

TEEM

Final Report

Owen Hsiao, Pooja Jain, Jong-kai Yang, Saikiran Dulla

May 2017



UC Berkeley
School of Information

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Executive Summary

TEEM is a smart solution which allows users to effectively schedule and make the most out of their team meetings! Users in non-profit organizations groups, student organizations, and academic project groups involve themselves in a variety of projects, and frequently collaborate with stakeholders in different organizations. Currently, these users lack a sophisticated solution which allow them to effectively find a common time to meet with each other. As opposed to an enterprise setting, our users don't have a standardized tool which allow them to access availability of other group members. Moreover, these users also lack a tool which assists them in keeping track of meeting progress and provide all group members synchronized meeting follow-up action items after the meetings. The existing tools which these users use have their own limitations. Some of which are functional issues (no feature to add team members, no automatic action items generator), while others are more of behavioral issues (less intuitive layout and confusing buttons).

To solve these problems, TEEM's algorithm leverages Google Calendar API to provide our users the ability to automate the meeting scheduling process, and mitigate the user pain points along this process. TEEM also utilizes voice recognition APIs to convert recordings of meetings to text transcripts upon which Natural Language Processing (NLP) techniques are performed to generate key takeaways during meetings, and distill actionable items for the team, allowing teams to efficiently capture meeting minutes. TEEM not only simplifies the meeting scheduling process in a multiple participants environment, but also reduces the overall manual effort of summarizing the meeting takeaways. Unlike other current products which only provide partial solutions to users' pain points, TEEM is an all-round solution, which allows the users to effectively schedule and manage their meetings!

Project Background and Problem Statement

TEEM focused on researching the current experience that UC Berkeley students have with meetings. The intent of this research is to provide key insights to guide the design of a tool that will help UC Berkeley students schedule their team meetings in an effective manner and also

make the most out of their meetings. An effective scheduling of a meeting would involve less steps, easier tools, and a quicker process. In addition, we consider an effective meeting as one that meets all items on an agenda within the allotted timeframe. We identified three phases in meetings: pre-meeting, during meeting, and post-meeting. Our project focused on the pre-meeting and during-meeting experiences.

Using various research methods such as interviews, focus groups, observation, and usability testing, we identified key research insights about UC Berkeley student experiences with the first two phases of meetings. Among those insights, we found that student teams find it challenging to find a common time to meet. Regarding available tools for students such as Doodle and Calendly, their limitations create a difficult experience for users to efficiency of schedule meetings. For instance, students must manually look up common times that work with all team members after they filled in their availabilities and manually send emails to all team members. Regarding the during meeting phase, we found that there is a lack of accountability for note-taking and time-keeping. Although agendas are created and referenced, students experience an inability to meet all items on their meeting agenda. These insights guided the designs for our tool which will improve the experience of meeting at a common time, meeting the goals of their meeting, and summarizing the takeaways of their meeting to reduce the overall manual effort.

Solution

User Segmentation

TEEM is designed for users who need to organize meetings with other stakeholders and does not have a standardized tool that allows them to access availability of other group members, as opposed to assisted by an enterprise tool (e.g. Microsoft Outlook). Moreover, TEEM is also designed for users who lack a tool which assists them in keeping track of meeting progress and provide all group members synchronized meeting follow-up action items after the meetings.

Based on this fundamental idea, TEEM's target users could be segmented in three main groups. The first group of TEEM users are the students who are involved in team projects which

require collaboration with other students. The second group of users are people who are involved in community non-profit organizations such as parent teacher associations, residents association meetings or fundraiser events. The third group of users are those who participate in student organization board meetings such as IMSA meetings, club board/general meetings. TEEM is a perfect tool which allows its users to schedule meeting with each other without the support of a standardized calendar view.

Value Proposition

TEEM provides our users three main values:

A). Smart Meeting Scheduler:

TEEM allows users in different organization to schedule group meetings with 3 simple steps. This is done by several unique approaches in TEEM's design. Traditionally, users need to go through a series of checking back and forth between their own calendars and other members' availabilities, and then email the invitation to the participants. This process not only is burdensome but also has its flaws. For example, when a member updates his/ her calendar with new events, the process of soliciting availabilities via emails will need to start again. Similarly, members of one particular meeting might be submitting multiple time slots to that meeting and hence they are not be able free these availabilities for other groups because of the pending invitations. With TEEM's approach, all of these problems could be solved. First of all, TEEM not only integrates calendar with invitation sending tools, but also automatically finds the common time amongst group members via its unique algorithm. As a result, users will be able to avoid the annoying back and forth process of scheduling a meeting. Furthermore, TEEM's algorithm also automatically updates the user's availability when new events are scheduled in the calendar so that the availability soliciting process does not have to start over again. Lastly, TEEM's algorithm will make availability recommendation before the users submit their availabilities based on other's responses allowing the users to free out possible availabilities for other meetings. Because of these unique algorithm and approaches, TEEM allows its users to easily schedule group meetings in few simple steps.

B). Automatic Action Item Generator

TEEM also allows its users to have synchronized meeting minutes and allows them to keep track of the action item after the meetings. Currently, users in a meeting take notes individually. As a result, the meeting minutes of a single meeting is different among different note takers. Furthermore, because of the lack of follow-up mechanism designed in the current system, these meeting notes and action items are usually lost in the email threads and never get executed. TEEM's automatic meeting minute generator will allow our users to have synchronized notes among all members of the group. Also, via the design of TEEM, the groups could easily follow-up with the action items after the meetings.

C). Central Meeting Minutes Archive

TEEM allows its users to keep track of the past meeting schedules and meeting minutes in a central archive. Traditionally, users will need to dive into the email inbox and search for the past meeting minutes and schedules. However, with a central archive, TEEM allows our users to keep track of the groups' project progress and performances.

Competitive Analysis

In order to understand the unfulfilled user needs and to guarantee that TEEM provides its user values different from its competitors, we conducted a competitive analysis among major players in the market including When2meet, Doodle, and Calendly. In our competitive analysis, these products are evaluated by whether they possess any of the following five features:

1). Automatically Find Common Time Feature, 2). Meeting Minute Generator, 3). Auto update with Current Availability, 4). Smart Availability Recommendation, and 5). User Friendly Mobile Interface.

While comparing with these features, TEEM is the only product that possesses all five features, in the market. Other products such as Doodle only contain one feature out of five, whereas products such as when2meet and Calendly do not contain any of the five features.

Supporting Trend

There are two main supporting trends which encourage us to develop TEEM and believe that TEEM is going to contribute great impact to its users.

The first trend is the growing demand and market size of the cloud collaboration services. The cloud collaboration market size is estimated to grow from USD 23.39 Billion in 2016 to USD 42.57 Billion by 2021, a 12.7% of increase for the market size. Cloud collaboration offers the user several benefits. For example, “cloud collaboration offers a communication system that is cost effective in information sharing and communication, allowing the real-time exchange of data and information.” It also “provides a reliable unified user interface and user experience across multiple devices and media types.”¹ Because of these benefits, the user adaption rate of cloud collaboration services has been increasing. Moreover, within the cloud collaboration market, the unified communication and collaboration segment occupied more than 50 % of the overall market share in 2015. Market analysts even indicate that “the rising dominance of conferencing services that include audio, video, and web conferencing services, will boost the growth prospects for this segment in the coming years.”² As a result of this growing adoption of unified communication and collaboration services/solutions, we believe that TEEM not only fulfills the needs of the users but also meets the demand of the market.

The second supporting trend for TEEM that we identify is the constant increasing usage of mobile devices of the users around the world. Studies have shown that US users spend 71% of their digital time on mobile devices. Moreover, 79% of smartphone owners use apps nearly every day, saying they use them at least 26 days per month. Based on this information, we believe that only by implementing a mobile application will TEEM align with the needs of the users and be widely adopted.

¹ "Global Cloud Collaboration Market 2016-2020." *Technavio*. N.p., n.d. Web. 04 May 2017.

² "Global Cloud Collaboration Market 2016-2020." *Technavio*. N.p., n.d. Web. 04 May 2017.

UX Research

Research Questions and Goals

We started with two main questions: How do teams schedule meetings? How do teams accomplish their objectives during meetings? Before we started the research process, we came in with the assumptions that there is currently an inconvenient scheduling process for group meetings. We also assumed that teams often have a difficult time accomplishing all items on their meeting agenda. In addition, we assumed that timekeeping during meetings is difficult, and it is difficult to keep team members accountable to complete tasks they were given during the meeting. We validated these assumptions through our interviews, observations, and focus group.

Our main goal was to understand the needs of students in order to help them schedule group meetings and run meetings more efficiently. An effective scheduling of a meeting would involve less steps, easier tools, and a quicker process. An effective meeting is one in which students accomplish their intended objectives during the meeting in a time optimised fashion. We also wanted to understand the challenges and opportunities of current tools relating to scheduling. Through our research findings, we hoped to develop a tool that accomplishes our goals in an automatic and user-friendly manner which accomplishes tasks quickly and with minimal errors. Since we are also in the process of creating a prototype, we also wanted to gather feedback from users about their experience on our product.

Methodology

Our team used four methodologies to answer the aforementioned research questions and goals: interviews, observations, a focus group, and two rounds of in-person usability testing. We recruited current UC Berkeley undergraduate and graduate students that have had experience working on student teams, either as a team lead or as a team member.

A). Interviews

Goals:

Our team chose to conduct interviews in order to achieve the following goals:

1. To learn about issues students may encounter during meetings that they are not comfortable voicing in a group setting.
2. To extract narratives about students' experiences, needs, and challenges using existing tools to schedule and manage meetings.
3. To develop personas that encapsulate the spectrum of students for which this tool will be designed.

Methods:

We interviewed eight students in total. Four were graduate students, and four were undergraduates. In addition, four are or were once team leads on their student teams, and four have been team members only. Each interview lasted between 30 to 40 minutes. Findings were analyzed using an affinity diagram. Additional details can be found in Appendix A.

Key Findings:

Scheduling:

1. Lack of notifications
 - a. *Description:* All interviewees identified the lack of notifications and reminders as a major pain point. Currently popular tools like Doodle and When2Meet don't send out reminders to members to respond, or to schedulers when all members have entered their availabilities.
 - b. *Quote:* "(The tool) should let the coordinator know when everyone has responded...it might take a while for me to remember to check."
2. Too much back-and-forth between tools
 - a. *Description:* Current tools require the user to utilize more than just the scheduling tool to complete the entire scheduling process. For example, when using When2Meet, the user must 1) open When2Meet, 2) open Google Calendar, 3) go back to When2Meet to complete the creation process, 3) open email to send the

invitation link, 4) check back on When2Meet to see if members have responded, and 5) open Google Calendar to confirm the time and to send final invitation.

- b. *Quote*: “If we can somehow combine When2Meet and Google Calendar, it would be perfect.”

During Meeting:

1. Lack of accountability

- a. *Description*: Many student teams have a horizontal structure with no designated roles, so oftentimes, no one has the authority to appoint someone to take meeting minutes or distill actionable items from the meeting for follow-up. It could be uncomfortable for a team member in this situation to assign responsibilities.
- b. *Quote*: “There are no official team roles...(so) I ended up taking on a lot of the work.”

2. Meeting structure varies

- a. *Description*: The flexibility of the structure or agenda of the meeting varies from group to group, and even from meeting to meeting. Sometimes, a group really needs to keep to an agenda, while at other times, it’s more important to allow members room to expand on certain items, or even to go on tangents altogether. Interviewees expressed the difficulty of knowing when and how to vary this structure.
- b. *Quote*: “It’s hard to gauge whether to devote more item to an agenda item...or to keep the team on track.”

B.) Personas:

Two personas were developed based on a data and a blend of characteristics from our interviewees. These personas exhibit the extremes of the potential users that will be utilizing our app for their meetings, which will help the team ensure our solutions satisfy both ends. One is a highly organized team lead in a graduate programs (Lydia), and another is a budding undergraduate that is still learning the ropes of working on collaborative team projects (Dan). These personas went on to guide the design of our remaining three methodologies and our prototype.

Lydia - The Team Lead



- *"I like being able to bond and catch up with team members, but I wish they would be more prepared for meetings"*

Age: 22

Work: UC Berkeley Graduate Student

Location: Berkeley, CA

Character: Efficient, Caring

Goals

- To establish good relationships with clients (potential employers)
- To support inexperienced team members

Frustrations

- Scheduling meetings require many steps and remembering to remind team members to respond
- Important items that aren't discussed at a meeting falls on her to complete

Bio

Lydia has plenty of experience working on student teams, and has worked on a few client projects in the past. She is currently leading two different student teams in the Computer Science department, on top of juggling 3 other classes and a job search before she graduates. Time may not be a luxury for her, but she is still determined to deliver quality work to her clients.

Dan - The Team Member



"I'm still new at this, so I'm kind of winging it as I go"

Age: 19

Work: UC Berkeley Undergraduate

Location: Berkeley, CA

Character: Curious, Ambitious

Goals

- To build a professional portfolio
- To learn about working for real clients

Frustrations

- His calendar and inbox are in disarray, making meeting invitations another annoyance
- No one on the team is familiar with how to run a meeting to address outstanding issues
- No one feels responsible for taking minutes or distilling action items

Bio

Dan is currently part of a student team with no assigned leader or roles. Like the rest of his team, Dan has never been part of a collaborative setting working on real world issues until this current project. He's learning how to keep track of all of these upcoming deadlines and tasks, especially now that he has a number of personal projects in various stages of completion, and an inbox with hundreds of unread messages.

Observations

Goals:

Our main goal was to understand how meetings are currently run in order to find what works as well as pain points that our app could help to improve.

Methods:

We attended a meeting for Toastmasters, a public speaking club on campus. Our participants were everyone that decided to come to the meeting. The meeting had 15 students present and lasted for 90 minutes. We also observed a meeting for the Information Management Student Association (IMSA). Our participants were the leadership members who were a part of the student group we observed. There were 9 students from the School of Information participating. The meeting lasted for 60 minutes. Additional details can be found in Appendix B.

Key Findings:

1. Timekeeping is important

- a. *Description:* During the Toastmasters meeting, the leadership were extremely efficient in time keeping during speeches and they held up colored cards during speeches to let the speaker know they had 2 minutes left (green card), 1 ½ minutes left (yellow card), 1 minutes left (red card). In this way, they were able to keep all of their meeting activities within the time they had allotted for it. On the other hand, the meeting at the I-School did not have strict timekeeping and therefore they ran out of time at the end to talk about everything they had originally planned to talk about.

2. Pre-assigned roles and responsibilities keep things moving

- a. Similar to our interview findings, we found that creating an agenda and assigning who would be in charge of facilitating particular parts of a meeting greatly improved the efficiency of the meeting. In the Toastmasters meeting, the entire agenda, including the person leading that part of the meeting, was written on the board. This allowed the meeting to very quickly, as there was no delay time between the events. On the other hand, there was no agenda for the IMSA meeting and instead the meeting chair who was facilitating asked the members at the beginning of the meeting what they wanted to talk about. Therefore, the meeting was a lot less efficient and there was more time wasted.

C). Focus Group

Goals:

We chose to conduct focus group to collect rich information on collective views from students and understand their experiences and pain points with the current process of scheduling meetings. We also wanted to qualify our data collected through other methods like interviews.

Methods:

We had 4 participants in total. The participants came from a diverse set of backgrounds namely – an MCB, sociology, and computer science undergrad, and a PhD from the School of Information. The session lasted for about 45 minutes. The findings were analyzed right after the focus group. The focus group discussion guide can found in Appendix C.

Key Findings:

1. Students prefer more personal methods to schedule meetings (e.g., verbally, through Facebook chat).
 - a. Although people prefer to use chat tools where they can ask others for a common time to meet, but it is considered less efficient and more time consuming.
 - b. There is a lot of uncertainty around when others are free and it gets frustrating when some team members are not available to meet or there is a conflict between their availabilities. Also, not everyone contributes from the start due to the lack of ownership, clarity or simply due to lack of reminders.
 - c. *Quote:* “You can specify I have to meet at 5 but I’m coming from somewhere so 5:30 would be better”
2. There is a high rate of unresponsive amongst team members as they are busy which delays the process of scheduling team meeting
 - a. The process of actually scheduling a meeting starts very late which leads to loss of the days they potentially could have met.
3. During meetings, members tend to not push others for accountability of action items or asking people to complete work on time for the sake of not appearing as a bad person.
 - a. *Quote:* “No one wants to be that bad guy”
4. Participants mentioned it would be nice to upload their calendars to enable an automatic merge with the rest of the team members’ calendars to find a common time without additional effort from the members.

D). Usability Testing - Competing Tools

Goals:

In order to understand the unfulfilled user needs and to guarantee that TEEM provides its

value proposition that differs from its competitors, we conducted a competitive analysis among major players in the market, namely Doodle and Calendly. We facilitated four usability test sessions of these two competing scheduling tools. We focused primarily on scheduling, which is the primary value proposition of these tools. The intent of the usability tests was to achieve the following goals:

1. Understand how people currently schedule their meetings in a group.
2. Identify challenges users face when using the tools to find a common time that works for all team members.
3. Identify design opportunities to guide the design for our prototype.

Methods:

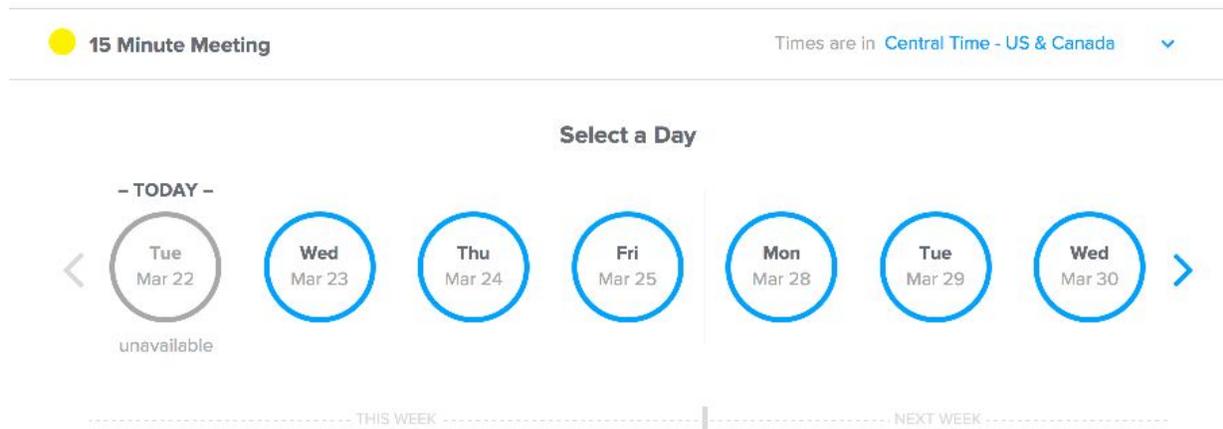
For each tool, we set up two tasks. The first task was intended to have participants create a meeting invite and send it out to all team members. The other task was to have participants respond to a pre-existing meeting invite.

Key Findings:

We found that users have a strong preference for layouts and event creation processes that are similar to Google Calendar. On screens that had too many options, the time it took for users to complete the task increased. Users also expressed a need to see other team members' responses on one screen. Lastly, we learned that users expected the tools to send invitations to members automatically.



Calendar view of competing tool - Doodle



Calendar view of competing tool - Calendly

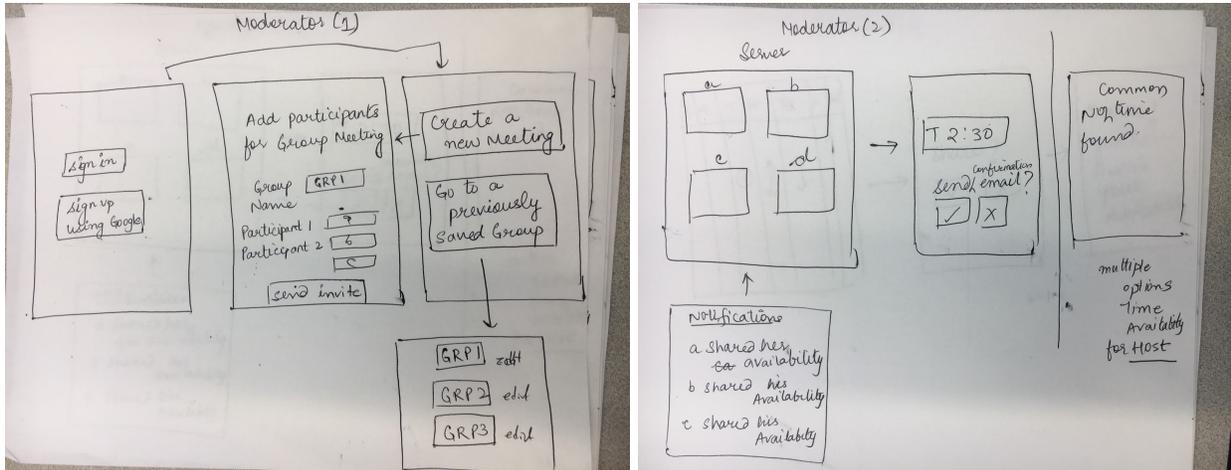
Design

Paper Prototypes

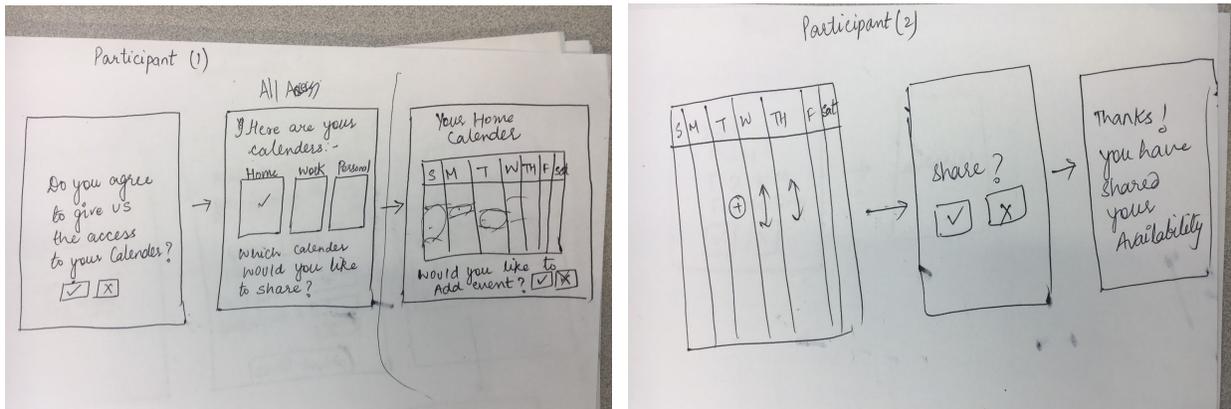
The first time we set pen to paper was with the paper prototypes. Translating the vague ideas in our heads to more concrete forms on paper was challenging. We wanted to diverge on ideas and therefore ended up with many ideas on the table by different members of the team. Early on we decided to develop various versions of the prototypes by refining all the ideas that we brought in, testing each of them to understand what might work and what didn't.

Doing think aloud with different versions of the prototypes and testing them helped us get a better sense of what features users liked and what left them utterly confused. Users liked the feature of editing their availabilities before sharing it with the host and sending meeting invitations to the team members. We also discovered areas that needed further refining; buttons needed more clarity, calendars needed to represent more information, the user flow needed more granularity.

Below is the paper prototype of the moderator View - group creation and meeting invitation



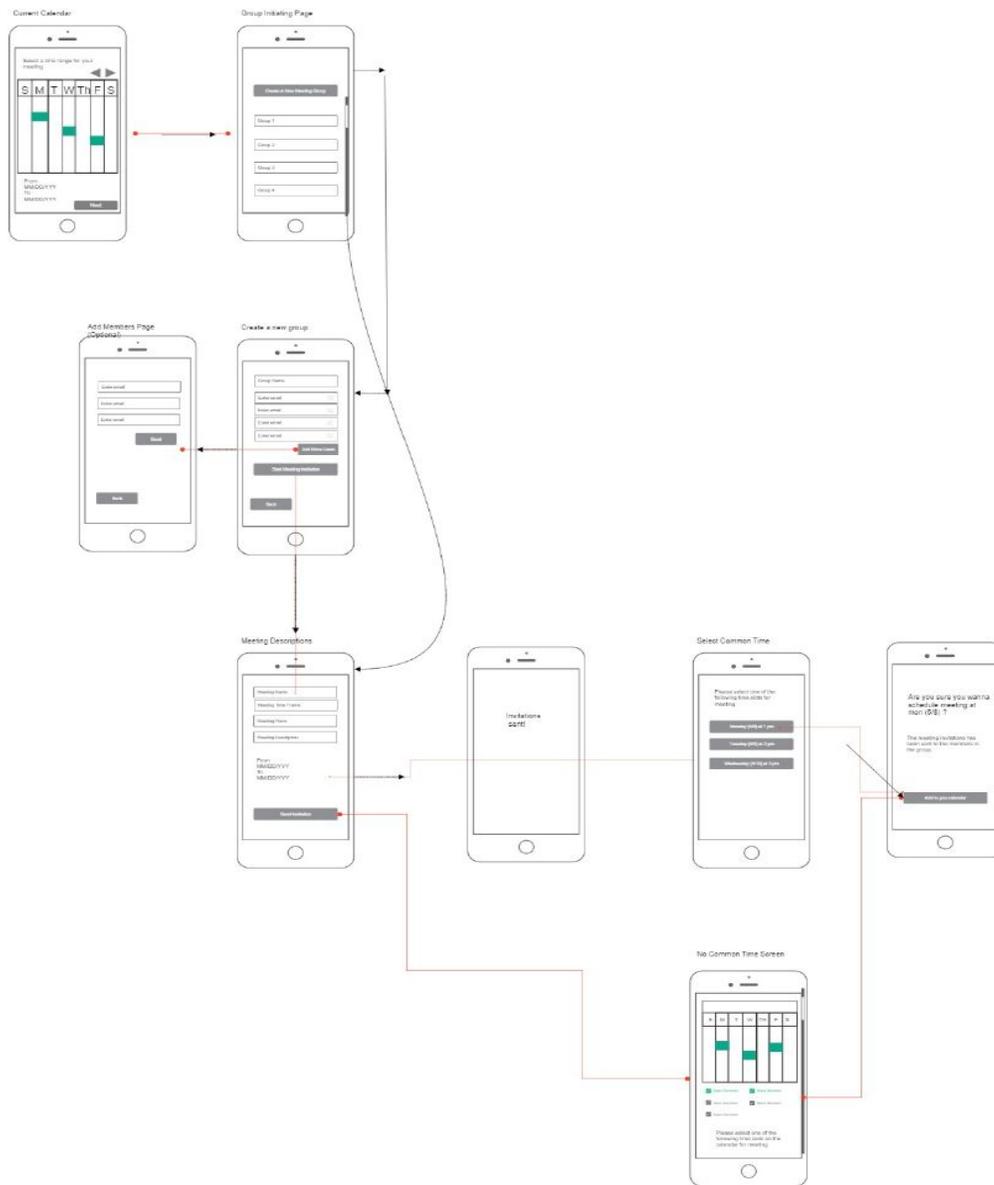
Below is the paper prototype of the participant View - responding to an invitation



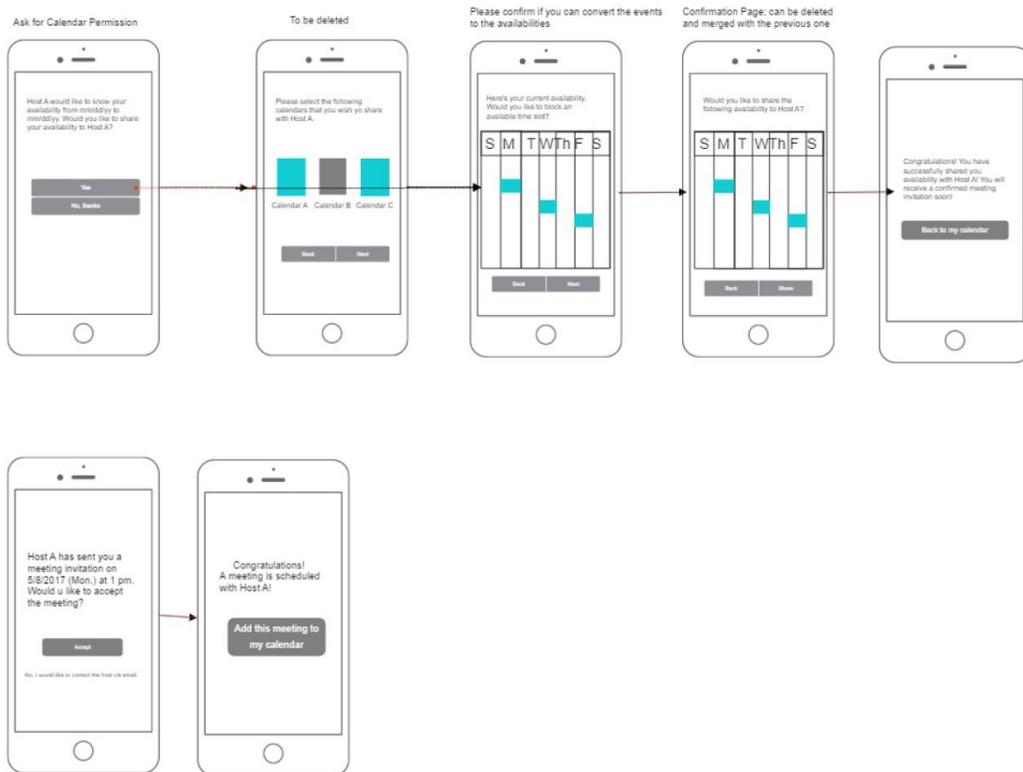
Mid fidelity

We made a user flow of our proposed app which captures the potential screens and paths which a user might take to accomplish the desired tasks. The user flow was designed for both the host and participant separately.

Moderator View - group creation and meeting invitation



Participant View - responding an invitation :



Final Prototype

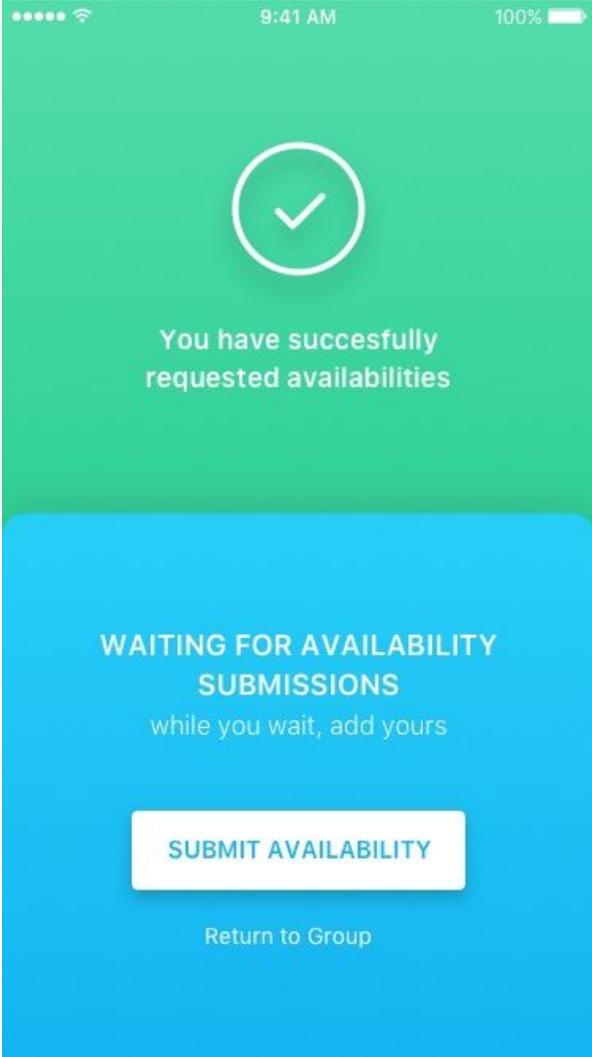
Our final prototype incorporated nearly all the functionality of our design plan. We focused on solving the main problems :

- Finding common time amongst group members. Automatically updating the user's availability when new events are scheduled in the calendar and making availability recommendation before the users submits their availabilities based on other's responses allowing the users to free out possible availabilities for other meetings.
- Generating automatic action items which allows users to have synchronized notes among all members of the group.
- Facilitating easy follow-up of action items after the meetings.
- Providing central archive which holds all previous meeting minutes.

The final prototype can be found here:

<https://projects.invisionapp.com/share/Z5BBXZZ36#/screens>

Following are the sample screenshots of the prototype:

	
<p>Screen confirming the host that the request for sharing availabilities has been sent to participants</p>	<p>Screen for participants to share availabilities with the host</p>

Technology

Meeting Scheduling

We decided to build a smartphone application for the service, given the ubiquity of smartphones, the availability of voice receiver on smartphones, and the convenience of integrating mobile applications with cloud services. Our technical stack includes a server, a mobile application client, and cloud services provided by Google, including Google Calendar API and Google Speech API.

The server is built using Python with the Django REST framework, on an Amazon Web Service EC2 instance. We use a relational database system, sqlite3, to store the states of the service. There is a table each for Teams, Users, Meetings, and relational tables for Teams-Users and Users-Meetings pairs. The many-to-many relational table for Teams and Users stores the memberships (as well as the user's acceptance status to team invitation) and leadership (and the privilege that comes along) of each team. The many-to-many table for Users and Meetings keeps track of the meeting invitation acceptance, meeting attendance, and time availability that each user shares. Lastly, the Meetings table also has a one-to-many foreign key from the Teams table, so we can query for all meetings a team had.

Our first mobile application client is built on the Android system, due to that we are slightly more experienced with Android application development and the language Java, than with iOS and swift. The app would call the APIs of Android System and Google API to obtain necessary information for the operation.

Meeting Transcribing

To summarize any meeting, we first have to reliably transcribe it. Technology giants like Google and Amazon hired the best talents of the world and poured in the resources they had to solve this problem, but had yet to release the technology to the world. The challenge of transcribing human languages turned out to be a difficult one that we lack the resources to conquer and eventually skipped, assumed it could be solved, and moved on to solve the transcription summarizing part.

We first explored Amazon Echo, an internet-connected device that responds to voice commands, a widely used chatbot. The APIs for programming Echo Amazon released are all about designing the voice commands, or the conversation “skill kits”. Amazon doesn’t open the speech recognition API directly for developers. We then turned to Google Speech API.

Although Google launched their own chatbot, Google Home, a few months ago, the Speech API itself won’t work on an ordinary smartphone as we expected. We made a minimum viable application that has the API running on a phone and tested it, only to be disappointed by the recognition accuracy. First of all, the API is not designed to recognize any sentence longer than an imperative command. If the user talked a long sentence, the speech recognition API would split it into a few completely irrelevant sentences. Second, the user has to speak very closely to the microphone, as if talking on a phone, to have the API catch the words and sentences accurately. But having people hold their phone near their face or use headsets during face-to-face meetings would not be a great experience. These pitfalls prevented us to continue using the Google Speech API, as it goes against the user flow we designed after our user research.

One of the main challenges we faced in collecting data for our analysis is to get sample meeting transcripts. To gather data for meeting transcripts, we recorded team meetings and tried to use the Google Speech API to convert audio to text. However, the accuracy of the transcription through Google Speech API was not satisfactory enough for us to be able to use it to perform any further text analysis for our project. Hence, we looked online for any available meeting transcripts to use to train our NLP model for the project. We found publicly shared meeting transcripts for Los Angeles County Board of Supervisors meetings, (<http://file.lacounty.gov/bos/transcripts/default.asp>), which are conducted on a weekly basis, with clearly defined owners for items in the agenda and specific roles for each participant in the meeting.

We note the following caveats of using these transcripts as the basis for our project.

1. These transcripts are human-generated and hence, very accurate, which is very hard to achieve with current speech-to-text conversion software.

2. These meetings have a well-structured agenda and may not represent types of meetings such as brainstorming, which have loosely defined agenda.
3. These meetings are long and weekly and mostly used for status reporting.

In future, when we have a software that can convert speech to text with reasonable accuracy, we plan to tune our model to perform well on differently structured meetings than the highly structured LA County Board of Supervisors meetings.

Meeting Summarizing (NLP Method)

After preprocessing the meeting transcripts, we trained an LDA model with meeting transcripts from the LA County Board of Supervisors Meetings, pre-processing these texts by removing stop-words, stemming (using NLTK's Porter Stemmer) and tokenizing. For the parameters of the LDA model we choose the number of topics as the number of agenda items and 20 passes. These parameters were chosen by trying different options to see which results made more sense (the resulting topics of the model)

We then use this model to classify the new text into one of these topics on the agenda items list. Since the topic definitions are not labeled clearly for the user to understand. This list is then fed to the gensim package's summarize function to return the most important sentences.

The summarize function of gensim returns a summarized version of the given text using a variation of the TextRank algorithm. The input must be longer than INPUT_MIN_LENGTH sentences for the summary to make sense and must be given as a string. The output summary will consist of the most representative sentences and will also be returned as a string, divided by newlines. For our algorithm, we set split parameter to True, so that a list of sentences will be returned.

The length of the output can be specified using the ratio parameters: ratio should be a number between 0 and 1 that determines the percentage of the number of sentences of the original text to be chosen for the summary (defaults at 0.2). We experimented with split

parameters ranging from 0.2 to 0.02 and eventually decided that a split parameter of 0.02 was giving the right sized summaries with 4 to 6 sentences in the summary.

Usability testing of prototype

Goals:

We conducted two usability tests on the I-School capstone project's prototype with the following goals in mind.

1. Better understand the user experience of the main features within the prototype
2. Capture student feedback to improve the tool
3. Evaluate if users still experience issues that they faced in the usability tests for competing tools

Methods:

The usability tests evaluated the user experience for two types of users: the meeting host and meeting participant. Tasks for the meeting host included creating a meeting, requesting team member's availabilities, sending meeting invites, and making adjustments to meetings. For meeting participant user scenarios, tasks included sending meeting availabilities, accepting invitations, and leaving a group.

Key Findings:

After conducting usability tests on the prototype, we found that users valued both simple design and functionality. Users expressed a need for keeping track of group meetings and updates among all the groups they belong to. In terms of improvement, we learned that the option to leave a group was unclear and the lack of call-to-action buttons made the user flow less intuitive.

Summary

Our team tackled the difficult task of how college students, student organisations and non profit organisations schedule and organize their meetings. With these users working on different projects and collaborating with other group members coming from different department, there isn't any single tool that helps these users to get a comprehensive view of each other's availability, find a common time to meet that works for everyone and keep track of the meeting notes for the past meetings. First, our team conducted interviews, focus groups, observations and usability tests with ours to understand the pain points of the overall meeting experiences. Our studies indicates that the current process is time-consuming, often confusing, and less reliable.

In order to solve the problems occur in the current meeting system, we utilize the user-centered design process to test and experiment with different designs to make the current meeting system better. Over the course of many prototypes, we utilize Google calendar API, Voice Recognition API and different NLP methods to develop TEEM and satisfy and unfulfilled users needs. TEEM's design and algorithm provides value to its users in many ways. In terms of scheduling a meeting, TEEM's smart scheling algorithm and design allow its users to easily schedule group meetings in few simple steps. For example, TEEM's algorithm will make availability recommendation before the users submit their availabilities based on other's responses allowing the users to free out possible availabilities for other meetings. TEEM's algorithm also automatically updates the user's availability when new events are scheduled in the calendar to avoid reiteration of the availability soliciting process. Furthermore, TEEM also allow its users to make the most their meetings and structurally manage the project progress. For example, TEEM's auto meeting minute generator and meeting minute archive mechanism also allow its users to keep track of their meeting progress more effectively. TEEM is an ideal tool which allow users in non-profit organizations groups, student organizations, and academic project groups to schedule and manage their meetings more effectively!

Appendix

Appendix A: Interviews

Interview Screener

Hello! I am currently taking the Needs and Usability Assessment course at the School of Information. My team and I are studying ways to help individuals schedule and facilitate team meetings, and we are hoping to conduct interviews to learn how you currently accomplish these tasks. We have a few questions to ask to see if you fit the profile of the individuals that we need for this study. The team will be in touch with you to schedule an interview if your background matches what we're looking for. Thank you for your time!

- Demographics:
 - Name
 - Are you currently a student at UC Berkeley? (If No, disqualify)
 - Major or program
 - Email
- Questions (must answer Yes to all questions in order to qualify):
 - Have you ever worked in a team?
 - Have you tried to schedule a meeting time with group of at least 3 people?
 - Do you schedule team meetings using an online tool?
 - Are you willing to be recorded? This is so that we can go back and capture more detailed notes. The recording will not be shared beyond our research team.

Interview Protocol

Intro:

Thank you for participating in this study about team meetings. My team and I are part of the Needs and Usability Assessment course at UC Berkeley, and for our final project, we are looking into ways to help student teams further improve their meeting experience. This includes studying the pre-meeting phase, which is primarily scheduling a meeting time during which everyone can

meet, and the during-meeting phase, which involves facilitation, engagement, and other team dynamics. We will not be addressing post-meeting activities for this particular study, but the I-School team that we're working with will also be considering those unique needs for its prototype application.

Purpose of Interview:

We are conducting interviews to help us better understand the needs of members of student teams. Today, I will be asking questions to learn more about your experience with scheduling team meetings, as well as how your team meetings are currently run.

Permissions:

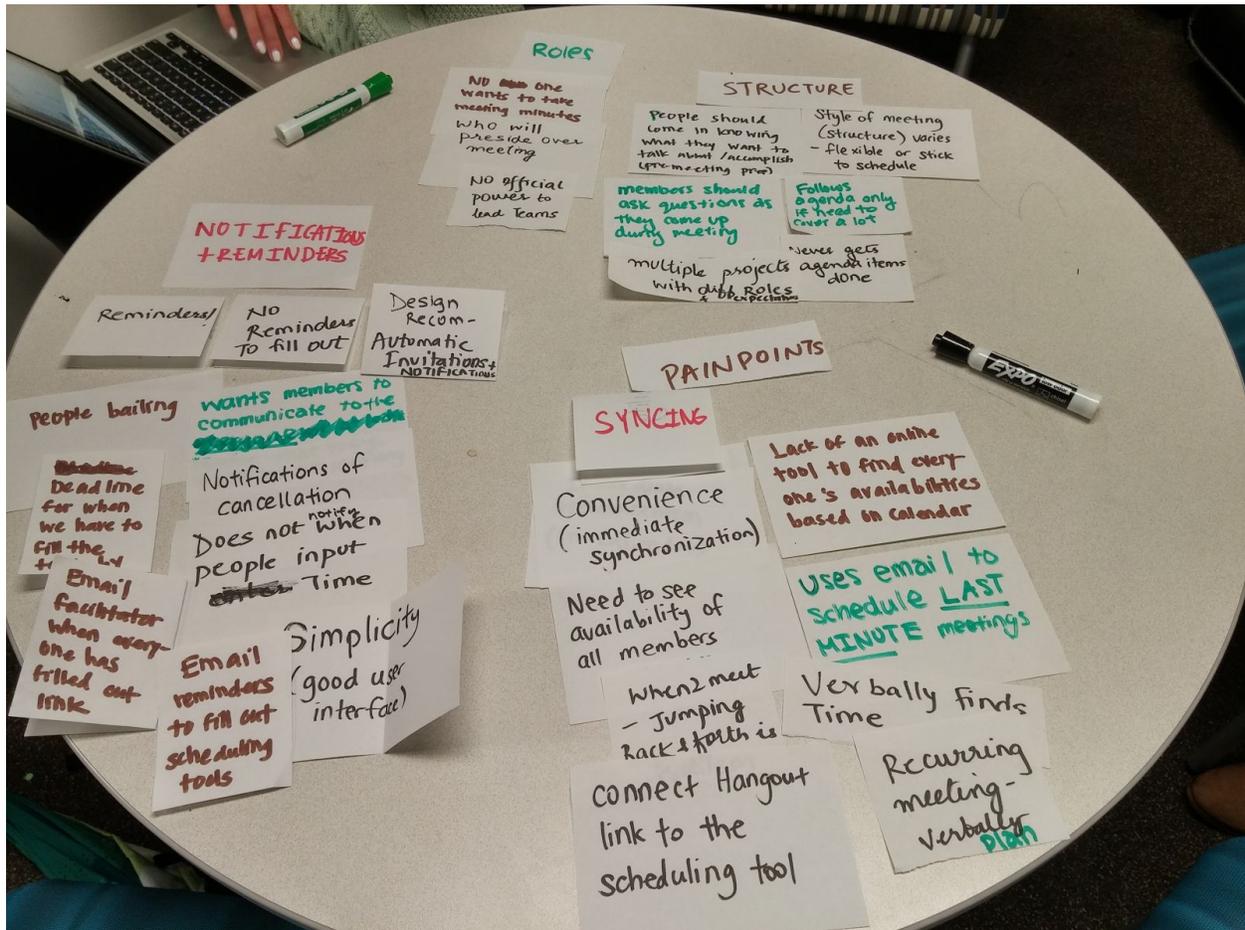
We will not identify you in any way in our study other than your affiliation as a student at UC Berkeley, and your major or program. You have the right to refuse to answer any of my questions, and you can stop this interview at any time. Do I have permission to record our interview, and to use your de-identified responses for this project?

Question	Motivation/Goal	Probes
1. Which student teams or groups are you currently a part of?	To get a sense of how extensive the interviewee's experience with team meetings is, and to understand the context of that experience (which groups, which major or class, etc.)	1. How many of these are for a class? How many are for student organizations? 2. If you are not currently part of any teams or groups, were you part of any in the past year?
2. How do you schedule group meetings? Do you use any online tools?	To learn about existing scheduling tools and key features that students find	1. What is your opinion about this tool? What are some key features that you find helpful?

	useful in order to ensure our app allows that functionality	Why?
3. Tell me about the most recent time when you scheduled a meeting with a group.	To try to find patterns in the anecdotal evidence. To have them explain the entire process of scheduling.	<ol style="list-style-type: none"> 1. What did you do? 2. Who did you talk to?
4. Moving on to the meeting itself, what role do you typically have in your student teams?	To distinguish between designated team leads and team members in our analysis	<ol style="list-style-type: none"> 1. If you have multiple roles, think about your role in the student team in which you are the most involved.
5. Can you walk me through how you participate in (or lead) meetings?	<ol style="list-style-type: none"> 1. Learn what key features of a meeting do people typically think of? 2. Learn what contributes to the feeling of accomplishment after a meeting? 	<ol style="list-style-type: none"> 1. For example, do you start with an agenda? 2. Does your team typically finish what's on the agenda? 3. Do you enjoy sticking to the agenda, or a more free-flowing structure? 4. Does your team have time set aside to catch up and socialize? 5. Do you leave meetings feeling satisfied with what was accomplished?
6. Tell me about a meeting you had recently.	To try to find patterns in the anecdotal evidence. To have them explain the entire meeting process.	<ol style="list-style-type: none"> 1. What was your role in the meeting? 2. Were you able to to accomplish everything you

		wanted to? 3. Were you able to give enough time to each things you wanted to at the meeting?
7. If you could make one change to improve the efficiency of scheduling meetings, what would it be?		1. Efficiency can mean the speed with which you can design and send an invitation to team members, or the speed with which you can respond to an invitation.
8. If you could make one change to improve the efficiency of running meetings, what would it be?		1. Efficiency can mean your ability to accomplish all of your main goals and objectives for a meeting, but it can also mean leaving the meeting feeling satisfied with what was discussed.
9. Is there anything we didn't talk about today relating to meetings that you'd like us to know?		

Photos



An affinity diagram was used to categorize the various responses and ideas generated from our eight interviews.

Appendix B: Observations

Observation Guide

Assumptions:

- Everyone talks at least once
- Student group leader facilitates
- A few members lead or dominate the meeting, while a few others contribute only once
- Team has some agenda items to talk about, or at least meeting objectives

Goals:

1. Activity - how are tasks getting accomplished
 - a. How do people meet their agenda items, do note taking, time keeping?
2. Social front - To observe the team dynamics
 - a. Ex: how does the group communicate to individuals that they've spoken for too long, or they're going off topic?
 - i. "Too long": after the first 20-30 minutes of observations, we'll hopefully get a sense of how long a member of this group speaks per turn, and we can use that as a gauge for what can be considered too long of a contribution

Guiding questions:

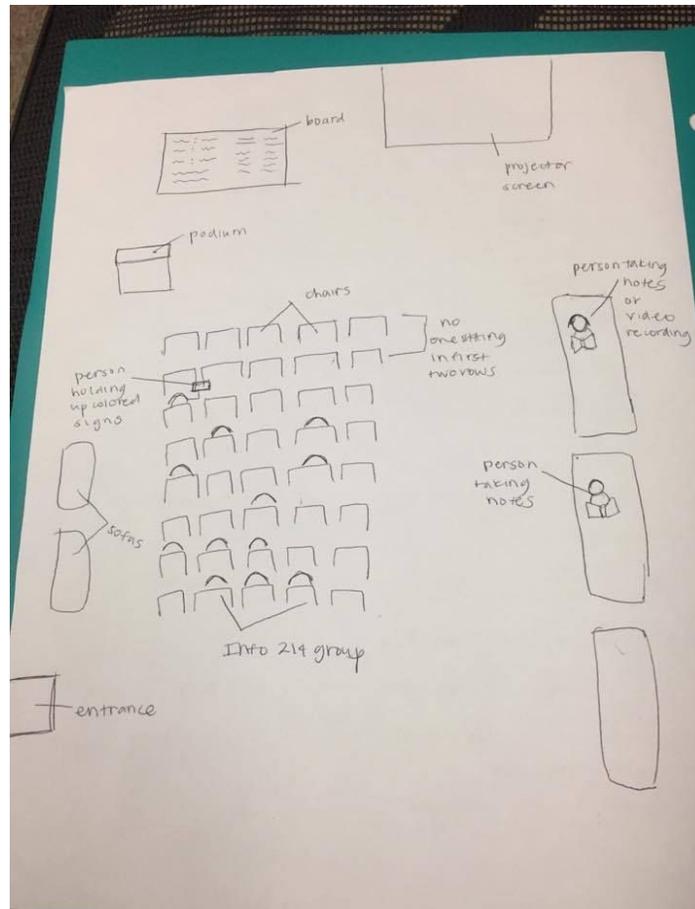
- Team dynamic
 - Who is speaking the most?
 - How are these members encouraged to speak/contribute less?
 - Who is speaking the least?
 - How are these members encouraged to speak/contribute more?
 - How is accountability being established?
- Team roles:
 - Who is taking notes? How?

- Who is timekeeping? How?
- Other roles? Are these roles assigned? How?
- What are the contributions to the meeting brought by each of these roles?
- Efficiency (in terms of completing agenda/objectives):
 - Are they covering everything on the agenda?
 - How is work assigned and delegated?
 - Is there a wrap-up/summary process? What does that look like?

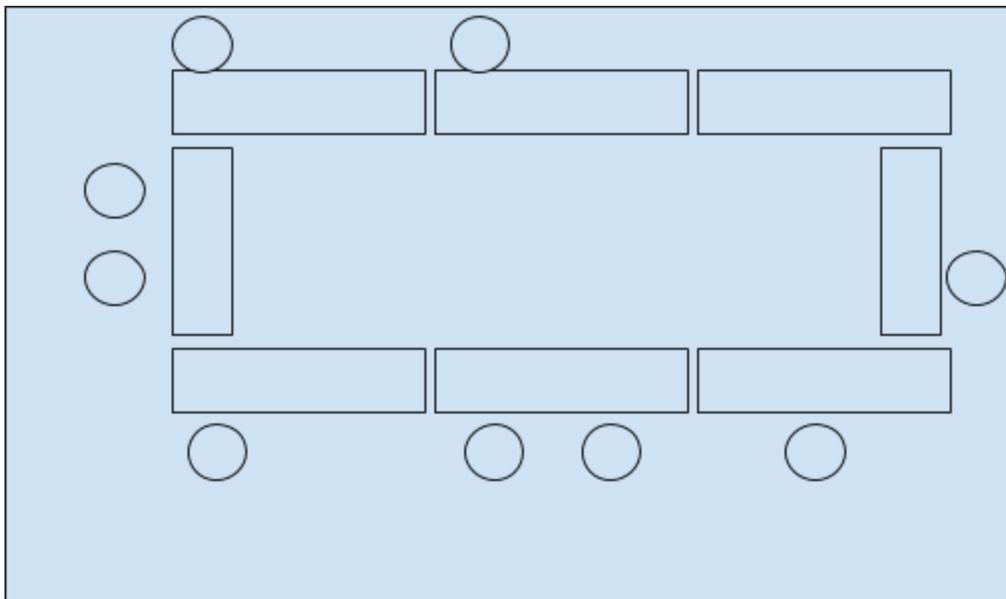
Team Roles for Toastmasters Observation:

- Stacy: team dynamic
- Pooja: team roles
- Sanjana: efficiency (in terms of completing agenda/objectives)

Photos



A sketch of the environment at the Toastmasters meeting.



An environment diagram of the IMSA meeting.

Appendix C: Focus Group

Focus Group Discussion Guide

Intro:

Thank you for participating in this focus group about team meetings. My team and I are part of the Needs and Usability Assessment course at UC Berkeley, and for our final project, we are looking into ways to help student teams further improve their meeting experience. This includes studying the the pre-meeting phase, which is primarily scheduling a meeting time during which everyone can meet, and the during-meeting phase, which involves facilitation, engagement, and other team dynamics. We will not be addressing post-meeting activities for this particular study, but the I-School team that we're working with will also be considering those unique needs for its prototype application.

Purpose of Interview:

We are conducting this focus group to help us better understand the needs of members of student teams. Today, I will be asking questions to learn more about your experiences with scheduling team meetings, as well as how your meetings are currently run.

Permissions:

We will not identify you in any way in our study other than your affiliation as students at UC Berkeley, your major, and your year (or graduate program). You have the right to refuse to answer any of my questions, and you can leave this focus group at any time. Do I have permission to record our interview, and to use your de-identified responses for this project?

Topic	Example Questions	Motivation/Goal	Time
Warm-up	Please tell us your: <ul style="list-style-type: none">• Name	<ul style="list-style-type: none">• Get participants comfortable	5 min

	<ul style="list-style-type: none"> • Major or program • The funniest or strangest occurrence you remember happening during a team meeting 	<ul style="list-style-type: none"> • Get them thinking about a specific team meeting 	
Scheduling Meetings	<ul style="list-style-type: none"> • How do you all currently schedule team meetings? (sketch your process for scheduling meetings; highlight areas of frustration and positive experiences) • What do you like about this tool? • What don't you like about it? 	<ul style="list-style-type: none"> • Get participants to think about what specific functions make them choose this tool over others 	20 min
Defining a Successful Meeting	<ul style="list-style-type: none"> • What needs to happen in order for you and your team to leave a meeting feeling satisfied? • Do you aim to cover everything on your agenda, or just reach an overall goal, or something else? • How do you define a successful meeting? Is it necessarily meeting all agenda items 	Learn what makes participants come away from a meeting satisfied	10 min
Wrap-up:	Of all the things we discussed	Have participants reflect on	8 min

Scheduling	about scheduling team meetings, which one is the most important to you?	discussion/experience	
Wrap-up: Meetings	Of all the things we discussed about what you think is important during a meeting, which one is the most important to you?	Have participants reflect on discussion/experience	2 min

Photos



A photo of the focus group discussing their sketches of their scheduling process.

Appendix D: Usability Testing

Usability Test - Competing Tools

- Study Goals
 - Goal: explore team efficiency, understand what makes team meetings efficient, understand how people currently schedule their meetings and if they face any challenges in finding a common time that works for all team members.
- Session Information
 - Session 1: 7:30pm Person A
 - Moderator: Pooja Jain
 - Note Takers: Melanie Silva, Sanjana Surkund
 - Recorder: Stacy Zhong
 - Session 2: 7:45pm Person B
 - Moderator:
 - Note Takers: Melanie Silva
 - Recorder:
 - Session 3: 8:00pm Person C
 - Moderator:
 - Note Takers:
 - Recorder: Melanie Silva
 - Session 4: 8:15pm Person D
 - Moderator: Melanie Silva
 - Note Takers:
 - Recorder:
- Background Information and non-disclosure information
 - The purpose of the study is to test two platforms, Doodle & Calendly, to evaluate how they help teams schedule meetings. We are testing the platforms, not you as users.
 - Do we have your permission to record you during this session?

- Please think aloud when you are completing the following tasks.
- Tasks & Questions
 - Warm-up questions:
 - Have you ever worked in a team before?
 - How do you typically schedule meetings to find a common time that works for all of you.
 - Introduction
 - Imagine you belong to a class project team of four people including you. Sometimes it is your responsibility to schedule the meetings for the team.
 - Doodle
 - Task 1 Scenario: creating the event
 - You would like to find an hour during the week of Monday 3/6 to Friday 3/10 to meet. You have availability from 10am to 12pm on MWF, and 1pm to 3pm on TTh. Use Doodle to schedule to complete this task.
 - Share the event with your availabilities added to the following emails:
 - pjain4161@gmail.com
 - msilva926@berkeley.edu
 - zhongstacy@berkeley.edu
 - ssanjana@berkeley.edu
 - Task 2 Scenario: responding to an event invitation
 - You receive a Doodle poll from your team lead asking you to indicate a time during which you will be able to meet with the entire team for an hour this week (Tuesday 3/7 to Friday 3/10). The rest of the team has already responded. You are available from 10am to 12pm on WF, and 1pm to 3pm on TTh
 - User link:
<http://doodle.com/poll/mwhbs96sb784vcyg#table>

- Calendly
 - Task 3 Scenario: creating the event
 - You would like to schedule a 30 minute meeting with your team on a day between Tuesday 3/7 to Thursday 3/16. Your available times are 10am-12pm and 5-8pm every day. Invite your group members to this meeting.
 - Task 4 Scenario: responding to an event invitation
 - Your team member uses Calendly to try to schedule a 1 hour meeting with your entire team on Tuesday 3/7 to Friday 3/10. You are available from 10-11am and 2-5pm on those days.
 - Find a common time to schedule the one hour meeting with that colleague
 - User Link: <https://calendly.com/ssunjna/project-meeting>
- Follow-up Questions
 - Which do you prefer to use for scheduling team meetings?
 - What functions did you find useful?
 - What functions weren't so useful in scheduling a meeting?