B.Sc. (Hons) in Software Development
Applied Project & Minor Dissertation

Project Proposal

Each student must complete the following form and submit it to their supervisor for consideration. Once your supervisor has signed-off on the proposal, you must submit the document for consideration using Moodle.

1. **Student Name:**   Fionn McGoldrick
2. **Supervisor Name:**   Douglas Mota Dias
3. **Project Name:**   AI-Powered Code Practice Web App

4. **Project Context**

Describe the context of the problem domain here. Explain what you are proposing to do and your rationale for doing it. Explain why the problem domain is of interest.

The project focuses on improving how people learn programming by creating a web-based platform inspired by Duolingo's engaging and fast-paced learning style. It aims to make programming education more accessible, personalised, and rewarding through short, targeted challenges powered by AI. As users select a programming language and topic, the system will generate interactive exercises that adapt to their level and provide immediate feedback.

A key motivation for this project is the growing difficulty many learners face in maintaining focus for extended periods. Attention spans are widely reported to be shortening, particularly in digital learning environments, which makes traditional long-form tutorials and lectures less effective. Additionally, critical thinking skills are becoming increasingly scarce while platforms such as LeetCode excel at advanced problem solving, they can often feel overwhelming and inaccessible to beginners and intermediate learners. There are also relatively few programming tools that focus on teaching theoretical concepts alongside practical exercises in a structured and rewarding way. By combining adaptive AI-generated challenges with a gamified learning experience, this project aims to bridge that gap and offer a more approachable path for learners to build both their theoretical knowledge and practical coding skills.

This problem domain interests me because I've seen these challenges affect my peers and have experienced some of them myself. I want to create a more approachable and rewarding way to learn programming – one that reflects the kind of adaptive environment I would have benefited from as a learner.

OTA Cathair na Gaillimhe
Bóthar Átha Cliath, Gaillimh,
H91 T8NW, Éire

ATU Galway City
Dublin Road, Galway, H91 T8NW, Ireland
Tel: +353 (0)91 753161

atu.ie

Ollscoil
Teicneolaíochta
an Atlantaigh

Atlantic
Technological
University

5. Project Objectives

Write out the key objectives of the project as bullet points. Each objective should be clear, realisable and measurable / testable, i.e. the success of your project is determined by the degree to which these are realised.

- Develop a fully functional web-based learning platform with user authentication, profiles, and progress tracking (videogame inspired 'level up' system)
- Implement AI-powered challenge generation, allowing users to select a programming language, prompt for a specific topic (optional), and receive personalised, structured exercises.
- Integrate automatic grading and feedback for both theoretical and practical challenges, including code evaluation through a secure sandbox environment.
- Design and build a gamified progression system, including XP, levels and rewards tp increase engagement and motivation.
- Ensure the platform provides accessible and beginner-friendly learning experiences, bridging the gape between introductory resources and advanced platforms like LeetCode.
- Evaluate the platforms effectiveness through user testing and feedback, focusing on usability, engagement and learning outcomes.
- Develop and integrate a custom AI classifier model to categorise quiz questions into difficulties.

6. Technologies & System Architecture

Explain the technologies you are going to use and why you selected them. These include the programming languages, operating systems, presentation and storage technologies and any cloud / 3rd party libraries / services that you intend to use.

- **Frontend**: React to build dynamic, component-based interface. Its virtual DOM enables fast updates, and it integrates easily with backend API's. Presentation will be handled using basic HTML, CSS, and JavaScript alongside React to build a responsive browser-based interface.
- **Backend**: Django to handle server-side logic, authentication, and API endpoints. Its built-in admin, security features, and structured framework make it reliable and efficient for rapid backend development. Python is also a language I want to improve at and I have never used Django before.
- **Database**: POSTGRESQL as the main database for its reliability, strong support for relational data, and for its compatibility with Django. It's also well-suited for handling structured user data and application content securely. I have not used POSTGRESQL or any object-relational database before and want to apply knew knowledge by learning how to use it in this project.
- **Containerization**: Docker to containerize the backend, database, and the frontend for consistent environments and easier deployment. This ensures the application runs the same way across different machines and will allow me to deploy it to testers for feedback.
- **Custom Classification Model**: Python with PyTorch, scikit-learn, pandas, and NumPy to build and train a classification model on a CSV dataset. Exporting to ONNX and embedding in backend. I want to gain hands-on experience with machine learning by developing a model and embedding it into the application's functionality.
- **Operating Systems**: With Docker containerization, the platform can be deployed on effectively any operating system. In terms of future deployment, the application could be hosted on AWS by deploying the Docker containers to a cloud service, allowing for scalable and reliable hosting..

OTA Cathair na Gaillimhe
Bóthar Átha Cliath, Gaillimh,
H91 T8NW, Éire

ATU Galway City
Dublin Road, Galway, H91 T8NW, Ireland
Tel: +353 (0)91 753161

atu.ie

7. Schedule of Work

Using a Gantt chart or tabular format, outline your schedule of work for all the key project activities, deliverables and dates.

OTA Cathair na Gaillimhe
Bóthar Átha Cliath, Gaillimh,
H91 T8NW, Éire

ATU Galway City
Dublin Road, Galway, H91 T8NW, Ireland
Tel: +353 (0)91 753161

atu.ie