School Management System
Database Table Designs

Database Schema Documentation

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Contents

1 Introduction

This document provides comprehensive table designs for the School Management System database. The schema follows a hierarchical user structure with role-based access control and supports comprehensive academic management functionality.

2 Core Tables

2.1 Schools Table

Column Name	Data Type	Constraints	Description
id	SERIAL	PRIMARY KEY	Unique identifier for each school
name	VARCHAR(100)	NOT NULL	Official name of the school
address	TEXT	NOT NULL	Complete address of the school
phone	VARCHAR(20)		Contact phone number
email	VARCHAR(100)		Official email address
principal_id	INTEGER	FK to principals(id)	Reference to current principal
created_at	TIMESTAMP	DEFAULT CURRENT_TIMESTAMP	Record creation timestamp
updated_at	TIMESTAMP	DEFAULT CURRENT_TIMESTAMP	Last update timestamp

2.2 Users Table

Column Name	Data Type	Constraints	Description
id	SERIAL	PRIMARY KEY	Unique identifier for each user
school_id	INTEGER	FK to schools(id)	Reference to associated school
username	VARCHAR(50)	UNIQUE, NOT NULL	System login username
password	VARCHAR(255)	NOT NULL	Encrypted password hash
first_name	VARCHAR(50)	NOT NULL	User's first name
last_name	VARCHAR(50)	NOT NULL	User's last name
email	VARCHAR(100)	UNIQUE, NOT NULL	Email address
phone	VARCHAR(20)		Contact phone number
address	TEXT		Residential address
last_login	TIMESTAMP		Last login timestamp
is_active	BOOLEAN	DEFAULT true	Account activation status
fingerprint	VARCHAR(255)		Biometric fingerprint data
created_at	TIMESTAMP	DEFAULT CURRENT_TIMESTAMP	Record creation timestamp
updated_at	TIMESTAMP	DEFAULT CURRENT_TIMESTAMP	Last update timestamp

3 Academic Structure Tables

3.1 Subjects Table

Column Name	Data Type	Constraints	Description
id	SERIAL	PRIMARY KEY	Unique identifier for each subject
name	VARCHAR(100)	NOT NULL	Subject name
code	VARCHAR(10)	UNIQUE, NOT NULL	Subject code (e.g., MATH101)
description	TEXT		Detailed subject description
created_at	TIMESTAMP	DEFAULT CURRENT_TIMESTAMP	Record creation timestamp
updated_at	TIMESTAMP	DEFAULT CURRENT_TIMESTAMP	Last update timestamp

3.2 Classes Table

Column Name	Data Type	Constraints	Description
id	SERIAL	PRIMARY KEY	Unique identifier for each class
name	VARCHAR(50)	NOT NULL	Class name
grade	VARCHAR(10)	NOT NULL	Grade level (e.g., 10, 11, 12)
section	VARCHAR(5)	NOT NULL	Section identifier (A, B, C, etc.)
teacher_id	INTEGER	FK to teachers(id)	Class teacher reference
created_at	TIMESTAMP	DEFAULT CURRENT_TIMESTAMP	Record creation timestamp
updated_at	TIMESTAMP	DEFAULT CURRENT_TIMESTAMP	Last update timestamp

4 User Role Tables

4.1 Students Table

Column Name	Data Type	Constraints	Description
id	SERIAL	PRIMARY KEY	Unique identifier
user_id	INTEGER	FK to users(id)	Reference to user account
student_id	VARCHAR(20)	UNIQUE, NOT NULL	Student ID number
class_id	INTEGER	FK to classes(id)	Current class assignment
enrollment_date	DATE	NOT NULL	Date of enrollment
parent_name	VARCHAR(100)	NOT NULL	Parent/guardian name
parent_contact	VARCHAR(20)	NOT NULL	Parent/guardian contact
gpa	DECIMAL(3,2)		Current GPA
created_at	TIMESTAMP	DEFAULT CURRENT_TIMESTAMP	Record creation timestamp
updated_at	TIMESTAMP	DEFAULT CURRENT_TIMESTAMP	Last update timestamp

4.2 Teachers Table

Column Name	Data Type	Constraints	Description
id	SERIAL	PRIMARY KEY	Unique identifier

Column Name	Data Type	Constraints	Description
user_id	INTEGER	FK to users(id)	Reference to user account
teacher_id	VARCHAR(20)	UNIQUE, NOT NULL	Teacher ID number
department	VARCHAR(50)	NOT NULL	Department/subject area
joining_date	DATE	NOT NULL	Date of joining
qualification	TEXT	NOT NULL	Educational qualifications
created_at	TIMESTAMP	DEFAULT CURRENT_TIMESTAMP	Record creation timestamp
updated_at	TIMESTAMP	DEFAULT CURRENT_TIMESTAMP	Last update timestamp

4.3 Section Heads Table

Column Name	Data Type	Constraints	Description
id	SERIAL	PRIMARY KEY	Unique identifier
teacher_id	INTEGER	FK to teachers(id)	Reference to teacher account
section_id	VARCHAR(20)	NOT NULL	Section identifier
department	VARCHAR(50)	NOT NULL	Department managed
created_at	TIMESTAMP	DEFAULT CURRENT_TIMESTAMP	Record creation timestamp
updated_at	TIMESTAMP	DEFAULT CURRENT_TIMESTAMP	Last update timestamp

4.4 Principals Table

Column Name	Data Type	Constraints	Description
id	SERIAL	PRIMARY KEY	Unique identifier
user_id	INTEGER	FK to users(id)	Reference to user account
school_id	INTEGER	FK to schools(id)	Reference to managed school
appointment_date	DATE	NOT NULL	Date of appointment
created_at	TIMESTAMP	DEFAULT CURRENT_TIMESTAMP	Record creation timestamp
updated_at	TIMESTAMP	DEFAULT CURRENT_TIMESTAMP	Last update timestamp

4.5 Admins Table

Column Name	Data Type	Constraints	Description
id	SERIAL	PRIMARY KEY	Unique identifier
user_id	INTEGER	FK to users(id)	Reference to user account
access_level	VARCHAR(20)	NOT NULL	Administrative access level
created_at	TIMESTAMP	DEFAULT CURRENT_TIMESTAMP	Record creation timestamp
updated_at	TIMESTAMP	DEFAULT CURRENT_TIMESTAMP	Last update timestamp

5 Relationship Tables

5.1 Teacher-Subject Relationship Table

Column Name	Data Type	Constraints	Description
id	SERIAL	PRIMARY KEY	Unique identifier
teacher_id	INTEGER	FK to teachers(id)	Teacher reference
subject_id	INTEGER	FK to subjects(id)	Subject reference
created_at	TIMESTAMP	DEFAULT CURRENT_TIMESTAMP	Record creation timestamp

5.2 Student-Subject Relationship Table

Column Name	Data Type	Constraints	Description
id	SERIAL	PRIMARY KEY	Unique identifier
student_id	INTEGER	FK to students(id)	Student reference
subject_id	INTEGER	FK to subjects(id)	Subject reference
created_at	TIMESTAMP	DEFAULT CURRENT_TIMESTAMP	Record creation timestamp

6 Academic Management Tables

6.1 Assessments Table

Column Name	Data Type	Constraints	Description
id	SERIAL	PRIMARY KEY	Unique identifier
title	VARCHAR(100)	NOT NULL	Assessment title
description	TEXT		Detailed description
due_date	TIMESTAMP	NOT NULL	Submission deadline
total_marks	INTEGER	NOT NULL	Maximum marks
subject_id	INTEGER	FK to subjects(id)	Related subject
assigned_to	INTEGER	FK to students(id)	Assigned student
created_by	INTEGER	FK to teachers(id)	Creating teacher
created_at	TIMESTAMP	DEFAULT CURRENT_TIMESTAMP	Record creation timestamp
updated_at	TIMESTAMP	DEFAULT CURRENT_TIMESTAMP	Last update timestamp

6.2 Exams Table

Column Name	Data Type	Constraints	Description
id	SERIAL	PRIMARY KEY	Unique identifier
name	VARCHAR(100)	NOT NULL	Exam name
exam_type	VARCHAR(50)	NOT NULL	Type of exam (midterm, final, etc.)
year	INTEGER	NOT NULL	Academic year
term	VARCHAR(20)	NOT NULL	Academic term
subject_id	INTEGER	FK to subjects(id)	Related subject
class_id	INTEGER	FK to classes(id)	Target class
date	DATE	NOT NULL	Exam date
duration	INTEGER	NOT NULL	Duration in minutes
total_marks	INTEGER	NOT NULL	Maximum marks
pass_marks	INTEGER	NOT NULL	Passing marks
average_marks	DECIMAL(5,2)		Calculated average
status	VARCHAR(20)	DEFAULT 'scheduled'	Exam status
created_by	INTEGER	FK to teachers(id)	Creating teacher
created_at	TIMESTAMP	DEFAULT CURRENT_TIMESTAMP	Record creation timestamp
updated_at	TIMESTAMP	DEFAULT CURRENT_TIMESTAMP	Last update timestamp

6.3 Exam Results Table

Column Name	Data Type	Constraints	Description
id	SERIAL	PRIMARY KEY	Unique identifier
exam_id	INTEGER	FK to exams(id)	Related exam
student_id	INTEGER	FK to students(id)	Student who took exam
marks	DECIMAL(5,2)	NOT NULL	Marks obtained
grade	VARCHAR(2)		Letter grade (A, B, C, etc.)
remarks	TEXT		Additional remarks
date	DATE	NOT NULL	Result date
created_at	TIMESTAMP	DEFAULT CURRENT_TIMESTAMP	Record creation timestamp
updated_at	TIMESTAMP	DEFAULT CURRENT_TIMESTAMP	Last update timestamp

7 Scheduling Tables

7.1 Timetables Table

Column Name	Data Type	Constraints	Description
id	SERIAL	PRIMARY KEY	Unique identifier
class_id	INTEGER	FK to classes(id)	Associated class
valid_from	DATE	NOT NULL	Start date of validity
valid_to	DATE	NOT NULL	End date of validity

Column Name	Data Type	Constraints	Description
created_at	TIMESTAMP	DEFAULT CURRENT_TIMESTAMP	Record creation timestamp
updated_at	TIMESTAMP	DEFAULT CURRENT_TIMESTAMP	Last update timestamp

7.2 Sessions Table

Column Name	Data Type	Constraints	Description
id	SERIAL	PRIMARY KEY	Unique identifier
timetable_id	INTEGER	FK to timetables(id)	Parent timetable
subject_id	INTEGER	FK to subjects(id)	Subject being taught
teacher_id	INTEGER	FK to teachers(id)	Teaching staff member
start_time	TIME	NOT NULL	Session start time
end_time	TIME	NOT NULL	Session end time
day_of_week	VARCHAR(10)	NOT NULL	Day of the week
created_at	TIMESTAMP	DEFAULT CURRENT_TIMESTAMP	Record creation timestamp
updated_at	TIMESTAMP	DEFAULT CURRENT_TIMESTAMP	Last update timestamp

8 Attendance Management

8.1 Attendance Table

Column Name	Data Type	Constraints	Description
id	SERIAL	PRIMARY KEY	Unique identifier
student_id	INTEGER	FK to students(id)	Student reference
session_id	INTEGER	FK to sessions(id)	Related session
date	DATE	NOT NULL	Attendance date
status	VARCHAR(10)	NOT NULL	Attendance status (present/absent/late)
remarks	TEXT		Additional notes
marked_by	INTEGER	FK to teachers(id)	Teacher who marked attendance
created_at	TIMESTAMP	DEFAULT CURRENT_TIMESTAMP	Record creation timestamp
updated_at	TIMESTAMP	DEFAULT CURRENT_TIMESTAMP	Last update timestamp

9 System Tables

9.1 Reports Table

Column Name	Data Type	Constraints	Description
id	SERIAL	PRIMARY KEY	Unique identifier
type	VARCHAR(50)	NOT NULL	Report type
date	DATE	NOT NULL	Report generation date
generated_by	INTEGER	FK to users(id)	User who generated report
content	TEXT	NOT NULL	Report content/data
created_at	TIMESTAMP	DEFAULT CURRENT_TIMESTAMP	Record creation timestamp
updated_at	TIMESTAMP	DEFAULT CURRENT_TIMESTAMP	Last update timestamp

9.2 Student Records Table

Column Name	Data Type	Constraints	Description
id	SERIAL	PRIMARY KEY	Unique identifier
student_id	INTEGER	FK to students(id)	Student reference
current_grade	VARCHAR(10)	NOT NULL	Current grade level
academic_year	VARCHAR(9)	NOT NULL	Academic year
subjects	JSONB	NOT NULL	Subject details in JSON format
attendance	JSONB	NOT NULL	Attendance records in JSON format
achievements	TEXT[]		Array of achievements
created_at	TIMESTAMP	DEFAULT CURRENT_TIMESTAMP	Record creation timestamp
updated_at	TIMESTAMP	DEFAULT CURRENT_TIMESTAMP	Last update timestamp

10 Database Indexes

The following indexes are created for optimal query performance:

- `idx_users_school_id` on users(school_id)
- `idx_students_user_id` on students(user_id)
- `idx_students_class_id` on students(class_id)
- `idx_teachers_user_id` on teachers(user_id)
- `idx_exam_results_student_id` on exam_results(student_id)
- `idx_exam_results_exam_id` on exam_results(exam_id)
- `idx_sessions_teacher_id` on sessions(teacher_id)
- `idx_sessions_timetable_id` on sessions(timetable_id)
- `idx_attendance_student_id` on attendance(student_id)
- `idx_attendance_date` on attendance(date)
- `idx_assessments_assigned_to` on assessments(assigned_to)

- `idx_teacher_subjects_teacher_id` on teacher_subjects(teacher_id)
- `idx_student_subjects_student_id` on student_subjects(student_id)

11 Foreign Key Relationships

The database maintains referential integrity through the following key relationships:

- Users are associated with schools through `school_id`
- Students, Teachers, Principals, and Admins inherit from Users
- Section Heads are promoted Teachers
- Classes have assigned Teachers and contain Students
- Subjects are taught by Teachers and studied by Students
- Assessments and Exams are created by Teachers for specific Subjects
- Timetables organize Sessions for Classes
- Attendance tracks Students' presence in Sessions