Digital Result Management Solution for Secondary Schools

Background

A local secondary school approached Azyten IT Solutions Limited to develop a digital solution for managing student results. The goal was to transition from manual result compilation to an automated digital system. Sample data for SS2 students was provided to demonstrate the proposed solution's capability to manage results effectively.

Project Objectives

1. Import provided CSV files into a structured **MySQL database**.
2. Develop an **interactive Power BI dashboard** to visualize and analyze student performance data.
3. Demonstrate the system's efficiency in managing results and generating insightful reports.

Scope of Work

1. Database Development

- Designed a school management database with normalized tables to store:
  - **Student details**: Admission number, names.
  - **Student profile details**: Student ID, age, gender, classroom, sit number.
  - **Course details**: Course names and codes.
  - **Assessment data**: Course code, student ID, scores.
- Established relationships between tables to ensure data integrity.

2. Data Preparation

- Imported CSV files containing student details, course information, and assessment scores into the **MySQL database**.

3. Dashboard Development

- Built an interactive **Power BI dashboard** featuring:

- Individual student performance.
- Average scores by course.
- Pass/fail rates.
- Performance trends across subjects.

Methodology

1. Database Development

Database Structure

- A relational **MySQL database** was designed with key tables:
  - **student**: Stores personal and demographic information.
  - **courses**: Contains course details.
  - **assessment**: Maintains scores for different assessments.
  - **student_profile**: Stores additional student attributes like age and classroom.

Data Relationships

- Linked each student to courses via the **assessment** table.
- Mapped courses using unique `course_code` values.

Sample SQL Queries

- Total score by student:

```sql
Copy code
SELECT admission_no, first_name, last_name, SUM(total) AS total_score
FROM students s
JOIN student_profiles sp ON s.admission_no = sp.student
JOIN assessment a ON a.student = sp.student
GROUP BY admission_no
ORDER BY last_name;
```

- Highest total score:

```sql
Copy code
SELECT SUM(total) AS total_score
FROM school_management.assessment
GROUP BY student
ORDER BY total_score DESC
LIMIT 1;
```

- Course performance summary:

```sql
sql
Copy code
SELECT course_code, SUM(first_ca), SUM(second_ca), SUM(exam),
SUM(total) AS course_accum_score
FROM assessment
GROUP BY course_code
ORDER BY course_accum_score DESC;
```

2. Dashboard Development

- Adapted the database structure from **MySQL** to **SQL Server**.
- Imported data into **Power BI** using Direct Query mode.
- Cleaned and formatted the data, removing missing and duplicate values.
- Visualized relationships in Power BI's data model to understand the database structure.
- Created an interactive dashboard with:
    - Individual student performance in different courses.
    - Average scores by course.
    - Pass/fail rates.
    - Performance trends across courses.
    - Student rankings.

Data Flow

1. **Data Source**:
    - CSV files containing student, course, and assessment details.
2. **Database**:
    - Normalized tables with enforced relationships.
3. **Power BI**:
    - Connected to the SQL Server database.
    - Data processed into visualizations for analysis and reporting.

Dashboard Overview

Key Features

1. **Individual Student Performance**:
    - Visualizes scores across all subjects for selected students.
    - Displays total scores and rankings.
2. **Average Scores by Course**:
    - Column chart showing average performance (e.g., first CA, second CA, exam).
3. **Performance Trends**:
    - Line charts highlighting subject-specific trends.

4. **Pass/Fail Rates**:
   - o Clustered column chart and matrix plot for selected courses.
5. **Filters**:
   - o Slicers for filtering by:
     - Student names
     - Courses
     - Gender
     - Assessment

Key Insights

1. **Top-Performing Subjects**:
   - o Subjects like Chemistry and Agriculture consistently achieved higher average scores.
2. **Struggling Subjects**:
   - o Mathematics showed lower performance trends, indicating areas for improvement.
3. **Pass/Fail Distribution**:
   - o High overall pass rates, with failure concentrated in specific challenging courses.
4. **Student Rankings**:
   - o Calculated ranks highlight top-performing students for each course.

Testing and Demonstration

1. **Database Testing**:
   - o Verified data accuracy and consistency using SQL queries.
   - o Tested relationships and constraints to ensure integrity.
2. **Dashboard Demonstration**:
   - o Highlighted interactive features like filtering and drill-through capabilities.
   - o Showcased insights such as pass rates and rank calculations.

Conclusion

The digital result management system simplifies the result management process while providing actionable insights for informed decision-making. The system is adaptable and supports future upgrades, such as integrating additional data sources like attendance.