

Programming Language Teamwork Learning Tool

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Abstract

With the development of computer science and information technology (IT), it is more and more common to make the use of computer and internet to support the activity of studying, there have already become one of the hot topics of e-learning in recent years. Collaborative learning includes the activities of interaction between learners, learners share the information and knowledge each other, and cooperate in finishing some tasks. The main purpose of collaborative learning allows users can participate positively in the course of study, share useful knowledge each other in the classroom, and then obtain more valuable knowledge from classmates, make the learner studying more and more effective. The combination of collaborative learning and information technology is commonly called "Computer Supported Collaborative Learning" (CSCL), and that is currently having many attention. So, we develop a tool of collaborative learning in this research, utilize the structure of server / client, and combine the functions of text and voice communication via the environment of the internet, it will allow user cooperated in finishing some special projects of C programming language together, and solve the problems during the process of programming together. The learners can studied in the course of group collaborative learning. Besides share their own knowledge each other, they can study some new knowledge immediately too, and acquire some experience in programming. Furthermore, they can gain the ability of solving problems. The purpose of our research is making students to improve the motivation in study C programming language, and participate actively to attain knowledge and experience of programming.

Keywords: Collaborative Learning, CSCL, C Programming Language, Problem-Solving, VoIP.

1. Introduction

This paper describes a collaborative learning tool which can help students to improve programming skill and the ability of problem-solving skills. The tool which we developed that includes voice and text communication to support collaboration and teamwork, and it has program co-editor interface [1]. Collaborative learning has provided a chance for learners working together to reach a common goal, and that uses a way of group-learning, with classmates learning together to increase their own and other classmates' awareness [2]. Teamwork and learner's collaboration always support group collaborative learning. The essence of collaborative learning is that active participation is significant in the learning process and that learners share the valuable knowledge to other learners in traditional classroom. Nowadays, computers and information technology (IT) become a general component on a lot of aspects of education [3].

In general course of C programming language [4], the student's individual learning is a major way; students have to complete the teacher's designated homework and project after class. In individual learning, every student must proceeds at their own pace to accomplish the study goal without other classmates' help. But in these processes, the students may encounter a lot of problems, for example, they may have some trouble in designing the structure of program, or they make some errors and cannot solve the problem in the process of compile and debug. These problems will make learners lose the interest of C programming language, and they may give up to studying.

In order to improve the learner's participation and studying motivation in knowledge construction by assisting creation, exchange, and analysis of information during learning group interactions, it will be made possible to increase the effectiveness of collaborative learning [5]. During the collaborative learning process, all teammates will benefit from each other [6].

The rest of this paper is organized as follows:

Section 2 presents related work about our research. Section 3 introduces the main research of the system architecture implementation. Section 4 we will discuss with the difference of other collaborative software and our tool. Section 5 concludes this paper and discusses the future works.

2. Related Work

In this section, we are going to introduce the related work about this paper. First, we will present the theoretical background about collaborative learning. Collaboration defined "working together to complete the shared goals" [8]. Collaborative learning allows students to share their knowledge and information each other within the problem-solving process [9]. Second, we present the concept about C programming language. At last, we will talk about the theoretical foundations of Voice over Internet Protocol (VoIP), the technology we use in our system.

2.1 Collaborative learning

Collaborative learning is a popular research topic in the past decades, which includes learners' interaction, share information and knowledge each other, and complete the tasks together. It also improves participants' satisfaction in learning process. According to studying have shown, the course of collaborative learning has already proved that more effective than the traditional teaching methods. It is even supposed that students are learning as much from each other as from teaching material of course or from the teacher in the class [3]. Furthermore, effective collaborative learning might be reached through enhancing information sharing and supporting the group process.

During the problem-solving process, the activities of collaborative learning allow students to improve their capacity for learning programming and problem-solving skills through sharing information between teammates [3]. The approach to education that is more suitable to the educational environment through group collaborative learning.

2.2 Concept of C Programming Language

C programming Language is a general-purpose, structured, procedural and imperative computer high-level programming language. It developed in 1972 by Dennis Ritchie at the Bell Telephone Laboratories for use with UNIX operating system. In practice, Students need to know how to [10]:

- a. Discover and understand the problem
- b. Work toward a solution

- c. Rework the solution into code
- d. Enter the code into the computer
- e. Debug syntax errors
- f. Test and debug logic errors
- g. Verify that the problem has been solved

Through these seven steps, students can learn logical thinking and how to solve the problem of C programming language. Besides these steps, students have to learn the syntax and structures of C programming language. Finally, students will accomplish more tasks and improve problem-solving skills when they master these steps.

2.3 Voice over Internet Protocol

Voice over Internet Protocol (VoIP) is a technology that allows users to make telephone calls using a broadband Internet connection to take the place of an analog phone line. It can transmit the packets of voice through Internet [11]. Because of the low cost feature of the internet usage, VoIP can greatly reduce the telephone call costs comparing with the traditional PSTN system [12]. Since the VoIP technology was developed, many VoIP protocols have been proposed. H.323 is considered as the first generation VoIP protocol. H.323 is an "umbrella" specification proposed at first in 1996 by ITU-T and has been updated several times [13]. It suggests a standard for multimedia communication over packet switched network such as LANs, WANs and internet. Now it is one of the most accepted VoIP standards utilized by many VoIP product vendors.

The main architecture of H.323 includes H.323 Terminal, Gateway, Gatekeeper, and MCU. The purpose is that can make VoIP to transmit the voice data through RTP (Real-time Transport Protocol) and incorporate the PSTN, Integrated Services Digital Network (ISDN) and Broadband ISDN (B-ISDN) in the telecommunication system [14]. Gateway is a channel that connected with other communication systems, and it is responsible for the exchange of the network package and conversion of circuit exchange. Gateway provides the functions about Signaling Translation and Decode. Gatekeeper is the administrator in H.323 system, and its main function includes Address Translation, Admission Control and Bandwidth Management. Besides, it also manages the H.323 system of Terminal, Gateway and MCU [15]. MCU offers the function of multi-communication, and it consists of MC (Multipoint Controller) and MP (Multipoint Processor); MC manages about the process control, MP is responsible for decode, encode and mix of audio or video.

In next section, we are going to present our system architecture of the collaborative learning tool, and introduce the major function about the tool.

3. System Architecture

Our system architecture is composed of voice server and master server (see Fig. 1). Considering the collaborative learning efficiency, we designed three users a team which includes one team leader and two partners to use our tool.

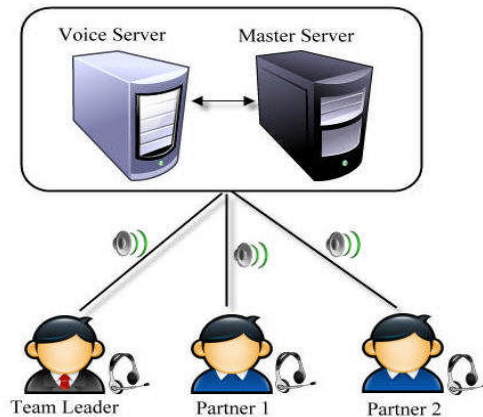


Fig. 1. System architecture

Master server mainly controls the learner information, such as learner portfolio and information transmission. We list the functions as follows:

- User Login/Logout: When user login the system which will record the IP address and learner information. After the user logout, the system will close the editing window and terminate the connection.
- Login User: We designed three people in a study group which is consisted of group leader and two group members. Because the main purpose of our system is to assist the group's work and cooperate together, to finish their homework and task.
- Record and Communicate the Message in the Chat Room: Users can discuss how to program or what kind of function should be used in the chat room. Master server will broadcast the instant message and record the message in a text file which will be stored in system record file permanently.
- Dispatch the Program Editor Sequence Automatically: Master server dispatches the users with login order, the user has his/her own editing interface.
- User Synchronous Programming: User can edit the program in each editing window; the user

program will be broadcasted to the team member after a period of time.

- Record the User Program Progress Automatically: The system will record user's program progress automatically in a period of time, in case that the users disconnect abnormally to lose the information.
- Connecting to Voice Server: Connecting and recording the voice server IP address to support voice communication service simultaneously.

In Fig. 2, this is our tool interface, the description are in the following:

- Editor: The upper side has three columns for three users to edit the program. The left window is designed for team leader, the other two windows for the team members. The system will distribute the user interface automatically. In Fig. 1, team leader can arrange the sub-tasks for the other two teammates. For program writing, there will be one main program and other functions. Team leader handles the main program, the other two teammates focus on functions writing. The system will record user's program progress automatically in a period of time, in case that the users disconnect abnormally to lose the information. During the process of program writing, the user can't edit other members' editor besides his own editor.
- Chat Room: Chat room plays a role to supply a text typing mode for uses who like to copy the code and communicate the programming problems. In programming course, some users have problems using the commands and variables. Some problems are suitable for text mode and some are proper to talk with voice directly. The similar situations occur in MSN communication in our daily life. Sometimes, people just like talk or type text when discussion. Therefore, we provide voice and text tools for communication.
- Debug: The "Debug" and "Debug All" are the functions of "Compile", these functions are using GCC compiler. They can examine the syntax of the user's C programming code, and when they finish, there will be shown the message in the "Debug Message" window (see Fig. 2). The "Debug" function is used in the situation of single user's operation, every user can use this function in his/her editing process, and it will examine the syntax of C programming code in his/her own editor window. The "Debug All" function is only used in the identity of leader. It will integrate all users' code to check for errors, the error

message also will be shown in the “Debug Message” window.

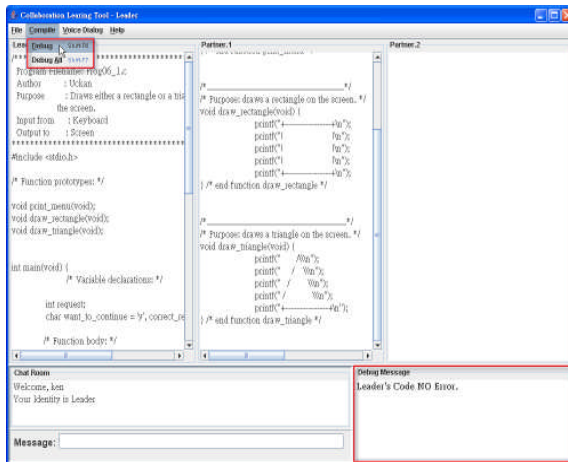


Fig. 2. Debug functions and debug message window

When the leader and partners edit C programming code in their own editor pane, they always need to examine whether their code have some errors. At this time, they can use “Debug” function, when they press “Debug”, the bottom right of the window will display the message after debug, they can see the syntax errors message in that window and fix the errors immediately. However, “Debug Message” window that can only display a message of debugging for a user. At last they finish all the code, the leader can press the "Debug all", it will integrate all the code and to check for errors.

- Voice Dialog: “Voice Dialog” assists the users to talk each other with VoIP. When users login our system and open our tool, the “Voice Dialog” window will be initialized, and it connect to voice server automatically at the same time. When it already connected to voice server, the status window will show the information of successful connection. “Call to Voice Server” is the function that users have not connect or exit voice server, they can click this button to connect server again. When users will exit or don’t need use voice function, they can close the “Voice Dialog” window or press “Hang Up (Call)” button, and then connection will be terminated.
- Personal Icon: “Personal Icon” can enable users to choose their fond of icon showing in the “Personal Picture” window. When users open the login window, they can choose their

private icon, and the icon will show in their own editor window. After login and open the editor window, users can also see other users' icon showing in their own window. If users are not choosing any icon, there will show the default icon in their image pane.

For example, the user “partner 2” opens the login window and inputs his own information; he can also choose his own icon in this time. When he login successful, leader and partner 1 will see his icon showing in the icon pane, and he can see leader’s and partner 1’s icon too.

4. Discussion

There have some similar collaborative tools developed in last 5 years, like NetBeans Collaboration Project, it’s a module named “Developer Collaboration” [20]. This module emphasizes that users can collaborate and share their work with Sun engineers or their team members simultaneously. And users also can communicate easily with each other and real time file sharing. Users can enter a message and then send it to the other participants in the conversation. And users can enter messages in the chat input pane in several formats: Plain text, Java, HTML, XML. Furthermore, user can share files with other members within a conversation. Files are shared using the Shared Files collaboration channel visible within each conversation window.

Our tool has some elements that are differ from the above-mentioned tool. Now, we will address some difference elements as follows:

- Voice communication: Besides text conversation, we also provide voice communication mode to improve the efficiency of communication. Because users communicate with each other in text mode, they may type too many word for conversation, and they will waste too much time. For this reason, we join voice communication mode to assist with text mode.
- Share information faster: Our tool can present users’ mutual editor panel more immediately, and show each member's progress. It does not need to open other windows or channels to share the progress and information presently in addition, and then it can be faster to discover and solve the problem.

Following above topics, we compare our developed tool to other tools as show in Table 1. The traditional programming editor only has editor; it doesn’t have voice and text communication, and also can’t share information synchronously. The

NetBeans project “Developer Collaboration” has editor and text communication, but it does not have voice communication mode. Our developed tool can help learner solve their problem and share their knowledge or information immediately.

5. Conclusion and Future Works

We have developed a friendly server / client tool, which embedded voice and text chat communication to support group collaborative learning via internet in our research. Learner can

find and solve the problem of C programming language designing through communicating and discussing. Through real time discussion and information sharing, users will finish their tasks and project more effective.

And then, we will test our system actually and check the effect on the learners using our tool in the future. We hope to test user's satisfaction to the system through the way of user's questionnaire.

Table 1. The comparison with other similar tools

	Our tool	NetBeans Collaboration Project:“Developer Collaboration”	Traditional Programming Editor
Programming editor	✓	✓	✓
Voice communication	✓	✗	✗
Text communication	✓	✓	✗
Share information	✓	✓	✗
Problem-solving	✓	✓	✗

References

- [1] H.C. Hong, Y.C. Chen: Design and Implementation of a Web-based Real-time Interactive Collaboration Environment. In: Ninth IEEE Workshop on Future Trends of Distributed Computing Systems (FTDCS'03), pp. 295 – 300 (2003)
- [2] F.C. Kao, T.H. Feng, C.L. Kuo: The Design of Internet Collaborative Learning System Structure with the Integration of 3D Virtual Instruments. In: 4th IEEE International Workshop on Technology for Education in Developing Countries(TEDC '06), pp. 71-75, Iringa (2006)
- [3] U. Björck: Theoretical foundations of Computer Supported Sustainable Learning Processes (CSSLP), in U. Nuldén & C. Hardless (eds.) CSCL, A Nordic Perspective. Papers From the Nordic Workshop on Computer Supported Collaborative Learning, pp. 11–17, Göteborg, Sweden (1999)
- [4] W.T. Wong, Y.M. Chou: An Interactive Bomberman Game-Based Teaching/Learning Tool for Introductory C Programming. In: conference of Edutainment 2007, Vol. 4469, pp. 433-444, Springer Berlin / Heidelberg (2007)
- [5] S. Caballe: On the Advantages of Using Web & Grid Services for the Development of Collaborative Learning Management Systems. In: First International Conference on Complex Intelligent and Software Intensive Systems (CISIS'07), pp. 263 – 270, Vienna (2007)
- [6] D. Yu, X. Chen: Supporting Collaborative Learning Activities with IMS LD. In: 9th International Conference on Advanced Communication Technology (ICACT'07), Vol. 1, pp. 316 – 320, Gangwon-Do (2007)
- [7] K. J. Wijekumar: Implementing Collaborative Learning Research in Web-Based Course Design and Management Systems. In IEEE International Conference on Advanced Learning Technologies, pp. 86 - 89, Madison, WI (2001)
- [8] N. Deshpande, B. de Vries, J.P. van Leeuwen: Building and Supporting Shared Understanding in Collaborative Problem-solving. In: Ninth International Conference on Information Visualisation (IV'05), pp.737 – 742 (2005)
- [9] Z. Liu, H. Jin, Z. Fang: Collaborative Learning in E-Learning based on Multi-Agent Systems. In: 10th International Conference on Computer Supported Cooperative Work in Design, pp. 1 – 5, Nanjing (2006)
- [10] K. Howell: First Computer Languages. J. Computing Sciences in Colleges archive, Consortium for Computing Sciences in Colleges, USA, Vol. 18, No. 4, pp. 317-331 (2003)
- [11] Ge Zhang, M. Hillenbrand, P. Müller: Facilitating the Interoperability among

Different VoIP Protocols with VoIP Web Services. In: First International Conference on Distributed Frameworks for Multimedia Applications (DFMA'05), pp. 39 – 44 (2005)

- [12] D. Butcher, X. Li, J. Guo: Security Challenge and Defense in VoIP Infrastructures. In: IEEE Transactions on Systems, Man, and Cybernetics-Part C: Application and Reviews, Vol. 37, No. 6, pp. 1152 – 1162 (2007)
- [13] C.S. Ko.: Voice Application On Multi-Player Online Game. Chung Hua University, Hsiehchu, Taiwan. [Text in Chinese] (2007)
- [14] Y.J. Mou: Using H.323 Protocol to build immersive audio communication in Massive Multi-Player Game. Chung Hua University, Hsiehchu, Taiwan. [Text in Chinese]. (2007)
- [15] Voice over IP 101 Understanding the Basic Networking Functions, Components, and Signaling Protocols in VoIP Networks, 2007, pp. 9-11. http://www.juniper.net/solutions/literature/white_papers/200087.pdf
- [16] NetBeans Collaboration Project, <http://collab.netbeans.org/index.html>