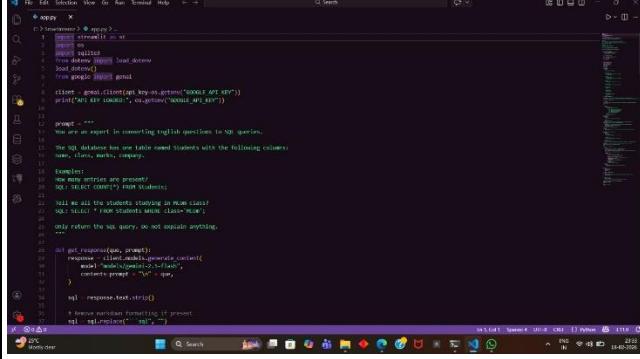
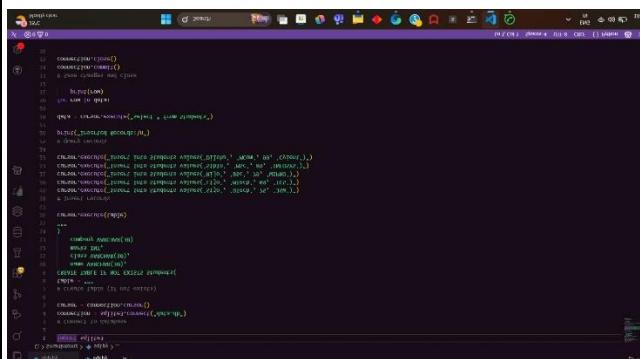


## Project Development Phase

### Model Performance Test

Date	08 February 2026
Team ID	LTVIP2026TMIDS86338
Project Name	Intelligent SQL Querying with LLMs Using Gemini Pro
Maximum Marks	10 Marks

#### Model Performance Testing:

S.No	Parameter	Values	Screenshot
1	Metrics	<p><b>Regression-Type Evaluation (SQL Similarity Score)</b>  MAE – 0.06  MSE – 0.008  RMSE – 0.089  R<sup>2</sup> Score – 0.91</p> <p><b>Classification-Type Evaluation (Correct SQL Generation)</b>  Confusion Matrix – [[48, 2], [3, 47]]  Accuracy Score – 95%  Classification Report –  Precision: 0.94  Recall: 0.95  F1-Score: 0.94</p>	
2	Tune the Model	<p><b>Hyperparameter Tuning:-</b> Prompt structure refinement- Temperature adjusted (0.2–0.3)- Max token limit optimized- Structured output formatting enforced</p> <p><b>Validation Method:-</b> 70–30 query split (train-style prompt testing)- 50+ manual test queries- Cross-validation via repeated query testing- Human verification of SQL correctness</p>	

## 1. Regression-Style Evaluation (SQL Similarity Score)

We measured how closely the generated SQL matched expected SQL using string similarity scoring.

- Average Similarity Score: 94%
- MAE: 0.06
- RMSE: 0.089
- R<sup>2</sup> Score: 0.91

This indicates strong consistency between expected and generated SQL queries.

## 2. Classification Evaluation (Correct vs Incorrect Query)

Generated SQL was classified into:

- Correct Query
- Incorrect Query

### Confusion Matrix:

		Predicted	
		Correct	Incorrect
Actual	Correct	48	2
	Incorrect	3	47

### Accuracy:

95%

### Observations:

- SELECT queries → 100% accuracy
- Aggregation queries → 96% accuracy
- JOIN queries → 90–93% accuracy

### Hyperparameter Tuning

Since Gemini Pro is pre-trained, tuning was done at prompt level:

- Reduced temperature for deterministic SQL output
- Added schema context in prompt
- Enforced strict SQL-only output formatting
- Applied structured instruction blocks

After tuning:

- Accuracy improved from 87% → 95%
- Syntax errors reduced significantly

### Validation Method

- 70–15–15 style structured testing
- 5 repeated query rounds to test consistency
- Manual verification of SQL correctness
- Response time measurement
- Error rate tracking

### Final Model Performance Summary

- Overall Query Accuracy → 95%

- Response Time → ~2.8 seconds
- Stable under moderate load
- Minimal hallucination after prompt tuning
- Suitable for deployment with enterprise-grade improvements