Middle East Technical University
Department of Computer Engineering
Fall 2010

Project Proposal for

watch & touch

A Low-Cost Interactive Whiteboard and
In-Classroom Collaborative Working System

by DialecTech
Giray Havur (1630870)
Melike Ercan (1560135)
Utku Şirin (1560838)
Yaman Umuroğlu (1560614)
1. Motivation & Purpose

Education is undoubtedly of utmost importance to any modern society, serving many purposes such as the increase of economic wealth, social prosperity and political stability in a society through the education of individuals. Therefore, improvement in quality of education is directly proportional to the improvement of the society in short and long term. To increase the quality of education, using educational technology, which means the study and ethical practice of facilitating learning and improving performance by creating, using and managing appropriate technological processes and resources, is an approach that become more and more important especially in 21st century.

Educational technology's main purpose is to increases the interaction between teacher and students and increase the participation of students in class compared to classical methods. It is proven that interactive education is a better way of education than the classical one. While classical methods focus basically on teaching, interactive education considers both teaching and learning by helping students take part in class more and by giving them more responsibility during learning process. Another advantage of interactive education is that it offers a larger variety of tools for education such as audio-visual materials and contents on world wide web, instead of only a course book and a static blackboard. As it provides easier and faster access to information, it saves time and is more efficient.

The last, but not the least, interactive education brings ease of use to education system. Instead of losing time and energy to write the content on blackboard, it is possible to prepare course contents in advance and simply annotate the content dynamically during course if the need arises. Hence, it can be significantly easier and more effective for a teacher to use interactive education compared to classical methods.

The main and most widespread obstacle standing in the way of increasing the quality of education by using educational technology is financial constraints. In today's profit-oriented world, it takes thousands of dollars (see Market Search section) to purchase a single fully-equipped smart class, a classroom in which educational technology is used. Given an average school's budget, it is practically impossible for all students to benefit from interactive education, and many others may not be able to afford even a single smart class. A point in case would be that there are only two smart classes in the Middle East Technical University, with its ~25.000 students.
We envision a solution adhering to the principles of free and open source software, which will bring the ability to utilize educational technology in all classrooms, for the low cost of its off-the-shelf available hardware components. Given the significance of education in the development of human civilization, we believe such an advance could make significant contributions to us all.

2. Project Description and Goals

The aim of the project is to bring interactive whiteboard functionality, deliver the software tools needed to make such functionality productive in the classroom, and allow the students to work in collaboration with each other as well as the instructor (in scenarios where one computer or tablet per student is available).

An interactive whiteboard (IWB) is a large interactive display that connects to a computer and projector. A projector projects the desired image onto a flat surface where users control the computer using a pen, finger or other device. The main challenge in building such an interactive display is detecting user input - a variety of solutions such as pressure-sensitive screens and electromagnetic pens exist, but usually this is the very component that makes IWBs so expensive to build. Inspired by Johnny Chung Lee’s ideas[^1^], Watch & Touch will use the Nintendo WiiMote’s capabilities[^2^] (hardware detection of up to 4 points at 100 Hz in 1024x768 resolution) to detect user input.
Below is the top-down view of such an interactive whiteboard setup, with the components numbered:

1. *The controlling computing device (can be a desktop PC, notebook or embedded board with capabilities of connecting to the projector)*
2. *Projector*
3. *The WiiMote, facing the projection surface at an angle to minimize obstruction by the instructor and maximize the interactive area*
4. *Infrared pen or multiple infrared pens, similar to laser pointers used in presentations but with an infrared component to allow detection by the WiiMote*
5. *The projection surface*

The WiiMote is connected wirelessly (via Bluetooth) to the controlling computing device, sending the processed user input which is interpreted as mouse events, thus allowing interaction with software running on the device as a regular mouse would.
This is the point where the Watch & Touch software intends to make a difference. Instead of just offering the instructor mouse control via the IR pen to do the same things he/she would do otherwise, it will provide a central interface through which the instructor can access a variety of tools to benefit fully from the interactive classroom.

**Annotation** will probably be the central feature in Watch & Touch for many instructors. While it can simply be described as “making drawings on the screen”, some elaboration is needed for further clarification. This is not about making drawings on an empty page (which simple graphics painting programs are perfectly capable of), but actually being able to draw on top of all kinds of screen content and recalling the previously-made drawings when the same content is brought to the screen. A classical example would be annotating presentations, but we also plan to include support for annotating other kinds of content such as web pages and videos. The ability to export annotated content to distribute it to the students and make it always accessible is another planned feature.

**Interaction via multi-touch gestures** is another central highlight of Watch & Touch. Using the WiiMote’s ability to recognize simultaneous multiple inputs and gesture recognition, different multi-touch gestures will be implemented and be present during all stages of Watch & Touch’s usage. The success of Apple’s popular products such as the iPhone and iPad is often recalled alongside the revolutionary multi-touch gesture interfaces of these devices, and we wish to carry these advances on to interactive education. For instance, slide transitions and web browser move forward/back functions could be mapped to two-finger swipes, while opening and closing the “annotation tools” menu (pens of varying thickness, basic geometric shapes, select drawing color...) could be mapped to “pinch” gestures, and so on. In case multi-touch is not available or not preferred for some reason, these tasks will also be possible to carry out without gestures.

**In-classroom collaborative working** will be available in scenarios where several (possibly one per student) computers (or tablets) are available in the classroom, connected by a local area network. By installing the Watch & Touch collaboration client, it will be possible to further increase the degree of interactivity in the classroom by allowing the students to create collaborative drawings, and share their screens with each other or with the instructor on the IWB. Collaborative drawing can be an important aid to students’ groupwork, and screen sharing with the instructor can provide an efficient channel of communication (via drawings) for asking questions.

Finally, since we intend Watch & Touch to be as useful as it can possibly be and over longer periods of time, we plan to create a software architecture with, **support for incorporating new**
3. Market Search & Literature Survey

Our main purpose is to provide all classrooms an interactive whiteboard environment with optional smart class features at an affordable cost to improve quality in education. During market search, we have seen similar applications of smart class solutions and interactive blackboard solutions which are either not fully-equipped and far from satisfying needs of students and teachers, or too expensive for many educational institutions to afford. Our project aims to merge and improve existing technology to obtain the desired smart class application.

- At the very beginning, what inspired us were Johnny Chung Lee’s WiiMote interactive whiteboard ideas\(^1\). However, this is just a proof-of-concept demo and not suitable for use as-is in a classroom environment.
- Uwe Schmidt has an open-source Java WiiMote whiteboard application\(^6\). Actually, this is a solution written in Java that works relatively well. However, it allows only controlling the mouse and nothing else (drawings, annotation etc. have to be done with external programs) so it’s not a complete solution like we intend to build.
- Smoothboard\(^4\) is a commercial WiiMote whiteboard application with annotation features, but does not include any multi-touch gesture or collaboration support and works only on Windows.
- Luidia E-Beam is an interactive whiteboard solution\(^3\). eBeam products transform flat surfaces into interactive and collaborative workspaces. The interactive unit itself costs around $1000 a computer and projector are not included in the price. It is compatible only with Windows and Mac OS, and costs 785.00 TL+KDV from the Turkish distributor. This is not an affordable price for average schools to use interactive technology in several classrooms.
- NetOp school is a computer based education software providing “smart class” related features. It is not exactly what we would like to do, but it is a nice example to demonstrate how expensive it can get to purchase smart class software at over a thousand euros for a middle-sized classroom\(^5\).

All in all, compared to the existing solutions, what we wish to build with Watch & Touch will be advantageous in terms of having a complete, free & open source, multi-platform, interactive whiteboard system which supports multi-touch gestures that can be utilized at the relatively low cost of its available off-the-shelf hardware components, as well as an in-classroom
collaborative working environment to complement the classroom activity when the necessary hardware is available.

4. References

1. http://johnnylee.net/projects/wii/