Schedule and Structure

Final Report

Team members:

Sk Ayon (Computer Engineering), sayon000@citymail.cuny.edu

Bethanie Charles (Computer Engineering), bethanie.charles@gmail.com

Kelly Dong (Computer Engineering), dongweiling27@gmail.com (POC)

Faculty Advisor:

Zhigang Zhu, Kayser Professor of Computer Science,

Grove School of Engineering, The City College of New York

Industrial Mentor:

Celina Cavalluzzi, Assistant Vice President, Day Services Director, Goodwill NY/NJ

Abstract

According to the CDC, ADHD (Attention-deficit/hyperactivity disorder) is one of the most common neurodevelopmental disorders of childhood. Symptoms of ADHD include being easily distracted, difficulty organizing a task, forgetting the details of routines, and behavioral issues. Another disability, ASD (Autism Spectrum Disorder) is steadily becoming more prevalent. Among other issues, people on the spectrum often have difficulty with executive function. This includes elements such as organizing, planning, and paying attention. Like ADHD, behavioral issues are also common with ASD. We aim to tackle these common issues between these disabilities by creating Schedule & Structure.

There are many Reminder, Scheduling, and To-Do List apps already available, but not many are specifically targeted toward those with ADHD and ASD. Distractions and difficulty with executive function may make other apps difficult to use as the user is usually required to do their own planning and organization. Therefore, our app will allow for collaboration between workers and supervisors. With its scheduling features, chat space, and mood tracker, it will allow those with ADHD or ASD to lead more structured and productive lives.

Background

ASD is a condition that affects roughly 5,437,988 adults in the U.S.[1] This equates to about 2.1% of the adult human population in the U.S. In addition, roughly 4% to 5% of adults in the U.S. suffer from ADHD.[2] Due to this, it is important to understand and serve the needs of adults with ASD. There are many symptoms that make life harder for adults with ASD and ADHD. For example, these adults with ASD have higher levels of anxiety in social situations, find it hard to express emotion, and need structure in their lives.[3] For adults with ADHD, they have trouble paying attention to tasks, have trouble with organizing, and often forget daily activities.[4]

There are 3 key ways to help these adults with one of these diagnoses. One of these is by giving these adults a mentor. By using a mentor, we can facilitate the improvement of social functioning in these types of adults.[5] Another is adding structure to their lives. These adults often engage in repetitive tasks and maintain a routine because it is a source of comfort for them.[6] In addition, a small study by Dahley, Weisner, and Singhal noted that adults with ASD that had a structured setting had better adaptive skills than those without a structured setting.[7] The last is to work on helping them to regulate their emotions. These types of adults are more likely to have mood disorders such as anxiety and depression.[8] Thus, there is some research that suggests that forms of therapy such as CBT (Cognitive Behavioral Therapy) would help improve mood regulation.[9]

Anecdotally, some of our group mates went to visit Goodwill NYNJ. We had a glimpse of the struggles that adults with ASD face. In the room, one of the participants in the Goodwill program seemed anxious when we were there. The woman who helps teach them told us that one of the reasons why he was anxious is because he is a very structured person. To set up the tour for us, lunch came a bit late for the participants. The participant was thrown off his schedule which became a problem for him to

complete his training with his program manager. This inspired us to focus on helping adults with ASD maintain some sort of structure in their life.

Goodwill has been helping people with their work schedule and managing each person individually during the beginning of their employment process. They would send mentors with participants to workplace such as pharmacies, grocery stores, etc. Mentors make sure that participants are completing their obligations. Mentors also must supervise participants individually for one to two weeks until participants are sufficient on their own which means that they are getting used to their work schedule and completing tasks on time. The mentor's job would be assisting participants with any difficulties they might encounter when completing their work whether it is communicating with customers, moving boxes, etc. After the initial phase, the job of a mentor lightens up a little bit in that they only check up on participants once a week. After we found out about how mentors are with participants for one to two weeks, we saw potential in creating a schedule and structure to help participants manage their time instead of being consistently supervised by mentors.

After seeing the success of these calendars with managing people's time we see the potential of using something like this to help those participants / employees with autism, especially in their workplace. Our application allows for close collaboration between ASD/ADHD workers and their supervisors. With its scheduling features, chat space and mood tracker, it will create greater ease of communication and building structure for their day.

Statement of the Problem

Looking at reminder and scheduling applications that are in the market right now, not a lot of these applications are designed for those who have ASD/ADHD. We have those who are using calendar applications such as Google Calendar, Outlook Calendar, and the built in Apple Reminders app. These are more directed towards those who are working and used mostly by organizations when setting up meetings between their workers/ clients. Recently, these applications are being used more in fields such as education due to COVID-19. These applications include features such as adding events and inviting multiple people to join the event. There are also features such as notifications prior to the event starting so that it reminds everyone who is joining the event. Professionals suggest that when working with people with ADHD and ASD, it is best to consistently remind them to perform things such as drinking water so that they get used to a certain routine. Instead of needing a human to manually remind these people with ASD and ADHD, it seems like a great idea to use technology to implement multiple reminders for those who need it. In addition to that there are ASD workers that get irritated when there's someone next to them during work so a digital reminder would be great in these use cases.

Inspiration also came from applications targeted towards ASD users. EaseeDoo is an app for kids with ASD and helps manage their emotional well-being. It deals with setting a routine for children as well as tracking their emotional state. In addition, there is another similar app called Brilli. Although Brilli is more geared towards children with ADHD, the key features of the app can also be applied to anyone on the spectrum. The app works by planning a routine, gamifying the routine, and then giving a reward when the routine is completed successfully. These are some apps that use schedule as a tool to help people with ASD as well as ADHD.

The issue is that these apps are designed for children with ASD. There are not many apps for adults with ASD that help them with scheduling and structuring their workplace experience. Although

ASD apps for kids are useful, they are only designed for kids, not adults. Adults have different needs

compared to children. For instance, adults need assistance in finding employment and adapting into the

workplace that children don't face. In addition, we want an app that supervisors can use so that they can

keep their employee with ASD working at a productive level. Finally, we want a mood tracker so that

we can give the user the ability to track their mood and understand their emotions. Thus, we want to

develop an app to tackle this specific issue and incorporate these 3 key features.

Rationale

Adults with ASD and/or ADHD do not have many resources in this country while the number in

this area is continuously increasing. With this application, supervisors have less of a need to

micromanage their workers, but can still maintain a close connection. The app allows for close

collaboration between ASD/ADHD workers and their supervisors and allows for greater ease of

communication to build structure. We acknowledge how difficult it is for ASD/ADHD adults to land a

job, but maintaining a job is the next step to being independent. This app will help foster a sense of

independence in these adults. When users with ASD/ADHD are familiarized with using the app, they

will be able to gain some independence by being able to stay on track using the app while also being

able to regulate their emotional well-being. With mood trackers and chatting features, professionals and

caretakers would also have previous data of their participants saved somewhere so they would be able to

create more designated planning for their participants. By this, we hope that all adults are satisfied with

their job and not miserable during work.

Currently, we are making it a freemium app where many base features are free, and users will

have to upgrade their accounts for AI features. This will be a phone app designed in Flutter and used on

iOS and Android. We will upload our app to both app stores and users can download it and use it on their personal cell phone devices.

Design

This app is designed to be a bridge between an employer/supervisor and their employee with ASD. We are planning to make a phone app based in Flutter so that it can be implemented both in iOS and Android. We will focus on 3 key features for our app. They are:

- A chatting feature for communication between the ASD adult and whoever is supervising/taking care of them.

- Mood tracker with AI to suggest activities to help them if something is going negatively.

- Scheduling feature with AI components to suggest activities for participants.

The main goal of the chatting feature is to foster communication between two parties. The app user would be able to use the ***chatting feature*** to talk to anyone simply by searching their email in the app. This makes it possible for an employer to directly communicate with an employee or send bulk messages to multiple employees. On the employee side, it's a great contactless way for them to address any questions they might have about a job assignment. The chat feature will be very similar to most chats on the market so that it's intuitive for users to adapt to.

The second big feature will be a ***mood tracker***. People with ASD can have trouble handling their emotions sometimes and we like the idea of tracking emotions using our app. The user will be able to put them in their mood so that they can track how they feel. Meanwhile, their supervisors are free to check on the linked employee's mood chart from
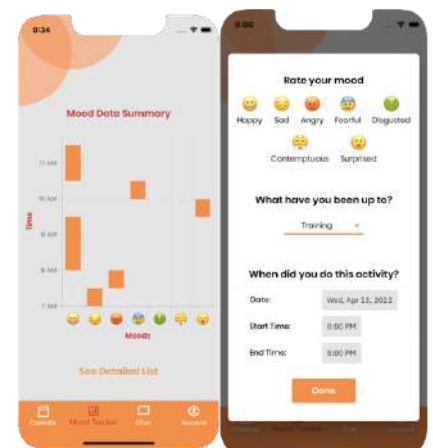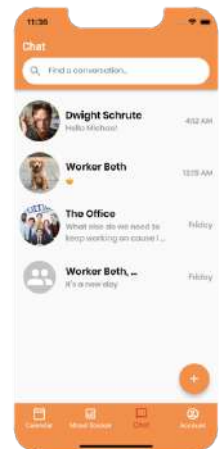
the supervisor's account. Based on how users feel, we will use AI to make suggestions on upcoming

tasks for employees. Our AI uses sentiment analysis to run through the mood tracker data and suggest

the best upcoming job task that is appropriate for an individual employee. With this feature, this takes

the load off the employer to assign individual tasks which are repetitive especially if they have multiple

employees.

The final and one of the most important parts of our app is the ***scheduling***

feature. With the scheduling feature, we can give adults with ASD structure in their

lives. Having a structured schedule can help ease their nerves and allow them to feel

less on edge. The schedule can be created by an employer or the employee on the app.

Whenever a task is completed, the notification system will notify both the employer

and employee along with passing encouragement phrases to the employee. Supervisors

can also leverage the AI to suggest tasks that an employee won't hate or fits an

employee's profile skills. If any changes occurred on a calendar, a notification would be sent out to

everyone linked to the calendar profile.

Development

Our development phase started at the beginning of this year. Since the goal of the application

was to be able to be used in multiple platforms, we created the UI using Flutter and Dart. This is used in

conjunction with Firebase to create a login-based system where users can make an account and have all

their info saved on it (such as chats, schedules). This will allow the app to store data in the cloud.

Having a cloud database as storage allows features such as texting through Wi-Fi, a built -in security

system from Google and a wide range of services and features for future upgrades. Firebase provides

machine learning integration which Schedule And Structure will be heavily dependent on in the future.

Up to this point, we have a functioning Calendar, Chat, and Mood Tracker along with extra features such as profile page and notification. We are still looking into more ways to improve our features such as adding filters for our mood tracker and highlighting important data for the supervisor to look at. Whenever we have a functional change in the app, we will reach out to our partner at Goodwill for any feedback they might have. We have our initial beta test of the application with AI using dummy data. We want to deploy the application in late May or early June to obtain actual user data and test out how the AI will run with that data.

Evaluation with Users and Partners

Throughout the process of designing and developing, we were in close contact with Goodwill and were open to refining any features that needed to be enhanced. Additionally, we also interviewed people who worked with ASD people or have ASD themselves. After creating our initial application design, we conducted several surveys to obtain some data from our users.

From our data, some people were skeptical about our AI system. In addition to that, there were a few concerns about the mood tracker of our application. Our mood tracker was initially on a 1-5 rating system for the sake of simplicity. However, based on the feedback received from our Goodwill partners we took action to redesign it to be more meaningful to our app's users. The new mood tracker design includes the seven basic moods to be

more specific than a 1-5 rating. Similarly, judges brought in by Professor Zhu helped us to revise it even
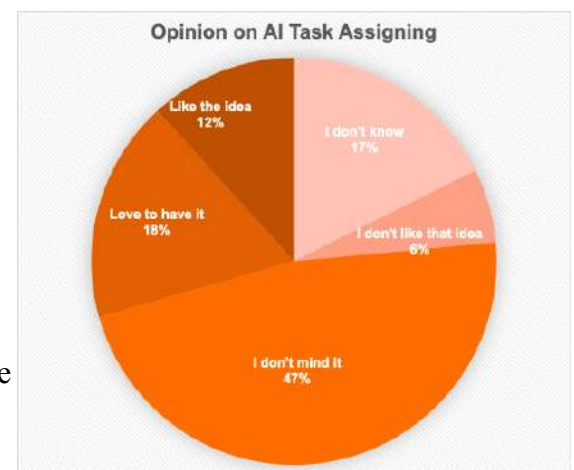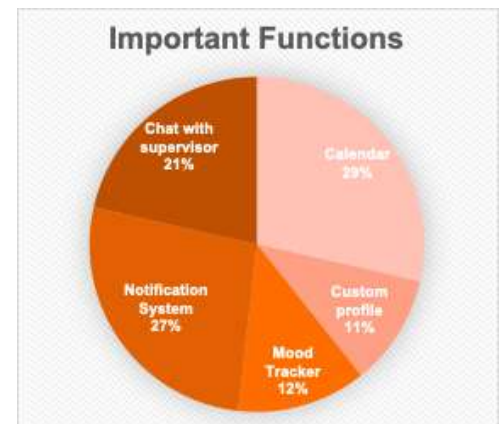
more by tying the moods to a specific activity and adding supervisor alerts if the concerning mood data is detected.

We also garnered feedback from the judges at the CREATE competition. The general consensus is that they liked the simplicity of the UI as well as how easy it is to be used for mentorship. Their main concerns dealt with both security and mood tracking. They wanted to know how the user's data is protected. We told them that we are using Firebase security features and encryption to make sure that the user's data is both protected and anonymized from the backend.

Overall the impression of our potential user's reaction came down to them being interested in our application and are eager to use it for daily purposes. The mood tracker and AI was the most eye-catching feature of our application that distinguished us from the competitor apps. However, there are a few concerns on the security issues of the application because the application stores personal data. This was fixed with the Firebase data security integration by the team before release for initial beta testing. When the amount of users increases, we will investigate security solutions that are more cost effective and secure based on the amount of users we have.

Discussion of Potential Markets and Future Work

Schedule and Structure is something new compared to the productivity applications that are already on the market. This app is targeted towards ASD/ADHD users and provides them a close connection with their supervisor. Through research and on site visit our team saw these people struggle with having anxiety, managing their emotions, and communicating their thoughts to others. With the number of people diagnosed with ASD/ADHD increasing, they deserve more attention from the public. They can complete tasks and do spectacular jobs but most of them are struggling to maintain their jobs after the initial struggle of finding one. This is due to the lack of communication between them and their

supervisors. With Schedule and Structure, we hope to eliminate some struggles of these workers and create a close bond between the employer and employee. This is achieved by making the employer's job easier, so they have more opportunity to think about ways to make the workplace enjoyable for their employees and increase productivity.

In terms of markets, there is huge potential for this app's customer base. First, we mentioned that there are at least 5 million adults in the United States with ASD. We are also targeting users with ADHD which includes another few million users. In addition, we have potential clients in Goodwill. Other organizations similar to Goodwill may also be interested in this app for its functionality and ability to perform remote coaching. Finally, there is sentiment from both our surveys and feedback in class presentations that people without ASD may be interested in using this app. Although it is designed for users with ASD, it can be used by adults without the condition.

In essence, we will start with a narrow scope of people with ASD and try to work with Goodwill to develop the app. Goodwill expressed interest in using our app as a means of remote coaching for adults in their training program. With this small scope, if they choose to work with us, we will develop the app to help with their program. Because of this, the app will be developed with a focus on adults with ASD. Eventually, if the app gets bigger, we will branch out. However, in the near term, we will be focused on enhancing the privacy of the app and improving the accuracy of our AI.

Branding

Our app uses a warm color scheme. We use a lot of orange and yellow with some hints of red. We used warm colors to symbolize compassion, warmth, and friendship. In addition to that the general design of the application consists of simple shapes with round corners so that applications have an overall fun aesthetic. We also used pastel colors for our app. This is because pastel colors are softer on the eyes compared to vivid colors and it is less likely to strain the eyes of the users.

In addition, we had many different logo designs. Below, we can see the numerous logos that we went through.
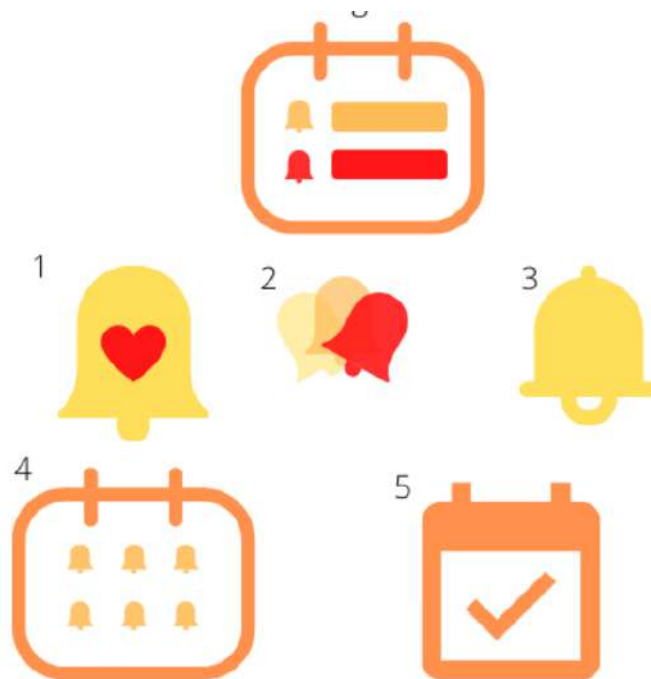
In the end, we ended up using the first logo. This is because from our surveys, we noticed that users preferred this the most. We wanted to make an app that was simple and therefore, had to make sure that our app reflected that. The logo is a simple app that both involves scheduling and reminders. In this small image, we are able to make a unique icon that can both easily identify us and demonstrate the utility of our app. For this reason, we use the app logo as seen below to represent the app.

S&S
Schedule and Structure

Individual Contributions

Kelly was the point of contact and lead designer on the project. After brainstorming the colors, fonts, and overall theme of the app with the rest of the team, she designed the app logo as well as the UI in Figma. She also handled the branding of the app by creating the video used in advertising for the CREATE competition. She requested Sk's help to perform the voicing. By using a tool called Animaker, she was able to make the animations for the video. Additionally, she handled all of the outreach to Goodwill, sending out surveys and setting up meetings whenever necessary. Whenever there was a meeting with Goodwill, she was there to represent the group and gather useful information.

Bethanie worked on the UI integration and frontend of the app. By using the design that Kelly mapped out, Bethanie implemented the UI using Flutter. Similarly, she also took on some of the design work feeding off of Kelly's mockups and designing some of the secondary pages of the app. Her focus was mainly on UX, keeping the pages intuitive, easy to navigate, and most importantly easy to use. She implemented the functionality of the three main features. She also worked with Sk on connecting the client side of the application to the backend. This included linking the login UI to user authentication in Firebase. Similarly the collaboration extended to sending data to the cloud and receiving and translating data from the cloud, as well as handling notifications received from the backend.

Sk worked on the backend and presentations. The backend involved many different parts. First, he needed to set up the Firebase account. The Firebase is used to store information about users on the cloud in a secure manner as well as offer secure login. The backend also involved computations and transforming raw data into usable data. For example, for the mood tracker, we needed to show different views of the user's data. To do that, we had functions that read the input of the moods and then made it into different data that is used to easily plot the user's data. This same idea was also used for the

scheduling parts. Another extremely important element was writing cloud functions to fire off the notifications when needed. Just as critical, he implemented the Firebase security rules to keep all data secure. In addition, he helped prepare the main bulk of the presentations. He tried his best to have easy to follow presentations that emphasized the main points of the presentation based on the rubric. Finally, he helped with voicing the video for Schedule and Structure.

Acknowledgements

References

1. CDC. (2020, April 27). *CDC releases first estimates of the number of adults living with asd*. Centers for Disease Control and Prevention. https://www.cdc.gov/ncbddd/autism/features/adults-living-with-autism-spectrum-disorder.html

2. Bhargava, H. (2021, March 9). *ADHD in adults*. WebMD. https://www.webmd.com/add-adhd/adhd-adults

3. *Signs of autism in adults*. (2019, May 2). Nhs.Uk. https://www.nhs.uk/conditions/autism/signs/adults/

4. *Attention deficit hyperactivity disorder (ADHD)—Symptoms*. (2017, October 20). Nhs.Uk. https://www.nhs.uk/conditions/attention-deficit-hyperactivity-disorder-adhd/symptoms/

5. Kathleen E. Feeney, Shanna L. Burke.The role of mentorship on social engagement among adolescents with autism spectrum disorders. *Research in Autism Spectrum Disorders*, Volume 88, 2021, p.101842. https://doi.org/10.1016/j.rasd.2021.101842.

6. 5 features of adults with autism. (n.d.). *Applied Behavior Analysis Programs Guide*. Retrieved October 15, 2021, from

https://www.appliedbehavioranalysisprograms.com/lists/5-features-of-adults-with-autism/

7. Tamara C. Daley, Thomas Weisner, Nidhi Singhal. Adults with autism in India: A mixed-method approach to make meaning of daily routines. *Social Science & Medicine*, Volume 116, 2014, Pages 142-149. https://doi.org/10.1016/j.socscimed.2014.06.052.

8. Morie, K. P., Jackson, S., Zhai, Z. W., Potenza, M. N., & Dritschel, B. (2019). Mood Disorders in High-Functioning Autism: The Importance of Alexithymia and Emotional Regulation. *Journal of autism and developmental disorders*, *49*(7), 2935–2945. https://doi.org/10.1007/s10803-019-04020-1

9. Kuroda, M., Kawakubo, Y., Kuwabara, H. *et al.* A cognitive-behavioral intervention for emotion regulation in adults with high-functioning autism spectrum disorders: study protocol for a randomized controlled trial. *Trials* 14, 231 (2013). https://doi.org/10.1186/1745-6215-14-231

10. Father develops an app to manage his son who suffers with ADHD with morning routines. Shared by Ana Duarte on 2019-06-27 15:15, About the author Pierre Séguin, & Séguin, P. (2019, June 28). *Father develops an app to manage his son who suffers with ADHD with morning routines*. Patient Innovation. Retrieved October 4, 2021, from

https://patient-innovation.com/post/2106.