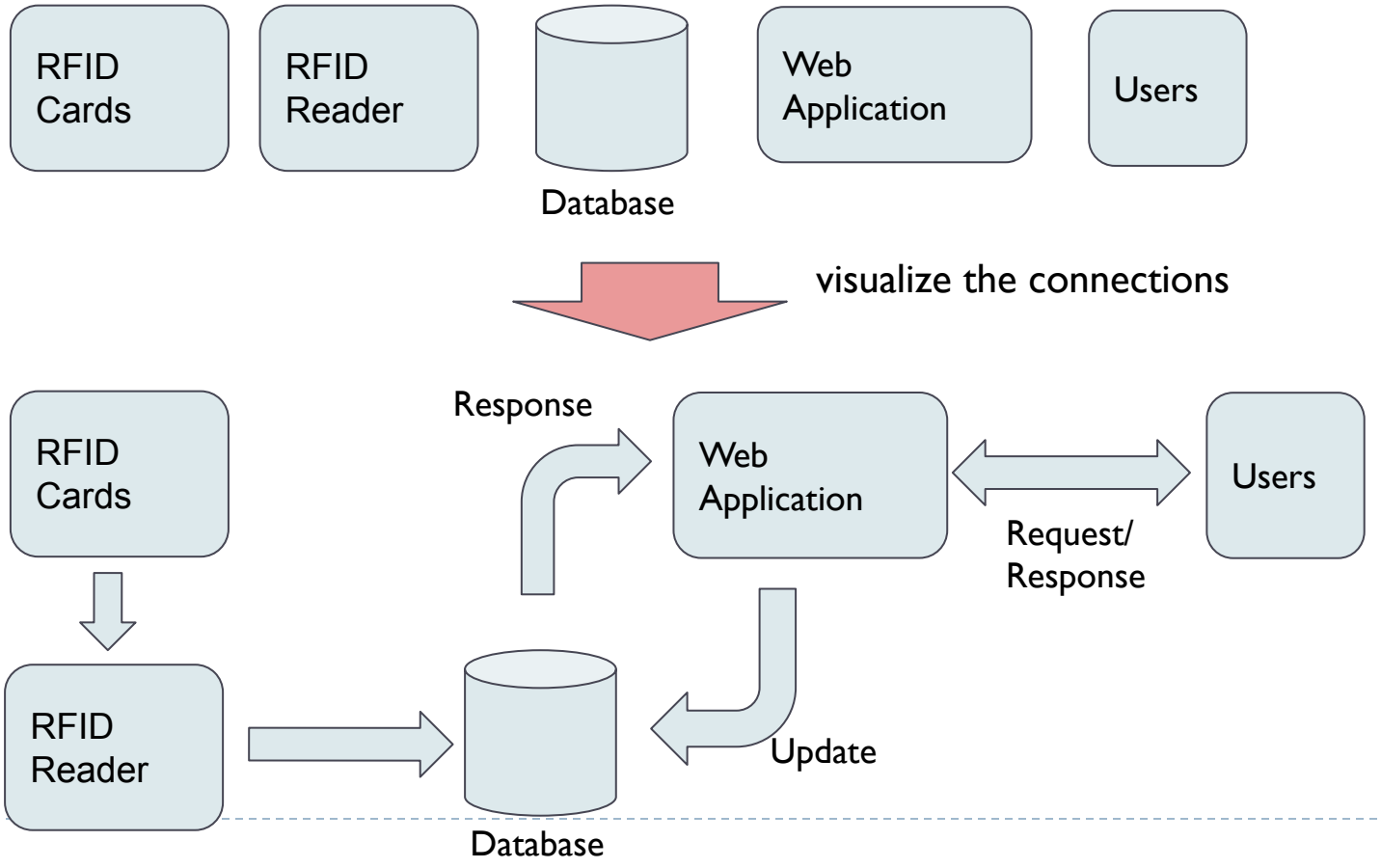
- Design framework
  - Major components of your project
    - RFID reader and RFID cards
    - Database
    - Web application



  - Relationships between these components
    - RFID reader reads the RFID info and add a record into database
    - User send request to view the attendance data
    - Web application send request to search in the database
    - Data is returned as a response to the web application
    - Web application visualize the data for display
    - Instructor could edit the records to accommodate exceptions

Project Design Example - Class Attendance (4)

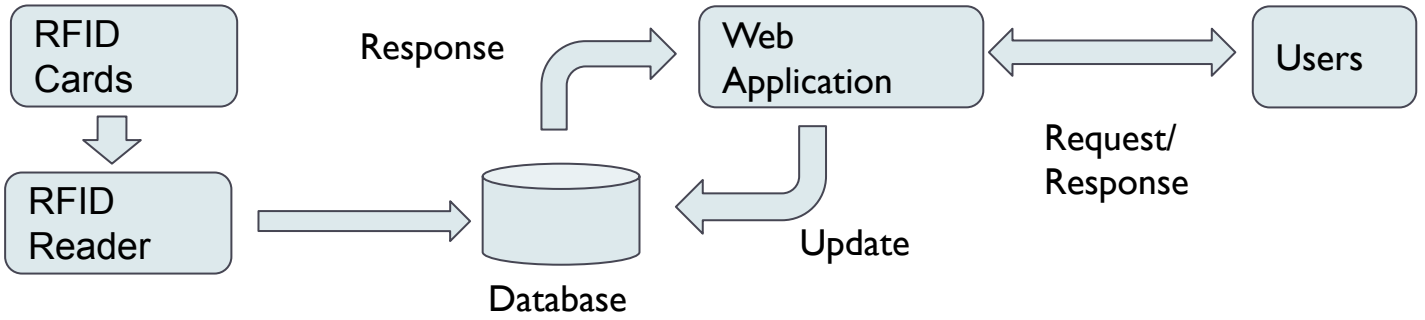
- Design framework
  - Relationships between these components



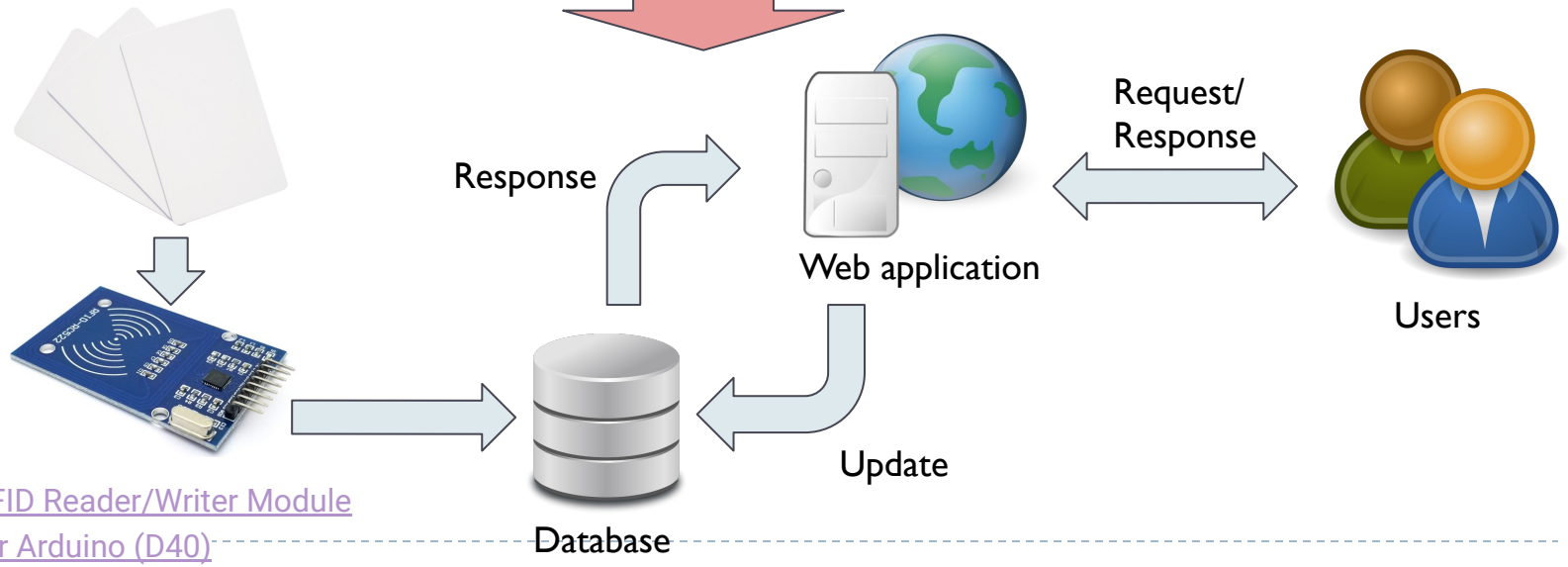
Project Design Example - Class Attendance (5)

- Design framework
  - Relationships between these components

This is good



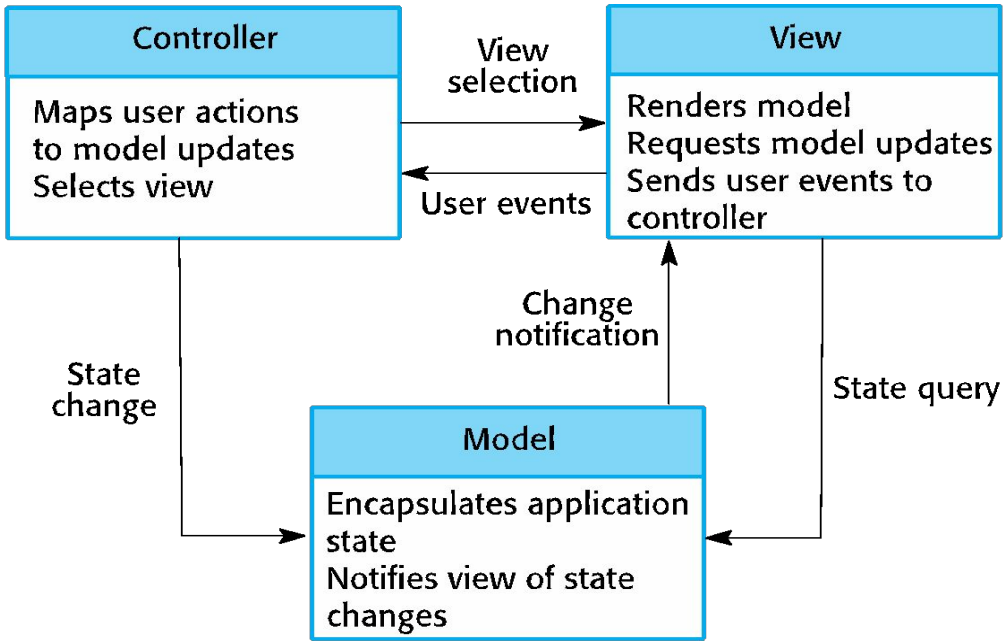
If you prefer using icons



RFID Reader/Writer Module for Arduino (D40)

Architecture Design

1. The Model-View-Controller (MVC) pattern

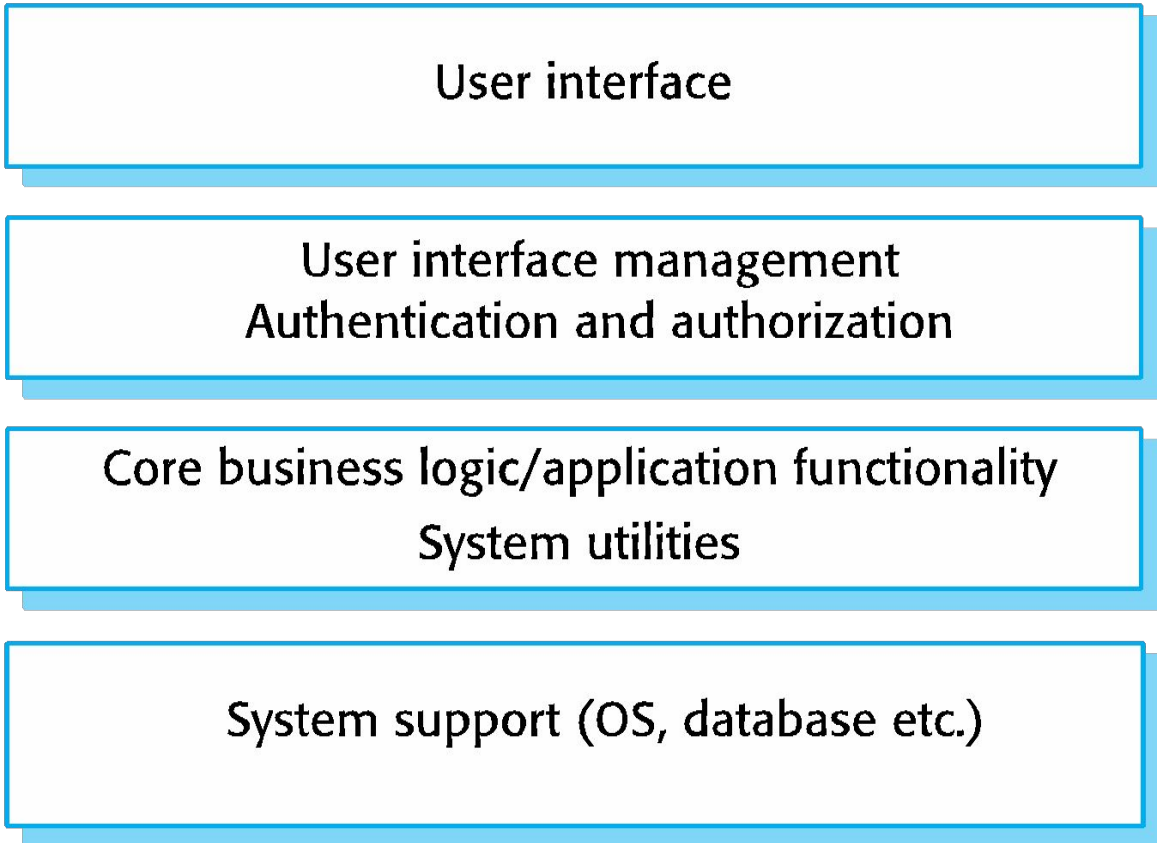


The organization of the Model-View-Controller

Source: Ian Sommerville. **Software Engineering**, 10th edition.

Architecture Design

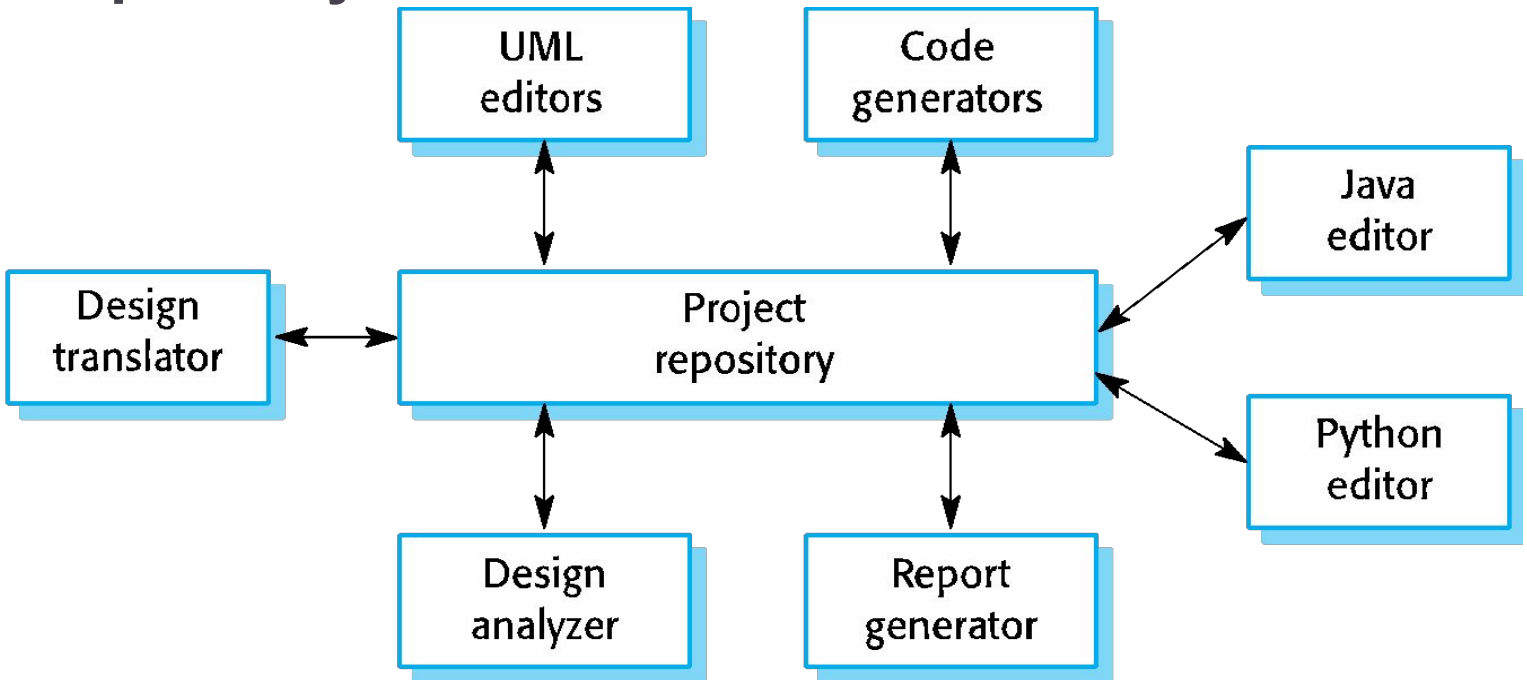
2. Layered architecture



Source: Ian Sommerville. **Software Engineering**, 10th edition.

Architecture Design

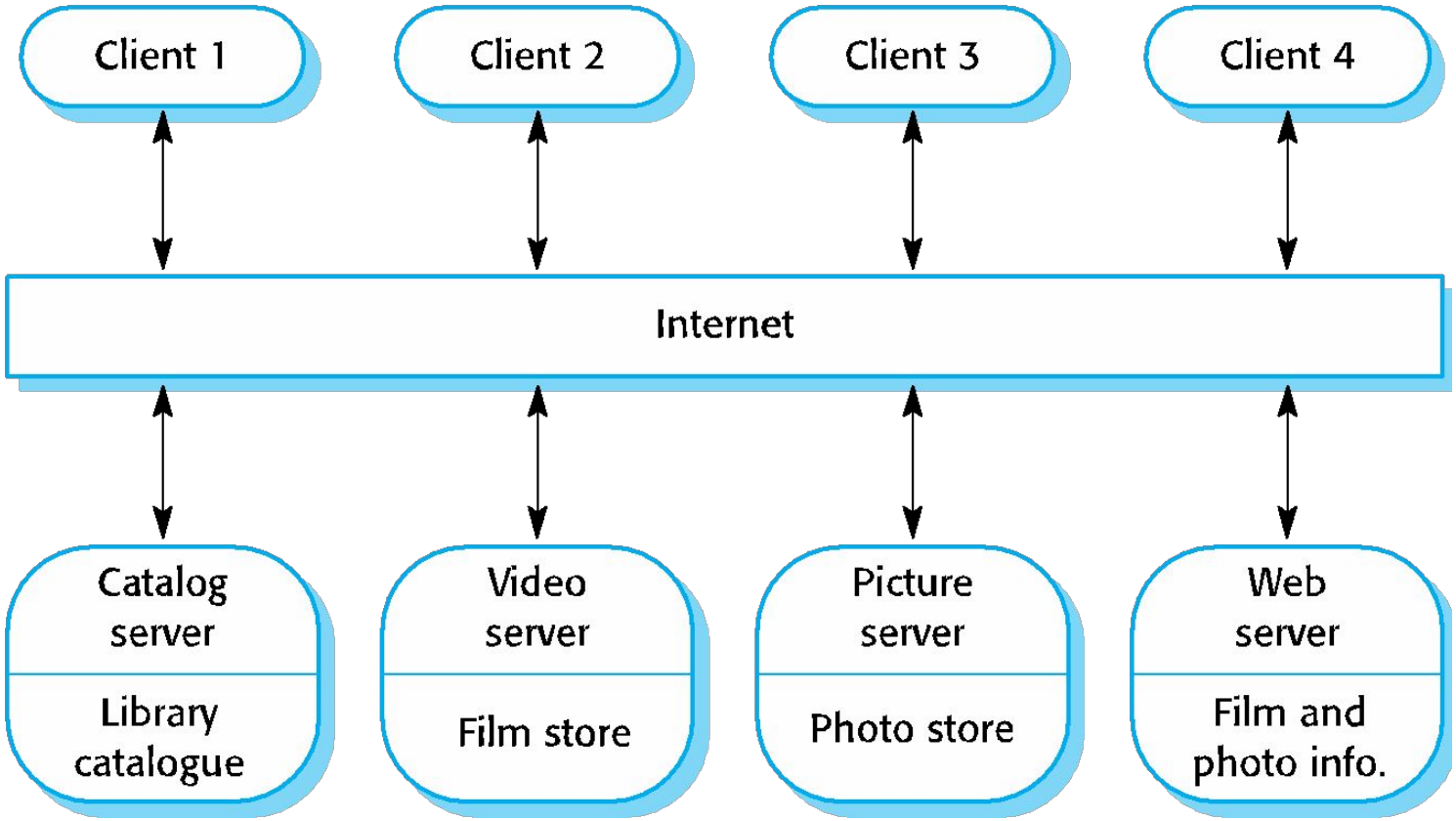
3. Repository architecture



Source: Ian Sommerville. **Software Engineering**, 10th edition.

Architecture Design

4. Client-server architecture



Source: Ian Sommerville. **Software Engineering**, 10th edition.

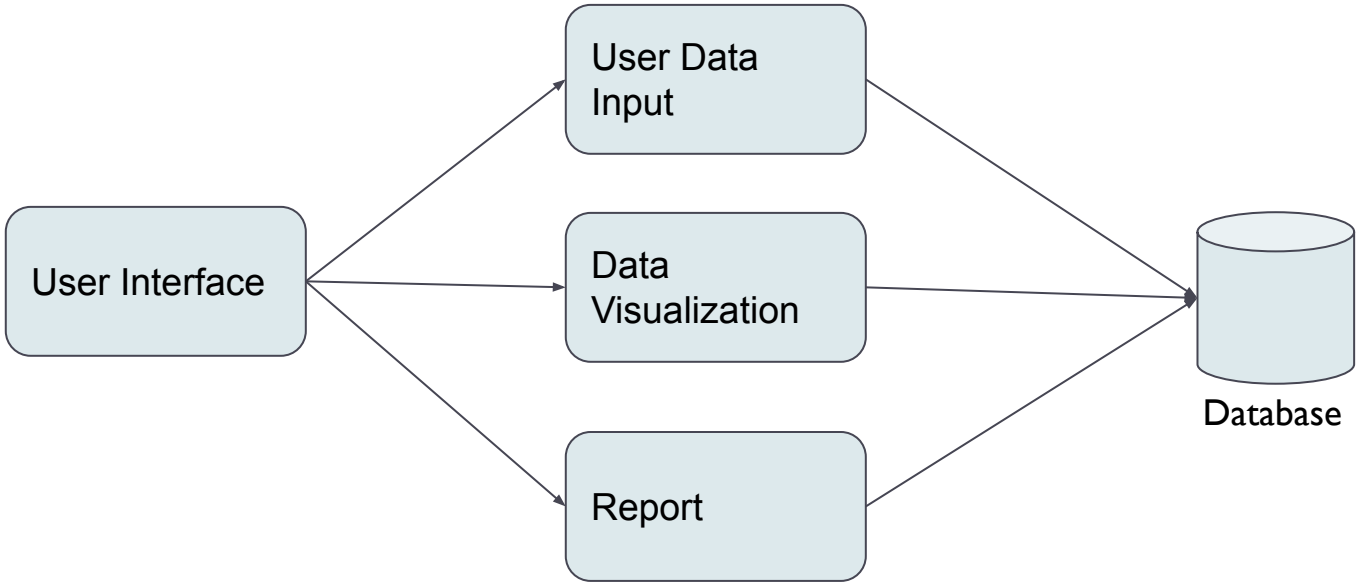
UML Diagrams for System Modeling

- **Activity diagrams**, which show the activities involved in a process or in data processing.
- **Use case diagrams**, which show the interactions between a system and its environment.
- **Sequence diagrams**, which show interactions between actors and the system and between system components.
- **Class diagrams**, which show the object classes in the system and the associations between these classes.
- **State diagrams**, which show how the system reacts to internal and external events.

Sample Miro Diagrams

Project Design Example - Class Attendance (6)

- Design framework
  - Web Application
    - User Data Input: enable administrators to add data to the system
    - Data Visualization: visualize the attendance data by class/student
    - Report: generate excel reports for downloading



Project Design Example - Class Attendance (7)

- Design framework
  - Web Application
    - User Data Input
      - Enable administrators to edit info of the whole system
        - Class info: add new classes every semester
        - Classroom info: add entry for new classroom or the RFID reader device
        - Instructors' info
        - Students' info
      - Display related info for administrator after the insertion or modification
    - Data Visualization
      - Visualize the attendance data by class for instructors
      - Visualize the attendance data for students
    - Report
      - Enable instructors to download report data for further analysis
      - Enable students to download personal attendance data

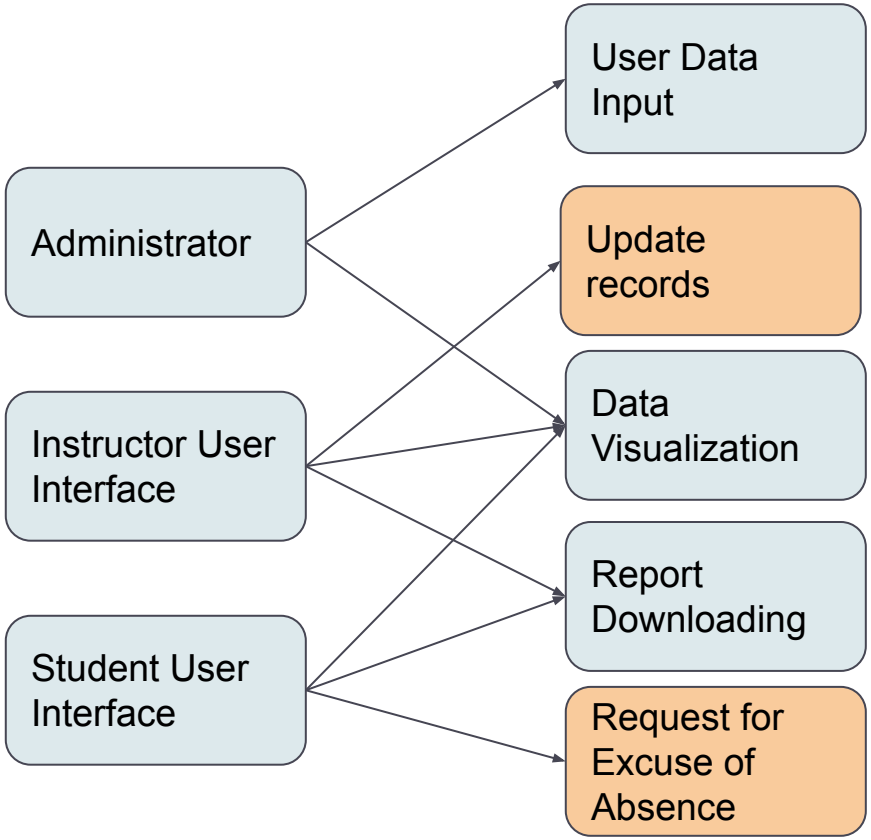
You could use a Miro template for brainstorm and use stories

Project Design Example - Class Attendance (8)

- Use Cases
  - Who are the users of your system?
    - Instructor, students, administrator
  - What are the scenario of user test cases?
    - Administrator add new data
      - Check the visualization module to confirm the operation is successful
    - An user swap a RFID card in front of a RFID reader
      - One entry is added to the attendance table
    - A student send a request for excuse of absence
      - Instructor will receive a notification from the system
      - Instructor approve or deny the request
  - What will be the range of the test?
    - Who will participate in your test?
    - For each scenario, how many times you will test it?
  - What metrics you would like to collect from the test?

Project Design Example - Class Attendance (9)

- Use Case Diagram



(1) use sequence/state/activity diagram to illustrate the processes of operations.
(2) Use diagrams to illustrate the layout of each web page

Revise the design if needed

2 new features are added in this diagram, which require the update design of database system

Project Design Example - Class Attendance (10)

- Design
  - Database

Instructor Info	
ID	RFID (unique)
UID	User ID (unique)
Name	User Name
Email	Email address

Student Info	
ID	RFID (unique)
UID	User ID (unique)
Name	User Name
Email	Email address
C_Nums	Class numbers

Class Info	
C_Num	Class number
C_Name	Class name
Semester	Semester info
Location	Classroom number
Instructor	UID of instructor
S-IDs	A list of students' UIDs
...	...

Classroom Info	
R_Num	Room number (unique)
R_Name	Room name
RFID_Reader_ID	Device number of RFID reader
Time	Timestamp for the entry

Attendance Table	
RFID_Reader_ID	Device number of RFID reader (unique)
Student_RFID	RFID number of student
Time	Timestamp
Source	Source of the record

Activity: Group Discussion

- Discuss with your group members on project design
  - Create a project design document and shared with your group members
  - Discuss the major modules/components of your project
  - Design a framework for your project
  - Visualize your design using UML diagrams
  - Identify other diagrams and models that are appropriate for your project