

Design of Interactive Whiteboard to Support E-Learning

1st Didik Dwi Prasetya

Jurusan Teknik Elektro, Fakultas Teknik
Universitas Negeri Malang (UM)
Jl. Semarang No 5 Malang, Indonesia
didikdwi@um.ac.id

2nd Muhammad Ashar

Jurusan Teknik Elektro, Fakultas Teknik
Universitas Negeri Malang (UM)
Jl. Semarang No 5 Malang, Indonesia
muhammad.ashar.ft@um.ac.id

Abstract— Electronic learning offers an effective solution that enables the creation of virtual classes. Unfortunately, the limitations of learning media features cause visual communication to be difficult, so that the explanation of the material is less easy to understand, especially in relation to illustrations, sketches, diagram, and modeling. Therefore, a flexible learning media solution that can be used together is needed. This paper proposes the design of web-based interactive whiteboard application to improve electronic learning service. The development of design adopts the waterfall software development model. Implementation of interactive whiteboard on the Internet network is able to generate interesting, collaborative learning, and support electronic learning, especially distance learning.

Keywords—interactive, whiteboard, online, e-learning

I. INTRODUCTION

Information and Communication Technology (ICT) has an important role in education, especially in the learning process. ICT solutions have proven to be instrumental in helping to improve the quality of education and learning services. One of the most popular ICT solutions to date is online learning or electronic learning (e-learning). E-learning technologies offer learners control over content, learning sequence, the pace of learning, time, and often media, allowing them to tailor their experiences to meet their personal learning objectives [1]. The online learning model is widely applied in educational institutions because it offers flexibility and flexibility. The learning process can be done directly and simultaneously although educators and learners are in a remote location.

In general, online learning is able to overcome various problems, such as distance, time, cost, and limited educator resources. Nevertheless, there are still some special issues that need attention, one of which is the limitations of learning media. In online learning, real-time visual information communication is still difficult to do [2]. On the other hand, the utilization of instant messaging is limited to text communication. This condition makes material explanations less easily digested, especially with regard to illustrations, sketches, and modeling. For example, online communication through chat is currently difficult to accommodate the explanation of a sketch or model. Therefore, a more flexible

and collaborative learning media solution is needed in the virtual classroom

Referring to the existing problem, this research suggests the development of interactive online web-based whiteboard applications to help improve electronic learning services. In addition to providing chat facilities for communication, the innovation offered by this application is an interactive whiteboard feature. Like a whiteboard in the classroom, this facility allows educators to write text, drawing diagrams, sketches, and models interactively that can be shared with all participants of distance education. This approach is able to cover some of the shortcomings of existing chat facilities, especially with regard to spontaneous explanations through handwriting. The interactive online whiteboard implementation has several impacts on learning, including increasing student engagement in the classroom, motivating students, and increasing enthusiasm for learning [3].

II. INTERACTIVE WHITEBOARD

In the context of ICT, the term whiteboard refers to a computer-based "whiteboard" that allows learners in a virtual class to view live visual presentation (text, sketches, images) of educators. Online interactive whiteboard is a type of electronic whiteboard that supports user interactivity and runs online on a computer network. This help software facilitates far-flung users to communicate and interact with each other collaboratively. In particular, interactive whiteboards are used in lecture or classroom environments and these technologies support interactive communication utilizing writing, drawing, and sketching [4]. The use of interactive whiteboards in collaboration with Internet services has great potential to increase the productivity of educators and learners. Interactive whiteboard technology is best used to support existing services, such as discussion forums or chats.

Research also shows that notes taken on an interactive whiteboard can play a key role in the student review process, leading to a higher level of student attendance. In addition to the positive impact observed on student learning, research shows that designing lessons around interactive whiteboards help educators streamline their preparation, more efficiently in ICT integration and improve their overall productivity.

There are several advantages of the online interactive whiteboard, among them are:

- Widely available, students only need to be connected to Internet network.
- Can be used together in a virtual classroom
- Enable collaboration among learners.
- It is a software that is adaptable to various situations and jobs.

Online whiteboards are very useful to support distance education because learning in this education requires a tool that helps collaboration between educators and learners [5]. The use of interactive whiteboards can support many different learning styles and is used in a variety of learning environments, including for students with hearing and visual impairments. Online interactive whiteboards have several impacts on learning, among which are increasing student engagement in the classroom, motivating students, and increasing enthusiasm for learning.

A. System Design

Products that will be generated in this study is a utility software. Referring to the characteristics of the product, this study uses waterfall model of software development which comprises the step of communication, planning, modeling, construction, and deployment [6]. The selection of this model is based on very well-known requirements, stable product definition, and understood support technology.

B. Research Design

The stages of waterfall development model can be described as follows: 1) Communication stage is the initiation of the project and aims to explore the interactive whiteboard product requirements specification. At this stage, we identify all the requirements of developing the system; 2) Planning phase includes estimation, scheduling, and trace product results. Here we also create an interface design of interactive whiteboard; 3) Modeling aims to analyze and design products. At this stage, an interactive whiteboard application model is created under the requirements and refers to the results of the analysis and design; 4) Construction is to translate the results of the modeling stage to a form of product applications and at the same time product testing results; 5) Deployment stage aims to broadly distribute products that can be used by the target users of the product.

The phases of the waterfall model of software development carried out systematically and sequentially. Each stage in this model is related, the next stage requires the previous stages as input, and so on until all the stages completed [7].

C. Product Description

The proposed innovative solution is a software application to help improve the quality of distance education services. This application is built using web technologies that are distributed over the Internet network. How it works online whiteboard application is to share display worksheet. A

teacher will deal with an interactive board for writing or drawing, then students can see the board's appearance even if it's in a different location. More information on the proposed system development architecture is shown in Fig 1.

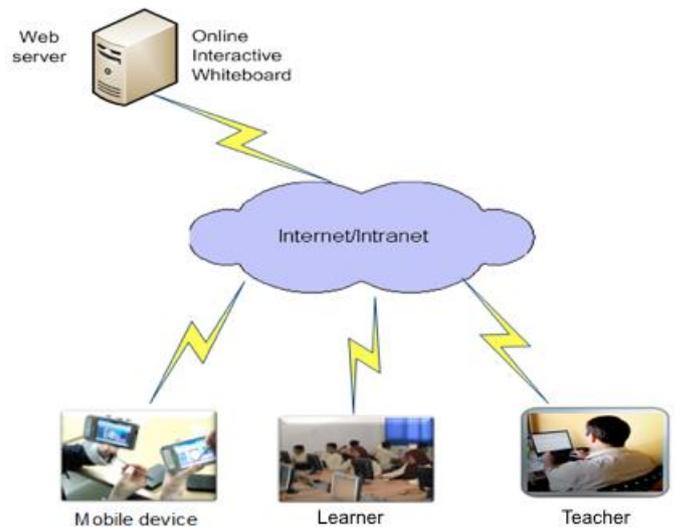


Fig. 1. System Design Architecture

D. Product Testing

Testing is performed as a verification that the developed software can meet the requirements specification and run in accordance with the scenario that has been described. The main purpose of the testing phase is to find unidentified errors. Product testing is limited in functionality testing using the black-box method. Testing is done by looking at the output of the software based on the input provided. To support the implementation of product testing, required a description of the test procedures and test cases.

The testing procedure starts from the unit or module to the whole software product. Test cases are written in a format that has the result statement accepted and rejected. Product testing conducted by engineers as an expert judgement who have the relevant competence. The testing procedure performed by observing the product and revising it based on the instruments that have been provided.

III. RESULTS AND DISCUSSIONS

The implementation stage is the stage to translate the analysis and design results to a machine-readable form. This section will also discuss the results of system design development.

A. Research Results

At this stage, an interactive whiteboard application is implemented using HTML5, CSS3, and Node.js as the backbone of communication via socket.

Development of interactive whiteboard application consists of two main modules:

1) *Whiteboard interactive*

This module represents the main functionality of the application as an interactive whiteboard.

2) *Live chat*

This support module has a role in providing live, text-based communication between students and teachers.

The whiteboard page is ideally a representation of a conventional whiteboard so the design is also made similar to its physical form [8]. On the whiteboard page also provided a page for chatting between students with teachers or students with other students.

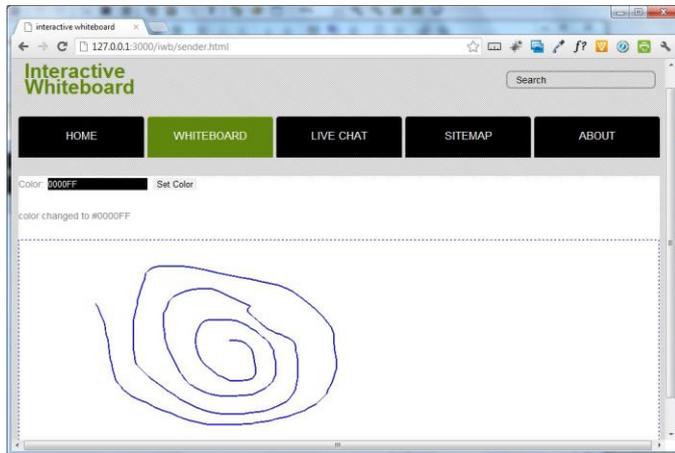


Fig. 2. Teacher Room Page

All teaching activities on the whiteboard will be recorded in real-time to all student's whiteboard pages. This concept embodies learning in virtual classrooms where students do not have to be in one room, but can be in any location that allows access to the application.

The student page view will look exactly like the lecture page, for example seen in Figure 3.

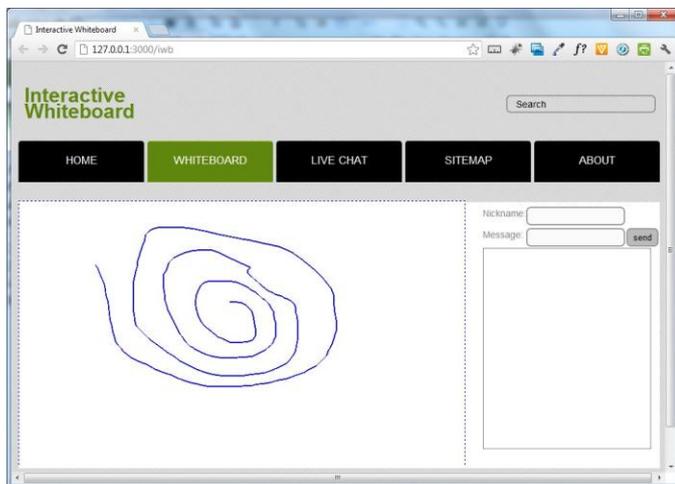


Fig. 3. Student Room Page

On the room page students are given restrictions that students can only see the activity of teachers only. That is,

students do not have the ability to modify or delete the whiteboard page.

The second module developed is a live chat module that also utilizes Node.js technology. This chat app can work in real-time without requiring user intervention, such as page refresh. Because of behind-the-scenes work, chatting activities can be done quickly and lightly without significant data communication barriers. Fast and light parameters are visible from very short application responses when accessed by different browsers.

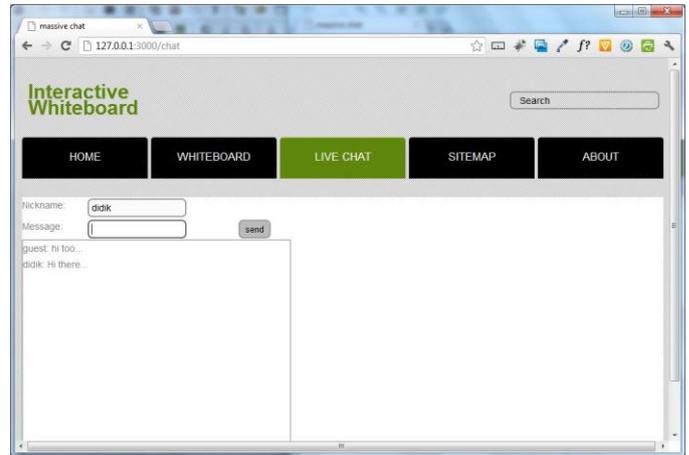


Fig. 4. Live chat Page

In accordance with the characteristics of web applications, the whiteboard interactive applications can also be accessed via mobile devices (tablet pc or smartphone). This will give more flexibility for the learners to follow the learning process.

B. Discussions

The implementation results show that interactive whiteboard applications can be developed by utilizing web technologies consisting of HTML and CSS3, and Node.js. The results of interactive web-based whiteboard application development demonstrate a solution to help improve electronic learning services. This ICT application approach offers several advantages, especially for electronic learning as it saves costs, time, and resources. The main share whiteboard feature is able to facilitate virtual classrooms, where learners do not have to physically come to the learning location.

Interactivity that characterizes the application is represented through the facilities provided. A teacher can interact (write or draw) directly to an interactive whiteboard via a browser connected to a computer network. This activity is done directly through the mouse input device. On the other hand, learners can see in real-time teaching activities on the whiteboard through their respective browsers that are also connected to the Internet network.

To ensure that the product is in conformity with the initial specification then conducted a series of black-box testing. The aspects assessed include the main function, performance, user experience, ease of use, and portability. The test results show that the product is in conformity with the initial specifications. The test results also show that interactive whiteboard

application able to adapt and adjust to the screen size of the browser to get the best view.

Utilization of such ICT applications has great potential to support education services, especially electronic learning. However, geographical constraints can be overcome with a web-based application development solution.

IV. CONCLUSION

The result of the development of interactive web-based whiteboard application design can be implemented in electronic learning. The design of this application is able to form virtual classes and supports visual explanations, especially regarding the writing of the text, drawing diagrams, sketches, and models interactively that can be shared with all participants in distance education. Thus, the explanation of learning materials more easily accepted by students. In addition, the availability of chat facilities also allows the workers to communicate in a virtual classroom.

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