

INFORMATICS INSTITUTE OF TECHNOLOGY

In collaboration with

UNIVERSITY OF WESTMINSTER

Module: Introduction to Programming

DOC 333

Module Leader: Mr. Sudharshan Walihinda

Type of Assignment: Individual Coursework

Submission Date: 11-12-2023

Topic: Project Management of XYZ Construction Company

Student Name: Mr. G.S. Karunathilaka

IIT Student Registration No: 20231659

UoW Student ID: W2084412

Abstract

XYZ Company, a prominent construction firm in Sri Lanka, is in the process of creating an information system to enhance project management efficiency. The system effectively monitors ongoing and completed projects, ensuring optimal allocation of the workforce for new assignments. Worker availability is validated before project initiation, and completed projects are moved to a separate list, freeing up resources for potential reassignment. The company's goal is to implement an information system that systematically maintains project records and provides realtime workforce tracking for assignments. This report primarily centers on the design of the information system and the executed test cases to evaluate the system's performance against the desired standards.

Acknowledgment

This is meant to convey the author's heartfelt gratitude for all the numerous individuals who have provided encouragement & assistance all over every step of this course work.

This is meant to convey the author's heartfelt gratitude to the supervised lecturer (Ms. Tharushi Amarasinghe) for providing her advice during every step of this course work.

Special thanks to the module leader (Mr. Sudharshan Walihinda) & the rest of academic staff of the IIT who supported to completion of this course work successfully.

Finally this is meant to convey the author's heartfelt gratitude to all the family members & loved ones who provided their immense support to complete this course work successfully.

Table of Contents

| | |
|---|-----|
| Abstract..... | i |
| Acknowledgment | ii |
| List of Tables | vi |
| List of Figures | vii |
| CHAPTER 01 - INTRODUCTION | 1 |
| 1.1 Problem Domain | 1 |
| 1.2 Project Scope | 1 |
| 1.2.1 In scope | 1 |
| 1.2.2 Out scope | 1 |
| 1.3 Problem Definition | 2 |
| 1.4 Problem Statement | 3 |
| CHAPTER 02 - STRUCTURAL ANALYSIS | 4 |
| 2.1 Identified Problems and the Solutions in Case Study Analysis..... | 4 |
| 2.2 Data Structure Used In the System | 4 |
| 2.2.1 Functions | 4 |
| 2.2.2 Variables | 5 |
| 2.2.3 Lists..... | 6 |
| 2.2.4 Module Imports..... | 6 |
| 2.3 Control Structures Used in the System | 7 |
| 2.3.1 Sequential Structure | 7 |
| 2.3.2 Selection Structure | 7 |
| 2.3.3 Iteration Structure..... | 7 |
| 2.3.4 Invocations of Functions | 8 |
| 2.3.5 List Manipulations | 8 |

| | |
|--|----|
| 2.3.6 Exception Handling | 8 |
| CHAPTER 03 – CODE INSIGHT | 9 |
| 3.1 Solution Description | 9 |
| 3.1.1 Main Menu | 9 |
| 3.1.2 Adding a New Project..... | 9 |
| 3.1.3 Removing a Completed Project | 10 |
| 3.1.4 Adding New Workers | 10 |
| 3.1.5 Updating Project Details | 11 |
| 3.1.6 Project Statistics | 11 |
| 3.1.7 Exit..... | 11 |
| 3.2 Algorithm Designed for the Solution | 11 |
| CHAPTER 04 –TESTING | 16 |
| 4.1 Objectives and Goals of Testing | 16 |
| 4.2 Testing Criteria | 16 |
| 4.3 Test Cases for Main Menu Interface | 16 |
| 4.3.1 Testing Results Snapshots | 18 |
| 4.4 Test Cases for Add New Project Interface | 19 |
| 4.4.1 Temporary Interface Modifications for Test-Phase | 19 |
| 4.4.2 Executing Test Cases | 20 |
| 4.4.3 Testing Results Snapshots | 23 |
| 4.5 Test Cases for Remove Completed Project Interface..... | 25 |
| 4.5.1 Temporary Interface Modifications for Test-Phase | 25 |
| 4.5.2 Executing Test Cases | 25 |
| 4.5.3 Testing Results Snapshots | 27 |
| 4.6 Test Cases for ‘Add New Workers’ Interface | 28 |

| | |
|--|----|
| 4.6.1 Testing Results Snapshots | 30 |
| 4.7 Test Cases for ‘Update Project Details’ Interface | 31 |
| 4.7.1 Temporary Interface Modifications for Test-Phase | 31 |
| 4.7.2 Executing Test Cases | 32 |
| 4.7.3 Testing Results Snapshots | 34 |
| 4.8 Test Cases for ‘Project Statistics’ Interface | 36 |
| 4.8.1 Ready for Test Case 03 and Test Case 04 | 36 |
| 4.8.2 Executing Test Cases | 38 |
| 4.8.3 Testing Results Snapshots | 39 |

List of Tables

| | |
|---|----|
| Table 1: Main menu details | 3 |
| Table 2: Functions used for the program | 5 |
| Table 3: Variables used in the program | 6 |
| Table 4: Format codes used in datetime class | 7 |
| Table 5: Test Cases for Main Menu Interface | 18 |
| Table 6: Test Cases for 'Add New Project' Interface | 22 |
| Table 7: Test Cases for 'Remove Completed Project' Interface..... | 27 |
| Table 8: Test Cases for 'Add New Workers' Interface | 30 |
| Table 9: Test Cases for 'Update Project Details' Interface..... | 33 |
| Table 10: Ready for Test Cases 03 and 04 in 'Project Statistic' Interface | 37 |
| Table 11: Test Cases for 'Project Statistics' Interface | 39 |

List of Figures

| | |
|---|----|
| Figure 1: Navigation: Main Menu redirecting to Add New Project interface | 18 |
| Figure 2: Error Message: Handling Negative Integer Input in Main Menu Choice | 18 |
| Figure 3: Error Message: String Input in Main Menu Choice | 18 |
| Figure 4: Error Message: Numeric Choice Out of Range (1-6)-Main Menu | 19 |
| Figure 5: Exiting the System from the Main Menu | 19 |
| Figure 6: Testing Modifications: 'Add New Project' Interface | 20 |
| Figure 7: Saving a new project in Add New Project Interface | 23 |
| Figure 8: Date format check and Project Status check in 'Add New Project' Interface | 24 |
| Figure 9: Testing Modifications: 'Remove Completed Project' Interface..... | 25 |
| Figure 10: Error Response: Incorrect Project Code-'Remove Completed Project' Interface | 27 |
| Figure 11: Removal of Completed Project | 27 |
| Figure 12: Testing Result: 'Remove Completed Project' Interface with No Ongoing Projects | 28 |
| Figure 13: Providing a character instead of an integer in the 'Add New Workers' Interface | 30 |
| Figure 14: Providing an integer in the 'Add New Workers' Interface | 30 |
| Figure 15: Conducting testing for adding new workers through the designated interface | 30 |
| Figure 16: Incorporating Additional workers into the system | 31 |
| Figure 17: Testing Modifications: 'Update Project Details' Interface..... | 32 |
| Figure 18: When an incorrect project code is entered in the 'Update Project Details' Interface .. | 34 |
| Figure 19: Modifying the project status to 'on hold' within the 'Update Project Details' Interface | 34 |
| Figure 20: Verification of the worker count update in the 'Update Project Details' Interface | 35 |
| Figure 21: Modifying the project status to 'completed' within the 'Update Project Details' Interface | 35 |
| Figure 22: Testing Outcome: 'Update Project Details' Interface with No Ongoing Projects in the system | 36 |
| Figure 23: First project setup for executing Test Cases 03 and 04 in the 'Project Statistics' Interface | 37 |
| Figure 24: Second project setup for executing Test Cases 03 and 04 in the 'Project Statistics' | |

| | |
|---|----|
| Interface | 37 |
| Figure 25: Third project setup for executing Test Cases 03 and 04 in the 'Project Statistics' Interface | 37 |
| Figure 26: Inspecting the 'Project Statistics' Interface when there are no stored projects in the system | 39 |
| Figure 27: Verifying the available workforce in the 'Project Statistics' Interface when there are no saved projects in the system | 40 |
| Figure 28: Inspecting 'Project Statistics' Interface when there are on-hold projects in the system | 40 |
| Figure 29: Inspecting 'Project Statistics' Interface when there are Completed Projects in the system | 40 |
| Figure 30: When adding a new project in the 'Project Statistics' Interface | 40 |

CHAPTER 01 - INTRODUCTION

1.1 Problem Domain

XYZ Construction Company, a leading construction company in Sri Lanka focuses on executing large housing construction projects. The company is planning to streamline their project management processes by developing a user-friendly Information System that mainly records the details of their new projects, ongoing projects and the completed projects. The ultimate goal is to manage the complete details of their projects efficiently and to have an easy access to the recorded details of the XYZ Company projects, ensuring a flawless communication with the clients which will helps to expand the company to a higher level in construction side in Sri Lanka.

1.2 Project Scope

The scope of this assignment can be categorized into in-scope which contains the inclusions of the assignment and out scope which contains exclusions if the assignment.

1.2.1 In scope

The in-scope of the assignment can be described as follows.

- Design and implement a user-friendly interfaces for easy system access.
- This assignment is focusing on the recording the essential details of a new project which can be removed or updated, including the Project code, Client's Name, Start Date, Expected end date, Number of workers working in the project, Project status (Ongoing, On hold, or Completed) in the system by developing individual interfaces for the Adding, Removal and Updating of project details.
- This assignment is focusing on the program to check for available workforce for a new project by comparing with the user required number of workers for a new project.
- Designing an individual interface to add new workers to the available workforce.
- Recording completed projects by including the actual end date with the recorded details for a new project.
- Overall statistics of the Ongoing and Completed projects is focused in this assignment.

1.2.2 Out scope

The out scope of the assignment can be described as follows.

- The system will mainly focused on data recording and advanced data recording and analyzing functions are excluded in this assignment.
- The system will not be considering the financial aspects on the XYZ company projects.

1.3 Problem Definition

As mentioned above, the primary objective is to record, organize, and retrieve the required details related to a project based on the 'Project Code' which is a unique code given for projects individually. In addition, the system aims to maintain a record of the workforce available for new projects. The Information System aims to have a comprehensive records of the ongoing, on hold, and completed projects through a Main menu which collects the required details by allowing access to sub interfaces using an integer choice of one to six from the user.

The Main menu is focused primarily on,

1. Recording the details of a new project.
2. Removing a completed project from the existing project.
3. Adding new workers to available workers for a new project.
4. Update details on ongoing projects.
5. Project statistics.
6. Exiting the menu.

The following Table1 explains the details of the Main menu mentioned in the case study.

| Main menu choices | Details |
|--|--|
| Recording the details of a new project | The Project code, Client's Name, Start date, Expected end date , Number of workers working in the project, Project status (ongoing, on hold, or completed) are to be taken from the user in order. When inputting zero 0 as the project code, the user should exit from the interface. When inputting the number of workers, the system should be able to consider the number of workers available to work for the new project. If the number of workers available are greater than the number of workers entered by user, the program should run and continue to the next input; Project status. In the end, the user is given with a choice of saving the entered project details or cancelling the entered project details. |

| | |
|---|--|
| Removing a completed project from the existing project. | When the project code is entered by the user, the user is given with a choice of removing the project relevant to the project code. Depending on the user's choice of removing, the details of the relevant project will be removed from ongoing projects and the removed details must be added to completed projects including the actual end date. |
| Adding new workers to available workers for a new project | The new workers will be added to the available workers for a new project through an individual interface. With the choice of the user, the saving of the entered new workers will be executed or cancelled. |
| Update details on ongoing projects | The new details of a project should be replaced with the old details of the project with the user's choice of saving or cancelling. When zero is entered for project code, the user should exit from the interface. |
| Project statistics | The overall amount of ongoing, on hold, and completed projects should be displayed to the user for inputting along with the numbers of available workers to assign. The interface should display the choice to add a new project. |
| Exit | With the exit command given by the user, the program should be stopped. |

Table 1: Main menu details

1.4 Problem Statement

XYZ is a leading construction company in Sri Lanka. It undertakes large housing construction projects through clients. The company is planning to have an information system which holds the details of all the ongoing projects, the details of completed projects, and the number of workers available to assign to new projects. The system should check the available workers before taking a new project and when a new project is taken, it will be assigned to ongoing projects with the details. When an ongoing project is completed, it will be removed from ongoing projects and will be assigned to completed project

CHAPTER 02 - STRUCTURAL ANALYSIS

2.1 Identified Problems and the Solutions in Case Study Analysis

In the case study the following problems were identified and following solutions were taken.

1. Number of available workers were not mentioned in the case study to check with the user entered workers for a new project. Number of available workers were assigned as thousand (1000) workers as a solution. Conditions for checking the entered number of workers with the available workers were created based on thousand available workers.
2. The case study has mentioned to assign the details from the new project interface to ongoing projects. But for the project status, the three options ongoing/ on hold / completed were mentioned. As a solution, a condition to check the projects status was added to the new project interface.
3. The case study has not mentioned about the on hold projects but for the project statistics interface, the number of on hold projects were asked to be mentioned in the interface. As a solution, in the update project details interface, according to the status chosen by the user (ongoing/ on hold/ completed), the program were created with a condition to update the details and move to on hold projects or completed projects or ongoing projects.

2.2 Data Structure Used In the System

As discussed in CHAPTER 01, the Main menu consists of six options with the exit choice to the user. This means five sub interfaces should be created in order to store the required details in each sub interface. To take the required inputs from the five interfaces and to store the taken inputs, python lists and python variables has been used. List is a built-in-data type used in python for data collection storage. Furthermore, Lists are used to store multiple items in a single variable. The reason for using lists for this Information system is due to the ordered and changeable nature and the ability to store any data type in them. For taking dates, python modules and constants has been used. For the separate interfaces, python functions has been used.

2.2.1 Functions

To create six interfaces including the main menu interface and the program end, seven functions has been used. A Function for exiting program was created for easy looping inside the functions. The created functions are mentioned below.

| Choice Number from Main menu | Interface | Function created |
|------------------------------|---|------------------|
| | Main menu interface | main_menu() |
| 1 | Adding new project interface | new_project() |
| 2 | Removing completed project interface | remove_project() |
| 3 | Adding new workers interface | new_workers() |
| 4 | Updating project details interface | update_details() |
| 5 | Displaying project statistics interface | statistics() |
| 6 | Exit the program | program_end() |

Table 2: Functions used for the program

2.2.2 Variables

To get the details and to assign values, variables were used.

| Choice Number from the Main menu | Interface | Variables created | Reason |
|----------------------------------|------------------------------|---------------------|---|
| | Main menu interface | choice=0 | To get user choice between 1 to 6 |
| 1 | Adding new project interface | available =1000 | Available number of workers not mentioned in case study to check with the number of workers entered by user |
| | | project=[] | To get the project code |
| | | name=[] | To get the client's name |
| | | start_date_input=[] | To get the start date |
| | | end_date_input=[] | To get the expected end date |
| | | workers=0 | To get the required number of workers for the project |
| | | status=[] | Project status(ongoing/ on hold/completed) |
| | | save=0 | Choice of saving the project (Yes/No) |

| | | | |
|---|---|---------------------|---|
| 2 | Removing completed project interface | remove=0 | Choice of removing the project entered (Yes/No) |
| | | actual_date_input=0 | To get the actual end date |
| 3 | Adding new workers interface | workers_add=0 | To get the amount of workers to add |
| | | add=0 | Choice of adding of newly entered number of workers to the available workers (Yes/No) |
| 4 | Updating project statistics interface | n_name=0 | To get the name to be updated |
| | | n_start_date=0 | To get the start date to be updated |
| | | n_end_date=0 | To get the expected end date to be updated |
| | | n_workers=0 | To get the number of workers to be updated |
| | | n_status=0 | To get the project status to be updated |
| 5 | Displaying project statistics interface | add_project=0 | Choice for the user to add a new project (Yes/No) |

Table 3: Variables used in the program

2.2.3 Lists

Three main lists were created to store, move and update the empty lists.

1. 'ongoing_projects' – to record the details of ongoing projects
2. 'hold'- to record the details of on hold projects
3. 'completed'- to record the details of completed projects

2.2.4 Module Imports

To get correct start date, expected end date and actual end date, Python Datetime Module; an inbuilt module which provides classes to work with dates, time and time intervals was used. Datetime module provides 6 different classes to work with date and time. From the Datetime Module, datetime class was imported at the beginning for the program.

After importing datetime class, a variable date_format was assigned as 'date_format = "%d-%m%Y"' to take any date in the program according to DD-MM-YYYY format.

To change the user entered string into the above format, python strptime() method was used. The strptime() method change the string into the Datetime object as per the code given above.

| Format Code | Meaning of Format Code | Example for Format Code |
|-------------|---|--|
| %d | Day of the month as a whole number from 01-31 | 31 st of January 2023 as 31-01-2023 (DD-MM-YYYY) |
| %m | Month as a number | |
| %Y | Full version of the year | |

Table 4: Format codes used in datetime class

2.3 Control Structures Used in the System

To create a program that functions according to the criteria given in the case study, following control structures were used.

2.3.1 Sequential Structure

The code is executed line by line in a sequential order.

2.3.2 Selection Structure

Used in places where the condition checking done by 'if', 'elif', 'else' statements. Some instances where the selection structures have been used are given below.

- In the 'new_project ()' function for checking the status of a new project.
- In the 'update_details ()' function for checking the status and taking different actions based on it.
- In the 'statistics ()' function for deciding whether to add a new project or not.

2.3.3 Iteration Structure

'while' loops were used for iteration. Some places where the iteration structures have been used are given below.

- In the 'main_menu ()' function for repeatedly prompting the user for a valid menu choice.
- In the 'remove_project ()' function for handling user input until a valid response is received.
- In the 'new_workers ()' function for prompting the user until a valid response is received.

2.3.4 Invocations of Functions

Functions are called to perform specific tasks which enhances the readability. Functions mentioned in Table 2 were used.

2.3.5 List Manipulations

Lists ('ongoing_projects', 'hold', 'completed') were used to store and manipulate project-related data.

2.3.6 Exception Handling

'try', 'except' and 'break' statements are used for handling exceptions in user input.

CHAPTER 03 – CODE INSIGHT

3.1 Solution Description

The aim of this case study is to create a user-friendly interface that provides a solution for the problem described in CHAPTER 01 .The system should provide functionalities such as adding new project, removing completed projects, adding new workers, updating project details and viewing project statistics. Below is a detailed description of the designed solution and the algorithm for the solution.

Additional Considerations:

1. Proper use of global variables to share data across different functions.
2. Implementing error handling mechanisms to maintain system's reliability.
3. Importing Datetime module enhance date processing capabilities.

3.1.1 Main Menu

The system starts with a main menu displaying to the user offering six options. The numerical choices starting from one and ending from six are assigned for the six options chronologically. User is able to navigate through the system by inputting numerical choices corresponding to the desired operation. Based on the choice given by the user, the options are shown separately to user with an ability to input required details in each option. After inputting the details, the user is given with a choice to save the details or cancel the save process.

The six options are,

1. Add a new project
2. Remove a completed project
3. Add new workers
4. Update project details
5. View project statistics
6. Exit

3.1.2 Adding a New Project

- User can input project details, including a unique project code, client's name, start date, expected end date, number of workers required and project status.

- The system should validates inputs, ensuring the project code is an integer, date inputs are in the correct datetime format, and workers' count is a non-negative integer and not a string.
□ Adequate error handling is implemented to guide user in case of invalid inputs.
- If available workers are sufficient, the system will give the user two choices which is saving the new project or cancelling the new project. If available workers are not sufficient, the user will return to the main menu.
- After saving the new project, the saved new project should be assigned to the completed projects. After saving or cancelling process, the system should run again which is getting project code and other details. If only the project code is entered as zero, the system will return the user to main menu.

3.1.3 Removing a Completed Project

- User can remove a completed project by inputting the project code and the actual end date.
- The system should validates inputs, ensuring the project code is an integer, the actual end date is in the correct datetime format.
- The system should check whether there are any ongoing projects to remove. If there are any ongoing projects, the system should give the user to enter the Project code, actual end date and the choice to remove the project; otherwise, the user should be notified that there are no ongoing projects to remove.
- The system should calculate whether the project is completed before, on or after the expected end date and remove the project from the ongoing projects and assigned it to the completed projects.
- The number of workers should be released and should be added with available workers.
- When assigning the project from ongoing projects to completed projects, the project status should change to 'completed'.
- After saving or cancelling process, the system will return the user to main menu.

3.1.4 Adding New Workers

- The users can increase the number of available workers by specifying the number of workers to add.
- The system should validate workers' count is a non-negative integer and not a string

- After saving or cancelling process, the system should add the entered number of workers to available workers and return the user to main menu.

3.1.5 Updating Project Details

- Users can modify the details of ongoing projects by giving the user an ability to enter client's name, start date, expected end date, number of workers and project status.
- The system should validate inputs, and updates the details accordingly. If the project status is changed to "on hold", the project is moved to the on hold projects list; if changed to "completed", the user is directed to removal process (choice 2- Remove Completed Project)
- After saving or cancelling process, the user should be redirected to main menu.

3.1.6 Project Statistics

- User can view statistics, including number of ongoing projects, completed projects, on hold projects, and available workers.
- Optionally, user can add a new project directly from the statistics interface and user is redirected to add new project interface (choice 1).

3.1.7 Exit

- User can choose to exit the system, ending the program.

3.2 Algorithm Designed for the Solution

As outlined in 3.1, an algorithm was formulated to develop a program meeting the requirements of the case study. The algorithm is presented below. For enhanced comprehension, the variables and functions employed to develop the program are highlighted in bold.

1. Start the program.
2. Display main menu interface ('**main_menu()**') with options numbered from 1 to 6
3. Prompt the user to input their choice ('**choice**')
4. Validate the user's input and set the 'choice' variable accordingly.
 - 4.1. Check if the input is an integer between 1 and 6; if not, display an error message and repeat step 4 until a valid choice is made.

- 4.2. If the input is an integer between 1 and 6, execute the function corresponding to the chosen option.
5. Repeat the main menu loop until the user chooses to exit.
6. If the user inputs the choice as '1', navigate the user to 'Add New Project' interface
 - 6.1. Display Add New Project interface. (**'new_project()'**)
 - 6.2. Display company header and instructions (Enter '0' to Project code to exit) for adding a new project.
 - 6.3. Prompt user input for the project code (**'project'**)
 - 6.3.1. Check if the input is an integer; if not, display an error message and repeat step 6.3.
 - 6.3.2. If the project code is 0, go to step 2.
 - 6.4. Request user input for the client's name(**'name'**)
 - 6.5. Prompt user input for the project start date (**'start_date_input'**) and expected end date (**'end_date_input'**).
 - 6.5.1. Ensure the expected end date is after the start date.
 - 6.6. Prompt user input for the required number of workers (**'workers'**)
 - 6.6.1. Validate the required number of workers is a non-negative integer; if not, display an error message and repeat step 6.7.
 - 6.7. Check if the required number of workers available
 - 6.7.1. If not, display an error message and go to step 2.
 - 6.7.2. If available, update the available workers (**'available'**) count by using the formula:
$$\text{available workers} = \text{available workers} - \text{required number of workers}$$
 - 6.8. Prompt user input for the project status (**'status'**)
 - 6.8.1. Ensure the status is "ongoing" as a new project cannot be on hold or completed.
 - 6.9. Prompt user input to save or cancel the project (**'save'**)
 - 6.9.1. If "yes", append project details to ongoing projects (**'ongoing_projects'**) and display a message to user about the project addition. Afterward, repeat from step 6.1 until the project code (**'project'**) entered as '0'.

- 6.9.2. If “no”, display a cancellation message and repeat from step 6.1 until the project code is entered as ‘0’.
- 6.9.3. If neither “yes” nor “no”, display an error message and repeat step 6.10.
- 7. If the user inputs the choice as ‘2’, navigate the user to ‘Remove Completed Project’ interface
 - 7.1. Display Remove Completed Project interface (**‘remove_project()’**).
 - 7.2. Display company header and instructions for removing a completed project.
 - 7.3. Check if ongoing projects exist; if not, display an error message and go to step 2.
 - 7.4. Request user input for the project code (**‘code’**)
 - 7.4.1. Check if the input is an integer; if not, display an error message and repeat from step 7.4.
 - 7.4.2. Check if the entered project code exists in the ongoing projects (**‘ongoing_projects’**)
 - 7.4.2.1. If not, display an error message and go to step 2.
 - 7.5. Prompt user input to confirm or cancel the project removal (**‘remove’**)
 - 7.5.1. If “yes”, proceed with the removal.
 - 7.5.2. If “no”, display a cancellation message and go to step 2.
 - 7.5.3. If neither “yes” nor “no”, display an error message and repeat from step 7.5.
 - 7.6. Prompt user input to actual completion date(**‘actual_date_input’**)
 - 7.6.1. Determine if the project completed after, on, or before the expected end date.
 - 7.7. Update the project status to “completed”.
 - 7.8. Append the project details to completed projects (**‘completed’**) list.
 - 7.9. Delete the project details from ongoing projects (**‘ongoing_projects’**) list
 - 7.10. Update the available workers (**‘available’**) count by using the following equation:
available workers = available workers +required number of workers.
 - 7.11. Display a message to the user about the removal of the project.
 - 7.12. Go to step 2.
- 8. If the user inputs the choice as ‘3’, navigate the user to ‘Add New Workers’ interface
 - 8.1. Display Add New Workers interface (**‘new_workers()’**)
 - 8.2. Display the company header and instructions for adding new workers.

- 8.3. Prompt the user input for the number of workers to add (**'workers_add'**).
- 8.4. Prompt user input to confirm or cancel worker addition (**'add'**).
 - 8.4.1. If "yes", proceed with addition.
 - 8.4.2. If "no", display a cancellation message and go to step 2.
 - 8.4.3. If neither "yes" nor "no", display an error message and repeat from step 8.4.
- 8.5. Update the count of available workers (**'available'**) by using the following equation:
$$\text{available workers} = \text{available workers} + \text{number of workers to add ('workers_add')}$$
- 8.6. Display the updated count of available workers.
- 8.7. Go to step 2.
9. If the user inputs the choice as '4', navigate the user to 'Update Project Details' interface
 - 9.1. Display Update Project Details interface (**'update_details()'**).
 - 9.2. Display the company header and instructions for Updating Project Details.
 - 9.3. Check if ongoing projects exist; if not, display an error message and go to step 2.
 - 9.4. Prompt user input for the project code(**'project'**)
 - 9.4.1. Check if the input an integer; if not, display an error message and repeat from step
 - 9.4.2. If the project code is 0, go to step 2.
 - 9.4.3. Check if the entered project code exists in the ongoing projects (**'ongoing_projects'**) list.
 - 9.4.3.1. If not, display an error message and go to step 2.
 - 9.5. Prompt user input for update project details: client's name (**'n_name'**), start date (**'n_start_date'**), expected end date (**'n_end_date'**), number of workers (**'n_workers'**) and status (**'n_status'**)
 - 9.6. Check if the required number of workers are available
 - 9.6.1. If not, display an error message and repeat from step 9.6
 - 9.6.2. If available, update the available workers count by adding the number of workers specified in the project list entered under the project code

- (**'project'**) and afterward, subtract the newly entered number of workers(**'n_workers'**) from available workers (**'available'**) .
- 9.7. Update the details of the specified project in the ongoing projects (**'ongoing_projects'**) list.
 - 9.8. If the status is “ongoing”, update details directly.
 - 9.9. If the status is “on hold”, move the project details to on-hold projects (**'hold'**) list.
 - 9.10. If the status is “completed”, go to step 7.1 (**'remove_project()'**)
 - 9.11. Display a message to user about the update process and repeat step 9.1 until the project code (**'project'**) entered as '0'
 10. If the user inputs the choice as '5', navigate the user to 'Project Statistics' interface.
 - 10.1. Display Project Statistics Interface (**'statistics()'**).
 - 10.2. Display company header and statistics related to ongoing projects, on-hold projects, completed projects and available workers.
 - 10.3. Prompt user input to add a new project(**'add_project'**)
 - 10.3.1. If “yes”, return to step 6.1 (new project function(**'new_project()'**))
 - 10.3.2. If “no”, break the loop and return to step 2 (**'main_menu()'**)
 11. If the user inputs the choice as '6', exit the program.
 12. End.

CHAPTER 04 –TESTING

4.1 Objectives and Goals of Testing

The main usage of using the testing phase is to confirm the functionality of the code that had been created based on the designed solution and the considered requirements mentioned in the case study. The key goals of the testing and their objectives are given below.

1. Satisfying the functional requirements mentioned in the case study.
2. Detect the system bugs and loopholes of the created code.
3. To make some further improvements according to the test results that were gathered during the testing phase.

4.2 Testing Criteria

The testing criteria are mainly going through satisfying test cases that were made for the testing phase which is to analyze the performance and the functionality of this system. The results of those test cases will be how this system performs to the desired standard and will be determined by the test case evaluation's overall result.

4.3 Test Cases for Main Menu Interface

| Test Case Number | Description of the Test Case | Action | Expected Outcome | Actual Outcome | Pass/Fail status |
|------------------|--|--------------------------------------|---|---|------------------|
| 01 | Verifying the transition from the Main menu interface to the 'Add New Project' interface | User inputting '1' as their choice. | User is to be directed to the interface for adding a new project when inputting '1' | User was redirected to add new project interface after pressing 1 | Pass |
| 02 | Presenting an error message to the user if a negative integer | The user inputting a randomly chosen | The system is expected to exhibit a clear error message | The system presented a clear error message, specifying the | Pass |

| | | | | | |
|----|---|---|--|--|------|
| | is entered as their choice | negative integer (-1523) as their selection | to the user, indicating the encountered issue and prompting the user to re-enter the choice. | encountered issue and prompted the user to re-enter the choice. | |
| 03 | Presenting an error message to the user in case a text (string input) is provided as the choice | User inputting a randomly chosen text (choice) as the selection | The system is expected to present an error message and prompt the user to enter a choice. | The system presented a clear error message, specifying the encountered issue and prompted the user to re-enter the choice. | Pass |
| 04 | Presenting an error message to the user when they input a numeric choice outside the valid range of 1 to 6. | User inputting two instances, 0 and 10. | The system is expected to exhibit a clear error message to the user, indicating the encountered issue and prompting the user to re-enter the choice. | The system presented a clear error message, specifying the encountered issue and prompted the user to re-enter the choice. | Pass |
| 05 | Terminating the system at the main menu. | User inputting '6' as their choice. | The user is expected to exit the system, leading to the | The user was logged out of the system | Pass |

| | | | | | |
|--|--|--|-----------------------------|--|--|
| | | | termination of the program. | | |
|--|--|--|-----------------------------|--|--|

Table 5: Test Cases for Main Menu Interface

4.3.1 Testing Results Snapshots

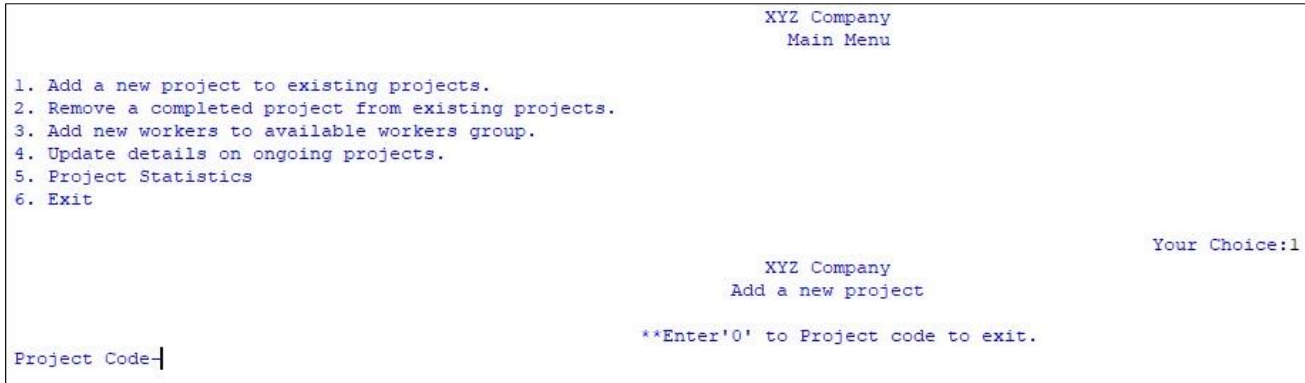


Figure 1: Navigation: Main Menu redirecting to Add New Project interface

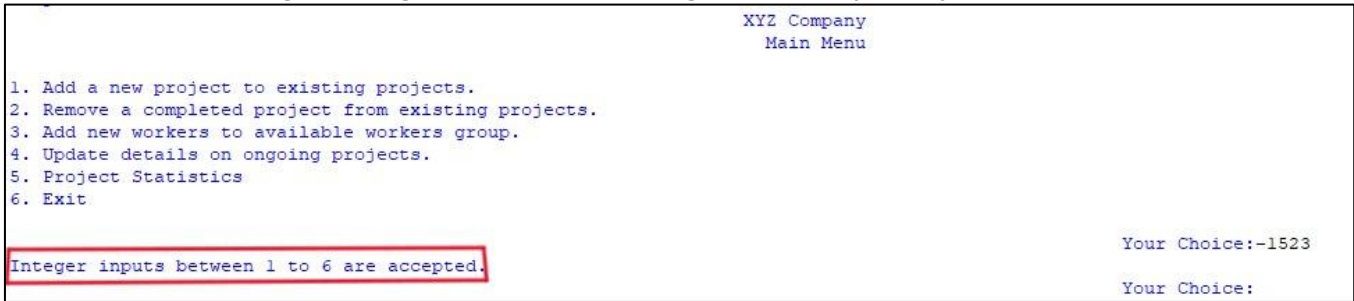


Figure 2: Error Message: Handling Negative Integer Input in Main Menu Choice

In the Figure 2, for a randomly chosen negative integer (-1523), the system generated an error: ‘Integer inputs between 1 to 6 are accepted’. The user was then prompted to re-enter a choice.

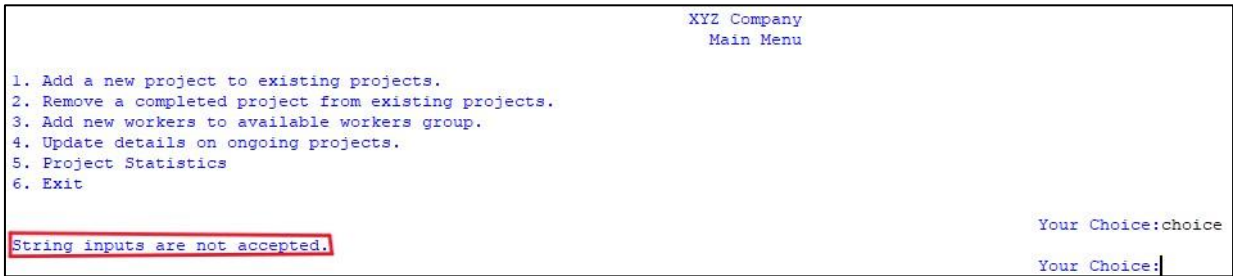


Figure 3: Error Message: String Input in Main Menu Choice

In the Figure 3, for a randomly chosen string input (choice), the system generated an error: ‘String inputs are not accepted’. The user was then prompted to re-enter a choice.

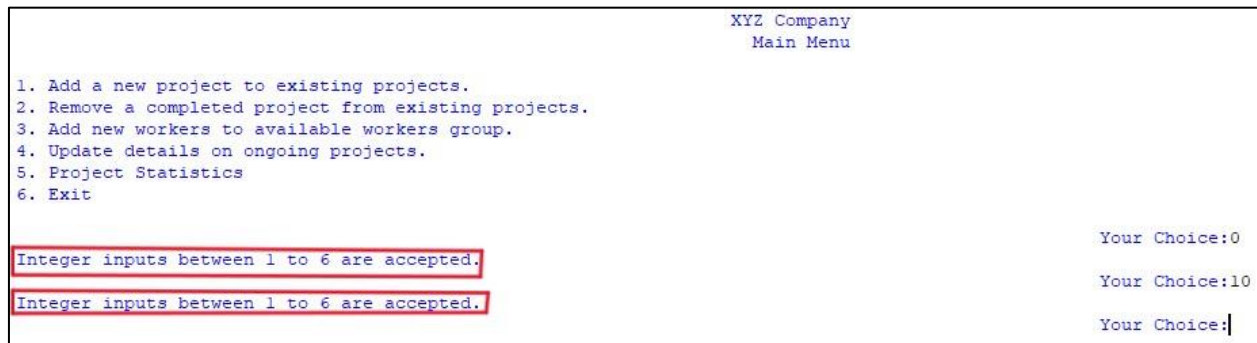


Figure 4: Error Message: Numeric Choice Out of Range (1-6)-Main Menu

In Figure 4, the entry of numbers 0 and 10, which fall outside the valid range of 1 to 6, resulted in an error message: ‘Integer inputs between 1 to 6 are accepted’. Afterward, the user was prompted to re-enter a valid choice.

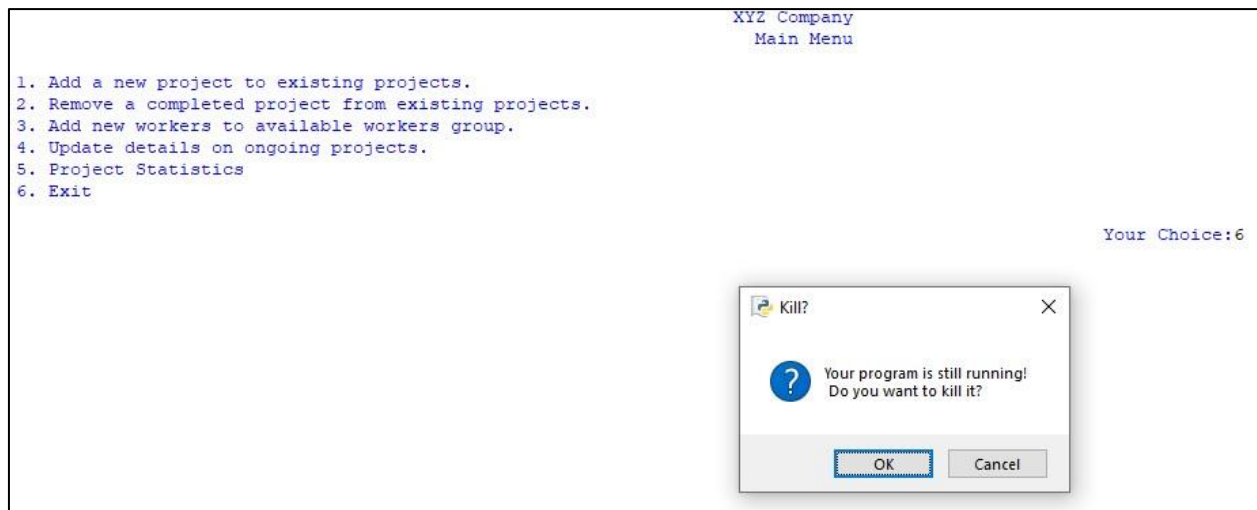


Figure 5: Exiting the System from the Main Menu

4.4 Test Cases for Add New Project Interface

4.4.1 Temporary Interface Modifications for Test-Phase

Interface adjustments were introduced to confirm test case results and evaluate the program's smooth operation without errors, involving temporary modifications in the following areas:

- Print statements were implemented to verify the storage of inputs in the ongoing projects list.
- A print statement was applied to validate the computation of remaining available workers following the input of the worker count.

```

ongoing_projects.append(workers)
ongoing_projects.append(status)
print("Ongoing project details:",ongoing_projects)
print("Remaining Available workers:",available)
print("Project", project, "saved Successfully.")
return new_project()
elif save == "no":
    print("Adding a new project cancelled successfully.")
    main_menu()
else: # checks an integer or other string inputs for save
    print("Only string inputs are accepted;choose from (Yes/No) options.")

```

Figure 6: Testing Modifications: 'Add New Project' Interface

4.4.2 Executing Test Cases

| Test Case Number | Test Case Description | Action | Expected Outcome | Actual Outcome | Pass/Fail status |
|------------------|---|---|--|---|------------------|
| 01 | Verifying the input of a text (string) for the project code | User inputting a randomly chosen text (code) as the selection | The system is expected to present an error message and prompt the user to input a valid project code | The system presented an error message and prompted the user to input a valid project code. | Pass |
| 02 | Capturing and storing project information in the interface. | User inputting precise details for each requested input and selected 'yes' to save the options. | The system is expected to provide a message to the user indicating that the project has been saved and afterward, return to the initial interface, enabling the user | System displayed a message to the user indicating that the project has been saved successfully and prompted a return to the initial interface for saving another project. | Pass |

| | | | | | |
|----|---|--|---|--|------|
| | | | to save another project | | |
| 03 | Confirming the availability of the required number of workers for a new project | The user inputting a request for 150 workers, which is fewer than the current available workforce. | The system is expected to inform the user regarding the availability of the necessary workers | The system displayed a message to the user, indicating the availability of the required number of workers for to assign for the project. | Pass |
| 04 | Returning to Main menu | User inputting 0 as the project code | System is expected to navigate the user back to main menu | System guided the user back to main menu | Pass |
| 05 | Verifying the start date and expected end date | User inputting an expected end date preceding the start date | The system is expected to display an error message to the user, prompting them to re-enter the date | The system displayed an error message and prompted the user to re-enter the date. | Pass |

| | | | | | |
|----|--|--|---|---|------|
| 06 | Verifying the date format for integer input | User inputting a randomly chosen numerical value (1) for the start date. | The system is expected to present an error message to the user, prompting them to enter the date in the correct format. | An error message was displayed. The user was instructed to enter the date in the correct format | Pass |
| 07 | Validating input for date as a string | User inputting a randomly chosen text (date) for the date | System should display an error message to the user and instruct to input the date in the correct format | An error message was displayed. The user was instructed to enter the date in the correct format | Pass |
| 08 | System verifying the date format | User inputting the date '11-20-2023' as the start date | The system is expected to present an error message to the user, prompting them to enter the date in the correct format. | System displayed an error message and user was prompted to re-enter the date | Pass |
| 09 | System checking for an Invalid string for the project status input | User inputting a randomly chosen string (new project) for the project status | System should display an error message and prompt the user to enter an input from the three options | System displayed an error message and prompted to re-enter the project status | Pass |

| | | | | | |
|----|--|--|---|--|------|
| 10 | System checking for the project status | User inputting 'on hold' initially and 'completed' afterwards. | The system is expected to display distinct error messages for two project statuses and prompt the user to input the project status. | The system displayed distinct error messages and prompted for reentry. | Pass |
|----|--|--|---|--|------|

Table 6: Test Cases for 'Add New Project' Interface

4.4.3 Testing Results Snapshots

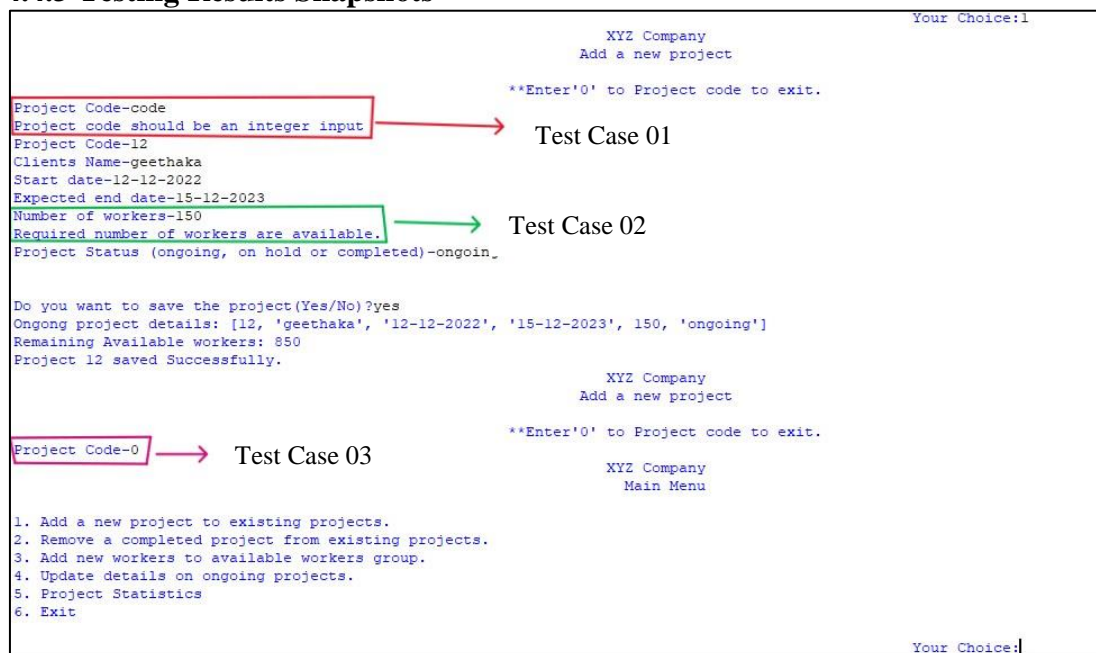


Figure 7: Saving a new project in Add New Project Interface

The above Figure 7 shows the accuracy of test case 01, 02, 03 and 04.

- Test case 01 demonstrates the system displaying a message “*Project code should be an integer input*” to the user when a string input was given to the project code. In the next line, system prompts the user to enter the project code repeatedly.
- Test Case 02 demonstrates detailed input, displaying the message ‘*Project 12 saved Successfully*’ to the user based on the entered project code. The saved details are then shown

in the Ongoing Project details list. After saving the project, the system returns to the beginning of the 'Add New Project' interface.

- Test case 03 demonstrates the system presenting a message “*Required number of workers are available*” to the user and the remaining available workers are also shown as “*Remaining Available workers: 850*”.
- Test Case 04: The user is redirected to the main menu from the 'Add New Project' interface after inputting zero as the project code.

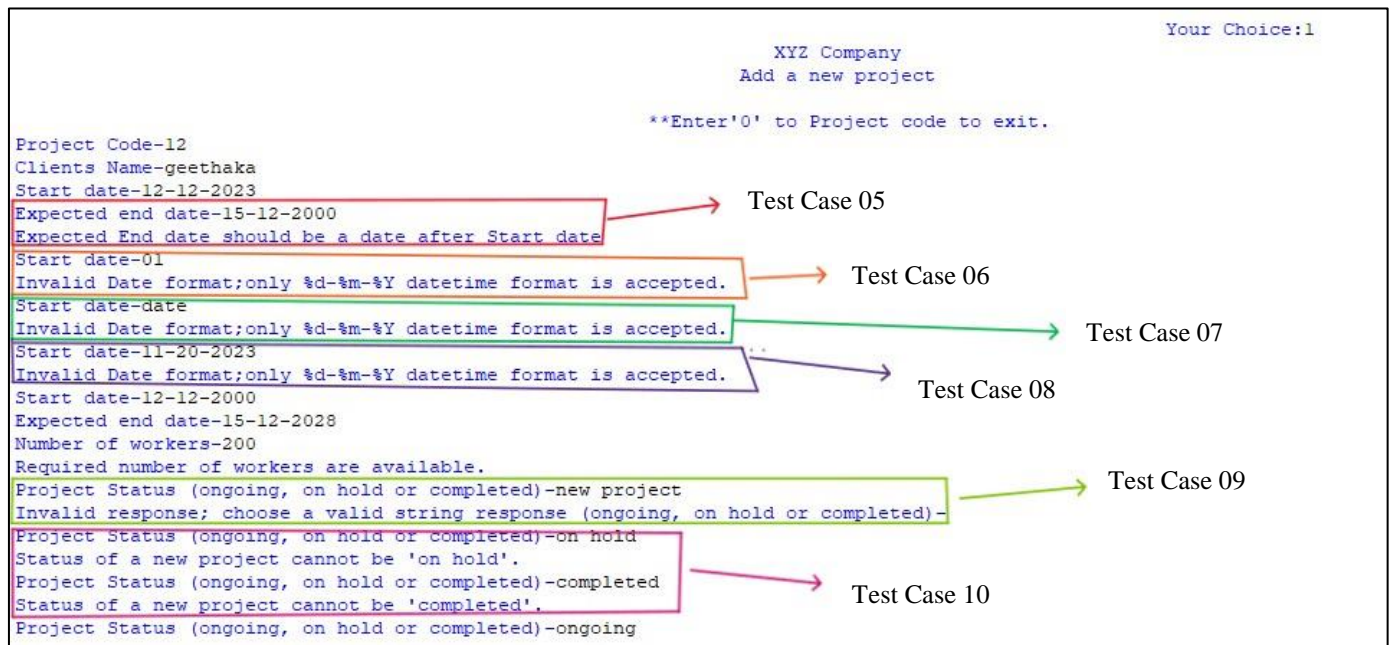


Figure 8: Date format check and Project Status check in 'Add New Project' Interface

The above Figure 8 shows,

- Test Case 05- Displays an error message “*Expected End date should be a date after Start date*” when the user enters an expected end date that precedes the start date.
- Test Case 06- Displays an error message “*Invalid date format; only %d-%m-%Y datetime format is accepted*” when the user enters an integer as the date input.
- Test Case 07- Displays an error message “*Invalid date format; only %d-%m-%Y datetime format is accepted*” when the user enters a string as the date input.
- Test Case 08- Displays an error message “*Invalid date format; only %d-%m-%Y datetime format is accepted*” when the user enters an invalid date.

- Test Case 09- Displays an error message “*Invalid response; choose a valid string response (ongoing/on hold/completed)*” when a string is entered by the user
- Test Case 10- Displays an error message: “*Status of a new project cannot be ‘on hold’*” when the user has entered ‘on hold’ as the project status for a new project and Displays an error message “*Status of a new project cannot be ‘completed’*” when the user has entered ‘completed’ as the project status.

4.5 Test Cases for Remove Completed Project Interface

Out of the below mentioned test cases, the test cases 01, 02, 03 and 04 were done using the previously saved list under the project code: 12 shown in Figure 8.

4.5.1 Temporary Interface Modifications for Test-Phase

Interface adjustments were introduced to confirm test case results and evaluate the program's smooth operation without errors, involving temporary modifications in the following areas:

- A print statement was applied to verify the reassignment of workers to the available workforce.
- Print statements were implemented to verify the removal of inputs in the ongoing projects list and to verify the assigning of project details to the completed list.

```
# assigning project details to completed projects
completed.extend([project, name, start_date_input, end_date_input, workers, status, actual_date_input])
del ongoing_projects[project_index:project_index + 6] # removing from ongoing projects
available = available + workers # releasing the workers in that project
print("Project", project, "removed from ongoing projects and added to completed projects")
print("Available workers are:",available)
print("ongoing projects:",ongoing_projects)
print("completed projects:",completed)
return main_menu()
elif remove == "no":
    print("Removing project", project, "cancelled successfully.")
    return main_menu()
else:
    print("Only string inputs are accepted;choose from (Yes/No) options.")
```

Figure 9: Testing Modifications: 'Remove Completed Project' Interface

4.5.2 Executing Test Cases

| Test Case Number | Test Case Description | Action | Expected Outcome | Actual Outcome | Pass/Fail status |
|------------------|-----------------------|--------|------------------|----------------|------------------|
| | | | | | |

| | | | | | |
|----|--|---|---|--|------|
| 01 | Verifying for the correct project code | User inputting a randomly selected number (15) as a project code. | System is expected to present an error message to the user. | System displayed an error message, prompting the user to input the correct project code. | Pass |
|----|--|---|---|--|------|

| | | | | | |
|----|---|---|---|---|------|
| 02 | Removing a project | User inputting '12' as a project code | System is expected to provide the user with the option to remove the project. | The user was provided with the option to remove the project. | Pass |
| 03 | Verifying user input for project removal. | User inputting the 'yes' option to remove the project | The system is expected to request the user for the actual end date and proceed to remove the project. | The system requested the user to enter the actual end date. Afterward, the project moved from ongoing to completed projects, and a message informed the user about the project's removal. | Pass |

| | | | | | |
|----|---|---|---|---|------|
| 04 | Verification of worker removal from the completed projects. | Initiating project removal by the user. | Following the removal process, the system is expected to allocate the workers assigned to that project back to the available number of workers. | The system successfully removed the project, notifying the user of the removal. The workers assigned to the removed project were then added to the available workforce. | Pass |
| 05 | Verifying the system output in the absence of ongoing projects. | The user inputting option 2 from the main menu choices. | The system is expected to display an error message to the user. | The system presented an error message to the user and afterwards redirected them back to the main menu." | Pass |

Table 7: Test Cases for ' Remove Completed Project' Interface

4.5.3 Testing Results Snapshots

```

XYZ Company
Main Menu

1. Add a new project to existing projects.
2. Remove a completed project from existing projects.
3. Add new workers to available workers group.
4. Update details on ongoing projects.
5. Project Statistics
6. Exit

Your Choice:2

XYZ Company
Remove Completed Project

Project Code-15
Project code: 15 not found in the ongoing projects list.
Project Code-

```

Figure 10: Error Response: Incorrect Project Code-'Remove Completed Project' Interface

```

XYZ Company
Remove Completed Project
Your Choice:2
Project Code-12
Do you want to remove the project(Yes/No)?yes
Enter the actual end date-15-12-2029
Project 12 completed after the expected end date.
Project 12 removed from ongoing projects and added to completed projects
Available workers are: 1000
ongoing projects: []
completed projects: [12, 'geethaka', '12-12-2023', '15-12-2028', 200, 'completed', datetime.date(2029, 12, 15)]
XYZ Company
Main Menu

1. Add a new project to existing projects.
2. Remove a completed project from existing projects.
3. Add new workers to available workers group.
4. Update details on ongoing projects.
5. Project Statistics
6. Exit
Your Choice:

```

Test Case 02 points to the confirmation prompt: "Do you want to remove the project(Yes/No)?yes".

Test Case 03 points to the completion message: "Project 12 completed after the expected end date."

Test Case 04 points to the available workers update: "Available workers are: 1000".

Figure 11: Removal of Completed Project

In the Figure 11,

- Test Case 03- After entering the actual end date, the system compares it with the expected end date (15-12-2028). A message displayed to user: “*Project 12 completed after the expected end date*”. Following the removal process, the user receives a message: “*Project 12 removed from ongoing projects ad added to completed projects*”. When the project is assigned to completed projects list, the project status is updated from ‘ongoing’ to ‘completed’
- Test Case 04- In the Figure 7, the input specified the need for 200 workers. Following the removal process, the system released these 200 workers, reassigning them into the available workers assign for a new project. To support this test, a temporary modification was done as mentioned in 4.5.1, resulting in the display of: “*Available workers are: 1000*”.

```

===== RESTART: C:\Users\USER\Desktop\IIT\DOC 333 Coursework report-20231659\XYZ.py =====
                                XYZ Company
                                Main Menu

1. Add a new project to existing projects.
2. Remove a completed project from existing projects.
3. Add new workers to available workers group.
4. Update details on ongoing projects.
5. Project Statistics
6. Exit

                                Your Choice:2

                                XYZ Company
                                Remove Completed Project

No saved projects;empty list

                                XYZ Company
                                Main Menu

1. Add a new project to existing projects.
2. Remove a completed project from existing projects.
3. Add new workers to available workers group.
4. Update details on ongoing projects.
5. Project Statistics
6. Exit

```

Figure 12: Testing Result: 'Remove Completed Project' Interface with No Ongoing Projects

In the Figure 12, an error message “No saved projects; empty list” is shown because the user selected choice 2 when there were no ongoing projects in the system. The system displayed the error message and redirected the user back to the main menu.

4.6 Test Cases for ‘Add New Workers’ Interface

| Test Case Number | Test Case Description | Action | Expected Outcome | Actual Outcome | Pass/Fail status |
|------------------|---|---|--|---|------------------|
| 01 | Verifying for a text (string input) for Number of workers | User inputting a randomly chosen string(workers) as input | System is expected to display an error message to the user | An error message was displayed. The system prompted the user to re-enter an integer input. | Pass |

| | | | | | |
|----|--|---|---|---|------|
| 02 | Validating the input for the number of workers to ensure it is an integer. | User providing an integer (150) as input. | The system is expected to continue adding workers to the pool of available workers. | Following the input of an integer, a prompt to add the specified number of workers was presented. | Pass |
|----|--|---|---|---|------|

| | | | | | |
|----|--|---|--|---|------|
| 03 | Verification of an integer input for the decision to include additional workers. | User providing a randomly selected integer whole number (1000) as the option. | System is expected to display an error message | An error message was displayed, prompting the user to input a valid response. | Pass |
|----|--|---|--|---|------|

| | | | | | |
|----|--|--|---|---|------|
| 04 | Verifying alternative string input for the choice to add workers or not. | User providing a randomly chosen string input (yes please) different from the specified options. | The system is expected to display an error message, prompting the user to input a valid response from the provided two options. | The user was prompted to choose a response from the provided options following the display of an error message. | Pass |
|----|--|--|---|---|------|

| | | | | | |
|----|--|---|---|--|------|
| 05 | Verifying the cancellation of the worker addition process. | The user choosing to decline the addition of workers by inputting 'No'. | The system is expected to guide the user back to the main menu. | The system presented a notification to the user regarding the cancellation and subsequently redirected to the main menu. | Pass |
|----|--|---|---|--|------|

| | | | | | |
|----|--|--|---|--|------|
| 06 | Verifying the process of saving newly added workers. | User inputting a randomly selected integer and confirmed by entering 'yes' to save the | System is expected to add the new number of workers to the available workers and afterward, inform the user of this update. | The system added more workers, informed the user, and guided the user back to the main menu. | Pass |
| | | addition of workers | | | |

Table 8: Test Cases for 'Add New Workers' Interface

4.6.1 Testing Results Snapshots

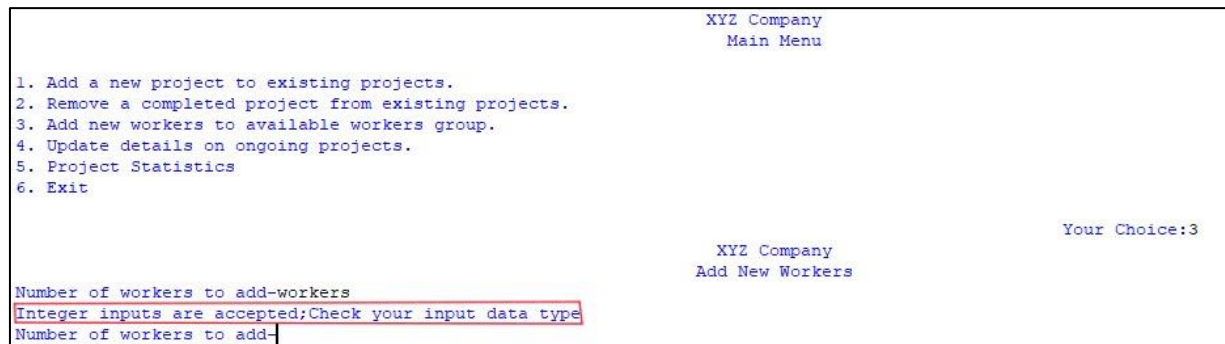


Figure 13: Providing a character instead of an integer in the 'Add New Workers' Interface

In the Test Case 01 (Figure 13), for a randomly chosen string (workers), the system generated an error: 'Integer inputs are accepted; Check your input data type'. The user was then prompted to re-enter a response.



Figure 14: Providing an integer in the 'Add New Workers' Interface

| | |
|--------------|--------------|
| Test Case 03 | Test Case 05 |
|--------------|--------------|

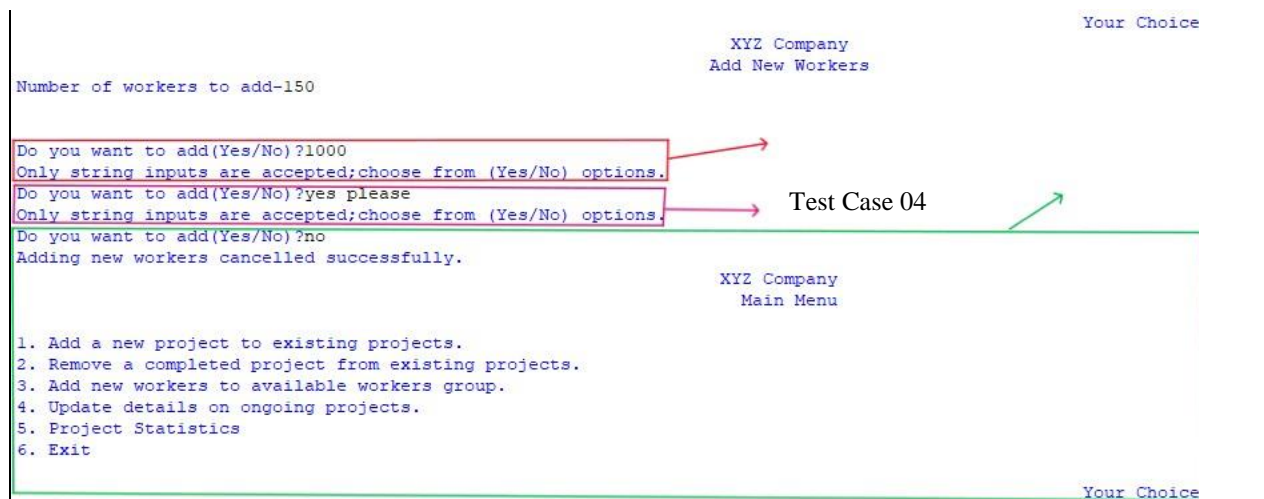


Figure 15: Conducting testing for adding new workers through the designated interface

In the Figure 15,

- Test Case 03- For a randomly chosen integer (1000), the system generated an error: *'Only string inputs are accepted; choose from (Yes/No) options.'* The user was then prompted to re-enter a response
- Test Case 04- For a randomly chosen string (yes please), the system generated an error: *'Only string inputs are accepted; choose from (Yes/No) options.'* The user was then prompted to re-enter a response.
- Test Case 05- After selecting 'no' from the two options, the user received a notification: *'Adding new workers canceled successfully.'* and was redirected to the Main Menu.

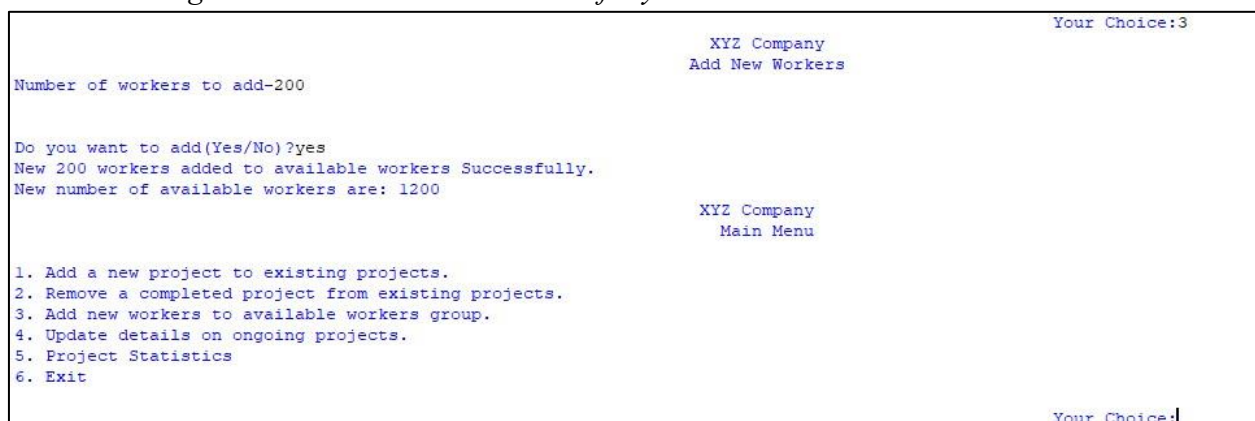


Figure 16: Incorporating Additional workers into the system

In the test case 06 (Figure 16), for a randomly entered integer (200), the system increased the available number of workers, displaying a message *'New 200 workers added successfully.'* The user was informed about the updated available workers count: *'New number of available workers:*

1200.’ Afterward, the user was redirected to the main menu.

4.7 Test Cases for ‘Update Project Details’ Interface

4.7.1 Temporary Interface Modifications for Test-Phase

Interface adjustments were introduced to confirm test case results and evaluate the program's smooth operation without errors, involving temporary modifications in the following areas:

- A print statement was applied to verify the updated available workers after re-assigning the workers in the specified project back to available workers
- A print statement was applied to validate the calculation of remaining available workers after subtracting the newly entered workers amount from the updated available workers.
- Print statements were introduced to validate the transfer of details from the ‘ongoing_projects’ list to the ‘hold’ list when the project status was specified as “on hold”.

```
elif n_status == "on hold":
    ongoing_projects[update_index + 1] = n_name
    ongoing_projects[update_index + 2] = n_start_date
    ongoing_projects[update_index + 3] = n_end_date
    available += ongoing_projects[update_index + 4]
    print("updated available workers",available)
    ongoing_projects[update_index + 4] = n_workers
    available = abs(available - n_workers)
    print("Remaining workers are",available)
    ongoing_projects[update_index + 5] = n_status

    hold.extend([project, n_name, n_start_date, n_end_date, n_workers, n_status,])
    print("on hold projects",hold)
    del ongoing_projects[update_index:update_index + 6]
    print("Details of Project", project, "updated and added to the on hold projects list successfully.")
```

Figure 17: Testing Modifications: 'Update Project Details' Interface

4.7.2 Executing Test Cases

| Test Case Number | Test Case Description | Action | Expected Outcome | Actual Outcome | Pass/Fail status |
|------------------|-----------------------|--------|------------------|----------------|------------------|
| | | | | | |

| | | | | | |
|----|--|---|--|--|------|
| 01 | Checking the scenario when there are no saved projects in the system | User inputting choice 5 in the main menu | System should display an error message and return to main menu | An error message was displayed and user was redirected to main menu | Pass |
| 02 | When incorrect project code is entered | User inputting a randomly selected integer as a project code which is not | System should display an error message and should ask the user to reenter the project code | Error message was shown o user and asked to re-enter the project code | Pass |
| | | saved in the system | | | |
| 03 | Changing the project status to on hold | Inputting on hold for the project status input | The project should be removed from ongoing projects and should be assigned to onhold projects and user should be notified about this | Project was removed from the ongoing projects and assigned to on hold projects and user was notified | Pass |
| 04 | Changing the project status to completed | Inputting completed for the project status input | The user should be redirected to remove completed project interface | The user was notified about the reason and redirected to completed project interface | Pass |

| | | | | | |
|----|---|--|---|--|------|
| 05 | Checking for the Number of workers updating | User inputting a randomly chosen number of workers | System should Checks the entered amount with the available workers and user should be notified about it if there are available workers, then the system should update the number of workers and the available amount of workers | System checked with the available number of workers and the user was notified about the availability and then the system updated the number of workers and the available amount of workers were also updated accordingly | Pass |
|----|---|--|---|--|------|

Table 9: Test Cases for 'Update Project Details' Interface

4.7.3 Testing Results Snapshots

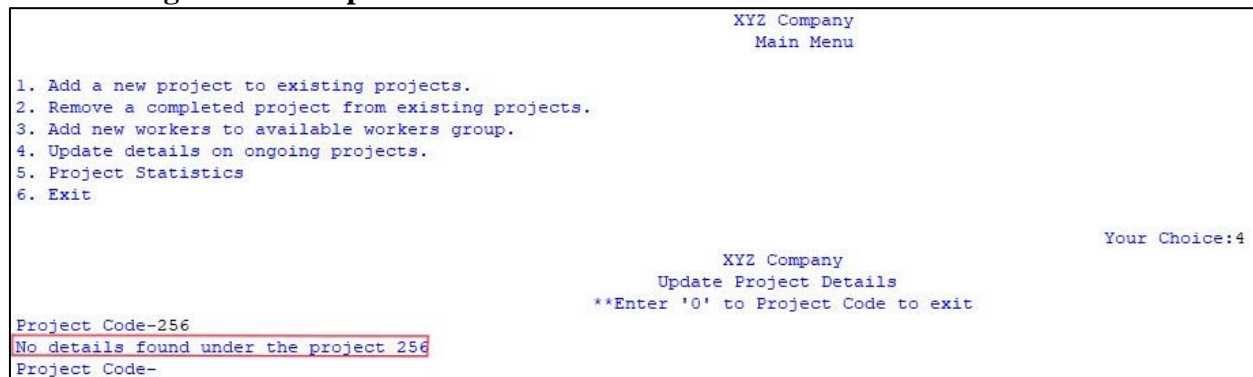


Figure 18: When an incorrect project code is entered in the 'Update Project Details' Interface

In Figure 18, an incorrect project code prompted the system error 'No details found under the project 256' requiring the user to re-enter.

```

                                XYZ Company
                                Update Project Details
                                **Enter '0' to Project Code to exit
Your Choice:4

Project Code-256
No details found under the project 256
Project Code-12
Details found under the project 12
Clients Name-sankalpa
Start date-01-01-2024
Expected end date-20-12-2028
Number of workers-350
Required number of workers are available.
Project Status (ongoing/on hold/completed)-on hold

Do you want to save the project(Yes/No)_?yes
updated available workers 1000
Remaining workers are 650
on hold projects [12, 'sankalpa', '01-01-2024', '20-12-2028', 350, 'on hold']
Details of Project 12 updated and added to the on hold projects list successfully.
                                XYZ Company
                                Update Project Details
                                **Enter '0' to Project Code to exit

No project details found;No saved projects.

                                XYZ Company
                                Main Menu

1. Add a new project to existing projects.
2. Remove a completed project from existing projects.
3. Add new workers to available workers group.
4. Update details on ongoing projects.
5. Project Statistics
6. Exit

Your Choice:|

```

Figure 19: Modifying the project status to 'on hold' within the 'Update Project Details' Interface

In Figure 19, after providing the correct project code (12), the system displayed the message 'Details found under the project 12'. Afterward, the user was prompted to enter the necessary details for updating. After inputting the project status as 'on hold' and choosing to save the project, the system updated the details, removed the project from ongoing projects, and assigned it to the on-hold projects. The user received a message confirming the successful update: 'Details of project 12 updated and added to the on-hold projects list successfully.' To further verify testing, in accordance with the aforementioned temporary modifications, the system presented the on-hold projects list with the updated project details: 'on hold projects [12, 'sankalpa', '01-01-2024', '2012-2028', 350, 'on hold']'

After transferring the project to the on-hold projects list, the system, recognizing that only one project (project 12) was retained in the ongoing projects list, subsequently directed the user back to the main menu due to the absence of ongoing projects in the system.

```

XYZ Company
Update Project Details
**Enter '0' to Project Code to exit

Project Code-256
No details found under the project 256
Project Code-12
Details found under the project 12
Clients Name-sankalpa
Start date-01-01-2024
Expected end date-20-12-2028
Number of workers-350
Required number of workers are available.
Project Status (ongoing/on hold/completed)-on hold

Do you want to save the project(Yes/No)_?yes
updated available workers 1000
Remaining workers are 650
on hold projects [12, 'sankalpa', '01-01-2024', '20-12-2028', 350, 'on hold']
Details of Project 12 updated and added to the on hold projects list successfully.

```

Figure 20: Verification of the worker count update in the 'Update Project Details' Interface

In the Figure 20, following the temporary modifications, the system presented a notification stating 'Updated available workers 1000' after incorporating the specified number of workers (200Project 12) into the available workforce. As there was only one project was saved in the system (project 12), the available workers were subsequently reset to their original count of 1000. Later on, the system indicated 'Remaining workers are 650' after adjusting the workforce by subtracting the newly entered number of workers (350) from the available number of workers.

```

Number of workers-200
Required number of workers are available.
Project Status (ongoing/on hold/completed)-completed
The project 12 should move to completed projects list.

XYZ Company
Remove Completed Project

Project Code-

```

Figure 21: Modifying the project status to 'completed' within the 'Update Project Details' Interface

In Figure 21, after inputting the project status to 'completed' and choosing to save the project, the system presented the message 'The project 12 should move to completed projects list.' Afterward, the user was redirected to the 'Remove Completed Projects' Interface. This message conveyed to the user that the project needed to be transferred from the ongoing projects list to the completed projects list.

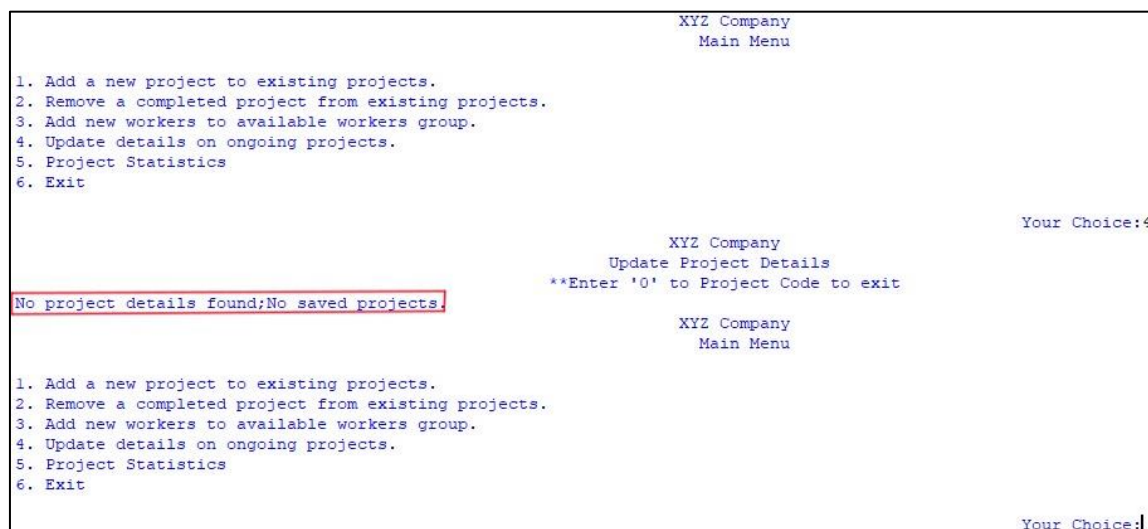


Figure 22: Testing Outcome: 'Update Project Details' Interface with No Ongoing Projects in the system

In the Figure 22, an error message “No project details found; No saved projects” is shown because the user selected choice 4 when there were no ongoing projects in the system. The system displayed the error message and redirected the user back to the main menu.

4.8 Test Cases for 'Project Statistics' Interface

4.8.1 Ready for Test Case 03 and Test Case 04

To execute test cases 03 and 04, three projects were recorded in the system with the project status set to 'ongoing'. The specifics of these three projects are outlined below

| First Project | | Second Project | | Third Project | |
|-------------------|------------|-------------------|------------|-------------------|---------------|
| Project Code | 10 | Project Code | 20 | Project Code | 30 |
| Name | geethaka | Name | sankalpa | Name | karunathilaka |
| Start Date | 12-12-2023 | Start Date | 12-10-2026 | Start Date | 20-05-2022 |
| Expected End Date | 15-12-2023 | Expected End Date | 15-12-2028 | Expected End Date | 12-10-2023 |
| Workers | 200 | Workers | 150 | Workers | 300 |
| Project Status | 'ongoing' | Project Status | 'ongoing' | Project Status | 'ongoing' |

Table 10: Ready for Test Cases 03 and 04 in 'Project Statistic' Interface


```

XYZ Company
Add a new project

**Enter'0' to Project code to exit.

Project Code-10
Clients Name-geethaka
Start date-12-12-2023
Expected end date-15-12-2023
Number of workers-200
Required number of workers are available.
Project Status (ongoing, on hold or completed)-ongoing

Do you want to save the project(Yes/No)?yes

```

Figure 23: First project setup for executing Test Cases 03 and 04 in the 'Project Statistics' Interface

```

XYZ Company
Add a new project

**Enter'0' to Project code to exit.

Project Code-20
Clients Name-sankalpa
Start date-12-10-2026
Expected end date-15-12-2028
Number of workers-150
Required number of workers are available.
Project Status (ongoing, on hold or completed)-ongoing

Do you want to save the project(Yes/No)?yes

```

Figure 24: Second project setup for executing Test Cases 03 and 04 in the 'Project Statistics' Interface

```

XYZ Company
Add a new project

**Enter'0' to Project code to exit.

Project Code-30
Clients Name-karunathilaka
Start date-20-05-2022
Expected end date-12-10-2023
Number of workers-300
Required number of workers are available.
Project Status (ongoing, on hold or completed)-ongoing

Do you want to save the project(Yes/No)?yes

```

Figure 25: Third project setup for executing Test Cases 03 and 04 in the 'Project Statistics' Interface

4.8.2 Executing Test Cases

| Test Case Number | Test Case Description | Action | Expected Outcome | Actual Outcome | Pass/Fail Status |
|------------------|-----------------------|--------|------------------|----------------|------------------|
|------------------|-----------------------|--------|------------------|----------------|------------------|

| | | | | | |
|----|--|---|--|---|------|
| 01 | Checking the scenario when there are no saved projects in the system | User selecting choice 5 from the main menu | The project statistics interface should be presented, showing zero counts for ongoing, on hold and completed projects. | User was navigated to the Project Statistics interface, displaying zero counts for ongoing, on-hold and completed projects. | Pass |
| 02 | Presenting the workforce availability in the absence of any saved projects in the system | User selecting choice 5 from the main menu | The current available workforce should be displayed as 1000 | The available workforce was presented as 1000 | Pass |
| 03 | Checking the scenario when the system contains onhold projects that have been saved | User choosing option 5 after updating the status of project 20 from 'on going' to 'on hold' in the ongoing projects list and saving the changes | The count of onhold projects is expected to display as 1, while the counts for ongoing and completed projects should appear as 2 and 0, respectively | The on-hold projects were indicated as 1, while the number of ongoing and completed projects were listed as 2 and 0, respectively | Pass |

| | | | | | |
|----|--|---|---|--|------|
| 04 | Checking the scenario when the system contains completed projects that have been saved | User choosing choice 5 after removing the project 30 from ongoing projects list and assigning it to the completed projects list | The count of oncompleted projects is expected to display as 1, while the counts for ongoing and on-hold projects should appear as 1 and 1, respectively | The completed projects were indicated as 1, while the number of ongoing and onhold projects were listed as 1 and 1, respectively | Pass |
| 05 | Checking the scenario when the user intends to add a new project | User inputting 'yes' to add a new project in the interface | The system is expected to navigate the user to the interface for adding new project. | The system guided the user to access the interface for adding a new project. | Pass |

Table 11: Test Cases for 'Project Statistics' Interface

4.8.3 Testing Results Snapshots

XYZ Company
Main Menu

1. Add a new project to existing projects.
2. Remove a completed project from existing projects.
3. Add new workers to available workers group.
4. Update details on ongoing projects.
5. Project Statistics
6. Exit

Your Choice:5

XYZ Company
Project Statistics

Number of ongoing projects- 0
Number of completed projects- 0
Number of on hold projects- 0

Number of available workers to assign- 1000
Do you want to add the project(Yes/No)?_

Figure 26: Inspecting the 'Project Statistics' Interface when there are no stored projects in the system

```

XYZ Company
Main Menu

1. Add a new project to existing projects.
2. Remove a completed project from existing projects.
3. Add new workers to available workers group.
4. Update details on ongoing projects.
5. Project Statistics
6. Exit

Your Choice:5

XYZ Company
Project Statistics

Number of ongoing projects- 0
Number of completed projects- 0
Number of on hold projects- 0
Number of available workers to assign- 1000
Do you want to add the project(Yes/No)?

```

Figure 27: Verifying the available workforce in the 'Project Statistics' Interface when there are no saved projects in the system

```

XYZ Company
Project Statistics

Number of ongoing projects- 2
Number of completed projects- 0
Number of on hold projects- 1
Number of available workers to assign- 350
Do you want to add the project(Yes/No)?

```

Figure 28: Inspecting 'Project Statistics' Interface when there are on-hold projects in the system

```

XYZ Company
Project Statistics

Number of ongoing projects- 1
Number of completed projects- 1
Number of on hold projects- 1
Number of available workers to assign- 650
Do you want to add the project(Yes/No)?

```

Figure 29: Inspecting 'Project Statistics' Interface when there are Completed Projects in the system

```

XYZ Company
Project Statistics

Number of ongoing projects- 1
Number of completed projects- 1
Number of on hold projects- 1
Number of available workers to assign- 650
Do you want to add the project(Yes/No)? yes

XYZ Company
Add a new project

**Enter '0' to Project code to exit.

Project Code-

```

Figure 30: When adding a new project in the 'Project Statistics' Interface