Designing and Implementation of Online AI Experiment Platform Based on Serverless Architecture

Student Name: Yiqi Huang

Student ID: 34180761

Supervisor: Reza Rezazadeh

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| Aims and Objectives |
| With the continuous development of computer and information science, artificial intelligence has become an essential factor in society’s development, and will also become the centre of the technology revolution in the future. Therefore, how to follow the growing AI technology, and use the existing methods to make sure students can study AI in schools are considered. As more and more schools have carried out AI education, it is urgent to understand the current situation of AI experiments education, clarify the key points, difficulties, and methods of it, and design and implement an artificial intelligence experiment platform suitable for practical needs. In addition, due to the rapid and widespread transmission of COVID-19, schools have had to resort to online teaching for the safety of students. Although the situation has improved, the virus has undoubtedly greatly accelerated the development of online education. This web-based education maximizes the utilization of learning resources and breaks the limitations of time and space through the Internet. While fully leveraging resources, it also promotes academic exchanges among schools worldwide. In the context of globalization, this concept undoubtedly meets the needs of social development. At the same time, cloud-based platforms have the functionality of automated management and remote interaction, greatly facilitating teaching management for teachers. This integration of the Internet and education provides a new approach to traditional education  In conclusion, this project aims to build a cloud-based web application as an education tool which is offered to universities to conduct online AI experiments, which mainly has three stakeholders: Experiment Administrators (Teachers), Students, and Platform Administrators.  The functionalities of stakeholders include:  1) Teacher User: Student information management, Experiments management (create, delete, check the result)  2) Student User: Personal information management, Conducting experiments (do experiments, save the result, comment on it)  3) Platform Administrator: Platform resource management, Platform maintenance, Teacher and student accounts management  The expected objectives include:   1. Front-end web pages of the platform: it is going to be built with HTML+CSS+JS 2. Back-end of the platform: uses APIs to connect to database, Serverless services and achieve functionalities of main stakeholders   3) Database: stores users’ information and all the data might be used in the platform  4) Network file system: it stores and share platform resources and Serverless architecture configuration files between nodes in the cluster.  5) Serverless Architecture: it is going to be built with Kubernetes and Docker to manage platform resources and provide cloud services to the platform.  6) A Machine Learning experiment: design a ML experiment as the default experiment in the platform using open-source data.  7) Testing, and evaluation to verify the integrity of the service and the effectiveness of the access control methods  8) Project essay and related materials |
| Summary of proposed research and analysis methodology |
| The major proposed research and analysis methodology would be Case study and Interview.  To gain a better understanding of the development of AI education, this project will primarily adopt a case study approach. By investigating the national policies regarding AI education, researching existing AI education products and markets, and studying the teaching methods employed by universities that have already incorporated AI education, such as MIT and Stanford, we aim to comprehend the current state of AI education from social, commercial, and academic perspectives. Through this research, we will learn how to construct this project and validate its feasibility.  Additionally, in order to analyse user requirements, this project applies conducting interviews with stakeholders, including teachers and students. These interviews aim to understand how schools set AI courses and the commercial collaborative models between schools and third-party education platforms. Based on this analysis, use case diagrams will be designed to describe the user requirements and platform functionalities.  During the research and analysis, this project will strictly maintain the confidentiality of interviewees and their privacy. The information provided by interviewees will only be used as a reference to create unique features and frameworks for this project, ensuring the prevention of plagiarism and the protection of interviewees' intellectual property rights. Interviews will be conducted through scheduled online or offline one-on-one meetings, with interview times confirmed in advance based on the interviewee's availability. The primary interviewees will be teachers from schools, and any information or content related to the interviewees will not be included in this project. The materials used for case studies in this project will be publicly available or open-source cases that can be found online, in libraries, and other sources, and will not involve any private or proprietary trade secrets.  Software and technologies suitable for the project:   1. Docker: The platform is going to use Docker as containers to provide consistent and isolated experiment environment for users. 2. Kubernetes: To easily and effectively control and manage Docker containers, Kubernetes, an open-source application for managing containers on multiple hosts in the cloud platform, is applied in our Serverless framework. It achieves the dynamic expansion and contraction of experiment containers and effectively improves the multi-user concurrency performance of the platform. 3. Flask is used to build the back-end part to provide APIs for the platform to access functionalities. 4. HTML+CSS+JS: It is used to build the front-end of the platform. 5. Test tools and manual tests: Once the application is developed, it will be tested and evaluated to verify the integrity of the service and the effectiveness of the access control methods 6. SQLite and Network File System: The combination of SQLite database and NFW is applied as the storage of the platform. |
| Research plan – Gantt chart |
| The project is expected to start on 17/6/2023 and last 10.5 weeks which is divided into 8 stages.  Stage 1: Write project brief (1 week)  Write a project brief as the preparation of the following works. It helps me and supervisor have a clear understanding of the project.  Stage 2: Research and user requirement analysis (1 week)  At the beginning of the project, I am going to conduct research on AI education. By reading literature, I aim to  understand the current status and future directions of AI education in policy, business, and academia. This stage will  provide feasibility validation and background support for the project. Additionally, I will use interviews to understand  user requirements and platform functionalities.  Stage 3: Design and build a Serverless framework with Kubernetes and Docker (1.5 weeks)  Once the user requirements and platform functionalities have been determined, the next step will be to use Kubernetes  and Docker to set up a Serverless framework. During this stage, cyber security methods will be applied to design and  deploy access control in order to address potential risks such as overprivileged functions and multi-tenant cloud risks.  Stage 4: Design and build a database and file system (1 weeks)  It should have two parts – a file system and an SQLite database. The file system is used to store experiment information  and files uploaded by teachers. SQLite database stores users’ personal information for authorization of the system.  Stage 5: Design and build the front-end web pages (1.5 weeks)  Stage 6: Design and build the back-end part (1.5 weeks)  Stage 7: Implement the platform and do tests (1 week)  Combine serverless and front-end and back-end together.  Stage 8: Essay writing, modification, revision, printing and binding (2 weeks) |