San Francisco State University
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Term Project
Higher or Lower Game

ENGR 478 Section 2
Instructor: Dr. George Anwar
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Team Name: ABE's (asian baby engineers)
Dennis Lin & Jessica Yip
dlin3@mail.sfsu.edu & jyip2@mail.sfsu.edu
915733564 & 916263015

Overview

The objective of this project was to create a Higher or Lower game using the Kentec LCD BoosterPack for the Tiva LaunchPad. The game starts with a number from 1 to 10 displayed on the screen along with two buttons labeled "High" and "Low". The player then guesses whether the next number will be higher or lower than the current number, and presses the corresponding button. If the guess is correct, a new number is generated and the game continues. The game ends once an incorrect guess is made.

Background

We modeled this game after a game of chance that my partner Dennis used to play. He would play a similar game online where he would bet and guess higher or lower in order to win accordingly. We wanted to recreate this game because it was a simple concept, but with the new challenge of using the microcontroller and an LCD screen instead of coding it to be a text program on a computer.

Project Design

Our project was designed using the Tiva C Series LaunchPad and the Kentec LCD BoosterPack. Our program was coded in C in Code Composer Studio 5.5.0. Our program was designed using the flowchart shown below.
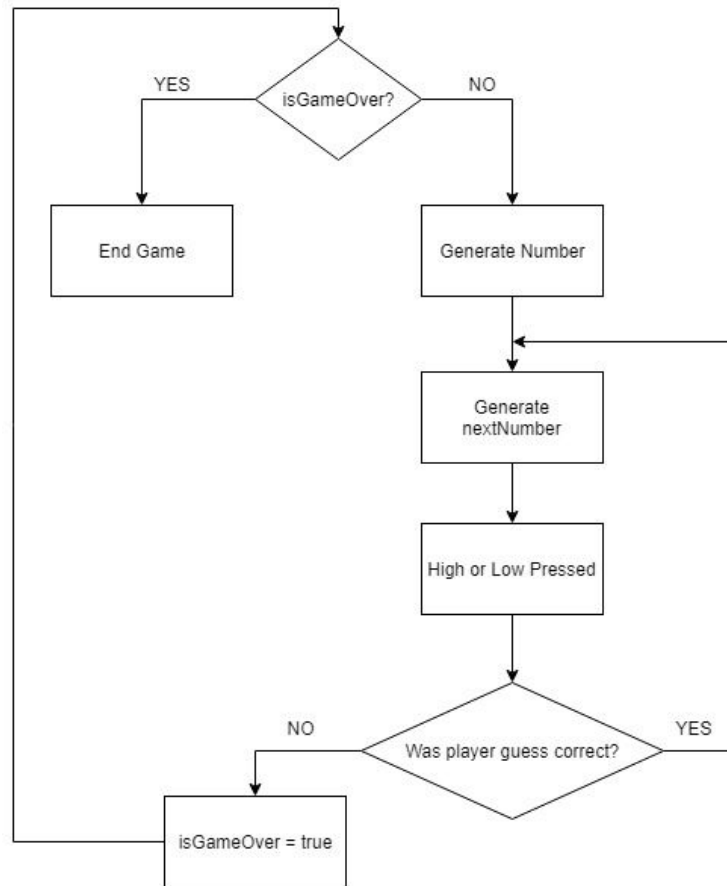
Figure 1: Higher or Lower Game Flowchart

In order to implement our design, we referenced the TivaWare Graphics Library and the Tiva LaunchPad Workshop Lab Manual in order to learn how to the use and code the LCD BoosterPack. We used the Canvas and RectangularButton widgets in order to implement our design. The Canvas widget was used to display the current number, the title of the game, and the "Game Over" screen once the game ended. The RectangularButton widget was used to create the "High" and "Low" buttons for the player's guesses. When a button was pressed, the appropriate comparison was made, and then a new number is generated or the game ends depending on the outcome of the comparison. We created functions `highPress` and `lowPress` in order to handle the comparisons which will continue or end the game. A boolean `isGameOver` was created and used as a flag to exit the game loop if an incorrect guess was made. When an incorrect guess is made, the push buttons are changed to say "Game Over".

In order to evaluate our implementation, we first had the `highPress` and `lowPress` functions output a string of text to ensure the function was being called when the corresponding button was pressed. We then used an array of integers instead of random numbers so the outcome could be predicted in order to test the correctness of our `highPress` and `lowPress` functions. Next

was how to arrange and update everything nicely on the LCD screen in order to ensure the widgets did not overlap and end up covering each other. The final challenge was to figure out how to generate a random number using the microcontroller.

Results

What is your interpretation and conclusion on the experimental results?
We were able to confirm that the `highPress` and `lowPress` functions were being called correctly, and were able to get the widgets laid out accordingly on the LCD screen without overlap. Our main challenge was trying to generate a random number using the microcontroller. In the past we would use the `rand()` and `srand()` functions in C to generate a random number to use in our program. However, these functions use the time from the computer and therefore did not work correctly in generating a new random number when loaded onto the microcontroller. We were unable to generate a new random number each time and used a number array to test our program.

Team Collaboration

Our team is made up of two people, Jessica Yip and Dennis Lin. We worked on all aspects of the project together in person due to having very similar schedules which allowed us to do so. We worked well together in that we each did research in our own time that allowed us to help each other understand how to use and program the LCD BoosterPack. We took turns coding and while one person coded, the other would offer suggestions or guidance, or do research when something became unclear. When a problem arose, we worked together on it in order to figure out a solution as well as offering solutions outside of the box

Discussion

One of the main takeaways of this project was to have multiple parts in case of failure. Our future work would be to include a score tracker in order to establish a type of leaderboard, or have the score earned depend on the probability of a higher or lower outcome. A level system could also be introduced where after earning a certain number of points, the range of numbers could increase from 1-10 to 1-20 and so forth in order to make the game more difficult as time goes on. A betting system could also be implemented where the player could choose to wager a certain amount of points and earn double if they are correct. A menu could also be implemented in order to start the game, see the leaderboard, and also exit the game early if desired.

A suggestion would be to incorporate labs that would slowly introduce students in using booster packs with the Tiva LaunchPad. This way it would make it more comfortable for students to transition into creating an open end project from the knowledge of incorporating the booster packs.

Constraints

Manufacturability, Modularity, and Expandability

Our project has a fairly simple manufacturability using only the Tiva LaunchPad and the LCD BoosterPack. This also allows for the software to be easier to develop since it's using a small amount of hardware components. Our design allows for easy expansion as well; the design could be expanded by using a bigger screen or a different microcontroller if desired.

Environmental Constraint

Our design implements an environmentally friendly design. It only uses one LaunchPad and one BoosterPack which have an overall low power consumption that produce a low level of energy waste such as heat.

Social and Political Constraint

The only social or political constraint that our project would encounter would be that our game imitates a gambling one. Online gambling has different rules and regulations depending on location which could lead to complications if our game were to be launched publicly.. A solution would be to only have our game use its points as in-game "currency" instead of allowing users to use real money. However, on the other side, simply having a game that imitates gambling could be receive social backlash for enabling or supporting a potential gambling addiction.

Conclusion

The objective of this final project was satisfied. We were able to create the project that we designed. We ran into some difficulties because we had to learn the syntax on how to program the widgets and implement functions from trigger releases when the buttons were pushed. It intrigued us when we were able to successfully make a function work on the LCD screen and we are satisfied with how our end product was finished.