Optimal Course Combination Selection After Second-Year Academic Results.

Index No	Name	Role	Contact Information
202262	H.G.G.K.Madulakshan		kavindu.h.g.g@gmail.com
202260	V.P.Y.Kawindi		yashodakawindi@gmail.com
202162	D.G.P.M.Shantha		pavithramshantha@gmail.com
202151	A.M.K.S.Sandunika		sayurisandunika@gmail.com
202069	M.A.Y.Iwanthi		iwanthiyashodha98@gmail.com

Supervised by

Mr.J.R.K.C.Jayakody

Department of Computing & Information System

Faculty of Applied Sciences

Wayamba University of Sri Lanka

Kuliyapitiya

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1. ABSTRACT

The project's objective is to create an AI-powered academic recommendation system that, through analyzing students' previous academic performance, helps them choose the best course combinations. Choosing a course can be difficult for students because they do not currently receive personalized guidance based on their individual skills and areas for growth. This system uses artificial intelligence (AI) methods, such as machine learning and predictive analytics, to suggest the best subject combinations for every student, providing the requirement for data-driven support. The algorithm will make suggestions that are consistent with students' ability by taking consideration of their personal preferences and academic background. The project's final objective is to develop an intelligent recommendation system that will improve academic preparation and enable students to make wise choices, maximizing their educational potential and ensuring success.

2. INTRODUCTION

2.1 Background/Context

In the education sector, choosing the right academic combinations plays a crucial role in determining a student's future success. However, many students do not receive personalized guidance when making these decisions, often resulting in mismatches between their abilities and chosen subjects. AI has shown potential in transforming the field of education. by providing data-driven insights that can help personalize learning experiences.

2.2 Problem Statement

Undergraduate students face a significant challenge in selecting subject combinations for their third year without adequate guidance or access to their complete academic performance. Specifically, students are required to register for their third-year courses before receiving their second-year second-semester results. This lack of prior academic guidance and incomplete performance data leaves them uncertain about which subject combinations would best align with their strengths and future goals. Consequently, students may struggle to make informed decisions, potentially impacting their academic success and career pathways.

2.3 Objectives

- To develop an AI system that analyzes previous academic results to recommend subject combinations.
- To create a predictive model that suggests combinations based on students' strengths and potential future success.
- To improve the decision-making process for students by providing data-driven, personalized recommendations.

3. LITERATURE REVIEW

Numerous AI models have been applied to student performance prediction. Most studies focus on predicting grades based on various academic factors but often overlook optimizing course combinations. Gaps exist in integrating predictive models with decision-making systems that recommend personalized academic pathways. Existing approaches will be explored, particularly neural networks and ensemble methods for result prediction.

4. PROPOSED SOLUTION

4.1 AI Approach

The system will consist of a recommendation system for course combinations. We will employ machine learning algorithms (such as Random Forest or Logistic Regression) to optimize course combinations. If the data size or complexity warrants, we may explore neural networks to capture deeper patterns.

4.2 Data Requirements

We will require academic data from the past years, including students' results and course enrollments. Data preprocessing (e.g., normalization, handling missing values) will be crucial to ensure model quality.

4.3 Architecture/Design

The system will consist of a recommendation system for course combinations. We will employ machine learning algorithms (such as Random Forest or Logistic Regression) to optimize course combinations. If the data size or complexity warrants, we may explore neural networks to capture deeper patterns.

4.4 Technological Stack

- Programming Language: Python
- Tools:

1. Database Layer (MySQL)
    - MySQL
    - MySQL Workbench/Xampp

2. Backend (Node.js)
    - Node.js
    - Express.js
    - Axios/Node-fetch
    - Flask/FastAPI (for Python Microservice)

3. Machine Learning Tools (Python)
    - Python
    - scikit-learn
    - pandas
    - NumPy
    - joblib or pickle
    - Jupyter Notebooks (optional)

4. Frontend
    - HTML/CSS/JavaScript

5. PROJECT PLAN

5.1 Timeline

	Month & Project Activity	**October**				**November**				**December**				**January**			
		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
1	**Research** (literature review, data collection)																
2	**Feasibility Study** (model training, testing)																
3	**Testing** (validation and optimization of predictions)																
4	**Deployment** (final model deployment and user testing)																

5.2 Milestones

- Data preprocessing completed
- Predictive model designed and trained
- Testing phase with real student data
- Deployment and course recommendation integration

6. EVALUATION METHODOLOGY

6.1 Metrics

We will evaluate the model using accuracy, precision, recall, and the F1 score to measure prediction quality.

6.2 Validation Strategy

To ensure that the model generalizes well and is not overfitting, we will use the following validation strategies:

K-Fold Cross-Validation: The dataset will be split into k equal parts (e.g., 5-fold). The model will be trained on k-1 parts and validated on the remaining part, repeating this process k times. This ensures robust evaluation and prevents overfitting by averaging results across different data splits.

Test Set Validation: After cross-validation, a separate test set (e.g., 20% of the data) will be used to assess the model's performance on unseen data, providing a realistic measure of how well the model generalizes.

7. EXPECTED OUTCOMES

7.1 Impact

The model is expected to provide valuable insights for students in selecting courses based on their academic strengths. This can improve their performance, graduation rates, and overall satisfaction with their academic path.

7.2 Challenges

Potential obstacles include the quality of data, dataset bias, and overfitting. These will be addressed by proper data cleaning, ensuring a diverse dataset, and applying regularization techniques.

8. BUDGET AND RESOURCES

8.1 Cost Estimates

- Hardware:
  5_Laptops: Rs.750 000
  2_Routers: Rs.10000

- Miscellaneous:
  Data packages: Rs.20 000
  Electricity bill: Rs.5000
  Printouts: Rs.100

8.2 Resource Requirements

- Human Resources: Faculty office of Applied Sciences