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CodeSpell – A Graphical Reactive Platform for Programming Learning

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Abstract

Nowadays programming learning for beginners is mainly focused in solving abstract problems, most of them of mathematical nature (*i.e.*, "implement an algorithm that prints the Fibonacci sequence"). As a result, students not only need to understand the programming concepts that are being transmitted, but also the complex abstraction behind it.
In order to combat that, CodeSpell intends to create a reactive graphical platform with awesome graphics, in a game-like style that allows students to visually identify and explore the effects of several programming mechanisms based on their code, and to provide documentation, tips and possible solutions for their problems. Achievements, scoreboards and community solutions have been implemented so that users feel motivated to improve their programming skills.

Implementation

For the frontend, technologies like *ReactJS* and *ThreeJS* are used to present the different pages, levels and overall look of the game as the user sees it.
To pass a level, the user is given an objective and he must provide code to complete that objective.
The code provided will be analysed and return a result. This code analysis is divided into a syntax analysis where it's checked for syntax errors and then a static code analysis to check if it meets the requirements to pass the level. After that, it will run in a safe environment and converted into a set of responses that our character in the game can understand and execute. These responses will then be sent to the game using web sockets technology, and our main character inside the game will reproduce them.

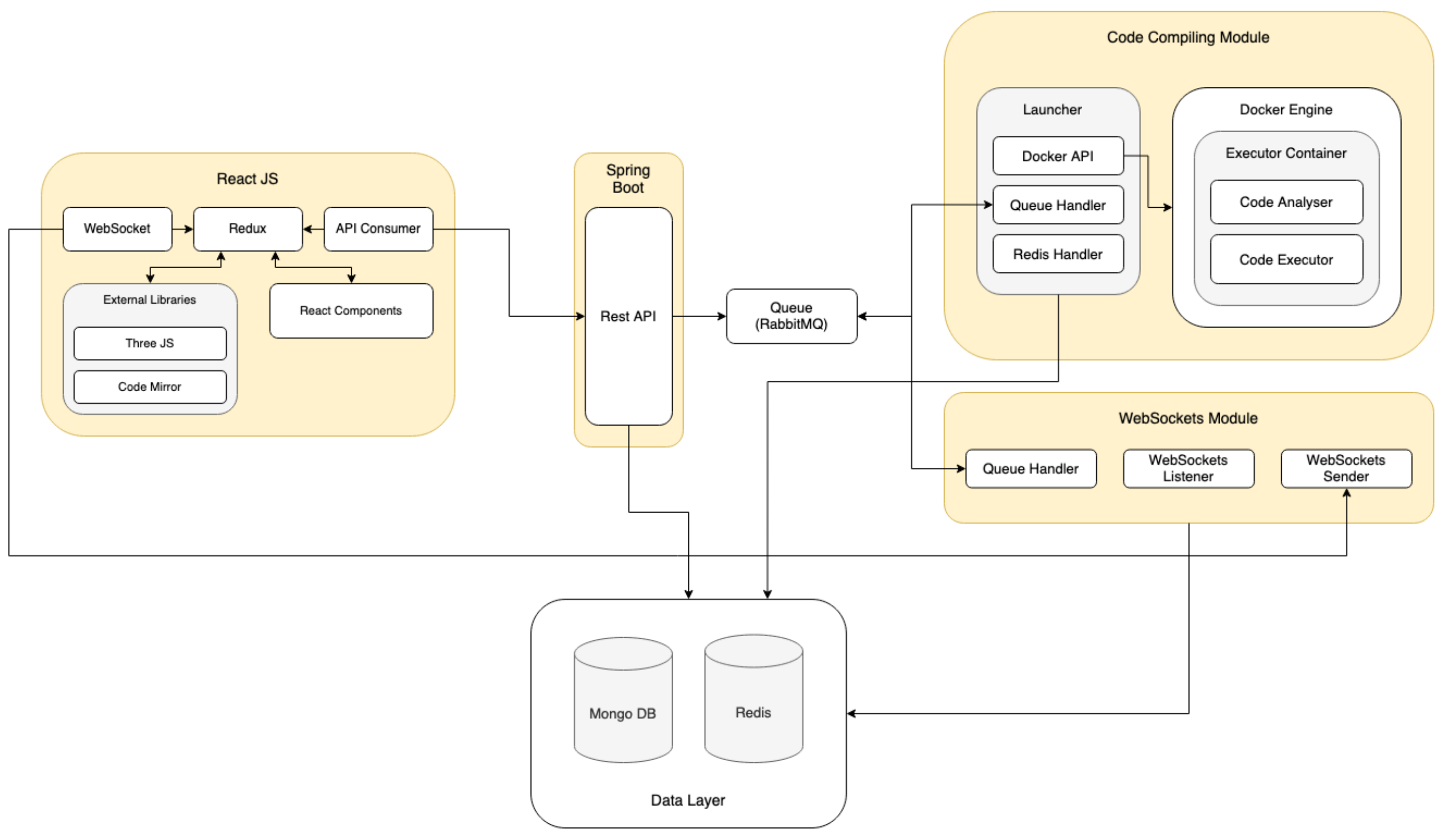

Fig 1- System Architecture .

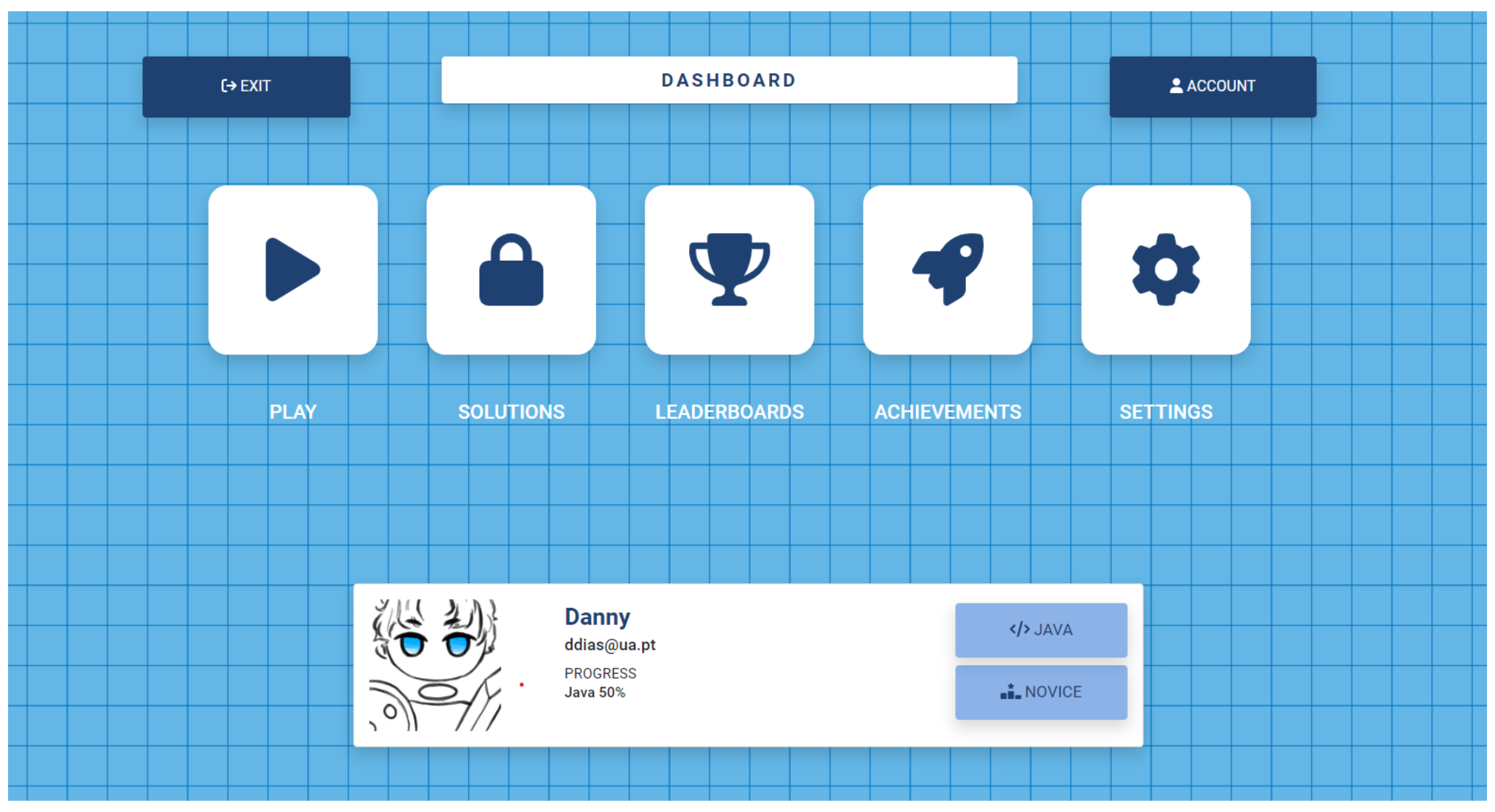

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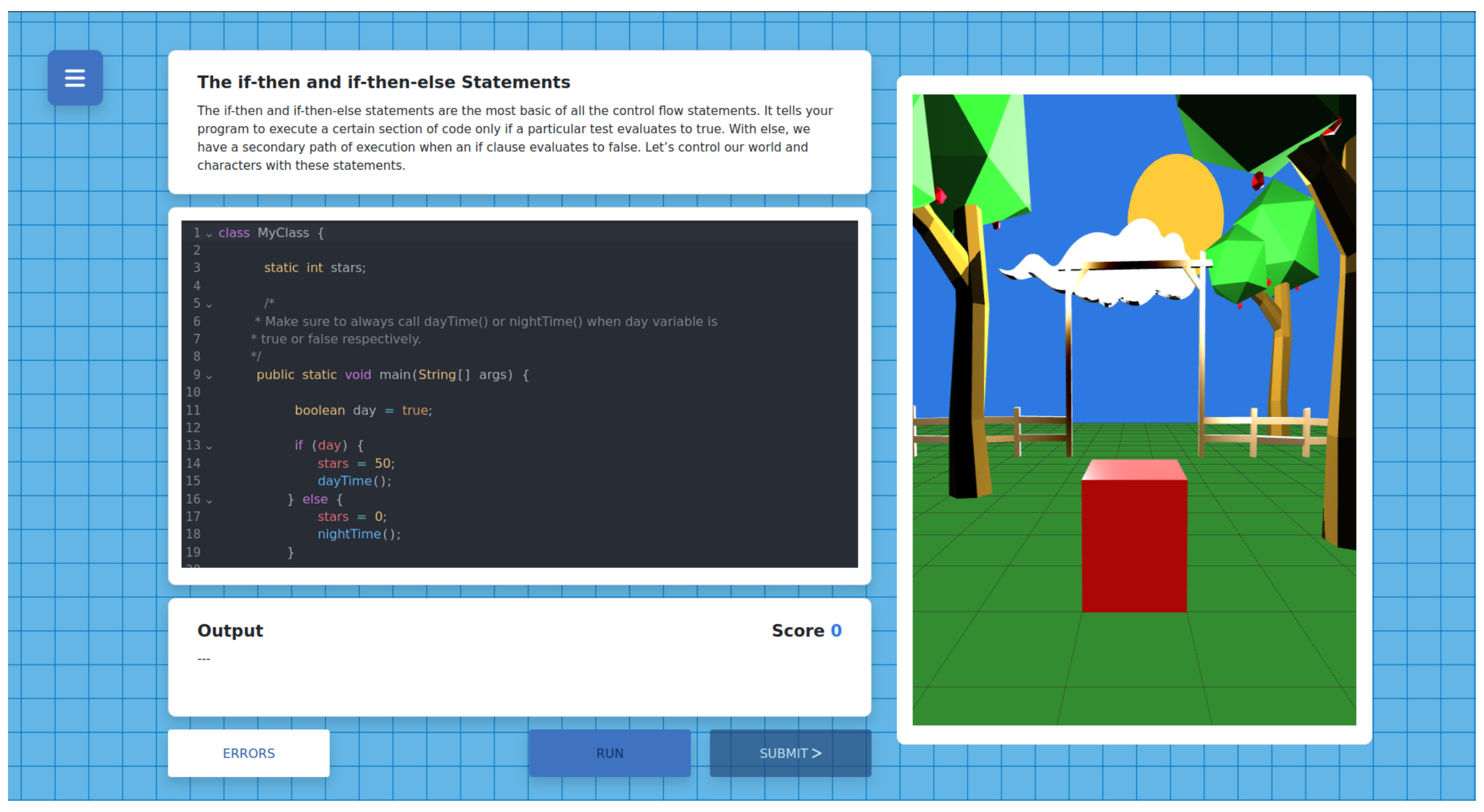
Fig 2- Dashboard page.

Functionalities

The user is able to create an account, explore the game and learn programming in a simple, visual and fun way. The game is divided into several levels, each one representing a programming topic, from simpler ones (*i.e.*, variables, operators) to more complex (*i.e.* branching statements). Documentation is provided for each level, focused on the current topic, as well as a Leader board, promoting efficient code use and competition between different players. Finally, rewards for different objectives are given to players, promoting their accomplishments.

Results

This platform aims to serve as a teaching mechanism, having the advantage of learning programming topics in a more interactive way. We were able to achieve these goals, while implementing other features that give room for improvement and competitiveness.



The if-then and if-then-else Statements

The if-then and if-then-else statements are the most basic of all the control flow statements. It tells your program to execute a certain section of code only if a particular test evaluates to true. With else, we have a secondary path of execution when an if clause evaluates to false. Let's control our world and characters with these statements.

```
class MyClass {

        static int stars;

        /*
       * Make sure to always call dayTime() or nightTime() when day variable is
       * true or false respectively.
       */
       public static void main(String[] args) {

            boolean day = true;

            if (day) {
                stars = 50;
                dayTime();
            } else {
                stars = 0;
                nightTime();
            }
```

Output

Score 0

Fig 3- Level page.

Conclusion

This work proved to be something with potential, in our opinion, if continued to be developed. With more resources and time more levels could be implemented, reaching a wider range of topics and features like allowing the community to create their own levels. Support to more programming languages could also be added.

CODE SPELL

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