PROG 3B TASK 1

Documentation

Application: Dewey Training
Application ID: DT1.16

Version: 1.16
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Course: BCAD3
Subject: PROG7312
Lecturer: Nirasha Ramckurran
Assignment: Task 1
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Contents

Introduction

As part of our PROG7312 (3B) module, we were tasked with developing a Dewey Decimal training application. I chose to develop the application in C#, using the Visual Studio 2019 IDE, as we were familiar with this IDE from other programming modules. My application has been built in Windows Presentation Foundation (WPF) in .Net Core 3.1. There were a number of requirements that the application had to perform, which have been implemented in my Task 1, and this will be expanded on for Task 2 and the POE projects, in accordance with our set question paper. (The Independent Institute of Education, 2020)

The training application allows users to perform multiple actions, including:

- **Register and login**
  The training application allows the user to register an account with their own preferences, and log in. User profiles are stored in a local MSSQL MDF file, along with their scores used by the application. This database can easily be migrated to an online Azure database, so that high scores are accessible by everyone in the library or elsewhere.

- **Replace Books**
  The application will allow users to order randomly generated Dewey Decimal Call Numbers (10) – including the decimals and authors into the correct order.
  Once the user correctly orders the call numbers, by dragging the books to their correct order, the user will be automatically navigated to a confirmation page.

- **Gamification Techniques**
  A number of gamification techniques have been implemented, including all those described in the research document.
  These include:
  - **Leaderboards**
    The user will be able to see the top ten scores (game completion times), as these are saved for signed-in users and stored in the database file. These scores are then retrieved and displayed on the home screen when the user first loads the application. (Quicksprout, 2016)
  - **Challenges**
    The application has implemented a timer, and difficulty levels. For example, the user can set the difficulty to “Easy” which allows the user 60 seconds to complete the ordering process. They can set it to “Medium” for 40 seconds, and “Hard” for 30 seconds. This provides different levels of difficulty for the user to complete the ordering in set timeframes. (Quicksprout, 2016)
  - **Feedback**
    The application displays a timer, and once the timer reaches 10 seconds, it will start to alternate between red and white text color, to indicate that the time is almost finished for the user to complete the ordering. (Laja, n.d.)

- **Rewards**
  The application shows the top ten scores on the home screen, and these scores are for logged in users only, as the score is linked to their user account. Anonymous users can still use the application without logging in, and will receive their time, however it will not be logged and displayed on the home screen.
  The top three scores will have different colours, much like a podium system, where the top scorer gets their row in gold, second in silver, and third in bronze. (Laja, n.d.)
- **Progress**
  In addition to the above gamification techniques, the user will be able to view all their personal scores on a grid view, and this will be displayed by highest score first (lowest time taken to complete the ordering). This allows the user to track their progress over time, if they are logged in. (Quicksprout, 2016)

- **Restart Training**
  Finally, the user will be able to restart their game by pressing the "Restart" button on the "Replace Books" page. This will reset the timer, replace the books with new auto-generated call numbers and authors, and allow them to start the game again. (The Independent Institute of Education, 2020)

Help File

The training application provides numerous functions, which will be described in depth in the following section. The help file has been broken up into multiple sections, describing each page of the desktop application.

Home Page

The application will first load to the home page, as an "Anonymous User". An anonymous user can view all high scores, set difficulty of the game, login, register, and access the "Replace Books" function required for Task 1.

- The high scores will be displayed in a data grid on the right-hand side of the home screen, with scores (time taken to complete the ordering of the books), usernames, and the date and time that the user took the test.

- The user can access the "Replace Books" function, however they will not be able to save their high scores or access their score log without signing in. Therefore, their high score will not be displayed on the home screen.

- In addition to this, the top three scores are displayed with different background colours, in order to create a podium-like system. For example, the highest score will be displayed with a gold background, second highest will be displayed with a silver background, and the third will be displayed with a bronze background.

- The user may use button click events to complete the following actions:
    - Navigate to the login / registration page,
    - Navigate to the replace books page,
    - Navigate to the identify areas page,
    - Navigate to the view all scores page,
    - Exit the training application,
    - Minimize the window.

- Once the user has logged in, and is no longer an anonymous user, they may select a "View All Scores" button on the home screen, which will display their score log on a data grid.

- The user may select the different score views by selecting the "Set Score View" combo box and choosing a test type.

- The user may also set the game difficulty by selecting the combo box at the bottom of the main page, and from there they can select either "Easy", "Medium", or "Hard", which will set the time limit for the various games.

The login functionality will be described next.

Login Page
Once the user selects the “Login” button on the home screen, they will be brought to a page where they can log into an existing account, or register a new account on the system.

The login page provides a number of buttons, and input, including:

- Username input,
- Password input,
- Register button – brings the user to a registration page,
- Login button – logs the user in,
- Back button (left arrow at the top left of the screen).

The user can enter their unique credentials, and log into their account. The logged in username at the top left of the screen will be changed to “User: <username>”, e.g. “User: Karl”.

Once the user has logged in successfully, they will be brought back to the home page, where they can navigate to all functionality of the application.

The login page validates user accounts, and therefore if the user credentials are incorrect, they will not be logged in, and a generic “Username / Password Incorrect” message will be displayed.
This is a generic message, as to not encourage username harvesting, whereby users attempt to determine valid usernames, if only the password is incorrect – e.g. the message does not display “Password Incorrect”, when a username is in fact valid, however a password is incorrect.

Register Page
The user can navigate to the register page, once they press the “Register” button on the login page. This page allows new users to sign up an account with the system.

A number of buttons and input boxes are displayed on the register page, including:

- Username input,
- Password input,
- Confirm password input,
- Register Account button,
- Back button (left arrow at the top left of the screen).

The user can enter unique credentials on this page, and create a new account with the system. If the user enters a username already in use, an error message will be displayed, and password validation ensures both the confirm password and password input boxes contain the same password values.

Once the user enters valid credentials, they can press the “Register Account” button, which will create the account in the database, and navigate the user back to the login page, where they can login with their new details.

Replace Books
This page provides functionality required for our Task 1 submission, where the user can:

- View auto-generated Dewey Decimal Call Numbers, which are shown on a data grid on the right of the page. These Dewey Decimal's show the decimal as well as the author.
  Both of these values (decimal, and author) are automatically generated using a custom random generator.

- Re-order the books into their correct order, as the application randomly places books on the "shelf", for example, the Dewey Decimal system requires that all books are ordered by numerical order as well as alphabetically – e.g. "035.8605 NVG" comes before "035.8605 ZAK" or "035.8605 NVG" comes before "125.8605 ABC".
  The user can simply drag and drop rows (books) into the correct order on the "shelf", once they press the "Start" button.

- Start the game by pressing the "Start" button on the bottom left of the page. Once started, the timer will start to tick down to show the time remaining. The difficulty setting will determine how long the user has to correctly order the books.
  In addition to this, the Call Numbers will be generated again, so users cannot determine where the books should be before starting the game, and have the timer tick down.

- The user may return to the main page by pressing the "Return" button. This will cancel the current training session or "game". This score will not be logged, and the user will have to restart the game to start again.

Once the user re-orders all books, they will be navigated to a confirmation page, where they can view time taken to order the books (score in seconds). If they are logged in, this score will be saved in the database, along with the logged in user and time taken of the test.

Confirmation Page
Once the books have been ordered, or the time has run out, the user will be navigated to a confirmation page, which will either display "The books have been successfully ordered" or "The books have not been successfully ordered".
When the user orders the books in the correct order within the specified timeframe (e.g. 30 seconds), the time taken to complete the ordering of the books will be displayed.

In addition to showing this information, the following actions can be completed on this page:

- Finish – navigates the user back to the home page.
- View Order – navigates the user to a page where the correct order of the books is displayed, according to the Dewey Decimal System – in numerical and alphabetical order.

Readme

Project Title: Dewey Training

Welcome to Dewey Training. This new desktop application has been developed for librarians and other users to learn the Dewey Decimal ordering system. The aim of this application is to get librarians and other users of the system to order and manage books efficiently at libraries. This would improve efficiency, and accuracy of these users, when they replace books on the numerous shelves in a library.

This application encourages users to improve their book replacement efficiency, and by extension the learning of the Dewey Decimal system. By implementing gamification techniques, such as leaderboards, challenges, feedback, rewards, and progress, the user is encouraged to compete with one another, and learn in the process. By tracking and displaying this information, the user is more likely to see the training software as a game, and therefore compete with one another.

In addition to this, the database will eventually be deployed to an online hosting platform (e.g. Azure SQL database), so that users on different devices may be able to compete with one another – they will be able to see one single leaderboard across multiple devices.

Getting Started

The following steps are required to get the Dewey Training software running on the development environment:

- Open the application source code in Visual Studio
- Set the start-up project to “Dewey Training”
- Run the application on any Windows PC
- Ensure the system is using the dot “.” Delimiter for decimals (EN-US)

Prerequisites

There are a few prerequisites required to run the application, including:

- Install the *latest Visual Studio
- Install prerequisites to run .Net Core 3.1 WPF desktop applications

*latest Visual Studio as of when the application was developed is: Visual Studio 2019

More detailed specifications are included below

Microsoft Visual Studio Enterprise 2019
Version 16.7.2
VisualStudio.16.Release/16.7.2+30413.136
Microsoft .NET Framework
Version 4.8.04084

Installing

- Open the application source code in Visual Studio
- Set the start-up project to “Dewey Training”
- Run the application on any Windows PC

The development test system has been detailed on the following page.

Test System
Development PC

OS Name	Microsoft Windows 10 Pro
Version	10.0.19041 Build 19041
Other OS Description	Not Available
OS Manufacturer	Microsoft Corporation
System Name	KARL
System Manufacturer	System manufacturer
System Model	System Product Name
System Type	x64-based PC
System SKU	SKU
Processor	Intel(R) Core(TM) i7-8700K CPU @ 3.70GHz, 3696 Mhz, 6 Core(s), 12 Logical Processor(s)
BIOS Version/Date	American Megatrends Inc. 2402, 2020/06/17
SMBIOS Version	3.0
Embedded Controller Version	255.255
BIOS Mode	UEFI
BaseBoard Manufacturer	ASUSTeK COMPUTER INC.
BaseBoard Product	ROG MAXIMUS X HERO
BaseBoard Version	Rev 1.xx
Platform Role	Desktop
Secure Boot State	Off
PCR7 Configuration	Binding Not Possible
Windows Directory	C:\WINDOWS
System Directory	C:\WINDOWS\system32
Boot Device	\Device\HarddiskVolume7
Locale	United States
Hardware Abstraction Layer	Version = "10.0.19041.423"
User Name	KARL\Karl
Time Zone	South Africa Standard Time
Installed Physical Memory (RAM)	48.0 GB
Total Physical Memory	47.9 GB
Available Physical Memory	35.0 GB
Total Virtual Memory	54.9 GB
Available Virtual Memory	37.1 GB
Page File Space	7.00 GB
Page File	C:\pagefile.sys
Kernel DMA Protection	Off
Virtualization-based security	Not enabled

Hyper-V - VM Monitor Mode Extensions	Yes
Hyper-V - Second Level Address Translation Extensions	Yes
Hyper-V - Virtualization Enabled in Firmware	Yes
Hyper-V - Data Execution Protection	Yes

Built With
Visual Studio – The IDE used to develop the desktop application
.NET Core 3.1 – Framework
WPF – Windows Presentation Foundation – Used to design the application in C# and XAML
Models – Used to structure data within the application.
Data Access Layer (DAL) – Assembly used to access the database.

Versioning

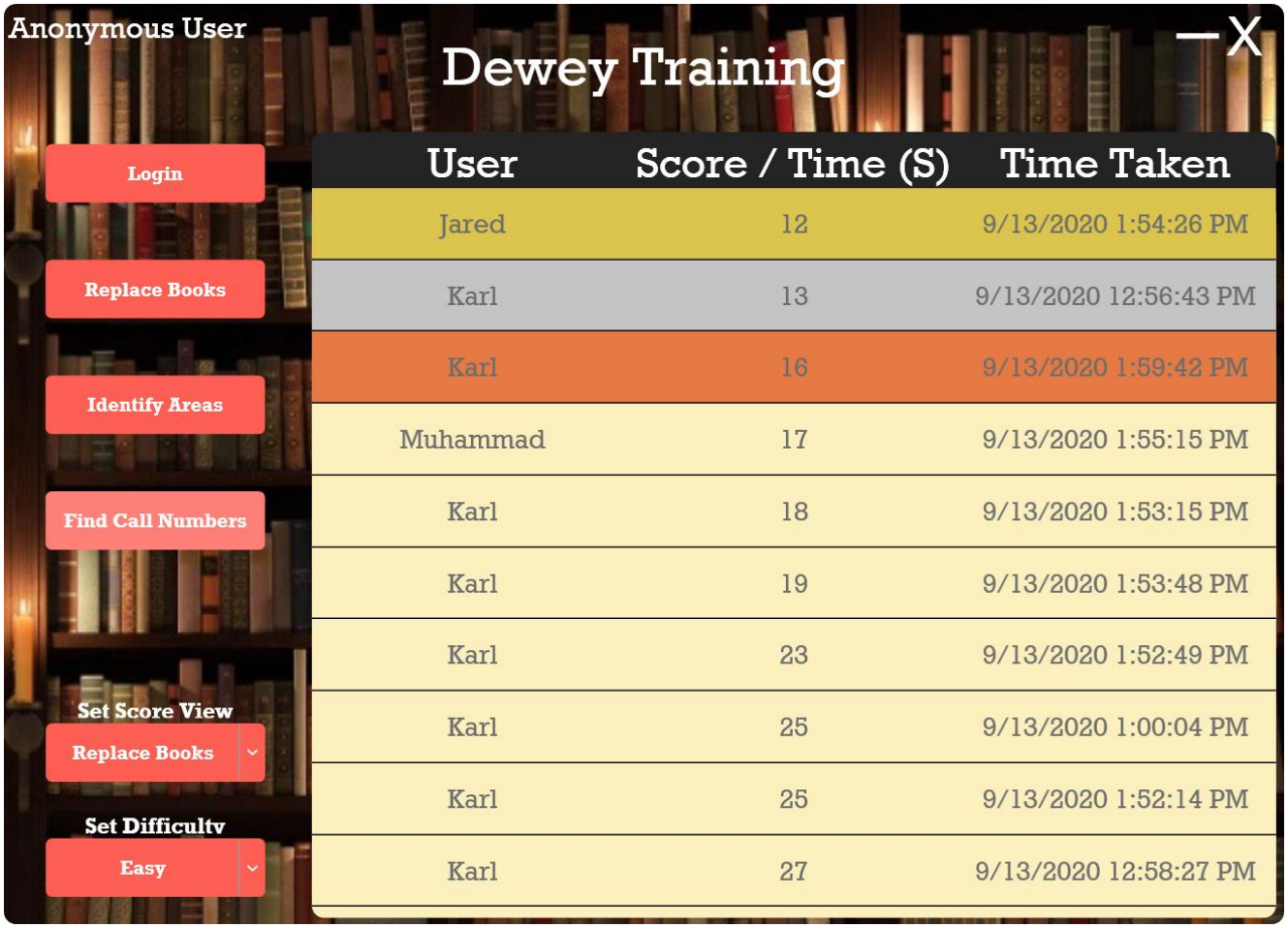
Version 16

Authors Karl Dicks – 17667327
Acknowledgments Inspiration: Programming 3B POE Question Paper
Demo Video link: https://youtu.be/BvGGQlEeJBQ

Screenshots

The user interface for Dewey Training desktop application has been designed, and all functionality has been implemented. Below is the interface for my application:

Home Page



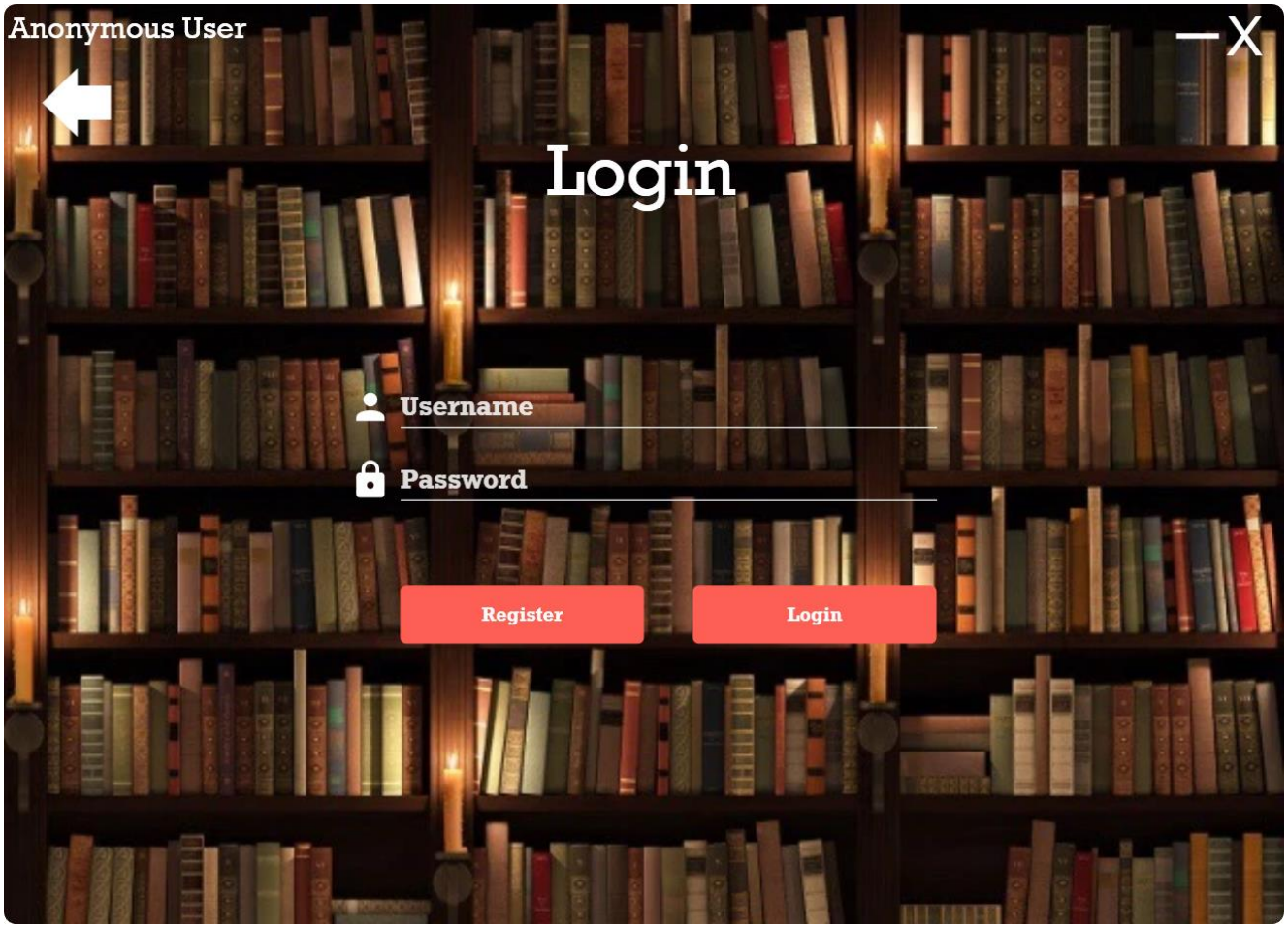
Once the user loads the application for the first time, they will be presented with the home screen, and will not be logged in.

The user can navigate to the login page, or complete training “games” anonymously, which will not save their scores to the database.

If the user would like to log in, and save their scores to the database, they can log into their account by pressing the “Login” button.

This action will bring them to the page provided on the following page.

Login



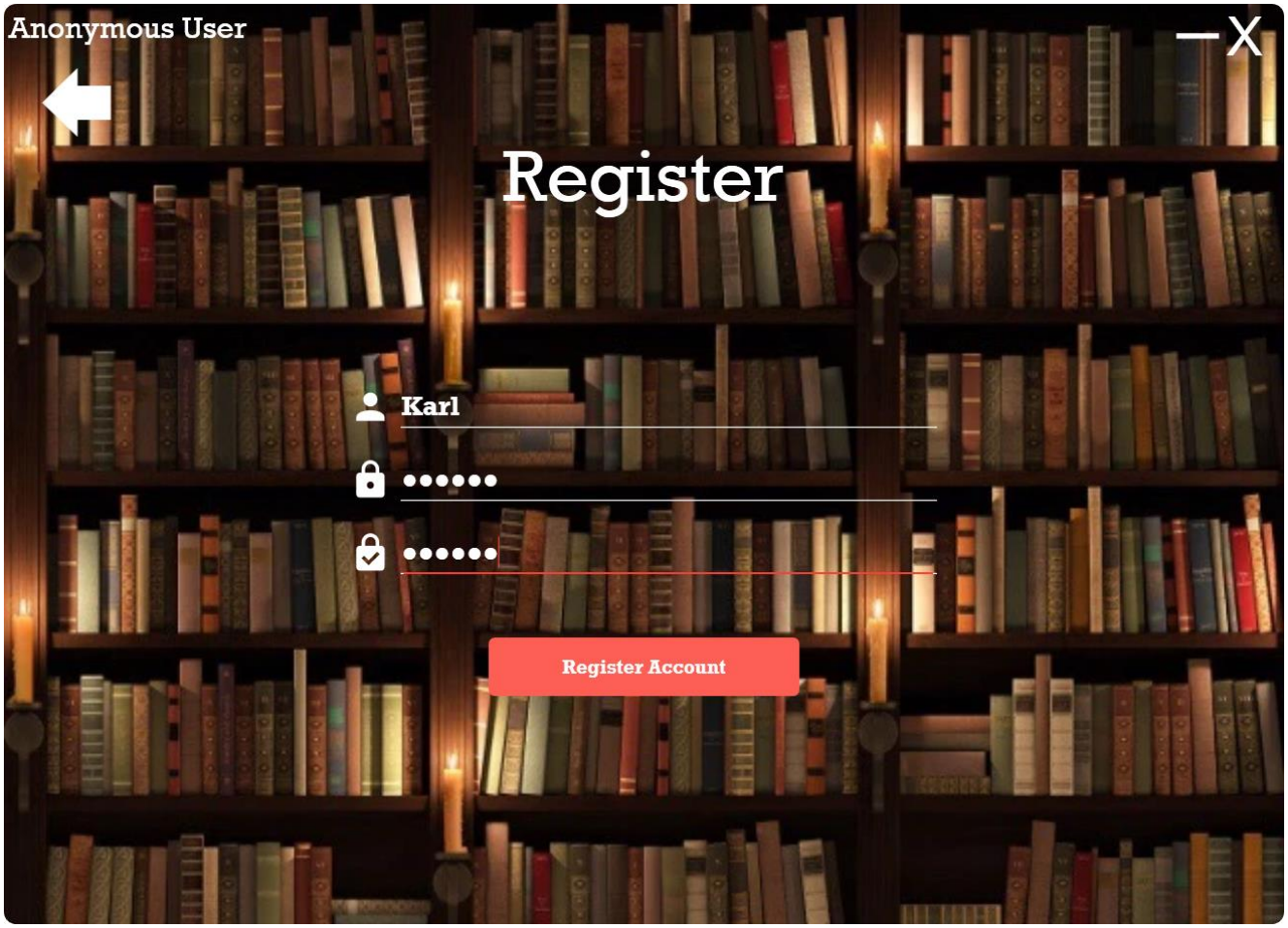
Once the user navigates to the login page, they can either log in with their previously created account, or register a new account by pressing the "Register" button.

Once the user registers a new account, they are brought back to the login page, and can enter their account details.

Once the user has pressed login, and the account is valid, they are brought back to the home page.

The register page is shown on the following page.

Register

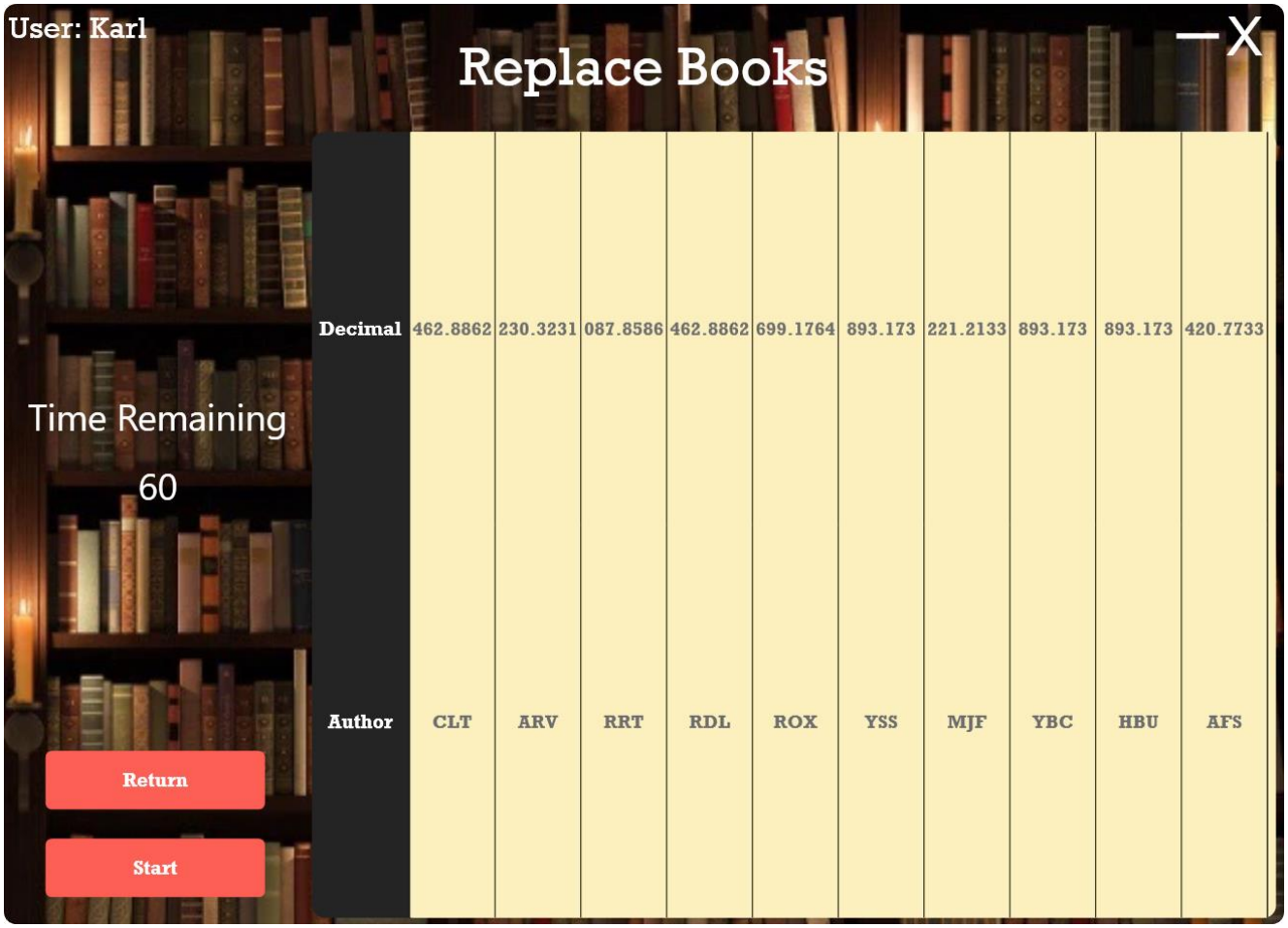


Once the user navigates to the register page, they can enter their account details, and press the “Register Account” button to create a new account on the system.

Once the user registers a new account, they are brought back to the login page, and can enter their account details.

The register page has input validation, so the passwords must match, and the username cannot be in use by another account.

Replace Books



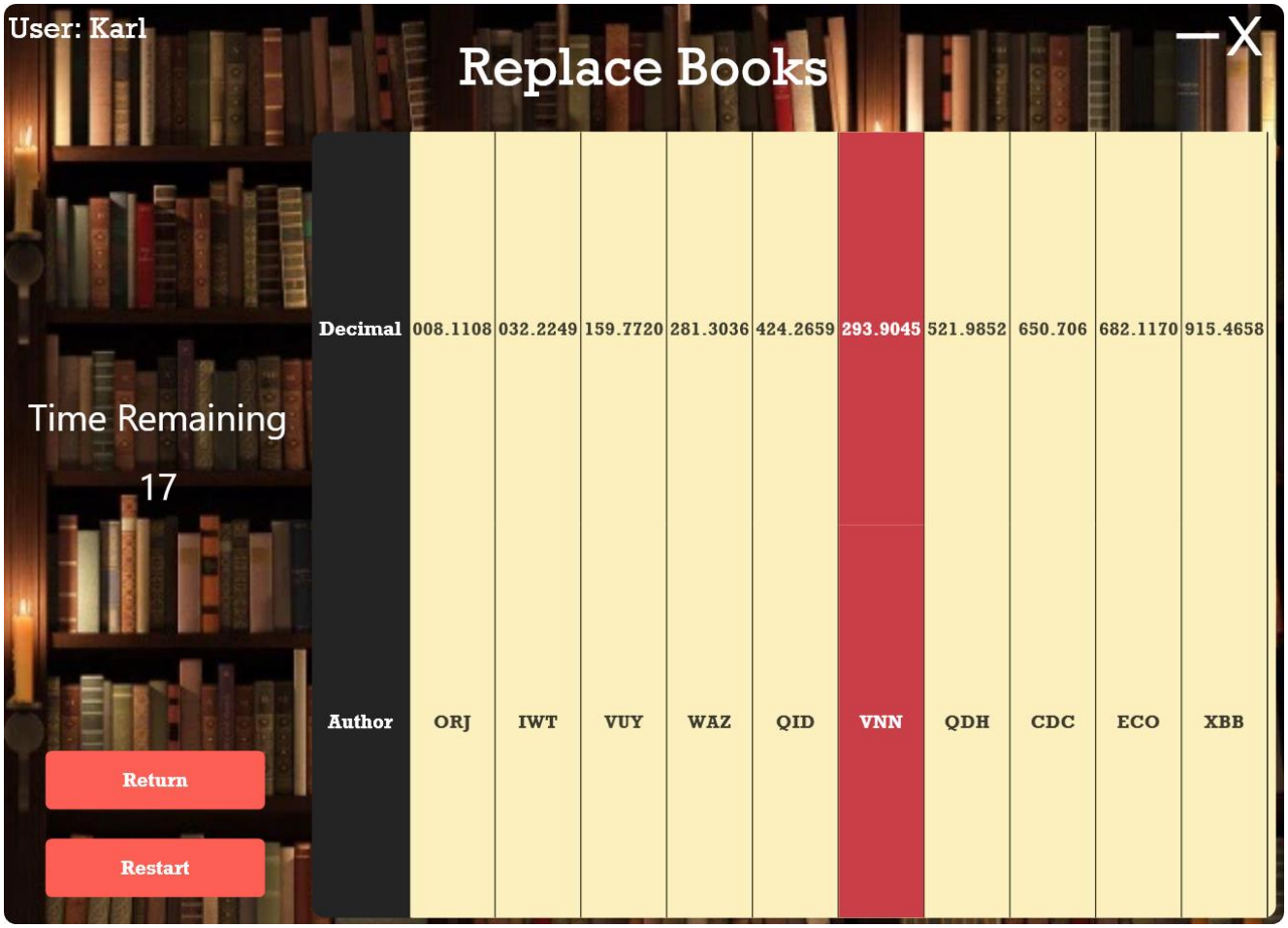
The “Replace Books” page can be accessed by pressing the “Replace Books” button on the main menu, which opens a new “game” or training session.

The replace books training session works by getting users to re-order the randomly generated call numbers, in numeric and alphabetic order – just like the Dewey Decimal system describes.

Once the user is ready to start the training session, they can press the “Start” button, which will refresh the call numbers and enable dragging of the Dewey decimals on the data grid.

Once the order is correct, the user will immediately be navigated to a confirmation page, where they can view the model answer, or return to the main menu.

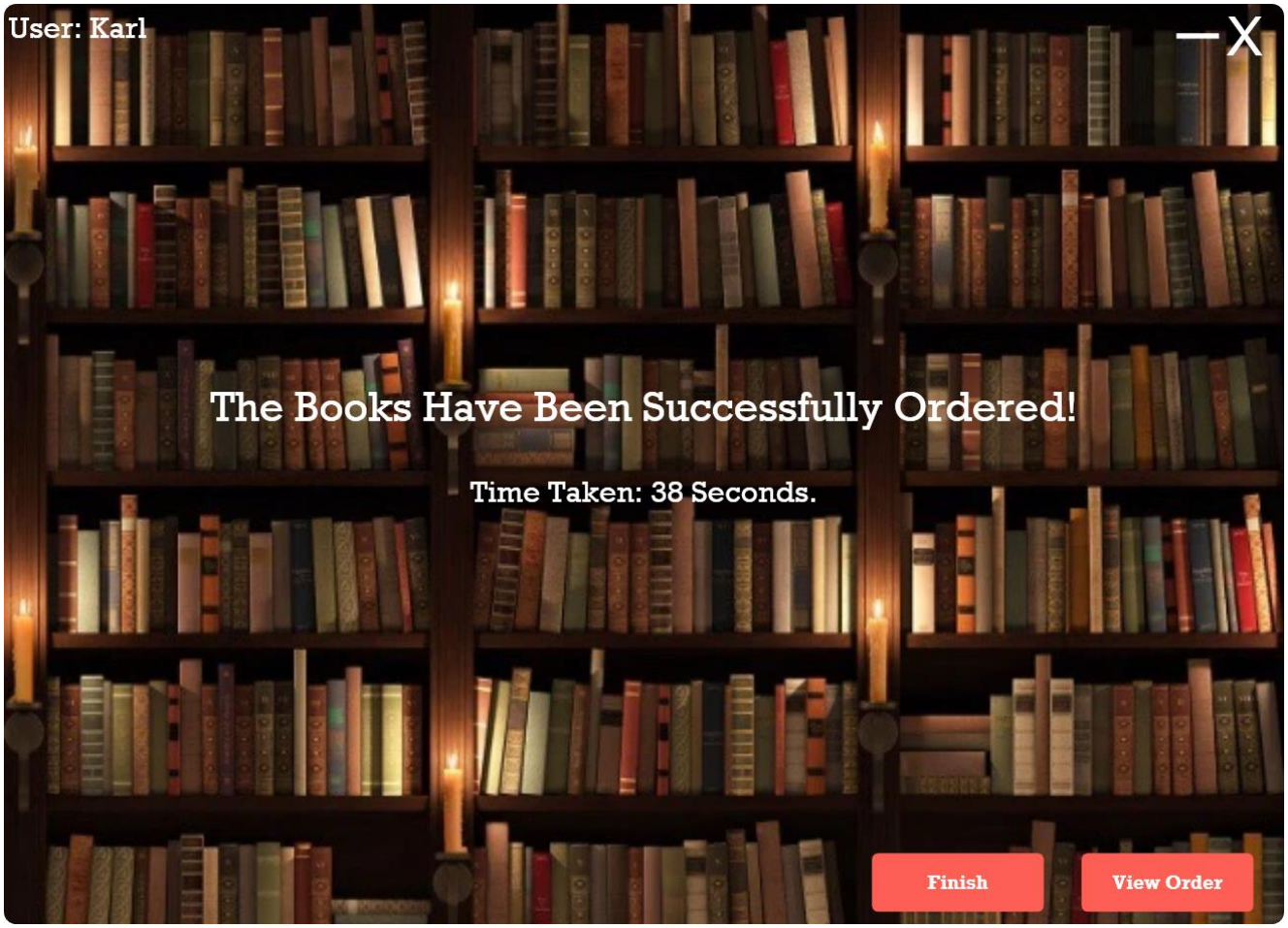
Replace Books



The user may re-order the books by dragging them across the page (clicking, holding, and moving them), which will allow the books to be re-ordered.

As can be seen on the provided image, the books have been partially ordered, and the timer is ticking down from 60 seconds, as the difficulty level has been set to “Easy” on the home page.

Confirmation Page



As soon as the correct order has been reached (once the call numbers are in their correct order), the user will be navigated to a confirmation page.

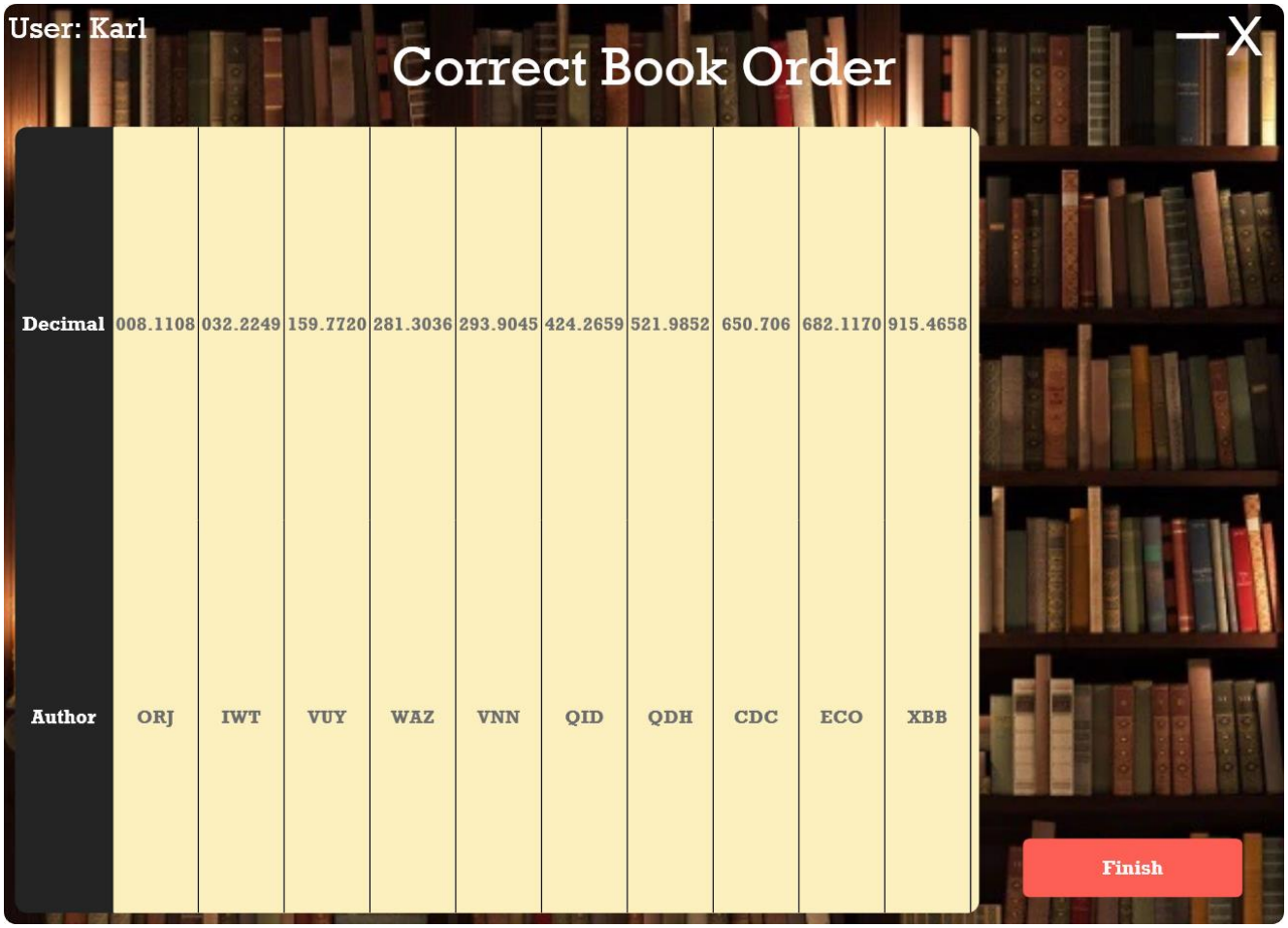
Firstly, this page will show whether the user has successfully ordered the books, with a confirmation message, and the time it took them to complete the session.

This confirmation page also provides the user with the ability to “View Order”, which allows them to access the model answer for the training session. Users can press the “View Order” to view this page.

It also allows them to return to the main menu by pressing the “Finish” button.

The “View Order” model answer page is shown on the following page.

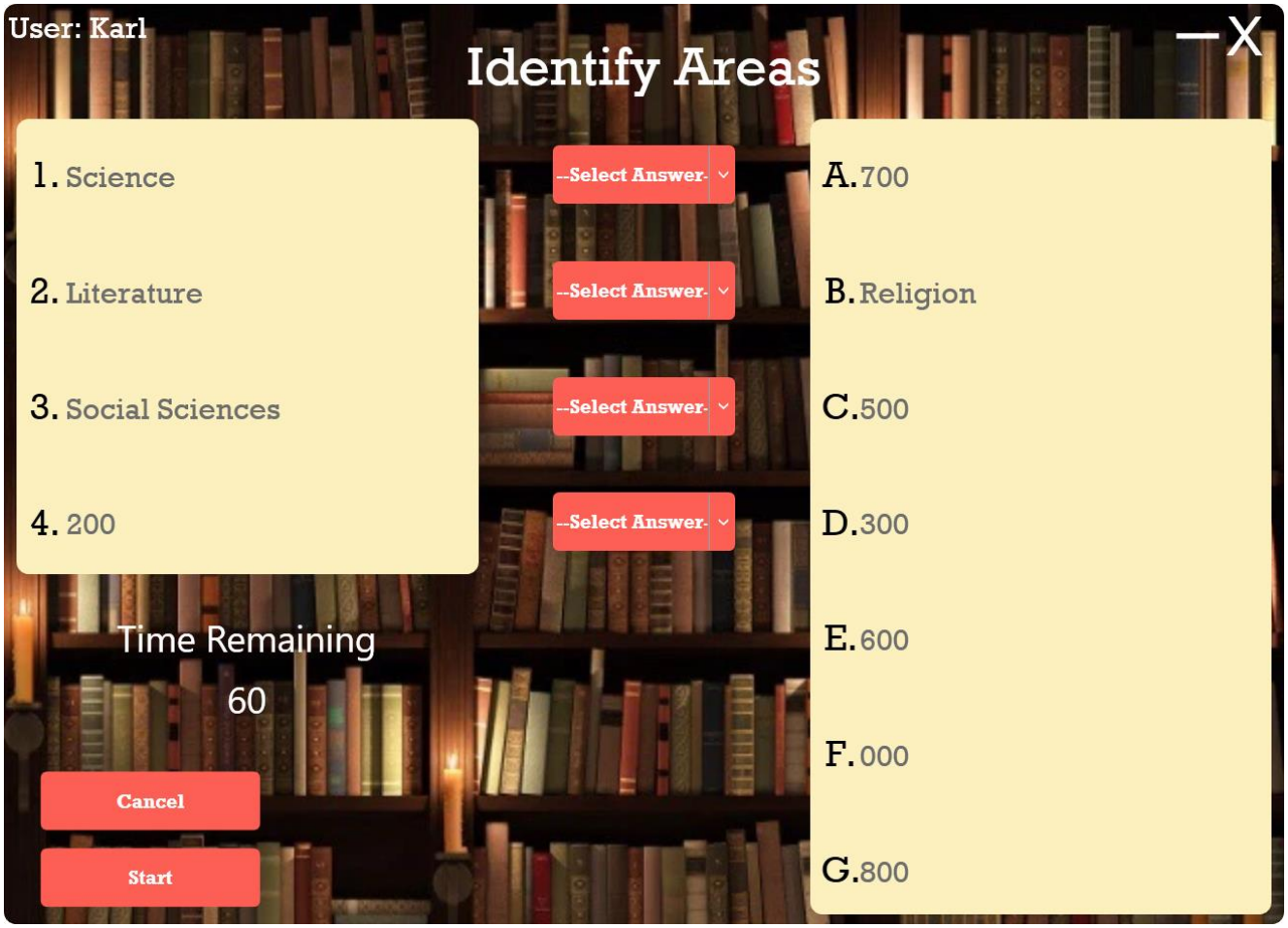
Correct Book Order



The “View Order” page is provided on the left, which shows the correct order of the Dewey decimal call numbers.

The user may press the “Finish” button to navigate back to the main menu after they have viewed the correct order for the call numbers.

Identify Areas

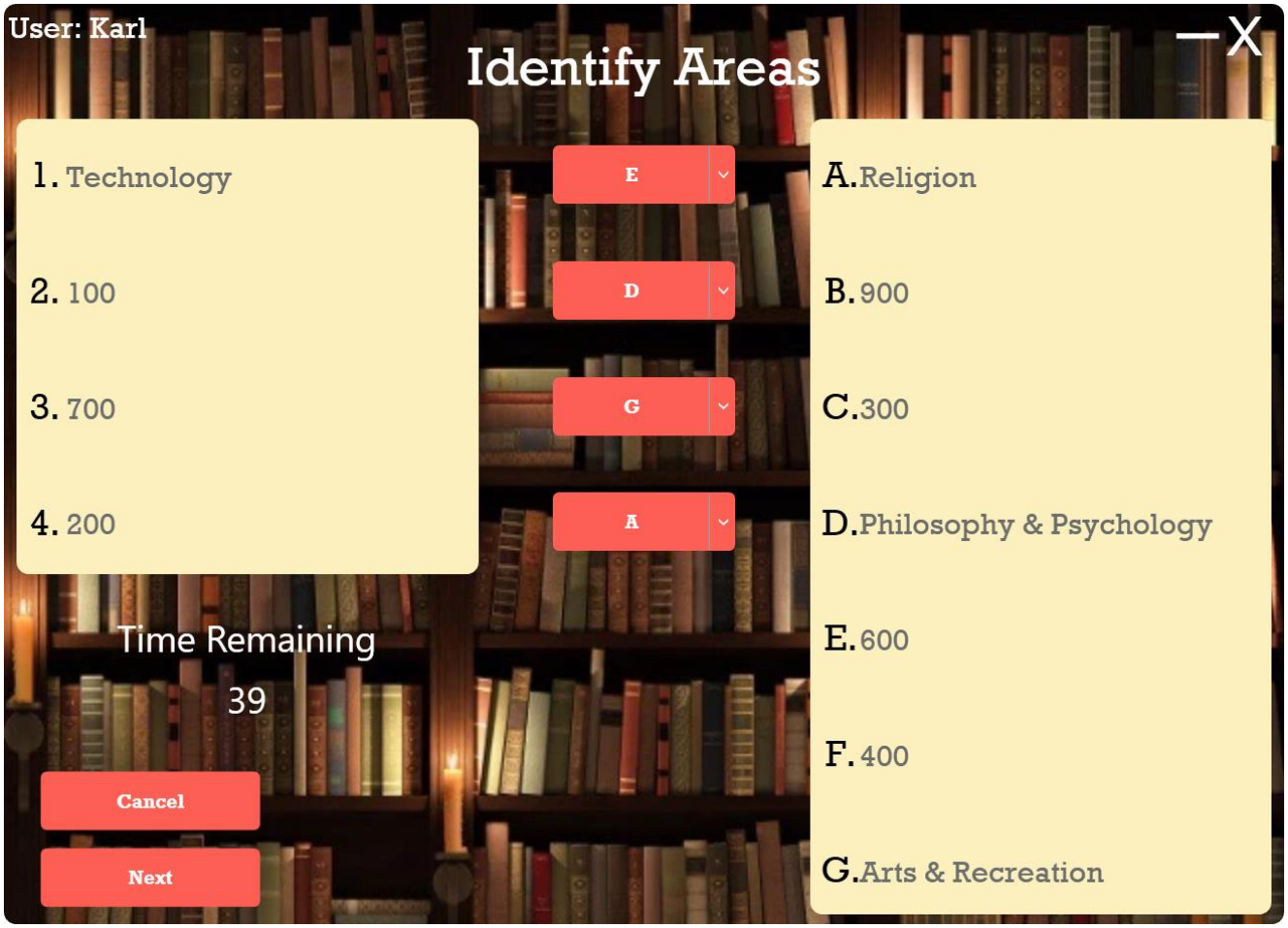


The identification of areas can be accessed by pressing the “Identify Areas” button on the main menu, which will navigate the user to the provided page.

This match-the-column training exercise provides the user with 4 randomly picked categories within the Dewey decimal system, and 7 potential answers on the right-hand side.

The user can press “Start”, which will randomize the questions and answers again, and will allow the user to select the correct answers from the dropdown boxes in the middle of the page – shown on the following page.

Identify Areas



The user may select the “Start” button, and select all their answers from the dropdown boxes next to each question.

For example, the image provided shows the answers to the provided training session.

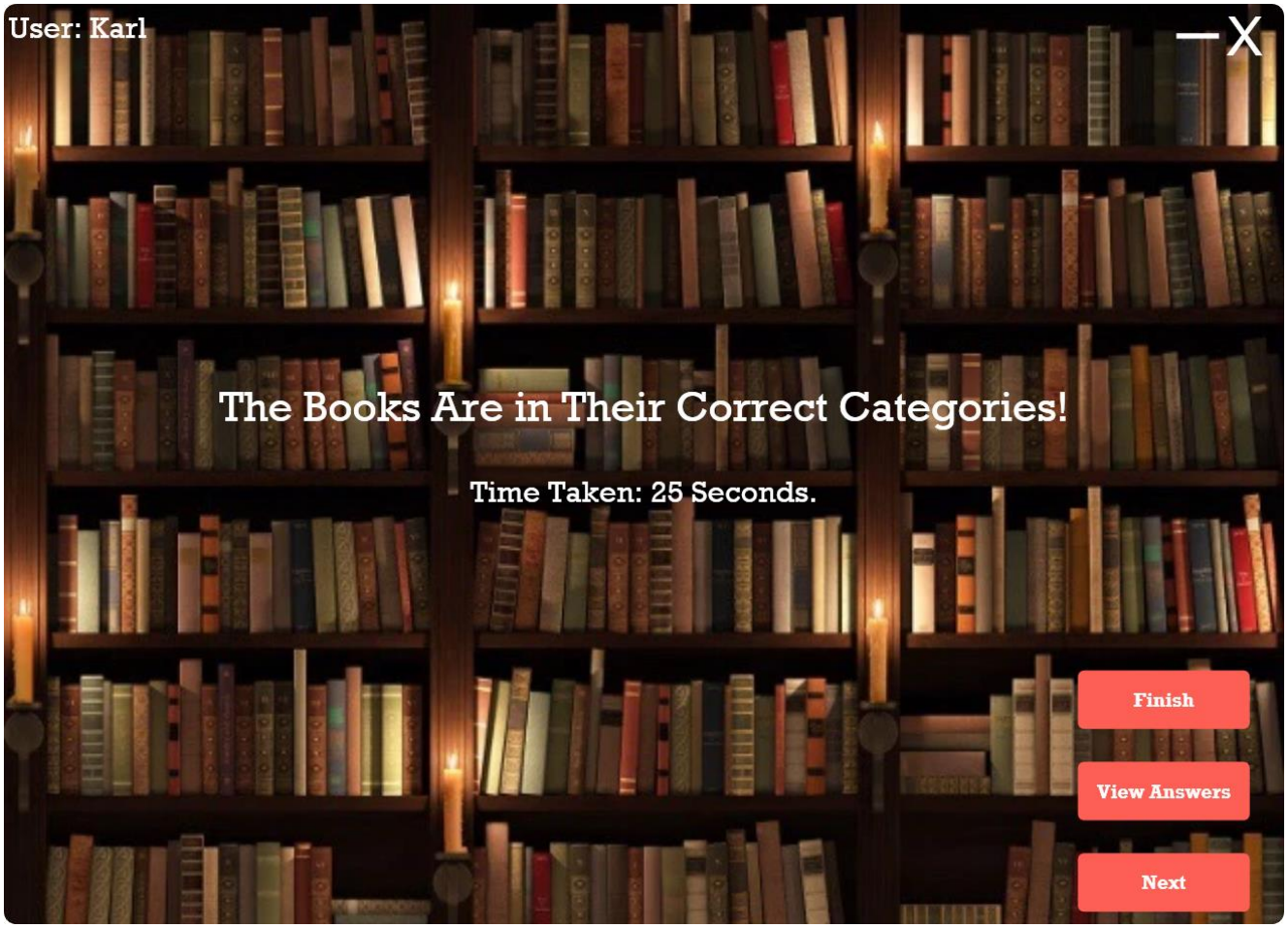
This training system also has gamification techniques implemented, in the form of a countdown timer, and logging of scores, much like the “Replace Books” exercise.

Once columns have been matched, by selecting an answer for each question from the dropdown boxes, the user can select “Next” to navigate the user to the confirmation page.

Input validation has been implemented on this page, so all inputs have to be valid.

Shown next is the confirmation page.

Confirmation Page



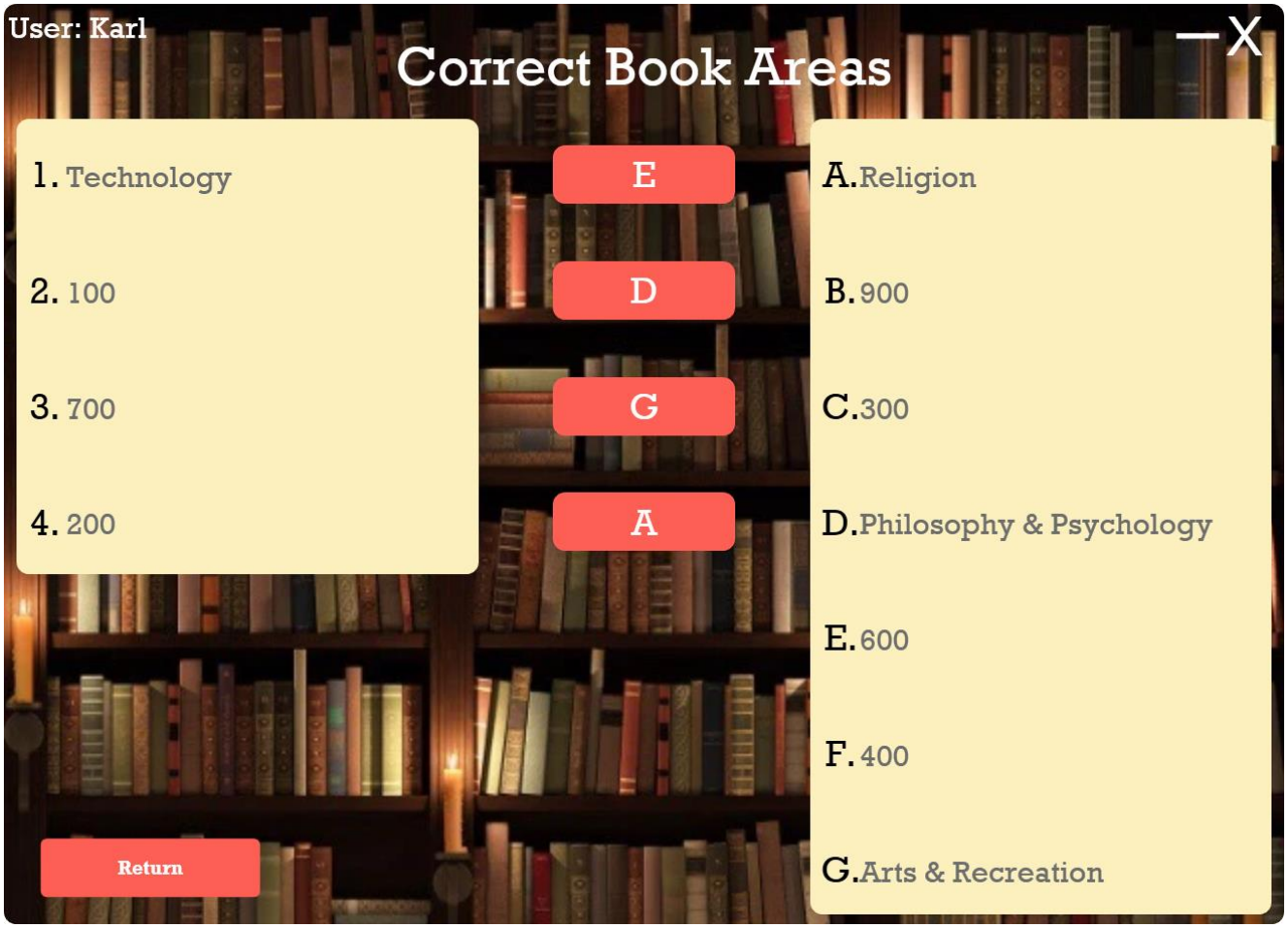
Once the user has selected “Next” or the timer has run out, the user will be navigated to a confirmation page, where it will be determined if all answers were correctly answered (the columns were matched correctly).

If so, the user will be provided with their time.

The user can navigate back to the main menu by pressing the “Finish” button, view the model answer by pressing “View Answers”, or press “Next” for another “Identifying Areas” training session.

The model answer page is provided on the following page, where the answers for all questions are provided.

Correct Book Areas



If the user presses the “View Answers” button, a page with the model answer will be provided, so that the students and librarians can learn from the system, and not only test their knowledge of the Dewey decimal system.

If the user presses the “Return” button, they will be brought back to the confirmation page, where they can continue with another identifying areas session, or finish the game.

View All Scores – Replacing Books

If the user presses the “View All Scores”, a page with all their personal scores will be displayed for both the “Replace Books”, and “Identify Areas” training sessions.

If the user wishes to view scores for the “Identifying Areas” sessions, they can select that option from the dropdown just above the “Return” button, and all their scores for that game / training type will be displayed.

View All Scores – Identifying Areas

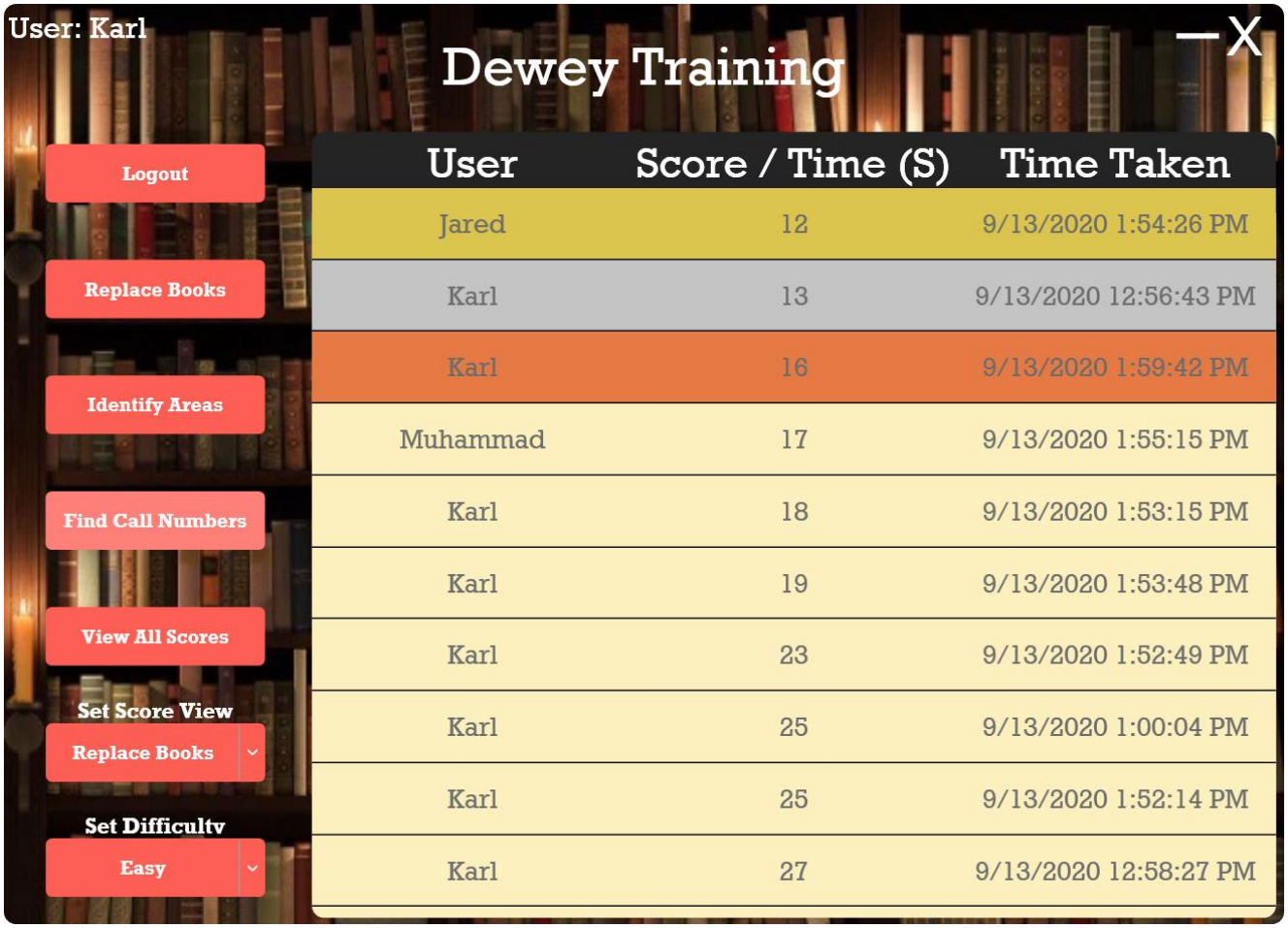
If the user selects the dropdown box from above the “Return” button, they are presented with all “game” types, including “Replace Books”, “Identify Areas”, and “Find Call Numbers”.

This can be set on the main menu page as well, where the top ten scores are shown.

The following image shows the scores for “Identify Areas” training sessions for the logged in user.

This includes the username, score, and the time that the test was taken.

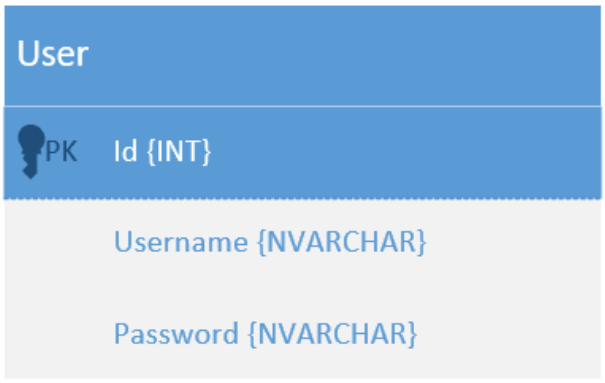
Set Game Difficulty



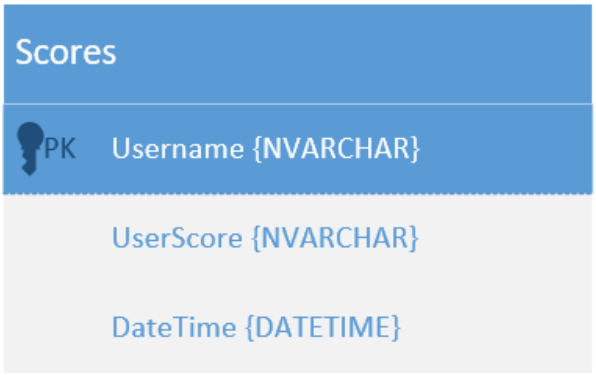
If the user wishes to change the game difficulty, by reducing the total time that is allowed for each training session, they can set the difficulty – the lowest dropdown element on the provided screenshot.

This will set the times of the counter to 60 seconds for Easy, 40 seconds for Medium, and 30 seconds for Hard difficulties.

Database Entities

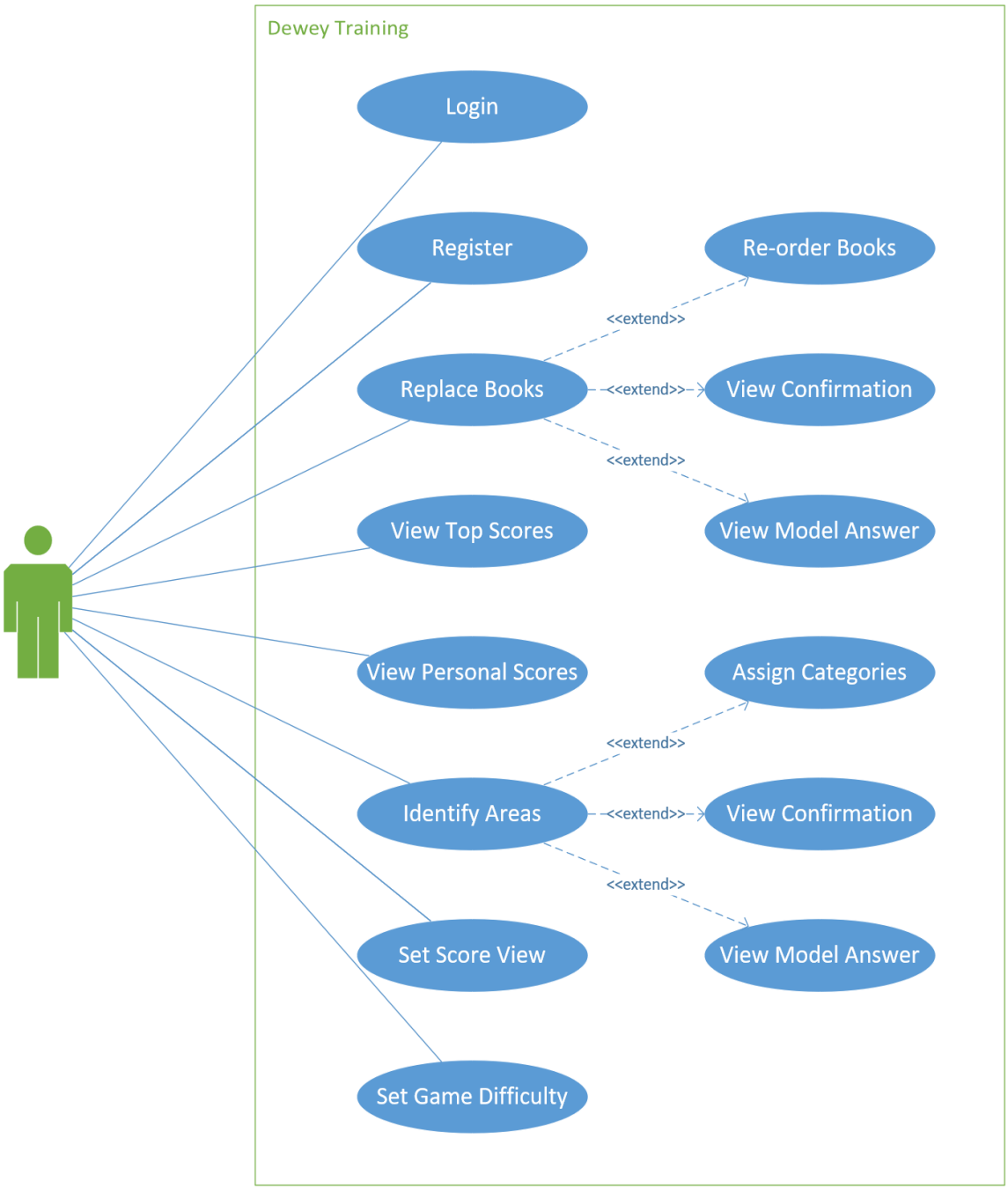


The User model defines what is saved for each user in the system. This includes the user id, username, and password.



The Scores model defines what is saved for each score entry in the database, which includes the username of the user who achieved the score, the score value, and the date and time that the entry was inserted into the database.

Use Case Diagram



Conclusion

In conclusion, this documentation has provided extensive development information in order to detail how and why the Dewey Decimal desktop application was developed in the way that it was. It described each function of each page within the “Help File” section, and provided user interface design information within the “Screenshots” section. A “Readme” section was also included in the document to provide information about the development environment, instructions on how the desktop application should be run, and other such critical information to get the application running on the user’s PC.
Additional information such as all the database entities was provided, which detailed how and where data was stored by the application.
In addition to the above, a use case diagram was included, which showed core functionality of the desktop application from the user’s perspective.

During the course of this project, we have learnt how to develop advanced C# desktop applications in the .Net Core 3.1 Framework. We also learnt how to use a Data Access Layer – DAL to access information from a local MDF file, and later on this will be hosted online. In addition to this, we have learnt how to use advanced data structures, including Doubly Linked lists, Dictionaries, Key Value lists, and Observable Collections in addition to other datatypes.

Once we receive feedback for this task, we will be in a position to complete Task 2 and POE tasks, which build on the functionality of this application.

References

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