



Bidding Document Project 06

Serious Game for C Programming Learner

Preference 3rd

Team 2018-10
COMP 2043.GRP
Software Engineering Group Project
University of Nottingham

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Developer Group

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Preface

These Standard Bidding Documents for Serious Game Project (PO6) have been prepared by Team 10 of COMP 2043.GRP, and are based on the project briefs on Moodle. Some of the contexts inside are from the Internet sharing.

The developer group consisted of six people, Runyu ZHANG, Qichen ZHANG, Yinglun LI, Huixing ZHANG, Zeyu ZHANG, and Yundan WANG, whom are from University of Nottingham, Ningbo, China.

This Project is the third choice of all available projects.

It is aimed to create a serious game for C programming learners.

A serious game is a game designed for a primary purpose other than pure entertainment. Its objective is to deliver information or knowledge by means of game playing, or in other words, to teach through lively activities.

The developer group will work together to complete a full cycle of software engineering process, aiming at a serious game for C programming learners (e.g. qualify year students). The serious game will be a video game that can be run on a mobile device. It is expected to deliver knowledge of fundamental topics in C programming to the users, such as I/O, iterations, functions, pointer, data structures, memory allocation, and etc.

This software engineering project will include requirements, SE approaches and methods, the serious game design, coding, debugging, testing, and etc.

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Chapter 1

Introduction

1.1 Document Outline

The document bid is structured in the following way:

Chapter 1 is the overview of the development team, and the basic concept of serious game.

Chapter 2 continues on the concept of serious game by first providing a detailed explanation of the definition of serious games and describing the elements of a game. Then, it discusses the feasibility for a serious game to become a tool for C Programming Learners.

Chapter 3 describes the development process of the serious game *Game for C Programming Learners (tentative)* is by discussing the software requirements, software approaches and methods, the design of serious game, together with coding, debugging and testing, etc.

Chapter 4 presents the schedule of the process of serious game development, including the important dates during the year, and the detailed timeline of the project.

1.2 The Developer Team: *why choose us?*

Members of our team generally have the ability and experience of using programming languages such as Java, C, C++, python and have a strong interest in machine learning, artificial intelligence, hardware and software development. Some of the team members have participated in computer competitions and won awards.

There are six members in the team, including a team leader. Everyone has unique advantages as well as clear logic, good understanding and expression skills. When work arrangements are needed, it is generally up to each member to come up with their own ideas, and then analyze them together. The final choice will be made by group leader and the tasks will be assigned reasonably to everyone according to their interests and abilities. Therefore, our group is able to complete the project correctly and efficiently.

1.3 CVs of Team Members

The following is a brief introduction of our team members.

Runyu ZHANG (*Team leader*)

Familiar with C, C++, Python, Java and have experience of writing programs in these languages.

Participated in robot competitions.

- Third prize in national robot competitions in high school and university.

- Second place in the Hong Kong Robot Track Obstacle Race.

Excellent decision making and leadership.

Interested in artificial intelligence and machine learning fields.

Yinglun LI

Skilled in using C and Java and have studied Python and Swift.

Have experience in program development.

- Participated in a smart medical system development.

- Participated in the design and production of some web multimedia.

Second Prize in the Computer and Multimedia Design Competition of the city.

Great understanding in code specification.

Strong aesthetic and design skills.

Zeyu ZHANG

Familiar with C, Java and Database establishment. Self-learned Python foundation.

Worked as an IT intern at an educational institution.

Interested in machine learning, robot programming and AI.

Good understanding and communication ability.

Strong sense of responsibility.

Danyun WANG

Familiar with C, Java and Database establishment.

Worked as an assistant of customer manager at the Bank of Communication.

Interested in machine learning and AI field.

Good understanding and learning ability.

Strong aesthetic and design skills.

Qichen ZHANG

Familiar with C, Java, Haskell and Database establishment.
Having experience in summer research in Neural networks.
Interested in machine learning, robot programming and AI.
Good understanding and communication ability.
Strong sense of responsibility.

Huixing Ren

Familiar with C, Java and Haskell.
Have teaching experience in C language.
Have good program skills and motivated to learn new knowledge
Great understanding and learning ability.
Strong aesthetic and design skills.

1.4 Background of Serious Game: a possible solution

In recent years, serious games have become increasingly popular. Many researches are dedicated to the potential of serious gaming to foster learning and motivation. Games are known for their entertaining side, they make the players enjoy challenges: although they present difficult tasks hard to accomplish and even if it takes the players many hours or days losing track of time, chasing objectives, they stay motivated and engaged. Furthermore, players could repeat the game many times without finding it boring. Games need motivation, willingness and hours of practice and so do learning.

In contrast, learning is not as challenging as video games, especially when it comes to learning programming languages. Like playing games, programming is a discipline that requires many skills such as analysis, critical thinking, and problem solving. It also requires a lot of practice so that the programmer gets familiar with new instructions. These are the prerequisites to understand a programming language. However, writing codes are not always challenging for students even if they are trying to solve a problem through a plan of instructions. In fact, students taking a programming course are struggling with high-level abstractions and complex instructions, which make the code difficult to understand and master.

One possible solution to this problem is using a new pedagogy based on games for teaching programming. The purpose is to make learning programming fun and engaging. This new practice has the potential to encourage learners discover abstract concepts and facilitate their understanding through a less frustrating process. To this end, we plan to developed a serious game to teach most useful concepts in C programming language.

Chapter 2

Serious Game

2.1 Defining Serious Game

2.1.1 Serious Game

Before defining serious games, a definition of game is required. Many attempts have been made to define a game, but it is still hard to find a general definition. For this thesis, the adopted definition is as follow:

A game is a system in which players engage in an artificial conflict, defined by rules, that results in a quantifiable outcome.

A serious game is a game designed for a primary purpose other than pure entertainment. The "serious" adjective is generally prepended to refer to video games used by industries like defense, education, scientific exploration, health care, emergency management, city planning, engineering, and politics. Serious games are a sub-genre of serious storytelling, where storytelling is applied "outside the context of entertainment, where the narration progresses as a sequence of patterns impressive in quality, and is part of a thoughtful progress". The idea shares aspects with simulation generally, including flight simulation and medical simulation, but explicitly emphasizes the added pedagogical value of fun and competition.

2.1.2 Elements of Serious Game

There are features included in games that help immerse the play experience of C programming game. If the game is being designed for commercial purposes, the sole aim is to come up with game mechanics that are fun and game elements that are intriguing. But when trying to design effective learning games, game mechanics and game elements that are utilized have to complement the learning goals.

Conflict

For a game to be interesting, there should be some sort of conflict to present a challenge for the player to overcome. The challenge could be a

physical obstacle, combat with another player, or a puzzle that has to be solved. There are various types of conflict that can be built in game-based learning. Designers can incorporate a conflict that arises with other players, where learners are pitted against one another. A sense of collaborative learning can also be built in with a challenge that all players must work together to overcome. Learners can be pitted against the game itself, to create excitement. Designers can also represent real world conflicts that learners can learn to deal with, like conflict between quality and time constraints or quality and budget. This empowers the learners to instill within themselves skills needed in everyday work life.

Strategy and chance

Strategy-based games put a lot of control into the players' hands in the form of decisions they can make that affect game play or their odds of achieving the goal. On the other hand, games that are heavily based on chance put the player in a highly reactive mode where they have little control over the outcome. For best learning delivery, serious games should combine a bit of both strategy and chance within the design to make it interesting. Most challenges within the work scenario of corporate employees are multi-layered. The problem that they encounter within the game can be based on chance while the solution that they come up with can involve the element of strategy. The blend of both chance and strategy gives the learners something to do and also provides required relief.

Aesthetics

Most seasoned game developers would agree that aesthetics consistently rate as an area of high appeal. By themselves, aesthetics have the power to pull people into the game. Visuals are a powerful means of engaging players and helping them immerse into the game experience. In video games, aesthetics are a huge part of this experience. With learning games, the temptation can be to cut corners on aesthetics and not realize the impact this has on the learning value of the game. Even if the emphasis of aesthetics in educational games is low compared to that of entertainment games, it is necessary to create certain amount of visual appeal in learning games as well. If budgetary restraints that do not include the moneys for a dedicated graphics designer for the game,

online resources can be utilized for inserting suitable aesthetics into them.

Theme and story

A theme can add interest and create engagement within a learning game. The theme can be conveyed with the visuals and with a brief “back story” that is included in the rules. Often, when themes are introduced within games, there is no accompanying narrative running through the game. Thematic elements are used to convey the idea of theme with minimal story. However, an entire story line can also be inserted within a learning game to make it interesting. Story offers a narrative thread that pulls through an entire game. Learners find it far easier to remember facts when they are part of a narrative than simply mugging up facts devoid of any “story” or context around them. To create a story line for effective learning games, it is important to keep in mind that a strong story has the 4 elements below. While it does take considerable efforts and a lot of creative thinking to come up with a string story within a game, it is certainly worth the efforts.

Rewards

Rewards are things or keepsakes that players earn through game play. The new wave in learning games and in gamification of learning is to give players achievements for accomplishing certain tasks or hitting certain milestones. There is a general trend towards giving lots of rewards, but game designers have to use them effectively. A popular strategy is to reward people for completing boring or menial tasks which are necessary within the game. It is also important to give rewards or points for performance rather than completion. However, if the reward is given for completion of a section to a certain standard of proficiency, it will encourage learners to perform their very best. Within a game, score is a powerful feedback tool. The players should understand the ways of accruing points or other incentives well and this will motivate them to play better as well as learn better.

2.2 Serious Game as a Tool for C Programming Learners

The main objective of this section is to define if, theoretically, it is possible to use serious gaming as a tool for C programming learners.

Students who are learning to C programming often have difficulties understanding cognitively complex concepts. Teaching programming is mainly focused on the syntax and features of programs, rather than to a deeper understanding of programming constructs and abstract concepts.

Computer game stimulates active learning and presentation of learning content in a variety of contexts that are funny and engaging for students. This has a positive impact on the motivation to learn.

Serious games with specific features which could be useful in the educational setting of C programming. The game is based on visualizations of different types of variables and on the interpretation of the assignment sentence, which actively encourages interactivity and deeper learning.

Chapter 3

Program Development

3.1 Requirements

The users of this game are the C programming learner(qualify year students). They have little knowledge of programming so they need to be told some basic points which are similar to the previous knowledge before doing some task. They needs a relaxing and interesting game environment so video is necessary. But the main purpose is to deliver information or knowledge of C programming such as I/O, iterations, functions, pointer, data structures, memory allocation. And after the users have done the tasks in the game, it should provide relevant information of learning and award the users.

3.2 Software Methods and Approaches

We will apply agile development. We have six students who are in the small teams, with small budgets. Agile methods exist to be flexible about the SE stages, there are times when it is good to plan, which gives us possibilities to fix our problem.

3.3 Serious Game Design

In the game design stage, we will make an Object-Oriented design. Produce a class diagram which contains the elements of this game and make component design in UML . Then, we will create a preliminary prototype. With the development of our project, the prototype will be improved.

3.4 Coding

Coding is very important. Well-coding means “easy to maintain”. In order to code to certain standards, we will coding according to certain strategies. One student will be the manager and other five students will be in charge of different developing parts, but all of us will have enough ideas of the whole situation. We will communicate frequently, and be sure that all of people meet the requirements.

3.5 Debugging

Debugging is a social, multi-faceted skill. So, we should first find bugs, try and reproduce it. We may use some debugging strategy such as binary search and hypothesis testing. Also, we may use a bug tracker which records data to help us judge the defect. Our group will print out the code and do a group code inspection twice a week or once a month.

3.6 Testing

First, we will build a test plan that developers can use it to test code before delivering it and managers can use it to estimate testing workload, and schedule it and include it in the budget. We may use Unit Testing to test the individual pieces and Integration Testing when we test combinations of pieces. Following are the Release Testing and Acceptance Testing. We will consider the result and may need to change our framework until the acceptance goes very successfully.

Chapter 4

Schedule

4.1 Important Dates

The serious game development project will be assessed through a number of tasks to be completed at specific times during the project. There are also other important deadlines that must be met. The tentative key dates and deadlines during the process of development are given in Table 4.1.1.

<u>Task</u>	<u>Date or Deadline</u>
Equipment requests	From 15 October 2018
Group project site up and running	Thursday, 31 October 2018
Interim reports due	Thursday, 13 December 2018
Final reports and software due	Thursday, 11 April 2019
Open Day (TBC)	Presentation Day (TBC)
Presentation Day (TBC)	Wednesday, 24 April 2019

Table 4.4.1 Important Dates (Tentative)

4.2 Project Timeline

The project timeline will be provided after the first formal meeting.

Chapter 5

Appendix

Appendix i. References

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