DAT602 – ASSESSMENT TWO
PROJECT
Milestone Three

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Milestone One

General Game Overview

The game is Wizard Quest. Players take turns moving around the map; as they do so, more of the world will be uncovered. The main aim is to collect gold to gain points. The map has several other items for players to collect and store in their inventory to assist in their quest. Players beware! Your quest is full of danger at every turn with traps that could lose you points or even end your quest! Players can set up an account, play, and communicate with other players in real-time.

Additionally, players will be able to save their games, delete their accounts, and administrators will be able to assist players with account and game issues.

Login

The game will initially begin with a login window. Users can enter their credentials:

- Existing users with credentials matching those stored on the database will proceed to the Wizard Quest, quest selection window, or they can delete their account.
- If the user is existing, but there is a credential mismatch, the user will be prompted to re-enter their password. The user has five attempts to enter the correct password before their account being locked and requiring administrator intervention.
- If credentials are not on the database, the user is asked if they would like to register. The user is prompted for their email address and password.

Quest Selection

The Quest Selection window appears after a user has successfully logged in. Users can see currently online players, a list of Quests (games) in play, and their saved quests from past interactions. The user can:

- Join a Quest that is in progress with other user(s).
- Re-join a saved Quest.
- Begin a new Quest.
- Logout.
- If the user is an administrator, they will be able to access the administration portal.

Gameplay or Questing

Once the user has made their selection and beings a quest (game), they are taken to the Questing window, where the gameplay commences. The player begins on a tile, and only a tiny amount of the map is uncovered. As they move around, more of the map will become visible, showing:

- **Gold** – the main aim of the game is to collect the gold and score points. Points will be added to the players game score, and they will be able to view this in the quest along with the score of any other player they are playing. The player that has the highest quest score after the quest ends wins that game.
- **Chances** – These will be some type of question mark tile graphic which will award the player some kind of item for their inventory. Examples include a spell gem or a wand with additional points. Or some detracting object is encountered like a cursed dragon's egg or a magic dead area which the player then loses points. This is the risk of taking the chance.

- **Traps** – Traps are unmarked and in a small allocation of tiles in the game. If a player chooses a tile where a trap has been set, the player can either:
    - Lose some points or
    - Lose all their points scored in that quest and die.

As players move around the map, more of the world is uncovered, and they can collect the gold they see. The quest ends once all the gold is collected or all players have died. Players do not have to choose a chance tile if they do not want to take a risk. However, chance tiles can be beneficial as the potential points could secure that player's quest victory.

While playing the game, users can chat via the chat console. Entering a message into the type to chat field and clicking the send button will send their message to other users in the same game.

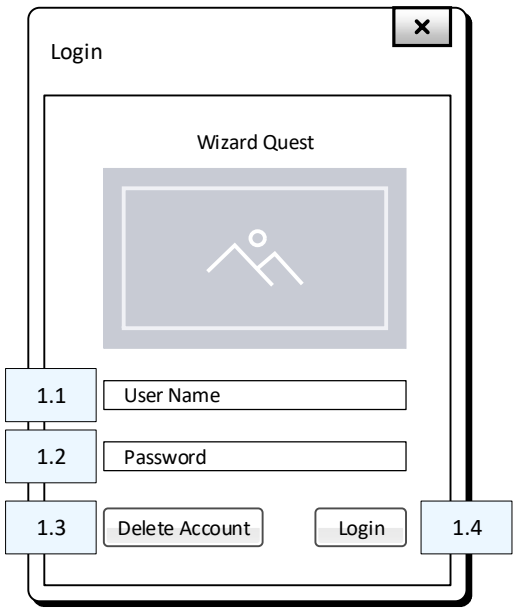
Administration

Users that have administrative credentials will have access to the Wizard Quest Administration Portal. Administrators can:

- End quests, add, modify, and delete users.
- They also can unlock accounts, grant administrative privileges, and adjusting user scores.

Storyboarding

Storyboard One - Login



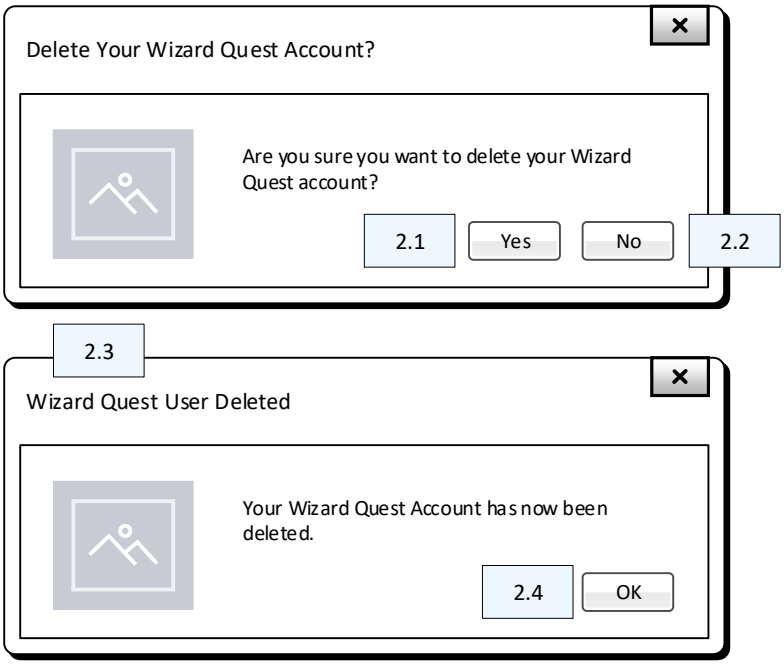
1.1 Textbox for username.

1.2 Textbox for password.

1.3 Delete Account button, if clicked and username and password are correct, go to storyboard two if password incorrect, go to storyboard three.

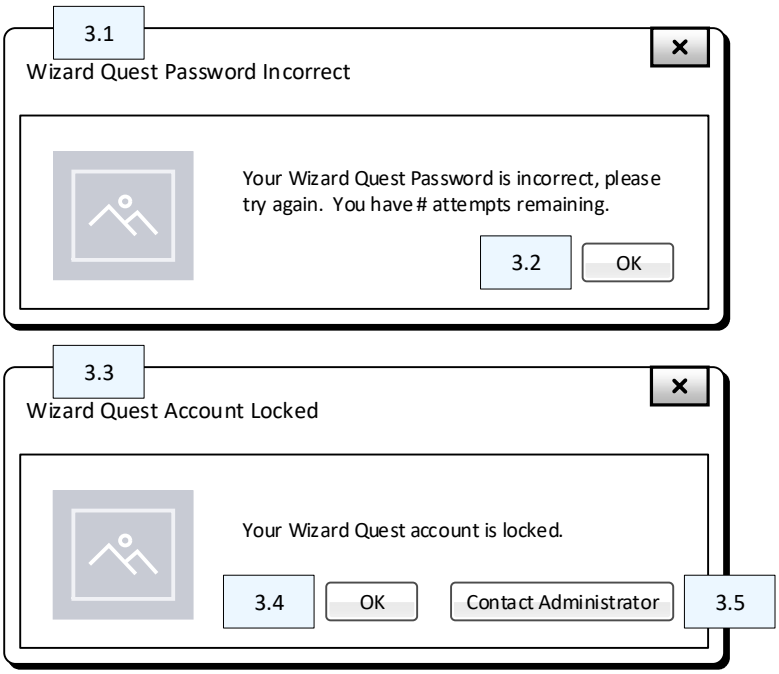
1.4 Login Button, if clicked and username and password are correct, go to storyboard six. If the username is valid and the password incorrect, go to storyboard three. If the username is not found, go to storyboard four.

Storyboard Two – Delete Account



2.1 Yes button confirms account deletion and displays (2.3) confirmation dialogue box.
2.2 No button returns the user to login. Go to storyboard one.
2.3 Account Delete confirmation dialogue box.
2.4 OK button. Returns to log in, go to storyboard one.

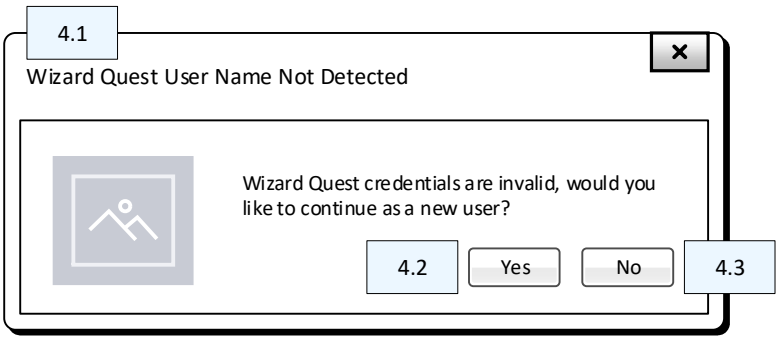
Storyboard Three – Incorrect Password



3.1 Incorrect password dialogue box displayed. Informs the user of how many attempts they have before their account is locked.
3.2 OK button returns the user to login. Go to storyboard one.

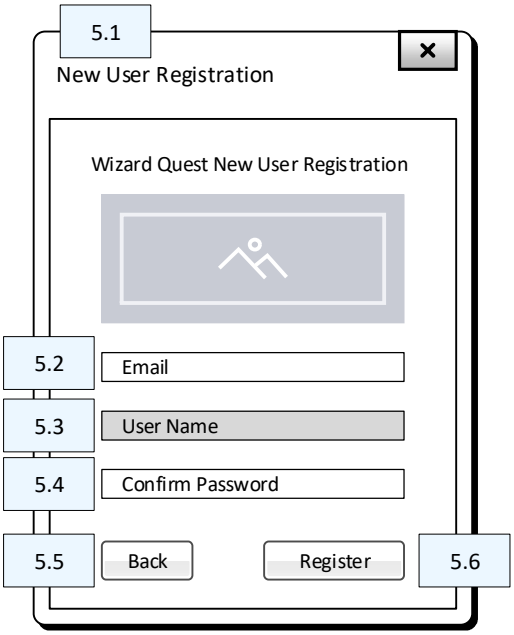
3.3 Account locked dialogue box displayed after five unsuccessful password attempts.
3.4 OK button returns the user to login. Go to storyboard one.
3.5 Gives user administrator email to contact for account reactivation assistance.

Storyboard Four – Username Incorrect



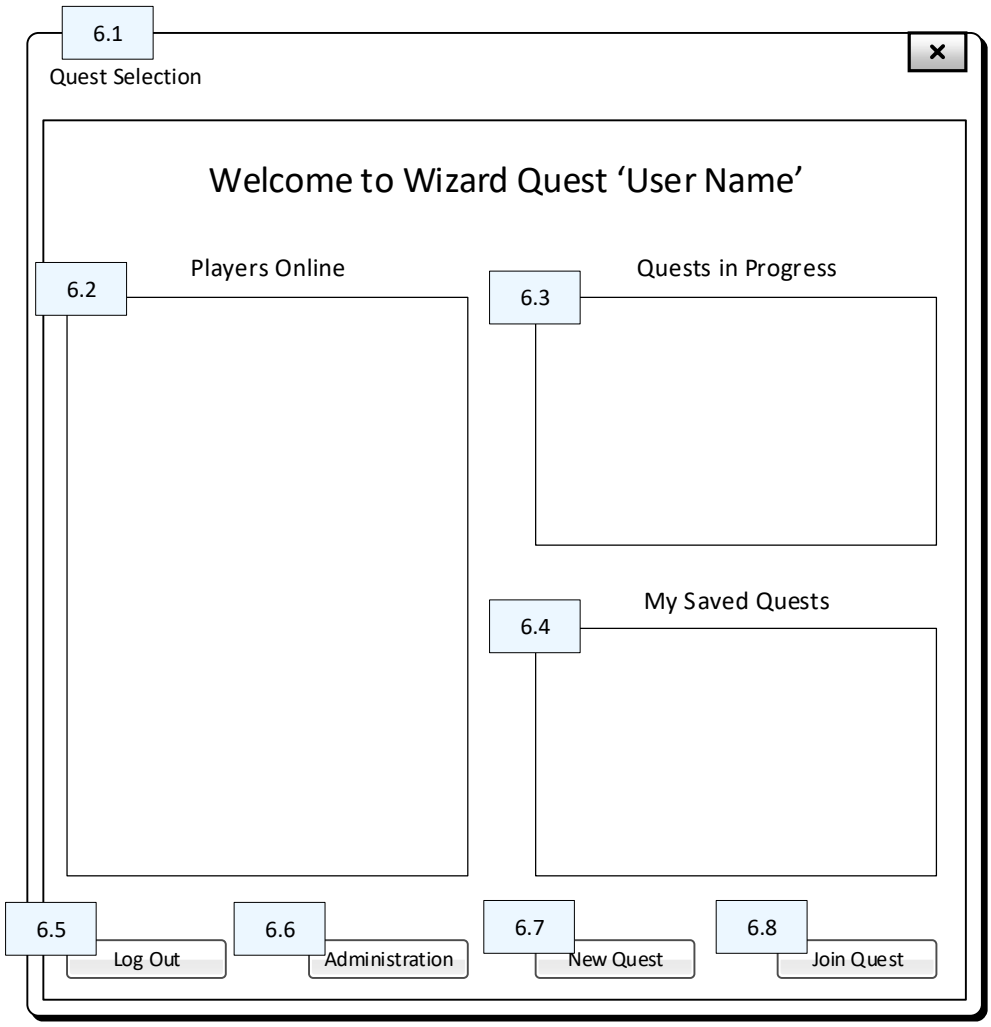
4.1 Username not detected dialogue box displayed.
4.2 Yes button, if clicked, the user can register. Go to storyboard five.
4.3 No button, if clicked, the user is returned to login. Go to storyboard one.

Storyboard Five – User Registration



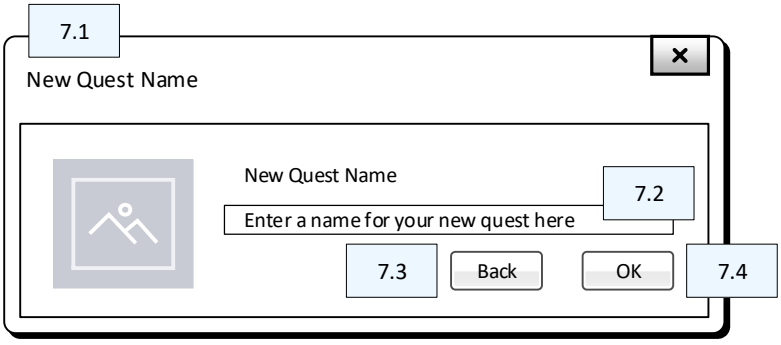
5.1 New user registration dialogue box displayed.
5.2 Textbox for the user to enter an email address.
5.3 Username textbox populates with username from the login screen.
5.4 Password textbox for user password.
5.5 Back button, if clicked, returns to login. Go to storyboard one.
5.6 Register button if clicked go to storyboard six.

Storyboard Six – Game Selection



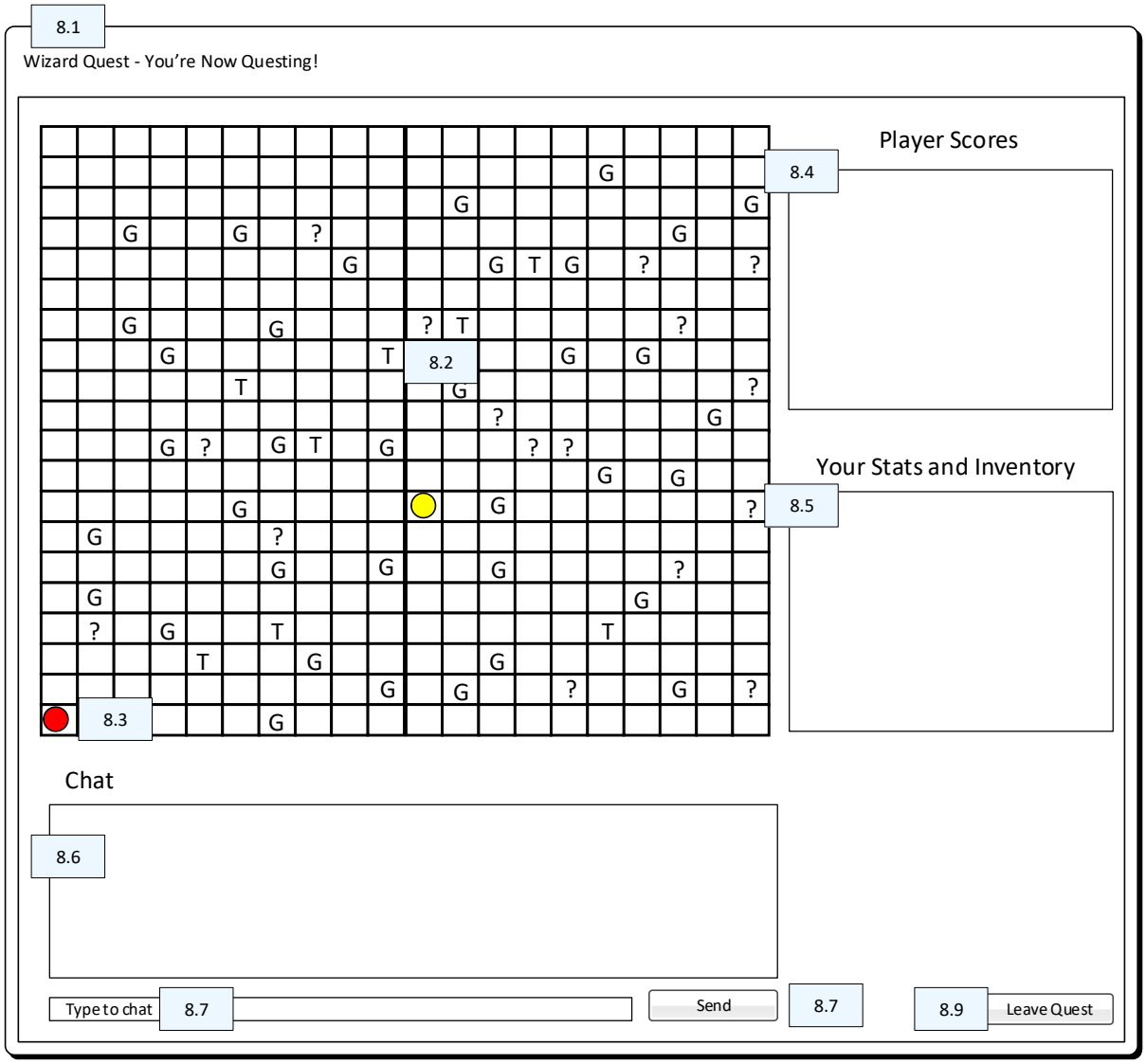
6.1 Quest selection dialogue box displayed.
6.2 Lists all players online and their scores, listed in high score order.
6.3 Lists all quests currently being played by other online players.
6.4 List all quest the user has previously started and are now saved.
6.5 Log out button if clicked returns to login. Go to storyboard one.
6.6 Administration button only visible If the user has administrative privileges. If clicked displays the administration portal. Go to storyboard ten.
6.7 New Quest button, if clicked, starts a new game. Go to storyboard seven.
6.8 Join Quest button clickable only when a quest is in progress of saved quest has been selected from lists 6.3 or 6.4 respectively. Go to storyboard eight.

Storyboard Seven – New Quest



7.1 New Quest dialogue box displayed.
7.2 Textbox for the user to enter a name for their new quest.
7.3 Back button, if clicked, returns to Quest Selection. Go to storyboard six.
7.4 OK button if clicked starts gameplay. Go to storyboard eight.

Storyboard Eight – Game Play



8.1 Game dialogue box displays quest.

8.2 Tilemap shows the world as the player moves around the map tiles with gold (G) give points, tile with chances (?) can provide inventory or cost player points, and traps (T) aren't shown, but if the tile is selected by the user, they can lose points or die. All notifications will appear as pop-up notifications and the final win/lose notification as a dialogue box. Go to storyboard nine.

8.3 Counters shows players current tile location.

8.4 Each player's score is listed in the game in ascending score order.

8.5 Show user's complete stats and inventory collected.

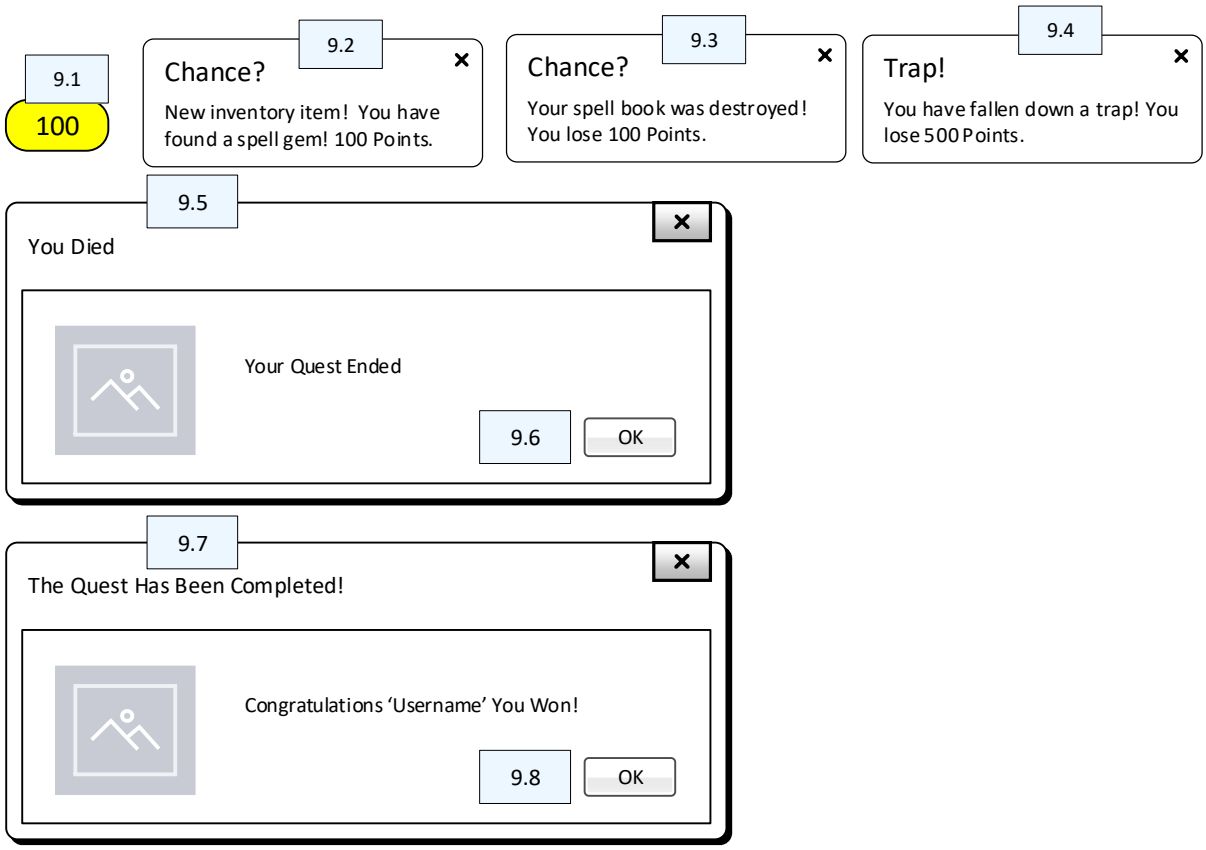
8.6 Chat window displays all messages sent in the game.

8.7 Chat textbox where the user can enter a new chat message.

8.8 Send button, the message entered will be seen by all players in the chat window (8.6).

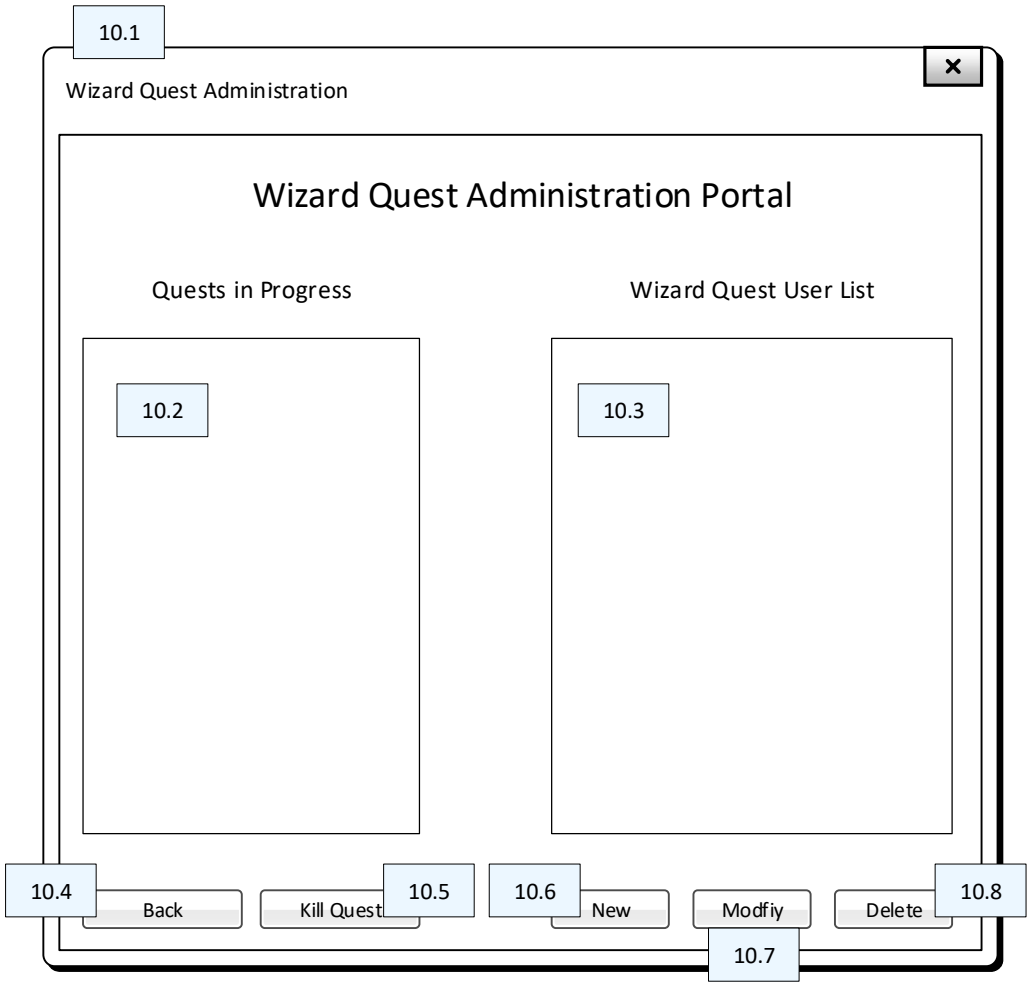
8.9 Leave Quest button. If clicked, the user returns to Quest Selection, where this game will now appear on the user's My Saved Quests list. Go to storyboard six.

Storyboard Nine – Game Play Notifications



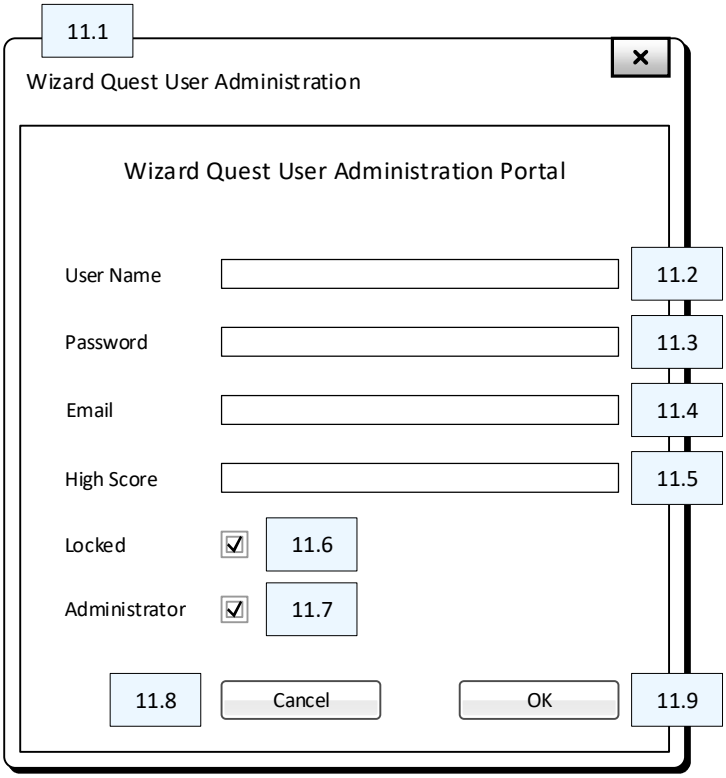
9.1 Bubble appears above player tile when gold is present, and player scores points.
9.2 Bubble appears when a chance tile is selected, inventory is acquired, and points are scored.
9.3 Bubble appears when a chance tile is selected and a player loses points.
9.4 Bubble appears when trap tile is selected, and a player loses points.
9.5 You Died dialogue box appears when the player dies during a quest by either trap or losing their points.
9.6 OK button returns the user to Quest Selection. Go to storyboard six.
9.7 Completed Quest dialogue box appears when all the gold has been found on the quest map, and the user with the most points acquired during the game wins.
9.8 OK button returns the user to Quest Selection. Go to storyboard six.

Storyboard Ten – Administration Portal



10.1 Administration Portal dialogue box.
10.2 List quests (games) currently in progress.
10.3 List all users.
10.4 Back button in clicked returns the user to Quest Selection. Go to storyboard six.
10.5 Kill Quest button kills selected quest from the Quests in Progress list (10.2).
10.6 New button, if clicked, opens a create user dialogue. Go to storyboard eleven.
10.7 Modify button if clicked opens modify user administration dialogue. Go to storyboard eleven.
10.8 Delete button if clicked deleted selected user from Wizard Quest User List (10.3).

Storyboard Eleven – User Administration



11.1 User Administration dialogue box.
11.2 Textbox for username.
11.3 Textbox for password.
11.4 Textbox for email.
11.5 Textbox for the high score.
11.6 Checkbox for account locked (checked) and unlocked (unchecked) status.
11.7 Checkbox for administrative privileges.
11.8 Cancel button returns the user to the administration portal. Go to storyboard ten.
11.9 OK button adds/modifies user details and returns administrator to administration portal. Go to storyboard ten.

Screen Design Rationale

Login

A simple login screen built to the brief and designed to reflect good UX and UI specifications. Using object-oriented principles, player registration could inherit from.

Quest Selection

The Quest Selection window acts as a collection point for all the user's information, gives them an overview of current online game and score activity, and is a central hub to interact with games in progress or start a new game. The design is easy to follow and understand while displaying the required deliverables.

Game Play or Questing

The questing game screen is a basic grid formation that follows map game layout conventions to assist the user with an intuitive and easy-to-use interface. Using 20 x 20 tiles at this stage in the design gives 400 tiles for players to move around on during their quest. Questing is achieved on the map, with player score overview and inventory information appearing on the right-hand side.

Additionally, users can chat with others playing the same game by utilising the chat terminal at the bottom of the quest window.

Administration

Administrators' requirements include ending running quests, adding new users, updating user details. The administration portal design meets these requirements with a simple to use dual window game and user management interface.

As with login, the modify and add user window is reused to align with object-oriented design principles.

CRUD Table

Entity/Attribute	User Registers	User Login	Delete Account	Lock Account	Quest Selection	New Quest	User Moves	User Chat	Quest Ends	User Logout	Administration Portal	Kill in Progress Quest	Delete User	Create User	Modify User
tblUser	C	R	D		R	R		R	RU	RU	R		D	RC	RU
UserID	C		D		R	R		R			R		D	C	R
UserName	C	R	D		R			R	R		R		D	RC	RU
UserPassword	C	R	D										D	C	RU
Email	C		D										D	C	RU
LoginAttempts	C	RU	D										D	C	RU
UserLocked	C	R	D	U									D	C	RU
UserOnline	C		D		RU					U			D	C	RU
Administrator	C		D		R								D	C	RU
TotalScore	C		D		R				RU	RU		RU	D	C	RU
tblQuest					R	C	U	R	U	U	R	U			
QuestID					R	C		R		U	R				
QuestName					R	C					R				
MaxUsers						C									
ActivePlayer						C	U			U					
QuestStatus									U	U	R	U			
tblQuestPlay			D		R	C		R		U	R		D		
QuestPlayID			D		R	C		R		U	R		D		
UserID			D		R	C					R		D		
TileID			D		R	C	U			U			D		
ChatID			D										D		
QuestID			D							U			D		
PlayerNumber			D			C				U			D		
tblQuestPlayInventory			D			C									
InventoryID			D			C									
QuestPlayID			D			C									
AssetID			D			C									
Quanity			D			C									
tblQuestScore			D		R	C						R	D		
ScoreID			D		R	C							D		
CurrentQuestScore			D		R	C	U		R	R		R	D		
QuestPlayID			D		R	C							D		
QuestID			D		R	C							D		
tblChat			D					C					D		
ChatID			D					C					D		
UserID			D					C					D		
Message			D					C					D		
tblQuestMap						C	R								
MapID						C									
QuestID						C									
xMax						C									
yMax						C									

Entity/Attribute	User Registers	User Login	Delete Account	Lock Account	Quest Selection	New Quest	User Moves	User Chat	Quest Ends	User Logout	Administration Portal	Kill in Progress Quest	Delete User	Create User	Modify User
tblQuestMapTile						C	R								
TileID						C	RU								
MapID						C	R								
xPosition						C	R								
yPosition						C	R								
TileActive						C	RU								
tblQuestTileAsset						C	RU								
TileAssetID						C	R								
TileID						C	R								
AssetID						C	R								
tblAsset						R	R								
AssetID						R	R								
AssetName						R	R								
AssetDescription						R	R								
AssetValue						R	R								

CRUD Table Analysis

User Registers

A user registering in the system would trigger an insert statement populating entries in the tblUser table.

User Login

A user logging in would require retrieving their username, password, and an account locked check. Successful logins would require an update to login attempts to be reset to zero.

Delete Account

Executed either by user or administrator would delete all records from tblUser and cascade to any referential child keys from tblQuestPlay, tblQuestPlayInventory, tblQuestScore, and tblChat.

Account Locked

With five unsuccessful attempts at password validation, the account locked attribute of tblUser would be updated to true for the selected username.

Quest Selection

Once logged in, the programme will need to retrieve the user information, other users online, games in progress and saved game data. User needs to be updated to online status (UserOnline = True) and retrieve their details UserID, UserName, Administrator, and TotalScore.

Retrieval of quests in progress where QuestStatus = True. Attributes required include QuestID, QuestName to display in the Quest Selection window.

Retrieval of QuestPlayID, UserID, TileID from tblQuestPlay and corresponding QuestScoreID from tblQuestScore will enable the quest selection window to populate online users, show a list of current high scores, and allow the user to join.

New Quest

When a user starts a new quest, they will name it, and this will be assigned to the QuestName attribute when created in the tblQuest table. This will also create dependent table entries in tblQuestPlay, tblQuestPlayInventory, tblQuestScore, tblQuestMap, tblQuestMapTile, tblQuestTileAsse, and tblAsset to initialise a new game.

User Moves in a Quest

When a user can move ActivePlayer = PlayerNumber, the TileID is updated to the new location. The CurrentQuestScore is refreshed to add any points the user may have scored by retrieving asset values for score additions from tblAsset when moving to the new tile location. tblQuestMapTile is retrieved and updated with new location information.

User Chat

Chat requires the retrieval of the players UserID and UserName, along with their quest information QuestPlayID. The user sent a chat that created a new chat record showing the username and their message to all current players.

Quest Ends

When a quest ends, the QuestStatus in tblQuest = False. The CurrentQuestScore of each user in the quest is retrieved to ensure it is ultimately added to TotalScore.

User Logout

User status is set to offline by updating UserOnline = false. Any quests the player was on are updated to reflect the user has left and offline and stores play information to re-join the quest in the future if still available.

Administration Portal

The administration button will only be visible if Administrator = true for the user. The administration portal will retrieve a list of users displaying UserID and UserName. Additionally, in-progress quests by name. Therefore QuestID, QuestName, QuestPlayID, and UserID will all be retrieved where QuestStatus = True.

Kill in Progress Quest

To kill an in-progress quest, the QuestStatus will be updated to false. Additionally, the retrieval of users and their current scores in the quest will be retrieved to ensure they are added to TotalScore.

Delete User

The administrator can delete a user. This will remove their attributes from tblUser and cascade to any dependent records in tblQuestPlay, tblQuestPlayInventory, tblQuestScore, and tblChat.

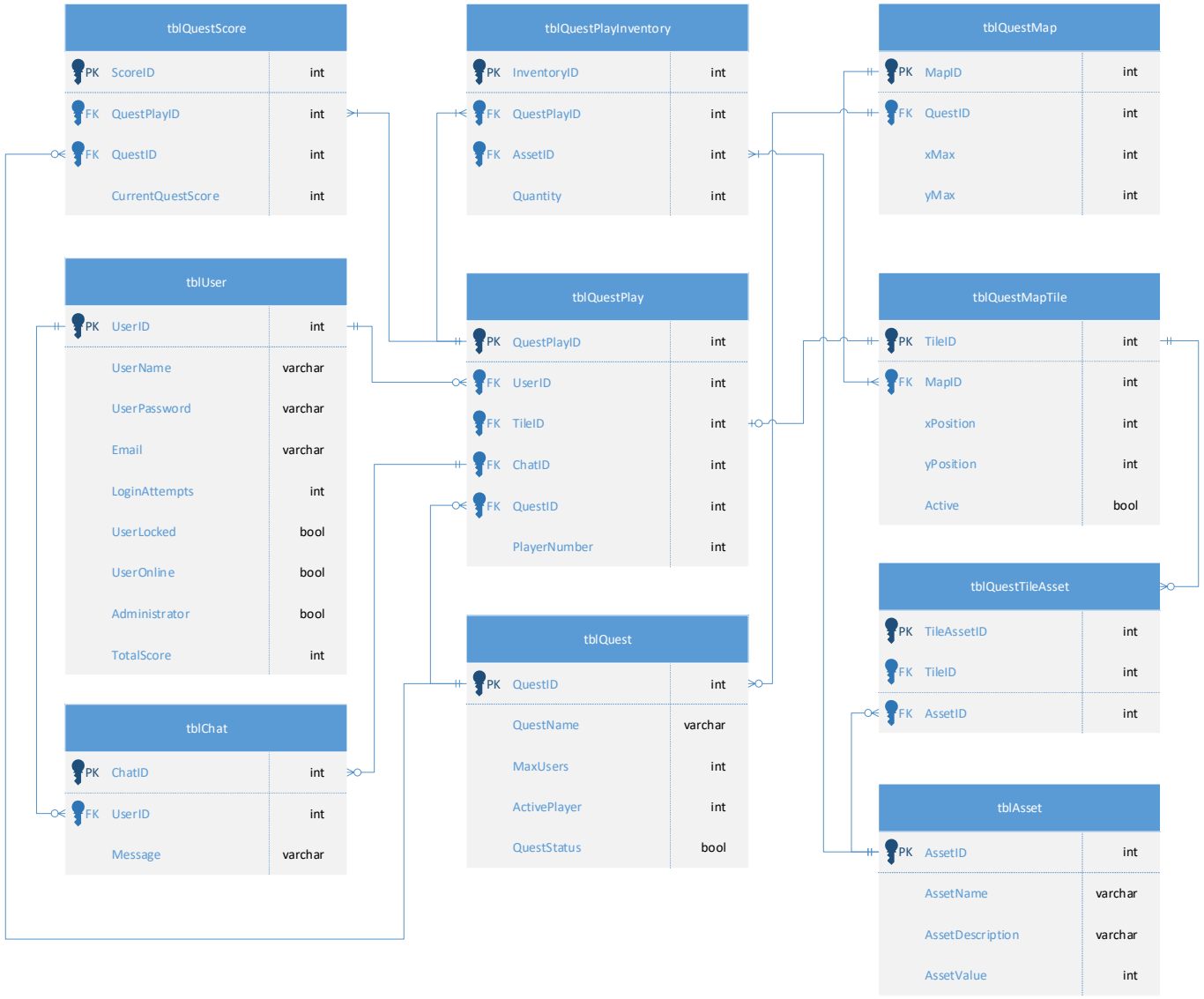
Create User

When the administrator adds a new user, the system must first check to see if the username is unique by retrieving UserName then inserting new user details in tblUser.

Modify User

The administrator modifies a user by selecting their username for the list in the portal. Details can then be modified and updated in tblUser.

Entity Relationship Diagram



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Entity Relationship Diagram Rationale

Players and their Quest's

The player's information is stored in tblUser. Details include their login credentials and total score data. Each quest is uniquely identified and named in tblQuest. Whilst each player that plays in a quest generates their own QuestPlayID in tblQuestPlay, respectively. This enables single and multiplayer options for each quest.

Quest and Quest Map

Each quest in tblQuest has its own unique map in tblQuestMap. This ensures that each game can be played with an independent map.

Quest Map, Map Tiles, and Assets

Each unique map populates with its own tiles and adds assets for players to collect. Each Quest has its own MapID in tblQuestMap, which in turn has its own tile configuration in tblQuestMapTile. Tiles with assets assigned a TileAssetID in tblQuestTileAsse, which enables players to score or lose point based on the asset value from AssetValue in tblAsset.

Quest Score and Inventory

Each player with their own unique QuestPlayID for each quest they are playing has their score calculated by tblQuestScore. This table calculates each player's current quest score as they accumulate assets. Any asset of positive value the user scores points, and the asset is added to their inventory in tblQuestPlayInventory. Their CurrentQuestScore is added to their TotalScore in tblUser to reflect their overall lifetime quest score.

Quest Chat

Each quest has a chat that all players in that quest can communicate. Chats are generated in tblChat and are displayed in the quest(QuestID) in which they are generated.

SQL

The SQL to build the database as per the entity-relationship diagram for the game creates a database call WizardQuest. Additionally, all DDL statements are compiled into one procedure call ddlWizardQuest, whilst all DML test statements exist in a procedure call dmlWizardQuest. Notes have been added to the DML statements to indicate what function they may be used for.
See repository file Milestone One – SQL.sql

tlbUser

The user table contains all user information for account verification, privileges, and total score.

- **UserID**
  - Integer, auto incremental, not null, and the primary key
  - Used to uniquely identify a user in different games with scores and chats
- **UserName**
  - Varchar, unique, not null
  - Used to identify the user in gameplay, chat, verification, and administration
- **UserPassword**
  - Varchar, not null
  - Used to verify user at login
- **Email**
  - Varchar, not null
  - Contact details for each user
- **LoginAttempts**
  - Integer, not null
  - Counts unsuccessful logins up to five for account lock requirement
- **UserLocked**, **UserOnline**, **Administrator**
  - All Boolean, not null.
  - Used to show if the account is locked, user online, and user administrator, respectively.
- **TotalScore**
  - Integer, not null
  - Holds the user's overall score for all their games played so far

tblQuest

the quest table contains a primary record of each quest that is being played.

- **QuestID**
  - Integer, auto incremental, not null, and the primary key
  - Used to uniquely identify the game being played
- **QuestName**
  - Varchar, not null
  - Initiating player can give the game a unique name.
- **MaxUsers**
  - Integer, not null
  - Maximum players in a game at one time

- **ActivePlayer**
  - Integer, not null
  - Holds the value of the player number currently taking a turn
- **QuestStatus**
  - Boolean, not null
  - Value to indicate if the game is currently being played

tblChat

The chat table contains all in-game chat data.

- **ChatID**
  - Integer, auto incremental, not null, and the primary key
  - User to uniquely identify each individual chat in each game
- **UserID**
  - Foreign key constraint connects chat to individual user
- **Message**
  - Varchar, not null
  - Contains the message that will be displayed in the chat terminal during gameplay. Not null ensures no blank messages can be sent

tblQuestPlay

The play table connects each individual player to a game/quest.

- **QuestPlayID**
  - Integer, auto incremental, not null, and the primary key
  - Used to identify each instance of a player in a quest
- **UserID**, **TileID**, **ChatID**, **QuestID**
  - Foreign key constraints to complete individual player instance in a quest
- **PlayerNumber**
  - Integer, not null
  - Contains the number of the player currently in play. If PlayerNumber is equal to ActivePlayer in the quest, that is, the player currently in play

tblQuestScore

The score table calculates each score for a user in every quest they a currently in.

- **ScoreID**
  - Integer, auto incremental, not null, and the primary key
  - Used to identify each score for a user in every quest they are in
- **QuestPlayID**, **QuestID**
  - Foreign key constraints linking individual score to play instance and quest instance.
- **CurrentQuestScore**
  - Integer, not null
  - Contains the user's current score in the quest.

tblAsset

The asset table stores all assets that can potentially be on a tile for each quest.

- **AssetID**
  - Integer, auto incremental, not null, and the primary key
  - Used to identify each unique asset and its value
- **AssetName**
  - Varchar, not null
  - Short name used for inventory and scoring notifications during quest play
- **AssetDescription**
  - Varchar, not null
  - Short description used for scoring notifications during quest play
- **AssetValue**
  - Integer, not null
  - Value used for scoring points during quest play

tblQuestPlayInventory

The inventory table keeps a total of each player's accumulated inventory in each quest instance.

- **InventoryID**
  - Integer, auto incremental, not null, and the primary key
  - Used for a unique inventory for each quest the user is playing
- **QuestPlayID**, **AssetID**
  - Foreign key constraints linking the inventory to a user's quest instance and their current accumulated assets
- **Quantity**
  - Integer, not null
  - Value to indicate assets in inventory

tblQuestMap

The map table has a unique map for each instance of a quest.

- **MapID**
  - Integer, auto incremental, not null, and the primary key
  - Identifies each map for each quest.
- **QuestID**
  - Foreign key constraint, each map has one and only one quest.
- **xMax**, **yMax**
  - Integer, not null
  - Holds a value for the maps total size on the x and y-axis.

tblQuestMapTile

The map tile table has each tile for each map in every quest.

- **TileID**
  - Integer, auto incremental, not null, and the primary key
  - Identifies each tile for each map

- **MapID**
  - Foreign key constraint, each tile has one and only one map.
- **xPosition**
  - Integer, not null
  - Indicates tile row position
- **yPosition**
  - Integer, not null
  - Indicates tile column position
- **Active**
  - Boolean, not null
  - Indicates if a tile is active.

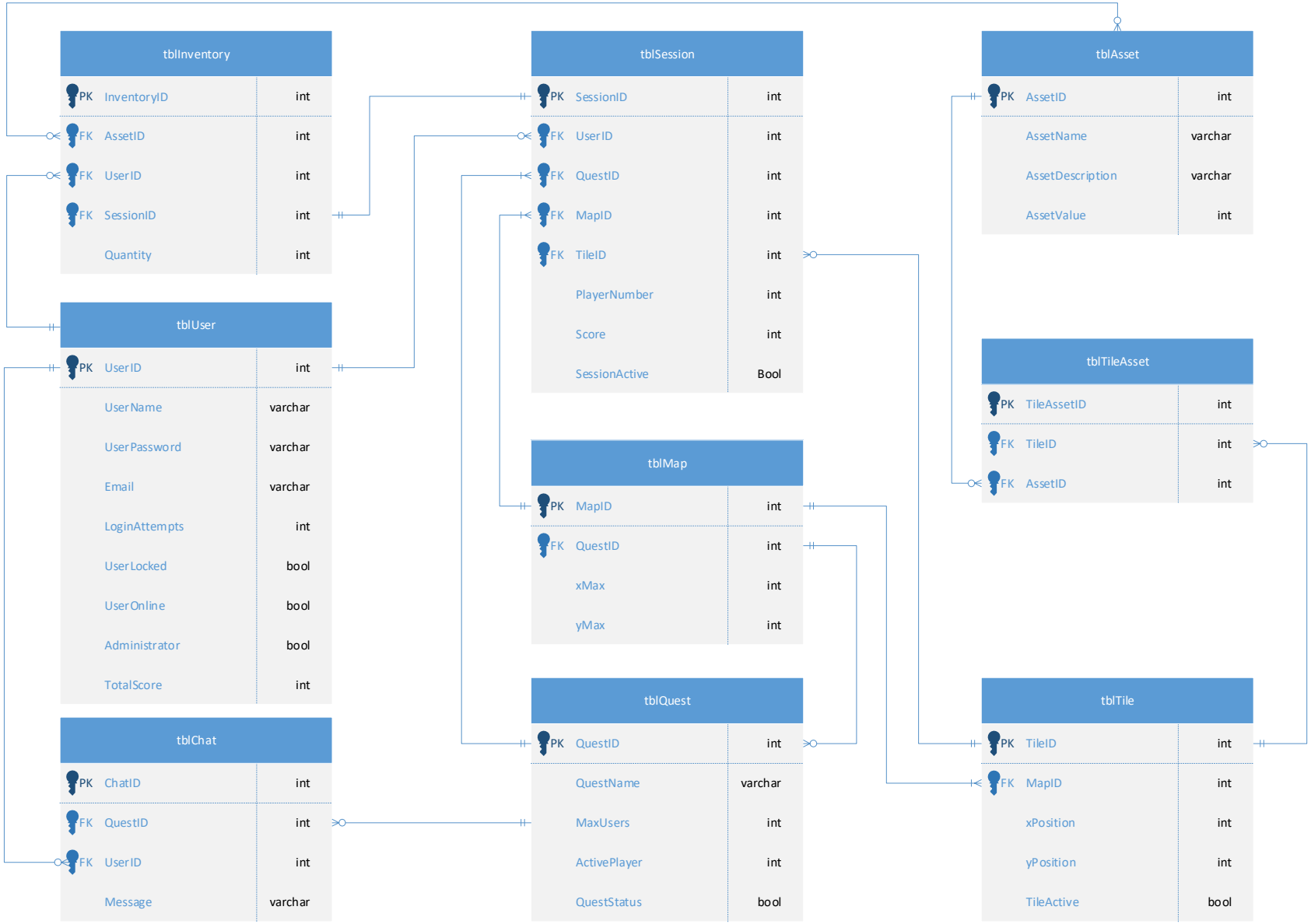
tblQuestTIleAsset

The tile asset table assigns asset to various locations on each map in every quest.

- **TileAssetID**
  - Integer, auto incremental, not null, and the primary key
  - Identifies each instance of an asset of a tile
- **TileID**, **AssetID**
  - Foreign key constraints, a unique combination of asset and tile used for location and scoring.

Milestone Two

Entity Relationship Diagram – Iteration Two



CRUD Table – Iteration Two

Entity/Attribute	User Registers	User Login	Delete Account	Lock Account	Join Quest	New Quest	User Moves	User Chat	User Leaves Quest	Quest Ends	User Logout	Kill in Progress Quest	Delete User	Create User	Modify User
tlbUser	C	R	RD		R	R	R	R	R	RU	RU		RD	RC	RU
UserID	C		D	R	R	R	R	R	R	R	R		RD	C	R
UserName	C	R	RD					R		R			D	RC	RU
UserPassword	C	R	RD										D	C	RU
Email	C		D										D	C	RU
LoginAttempts	C	RU	D										D	C	RU
UserLocked	C	RU	D	RU									D	C	RU
UserOnline	C	RU	D								RU		D	C	
Administrator	C	R	D										D	C	RU
TotalScore	C		D							RU			D	C	RU
tblQuest					R	C	RU	R	RU	RD		RD			
QuestID					R	C	R	R	R	RD		RD			
QuestName						RC				RD		D			
MaxUsers						C				RD		D			
ActivePlayer						C	RU		RU	RD		D			
QuestStatus						C				RD		D			
tblSession			D		RC	C	RU		R	RD		RD	RD		
SessionID			D		RC	C	R		R	RD		D	D		
UserID			D		RC	C	R		R	RD		D	RD		
QuestID			D		R	C	R		R	RD		RD	D		
MapID			D		R	C	R		R	RD		D	D		
TileID			D		C	C	R		R	RD		D	RD		
PlayerNumber			D		C	C	R			D		D	D		
Score			D		C	C	RU			RD		D	D		
SessionActive			D		C	C			RU	D		D	D		
tblInventory			D		C	C	RU			RD		D	RD		
InventoryID			D		C	C	R			RD		D	D		
AssetID			D		C	C	R			D		D	D		
UserID			D		C	C	R			RD		D	RD		
SessionID			D		C	C	R			RD		D	D		
Quanity			D		C	C	RU			D		D	D		
tblChat			D					C		RD		D	RD		
ChatID			D					C		D		D	D		
QuestID			D					C		RD		D	D		
UserID			D					C		D		D	RD		
Message			D					C		D		D	D		
tblMap					R	C	R		R	RD		D			
MapID					R	C	R		R	RD		D			
QuestID					R	C	R		R	RD		RD			
xMax						C				D		D			
yMax						C				D		D			

Entity/Attribute	User Registers	User Login	Delete Account	Lock Account	Join Quest	New Quest	User Moves	User Chat	User Leaves Quest	Quest Ends	User Logout	Kill in Progress Quest	Delete User	Create User	Modify User
tblTile					R	C	RU		RU	RD		D	RU		
TileID					R	C	R		R	RD		D	R		
MapID					R	C	R		R	RD		D			
xPosition					R	C	R			D		D			
yPosition					R	C	R			D		D			
TileActive					R	C	RU		RU	D		D	RU		
tblTileAsset						C	RD			RD		D			
TileAssetID						C	RD			RD		D			
TileID						C	RD			RD		D			
AssetID						C	RD			RD		D			
tblAsset						R	R								
AssetID						R	R								
AssetName						R	R								
AssetDescription						R	R								
AssetValue						R	R								

ERD and CRUD Iteration Two Discussion

Minor changes to ERD and CRUD have been made based on feedback and learning from creating MySQL procedures during milestone two development. Specific changes include:

- Minor changes to ERD relationship notations based on feedback.
- Additional SessionActive attribute to tblSession to indicate if a player has left the quest.
- The removal of the scoring table and the addition of a Score attribute in tblSession.
- Refactor the chat table to have both the QuestID and UserID as foreign keys.
- Minor changes to table names for shorter and terms and better understanding when coding.

CURD Activities MySQL Procedures

Each CRUD activity has been developed into a MySQL procedure and tested in the console application provided with this document.

User Registration

See the userRegistration procedure that creates a user record in tblUser, respectively.

User Login

See the userLogin procedure that verifies user credentials and login activity.

Delete Account

See the userDelete procedure that verifies the user credentials and deletes the user records.

Lock Account
Included as part of the login procedure.

Join Quest
See the joinQuest procedure that verifies the chosen quest and inserts the user's details into the game if successful.

New Quest
See the newQuest procedure that verifies chosen quest name and builds a new quest, map, tiles, assets, and user details.

User Moves
See the userMove procedure that verifies the user's input, scores point, update tiles, and inventory.

User Leaves Quest
See the leaveQuest procedure that updates the user's quest status and ensure the tile they were on is now available for other players.

Quest Ends
See the questCheck procedure that runs at the end of each userMove procedure. It validates the current quest to see if there are any players with a winning score and that there are still assets available. If the game is over, the questCheck procedure ends the game, updates the user's total score and informs them of the winner.

User Logout
See the userLogout procedure that updates online status.

Kill In Progress Quest
See the administratorKill procedure that kills any in-progress quest and removes all records.

Delete User
See administratorDelete procedure that deletes selected user and their records.

Create User
See administratorAdd that creates new user records.

Modify User
See administratorModify that modifies existing user records.

ACID and Multi-Player Game Support

ACID, according to Jepson (2001), is an excellent way to test overall quality. ACID is an acronym that describes four properties of a robust database system: atomicity, consistency, isolation, and durability. These features are scoped to a transaction, a unit of work that the programmer can define. A transaction can combine one or more database operations.

Atomicity

Jepson (2001) states that atomicity is an all-or-none proposition. Suppose you define a transaction that contains an UPDATE, an INSERT, and a DELETE statement. These statements are treated as a single unit with atomicity, and thanks to consistency (the C in ACID), there are only two possible outcomes: either they all change the database, or none of them do. Furthermore, Kaur (2021) states that atomicity is also known as the 'All or nothing rule', meaning transactions must be executed in their entirety to ensure the correctness of the database state.

With Wizard Quest, the procedures are designed to complete single functions for users. If the process does not complete, the database will not be updated. For example, the userMove procedure handles a player moving, scoring any points associated with that move, and setting the following players turn all in the same procedure. If the database failed at any point during the move, none of these changes would happen, keeping the database in a stable state. Additionally, the game structure is designed to ensure only one player at a time can move in a quest. This adds a further constraint to the database, ensuring only one user is making changes in a game.

Consistency

Consistency links into the previous discussion about users moving in the game, and Jepson (2001) discusses, consistency guarantees that a transaction never leaves your database in a half-finished state. If one part of the transaction fails, all of the pending changes are rolled back, leaving the database as it was before you initiated the transaction. For instance, when you delete a customer record, you should also delete all of that customer's records from associated tables.

In Wizard Quest, all quest data is deleted, and players scores are calculated when the quest ends, including any map entries, assets, and user quest details. If the game ends successfully, MariaDB (2018) states, new data will be added to the database and the resulting state will be consistent with existing rules.

Isolation

Jepson (2001) discusses isolation as keeping transactions separated from each other until they're finished. Furthermore, Tech School (2020) explains that when working with database transactions, one crucial thing we must do is choose the appropriate isolation level.

- The lowest isolation level is **read uncommitted**. Transactions in this level can see data written by other uncommitted transactions, thus allowing dirty read phenomenon to happen.
- The next isolation level is **read committed**, where transactions can only see data that other transactions have committed. Because of this, dirty read is no longer possible.
- A bit more strict is the **repeatable read** isolation level. It ensures that the same select query will always return the same result, no matter how many times it is executed, even if some other concurrent transactions have committed new changes that satisfy the query.

- The highest isolation level is **serializable**. Concurrent transactions running in this level are guaranteed to yield the same result as if they're executed sequentially in some order, one after another without overlapping.

Importantly Oracle (2021) state that isolation level read uncommitted and serializable change processing behaviour so drastically that they are rarely used.

It is important to note that these isolations level behaviours as described are specific to MySQL. Given these insights and further discussions in class, a global isolation level of read committed has been applied to the Wizard Quest database. Isolation at this level protects the integrity within each transaction and prevents dirty reads. This level, combined with the nature of the game being a turn-based game, is the best solution ensuring each transaction is completed with the latest data available, system performance is maintained, and accurately supports a multiplayer transaction environment.

Durability

Jepson (2001) discusses that durability guarantees that the database will keep track of pending changes in such a way that the server can recover from an abnormal termination. Hence, even if the database server is unplugged in the middle of a transaction, it will return to a consistent state when it's restarted. Furthermore, Kaur (2021) state durability ensures that once the transaction has completed execution, the updates and modifications to the database are stored in and written to disk, and they persist even if a system failure occurs. These updates now become permanent and are stored in non-volatile memory. The effects of the transaction, thus, are never lost.

The ACID properties, in totality, provide a mechanism to ensure correctness and consistency of a database in a way such that each transaction is a group of operations that acts as a single unit, produces consistent results, acts in isolation from other operations and updates that it makes are durably stored.

Milestone Three

Prototype Implementation Overview

The Wizard Quest database game evolution from simple console application to prototype GUI has been an intriguing learning experience. Considering how to bridge the relationship between application and database while ensuring the logic is completed in that database has been a long, sometimes frustrating, but rewarding task. My understanding of databases in MySQL and application development in C# has benefited dramatically.

Use-Case Storyboard – GUI Realisation

Each use-case identified in the initial storyboarding processes has been realised by completing minor modifications to the procedures developed for the console application. These procedures now output a status message for each given outcome. The application receives the status message and reacts according.

Storyboard One – Login

The login procedure (userLogin) in MySQL has been modified to output five different statuses:

1. Success – username and password are correct, and the user progresses to the quest selection form.
2. Administrator – username and password are correct, and administrative user progresses to the quest selection form with administrator privileges.
3. Password – username is correct, but the password is incorrect.
4. Locked – username is correct, but the account is locked.
5. Username – username is not currently in the database; user is asked if they would like to register.

The database code has been refactored into one-word status messages sent back to the application and stored in a login status attribute in the C# DataAccess class. The initial procedure has been updated to identify an administrator login. The application handles the administrator successful login scenario by updating the _adminstrator Boolean attribute on the quest selection form to true. When this attribute is true, the administration button is active for the user.

Storyboard Two – Delete Account

The user deletes account procedure (userDelete) in MySQL has been modified to output two different statuses:

1. Success – the user has been deleted.
2. Fail – the username or password supplied is incorrect.

Again these one-word statuses are then handled by the application accordingly. Changing the output message was the only change to this procedure.

Storyboard Three – Incorrect Password

The incorrect password use case is handled in the login procedure (userLogin). The application displays either an incorrect password notification if the output is “Password” and a locked account notification if the output is “Locked”.

Storyboard Four – Incorrect Username

As discussed in storyboard one, if the login procedure (userLogin) does not find the username supplied in the database, the login status "Username" is handled by the application by displaying a username not found message. The message invites the user to register via a yes or no response. No sends the user back to the login screen, and the yes option sends the user to the registration form.

Storyboard Five – User Registration

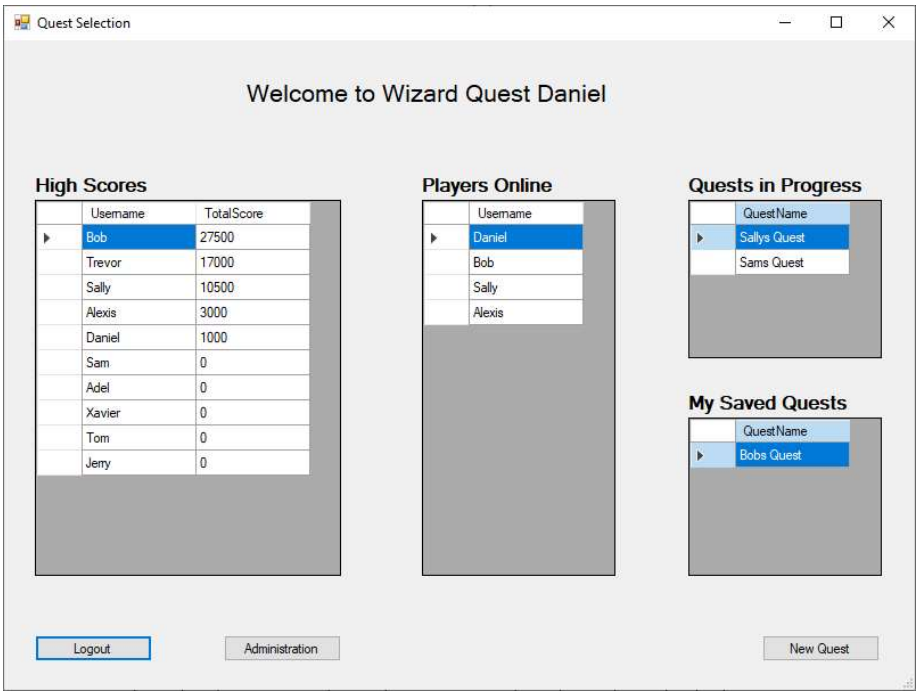
The user registration procedure (userRegistration) in MySQL has been modified to output two different statuses:

1. Success – the user has registered successful, and the application takes the user to the quest selection form.
2. Username – the user has modified their chosen username on the registration form, and it now matches that of a current user.

Validation has been added to the form to ensure no null values are sent to the database from the application. Additional validation could be added in the next iteration of the prototype, ensuring that email addresses are in the correct format, for example.

Storyboard Six – Game Selection

Game selection is completed in the quest selection form in the GUI application. This form differs slightly compared to the original storyboard.



The addition of a leaderboard to show the top ten scores on the selection screen seemed appropriate to the multiplayer game application. A future iteration could include a player stats option that could display all players' current scores and their rank in Wizard Quest.

Removing the join quest button as linking it to either quests in progress or my saved quests proved difficult, and the example code we were supplies with in-classes used a cell double click method to solve this.

High Scores

The high scores leaderboard has been completed by creating a high score data grid. The grid is populated by the high score procedure (getHighScores) in MySQL. The procedure returns the current high scores to the application, and the application stores the procedure data in a list utilising the score class.

Players Online

The player's online list has been completed by creating a user online data grid. The grid is populated by the online user's procedure (getOnlineUsers) in MySQL. The procedure returns the current users online to the application, and the application stores the procedure data in a list utilising the user view class.

Quests in Progress and My Saved Quests

Both of these data grids display the same type of data. However, they result from two different select statements: one finds all the quests that the user is not a player of, and the other finds active quests in which the user is currently a player. The user can double click either of these lists to join or rejoin the listed quest.

I have achieved the different list by using two separate stored procedures (getActiveQuest and getUserActiveQuest). These both use the active quest class in the application to generate list data for the data grids.

Joining and Existing Quest

Double-clicking any of the grid data will display a confirmation message asking if the user would like to join the selected quest. If the user selects yes, the application will attempt to join the user in the quest. The application uses the questID from the data gird data and the user's userID as parameter input for the join quest procedure (joinQuest) in MySQL. The procedure has been modified to give four different statuses:

1. Join – the user has joined the selected quest successfully, and the application loads the quest form displaying current quest data.
2. Rejoin - the user has rejoined the selected saved quest successfully, and the application loads the quest form displaying current quest data.
3. Full – the selected quest already has the maximum number of players, and the user cannot join and returns to the quest selection screen.
4. InUse – the user has rejoined the selected saved quest successfully. However, the tile user was last active during their previous turn in the quest is occupied by another user. The application loads the quest form displaying current quest data, but the user must choose another tile before restarting the game.

I would consider developing a bettering understanding of LINQ and possibly experiment with a single stored procedure that gets all quest data in future iterations. Then supplementing LINQ to select sets for all required data grids in the application, including quests in progress, saved, and the administrator's quest list.

Logout

The logout button logs out the user using the user logout procedure (userLogout) in MySQL. The user receives a confirmation message that they have logged out successfully, changes their online

status to false, and returns the application to the login screen. Importantly, I have also ensured that the logout method is executed to update the online status if the application is closed.

Storyboard Seven – New Quest

A new quest is started by the user selecting the new quest button on the quest selection screen. The application then provides the user with input to name their new quest. This new quest name and user's userID is used as a parameter input by the application for the new quest procedure (newQuest) in MySQL. The procedure has been modified to give two different outputs:

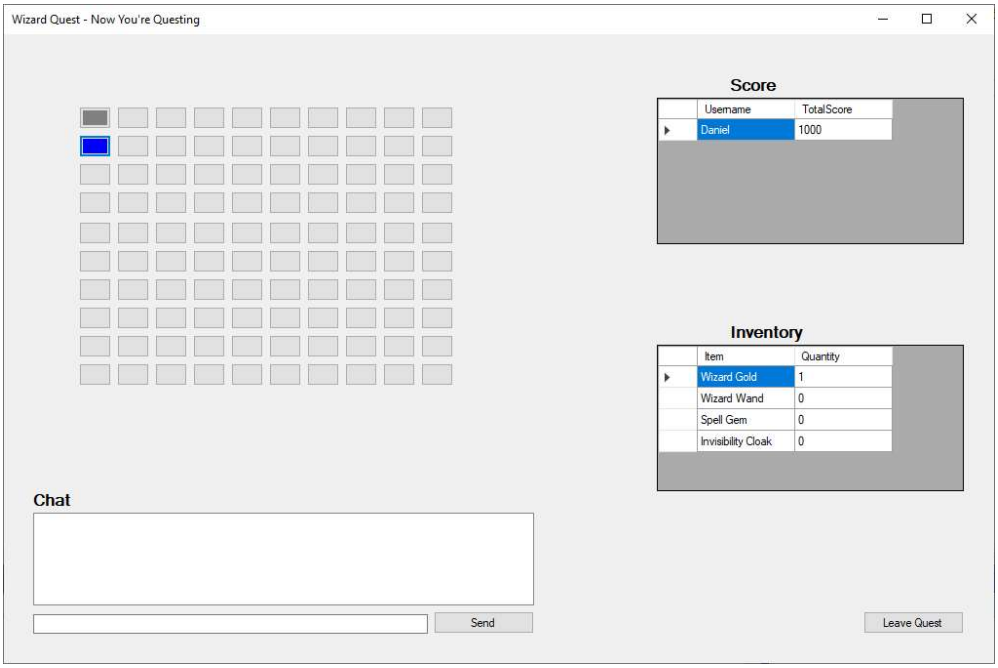
1. Success – the quest name selected is valid, and the application shows the quest screen with the new quest data.
2. Invalid – the quest name selected is not unique, and the user is invited to try another name.

Storyboard Eight – Game Play

Gameplay has been achieved by translating tile data in the database to a grid on the quest screen populated by buttons. Discussing the original 20 x 20 grid, I had developed in my game. The tutor suggested using a smaller test grid for the iteration of the GUI prototype.

Tile Map

I have adjusted the new quest procedure in MySQL to accommodate the new grid size discussed with the tutor. Additionally, the tutor demonstrated using a formula to translate the x and y grid positions from a tileID in the database. Used in the user move and user join procedures in MySQL. While the tutor said the formula supplied was being used in smaller grid sizes successfully is was encouraged to test it on my 10 x 10 grid. Testing revealed issues with some of the locations, namely row 5 and column 10. As a resolution, I developed a quest map matrix combined with a tile search method that searches the matrix for the tileID selected and returns x and y values for the application to use via a tuple return type—perhaps not the most elegant solution but a reliable one.



The quest screen shows the active tile as blue. The application updates the button grid after each successful click. Marking the new tile as active (blue) and the old tile colour then updated to grey. Each time the user attempts to move, the game data is refreshed using the update display method.

In future iterations, add an on tick to the update display for chat data to update or investigate how multiplayer interactions with the application could trigger a refresh event. This would significantly reduce the volume of request to the database and improve efficiency.

Score and Inventory

These data grids have been developed identically to the leaderboard and quest lists in the quest selection screen. They use the getQuestScore and getUserInventoy store procedures in MySQL, respectively. Data in these grids are refreshed each time the user interacts with the quest screen executed via the update display method.

Chat

The chat store procedure (userChat) in MySQL functions much the same as the console application with the addition of quest validation. The send button is only active if the application detects input in the chat text input box. The input, questID, and userID are all used as parameter input for the userChat procedure. The procedure has been modified to insert the chat text if the questID is valid and give two different output messages:

1. Success – if the chat message has been inserted into the database successfully.
2. Faile – the questID is not found. Therefore the quest has already ended.

The chat messages are displayed in the chat list, list box on the quest screen. The list box is populated by using a new procedure (getQuestChat) in MySQL. The procedure produces a list of all the chat messages from each user in the quest in sent order utilising the chat class. The application displays the messages in the list box showing the username of the sender and their message. The messages refresh after any user interaction with the quest screen. However, as previously mentioned, a method that could refresh based on multiplayer interaction results with the application in the same quest would produce almost real-time game data and significantly reduce requests to the database.

Leave Quest

The leave quest button uses the leave quest stored procedure (leaveQuest) in MySQL. It validates the quest to ensure it is still being played and updates the user's status in the quest to offline, and updates the tile where they were last active so that other users can now select it in their absence. The user is returned to the quest selection screen, where the quest they just left will appear in the my saved quests list. Notably, the leave quest method is also utilised in the event the application closes unexpectedly mid quest.

Storyboard Nine – Game Play Notifications

Gameplay notifications have been achieved by using a check quest stored procedure (checkQuest) in MySQL. The procedure is used to validate if the quest is still being played as the quest is deleted once it is won. The procedure output updates the quest status attribute in the applications DataAccess class with four different messages:

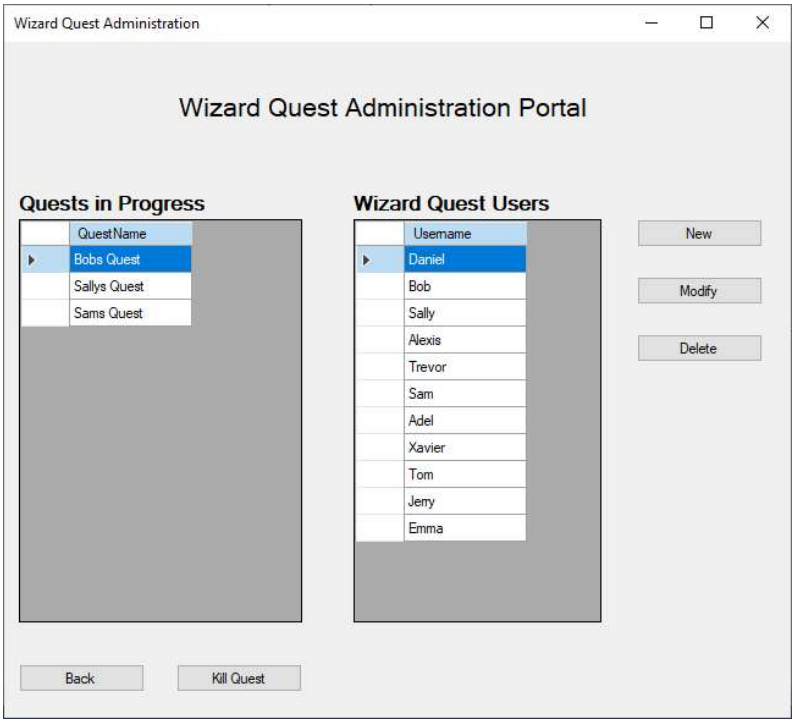
1. Valid – a valid move the application displays a move success message.

2. Death – the user has moved to a tile with an asset with a negative value and depleted their quest score. The user is no longer eligible to continue. The application displays a game over message, and the user is exited from the quest.
3. ! – a status ending with "!" indicates a winner notification. The application displays a game over message and notifies the user of the winner.
4. NotFound - means another player has already won the quest being played, and the user has not been notified. A game over message is displayed, and the application returns the user to the quest selection form.

These messages are only basic functionality of the game in this prototype as a proof of concept. I would consider developing a label in the game that displays a message after each move rather than a message box in future iterations. Furthermore, adding additional statuses includes more information about gameplay, such as assets the user has obtained on their chosen tile. Finally, I would also investigate a solution to ensure all active players in a quest are informed of the winner before the quest data is deleted.

Storyboard Ten – Administration Portal

The procedures developed for administration in the console application required minor alterations to their output to integrate into the applications administration functionality. The quest in progress and wizard quest users list have been developed identically to the data grids found in the quest selection screen.



Kill Quest

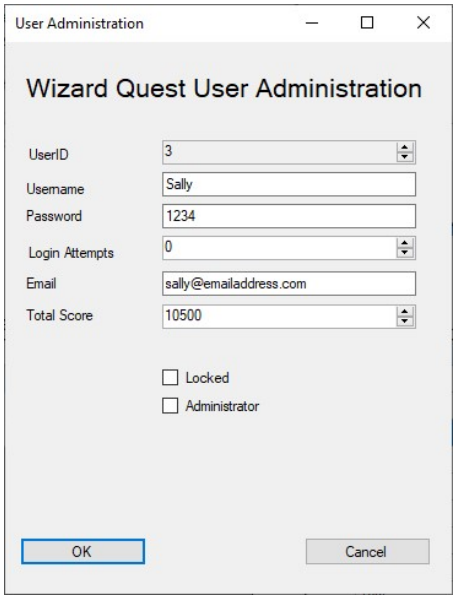
The kill quest button prompts the user if they would like to delete the selected quest. If yes, the application uses the questID of the selected quest as a parameter for the kill quest procedure (administratorKill) in MySQL. The procedure validates that the quest is still active then deletes all quest data. The portal is refreshed to display the updated quests in progress.

Delete User

The user delete button validates that the administrator's userID is not equal to the selected userID as no user in the application can delete their own account. If the selected user is valid, the application prompts the user if they would like to delete the selected user. If yes, the application uses the userID of the selected user as parameter input for the delete user procedure (administratorDelete) in MySQL. The procedure validates that the selected userID still exists and then deletes it from the database. The portal is refreshed to display the updated wizard quest user list.

Storyboard Eleven – User Administration

The user administration screen is accessed when choosing the new or modify buttons on the applications administration portal screen. As previously discussed, the add and modify user procedures developed for the console application had minor adjustments to their output to integrate into the GUI application.



Add/Modify User

The user administration screen has been developed in the application as the userform form. The form translates all the selected user attributes stored in the database onto the user screen when changes can be made and applied back to the database. When adding or modifying a user, the application performs validation to ensure no null values are sent to the database. If there are no null values, the application uses all the input fields displayed on the user screen as parameters for adding or modifying user procedure (admininistratorAdd or admininistratorModify) in MySQL. There are three different output statuses for these procedures:

1. Success – the user has been added/modified successfully, and the user is returned to the administration portal, where the data is refreshed and will show any changes.
2. Username – the selected or modified username already exists. The user is returned to the user screen where they can alter the username.
3. UserID – the selected user no longer exists and cannot be updated.

In the class demonstration code, the tutor's example used a refresh method where the modified user data was used to update the user data in the database and update the user data stored in the list class in the application. The refresh method developed was then meant to show the updated data on the user list main form. However, this was not functioning correctly, and the problem was left to us to develop a solution.

My approach was to only use the new input data as parameters for the corresponding procedure. If the application returned a successful status for the input, the user's display would be refreshed. The application contains an update display method for each screen. Any data displayed in data grids have their data sources reestablished with the required data from the database after the user's last interaction with the application. Therefore, the data displayed is both up-to-date and directly from the database. With the tutor's example, the displayed list data could potentially be different from that in the database. My solution has ensured the most up-to-date data is displayed. The logic in this method is replicated throughout the application wherever database attributes are displayed and consistently updated.

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