

University of Toronto
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ASD PlayDate
ECE 1778 Creative Applications for Mobile Devices

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1 Introduction

1.1 Background

Autism Spectrum Disorder(ASD) is characterised by impairments in social communication behaviours which includes how, why, and how often a person interacts with another person. Children with ASD spend a lot of time learning how to interact with adults (e.g., parents, teachers, therapists), much less time on interacting with peers. It is well documented that communicating with adults does not generalise well to communicating with peers. Social communication groups exist for children with ASD, which have been shown to be inconsistently effective. But there are few of them and when the groups end, those children often do not yet have the skills to coordinate play dates on their own, even if their social communication skills have improved over the course of the group.

1.2 Motivation and Goal

Speech-Language Pathologists have recommended play dates to get ASD children familiar and comfortable with peer play. Research has shown that with increased play date frequency and decreased conflict on play dates, children interact better at school. It has also been shown that children who engage in play dates are responded to more frequently by peers. The benefits of play dates are enhanced for the children whose families host the play dates.

Our Specialist Ian Roth is a Speech-Language Pathologist and his area of clinical focus is on children with ASD. With the goal to improve children’s social skills, our app ASD PlayDate is designed to help parents find compatible playmates for their children, arrange suitable play dates and carry out those play dates using strategies based on Ian’s clinical experience.

2 Overall Design

2.1 Block diagram

Below is the block diagram of ASD PlayDate. It consists of five major function blocks.

Child Profile gathers basic personal information and preferences, which will be used in the recommendation algorithm to search new friends, such as communication stage and leader/follower level. The personal information is kept secretly and just username, age and gender can be seen by others. The data is stored in the online and local database.

Search New Friends function involves the recommendation algorithm, where we assign different weights to different elements and recommend friends using the total ranking score calculated by that algorithm. The input of the algorithm is the users information and output is the id of a suitable playmate.

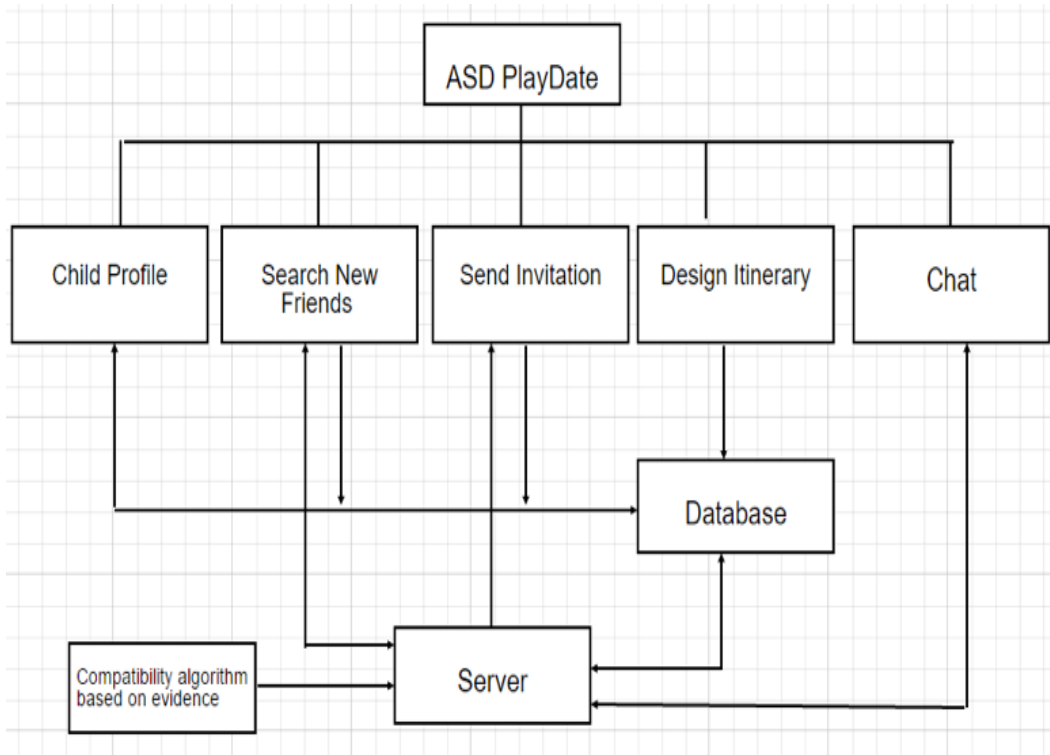


Figure 2-1. Main Page

Design Itinerary is the most important part in this application. Parents can schedule the activity plan for their children with some tips provided by us. Also, they can share them with other parents and we will realize this in sending invitation module. The Visual Schedule, which let users upload pictures to present their activities, will be used to help children to mentally prepare for transitions between activities during the PlayDate.

Send Invitation is used to send invitations to friends after setting the time, location and itinerary. Sending an invitation requires us to deal with communication between users via back-end server or database. Sender can track the invitation status and receiver can receive the invitation and determine whether to accept or not.

Chat enables parents to chat with each other in time like the general social platform to discuss more details about the playdate.

2.2 Friend matching algorithm

Searching Algorithm is used for finding a suitable playmate for children. When user requests to find a new playmate, the user-end application will invoke server function providing the user id as the input. Server will then fetch users data from online database and after calculating compatibility scores, a friend id as a best suitable friend will be returned and added in the users friend list.

In order to match children to find suitable playmates, we designed 8 elements that contribute to

the algorithm and assign different weights to different value pairs. Below are the eight elements.

1. Leader/Follower

The leader/Follower element is one of the most important features. We assign 6 different levels for user to choose. Some children tend to be a leader during playdates while another might prefer to be a follower. Our algorithm will match leader with follower and avoid to put two leaders together.

2. Availability Time

One point is assigned for every additional overlapping time and it is necessary that there is at least one overlapping time.

3. Childs Age

It is likely to be more suitable when two childrens age is within 1 year. 3 points for being within 12 months; 2 points for being within 18 months; 1 point for being within 24 months.

4. Interest

One point is assigned for every overlapping favorite things.

5. Communication Stage

Communication is another important element in our algorithm. 3 points is assigned if both are from the same category; 2 points if both are from adjacent categories; 1 point if both are from two categories away; 0 points if both are from 3 categories away

6. Language

2 points is assigned if an exact language matches.

7. Postal Code

3 points is assigned if first 3 characters of postal code are an exact match.

8. Favorite outings

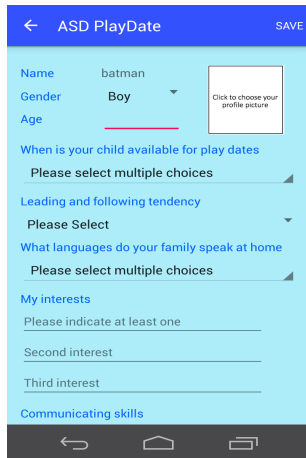
One point is assigned for every overlapping favorite community outings

3 Statement of Functionality & Screenshots from App

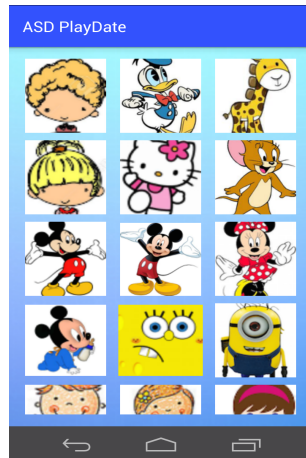
3.1 Create Profile

When first open this application, after registering, the user will be prompted to enter profile information for the child. All information here are critical for the algorithm to find a compatible friend. For privacy reason, users are suggested to use nicknames and cartoon images as their usernames and profile pictures.

With information stored by clicking on "Save", profile information will be stored in both local database and server database. And users can also modify and update their profile later following the same steps.



(a) Enter Profile



(b) Select picture

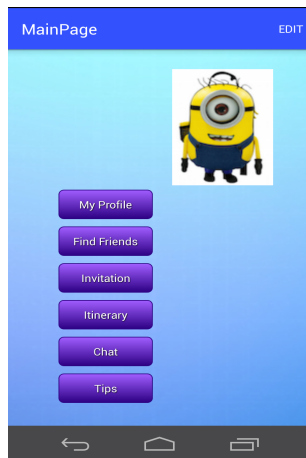


(c) View Profile

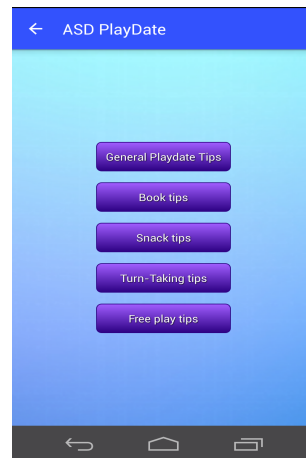
Figure 3-1. Creat Profile

3.2 Main Page

After entering the profile information once, this is the main page which users will see every time when they enter this application. The upper five buttons will navigate to five different functions and the bottom "Tips" button is a short-cut to access tips of all kinds of activities for user's convenience.



(a) Main Page



(b) View Tips

Figure 3-2. Main Page

3.3 Find Friend

Before users can send invitations and chat, they need to find friends by navigating from main page to this screen. Here it shows all the friends user already exist and also allows user to add a friend. Simply by clicking on "+" button on the upper right, the app will query the server and display

a friend that has the highest compatibility score. Again, for reason of privacy, only nickname, age and gender are displayed in the friend list. For further information, they can communicate in chat function.

All friends information are stored both in local database and server database.

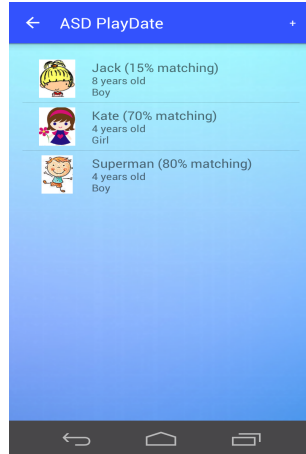


Figure 3-3. Find Friends

3.4 Create Itinerary

Itineraries are lists of activities designed for playdates. Users need to create itinerary before sending an invitation. There are basically three steps for designing a successful itinerary.

First navigate from main page to new itinerary, then enter a representative name for the itinerary that is easy to remember(see figure 3-4).

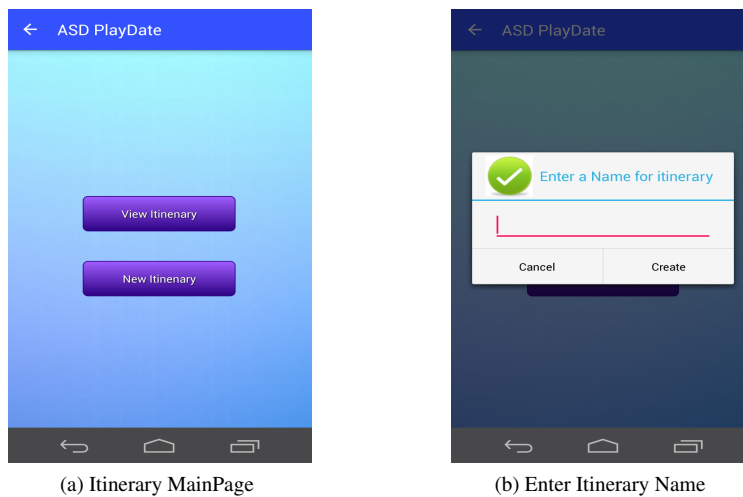


Figure 3-4. Create Itinerary

Second, add activities to the itinerary(see figure 3-5) by first select an category, enter the

activity name and then select some tips for this activity to save with this itinerary which can be viewed during actual playdate.

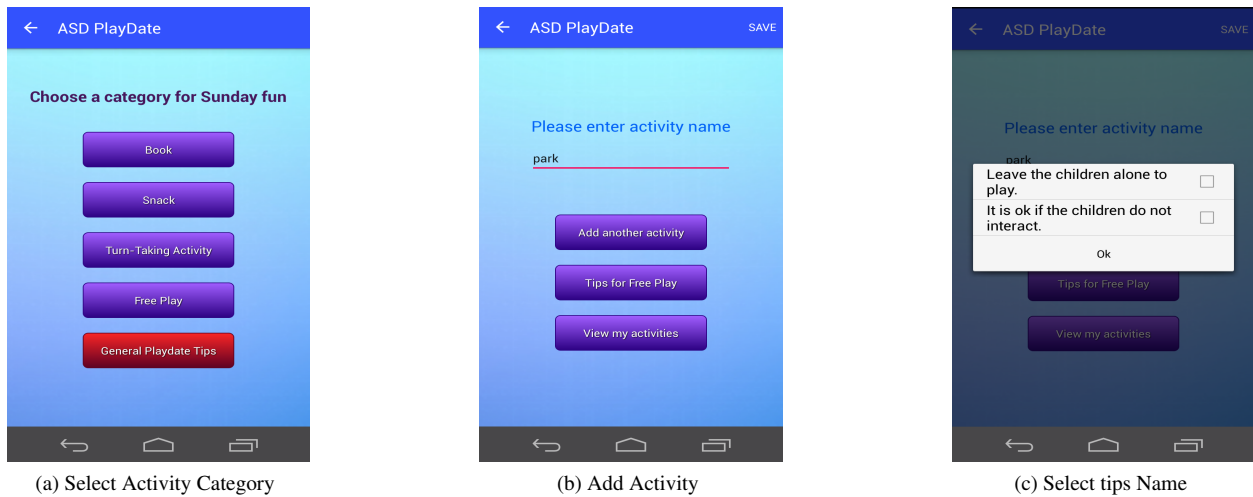


Figure 3-5. Add Activity

Third, view the activities and visualize the schedule after creating the itinerary(see figure 3-6). Users can delete any activity by swiping the activity item or changing the order by dragging activities up and down. According to Ian, visualizing activities can help children with autism better understand their playdate and easily transit from one activity to another. Users do this by entering visualize schedule and take a picture for each activity.



Figure 3-6. View and visualize activities

3.5 Send Invitations

Finally, after adding friends and creating itineraries, user can send invitations to their friends. User can enter this screen by clicking on one of their friends from friend list or navigating from main page. User will need to enter location of the playdate, select a date, an itinerary and a friend to play with(which will be populated automatically if entered from friend list). If the date is not entered, it will be saved as "To be determined" which can be decided later.

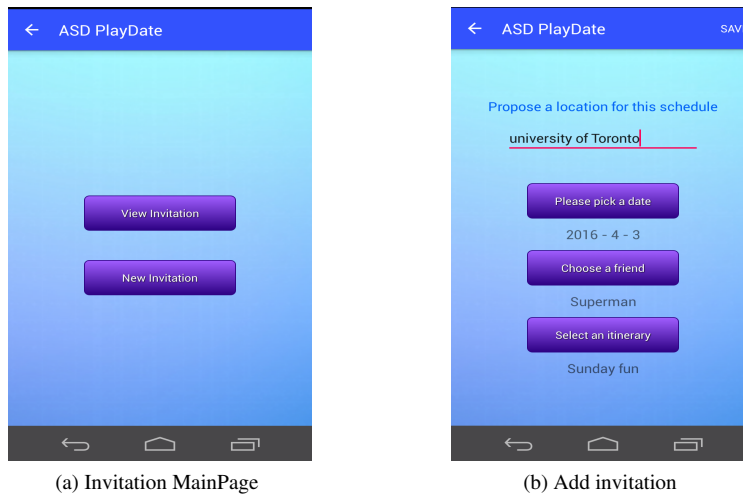


Figure 3-7. Add invitation

Clicking on "Save" and then user can share this invitation or delete this invitation. We can see from below are two screens before sharing with a friend and after sending the invitation. And after receiving a response which can be "Accepted" or "Declined", the status information will be updated accordingly.

3.6 Chat

Chat room is where friends can discuss details for their playdate as well as exchanging personal information like address and phone numbers. All friends added from friend list will also be added in chat list. When parents send a message, the SaaS online server platform will receive it and send this message to the target user by the API key.

4 What did we learn?

4.1 Technical

Since this is the first time for all of us to work on big android project, we learned a lot from this experience.

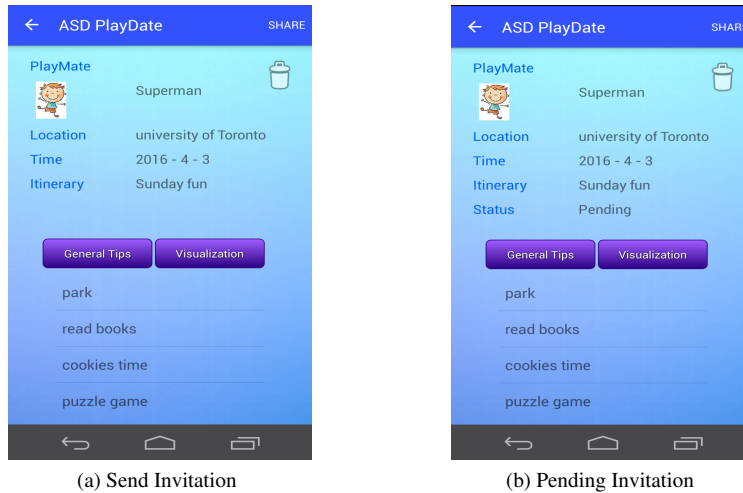


Figure 3-8. Send Invitation

- First, we learned how to organize different kinds of information and how to store them inside the app that can allow multiple users accessing their own information from a single application.
- Then we expanded our knowledge from a standalone app to apps connected with web server and online databases. Specifically we are using AWS web service to construct our server and database which saved us some time on building a web service from scratch.
- Moreover, we also have more clearer understanding on how to make an app more user friendly thanks to our specialist's suggestions.

4.2 Non-technical

We had a lot of fun doing this project with our external specialist Ian. We got to understand more on ASD, and also on how to communicate between programmers and specialist to strike a balance between requirements and technical advices. We also realized the importance of clear specification and setting up a practical plan at the beginning.

5 Member Contribution & Teamwork

5.1 Work division

Starting from our block diagram, we divided the work into server, application UI and database. We are using Github for work collaboration and program version control. Source code can accessed from <https://github.com/ChristineDu/ASDPlayDate>.

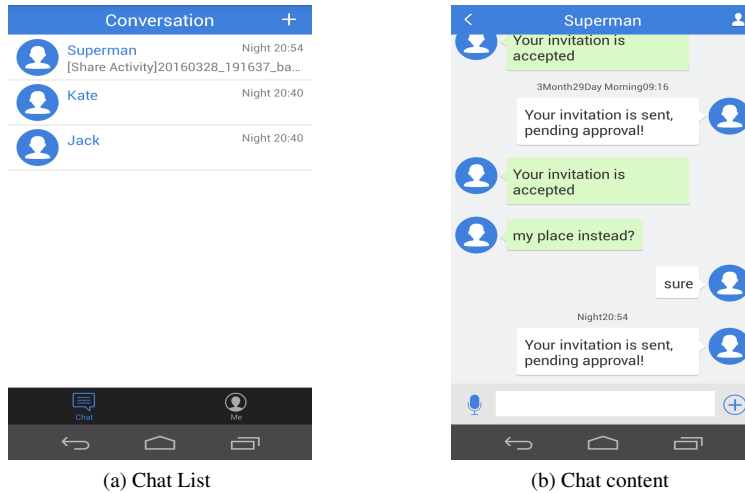


Figure 3-9. Chat

5.2 Peiwen Zhong

Peiwen Zhong contributed to server side code including realizing the finding friend algorithm in Node.js and also part of the UI including log-in, register and the implementation of chat module. Chat module enables users to send playdate invitations via online server including content of itineraries as the payload. Receiver can get notification when receiving an invitation or being responded to an invitation.

5.3 Yuqing Du

Yuqing Du contributed to all other UIs including user profile, find friends, create and view itinerary, send and receive invitations. She also designed and built databases on both user side and server side. User-end database stores user friends list, itinerary information and invitation details. Server database stores user profiles and user friend relations. Finally, she created the interfaces of connecting to online server, invoking server function and dealing with server results.

5.4 Ian Roth

Ian's role on the team was to bring research and clinical experience to our discussions. When suggesting the formula for the matching algorithm, for example, Ian created a concrete, numerical formula for each of the components, which was well received.

6 Specialist Context

The goal for this app was to allow parents of young children with ASD to connect with each other and arrange mutually beneficial play dates for their children. The way ASD PlayDate was developed, it fulfills all of the initial objectives and more.

First, the Child Profile takes into consideration the child and family characteristics likely to lead to compatible peer interactions. The profile thus addresses the well cited notion that parents of children with autism do not know whom to approach when wanting to plan a play date. By using this app, parents acknowledge they have common social interaction goals for their children. Research has shown that peer interaction among children with ASD can be just as productive when paired with another child with ASD as when they are paired with a neuro-typical child.

The second major accomplishment of this app is that it guides parents to select activities that promote peer interaction. Based on the literature and on clinical experience, certain activity categories promote peer interaction among children with ASD. This app cues parents to create an itinerary in advance of the play date using those categories. Clinical experience has shown that even when parents do arrange play dates for their children, they often do not pre-plan activities or intervene to help the children to interact. This is because they do not know how or because they are not sure it is their place to coach someone else's child. By allowing parents to create an itinerary and share it with the other parent in advance of the play date, it makes clear that parents will be involved in each of the activities, and outlines exactly what the parents' roles will be.

Parent roles are communicated through the tips that can be found when planning an itinerary, reading an invitation from another parent, or by looking on the home page of the app. These tips, which include general play date tips as well as tips that are specific to each activity category, are the same ones that a speech pathologist would use when moderating a social communication group or dyad. They include the techniques and strategies that maximise social interaction by helping the children to pay attention to each other, share materials, and even communicate with one another.

The visual schedule function of the app was a pleasant surprise. Visual schedules have long been used with children with ASD to help them understand and prepare for transitions. Recently several visual schedule apps have entered the market. The visual schedule on ASD PlayDate is easier to use than any other currently on the market.

For many years now, parent involvement has been considered best practice in the intervention of children with ASD. This app now empowers parents by removing some of the obstacles that previously prevented their children from engaging in successful play dates.

7 Future Work

Since there are a lot of functions in this app, given a short time period, we just realized the fundamental functions. There are still a lot of details to improve such as beautify the user interface, adding a map to the invitation location and a calender showing all invitation information which can help and remind users scheduling and attending the playdates.

Besides, algorithm can also be more intelligent when matching compatible friends. For instance, currently for calculating similar interests, we just compared whether the inputs of too users contain the exact same words. Natural Language Processing can be very useful on improving the algorithm.

Overall, we are also looking forward to conducting some experiments with ASD children and get feedbacks to improve our application.