

MICHIGAN STATE

U N I V E R S I T Y

Project Plan

Training Scheduling and Optimization System II

The Capstone Experience

Team United Airlines

Laura Danila

Andrew Ferguson

Josh Pezeshki

Jack Soenke

Department of Computer Science and Engineering

Michigan State University

Fall 2019



*From Students...
...to Professionals*

Functional Specifications

- Update and enhance the scheduling system from the spring semester
- Implement an optimizer to recommend a schedule based off different priorities
- Make the web application mobile friendly
- Warn the user of potential conflicts when scheduling a class







Design Specifications

- Schedule Optimizer
 - The user can input a time frame, specific classes, and locations, then hit “Optimize”
- Notification system
 - Include popup notifications whenever the user tries to schedule a class that will cause a conflict
- Training requests
 - Connecting training requests with the current schedule
- Support for mobile browser
 - Currently only desktop version of application is correctly displayed
- Updating Calendars
 - Changing the view, adding pop out calendars, adding a planned courses calendar
- Access levels
 - Six different user levels, including guest, manager and admin
 - Users can view specific pages based on their level



Screen Mockup: Schedule Optimizer

The screenshot displays a web browser window with the URL `https://trainingscheduleroptimizer.azurewebsites.net/schedule-optimizer`. The page features a dark blue header with the "UNITED" logo on the left, the text "Learning Scheduling System" in the center, and a user profile "Last, First" with a notification badge "20" on the right. A left-hand navigation menu lists various system functions: HOME, CALENDARS, EXCEPTIONS, COURSE SCHEDULE, SCHEDULE OPTIMIZER (highlighted), SCHEDULE PLANNER, COURSE CATALOG, INSTRUCTOR QUALIFICATIONS, TRAINING REQUESTS, ATTENDANCE, and ADMIN. The main content area is titled "SCHEDULE OPTIMIZER" and includes a search bar, a "Start" input field, an "End" input field, and "Add Class" and "Optimize" buttons. Below these controls is a table with the following data:

| Action | Course Code | Start Time | Location | # of times to run |
|---|-------------|------------|----------|-------------------|
|   | POTS | 06:00:00 | LAX | 5 |
|   | MAG1 | 22:00:00 | ORD | 2 |



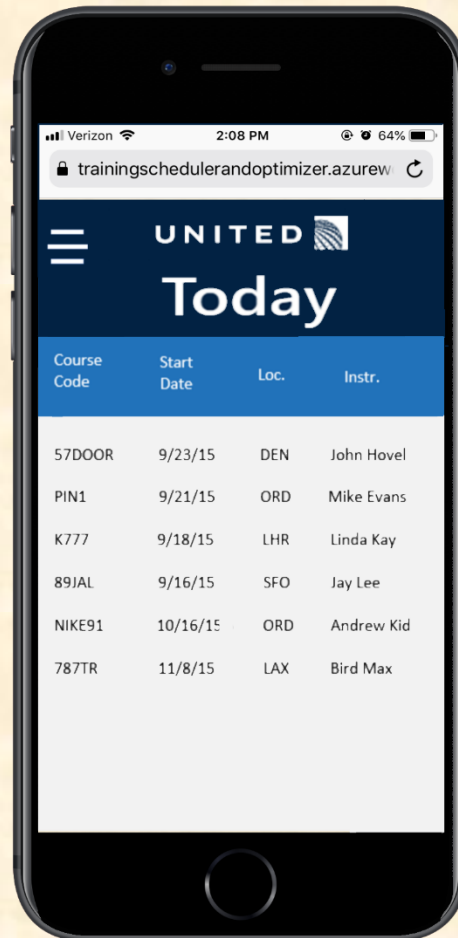
Screen Mockup: Optimized schedule

The screenshot displays the 'Learning Scheduling System' interface. The browser address bar shows the URL: `trainingscheduleroptimizer.azurewebsites.net/schedule-optimizer/schedule`. The page title is 'Learning Scheduling System' with a user profile dropdown labeled 'Name, User'. A dark blue sidebar on the left contains navigation links: HOME, CALENDARS, EXCEPTIONS, COURSE SCHEDULE, SCHEDULE OPTIMIZER (highlighted), SCHEDULE PLANNER, COURSE CATALOG, INSTRUCTOR QUALIFICATIONS, TRAINING REQUESTS, ATTENDANCE, and ADMIN. The main content area is titled 'Optimized Schedule' and features three calendar tabs: 'Location Calendar' (selected), 'Instructor Calendar', and 'Monthly Calendar'. A legend indicates: green square = scheduled, yellow square = planned, and blue square = optimizer result. The calendar grid shows dates from 21 to 29 of September 2019. The left column lists locations with expandable dropdowns: CLE (Hangar 2, Building 212: 1 and 2), DEN (DIA Hangar: 1041-A and B, FTC: A001, A005, A011), EWR (Hangar 100: 211, 212, 213, 217, Hangar 55: Fir-2, 3), GUM (AO General Office: AT-3), and HNL (Hangar: A). Scheduled events (green) include 'B757 Main Entry Door (MED) Rig' on Sept 23. Planned events (yellow) include 'Ultrasonic Theory and Procedures' on Sept 25. Optimizer results (blue) include 'B757 Reliability Training' on Sept 28 and 'Airbus Reliability Training' on Sept 29. The word 'Scheduler' is visible in the bottom left corner of the sidebar.

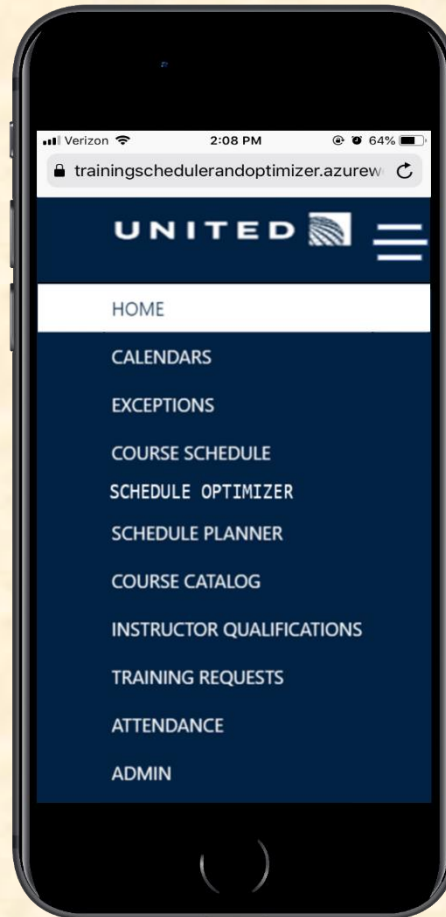
| | September 2019 | | | | | | | | | |
|-----------------------------|----------------|----|--------------------------------|----|----|----|----|----|----|----|
| | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| ☐ CLE | | | | | | | | | | |
| ☐ Hangar 2, Building 212: 1 | | | | | | | | | | |
| ☐ Hangar 2, Building 212: 2 | | | | | | | | | | |
| ☐ DEN | | | | | | | | | | |
| ☐ DIA Hangar: 1041-A | | | | | | | | | | |
| ☐ DIA Hangar: 1041-B | | | | | | | | | | |
| ☐ FTC: A001 | | | | | | | | | | |
| ☐ FTC: A005 | | | B757 Main Entry Door (MED) Rig | | | | | | | |
| ☐ FTC: A011 | | | | | | | | | | |
| ☐ EWR | | | | | | | | | | |
| ☐ Hangar 100: 211 | | | | | | | | | | |
| ☐ Hangar 100: 212 | | | | | | | | | | |
| ☐ Hangar 100: 213 | | | | | | | | | | |
| ☐ Hangar 100: 217 | | | | | | | | | | |
| ☐ Hangar 55: Fir-2 | | | | | | | | | | |
| ☐ Hangar 55: Fir-3 | | | | | | | | | | |
| ☐ GUM | | | | | | | | | | |
| ☐ AO General Office: AT-3 | | | | | | | | | | |
| ☐ HNL | | | | | | | | | | |
| ☐ Hangar: A | | | | | | | | | | |



Screen Mockup: Mobile Home Screen



Screen Mockup: Mobile Side Menu

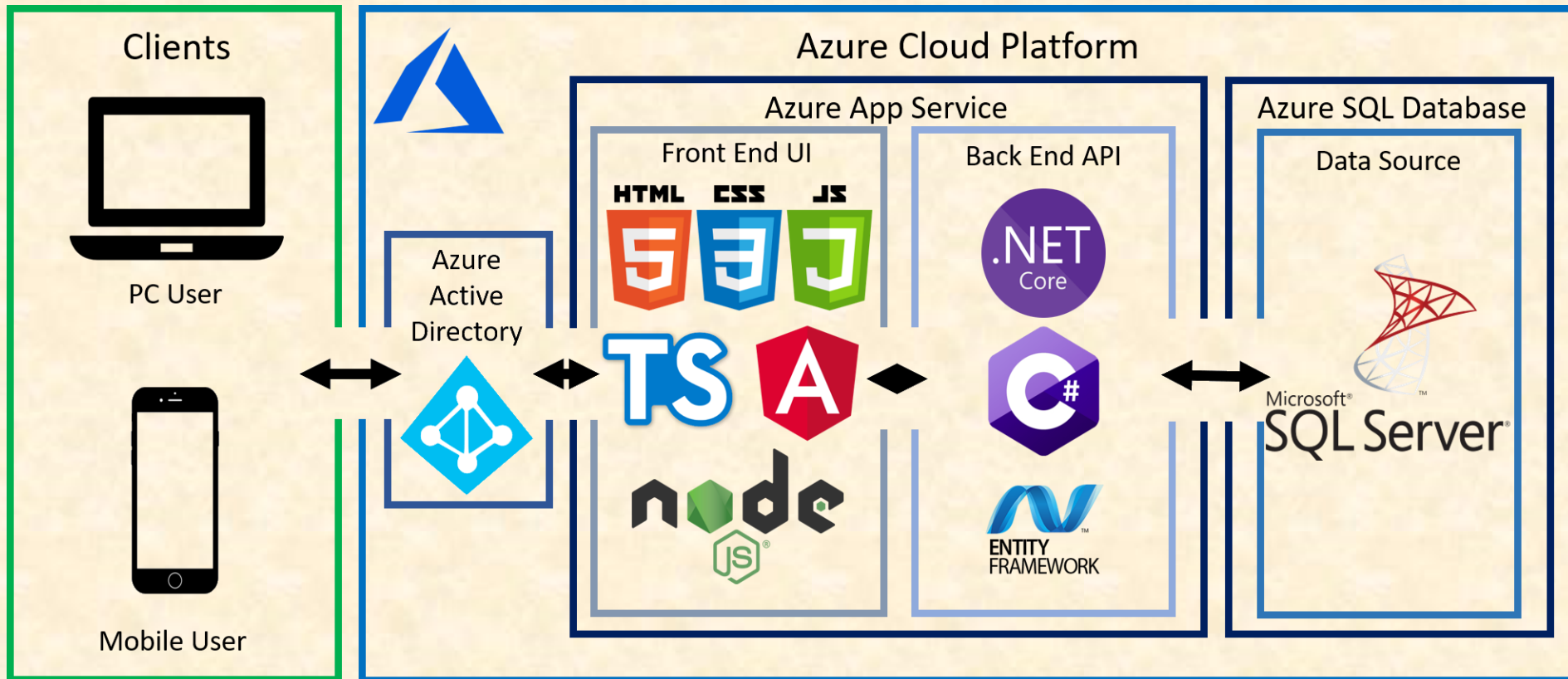


Technical Specifications

- Web Application
 - ASP.NET Core with Angular UI hosted as an App Service on the Azure Cloud Platform
- Mobile Compatibility
 - Each Angular component will have a unique mobile HTML and CSS to optimize the UI for a smartphone
- Azure Active Directory
 - Will utilize Azure Active Directory for authentication during development and will migrate to OAM for handoff
- Azure SQL Database
 - The client provided testing data will be hosted on Azure



System Architecture



System Components

- Hardware Platforms
 - iMacs and personal laptops
 - MS SQL Server hosted on Azure
- Software Platforms / Technologies
 - Visual Studio 2019 Community Edition
 - DayPilot Calendar Plugin
 - Angular, Node.js, Entity Framework, ASP.NET Core, C#, Azure SQL Database



Risks

- Handoff of Final Code between Team and Client
 - The team will send United a beta version of the code at the end of November to deal with any issues early.
 - Add an app configuration page for the LDAP and email server.
- Runtime for Schedule Optimizer
 - Creating a recursive tree to represent all possible schedules within a time frame will cost a substantial amount of time.
 - Bounding will be used extensively on the recursive tree to minimize the number of branches that are created.
- Oracle Access Manager (OAM)
 - We are unsure if it is possible to integrate OAM with our web application if it is hosted on Azure.
 - We will rebuild the login page of the application to utilize Azure Active Directory.
- Accuracy of Data
 - Currently, we are using test data provided by United.
 - The group will communicate with the client to gain access to the existing data.



Questions?

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