

CS 524 - Final System Design

Andrew Bezman - *Team Lead*

Nicha Unnopavong - *Scrum Master*

Karishma Gouni

Jose Susairaj

Ekene Okoroafor

Christopher Smalls

John Caruthers

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Outline and Team Member Assignments:

1. System Description (*All*)

- 1.1. Description and Diagram
- 1.2. Platform and System Requirements
- 1.3. Technology Stack

2. Components

- 2.1. Logon Page (*Ekene*)
- 2.2. Communicator (*Nicha, Karishma*)
- 2.3. Learning/Training Center (*Jose, Andrew, Christopher*)
- 2.4. Database (*Andrew, John*)

3. Games

- 3.1. Flappy Alien (*Andrew*)
- 3.2. Astronaut Quiz (*Karishma*)
- 3.3. Space Quiz (*Jose*)
- 3.4. Knowledge Based Triva (*Ekene*)
- 3.5. Sliding Puzzle (*Nicha*)
- 3.6. Problem-Solving (*Christopher*)
- 3.7. Math Defense (*John*)

4. References

1 System Description

1.1 Description and Diagram

Our Astronaut Training Application is a web based application that can be run on most browsers from a computer or mobile device. The goal of our Astronaut Training Application is to provide a space-themed, fun and educational, resource for adults and children who are interested in astronomy, physics, mathematics, and the history of discovery in outer space. It does this by using space based games to educate the players. Players are able to make an account and track their progress. Games are meant to be quick games that can be completed in 5 minutes or less

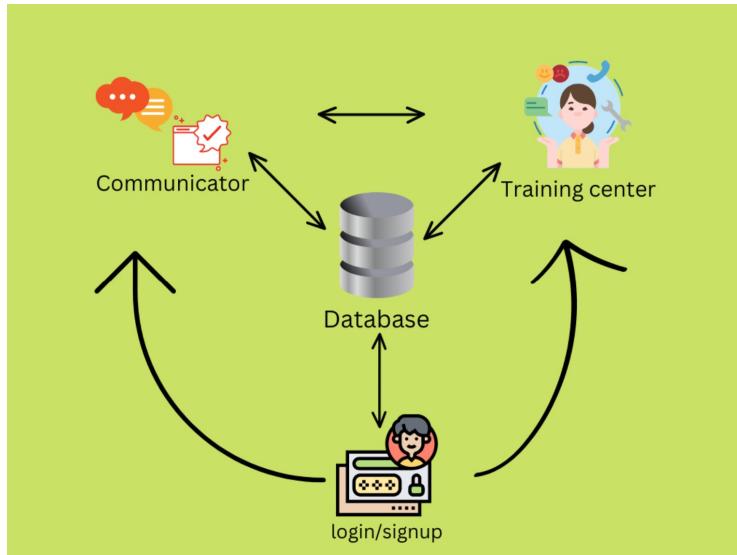


Figure 1: Component Diagram

Components of the application are the Logon Page, Communicator, Learning/Training Center and Database. Figure 1 above shows how these components interact. First, players will create an account on the Logon Page. This data is stored on the client's device. Once an account is made, the player is directed to the Learning/Training Center where they are able to see their progress and can click on buttons to play games. The Communicator emails the players when they make an account, and of any progress they have made. It will also remind players of daily challenges.

The component diagram above shows how the components interact with one another. The Login/Signup page will write data to the Database when a new player signs up. For login, the Database is used to verify the correct data, returning a boolean value to the login. The Login/Signup also page will direct players to the Learning/Training Center after a successful login. The Learning/Training Center interacts with the Database to write score updates after the player completes a game. It will also send data to the Communicator to congratulate user for completing a game. The Communicator reads data from the Database for emailing users.

1.2 Platform and System Requirements

The Astronaut Training Application is meant to run on internet browsers on a computer or mobile device. It is hosted on AWS Amplify and utilizes Amazon Web Services (AWS) Lambda functions to provide intractability between the different components and games. The players data is not stored on the server, it is stored on the clients local storage of the player's browser utilizing Mozilla Client

Side Storage. The user can use Chrome, Edge or Firefox on either Windows, Linux or iOS. Any browser that is compatible with JavaScript ES5 and above is suitable to run this application.

1.3 Technology Stack

Many tools were used to build the visual content of this application. These include: InkScape, Adobe Illustrator, Adobe Photoshop, Figma, Paint, Tiled, and Canva. Secondly, content was made with HTML, CSS and JavaScript. Program logic was built with JavaScript. There are two sections to the database: Mozilla Client Side Storage, and AWS. Username, passwords, emails and scores are stored locally on the clients device. AWS stores the HTML, CSS and JavaScript files of all components and games. The logic is run on the cloud using AWS Amplify, AWS API Gateway, and AWS Lambda. Figure 2 below shows the Technology Stack layers.

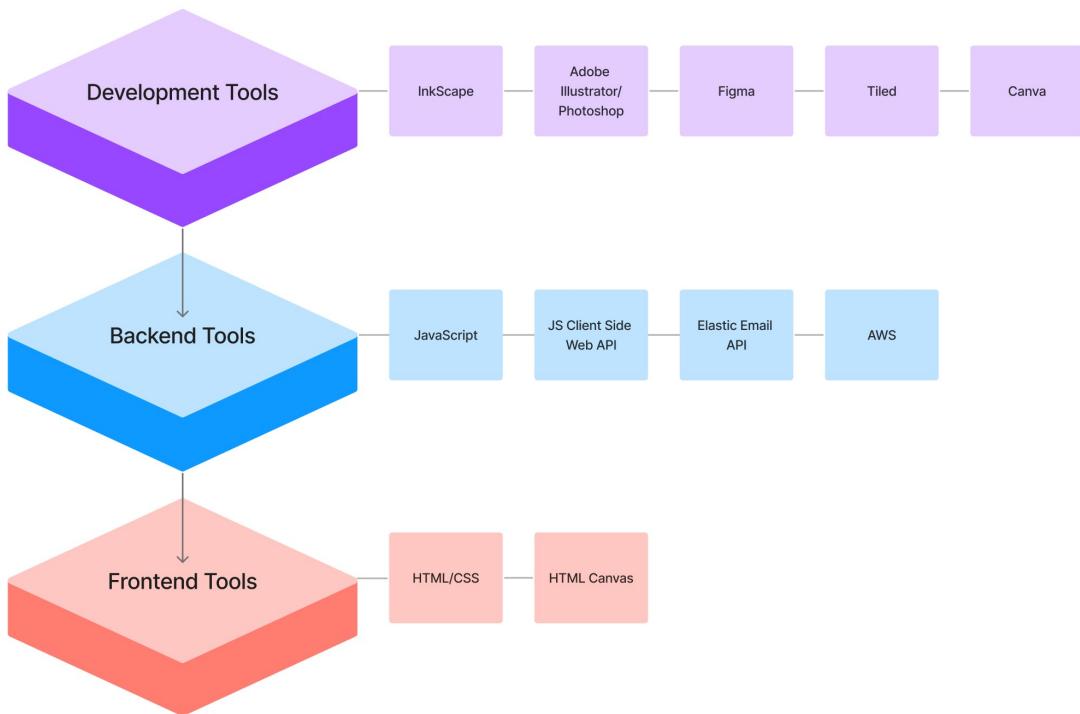


Figure 2: Technology Stack

2 Components

2.1 Logon Page

The signup page allows the user to register with his credentials like username, password, and email. Once the user had created the account, they are redirected to the login page where they can login to their account with registered username and password. Notifications are shown according to the user's action on the page. If there is any invalid data entered during the registration process, or while trying to login to their respective accounts, An error will popup saying: "Invalid email. please try again!!" or "The username or password you entered are incorrect. Please try again!!".

Additionally, there is a 'forgot password' option which redirects the user to the forgot password page. Here, the user is requested to enter the valid username and email address. Once these creden-

tials are validated, their password is displayed on the screen. In case of any invalid data, a notification will appear stating: "Invalid username. Please try again!!" or "Invalid email. Please try again!!" Figure 3 below shows a snip of the Login Page.



Figure 3: Login Page

2.2 Communicator

The communicator works behind the scenes on the client's device and communicates with them via email and notifications that relate to our web app. The Simple Mail Transfer Protocol (SMTP) server handles sending email automatically, once clients have signed up. The "Today's challenges" will be reminded by notifications. Communicator validates the email and passwords of the user. In case of invalid details, it shows a popup.[6]

2.3 Learning/Training Center

The Learning Center and Training Center were combined to the Training Center. Andrew and Chris worked on the Training Center application and Jose worked on the learning center application. The Training Center is a home screen for the user. A user interface that displays the user's profile, scores, and progress towards completion. Also, buttons that take them to a game of whichever type is titled on the button. The Learning Center contains the demo video for the application. Along with the tutorial video it also acts as a platform for various articles, recent events and study materials for the users to enhance the knowledge on Astronomy and Space. Figure 4 through 6 show the Training Center and Learning Center.

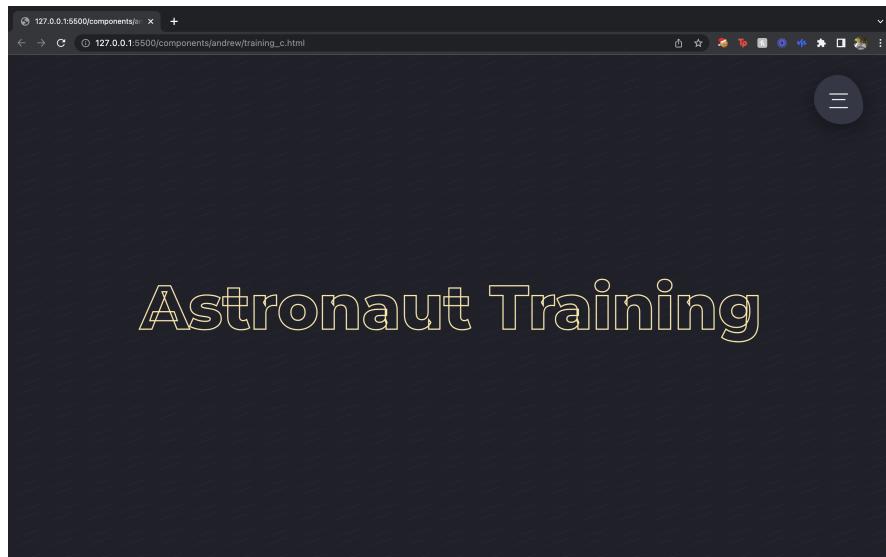


Figure 4: Training Center Home Page

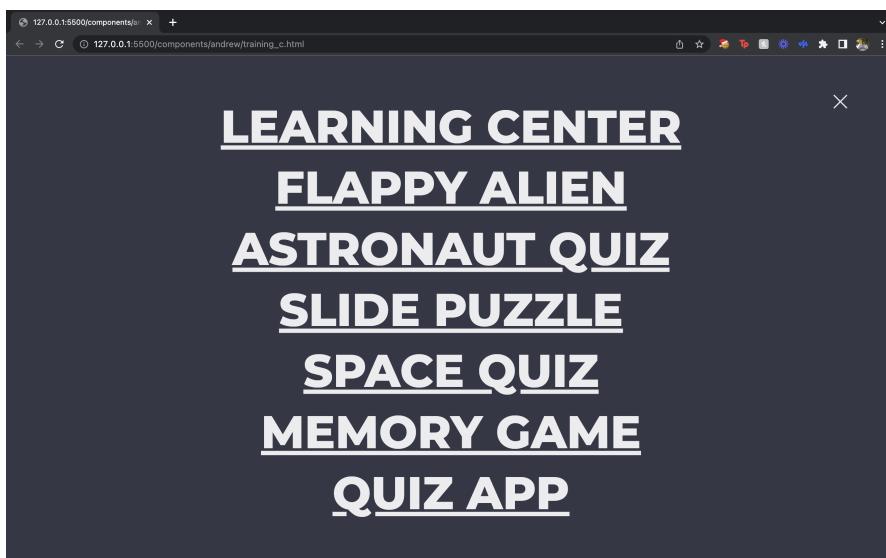


Figure 5: Training Center Menu Page

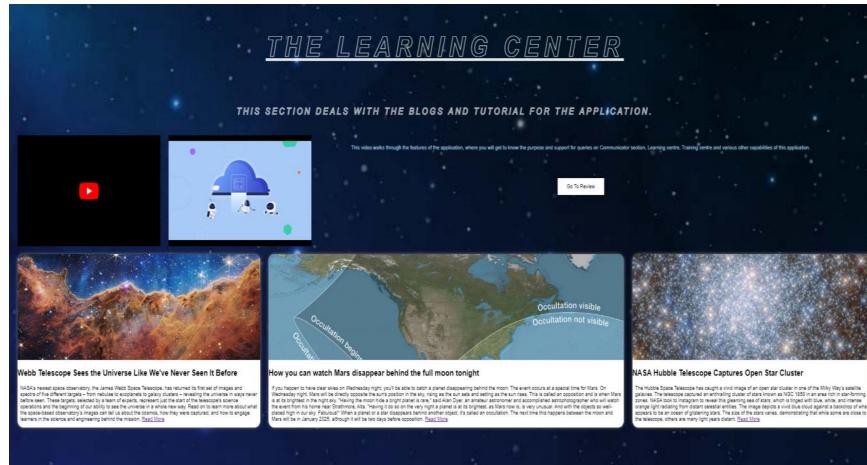


Figure 6: Learning Center

2.4 Database

The database is broken up into two components. First the client's browser stores the player's username, email, password, and scores. It uses the JavaScript local client side storage API to transfer login information to the user's device. Next, AWS hosts the website and stores the HTML, CSS, and JavaScript files. All logic is performed in the cloud using AWS Amplify, AWS Lambda and AWS API Gateway.[3][1]. Figure 7 below shows how the information is stored on the "Local Storage" in the devices browser Application files.

Key	Value
username	testusername
email	test@hood.edu
scores	0,0
password	testpassword

Figure 7: Learning Center

3 Games

3.1 Flappy Alien

Flappy Alien is an arcade-style game in which the player controls the Alien, which moves persistently to the right. The player is tasked with navigating the Alien through pairs of pipes that have equally sized gaps placed at random heights. The Alien automatically descends and only ascends when the player taps the touchscreen (space bar if on PC). Each successful pass through a pair of pipes awards the player one point. Colliding with a pipe or the ground ends the gameplay. During the game over screen, the player is awarded a bronze medal if they reached ten or more points, a silver medal from twenty points, a gold medal from thirty points, and a platinum medal from forty points.



Figure 8: Flappy Alien

3.2 Astronaut Quiz

Astronaut quiz is a fun game which trials the players knowledge. This game consists of questions related to the life of an astronaut in space, and interesting facts about space and the universe. This game will have 10 questions and each right attempt increases the score to 100 points. Every question will have a hint, which helps to solve the quiz with more comfort.

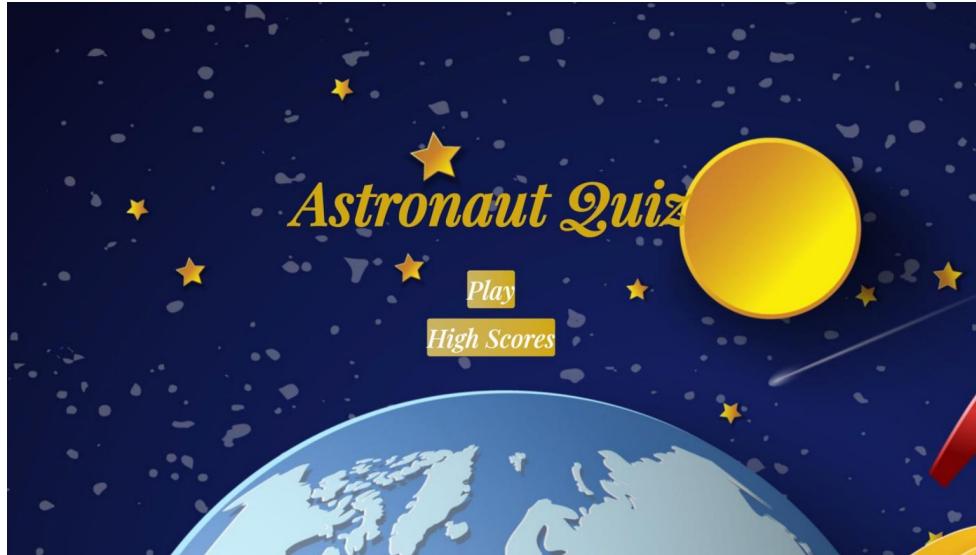


Figure 9: Astronaut Quiz Into Page

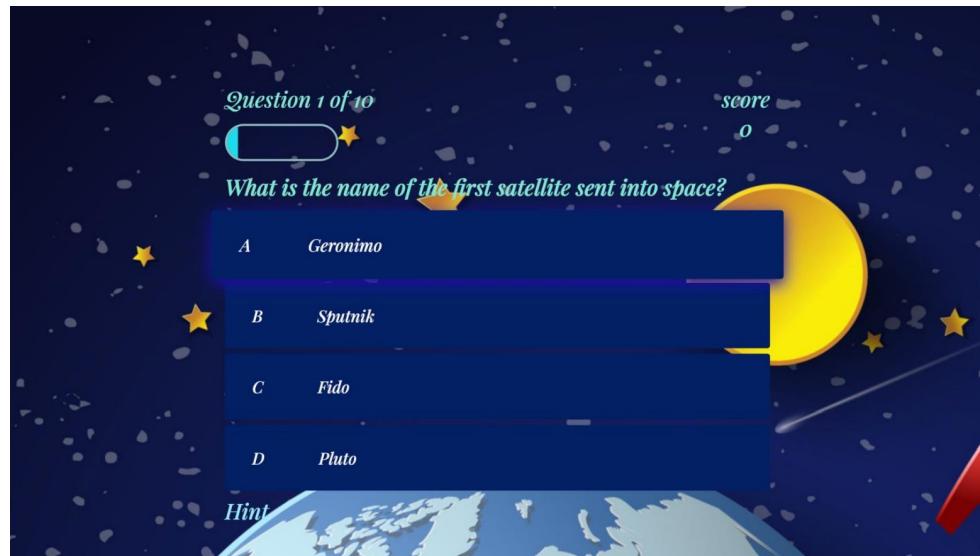


Figure 10: Astronaut Quiz Question Example

3.3 Space Quiz

The quiz game enables users to answer random questions with 4 options to choose among. Once a question is answered the game opens a new question for the user and the options chosen by the user will be evaluated instantly, where the user can see a green or red colored text for the selected option. The scores are also displayed after every answers. Once the user finished answering the questions, the result score is calculated and both right and wrong answers are displayed for a better understanding to the user.

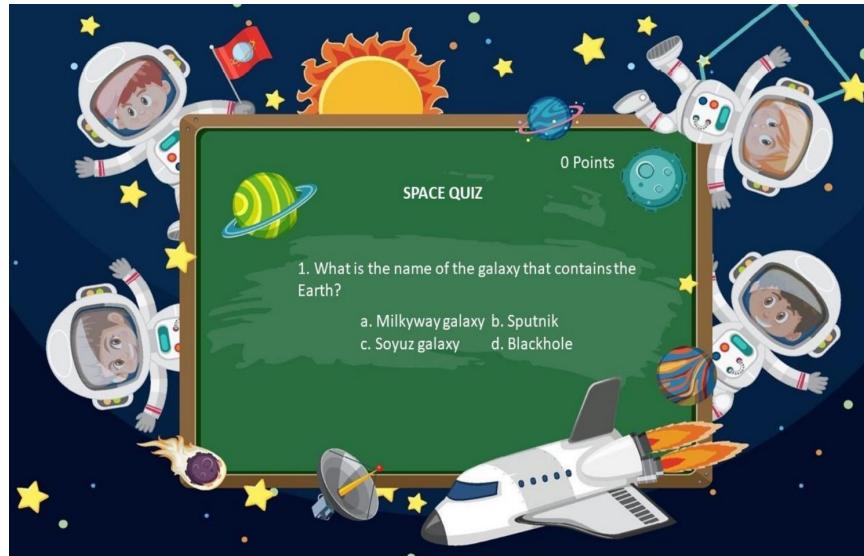


Figure 11: Space Quiz Snip

3.4 Knowledge Based Trivia

In the knowledge based game, the player is asked about his knowledge about space, rockets and the physics behind space travel. In order to equip and test him with the current ideas about space. The questions could be about history or math concepts in space development. The player chooses the correct answer which is displayed in Green after he clicked on it, else it will be displayed in Red.



Figure 12: Space Quiz Snip

3.5 Sliding Puzzle

A sliding puzzle game is a problem-solving game in which the player has to slide the tiles around the board until the tiles have been arranged in the correct order. By dragging the pieces in want to move to the empty space beside it. The challenge is how to finish the game in a minimum number of moves.

3.6 Problem-Solving

A memory matching game that enables a user to select a card and attempt to find the card that has a similar graphic. When the user clicks a button titled problem-solving, a list of games is displayed which contains the game.

3.7 Math Defense

Math Defense is a space based tower defense game that has the player build defenses to protect the moon base from alien attackers. The player generates income for tower purchases by solving math problems. Math problems are simple addition, subtraction and multiplication problems. Each enemy wave becomes increasingly harder and includes more enemies. The enemies become faster and more numerous as each wave progresses. The game ends when the moon base health reaches 0. The figure below shows a snip of the Math Defense game. Red circles are enemies, dark blue squares are defense towers, light grey squares (around the path) are areas where towers can be built. The HUD shows the wave number, currency and health. Below the canvas is the math puzzle with multiple choice answers[4][5][2].

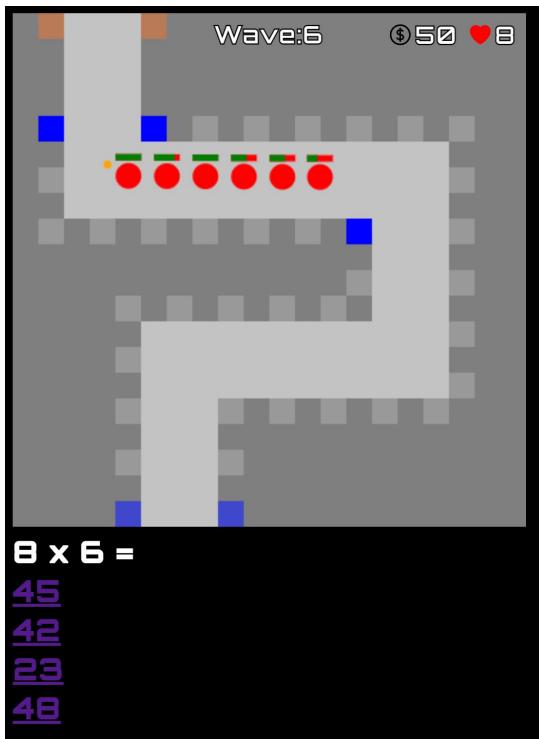


Figure 13: Math Defense Snip

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- [1] AWS Amplify. <https://aws.amazon.com/getting-started/hands-on/build-web-app-s3-lambda-api-gateway-dynamodb/>.
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- [6] Simple Mail Transfer Protocol. <https://app.elasticemail.com/api/>.