IOWA STATE UNIVERSITY

AEROSPACE ENGINEERING DEPARTMENT

COMPUTATIONAL TECHNIQUES FOR AEROSPACE DESIGN

AERE 361

PROJECT PROPOSAL

THE B-TEAM

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I ABSTRACT

This project includes the following members: Tristen White, Gerald McCarrick, John Blochowitz, Mitchell Strobbe, and Brandon Case. Side-scrolling games have been around for a very long time. One of the most popular, "Doodle Jumper", was released in 2009. Vertical scrolling games are even older. An example, which happens to be one of the most famous of them all, would be "Flappy Bird" released in 2013. Our game will take the gameplay component of "Flappy bird" (ex., moving an object through obstacles) and integrate it with the tilt controls and vertical scrolling layout (objects seeming to fall from the top of the screen) of "Doodle Jumper." Our main objective for this project is to create a game where the user has to stay active from start to end, so they are always engaged. We will use the C programming language to create this game and display the visuals through the Adafruit CLUE board. Throughout the development process, we will continuously test our code and make critiques to ensure the game runs smoothly with little to no bugs. We not only want our game to be fully functional but efficient and compact as well. With our beginner level of knowledge, we hope to create a functional and nostalgic game for those who wish to play.

II INTRODUCTION

Vertical-scrolling games have been around since the 1970s. These games are typically coded using subroutine blocks. Functions and if-statements comprise the bulk of the code blocks, allowing the developer to compartmentalize each task. Loops then "activate" these code blocks, controlling what is added to the game and when; this approach is outlined in Takahashi's article, *Small Basic Game Programming- Vertical Scrolling Game* [4]. For example, the obstacles present in the game may be controlled by a function that generates a set number of characters and then randomly populates them into elements of an array. "Doodle Jump" uses this approach to generate the platforms for the player's character to navigate.

Even though vertical scrolling games are rooted in retro-styled experiences, they still have their place in the modern world. Another one of the most popular modern vertical-scrolling games, "Subway Surfer", was released on May 24, 2012. With its sleek feel and smooth controls, Subway Surfer was a huge step up from its retro-style predecessors, with a much more sophisticated feel than your classic Doodle Jump. However, at its core, Subway Surfer still features the same approach used in other vertical-scrolling games- subroutine blocks of code and loops that load all the obstacles, player characters, and the scrolling movement of the screen during gameplay.

III FEATURES

Our game will feature a menu to start playing the game, exit the game, and power off the device. The menu will be controlled with a simple interface of two buttons. One of the buttons will be used to move between the menu options (the cursor will always move downwards), and the second button will select the option the user has highlighted. A similar process will be used when the user loses the game; a menu will appear, allowing the user to choose between playing again or powering off the device to end the game.

For the actual gameplay, we plan to use tilt controls to move the user's character left and right to avoid random obstacles moving toward the player. A timer will keep track of the amount of time a player survives. When the ball collides with an object, the player loses and is returned to the start of the game.

The main method of controlling the ball during gameplay will be done with the STF Micro series 9-DoF motion sensors. This will allow us to use tilt controls to move the ball side to side across the bottom of the screen in one dimension. Many similar smartphone games use this control method, such as "Doodle Jump," where tilting the phone causes the player to move from side to side using an Inertial Measurement Unit (IMU). An IMU is an electronic device that determines the position, orientation, and velocity of an object in space relative to its initial space; a sample code for regulating an IMU can be found in this online article, *MATRIX* [3]. In our case, it will be used to relate the handheld device's physical state to the ball's corresponding position on the screen. Using the vectors from the accelerometers in the IMU, the code will determine the angle the user tilts the device. If a certain critical angle is achieved, say fifteen degrees, the user will be moved in a certain direction.

Ideally, our game will fit into a compact handheld format. This would mean it should be free of cables and able to run solely on three AAA or AA batteries. The device's enclosure will be 3d printed; however, we aim to make it aesthetically pleasing and easy to hold. We think this is necessary because no one would want to play a game while having to hold onto a circuit board. The device's casing should also withstand slight abuse but nothing involving throwing or dropping.

Another feature of the handheld will be an electronic buzzer. This would give audible feedback when the ball collides with the obstacles. If the player loses, it should play a losing sound. While this feature isn't technically necessary to the function of the game, many other retro handhelds have a simple buzzer implemented to play sound effects and music.

Integrating a high score counter is also another important component. This would allow players to see the highest score on the device. The high score could be based on how quickly levels are beaten, the highest level achieved, or the longest survival time. We have not yet decided what score metric we will use or if we will use multiple metrics. This detail will be decided once we have finalized the characteristics of the game's different levels.

IV PROBLEM STATEMENT

As anyone who has attended high school or college before can attest, homework and class time can generate a lot of frustration and stress. While this is inevitable, the pressure of deadlines, performance expectations, and the multitude of extracurricular responsibilities can greatly affect students' mental health and overall well-being. Research shows that stress among college students is on the rise, with students reporting increased levels of anxiety and depression. According to a 2018 survey by the American College Health Association (ACHA) [2], 63% of college students in the United States reported experiencing overwhelming anxiety in the previous year, an increase from 50% in 2011. Additionally, the same survey found that 40% of students reported feeling so depressed that it was difficult to function, up from 34% in 2013.

V PROBLEM SOLUTION

Playing low-stress games is a possible solution to help minimize this increase in stress and help students focus for longer. As reported by [1], "POMS scores on Total Mood Disturbance significantly changed for all three games supporting the theory that while there were effects on brain wave activity in different parts of the brain, the result was improved perceived mood, "(63). Low-stress games are designed to be calming and relaxing, allowing students to take their minds off of academic responsibilities and troubles. By engaging in such low-pressure activities, students may be able to reduce their stress levels and, ultimately, improve their focus and performance on the things that matter.

So, to counter the increase in stress levels among high school and college students, we have come up with the idea to create a game with similar features to "Doodle Jumper" and "Flappy Bird" as previously mentioned in the Abstract section of this report. The handheld concept art, seen in Figure 1, is as simple as we could come up with to ensure the least amount of complexity for the user. We will allow movements of the user's character in the horizontal direction while objects "fall" at the user in the vertical direction; this can be seen in Figure 2. With the simple movements we plan to implement in our game, the user only has to focus on which direction they would like to move (left or right) to evade the moving obstacles coming toward them. This creates a very low-stress environment for the said user, allowing them to release stress after a long day of exams, classes, and studying and decreasing anxiety and depression overall.

Table 1: Parts Requested

Part Description	Qty
Adafruit Clue Board	1
AAA Battery Holder	1
USB Cable	1
3D Printed Enclosure	1
*Arcade Style Selection Buttons	2
"*" denotes potentially need	

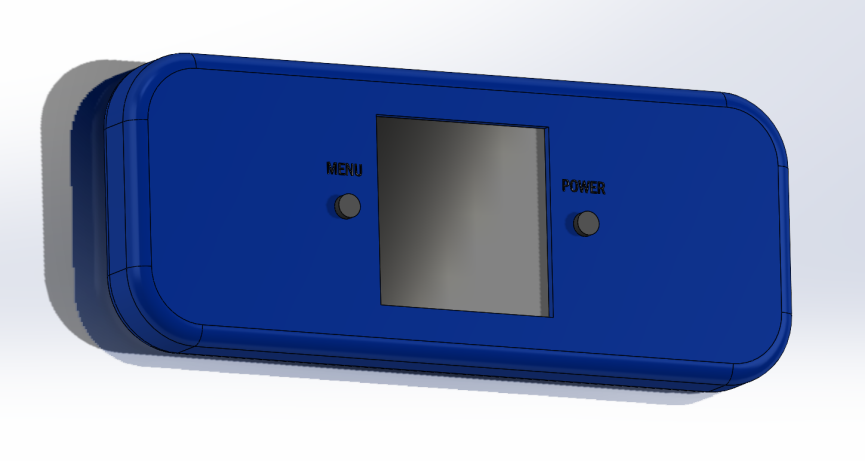

Figure 1: Handheld Concept Art

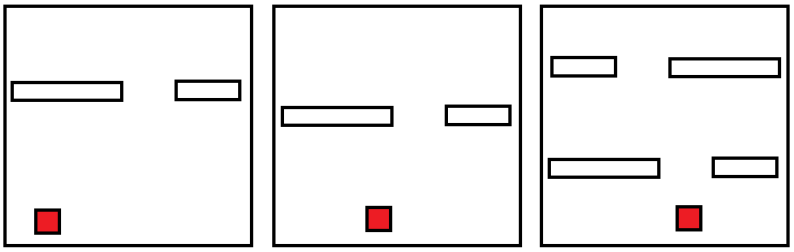

Figure 2: Time Progression of Gameplay

VI CONCLUSION

Our team plans to begin by ensuring the code is first developed and as bug-free as possible. We hope to be able to spend a lot of time debugging and optimizing the code. One of the last steps of our project will be dedicating time to ensure the form and function of the 3D-printed enclosure. We will do our best to stick to the parts list outlined in this report, but we have a few backup plans if things don't go according to plan. With this project, we hope to deliver a functional and fun experience for anyone interested in retro-style games who want to reduce their stress levels simultaneously.

References

[1] Kevin O'Brien Carmen V. Russoniello and Jennifer M. Parks. "THE EFFECTIVENESS OF CASUAL VIDEO GAMES IN IMPROVING MOOD AND DECREASING STRESS". In: *Journal of CyberTherapy & Rehabilitation* 2.1 (2009), pp. 53–66.

[2] *FALL 2018 Reference Group Executive Summary*. URL: https://www.acha.org/documents/ncha/NCHA-II_Fall_2018_Reference_Group_Executive_Summary.pdf. (accessed: 03.22.2023).

[3] MATRIX. *IMU*. URL: https://matrix-io.github.io/matrix-documentation/matrix-hal/examples/imu/. (accessed: 03.22.2023).

[4] Nonki Takahashi. *Small Basic Game Programming- Vertical Scrolling Game*. URL: https://techcommunity.microsoft.com/t5/small-basic-blog/small-basic-game-programming-vertical-scrolling-game/ba-p/336809. (accessed: 02.24.2023).