uOttawa

Project Report

Affective and Persuasive Computing

Design of a Serious Game: Captain Coder

by The Team – Members:

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1. Introduction

Our final project for the Affective and Persuasive Computing has been to design a serious game to teach grade 11 or 12 high-school students basic programming concepts. The aim of this project is to introduce the concepts of “if statements” and “for loops” to students through a serious game. We are assuming that the students are already familiar with basic programming concepts, therefore the game should only be focused on the mentioned topics.

When we first started our project, we intended to use Python and Turtle library to develop our game. As we proceeded with development of the game, we realized that integration of Turtle library with other game development libraries in Python are creating a lot of issues in running and maintaining different aspects of our app.

We eventually had to change our platform from Python to Scratch, a web-based graphical game design platform that offers most of the capabilities that we were looking for in our game. We learned a lot in our first experience of coding a game using Python, and we realized that the code structure and dependencies on a game project can get become very complicated.

2. Game Concept Document

2.1. Characterizing Goal

The characterizing goal of Captain Coder is education, as the game is designed to be used by high school students who are learning programming concepts. The game's characterizing goal has been identified by professor Al Osman who is the domain expert.

2.2. Problem Statement

Most of the resources used for learning programming languages concepts are through books and video materials, which students may find boring. To improve the learning process of students, we are going to teach the programming concepts by integrating them into a serious game.

Captain Coder is a 2D game where the player takes the role of a flight captain and uses for loops and if statements to draw shapes in the sky.

2.3. Constraints

The constraints for Captain Coder are:

- The characterizing goal should be learning
- The target group of the game is grade 11 and 12 high-school students
- The game should be playable in of the following platforms:
    - Web (any browser)
    - Android
    - Windows
    - Linux
- Normal computer screen size is preferred
- Mouse / keyboard are to be used as main inputs for the game

2.4. Domain and User Analysis

Learning programming has become one of the most in-demand skills of the recent years. As different programming languages emerge, the need for up-to-date documentations and tutorials has also stayed strong.

Programming is now becoming one of the standard courses at many high schools. Most educational systems seem to be creating a link between math courses and programming to teach students the concepts of coding.

Teaching programming concepts through video games seems to be an effective method to teach the logic behind code to high school students, who are the target group of this game design project. As mentioned earlier, the users of Captain Coder will be all grade 11 and 12 high school.

2.5. Game Genre

The main genre of Captain Coder is considered Puzzle and Edutainment, as the player is required to solve different puzzles through drawing shapes with “for loops” and “if statements”. Each level presents a new problem to the player and they need to place the code blocks in the right location to solve the puzzle, i.e., run the code.

2.6. Storyline (summary)

In Captain Coder, the user is a pilot who is completing flight courses by drawing shapes in the sky. These shapes are drawn using for loops and if statements. As the user progresses in the game, they unlock more advanced planes and are introduced to new maps.

3. Game Design Document

In this section, the key aspects of the Captain Coder game will be illustrated.

3.1. Storyline (detailed)

In Captain Coder, the player takes the role of a pilot who is on their training to become a professional pilot. To become a professional pilot, the player must complete the challenges introduced in each level. To meet the characterizing goal of this game, the objective of each level is to draw a shape in the sky using “for loops” and “if statements”, two popular programming concepts. As the player proceeds in the game, they unlock different achievements.

The missions the player needs to complete becomes more complicated as the player goes to higher levels of the game. This means that the shapes that the player needs to draw become harder, which would require more complicated combinations of “for loops” and/or “if statements” to finish a level.

In each level, an assistant will be accompanying the player and can provide hints in case the player is stuck at a level.

3.2. Characterizing Goal Integration

The characterizing goal has been integrated into this game statically. Also, the serious content is extrinsic to the game. However, problems that the player would have to solve directly affect the game behavior, as mentioned earlier, the player can choose the pattern that the plane will draw in the sky by defining a for loop, and the plane will draw the shape that the player creates using the for loop or the if statement.

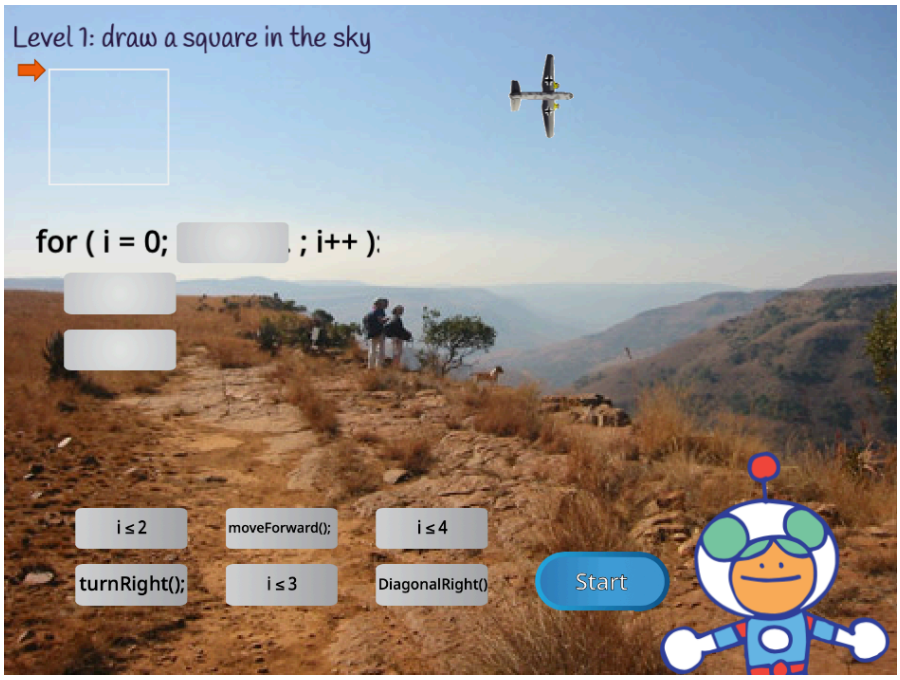
With that being said, the connection between solving the programming problem and the results in the game are not completely separate from one another.

3.3. Characters

When it comes to characters, our game is mainly focused on the types of planes that the user can choose to fly with. Players can choose the plane they want to fly with in the beginning of the game and can also unlock new planes as they complete the game levels.

3.4. Game World

The game is set to take place in three different map types that have the same feel and look of the era that the plane belongs to. The maps are simply the background images that change in each level to make the game more visually appealing to the players. Also, levels will have different background music based on the era they are depicting.



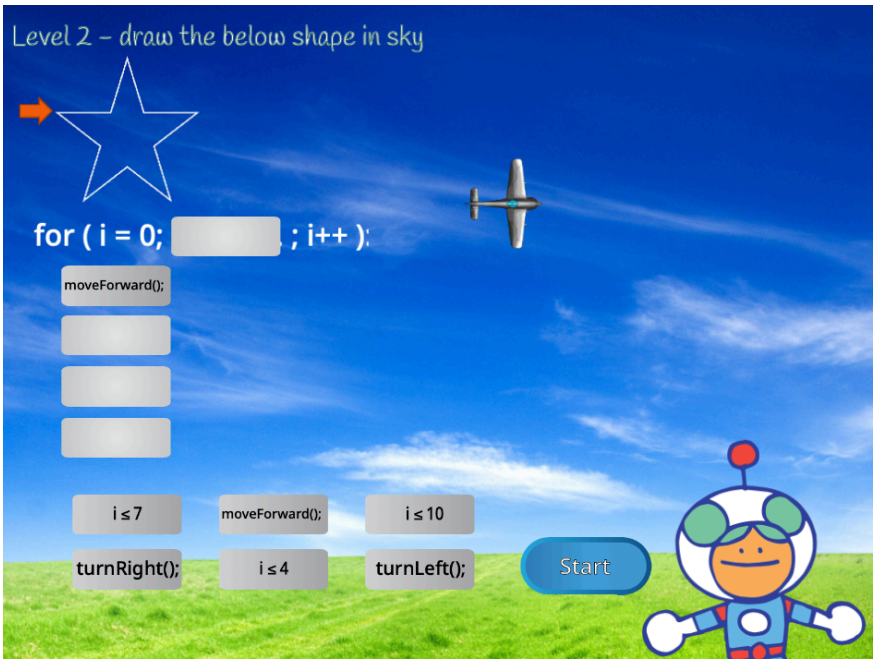
3.5. Motivators

Motivators play an important role in making the game more enjoyable for the player and they help create a more entertaining experience for them. To add the motivation aspect to the Captain Coder game, the players will receive medals as they complete each level of the game. Also, as the player goes to higher levels of the game, they will unlock more advanced planes to give them the feeling that they are able to solve more complicated problems with the upgrade they have received.

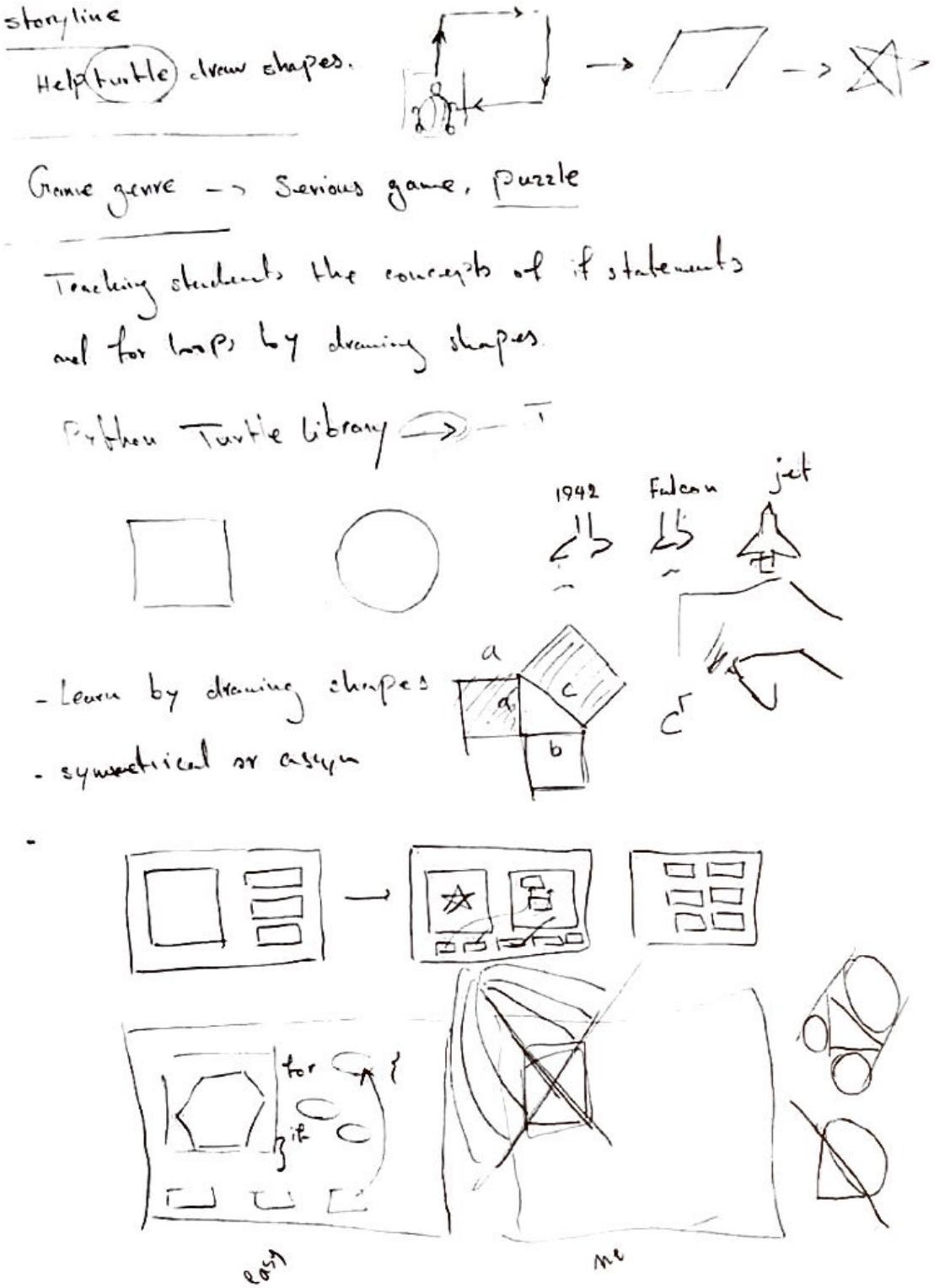
3.6. Levels

Each level of Captain Coder introduces a new problem for the player to solve. The difficulty level of the game increases as the player makes progress in the game. The shapes that the player is required to draw can get more complicated throughout the game.

To match the characters and the general look and feel of the game, the more complicated levels of the game are played with “advanced” planes which are modern jets. That can give the player the sense of getting better at solving the game puzzles, which should make the game more fun to play as well.



3.7. User Interface Sketches



```
for (      ;      ;    ) {
    ;
    ;
}
```

turnRight(90) | turnLeft(90) | i++ | for | if | moveForward(100)

i=1 | i=0 | i <= 3 | moveBackward(100) | i <= 4 | Help

```
for () {

}
```

Type Here

3.8. Game Controls Description

Mouse input is used as the main game control tool in this game. In the beginner and Intermediate levels, the user has to use drag-and-drop to place the code blocks in the code. For the advanced levels of the game, the player is required to type in the entire for loop and/or if statement using keyboard to complete the level.

4. Breakdown of Requirements

We have broken down the requirements of developing our game into user stories, and below is a list of all the captures requirements:

- As a game designer, I want a drag-and-drop functionality to make the game easier to play for beginners.
- As a game designer, I want each level to have a matching feel and look so that the players are motivated to play.
- As a game designer, I want to ensure the game difficulty increases gradually so that the game successfully delivers its characterizing goal.
- As a game designer, I want the game to continuously show the progress of the player
- As a programmer, I want the game to show feedback for all actions so that the game is interactive.
- As a programmer, I want the game to be compatible with as many devices as possible so that it can reach to more users.
- As an artist, I want to make sure that the planes, maps, and music match in each level so that the game can provide an engaging storyline.
- As an artist, I want to design characters and levels that comply with game's storyline so that the users continue playing all levels of the game.
- As a player, I want to be able to get hints in levels so that I will not be stuck at a level.
- As a player, I want the game to have nice animations so that I enjoy playing it.

5. Conclusion

Captain Coder has been our first attempt to build a game and we learned a lot about different aspects of making games while working on this project. As noted earlier, we started our project with the intention to build the game in Python using Turtle library. However, after multiple development issues we realized that we would not be able to deliver the project on time and had to switch to Scratch, which provides a graphical user interface for building games.

The game currently has two levels and some of the features described in this report have not been fully implemented in the report. However, the key features of the game described in the report have been added to the game.

There are still a lot of improvements that can be made to Captain Coder and the game has some bugs that need to be resolved in future work.

The game is available online at: https://scratch.mit.edu/projects/460973131