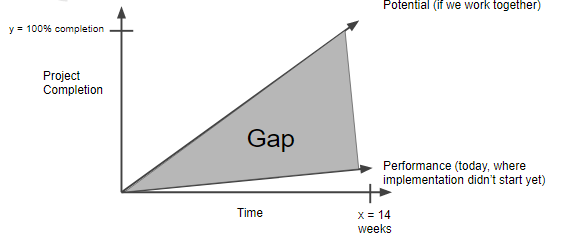
**“Capstone Defense” Project Documentation**

1. **Project vision** 
   1. **Backgrounds**

* Mitchell O’Hair: Computer Science, Java, C#, Unity, MySQL, Blender
* Doug Hartley: Computer Science, Java, C++, quality assurance testing, diagrams, HTML
* James Bridges: Information Technology, Java, C#, Unity, MySQL, Html, Php, CSS, JavaScript
* Jagjot Singh: Computer Science, MySQL, Html, PHP, CSS, Java and JavaScript
* Jenna Mackool: Information Technology, Web Development, HTML, CSS,
* Stevan Rajkovic: Information Technology, QA, Java, PHP, CSS, HTML, C++, Shell scripting
  1. **Socio-economic Impact, Business Objectives, and Gap Analysis**

The socio-economic impact of this project is minimal. It will likely do little to change the lives of anyone except maybe put a smile on their face for an hour or so. This game should be enjoyable to young children and the elderly alike. Our business objective is to have monetization from either in-game purchases and/or Unity ads.



* 1. **Security and ethical concerns**

The database must be secure to prevent data breach.

In order to view player data from the database, a login is required via the accessible website.

Player time: how much time is too much? We need to determine how to find the right balance and notify users when they have been playing too much.

Will not monetize via “loot boxes” as they are predatory in nature towards people with gambling addictions.

* 1. **Glossary of Key Terms**

Tower Defense: A genre of game in which the player places structures that hold off increasingly challenging discrete waves of virtual opponents. These games are typically endless and associated with a survival score.

1. **Project Execution and Planning** 
   1. **Team Information**

Mitchell O’Hair: [mlohair@oakland.edu](mailto:mlohair@oakland.edu) 248-408-0485

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* 1. **Tools and Technology**
     + GitHub for file sharing
     + Trello for Sprint management
     + Visual Studio for IDE
     + Unity as the Game Engine
     + Discord and email for communication
     + Blender for 3D asset creation (and unity asset store)
  2. **Project Plan**

Tower Defense - a player places structures to hold off discrete waves of opponents; the longer the player stays alive, the better the score. It will be a 3D point defense game using C# and Unity gaming engine. Audio will also be implemented using Unity. High scores and login information stored in SQL database. Website protected by username/password and after logging in will show high scores.

* 1. **Best standards and Practices**

Each member in our group in an expert in a specific area of software engineering. James and Mitchell specialize in video game development and responsible for overall gameplay; both graphics and functionality. Jagjot and Jenna specialize in web development, and responsible for implementing the database of high scores and the website. Steven specializes in quality assurance and has a proven record of efficiently testing software products. Doug specializes in quality assurance as well and maintains well-written documentation to help communicate work between groups. We believe that due to our backgrounds, we can all use our expertise in our areas of expertise to the fullest potential to build a high-quality product. This is our best practices development strategy and it’s worked well.

1. **System Requirement Analysis** 
   1. **Function Requirements**

User should be able to create an account on the website.

User should be able to verify their email to play the game with an account.

User should update account information.

User should see the high scores listed in a table view.

User should be shown that they are logged into the website.

User should play the game without an account, but high score functionality will not be present.

User should be able to download the Android game from the Google Play Store.

User should be able to play the game on a PC in the web browser.

User should be able to pause the game at any time and continue where they left off.

User should be able to quit the game at any time.

User should be able to return to the main menu at any time.

(insert more functionality as it’s implemented here)

* 1. **Non-functional Requirements**

The website shall be free from spelling and grammar errors.

The website should have a clean user interface that is easy to use by customers.

The main menu for the mobile game should be functional and easy to use.

The in-game user interface should be un-obtrusive so that users could focus on the game itself.

(more requirements should be listed here)

* 1. **On-Screen Appearance of landing and other pages requirements.**
  2. **Wireframe designs**

1. **Functional Requirements Specification** 
   1. **Stakeholders**
   2. **Actors and Goals**
   3. **User stories, scenarios and Use Cases**

As a user, I want to create a new user account for the game.

As a user, I want to set up/change the password for my user account.

As a user, I want to change the username affiliated with my user account.

As a user, I want a way to verify my email address.

As a user, I want to be able to unlock my account if it was locked for security reasons.

As a user, I want to log into my account using the website.

As a user, I want to log into my account using the desktop app.

As a developer, I want to lock user accounts if they are trying to be compromised.

As a gamer, I want to be able to play the game without distractions.

As a gamer, I want to be able to move my character using movement controls.

As a gamer, I want to check my personal high score in the game.

As a gamer, I want to be able to view the leaderboard for all the high scores that exist.

As a gamer, I want to be able to change my username after creating the account.

As a gamer, I want to be able to change my password anytime I want to.

As a gamer, I want to set a limit on how long I want to play the game.

As a gamer, I want to be reminded to take a break when I’ve been playing the game for too long.

As a gamer, I want to be able to login using Google authentication rather than creating a new account.

As a gamer, I want to view my scores on a publicly visible leaderboard.

As a gamer, I want to be able to use Google authentication to log into my account.

As a gamer, I want to view a new high score on the leaderboard if I exceed my previous high score.

As a gamer, I want to view the health status of my character.

As a gamer, I want the towers in the user interface to be functional.

As a gamer, I want to control my player using real-time physics.

As a gamer, I want to be able to choose different worlds to play in.

As a gamer, I want to be able to activate a menu to play the game.

As a gamer, I want to be able to activate a menu to access settings.

As a gamer, I want an easy way to quit the game in the middle of playing it.

As a gamer, I want to be able to access an in-game menu.

As a gamer, I want to be able to be shown that I’m logged in.

As a gamer, I want to be able to see the score I’m accumulating.

As a gamer, I want my score to be posted on the leaderboard after the game has ended.

As a gamer, I want the resume functionality to work after I pause the game.

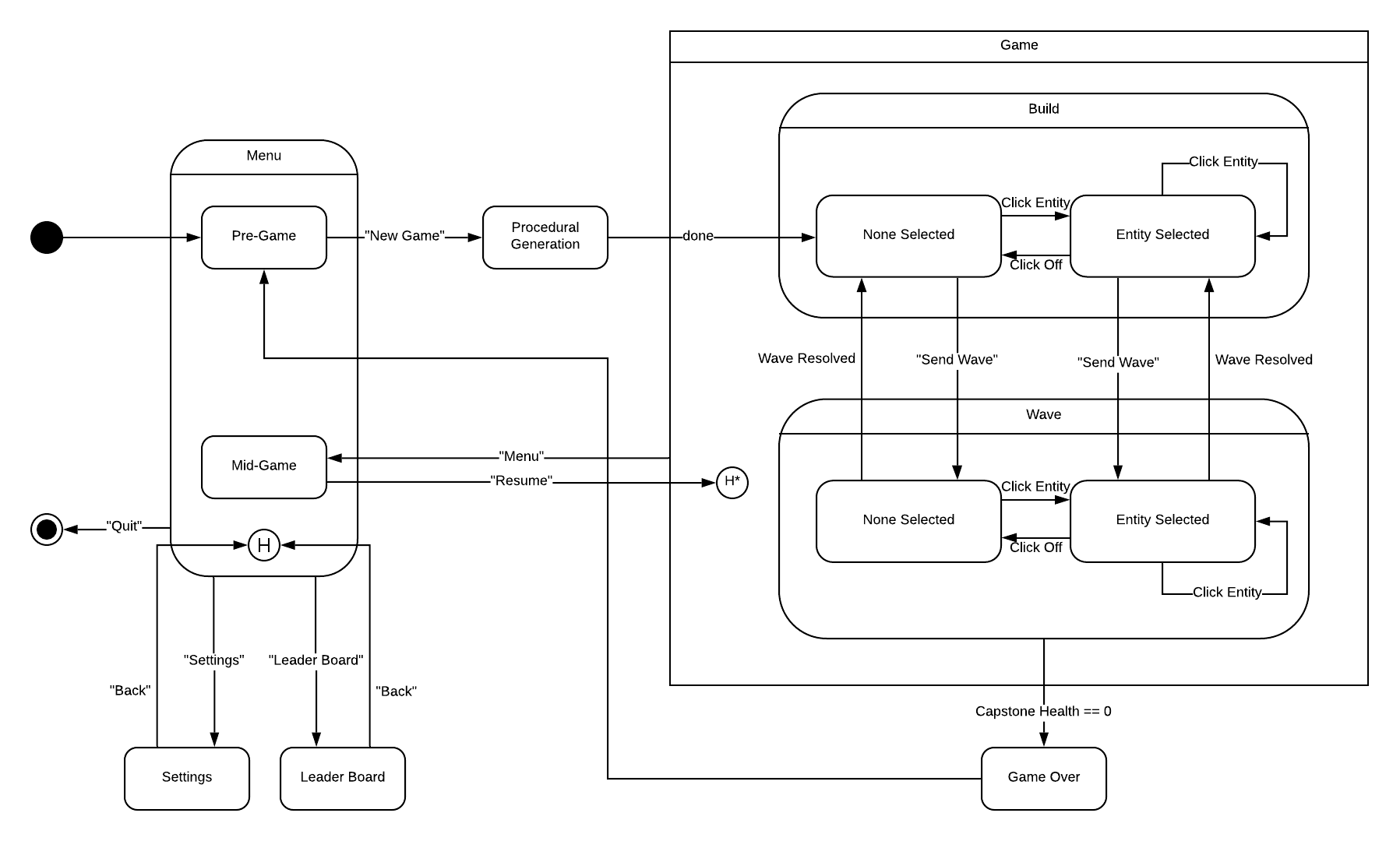
As a gamer, I want to be able to view the circumference of the cannons to help me with the game.

As a gamer, I want the world to spawn with different assets.

As a gamer, I want to be able to play in different worlds with different scenery and characteristics.

* 1. **System Sequence / Activity Diagrams**

1. **User Interface Specifications** 
   1. **Preliminary Design**
   2. **User Effort Estimation**
2. **Static Design** 
   1. **Class Model**
   2. **System Operation Contracts**
   3. **Mathematical Model**
   4. **Entity Relation**
3. **Dynamic Design 7.1. Sequence Diagrams.** 
   1. **Interface Specification**
   2. **State Diagrams**



1. **System Architecture and System Design** 
   1. **Subsystems / Component / Design Pattern Identification**
   2. **Mapping Subsystems to Hardware (Deployment Diagram)**
   3. **Persistent Data Storage**
   4. **Network Protocol**
   5. **Global Control Flow**
   6. **Hardware Requirement**
2. **Algorithms and Data Structures** 
   1. **Algorithms**
   2. **Data Structures**
3. **User Interface Design and Implementation** 
   1. **User Interface Design**
   2. **User Interface Implementation**
4. **Testing** 
   1. **Unit Test Architecture and Strategy/Framework**
   2. **Unit test definition, test data selection**
   3. **System Test Specification**
   4. **Test Reports per Sprint**

JAN 12 – 21 SPRINT 1

* Testing website functionality:
  + Website on following platforms:
    - Windows
      * Chrome – Fully functional
      * Firefox – Fully functional
      * Microsoft Edge – Fully functional
    - Mac
      * Safari – Fully functional
      * Chrome – Fully functional
      * Firefox – Fully functional
    - Android
      * Chrome – Top navbar does not show up properly otherwise functional
      * Samsung Internet app – Top navbar does not show up properly otherwise functional
    - IOS
      * Chrome – Top navbar does not show up properly otherwise functional
      * Safari – Top navbar does not show up properly otherwise functional
* Testing user account creation:
  + Desktop Web Browsers
    - User account creations are successful
    - User log in is successful
  + Mobile Web Browsers
    - User account creations are successful
    - User log in is successful

JAN 22 – February 3 SPRINT 2

* Testing website functionality:
  + Website on following platforms:
    - Windows
      * Chrome – Fully functional
      * Firefox – Fully functional
      * Microsoft Edge – Fully functional
    - Mac
      * Safari – Fully functional
      * Chrome – Fully functional
      * Firefox – Fully functional
    - Android
      * Chrome – Top navbar does not show up properly otherwise functional
      * Firefox - Top navbar does not show up properly otherwise functional
    - IOS
      * Chrome – Top navbar does not show up properly otherwise functional
      * Safari – Top navbar does not show up properly otherwise functional
* Testing account creation:
  + Windows:
    - Edge: When submitting information to create an account, an error shows “Please enter a valid.”. This message needs to be changed to be more detailed and not show if all fields are submitted/added to database.
    - Chrome: Same behavior as Edge above
    - Firefox: Same behavior as Edge/Chrome above
  + Mac:
    - Safari: Same behavior as browsers on Windows
    - Chrome: same behavior as Chrome on Windows
    - Firefox: same behavior as Firefox on Windows
  + iOS:
    - Safari: Unable to test due to missing navbar (see “website functionality”)
    - Chrome: Unable to test due to missing navbar (see “website functionality”)
* Testing email verification:
  + Received email indicating “Visit the following link to activate your account” but no link is shown. Tested email sent to iCloud and gmail email addresses.
* Design issues:
  + Windows:
    - Edge: Perhaps make “login” or “register” on homepage hyperlinks to their corresponding webpages
    - Firefox: Perhaps make “login” or “register” on homepage hyperlinks to their corresponding webpages
    - Chrome: Perhaps make “login” or “register” on homepage hyperlinks to their corresponding webpages
  + Mac:
    - Safari: same as browsers above
    - Firefox: same as browsers above
    - Chrome: same as browsers above
  + iOS:
    - Safari: same as browsers above
    - Chrome: same as browsers above
  + Android:
    - Firefox: same as browsers above
    - Chrome: same as browsers above

FEB 4 – FEB 17 SPRINT 3

* WEBSITE FUNCTIONALITY
  + Mobile testing
    - IOS and Android are still having issues with navigation of website. (SR)
    - Top navbar does not show up properly on iOS Safari or iOS Chrome (DH)
    - Unity demo functional across all browsers. (SR)
  + User Account Creation
    - Needs confirm password for extra security when creating accounts. (SR)
    - Email verification with link and security code fully functional on desktop web browsers. Tested on chrome, firefox, safari and edge. (SR)
    - Need verification to confirm login status on the top of the page. (SR)
    - Currently there is no way to verify if a user is currently logged in to their account on the website. (SR)
    - Need to redirect users to the main playable game page when logged in successfully. (SR)
    - Successful account creation message now appears properly (DH)
    - Receiving verification email to an iCloud email account sends a invalid link. Testing with Gmail email address works properly. (DH)
  + Website Design Issues:
    - Clicking “login” or “register” should be hyperlinked to their corresponding webpages. (DH)
* Game functionality
  + Old build still functioning properly on the demo page of the website. (SR)
    - Current issues include collision on objects are not working properly but collision is working properly within the editor. (SR)
  + Take a break reminder pops up as intended but does not disappear currently and sits at the top of the game. (SR)
  + Building towers and placing them on the map is functioning as intended. (SR)
  + Scoring still needs to be implemented and tested. (SR)
  + Clicking “new game” starts a scene and a sound plays. This is working as intended. (DH)
  + Settings gear icon presents landing screen. This is functional. (DH)
  + Resume button restarts game, should resume the current world. (DH)
  + Quit button on the landing screen is not functional. (DH)
  + Settings button is not functional. (DH)
* UI functionality
  + Need to build a health bar that is easily seen by players indicating health of home base structure. (SR)
  + Resource management bar is implemented, needs to be tested further based on progression through the game. (SR)
  + Gear icon implemented in the UI which brings up the paused menu, working as intended. (SR)
  + Considering adding enemy health bars to help with identifying how much damage is being done by the player. (SR)
* Database testing
  + ORM layer code installed. (SR)
  + Firebase installed to pull data from unity to populate the leaderboard database. (SR)

(insert QA from sprint 4-6 here)

1. **Project Management** 
   1. **11.1 Project Plan**
   2. **11.2 Risk management**
2. **References**