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A NEW APPROACH TO ENGINEERING EDUCATION: CPU PROCESSING MODEL

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Abstract

In recent years, education environment have many new approaches that support learning and teaching. Some of them are general applicable theorems to all courses; some of them are domain-specific theorems. Domain-specific approaches are usable on one scientific subject. These type of approaches are more effective than others. Because, each area has different needs, different problems and needs different teaching and learning methods. From a different viewpoint, Edgar Dale's cone of learning shows that people generally remember 90% of what they do. And if they learn by doing, they get analyzing, defining, creating and evaluating abilities. All these learning and teaching approaches point a domain-specific learning by doing education method. Therefore, we propose a new learning and teaching activity for university students. This method can be used for computer supported departments as computer engineering, informatics, management information systems etc. Computer aided courses need laboratory applications, especially in engineering education. Also, applying the theoretical knowledge helps the development of students on their career in educational environments. For these reasons, we have designed software for microprocessor (CPU) course. It supports both experimental and gaming models.

Keywords: Teaching Method; Educational Material; Applied Learning; Learning by Doing; Higher Education; Computer Aided Learning; Engineering Education

1.Introduction

Education has two processes: teaching and learning. These systematic terms support each other. Starting in about 3500 BC, various writing systems developed in ancient civilizations around the world (Korst, Newble&Cannon, 1994). Education issue comes to light with this important development. People have tried better systems to have better educational results during centuries. We have developed one of them.

There are many teaching and learning methods. Main teaching strategies include lecture by teacher, class discussion conducted by teacher, research and examination. These three main teaching strategies have many methods. In this paper, we have studied and developed a new method for one of the teaching strategy that is research and examination. The purpose of this study is to teach students research and generate results for problems. Some usual technics are problem solving, dramatization, observation and experiment. On these methods, students and teacher can use extra materials. With the development of technology, computers are one of the main materials in schools. The use of Information Technology (IT) and the World Wide Web (WWW) as a teaching tool and rich source of information is increasing rapidly (McKimm&Jollie, 2007).

2.Learning Methods

The use of technology in class brings some advantages and disadvantages. Some advantages of IT: providing access to expert knowledge all over the world, link resources in different formats, providing learning environment, easy to use etc. However, it has some barriers to the successful use of IT -based teaching and learning (Korst, Newble&Cannon, 1994).

- The technology and supporting infrastructure can be very costly.
- Developing IT-based resources can be very time-consuming and expensive.
- Information overload can detract from student learning.
- It may take more time to cover the same material in on-line classes than in face-to-face classes.
- Students can feel isolated and IT-based teaching and learning cannot totally replace 'face-to-face' contact.

For these reason, technology shouldn't be a purpose, but it should be a supporting material for education. We have proposed experimental gaming model based on this study. On educational environment, gaming and experimental learning methods are used separately.

Experimental learning is the process of learning through experience and defined as "learning through reflection on doing". Beginning in the 1970s, David A. Kolb helped to develop the modern theory of experiential learning (Ramsden, 1992). This theory does not need a teacher; it directly depends on student experience. On the other hand, educational games are designed with educational purposes and help people to learn about certain subjects, expand concepts, reinforce development, understand an historical event or culture or assist them in learning a skill as they play. We have combined these two methods.

3.Engineering Education

The sample of this study is computer engineering departments of engineering faculties. Microprocessor (CPU) is a compulsory lesson at most computer engineering education. Students learn theoretical execution principles of microprocessors on course by lecturer. Our game based application helps students to learn the execution step by step. Students can imagine the working principle of CPU by using visual memory on our application. As we know, computers execute all command on logical level. We cannot do it on physical environment or it needs expensive equipment. Therefore, the best and cheap way of understanding the execution is simulations for computers. It simplifies learning and supports learning by doing applications.

At the same time, laboratory method in learning is a heuristic learning method that means students get a problem solving, an independent and critical thinking abilities (Forsyth, 2001). The application does not have a temporal constraint. Each student is under equal circumstances and they proceed their own learning speed. They can repeat all steps until succeed. These advantages of our application provide active participation to course. For these reasons, this study supplies better learning and teaching system than classical laboratory leaning activities.

4.An Experimental Gaming Model

On this part, we will give information about application steps, background and interface. CPU is the brain of the computers. Therefore, it affects all executing steps of computer. It has three parts in it: registers, arithmetic logic unit (ALU) and status registers. Each command on computer is executed on CPU. It has complicated structure. Each command has 3 parts: source, destination, operation. For example, MOV R0, 8 means that move 8 to R0 register. The operation is MOV (move), source is 8 and destination is R0 register.

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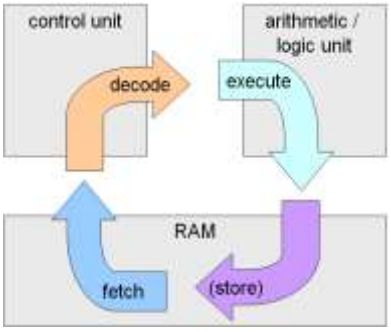

Figure 1: CPU Execution Cycle

In figure 1, CPU execution cycle is shown. When user give a command, fetch process is implemented. If it is needed on command, it goes to main memory to get the values. Then, decoding process is implemented. That means command is decoded. Next is the execution process and finally, the result is written to memory.

4.1Application Steps

This interface has been programmed on C# language. To understand the execution cycle of CPU following steps are given. It is an addition process of two numbers.

- CPU wants number A from memory using address bus.
- Memory brings number A to the CPU using data bus.
- CPU wants number B from memory using address bus.
- Memory brings number B to the CPU using data bus.
- CPU adds A and B on ALU and finds result.
- CPU informs memory to send the result to the number C using address bus.
- CPU sends number C to the memory using data bus.
- Memory registers the result as a number C.

Figure 2 shows the interface. There are 4 parts of structure. At the “codes” part, user chooses addressing mode, command, source and destination. You can run one command or write a program that consists branches.

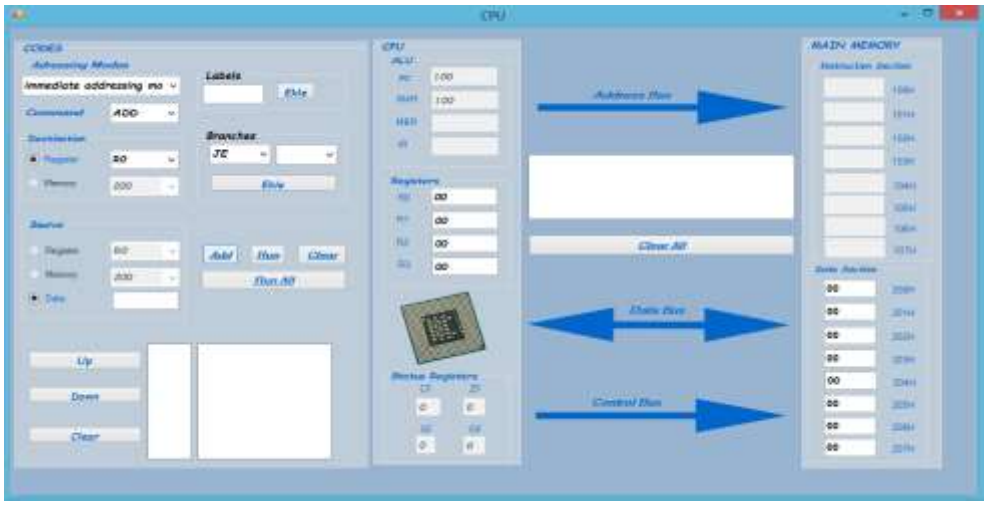

Figure 2: CPU gaming model interface

In addition, the programmer can add labels. After the list of commands is created, "run all" button has pushed. CPU starts execution process. There is a small piece of label that moves on interface. It shows the movements on CPU in real life. Also, there is an explanation box between CPU and main memory. It shows the each step and writes it on box. There are three buses between them. Address bus carries addresses to memory. Data bus carries and writes data between CPU and memory. The label moves on these busses, between memory cells and in CPU

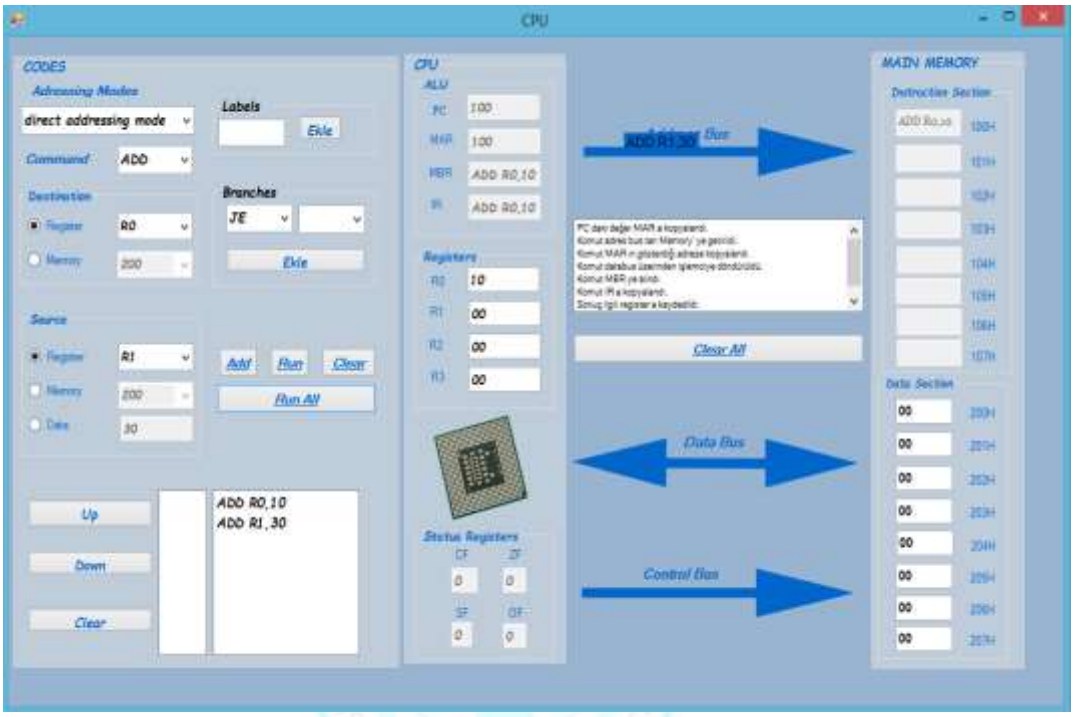

Figure 3. CPU gaming model interface

Students can write commands/programs, see the execution steps and results. It is really difficult on real world application to show these steps. This interface helps students to cover the subject.

Conclusion

Experimental gaming model on engineering education will help students and lecturers to teach and learn one of the most important subjects of computer engineering courses. It is a game model. Students write their own programs. It is not a general application. It is a student centered interface. It is special for each student. If student has better knowledge program executes correctly. The speed, correctness of results, memory management is based on student. Therefore, people can see the self-knowledge about CPU. It will be easier for students to understand the subject and it will be easier for lecturers to teach execution process for each student.

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