

INF2001

Introduction to Software Engineering



# Milestone 1: Software Development Plan & Specification

for

## Musikee School

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# **1 Introduction**

With workload being assigned monthly and allocation planning starting every 20<sup>th</sup> of the month, all employees are required to input their availabilities in the system every 19<sup>th</sup> of the month to be considered in the planning. Failure to meet the deadlines would result in the staff's request being dealt with on a case-by-case basis. Therefore, work-life balance is hardly achieved due to the competitive nature of this system. As the current process of communicating workload availability is in the form of physical paper submissions, our client – Musikee, a Music School, has decided to collaborate with us to work on an online workload management system to balance employee workload, improve work-life balance and transition from the old-fashioned paper process to a digitalised format.

## **1.1 Product Scope**

The music school workload management system will be designed to help streamline the management of employee workloads, facilitate job allocations, and promote effective communication between both staff and manager. From the manager's point of view, the system will provide the manager with an informative overview of all staff's current workload schedule for the week in real-time on the landing page. Amendments can also be made through the system seamlessly, such as assigning jobs and rejecting cancellation approvals. Staff can either add, update, or cancel their availability through the system and view their overall workload for the month to provide them with the information to plan accordingly. Lastly, the IT administrator can add new staff and managers to the system via an online form in the system itself.

Overall, the system aims to provide transparency, fairness, and efficiency in terms of workload management and work-life balance in the context of the music school industry. The main goal is to achieve excellent performance and work-life balance among staff members, while maintaining happiness and enjoyment while working at the music school.

## **1.2 Related Background Literature**

Work-life balance is defined as the balance of work and non-work duties in harmony [1]. Studies have shown that work-life balance helps to alleviate emotional exhaustion, and the main reason for a rise in emotional exhaustion is due to the consequences of work-life imbalance [2]. Similarly, teachers

in the music industry suffer from the same fate with the immense amount of stress and burnout. This can be directly linked to music teacher retention with both conditions stemming from factors such as a lack of emotional support, and unreasonable ad hoc responsibilities being assigned to music teachers in school [3]. Therefore, implementing a solution to help improve music teachers' overall work experience with the addition of a better work-life balance can help increase music teacher's retention.

As our workload management system functions similarly to an employee scheduling software, our team have decided to evaluate the list of leading employee scheduling software in 2023. This evaluation aims to enhance our product's ability while still being able to accurately meet and fulfill our client's demands through a careful analysis of the current top competitors in the market.

### **Deputy:**

Deputy is a web-based workforce manager solution and was designed to assist users by simplifying their schedules, timesheets, tasks, and many more [4]. Its core features include [5]:

- Scheduling
  - Drag and Drop feature to create schedules for employees
- Time Tracking
  - Employees can see real-time attendance on mobile, tablet or desktop
- Employee Time Clock
- Payroll Integration
- Shift Management
- Leave Management
- Employee Onboarding
- Task Management

### **ZoomShift:**

ZoomShift enables businesses to save time by providing them with scheduling templates that allow them to quickly copy and apply schedules weeks in advance [6]. ZoomShift also offers multiple features such as:

- Automated Scheduling
- Shift Swapping
- Mobile Access
- Online Time Clock
- Messaging

Given that there are hundreds of employee scheduling software available, we took inspiration from these widely adopted software to produce the best possible product for our client. We also adjusted

our product's features strictly based on our user's requirements and needs to ensure maximum user satisfaction.

### **1.3 Intended Audience and Document Overview**

This document is intended for the client, the Singapore Institute of Technology (SIT) professors who oversee this module as well as the software developers for this project. This Software Development Plan & Specification document provides a comprehensive overview of the project and is divided into multiple sections. The document consists of the project and product scope of the workload management system for the client, Musikee. The project presents the product's details alongside mock-ups of the workload management system, providing explanations for each component.

### **1.4 References and Acknowledgments**

- [1] J. H. Wayne, H. Vaziri, and W. J. Casper, "Work-nonwork balance: Development and validation of a global and multidimensional measure," *Journal of Vocational Behavior*, vol. 127, p. 103565, Jun. 2021, doi: 10.1016/j.jvb.2021.103565.
- [2] C. Wei and J.-H. Ye, "The Impacts of Work-Life Balance on the Emotional Exhaustion and Well-Being of College Teachers in China," *Healthcare*, vol. 10, no. 11, p. 2234, Nov. 2022, doi: 10.3390/healthcare10112234.
- [3] C. B. Hancock, "Is the Grass Greener? Current and Former Music Teachers' Perceptions a Year After Moving to a Different School or Leaving the Classroom," *Journal of Research in Music Education*, vol. 63, no. 4, pp. 421–438, Nov. 2015, doi: 10.1177/0022429415612191.
- [4] 'Pros and Cons of Deputy 2023'. <https://www.trustradius.com/products/deputy/reviews?qs=pros-and-cons> (accessed Sep. 13, 2023).
- [5] 'Deputy - Employee Scheduling, and Time Tracking Solution for Small Businesses', *Sensible Solutions*, Apr. 12, 2021. <https://www.sensible-solution.com.au/tips-tricks/deputy-for-farmers> (accessed Sep. 13, 2023).
- [6] 'ZoomShift (About Us)', *ZoomShift*. <https://www.zoomshift.com/about> (accessed Sep. 13, 2023).

## 2 Overall Description

### 2.1 Product Overview

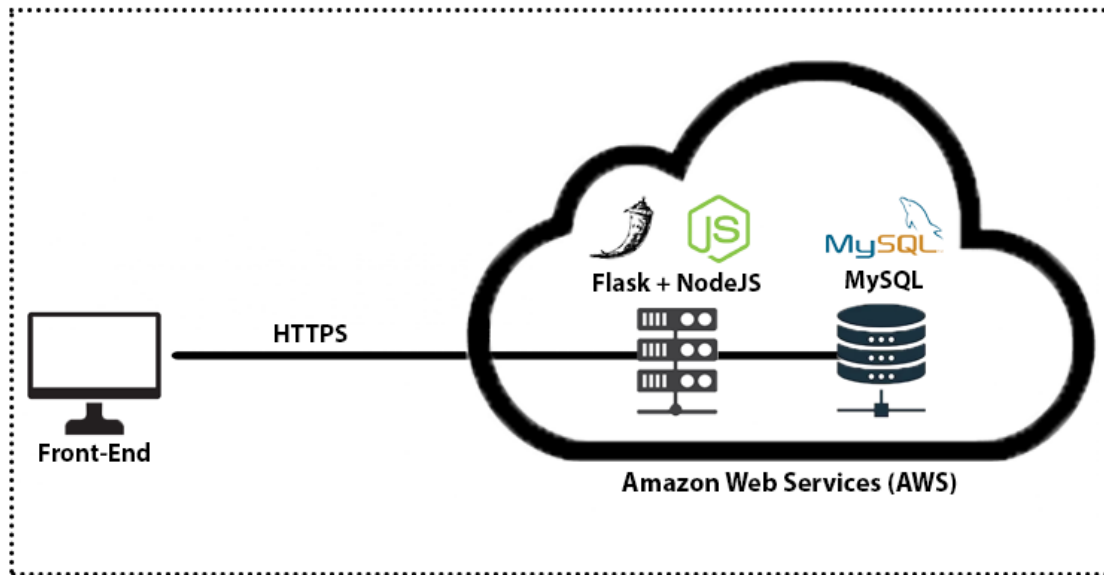


Figure 1: System Architecture diagram

The workload management system specified in this document is a new, self-contained product. The system aims to address the challenges faced by Musikee music school in terms of handling employee workload and facilitating job allocations. It offers a solution that aims to improve the work-life balance while also enhancing the overall work environment for both employees and administrative staff at Musikee.

As seen in the high-level system architecture diagram in Fig. 1, we illustrated how the product interacts with the environment and its context of use. An example of a front-end device could be a web-based interface that is able to connect to the cloud-based service, Amazon Web Services (AWS) securely via Hypertext Transfer Protocol Secure (HTTPS). Within AWS, there are several key components:

1. **Flask and NodeJS Application:** This component serves as the core of the workload management system. It can perform the primary tasks required based on the user's requirements. The tasks include handling user interactions, job allocations, availability tracking and communication between the staff and manager. Flask is used for the server-side logic. On the other hand, NodeJS manages real-time interactions and data updates.

2. **MySQL Database:** The MySQL Database was the preferred database as it provides a highly reliable and structured storage solution for managing data and information. It can store important data related to the employee's schedule, job assignments and their availability.
3. **External Interfaces:** Front-end devices such as laptops and mobile phones may interact with the workload management system via the HTTPS protocol. Additionally, the system can also integrate with external data sources or APIs for enhanced functionality.

This system architecture diagram shows the critical components required for the workload management system. It also displays the link or connections between the various components to provide a clear understanding of its functionality and interactions to the user.

## **2.2 Product Functionality**

**Product Functionality (PF)** incorporates the features and capabilities of a product or software, defining what it can do to meet user needs and objectives.

- **PF1:** The product shall allow IT administrators to create user accounts for staff (teachers) and managers.
- **PF2:** The product shall allow staff (teachers) to view weekly assignments.
- **PF3:** The product shall allow staff (teachers) to view overall overload for the month.
- **PF4:** The product shall allow staff (teachers) to add work availabilities.
- **PF5:** The product shall allow staff (teachers) to edit work availabilities.
- **PF6:** The product shall allow staff (teachers) to indicate job preference.
- **PF7:** The product shall allow staff (teachers) to reject jobs assigned.
- **PF8:** The product shall allow managers to view staff (teachers) availability.
- **PF9:** The product shall allow managers to view staff (teachers) workload.
- **PF10:** The product shall allow managers to allocate jobs to staff (teachers).
- **PF11:** The product shall allow managers to view up to three staff (teachers) availability and any relevant information.
- **PF12:** The product shall allow managers to view top three staff (teachers) with the lowest workload.
- **PF13:** The product shall allow managers to view all staff (teachers) exceeding 40 hours of job assignments within the current week.
- **PF14:** The product shall allow manager to enroll new students into class.
- **PF15:** The product shall allow manager to unenroll existing students from class.
- **PF16:** The product shall allow manager to create teaching schedule.

- **PF17:** The product shall allow IT administrators to delete existing user accounts for staff (teachers) and managers.
- **PF18:** The product shall allow IT administrators to assign access rights to user accounts.
- **PF19:** The product shall allow staff (teachers) and managers to reset user account password.
- **PF20:** The product shall allow staff (teachers) and managers to change user account password.
- **PF21:** The product shall allow managers to view and allocate staff (teachers) based on their availability.
- **PF22:** The product shall allow managers to approve job assignment rejection requests made by staff (teachers).
- **PF23:** The product shall allow managers to disapprove job assignment rejection requests made by staff (teachers).
- **PF24:** The product shall allow managers and staff (teachers) to update their personal particulars.
- **PF25:** The product shall allow managers to update personal particulars of existing students.
- **PF26:** The product shall allow managers to filter and view student class lists.

## **2.3 Assumptions and Dependencies**

- The website shall be developed using a collection of software technologies consisting of Hypertext Markup Language (HTML), Cascading Stylesheet (CSS), JavaScript, C#, and Python for optimal functionality.
- The website shall be hosted on cloud services using Amazon Web Services (AWS).
- The database shall be hosted on cloud services using Amazon Relational Database Service (ARDS).
- The cost of the website and database that is hosted on cloud services are fully paid by the company, Musikee.
- All staff members of Musikee who interact with or manage the website must possess basic computer literacy such as being able to navigate website with ease.
- The website use case will be under the assumption that the user has already login to an account.



## **3 Specific Requirements**

### **3.1 User Interface Requirements**

**UIR1:** The website must be in English.

**UIR2:** The website shall use colours that are pleasing to the eye and easy to comprehend.

**UIR3:** The website shall use contrasting colours that aid in reading.

**UIR4:** The website shall feature a calendar widget to select the date and week of schedule.

**UIR5:** The website shall allow pop-ups for the system to prompt the user for their input.

**UIR6:** The website shall allow the user to switch between daily and weekly schedules.

**UIR7:** The website shall have a search bar and filter functionality to ease filtering of students.

**UIR8:** The website shall allow users to have a quick overall glance of the important information at the landing page.

**UIR9:** The website shall use small colour-coded tiles to display workload schedules.

**UIR10:** The website shall allow these small colour-coded tiles to be dragged and dropped accordingly to tweak workload schedule.

## 3.2 User Interface Mock-up

### Manager Mock-up



Figure 2: Manager Dashboard

Upon logging in with the manager account, the manager will be greeted with a dashboard showcasing the staff's workload schedule immediately on the landing page. There will also be a search and filter function on the dashboard to help provide the manager with a seamless way of grouping and filtering the workload schedule by teachers and instruments. The dashboard will also feature an overview of teachers' and students' assignment and instruments for the week.



Figure 3: Workload Charts

At the bottom of the dashboard, the manager can view the top three staff with the lowest workload and highlight all staff that has exceeded over 40 hours of jobs allocated for the week. The staff who have exceeded the 40 hours will be highlighted in red under the “Exceeded Workload” section of the dashboard. The top three staff with the lowest workload will be shown under the “Lowest Workload” section of the dashboard.

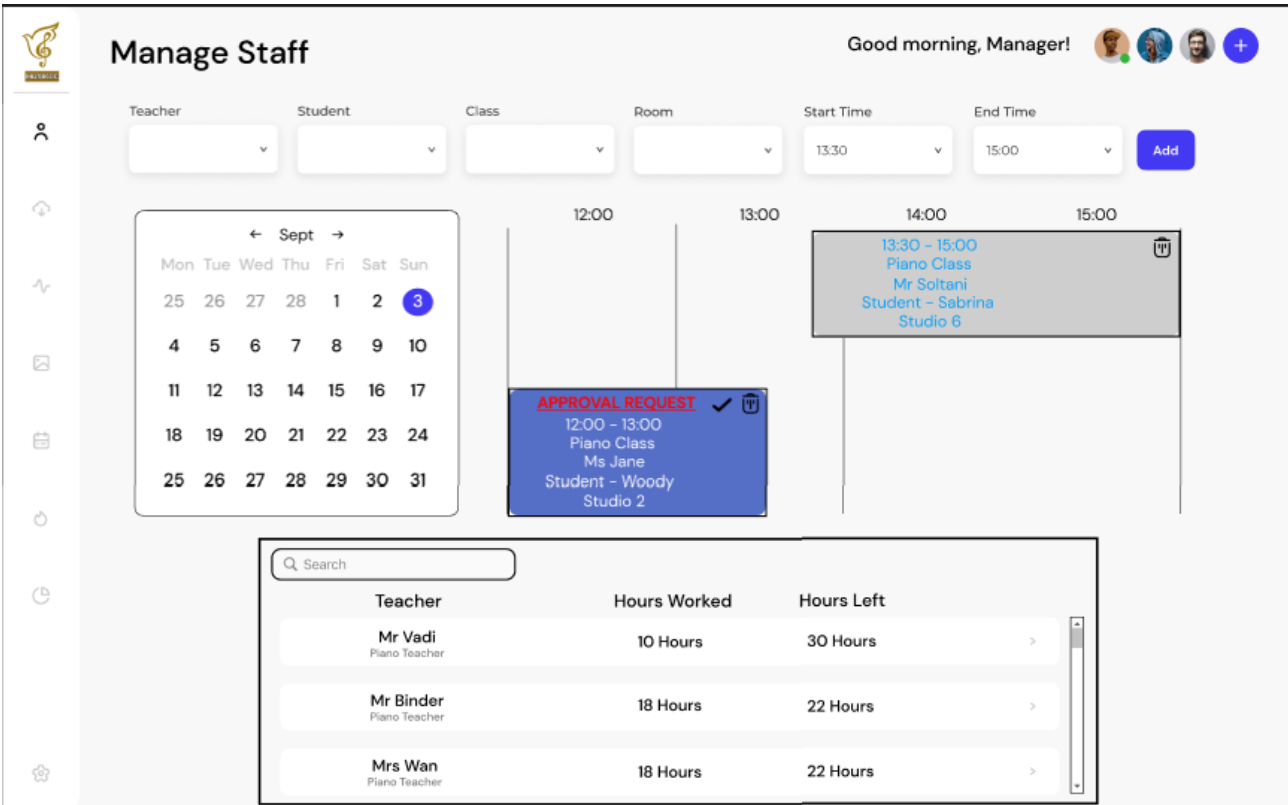


Figure 4: Manager Staff/Job Allocation Page

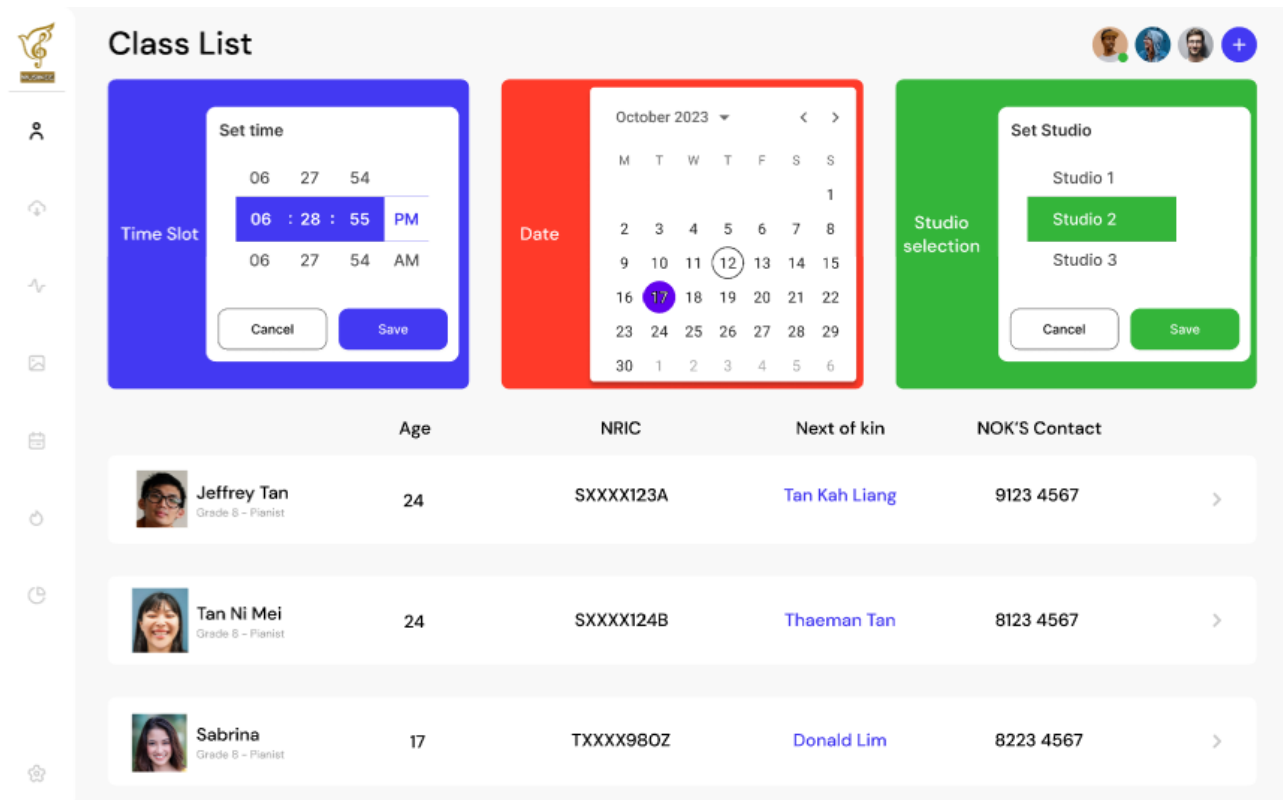
On the Manage Staff/Job Allocation page, the manager will be able to view up to three staff availability and any relevant information regarding the staff for easier job assignment. In our case,

the hours worked, and the hours left for the week are displayed. There is also a search and scroll function in the scenario that there are more than three staff with low workload and the manager is required to scroll through the list.



*Figure 5: Managing Approval Requests*

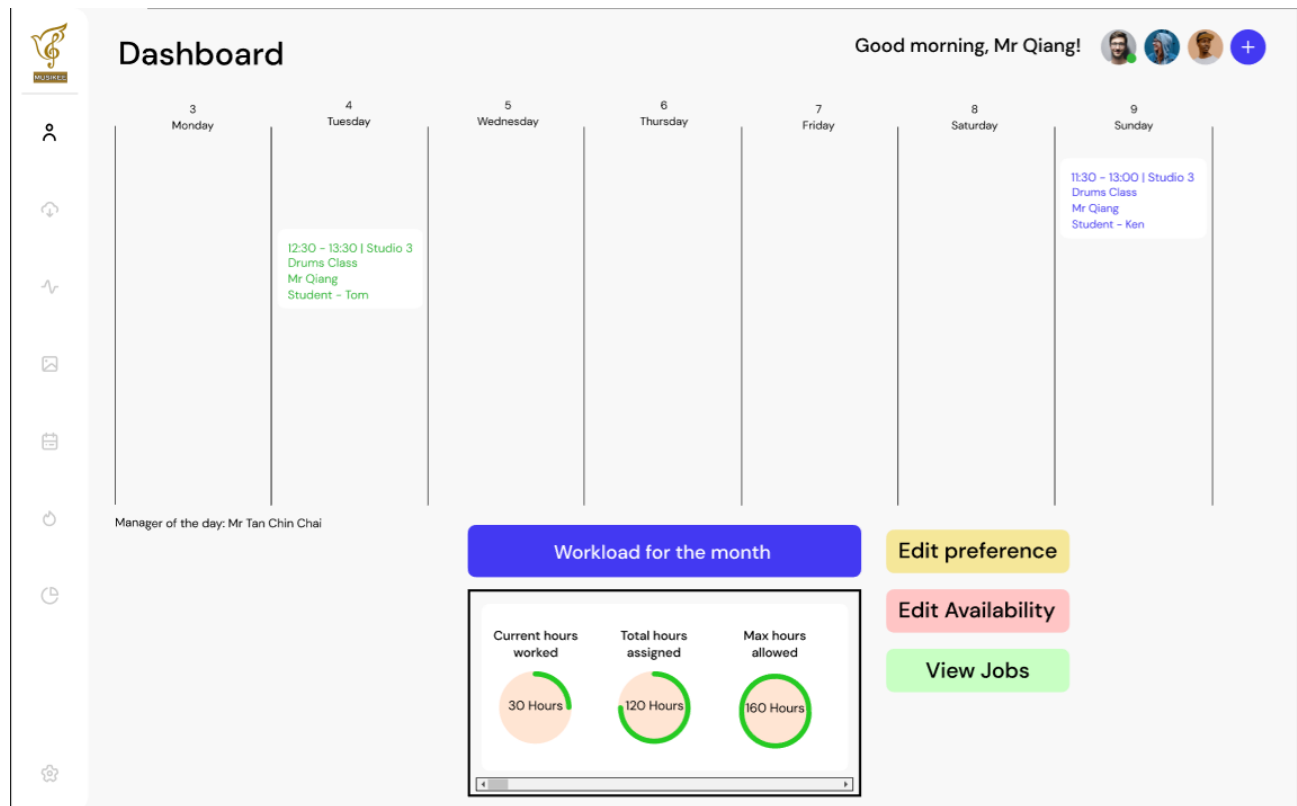
When the staff states their interest in taking up a lesson for a particular day, the manager can either approve or cancel the approval request via the “tick” and “rubbish bin” icons at the top right. These approval requests will be in a different colour as compared to the confirmed lessons for easy readability and dissertation.



*Figure 6: Student Class List*

A class list will also be provided to help aid the manager in overseeing the status of students in the music school. The student's full name, age, masked NRIC, Next of Kin, and Next of Kin's Contact will be shown. Additionally, to comply with PDPA, only the last 4 digits of the NRIC can be shown to the manager.

The top few widgets feature a time, date, and studio selection. These widgets provide the manager with a way to finetune and filter the students based on their timeslot, date of lesson, and studio they are in.



*Figure 7: Staff Dashboard*

From a staff member's perspective, the staff will be greeted with a similar dashboard to the managers. However, instead of being able to see every staff's workload for the week, they will only be presented with classes that they have. Similarly, the bottom of the dashboard will be replaced with a "Workload for the month" section. This provides the staff with an overview of their workload for the month and helps provide them with essential information that can help plan out their work-life balance. The staff will also be presented with three options, "Edit Preference", "Edit Availability", and "View Jobs".

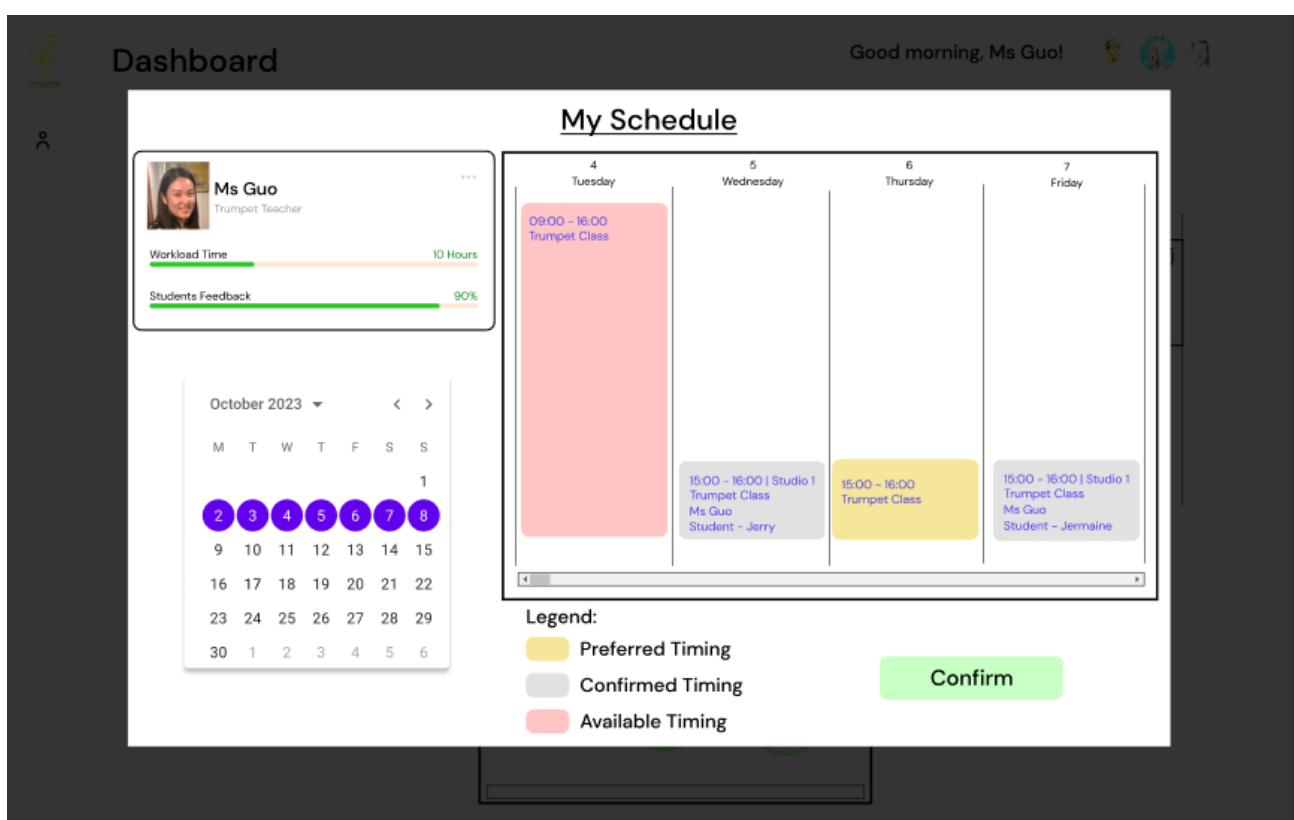


Figure 8: Staff Personal Schedule Page

When deciding to edit their availability, the staff will be able to select their available time and click on the “Confirm” button to confirm their availability. The schedule will be aided by a colour coded legend at the bottom of the popup. There will also be a calendar widget at the left for staff to indicate their job preference for the week. They are also able to edit their availabilities up to 5 weeks ahead of time, with the help of the calendar widget on the left.

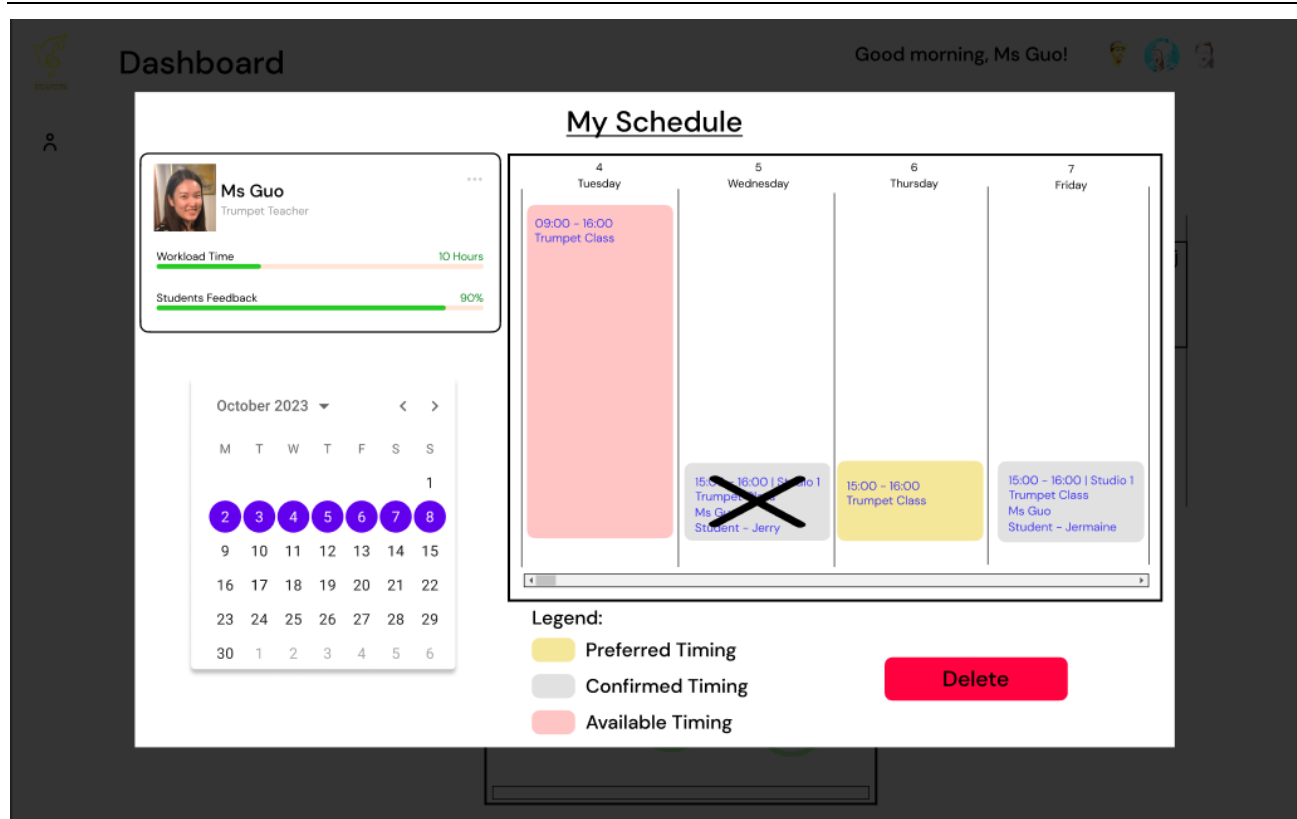


Figure 9: Staff Personal Schedule Page (Reject Job Assignments)

In the scenario that the staff would like to reject jobs assigned to them, they will be able to delete it from the staff personal schedule page. However, they will be warned to discuss the jobs with their manager before proceeding with the rejection.

The screenshot shows a web application interface for an IT administrator. At the top, there's a dark header with a logo on the left, the text 'Admin Dashboard' in the center, and a greeting 'Good morning, IT Admin!' on the right. Below the header, a white modal window titled 'Create Staff' is displayed. This modal contains several form fields: 'Staff's Name' with a placeholder 'Enter the new staff's Full Name'; 'Password' with a placeholder 'Enter password' and a note 'Your password must consist of special characters and numbers'; 'Job Title' with a dropdown menu showing 'Manager' (selected), 'Piano Teacher', and 'Drums Teacher'; 'Staff's NRIC' with a placeholder 'Enter the new staff's NRIC'; 'Staff's Contact Number' with a placeholder 'Enter the new staff's Contact Number'; 'Staff's Address' with a placeholder 'Enter the new staff's Address'; and 'Staff's Date of Birth' with a placeholder 'Enter the new staff's DOB'. A blue 'Create Staff' button is located at the bottom right of the modal.

*Figure 10: IT Administrator Page*

Lastly, the IT administrator will have his/her own personal page tagged to their role. As the IT administrator is tasked with adding new staff and managers to the system, they will be provided with an online form page where they can enter the new staff's credentials and relevant information into the system.



### **3.3 Functional Requirements**

**Functional Requirement (FR)** outlines what the system should do in terms of its functions and operations to fulfill user requirements.

**FR1:** The website shall allow staff (teachers), managers, and IT administrators to access their designated landing pages upon successful verification of their login credentials using username and password on the login page.

**FR2:** The website shall allow IT administrators to create new user accounts for staff (teachers) and managers.

**FR3:** The website shall allow IT administrators to delete existing user accounts for staff (teachers) and managers.

**FR4:** The website shall allow IT administrators to assign access rights to user accounts for staff (teachers) and managers.

**FR5:** The website shall allow staff (teachers) and managers to change password at their designated landing page upon successful log in.

**FR6:** The website shall allow teachers and managers to reset password at the login page, without the necessity of prior log in.

**FR7:** The website shall allow staff (teachers) to view weekly job assignments on their landing page.

**FR8:** The website shall allow staff (teachers) to view overall workload for the month on their landing page.

**FR9:** The website shall allow staff (teachers) to add their work availabilities up to 5 weeks in advance on their landing page.

**FR10:** The website shall allow staff (teachers) to edit their work availabilities up to 5 weeks in advance on their landing page.

**FR11:** The website shall allow staff (teachers) to choose job preferences for the upcoming week.

**FR12:** The website shall provide staff (teachers) with an option to reject job assignment assigned by managers.

**FR13:** The website shall display a warning message to staff (teachers) when they proceed to reject an assigned job.

**FR14:** The website shall allow managers to view staff (teachers)' workload on the landing page.

**FR15:** The website shall allow managers to allocate jobs to staff (teachers) on the job allocation page for one week at a time.

**FR16:** The website shall allow managers to enroll new students into classes.

**FR17:** The website shall allow managers to unenroll existing students from classes.

**FR18:** The website shall allow managers to approve job assignment rejection request made by teachers.

**FR19:** The website shall allow managers to disapprove job assignment rejection request made by teachers.

**FR20:** The website shall allow managers to view the top three staff (teachers) with the lowest workload based on working hours, on the managers' landing page.

**FR21:** The website shall allow managers to view all staff (teachers) exceeding 40 hours of job assignments allocated for the week on the managers' landing page.

**FR22:** The website shall allow managers to concurrently view the availability and relevant information of up to three staff (teachers) on the job allocation page.

**FR23:** The website shall allow managers to filter and view student class lists by time slot, date, and studio on the student list page.

**FR24:** The website shall allow managers to view the profile of enrolled students.

**FR25:** The website shall allow managers to update the profile of enrolled students.

**FR26:** The website shall allow managers to create teaching schedule for piano, drums, violin, and trumpet class.

### **3.4 Use Case Model**

Based on our user's requirements, we have come up with the use case model as shown below. It illustrates the various use cases or functionalities the system has to offer to the various users while also defining the scope and boundaries of the system through identifying its primary actors and the specific use cases they are involved in.

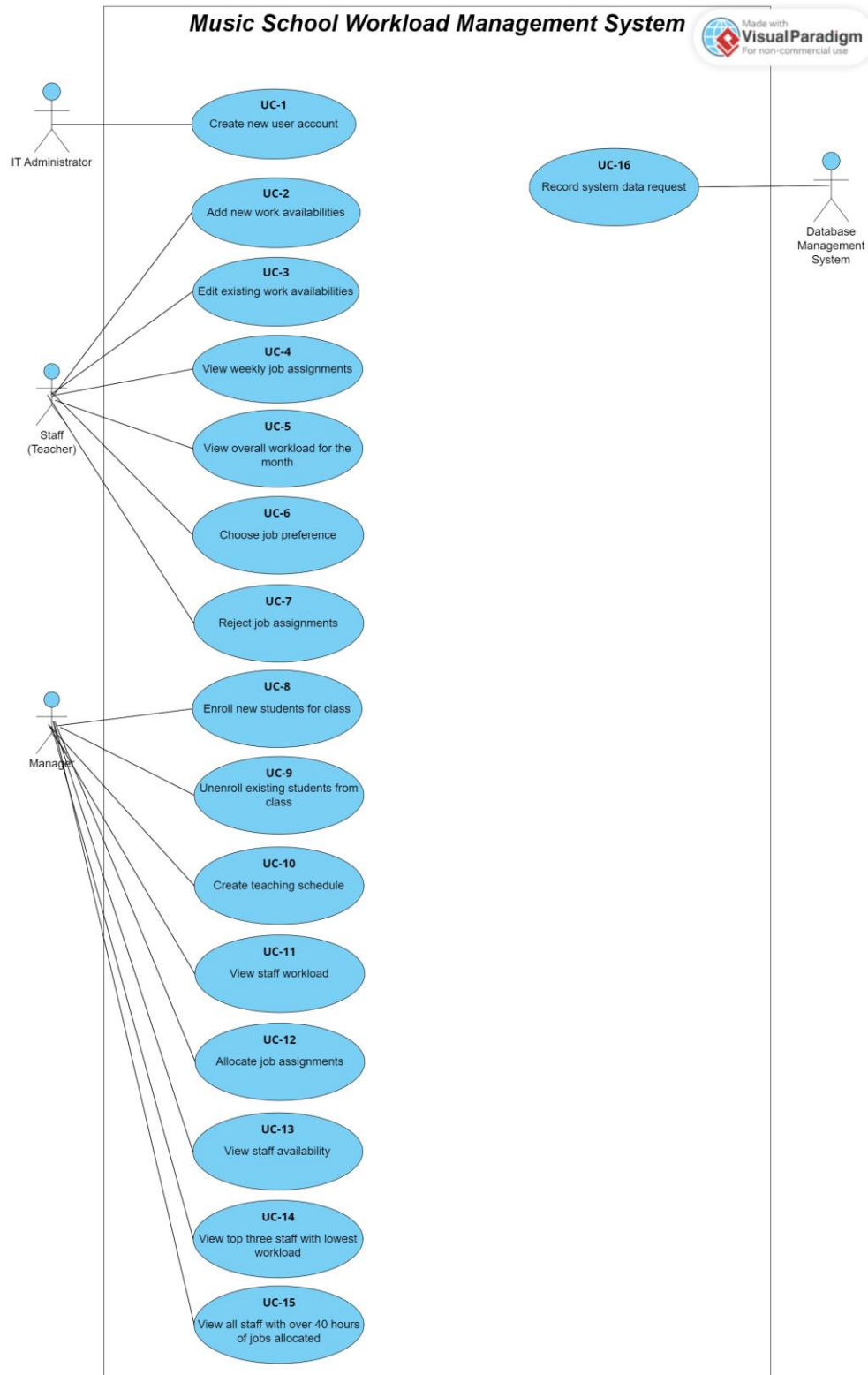


Figure 10: Use Case Diagram for Music School Workload Management System

## **3.5 Non-functional Requirements**

**Non-Functional Requirements (NFR)** detail the system's performance, quality, and constraints to complement the Functional Requirements (FR) in meeting user needs.

**NFR1:** The website shall provide an interactive and visually engaging user interface to enhance the user experience.

**NFR2:** Users authentication shall be required for accessing the website and users shall utilize login credentials consisting of username and password.

**NFR3:** The website shall be developed using a collection of software technologies consisting of Hypertext Markup Language (HTML), Cascading Stylesheet (CSS), JavaScript, C#, and Python for optimal functionality.

**NFR4:** The database for storing information associated with IT administrator, staff specifically staff, managers, and students shall be implemented using Microsoft SQL Server to ensure data integrity and reliability.

**NFR5:** The website shall be deployed on a cloud hosting platform, and Amazon Web Services (AWS) shall be the chosen cloud infrastructure provider.

**NFR6:** The database shall be hosted on Amazon Relational Database Service (RDS) within AWS to ensure scalable data storage.

**NFR7:** The website shall ensure that users can access desired content or functionality with a maximum of four user interactions.

**NFR8:** The website shall not undergo scheduled maintenance or upgrades on the 20<sup>th</sup> day of each month between 9:00AM and 9:00PM, Singapore Time (SGT) on weekdays and 8:00AM and 8:00PM, SGT on weekends. This maintenance restriction is in place to accommodate workload allocation planning.

### **3.5.1 Performance Requirements**

**NFR9:** The website must maintain an uptime of 99.5% annually based on the service level agreement, unless subjected to maintenances and upgrades.

**NFR10:** The website shall not have a loading time exceeding 10 seconds.

**NFR11:** The website shall respond to a user's click within 5 seconds.

**NFR12:** The website shall be compatible across 4 web browsers specifically: Google Chrome, Mozilla Firefox, Microsoft Edge, and Safari.

**NFR13:** The system shall implement continuous integration and deployment (CI/CD) to facilitate seamless updates. This CI/CD shall automate the build, testing, and deployment processes, ensuring rapid and error-free updates to the website.

### **3.5.2 Safety and Security Requirements**

**NFR14:** Data transmitted from and received are always encrypted with AES-128.

**NFR15:** Creation and deletion of user accounts shall only be performed by IT administrators.

**NFR16:** The collection of data and information associated with staff specifically teachers, managers, and students must comply with the provisions and requirements outlined in the Personal Data Protection Act (PDPA).

**NFR17:** Data and information associated with IT administrators, staff specifically teachers, managers and students shall be encrypted with SHA-3 in database.

**NFR18:** The first four numerical number of the National Registration Identity Card (NRIC) must be masked with an X. (Ex: SXXXX431H)

**NFR19:** The website must validate user account password, and ensure it fulfils at least 12 characters long comprising of uppercase alphabets and lowercase alphabets, numbers, and symbol.

**NFR20:** The website must have a valid Transport Layer Security (TLS) certificate signed by renowned certificate authority.

**NFR21:** The website must limit the number of incorrect logins attempts by users due to incorrect username or passwords, best practice - three consecutive times.

**NFR22:** The website must not be vulnerable to known vulnerabilities listed on top 10 OWASP web vulnerabilities.

## 3.6 Activity Diagram

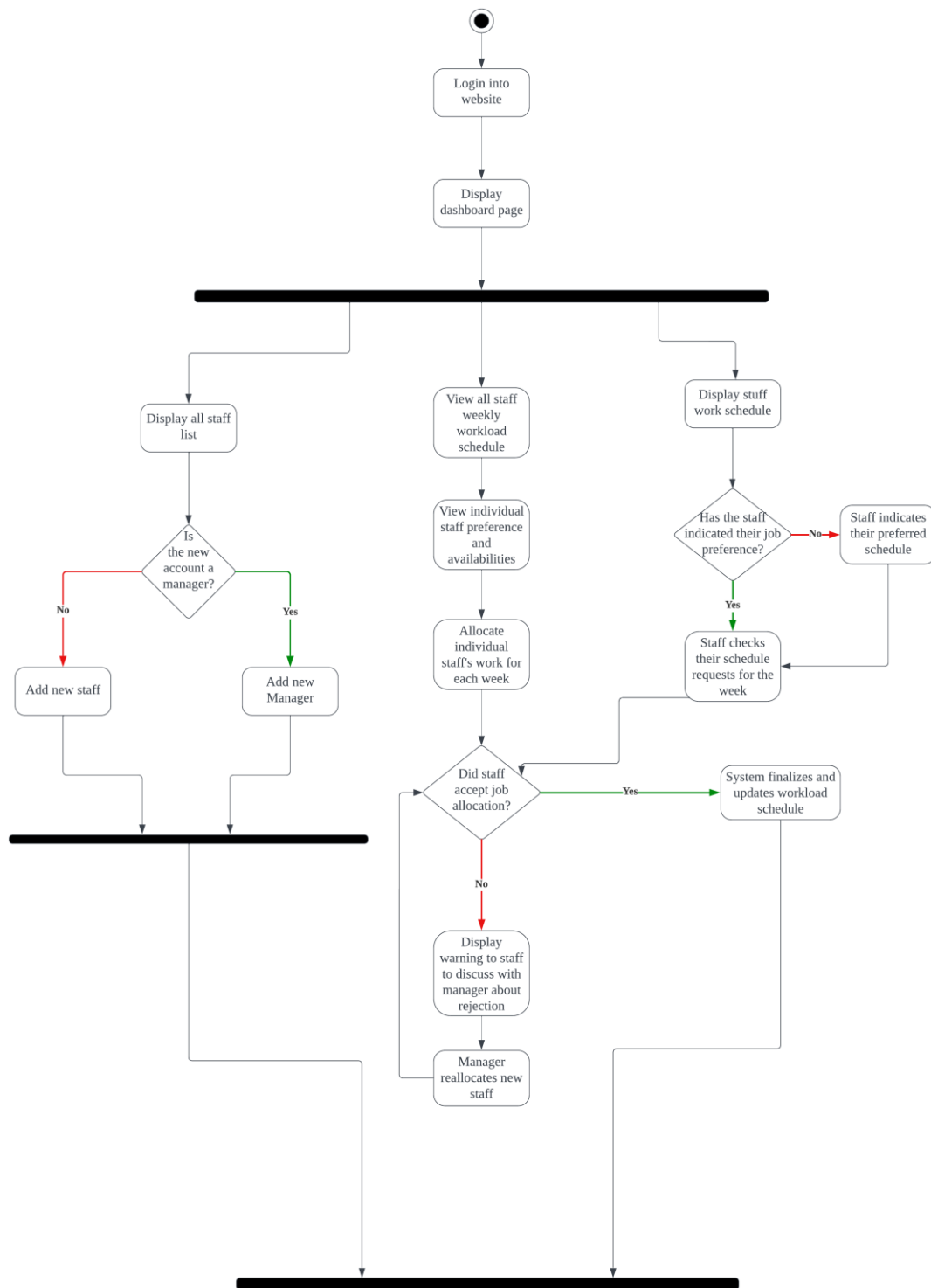


Figure 11: Activity Diagram

## 4 Project Estimation and Plan

### 4.1 Software Estimation

At this stage of the project, our team does not have the necessary details or progression to perform software estimation using Functional Points (FP) or Lines of Code (LOC). Instead, Use Case Points (UCP) will be used to determine the development effort required for the project. In the future, as the project continues to mature and more information is gathered, we can then consider performing software estimation using FP and LOC.

The following are our calculations and estimation of the project using UCP estimation:

i. Unadjusted Transactions Weight

Use Case Number	Use Case Name	Total Transactions/usecase (improved)	Complexity of a Usecase (improved) - Don't edit this
1	Create New User Account	5	10
2	Add New Work Availabilities	5	10
3	Edit Existing Work Availabilities	6	10
4	View Weekly Job Assignments	2	5
5	View Overall Workload for the Month	3	5
6	Choose Job Preference	5	10
7	Reject Job Assignments	6	10
8	Enrol New Students for Class	8	15
9	Unenroll Existing Students from Class	7	10
10	Create Teaching Schedule	6	10
11	View Staff Workload	2	5
12	Allocate job assignments	6	10
13	View staff availability	3	5
14	View top 3 staff with lowest workload	2	5
15	View all staff with over 40 hours of jobs allocated	2	5
16	Record System Data Request	5	10
		<b>Total unadjusted use case weight</b>	<b>135</b>
		<b>Adding actors weight</b>	<b>146</b>

Figure 12: Use Case Estimation Table

- Unadjusted Transactions Weight = **135**

ii. Unadjusted Actor Weight

Actor	weight	count	product
Simple	1	0	0
Medium	2	1	2
Complex	3	3	9
		<b>Total</b>	<b>11</b>

Figure 13: Use Case Actors Estimation Table

- Unadjusted Actor Weight: 11

- Total unadjusted points (UUCW):

Unadjusted Transactions Weight + Unadjusted Actors Weight

= 135 + 11

= **146**

iii. Technical Complexity Factor

Factor	Description	Weight	Assesment	Product
T1	Distributed system	2	0	0
T2	Response time/performance objectiv	1	5	5
T3	End-user efficiency	1	5	5
T4	Internal processing complexity	1	2	2
T5	Code reusability	1	4	4
T6	Easy to install	0.5	5	2.5
T7	Easy to use	0.5	5	2.5
T8	Portability to other platforms	2	2	4
T9	System maintenance	1	5	5
T10	Concurrent/parallel processing	1	1	1
T11	Security features	1	5	5
T12	Access for third parties	1	3	3
T13	End user training	1	2	2
			Total	41

Figure 14: Technical Complexity Factor Estimation Table

- Technical complexity factor (TCF)

$0.6 + 0.01 \times \text{Degree of influence (DI)}$

=  $0.6 + 0.01 \times 41$

= **1.01**



iv. Environmental Factor

Environment	weight	Assessment	Product
Familiar with Development Process	1.5	2	3
Part time workers	-1	0	0
Analyst capability	0.5	0	0
Application experience	0.5	5	2.5
Object oriented experience	1	4	4
Motivation	1	3	3
Difficult programming language	-1	3	-3
Stable requirements	2	4	8
		Total	17.5

Figure 15: Environmental Factor Estimation Table

- Environmental factor (EF)

$$= 1.4 + (-0.03 \times \text{EFactor})$$

$$= \mathbf{0.875}$$

- Use Case Point (UCP)

$$= \text{UUCW} \times \text{TCF} \times \text{EF}$$

$$= 146 \times 1.01 \times 0.875$$

$$= 129.0275$$

$$\approx \mathbf{129}$$

v. Effort Estimation using UCP

Based on Gustav Karner's guidelines for UCP, where each UCP is estimated to be between 15 to 30 hours, our project's estimated effort for a single developer is between 1,935 to 3,870 hours. See the breakdown below:

**129 UCP x 15 Hours = 1,935 Hours (Best Case)**

**129 UCP x 30 Hours = 3,870 Hours (Worst Case)**

As team consists of 6 developers, the estimated developer-hours per developer is projected to be between 322.5 to 645 hours. The detailed calculations are provided below:

**1,935 hours / 6 developers = 322.5 hours per developer (Best Case)**

**3,870 hours / 6 developers = 645 hours per developer (Worst Case)**

Starting from the upcoming week (Week 5), we have 9 weeks left to complete the project deliverables. Each developer is anticipated to spend between 32 to 64 hours weekly. The calculations are outlined below:

**322.5 hours / 9 weeks  $\approx$  36 hours per week per developer (Best Case)**

**645 hours / 9 weeks  $\approx$  72 hours per week per developer (Worst Case)**

## **4.2 Project Management**

We have developed a Work Breakdown Structure (WBS) and a Gantt Chart to aid in project management. The WBS breaks down our complex software development process into manageable components, enabling precise task allocation and resource planning. Meanwhile, the Gantt Chart offers a visual timeline representation, aiding in identifying critical paths and optimizing project efficiency. These tools are essential for effective project planning, control, and communication, ensuring that our project stays on course and meets its objectives while also balancing workload among all team members.

## Work Breakdown Structure

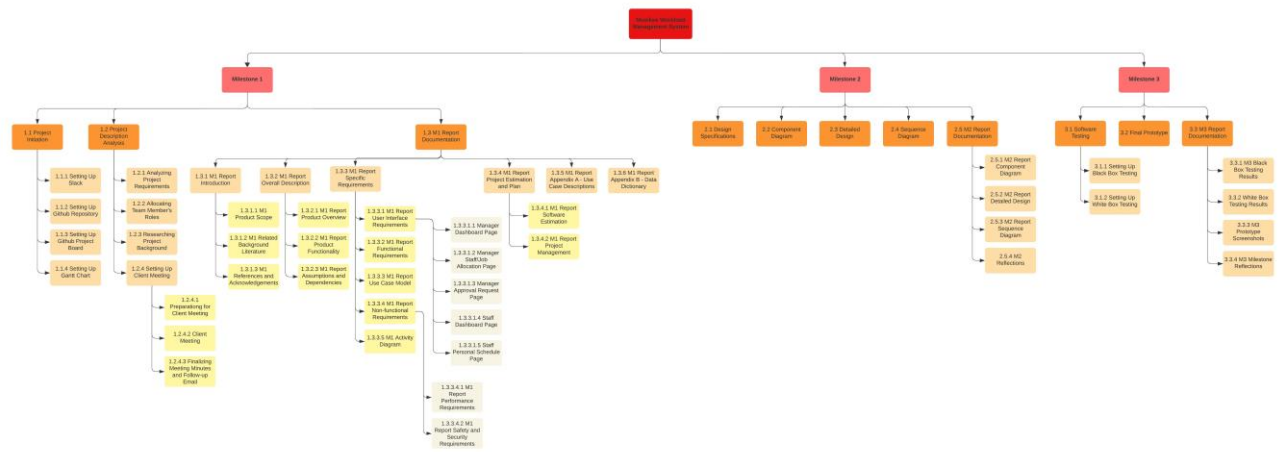


Figure 16: Work Breakdown Structure







## Appendix A – Use Case Descriptions

Use Case ID:	UC-1
Use Case Name:	<b>Create New User Account</b>
Description:	IT Administrator can create a new user account for newly recruited staff.
Primary Actor:	IT Administrator
Preconditions:	<ul style="list-style-type: none"><li>• IT Administrator must be logged into the system</li><li>• The system is operational and accessible</li></ul>
Postconditions:	Main: A new user account has been created successfully and a confirmation message is displayed.  4a. IT Administrator accidentally keyed in wrong information.  5a. System encounters an issue while creating a new user account.
Main Success Scenarios:	<ol style="list-style-type: none"><li>1. IT Administrator selects the "Create New User Account" option.</li><li>2. Systems shows the form the IT Administrator needs to fill in.</li><li>3. IT Administrator fills out the user account details.</li><li>4. IT Administrator confirms creation of new user account.</li><li>5. System validates and creates the user account.</li><li>6. System notifies the IT Administrator of the successful creation of the user account.</li></ol>
Alternative Scenarios:	4a. IT Administrator accidentally keyed in wrong information.  4a1. System allows IT Administrator to edit the newly created account after its creation.  5a. System encounters an issue while creating a new user account.  5a1. System displays an error message.  5a2. IT Administrator can choose to try again or quit screen.
Priority:	High

Use Case ID:	UC-2
Use Case Name:	<b>Add New Work Availabilities</b>
Description:	Staff can indicate their work availabilities for future jobs.
Primary Actor:	Staff (Teacher)
Preconditions:	<ul style="list-style-type: none"><li>• The system is operational and accessible</li><li>• Staff must be logged into the system</li></ul>
Postconditions:	Main: New work availability added into the system.

	2a. Staff decides to cancel adding new work availability.
	5a. System encounters an issue while adding a new work availability.
Main Success Scenarios:	<ol style="list-style-type: none"> <li>1. Staff selects the "Add New Work Availabilities" option.</li> <li>2. System presents a form for specifying work availabilities.</li> <li>3. Staff enters the desired work schedule details.</li> <li>4. Staff confirms and submits the form.</li> <li>5. System validates and records the new work availability.</li> <li>6. System notifies staff of the successful addition of their work availability.</li> </ol>
Alternative Scenarios:	<p>2a. Staff decides to cancel adding new work availability.</p> <p>2a1. System discards the entered data.</p> <p>2a2. No new work availabilities are recorded.</p> <p>5a. System encounters an issue while adding a new work availability.</p> <p>5a1. System displays an error message.</p> <p>5a2. Staff are prompted by the system to either retry or exit the screen.</p>
Priority:	High

Use Case ID:	UC-3
Use Case Name:	<b>Edit Existing Work Availabilities</b>
Description:	Staff can amend their existing work availabilities.
Primary Actor:	Staff (Teacher)
Preconditions:	<ul style="list-style-type: none"> <li>• The system is operational and accessible</li> <li>• Staff must be logged into the system</li> <li>• Staff has created a work availability request beforehand</li> </ul>
Postconditions:	<p>Main: Staff successfully edited their work availability record.</p> <p>2a. No work availability is displayed to the staff.</p> <p>3a. Staff decides to cancel editing their work availability.</p> <p>6a. System encounters an issue while trying to update the work availability.</p>
Main Success Scenarios:	<ol style="list-style-type: none"> <li>1. Staff selects "Edit Existing Work Availabilities" option.</li> <li>2. System displays the existing work availabilities for the staff.</li> <li>3. Staff chooses which work availability they want to edit.</li> <li>4. Staff makes the necessary changes (E.g., Adjust time slot).</li> <li>5. Staff confirms and submits the changes.</li> <li>6. System updates the work availability record.</li> <li>7. System confirms the successful update of the work availability.</li> </ol>



Alternative Scenarios:	<p>2a. No work availability is displayed to the staff.</p> <p>2a1. System displays a message indicating that there is no work availability for the staff.</p> <p>2a2. System offers to direct the staff to the “Add New Work Availabilities” page.</p> <p>3a. Staff decides to cancel editing their work availability.</p> <p>3a1. System discards the changes.</p> <p>3a2. Work availability remains the same.</p> <p>6a. System encounters an issue while trying to update the work availability</p> <p>6a1. System displays an error message.</p> <p>6a2. Staff are prompted by the system to either retry or exit the screen.</p>
Priority:	Medium

Use Case ID:	UC-4
Use Case Name:	<b>View Weekly Job Assignments</b>
Description:	Staff can view their weekly job assignments
Primary Actor:	Staff (Teacher)
Preconditions:	<ul style="list-style-type: none"><li>• The system is operational and accessible</li><li>• Staff must be logged into the system</li><li>• System must contain the staff’s weekly job assignment data</li></ul>
Postconditions:	<p>Main: Staff successfully view their weekly job assignments for the current week.</p> <p>2a. System encounters an issue retrieving or displaying the weekly job assignments.</p>
Main Success Scenarios:	<ol style="list-style-type: none"><li>1. Staff selects “View Weekly Job Assignments” option.</li><li>2. System retrieves and displays the weekly job assignments for the Staff for the current week.</li></ol>
Alternative Scenarios:	<p>2a. System encounters an issue retrieving or displaying the weekly job assignments.</p> <p>2a1. System displays an error message.</p> <p>2a2. Staff are prompted by the system to either retry or exit the screen.</p>
Priority:	Medium

Use Case ID:	UC-5
Use Case Name:	<b>View Overall Workload for the Month</b>

Description:	Staff can view their overall workload for the entire month
Primary Actor:	Staff (Teacher)
Preconditions:	<ul style="list-style-type: none"><li>• The system is operational and accessible</li><li>• Staff must be logged into the system</li></ul>
Postconditions:	Main: Staff can successfully view their overall workload for the month.  2a. Staff can choose to view their workload for pervious months.  2b. System encounters an issue retrieving or displaying the overall workload for the month.
Main Success Scenarios:	<ol style="list-style-type: none"><li>1. Staff selects the "View Overall Workload for the Month" option.</li><li>2. System retrieves and displays an overview of the staff's workload for the current month.</li></ol>
Alternative Scenarios:	2a. Staff can choose to view their workload for pervious months. 2a1. System displays the staff's list of jobs for previous months.  2b. System encounters an issue retrieving or displaying the overall workload for the month. 2b1. System displays an error message. 2b2. Staff are prompted by the system to either retry or exit the screen.
Priority:	Medium

Use Case ID:	UC-6
Use Case Name:	<b>Choose Job Preference</b>
Description:	Staff can select their job preference
Primary Actor:	Staff (Teacher)
Preconditions:	<ul style="list-style-type: none"><li>• The system is operational and accessible</li><li>• Staff must be logged into the system</li></ul>
Postconditions:	Main: Staff can successfully choose their job preference  3a. Staff decides to cancel choosing their job preference.  5a. System encounters an issue recording the staff's job preference.
Main Success Scenarios:	<ol style="list-style-type: none"><li>1. Staff selects the "Choose Job Preference" option.</li><li>2. System retrieves and displays a list of available job preferences/assignments.</li><li>3. Staff selects their preferred job preference.</li><li>4. Staff confirms their selections.</li><li>5. System records the staff's job preference.</li></ol>

	6. System provides the staff with a confirmation message indicating that their job preference selections have been successfully recorded.
Alternative Scenarios:	3a. Staff decides to cancel choosing their job preference. 3a1. Job preferences remain the same. 3a2. Staff is redirected back to the main screen.  5a. System encounters an issue recording the staff's job preference. 5a1. System displays an error message. 5a2. Staff are prompted by the system to either retry or exit the screen.
Priority:	Medium

Use Case ID:	UC-7
Use Case Name:	<b>Reject Job Assignments</b>
Description:	Staff can reject their allocated job assignments
Primary Actor:	Staff (Teacher)
Preconditions:	<ul style="list-style-type: none"><li>• The system is operational and accessible</li><li>• Staff must be logged into the system</li><li>• Jobs have already been assigned to the staff by the manager</li></ul>
Postconditions:	Main: Staff successfully reject their job assignment(s)  4a. Staff decides to cancel their action.  6a. System is unable to update the job assignment status due to a technical error.
Main Success Scenarios:	<ol style="list-style-type: none"><li>1. Staff selects the "View Weekly Job Assignments" option.</li><li>2. System retrieves and displays the weekly job assignments for the staff.</li><li>3. Staff identifies and selects which job assignment(s) they wish to reject.</li><li>4. System prompts the staff to confirm their rejection.</li><li>5. Staff confirms the rejection.</li><li>6. System updates the job assignment status to "Rejected" for the selected task(s).</li><li>7. System provides a confirmation message to the staff indicating that their rejection of the job assignment was successful.</li></ol>
Alternative Scenarios:	4a. Staff decides to cancel their action. 4a1. System cancels the rejection process. 4a2. Job assignment status remains unchanged. 4a3. System displays a message confirming the cancellation of the rejection.

	<p>6a. System is unable to update the job assignment status due to a technical error.</p> <p>6a1. System displays an error message to the staff indicating that an error has occurred.</p> <p>6a2. Staff are prompted by the system to either retry or exit the screen.</p>
Priority:	Medium

Use Case ID:	UC-8
Use Case Name:	<b>Enrol New Students for Class</b>
Description:	The manager can enrol new students for classes
Primary Actor:	Manager
Preconditions:	<ul style="list-style-type: none"><li>• The system is operational and accessible</li><li>• Manager must be logged into the system</li></ul>
Postconditions:	<p>Main: Manager can successfully enrol new students for class</p> <p>2a. There are no available classes for enrolment</p> <p>2b. There are no eligible students to enrol</p> <p>2c. Manager decides to cancel the action</p> <p>7a. System encounters an issue updating the class enrolment records</p>
Main Success Scenarios:	<ol style="list-style-type: none"><li>1. Manager selects the "Enrol New Students for Class" option.</li><li>2. System displays a list of available classes for enrolment.</li><li>3. Manager selects a class to enrol new students</li><li>4. System displays a list of available students who can be enrolled in the selected class.</li><li>5. Manager selects the students to enrol in the class</li><li>6. Manager confirms the enrolment</li><li>7. System updates the class enrolment records based on the selected students</li><li>8. System provides a confirmation message to the manager indicating that the enrolment of new students for the class was successful.</li></ol>
Alternative Scenarios:	<p>2a. There are no available classes for enrolment</p> <p>2a1. System displays a message to inform the manager</p> <p>2a2. Manager can return to the previous screen</p>

	<p>2b. There are no eligible students to enrol</p> <p>2b1. System displays a message to inform the manager</p> <p>2b2. System can return to the previous screen.</p> <p>2c. Manager decides to cancel the action</p> <p>2c1. No changes are made to the class enrolment records</p> <p>2c2. Manager can return to the main screen</p> <p>7a. System encounters an issue updating the class enrolment records</p> <p>7a1. System displays an error message to the manager</p> <p>7a2. Manager are prompted by the system to either retry or exit the screen.</p>
Priority:	High

Use Case ID:	UC-9
Use Case Name:	<b>Unenroll Existing Students from Class</b>
Description:	Manager can unenroll existing students from classes based on when the students decide to stop going for classes
Primary Actor:	Manager
Preconditions:	<ul style="list-style-type: none"><li>• The system is operational and accessible</li><li>• Manager must be logged into the system</li></ul>
Postconditions:	<p>Main: Manager can successfully unenroll existing students from class</p> <p>2a. Manager decides to cancel the action</p> <p>4a. There are no enrolled students in the class</p> <p>7a. System encounters an issue while trying to update the class roster</p>
Main Success Scenarios:	<ol style="list-style-type: none"><li>1. Manager selects the "Unenroll Existing Students from Class" option.</li><li>2. System displays a list of classes.</li><li>3. Manager selects a class from which to unenroll students.</li><li>4. System displays a list of currently enrolled students in the selected class.</li><li>5. Manager selects the student(s) to unenroll from the class</li><li>6. Manager confirms the unenrollment.</li><li>7. System updates the class roster by removing the selected student(s).</li><li>8. System provides a confirmation message to the manager, indicating that the unenrollment of student(s) from the class was successful.</li></ol>
Alternative Scenarios:	2a. Manager decides to cancel the action

	<p>2a1. No changes are made to the present roster</p> <p>2a2. Manager can return to the previous screen</p> <p>4a. There are no enrolled students in the class</p> <p>4a1. System informs the manager</p> <p>4a2. Manager can return to the previous screen</p> <p>7a. System encounters an issue while trying to update the class roster</p> <p>7a1. System displays an error message</p> <p>7a2. Manager are prompted by the system to either retry or exit the screen.</p>
Priority:	Medium

Use Case ID:	UC-10
Use Case Name:	<b>Create Teaching Schedule</b>
Description:	Manager can create teaching schedules for various music classes
Primary Actor:	Manager
Preconditions:	<ul style="list-style-type: none"> <li>• The system is operational and accessible</li> <li>• Manager must be logged into the system</li> </ul>
Postconditions:	<p>Main: Manager successfully creates a teaching schedule</p> <p>2a. Manager decides to cancel the action</p> <p>3a. Manager selects an unavailable date or time slot</p> <p>6a. System fails to update the teaching schedule</p>
Main Success Scenarios:	<ol style="list-style-type: none"> <li>1. Manager selects the "Create Teaching Schedule" option</li> <li>2. System displays a calendar or schedule view for the manager to create the teaching schedule</li> <li>3. Manager selects a date and time slot</li> <li>4. Manager specifies the type of music class</li> <li>5. Manager confirms the teaching schedule</li> <li>6. System updates the teaching schedule</li> <li>7. System provides a confirmation message to the manager indicating that the teaching schedule has been successfully created</li> </ol>
Alternative Scenarios:	<p>2a. Manager decides to cancel the action</p> <p>2a1. Manager can return to the previous screen</p>

	<p>3a. Manager selects an unavailable date or time slot</p> <p>3a1. System displays an error message</p> <p>3a2. System prompts the manager to choose an alternative slot</p> <p>6a. System fails to update the teaching schedule</p> <p>6a1. System displays an error message</p> <p>6a2. Manager is prompted by the system to either retry or exit the screen.</p>
Priority:	High

Use Case ID:	UC-11
Use Case Name:	<b>View Staff Workload</b>
Description:	Manager can view the workload of staff members
Primary Actor:	Manager
Preconditions:	<ul style="list-style-type: none"><li>• The system is operational and accessible</li><li>• Manager must be logged into the system</li></ul>
Postconditions:	<p>Main: Manager can successfully view staff workload</p> <p>2a. System fails to retrieve staff workload data</p>
Main Success Scenarios:	<ol style="list-style-type: none"><li>1. Manager selects the "View Staff Workload" option</li><li>2. System retrieves and displays a list of staff and their respective workload</li></ol>
Alternative Scenarios:	<p>2a. System fails to retrieve staff workload data</p> <p>2a1. System displays an error message</p> <p>2a2. Manager are prompted by the system to either retry or exit the screen.</p>
Priority:	Medium

Use Case ID:	UC-12
Use Case Name:	<b>Allocate job assignments</b>
Description:	Manager can allocate job assignments for staff members
Primary Actor:	Manager
Preconditions:	<ul style="list-style-type: none"><li>• The system is operational and accessible</li><li>• Manager must be logged into the system</li></ul>

Postconditions:	Main: Manager can successfully allocate job assignments  2a. Manager decides to cancel job assignment allocation  4a. Manager selects an unavailable staff member  6a. System fails to update job assignment
Main Success Scenarios:	<ol style="list-style-type: none"><li>1. Manager selects the "Allocate Job Assignments" option</li><li>2. System displays a list of available job assignments</li><li>3. Manager chooses a job assignment to allocate to a staff member</li><li>4. Manager selects the staff member and assigns the job</li><li>5. Manager confirms the job assignment allocation</li><li>6. System updates the job assignment status</li><li>7. System displays a confirmation message to the manager, indicating that the job has been successfully assigned to the staff member</li></ol>
Alternative Scenarios:	2a. Manager decides to cancel job assignment allocation 2a1. No job assignment will be allocated 2a2. Manager can return to the previous screen  4a. Manager selects an unavailable staff member 4a1. System displays an error message 4a2. System prompts the manager to select a different staff member  6a. System fails to update job assignment 6a1. System displays an error message 6a2. Manager are prompted by the system to either retry or exit the screen.
Priority:	High

Use Case ID:	UC-13
Use Case Name:	<b>View staff availability</b>
Description:	Manager can view the availability of staff members
Primary Actor:	Manager
Preconditions:	<ul style="list-style-type: none"><li>• The system is operational and accessible</li><li>• Manager must be logged into the system</li></ul>
Postconditions:	Main: Manager can successfully view a list of staff availability



	2a. System displays an empty list  2b. System fails to display a list of available staff members
Main Success Scenarios:	1. Manager selects the "View Staff Availability" option 2. System displays a list of staff members that are available for the week/month
Alternative Scenarios:	2a. System displays an empty list  2a1. System informs the manager that there are no available staff members  2a2. Manager can return to the previous screen  2b. System fails to display a list of available staff members  2b1. System displays an error message  2b2. Manager are prompted by the system to either retry or exit the screen
Priority:	Medium

Use Case ID:	UC-14
Use Case Name:	<b>View top 3 staff with lowest workload</b>
Description:	Manager can view the top 3 staff with the lowest workload
Primary Actor:	Manager
Preconditions:	<ul style="list-style-type: none"><li>• The system is operational and accessible</li><li>• Manager must be logged into the system</li></ul>
Postconditions:	Main: Manager can successfully view the top 3 staff with the lowest workload  2a. System fails to display the top 3 staff with the lowest workload
Main Success Scenarios:	1. Manager selects the "View top 3 staff with lowest workload" option 2. System displays the top 3 staff with the lowest workload
Alternative Scenarios:	2a. System fails to display the top 3 staff with the lowest workload  2a1. System displays an error message  2a2. Manager are prompted by the system to either retry or exit the screen
Priority:	Medium

Use Case ID:	UC-15
Use Case Name:	<b>View all staff with over 40 hours of jobs allocated</b>
Description:	Manager can view all staff members that have been allocated over 40 hours' worth of jobs
Primary Actor:	Manager
Preconditions:	<ul style="list-style-type: none"><li>• The system is operational and accessible</li><li>• Manager must be logged into the system</li></ul>
Postconditions:	Main: Manager can successfully view all staff with over 40 hours of jobs allocated  2a. System fails to display the staff with over 40 hours of job allocated
Main Success Scenarios:	<ol style="list-style-type: none"><li>1. Manager selects the "View all staff with over 40 hours of jobs allocated" option</li><li>2. System displays a list of staff members with over 40 hours of jobs allocated</li></ol>
Alternative Scenarios:	2a. System fails to display the list of staff members with over 40 hours of jobs allocated  2a1. System displays an error message  2a2. Manager are prompted by the system to either retry or exit the screen
Priority:	High

Use Case ID:	UC-16
Use Case Name:	<b>Record System Data Request</b>
Description:	The Database Management System (DBMS) can record and process data requests from various system components and actors such as information retrieval, updates, or other data-related operations.
Primary Actor:	Database Management System
Preconditions:	<ul style="list-style-type: none"><li>• The DBMS is operational and ready to receive data requests</li><li>• The relevant system components and actors initiates data requests.</li></ul>
Postconditions:	Main: DBMS successfully records system data request  3a. Unauthorized data request  4a. Invalid data request

	5a. DBMS fails to execute the request
Main Success Scenarios:	<ol style="list-style-type: none"><li>1. A system component or actor initiates a data request by sending a request message to the DBMS</li><li>2. DBMS receives the request</li><li>3. DBMS verifies its authenticity and authorization</li><li>4. If the request is valid, DBMS will fulfill the request based on its needs (E.g., Retrieve data, update, etc.)</li><li>5. DBMS successfully executes the request</li><li>6. DBMS sends a response message to the system component or actor indicating the outcome of the request (E.g., Data retrieve, update completed, etc.)</li></ol>
Alternative Scenarios:	<p>3a. Unauthorized data request</p> <p>3a1. DBMS generates an error response message</p> <p>3a2. DBMS does not proceed with processing the request</p> <p>4a. Invalid data request</p> <p>4a1. DBMS generates an error response message detailing the issue</p> <p>4a2. Request fails to be processed by the DBMS</p> <p>5a. DBMS fails to execute the request</p> <p>5a1. DBMS generates an error response message</p> <p>5a2. DBMS suggests trying again or quit screen</p>
Priority:	High

## Appendix B – Data Dictionary

### *Glossary of Terms, Abbreviations and Acronyms*

The document uses the following terms, abbreviations, and acronyms:

<b>Term or Abbreviation</b>	<b>Definition</b>
<b><i>HTTPS</i></b>	Hypertext Transfer Protocol Secure
<b><i>DBMS</i></b>	Database Management System
<b><i>SQL</i></b>	Structured Query Language
<b><i>Administrator</i></b>	A user of the system that has privileges to the entire system, such as creating, inserting, updating, deleting entries in the system.
<b><i>Manager</i></b>	A user of the system that manages the allocation of the staff's work schedule.
<b><i>Staff</i></b>	A user of the system that teaches an instrument in the music school, Musikee.
<b><i>Schedule</i></b>	A timetable of the company's studio at any given day and time.
<b><i>Availability</i></b>	The date and time on which the staff indicates that they are available to commit for lessons.
<b><i>Preferences</i></b>	The date and time of which the staff indicates that they wish to commit for lessons.