2016 Fall Social Computing Application Design
Final Project Report

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Motivation

Recently, technologies have evolved faster and faster. We can now communicate with each other via internet-based communication systems, like Facebook, LINE, etc. These tools are quite convenient, but, still, there are several minor deficiencies that can be improved. When it comes to teaching or group discussion, it is not quite easy to articulate oneself clearly through plain text messages. Therefore, here we introduce many kinds of new functions in our newly designed project, which can provide people a better platform to engage in more interactive conversations.

Google document and communication softwares (Line, Facebook, etc) are frequently used when it comes to group discussion. Therefore, we did a survey on how people think about these tools. This survey is mainly about which functions of these tools need to be improved.

Chart. 1

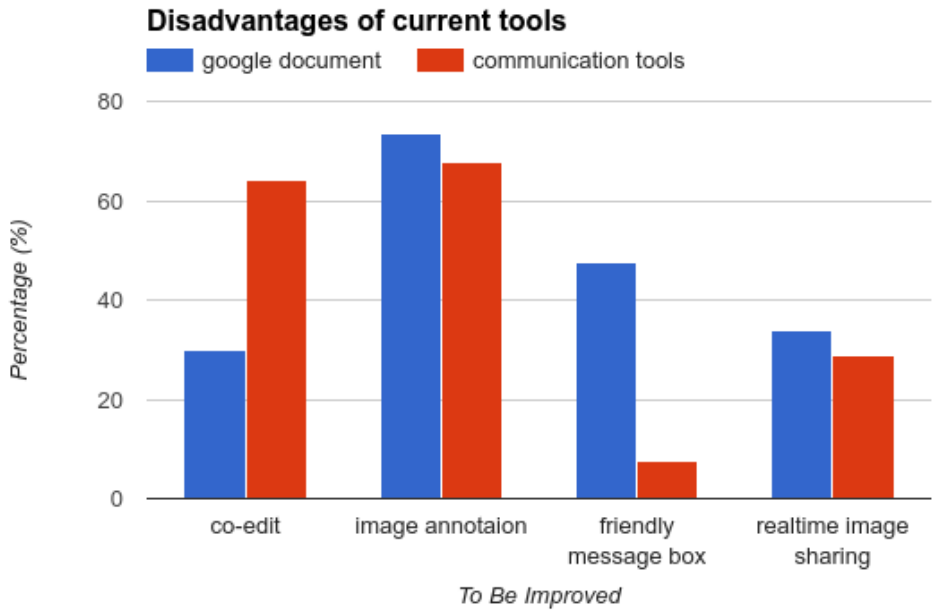
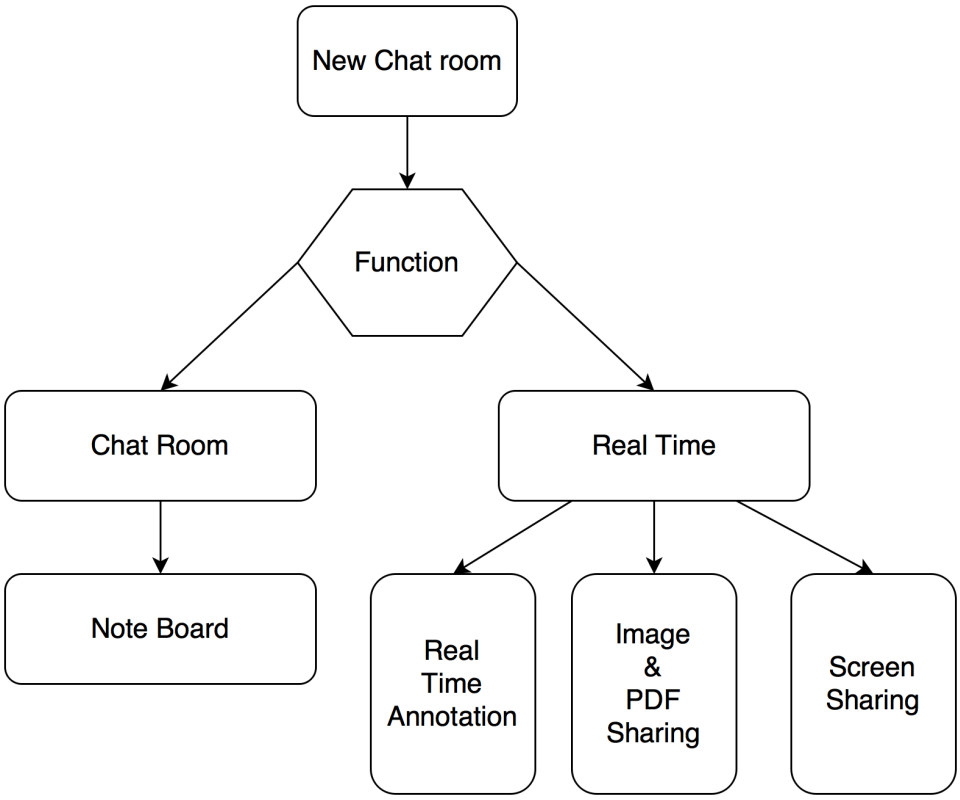


Chart. 1 shows that both Google document and communication tools lack image annotation and realtime image sharing function. Moreover, communication tools do not have a good performance on co-edit part, while Google document does a bad job on instant message part.

Design



Flow Chart.

1. Real Time

Now, we have Google Document many other communication platforms that can serve as a co-editing tool for people to work together in real time. But we think that they all lack some of the import features. Here we'll design cool features that will make users more convenient when they want to discuss something on the internet together.

1. Real-time annotation
   Sometimes it will be very difficult to easily convey our thoughts using simply plain texts in the chat room. Thus, here we design the function of annotation. That is, one can draw arbitrarily on shared documents. We've designed many different annotation tools, such as a pencil, a highlighter, an eraser, etc. The pencil can be of many different colors that creates diversity and the highlighter can help users mark important lines in the documents. With real-time annotation, we can discuss things in a more straightforward way.

2. Image and PDF sharing
   We provide image and PDF uploading. Users can choose to upload images of any format. The image will resize itself to fit in the screen of the drawing board. When users upload a PDF file, it will show one page at a time, and they can change the pages at anytime.

3. Screen sharing
   During group discussion, taking notes on documents makes it easy to clearly express oneself. For real-time discussion, we also design the feature of screen sharing, which means that every user in the same chat room will be able to synchronize with other people. They will see exactly the same thing with other group members. This feature provides users a great platform to discuss together without having trouble not catching up.

2. Individualization / Notes

According to our survey, we found that, generally, students have difficulties discussing problems through Internet-based communication systems. This primarily results from “note-lacking” feature in the chat room. That is, if several people send words in the same time, the small chat room box would receive large amount of the information in a short time. Some messages may be ignored. Or, on the other hand, some people may not be able to stay online during full discussion, so they might have to catch up with the discussion by scrolling through all the previous messages. Thus, we aspire to provide a more friendly chat room platform. Not only can we log in the chat room with character choosing as our own profile picture, we can also type brief and crucial information on the note board below the chat room. This allows everyone to have a clear map on what’s going on “now”. This note board has real-time co-editing feature, which means that everyone shares the same board and can help correct others’ errors directly only by typing on our own board.

Technical Part

1. Server
   For instant message and synchronized annotation, a server is needed. We use Nodejs to build up our server, the server listens on movements of a client and broadcast the message to every client.

2. Socket.io
   Socket.io is a powerful javascript library which is widely used for realtime web applications. Building our server with Nodejs, we implement our real-time functions through this library. With socket.emit() function from Socket.io library, the clients can send their message to the server. With socket.on() function, the server receives the message and broadcasts it to the clients. Once a client receives a message with socket.on() function, it can parse the message and add it to its own database.

3. HTML Canvas
   HTML canvas element supports drawing functions, such as drawing a line, a rectangle and a circle. However, the drawing stays on the local side, other clients can not see the drawing. All we want to do is to make the drawing, that is, the annotation be synchronized.

   Synchronized pencil / marker line / eraser
   When a client is drawing a line, use socket.io to emit the drawing information every single second so that every client receives the drawing immediately and their screen shows the annotation immediately.

   Synchronized circle / rectangle shape
   Unlike synchronized line, drawing synchronized circle and rectangle needs to show the dynamic drawing process. Therefore, for each user, it is crucial to save the previous step, so that when dragging a circle or a rectangle, the canvas can recover to the previous one during the process and show the current shape. If we do not store the previous step, there will be dozens of rectangles or circles on the canvas.

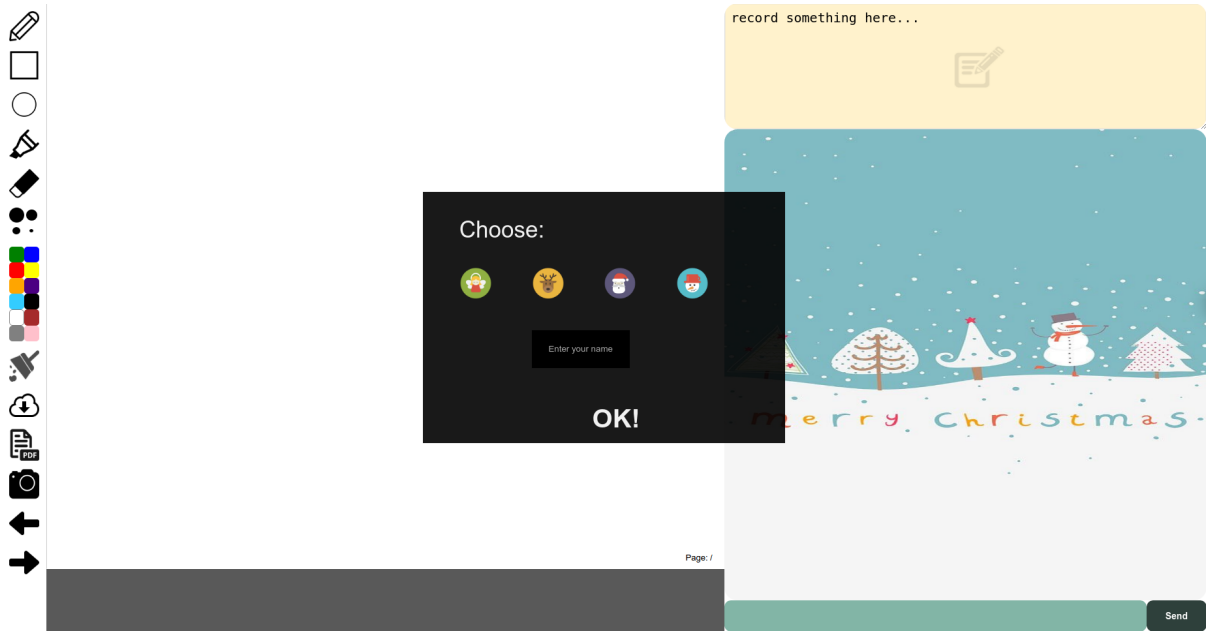
4. Client Information Saving
   Different clients have different information, such as pen type, pen color, etc. Once a client click on a color or a line width, use socket.io emit() to broadcast the information to every client. As a result, every client has a user dictionary to store users' information. Upon receiving other clients' drawing position message, draw on the canvas according to the information (color, pen type, etc) in the user dictionary.

5. Image Upload
   To add annotation on the image, we put the image on the canvas background. Therefore, using eraser would not clear out the background image. Once a client adds an image, every client sees that image on their own screen. Moreover, our website supports multiple images, that is, clients can upload several images and small images are showed on the bottom of the website. Once a client click on the small image, a message is emitted to every client and every client's screen shows the same image.

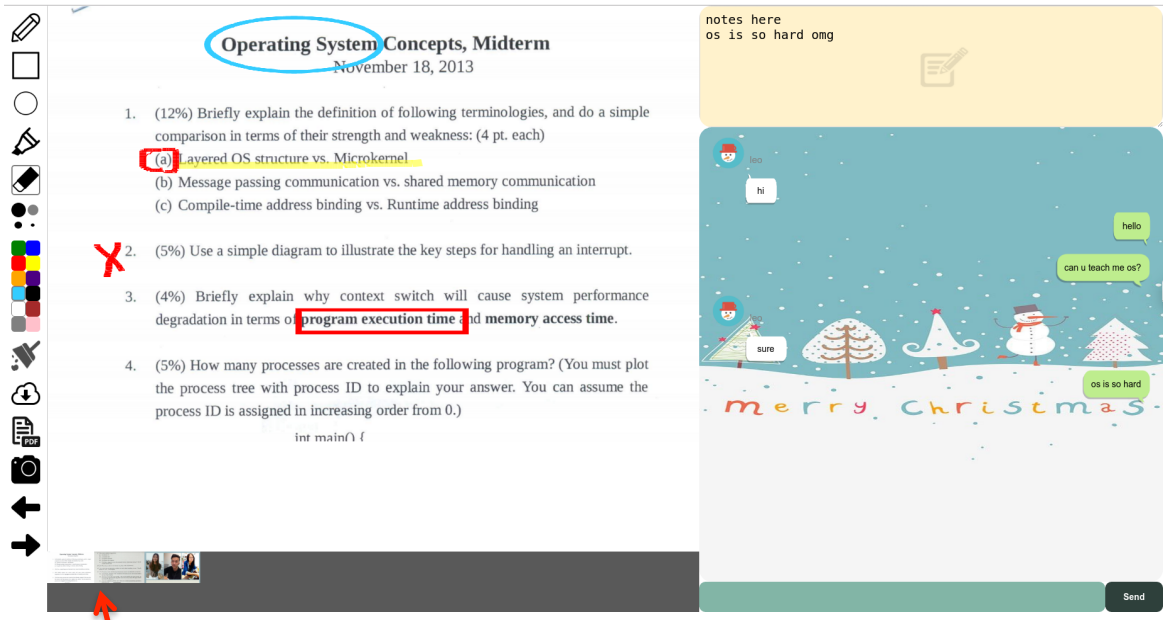
6. PDF Upload using PDF.js
   PDF.js is a Portable Document Format (PDF) viewer that is built with HTML5. Using this tool, we convert PDF files to canvas element, so our users can draw directly on the PDF files.

7. Download
   The download feature is created by downloading the entire drawing on canvas. But when users upload images or pdf files, the files will be transferred to the background image of the canvas. Therefore, when users press the download button, we'll have to draw the background image on the canvas, and then it can be downloaded together with the drawings of users.

Result

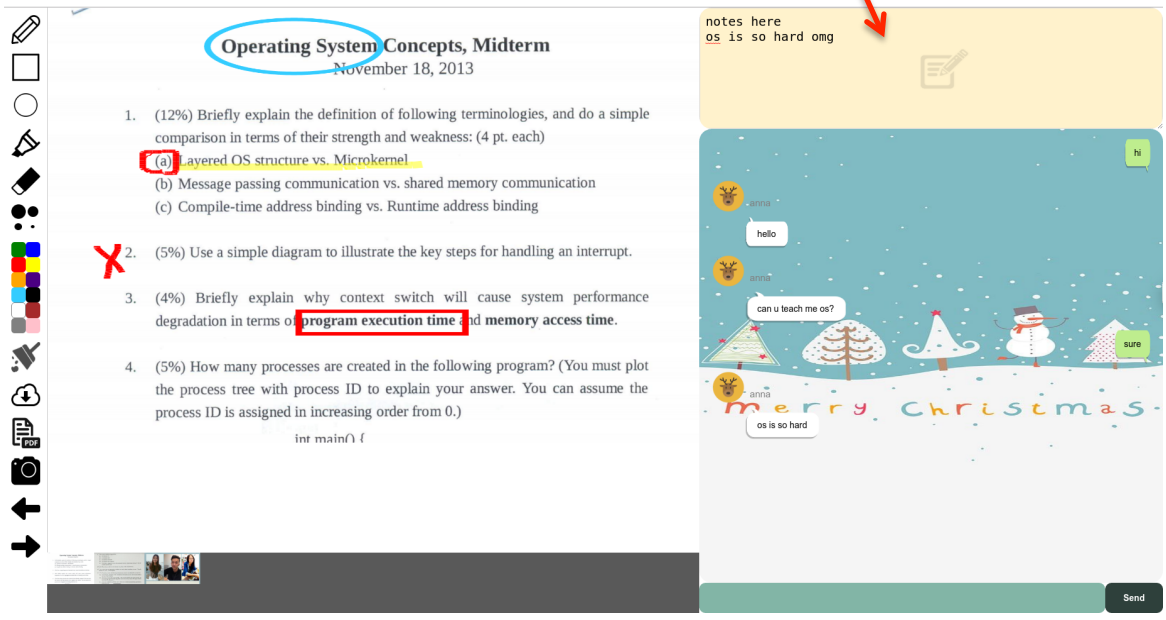


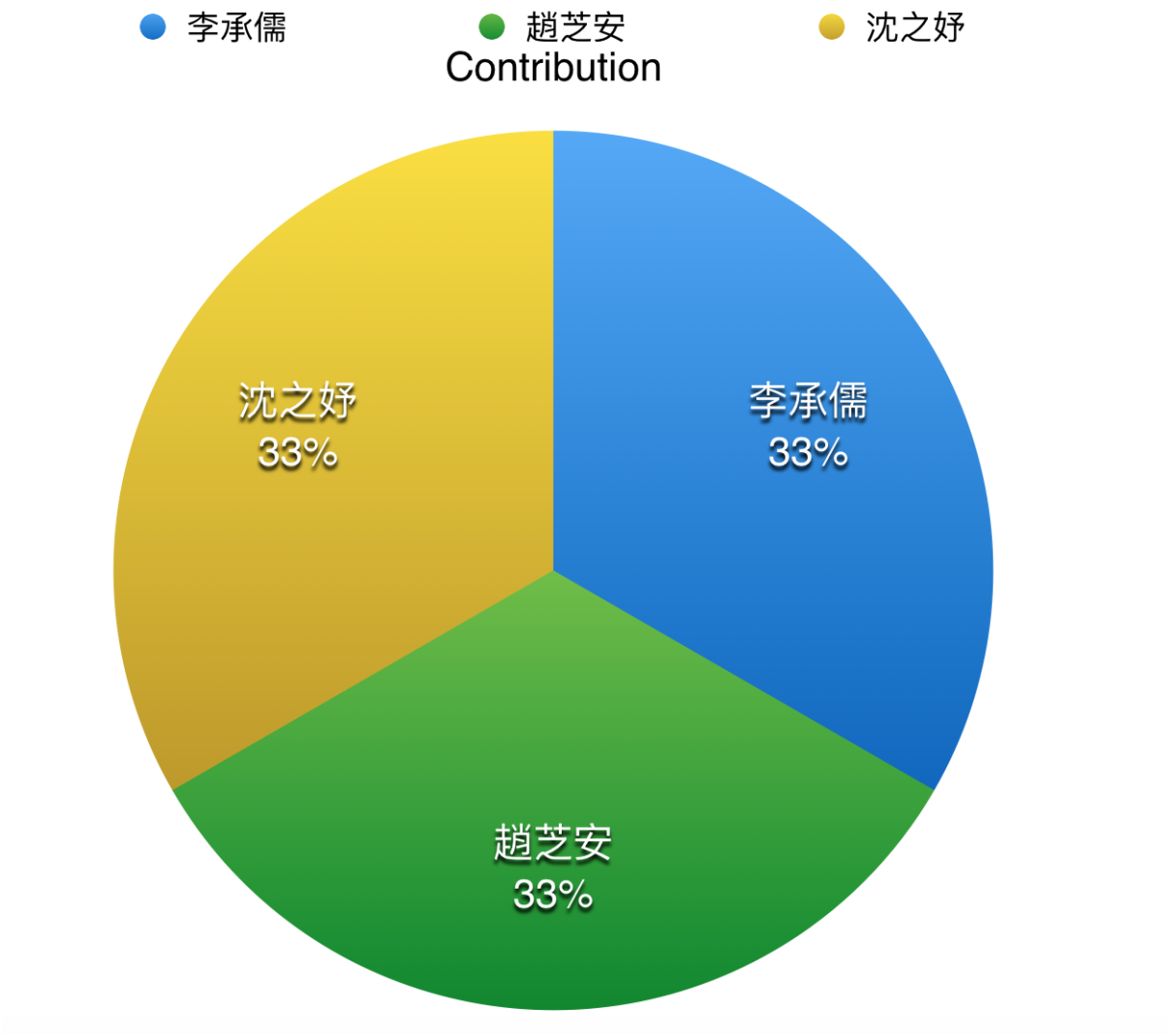
The entrance menu where users will choose one picture as profile picture and enter their names to start to meet in.



All uploaded pictures are shown hear, and we can choose desired one by clicking the picture.

Real-time white board. We can write down brief and crucial information here.

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