Programming language and software framework overview

The project is to develop software which can visualise sorting algorithms. In detail, the software shall be able to animate and display graphical objects and react to what users do, such as button clicking event and text inputting event.

In this case, the programming language to be used in the project shall be adaptable to a graphical user interface (GUI) and able to respond to user request through the GUI. Three main programming language will be introduced below with both advantages and disadvantages.

Java

In JDK, Java provides two basic tools for building a graphical user interface, which is AWT and Swing. JavaFX was once a component of JDK but is a third-party tool now. AWT was introduced in JDK 1.0 and heavily depended on the Windows platform, while Swing is more flexible and can be executed in multiple platforms with Java. [1][2]

Advantages

Java is a cross-platform language based on Java Virtual Machine. Both Swing and JavaFX take advantage of this feature, which allows the software built to be easily distributed in multiple platforms. [3] Basic functions to build software we need are fully supported in those Java tools. As a back-end language, Java takes advantage of object-oriented and is good at express business logic of the front end. The property of strongly typed also improves the efficiency of programming process.

Disadvantages

AWT was introduced in JDK 1.0. Swing is released in JDK 2.0. Both are old and using a coding style to build the user interface with built-in graphic components. It is not straightforward to see and adjust the layout.[1][2] Relevant discussions and resources are not sufficient, even on the Internet. Lack of references would be an obstacle to the team’s progress. As for Java itself, the efficiency of compile would not be satisfying.

Web framework solution with JavaScript or Java

JavaScript is a programming language which is used with the Web. A web browser is responsible for parsing the Web code along with JavaScript and displaying interactive content to users. A web browser is a basic software on Windows, Mac, iOS and Android.

Advantages

Web solution allows accessing a web page on multiple platforms with the same contents. Therefore, it is a fully cross-platform solution to build software once but run anywhere. The web consists of two parts, front end and back end. The front end provides a user interface only using markdown language HTML5,[4] and the back end works as a server which listens to the actions that users take and handle these actions with programming language JavaScript or Java. The field of web software has been developing fast since the mobile market expanded in recent years.[5] Many third-party tools and open-source software such as Spring framework therefore take place.[6] Online resources such as plugins and existing web structures and plentiful discussions are also helpful for building such software. What’s more, a web application can be simply conferted into desktop executable, which can run on multiple platforms even without a browser.

Disadvantages

The web was taught in the previous semester, and only basic knowledge of it is mentioned. Some of the programming skills are forgotten by the team. The communication between the front end and back end may lead to relatively lower efficiency compared to a pure programming language like Java.[5]

C#

Using C#, developers can create secure and robust software that runs in the .NET ecosystem. It is an object-oriented language that is introduced by Microsoft.[7]

Advantages

The syntax is elegant and expressive.[7] As a commercial product, C# is well supported by Microsoft and have plenty of relevant tools and a fully supported online community built by Microsoft. Therefore, learning resources would be sufficient, and troubleshooting might be easy with other developers’ help. Graphics programming is also well supported in C#.

Disadvantage

C# is a product of Microsoft and can only work on Windows. Team 10 has not yet learnt anything about this. It would be a brand-new field, and exploring it could take much time.

References

[1] Oracle. (2020). *Package java.awt.* Retrieved from

https://docs.oracle.com/en/java/javase/15/docs/api/java.desktop/java/awt/package-summary.html

[2] Oracle. (2020). *Package javax.swing.* Retrieved from

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[3] Oracle. (2020). *The Java® Virtual Machine Specification: Java SE 15 Edition.* Retrieved from

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[4] Hunt, L. (2010, August 9). *HTML5 Reference.* Retrieved from

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[5] Ahmad, T. (2020). *Performance Exploration and Testing of Web-based Software Systems.*

[6] Spring Framework 5.3.1

<https://spring.io/projects/spring-framework>

[7] Introduction to the C# language and .NET

<https://docs.microsoft.com/en-us/dotnet/csharp/getting-started/>