**Technical Research**

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. Platforms need to be suitable for both users’ usage and developers’ development. As a significant coding tool, the choice of IDE should also be carefully considered. Analysis of these three parts is presented as follows.

**Platform**

While discussing the platform for developing this software, four platforms were come up, which are PC (macOS/Windows), a mobile terminal (iOS or Android), web and WeChat mini-app.

**WeChat mini app**

Advantage:

WeChat is a widely used application, users can access this software quickly and conveniently.

Disadvantage:

The screen size for a mobile device is too small, so users might not be able to see the animation.

**Web**

Advantage:

Same as WeChat mini-app, user can use this software easily using the web without installing anything. Besides, it can be used on any devices that have a browser and link to the network.

Disadvantage:

User privacy might be a problem. 'User guide' part for new user and 'history' part will be included in this software, so if this software is going to be built on the web, cookies must be needed. As a web-tracking and information-gathering technology, users' personal information can be easily gained without being informed by cookies (Janice, Burke, 2011).

**PC**

Advantage:

Users can access software by the local computer. There is no need to link to the network. Also, installation and employment are easy. According to the questionnaire result, PC is more welcomed among students, our stakeholder.

Disadvantage:

The computer is not that easy-carry as mobiles and other portable devices.

**Mobile terminal**

Advantage:

Same as PC, the software can be used without network.

Disadvantage:

Mobile's screen size is small. According to the questionnaire, users seem to prefer the PC.

**Programming language and software framework overview**

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 to be easily distributed in multiple platforms. [3] Basic functions to build software are fully supported in those Java tools. As a back-end language, Java takes advantage of object-oriented and it is good at express the business logic of the front end. Its property of strongly typed also improves the efficiency of the programming process.

Disadvantages

AWT was introduced in JDK 1.0 and Swing is released in JDK 2.0. Both are old and using a coding style which develops the user interface with built-in graphic components. It is not straightforward to see and adjust the layout.[1][2] Besides, 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 compiling 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. 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 everywhere. 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 softwares, such as Spring framework, 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 easily converted into a 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. 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, there are 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 learnt anything related yet. It would be a brand-new field, exploring it could take much time.

**References**

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

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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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[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/>

**Development tools**

**Eclipse**

Eclipse was originally developed by IBM as the next generation IDE development environment to replace commercial software visual age for Java. It was contributed to the open-source community in November 2001. It was managed by the Eclipse Foundation, a non-profit software supplier alliance. [1]

Advantage

Eclipse is a light-weighted IDE, which takes less storage than IntelliJ IDEA.

Disadvantage

It has incompatibility issues between versions, especially for plug-ins. As for JDK, when a new version of JDK launches, eclipse generally lags for a long time before a new version supports the new JDK.

**IntelliJ IDEA**

IntelliJ IDEA is a product of JetBrains. It is an integrated environment for Java programming language development. It mainly supports intelligent code assistant, code automatic prompt, refactoring, Java EE support, various versions of tools (GIT, SVN), JUnit, CVS integration, code analysis, innovative GUI design[2].

Advantage

It is equipped with strong integration capabilities such as git, maven, spring, etc. As for the prompt function, it is fast and convenient, and the scope of it is relatively broad. Besides, it allows users to simplify operations by shortcut keys and useful templates. The precise search feature is also preferred.

Disadvantage

There is a lack of plug-in development. Only one project is supported at the same page, which brings some inconvenience to the development, especially for the programmers who like to build a test process to test some methods during development. It requires much storage and memory compared to Eclipse.

References

1. Eclipse Foundation. Retrieved from:

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