**Product Requirements Document (PRD)**

**Project Title:** Automated School Timetable Scheduler

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**1. Overview**

The Automated School Timetable Scheduler is a software application that simplifies and automates the process of creating weekly school timetables. It intelligently assigns subjects, teachers, and classrooms while ensuring there are no clashes, respecting institutional rules, and optimizing available resources.

**2. Goals and Objectives**

* Reduce manual effort in timetable creation.
* Eliminate scheduling conflicts.
* Optimize teacher and classroom utilization.
* Allow flexible updates to constraints and quick regeneration of schedules.
* Provide printable and editable timetable exports.

**3. Scope of MVP**

**Core Features:**

* Class, Subject, Teacher, and Room management (Like Laboratories if available).
* Period & Day definitions (e.g., 8am to 2pm, Monday to Friday).
* Constraint-driven automatic schedule generation.
* Clash detection and resolution logic.
* Timetable views for classes and teachers.
* PDF and Excel export functionality.
* Settings page require for optional changes

**4. User Personas**

* **Admin/School Scheduler:** Creates and manages schedules.
* **Teachers:** View personalized timetables.
* **Principal/School Head:** Approves or modifies generated schedules.

**5. Functional Requirements**

**Admin Interface:**

**Scheduler Engine:**

**Viewer Interface:**

**6. Non-Functional Requirements**

* Platform: Web-based (desktop-first, mobile-friendly optional)
* Performance: Schedule generation within 10 seconds for 100+ classes
* Security: Authentication required for schedule creation and edits

**7. Tech Stack**

* **Frontend:** React.js
* **Backend:** Node.js (Express) or Django
* **Database:** PostgreSQL
* **Scheduler Engine:** Python with OR-Tools or custom constraint logic
* **PDF/Excel Export:** jsPDF and ExcelJS or Python xlsxwriter
* **Deployment:** Vercel + Render or Heroku

**8. UI Wireframes (Description)**

**Dashboard (Admin)**

* Sidebar: Classes, Subjects, Teachers, Settings, Generate Schedule
* Main Panel: Summary widgets, quick access buttons

**Class & Subject Setup**

* Form layout with table inputs for quick edits

**Teacher Setup**

* Teacher info form with subject expertise, availability calendar

**Generate Timetable**

* Button to generate schedule
* Notification on success/failure

**Timetable View**

* Tabular format:
  + Rows: Time slots
  + Columns: Weekdays
  + Cells: Subject + Teacher (clickable for edit)

**Export Panel**

* **Options:**

**9. Milestones**

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| --- | --- | --- |
| **Phase** | **Milestone** | **Timeline** |
| Phase 1 | Requirement Analysis & Design | Week 1 |
| Phase 2 | Backend & Database Setup | Week 2-3 |
| Phase 3 | Frontend Development | Week 3-5 |
| Phase 4 | Scheduler Logic & Engine | Week 5-6 |
| Phase 5 | Testing & Validation | Week 7 |
| Phase 6 | Deployment & Feedback | Week 8 |

**10. KPIs for Success**

* Schedule generation time < 10 seconds
* 95% clash-free schedules on first run
* <5% manual overrides required after generation
* 100% export success (PDF/Excel)
* Admin satisfaction score > 8/10

**11. Future Enhancements (Post-MVP)**

* Classroom allocation
* Mobile app interface
* AI-based conflict prediction
* Notifications and alerts
* Integration with school portals
* API for external usage