FSAD Project

Phase 1 - Architecture and Design

Database Design

The User's details collection, the authentication for *"Admins"* and the contact details for *"Students/Parents"*.

Users

Field Name	Data Type	Validation and or Notes
id	Int (Primary)	Given in increments of 1 starting with 10011. (Or this could be auto-generated and incremented by MySQL, this is to be reviewed later). Used for login.
name	String	Data Required. Must be Full name.
role	String	Enum: ['admin', ' student', 'parent'] Defaults to 'student'
email	Varchar	Data Required. Must be unique. Used for login Used as contact
password	Varchar	Data Required. Store as a bcrypt hash, never as plain test.
phone_number	Int	Data Optional. Used as Contact

Tutors

Field Name	Data Type	Validation and or Notes
id	Int (Foreign)	Given in increments of 1 starting with 20021. (Or this could be auto-generated and incremented by MySQL, this is to be reviewed later). Used for login.
name	String	Data Required. Must be Full name.
email	Varchar	Data Required. Must be unique. Used for login Used as contact
password	Varchar	Data Required. Store as a bcrypt hash, never as plain test.
phone_number	Int	Data Optional. Used as Contact
Bio	String	Data Required. Short description for profile.
Profile_picture	String	URL string set to image file.

Field Name	Data Type	Validation and or Notes
Qualifications	Varchar	Data Required. Metric to assess tutors capability. A-levels/GCSE or other professional qualifications.
DBS	String	Data Required. Must be updated to recent check.
SubjectID	Int (Foreign)	Array[“Maths”, “English”, “Science”]. Selected by tutor. One to one link with subjects in booking table.

Sessions/Bookings

Field Name	Data Type	Validation and or Notes
id	Int (Foreign)	Auto-generated
SubjectID	Int (Foreign)	One to one link with subjects in tutor table.
StudentID	Int (Foreign)	User id must exist. Reference linking session/booking to student.
TutorID	Int (Foreign)	User id must exist. Reference linking to tutor.
Available_Dates	Date	Set by tutor
Time_Slots	Int	Set by tutor
Tutor_Mode	String	In-person or online class with tutor
Status	String	Enum: [‘Pending’,

		‘Confirmed’, ‘Cancelled’] Default to “Pending”.
Sessions_Attended	Int	Shows number of attended sessions. Should link to calendar to show the days of attended sessions.
Dates_Booked	Int	Data Required.

Resources

Field Name	Data Type	Validation and or Notes
id	Int (Foreign)	Auto-generated
title	String	Required. Example. “Year 11 Mathematics Scheme”
type	String	Enum: [‘Free’, ‘Paid’].
subject	String	Category for filtering.
file_Url	String	Required. Path to downloadable file(PDF).
UploadBy	Int	Reference User.

I chose a relational database(MySQL) structure over NoSQL because of the assignment requirements, giving a good standard quality whilst not going too far with unnecessary features. MySQL allows me to have multiple, complex relationships between the tables and makes it easier to query the database due to the predefined schema set and its structured nature format.

What I will showcase on the homepage of the mobile view website version:

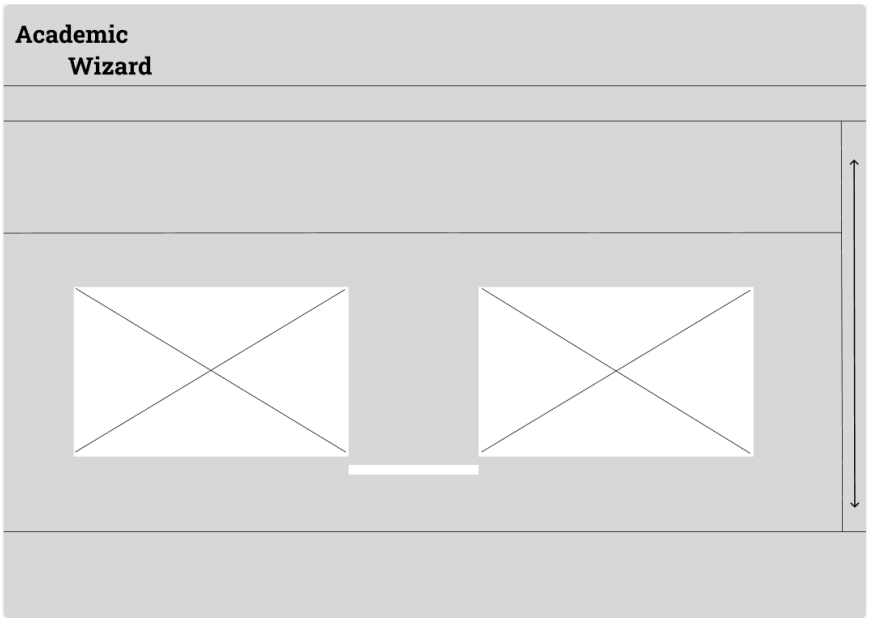
Feature	Position
The “Academic Wizard” name	at the Left side of the Header
Hamburger menu that encloses: ● “Find a tutor” ● “Book a session” ● “Study resources” ● “Admin” ● “Help and faq”	at the right side of the Header
A “Login”	in the header
A Banner with a motto	at the right side of the page
A “book a session” button	On the bottom of the banner to the left
A Scroller	at the right side of the page
Testimonials	displayed for the rest of the screen
“About us”	at the left side of the footer of the page
“Contact info ”	at the right side of the footer of the page

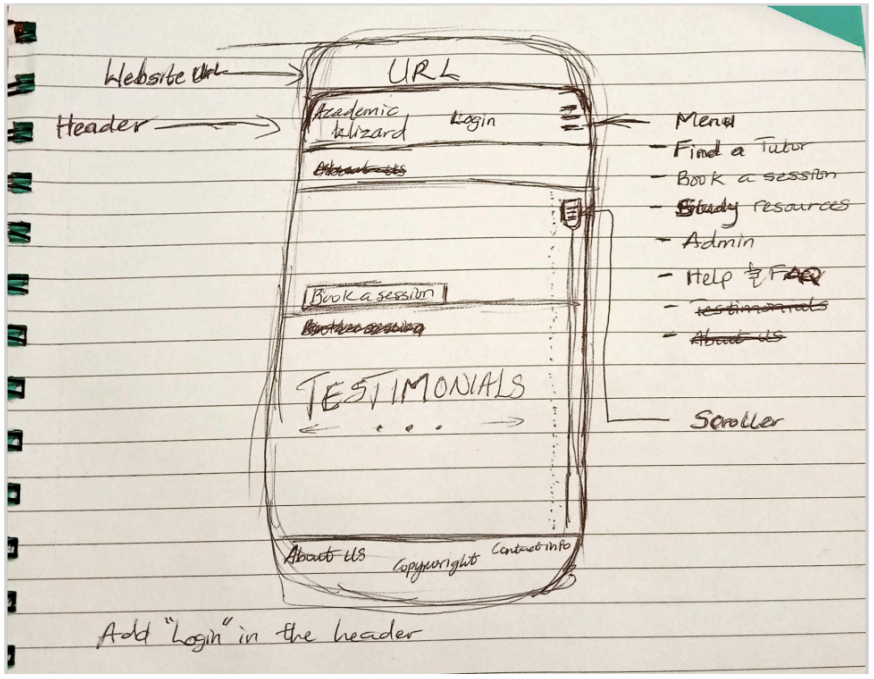
The mobile view website created by Figma works well. Some changes I had in mind for it were:

- Make the testimonials move horizontal like college website rather than vertically
- Remove the Subjects list.

Task 2

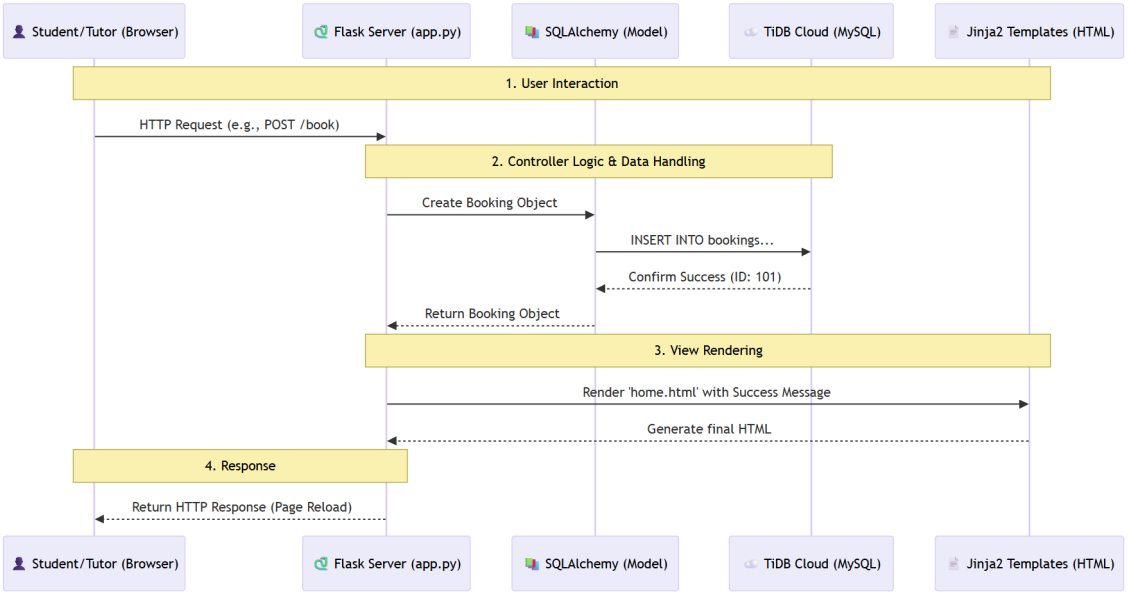
Design Documentation

- Wireframes and UI mockups :-
  - 

  - **Sketch of Homepage**
    

    Regarding accessibility, I designed the menu button to be at least 44x44 pixels to meet the touch target accessibility standards, ensuring it is easily accessible to all users regardless of motor skills.

- System architecture :- The application follows the Model-View-Controller (MVC) architectural pattern. This separates the internal representation of information from the way information is presented to and accepted from the user.



  - Diagram
    - Database :- TiDB Cloud (MySQL): A serverless, distributed SQL database hosted in the cloud.
    - Server :- Python Flask: A lightweight WSGI web application framework.
    - Front-end :- Jinja2 Templates: HTML files with dynamic content rendering, styled with standard CSS3.
- Database schema :-
  - Table: Users (Student/Parent)
    - `id` (INT, Primary Key, Auto-increment)
    - `name` (VARCHAR, Required)
    - `email` (VARCHAR, Unique, Required)
    - `role` (ENUM: 'Student', 'Parent', 'Admin')
    - `password_hash` (VARCHAR, Secure storage)
  - Table: Tutors
    - `id` (INT, Primary Key, Auto-increment)
    - `name` (VARCHAR, Required)
    - `subject` (VARCHAR, Required)
    - `bio` (TEXT)
    - `is_verified` (BOOLEAN)
  - Table: Bookings
    - `id` (INT, Primary Key, Auto-increment)
    - `student_id` (INT, Foreign Key linked to Users)
    - `tutor_id` (INT, Foreign Key linked to Tutors)
    - `date` (DATE)

        - `time` (TIME)
        - `status` (ENUM: 'Pending', 'Confirmed')
- Used Technology justification :-
    - Python & Flask: Flask was chosen for its lightweight nature, allowing for rapid prototyping without the heavy boilerplate of larger frameworks. It integrates seamlessly with SQLAlchemy for robust database management.
    - MySQL (TiDB Cloud): A relational database was selected over NoSQL because the data is highly structured (e.g., a Booking *must* link to a valid Tutor and Student). TiDB Cloud was chosen to ensure database accessibility from restricted college networks where local database ports were blocked.

Development Process

- Steps taken :-
    - Requirement Analysis: Defined the core features (Booking, Tutor selection) and database structure.
    - Environment Setup: Attempted Node.js setup (blocked), then successfully established a Python virtual environment.
    - Database Connection: Configured TiDB Cloud with whitelist rules to allow connection from the college network.
    - Backend Logic: Implemented Flask routes to handle form submissions (Booking/Registration).
    - Frontend Integration: Created Jinja2 templates to display database content dynamically.
- Relevant code
    - Snippets :-

```
# Model Definition (SQLAlchemy)
class Booking(db.Model):
    id = db.Column(db.Integer, primary_key=True)
    student_name = db.Column(db.String(100),
nullable=False)
    tutor_id = db.Column(db.Integer,
db.ForeignKey('tutor.id'))
    date = db.Column(db.String(20), nullable=False)

# Controller Route (Flask)
@app.route('/book', methods=['POST'])
def book_session():
    tutor_id = request.form.get('tutor_id')
    new_booking = Booking(tutor_id=tutor_id, ...)
    db.session.add(new_booking)
```

```
            db.session.commit()
            return redirect(url_for('home'))
```

- Explanation :-
  - The Model snippet defines the structure of the `Booking` table using Python classes, which SQLAlchemy translates into SQL commands.
  - The Controller snippet listens for a POST request from the browser (when a user clicks "Book"), captures the form data, saves it to the database, and refreshes the page.

- Challenges
  - Encountered :-

    Restricted Execution Environment: The college's Group Policy prevented the installation of Node.js packages and blocked the execution of runtime scripts (PowerShell restrictions).

    Additionally, the college firewall blocked standard local database ports (3306), preventing a local database instance from running.

  - Solution :-

    Architecture Pivot: I pivoted the technology stack to Python, which was whitelisted on the college system. To solve the database connection issue, I utilized TiDB Cloud (Port 4000) and configured a "Public Endpoint" with a wildcard (`0.0.0.0/255.255.255.255`) whitelist.

    This effectively bypassed the local restrictions by offloading the database to the cloud.

Evaluation

- Effectiveness in usage of
  - API's :- The application effectively communicates with the TiDB Cloud API via the SQLAlchemy connector. This proved highly effective for maintaining data persistence across different locations (College and Home) without manual data transfer.
  - Frameworks :- Flask proved highly effective for this scale of application. Its modular design allowed for easy separation of the Routing logic (`app.py`) and the Presentation logic (`templates`), fulfilling the MVC requirement efficiently.
- Evaluation of website's
  - Strengths :-

        - Portability: Due to the cloud database integration, the application is "device agnostic" and retains data state regardless of where it is run.
        - Architecture: The strict MVC structure ensures the code is maintainable and scalable.
    - Weaknesses :-
        - Styling: The current user interface relies on basic CSS and lacks responsive design for smaller mobile screens.
        - Authentication: The current "Login" is simulated (entering a name) rather than a secure hashed-password system.
- Suggestions of
    - Potential improvements :-
        - Secure Authentication: Implementing “Flask-Login” to handle secure user sessions and password hashing.
        - Input Validation: Adding server-side validation to ensure dates selected are in the future and do not clash with existing bookings.
    - Additional features :-
        - Calendar Integration: Visualizing bookings on a calendar view rather than a list.
        - Payment Gateway: integrating Stripe API to allow for paid tutor sessions.