

LabEMS Project Summary

Project Overview

LabEMS (Laboratory Equipment Management System) is a web based application used to manage laboratory equipment, user accounts, and equipment bookings. The system improves equipment tracking, reduces booking conflicts, and provides administrators with full oversight of laboratory resources.

Project Objectives

- Provide a centralized platform to manage laboratory equipment.
- Allow students to browse and book available equipment.
- Prevent booking conflicts through automated validation.
- Allow administrators to manage users, equipment, and maintenance.
- Maintain system transparency through audit logs and reporting.

Core Functionalities

- Equipment catalogue with status indicators such as Available, In Use, Under Maintenance, and Out of Order.
- Online equipment booking with date and time selection.
- Automatic conflict detection to prevent overlapping bookings.
- User account and role management.
- Maintenance scheduling for equipment.
- Audit logs to track user and system activity.
- Exportable reports for users, equipment, and bookings.

Technology Stack

- Frontend: JavaScript with Lit components and Vite build system.
- Backend: ASP.NET Core Web API.
- ORM: Entity Framework.
- Database: MySQL relational database.
- Authentication: JWT token based authentication.
- Password Security: BCrypt hashing.
- Email Notifications: SMTP email service integration.
- Infrastructure: Hosted on Microsoft Azure web services.

How the System Works

Users access the LabEMS web application through a browser and authenticate using their credentials. After login the system identifies the role of the user using JWT authentication tokens. Students access features such as browsing equipment, creating bookings, viewing booking history, updating bookings, and

managing their profiles. Administrators access additional system management tools including user management, equipment management, maintenance tracking, audit logs, and system reports. All data interactions occur through the ASP.NET Core API which communicates with the MySQL database using Entity Framework. The application validates booking requests to prevent scheduling conflicts and automatically sends email notifications for booking confirmations or updates.

User Roles

Student Role:

- Browse equipment catalogue.
- Create, update, and cancel personal bookings.
- View booking history and status.

Administrator Role:

- Manage equipment records.
- Create and manage user accounts.
- Schedule equipment maintenance.
- View audit logs and generate reports.

Project Access Links

Production System URL: (Not currently active)

<https://labems-a3cjf7e7d8e8czfd.southafricanorth-01.azurewebsites.net/>

eFundi Project Page:

<https://efundi.nwu.ac.za/portal/site/d827c072-5db6-4066-948b-5ff2eb0431da/tool/b6e1bfe0-a455-45a4-bc95-b5efa399607d?panel=Main>

Repo Link

https://github.com/Group8LabEMS/Cmpg323_Group8_EmsLab

Project Demonstration Videos

System Demonstration Video:

<https://efundi.nwu.ac.za/access/content/group/d827c072-5db6-4066-948b-5ff2eb0431da/2025%20Projects-1/LabEMS%20-%20Equipment%20Management%20System%20-%20Mr%20Renier%20van%20Rooyen/LabEMS%20Final%20Video.zip>