Software Engineering Department
ORT Braude College

Capstone Project Phase A

EnlightenedCircls

Or Meira Balmas

Ofir Galai

Supervisor: Dr. Anat Dahan

24-1-D-22

1. Introduction

The awareness of individuals with special needs, particularly children with special needs, has been steadily increasing over the years.

Children with special needs, for several reasons and degrees of difficulty, often face numerous challenges throughout their lives. These challenges can be physical, emotional, or a combination of both. They may encounter limitations both socially and in terms of their personal independence. For example, a child with a visual or hearing impairment may struggle to understand their environment if it is not adapted to their condition.

The children with disabilities are not the only one who are dealing with the challenges above. Also, their parents have their own challenges, raising a kid with disabilities.

The problem:

Today, there are families across the country coping with one or more children constant attention to the child, necessary physical presence (the child cannot be left alone or in an environment unsuitable for their needs), leisure activities, and maintaining the daily routine of the household. Many parents face daily challenges in providing support both to their child and to themselves and other family members. Sometimes, these parents require supportive assistance from both professionals and those who have experienced similar situations. Additionally, these parents often struggle to find leisure or personal time for themselves due to the demands and needs of their child.

So, what are the existing solutions today?

Social Media Groups: There are groups on different social media platforms like Facebook and WhatsApp where families can connect and share their experiences. However, these large groups do not always have features such as age range or difficulty level, which can make it challenging to find specific and immediate solutions.

Support Associations: There are support associations specifically for families with children with special needs, such as “Wings of Krembo” and “Aleh.” These associations provide guidance, professional care, and comprehensive rehabilitation services.

However, we believe that the existing solutions do not offer an intimate and immediate solution like the one we propose. Our solution involves creating a social network (app) specifically for families with children with special needs.

Our solution:

A platform that will help and supports this families.

Families with children with special needs can register on this platform. The network will include location-based and other features groups where users can share their needs and receive relevant responses.

Users can also connect with others in their area who have children with similar needs. For example, they can find a babysitter for a few hours, arrange playdates with other children with similar needs, or seek advice from professionals.

This Users can consult with each other through forums or chat about similar experiences, daily challenges, and professional advice. They can also see questions that have already answered or post new questions.

Our solution aims to provide a more focused and personalized approach to support families with children with special needs, allowing them to connect with others who truly understand their situation and receive timely assistance.

2. Background & Related work:

The experiences of parents caring for the complex care needs of children with special needs and different disorders are not well understood. Parents struggle to meet their children's medical, behavioral, and social needs within and across health, social, and family systems[1]. Several research results showed that parents of children with special needs were less satisfied with life in general, as well as less happy and less satisfied with health, family, friends, and safety[2].

Those parents face difficulties in 4 main themes[1]:

1. Difference and Vulnerability: Parents reported feeling different and vulnerable due to their children's unique needs. They faced challenges in social settings due to lack of understanding and acceptance from others. The parents' experiences were unique from mainstream parenting, leading to a sense of social difference.
2. Social Taboo and Stigma: Parents experienced social taboo and stigma when interacting with families who had neurotypical children. They often felt judged and misunderstood, leading to avoidance of social situations and increased stress.
3. Systemic Dis-ease: Parents expressed frustration with systemic barriers in medical and government systems. They faced issues with episodic care models and lack of coordination services, leading to increased burden of care.
4. Incomprehension: Parents felt misunderstood by family and friends about the reality of caring for their children. They expressed a desire for more understanding and support from their community.

parents of children with special needs are often reported that they were less satisfied with their lives and reported a lower level of happiness. They also reported they were less satisfied with health, relationships with family and friends, safety, and future security[2].

More than that, Results show that mothers of children with developmental disabilities are at elevated risk of depression compared to mothers of typically developing children. Depression in mothers of children with developmental disabilities is a condition that is presently not being addressed on a wide scale, although promising interventions are available[3].

The beginning of parenting a child with special needs is usually characterized by anxiety, confusion, and emotional focus. In most cases, parents go through a crisis when they are informed that their child has special needs.

[1] "isolation and exclusion: the parents' experience of caring for children with rare neurodevelopmental disorders", Genevieve Currie and Joanna Szabo

[2] "Parents of Children with Developmental Difficulties and Parents of Typically Developed Children: What Happens in a Year?", Lana Lučić

[3] "Singer G.H. Meta-analysis of comparative studies of depression in mothers of children with and without developmental disabilities", Am. J. Ment

After receiving the news about the diagnosis of the child, and also later in life, families of a child with special needs develop their personal coping strategies with the child, with the nuclear family - parents, siblings, with the extended family, against external systems in the community such as kindergarten and school, and against various caregivers.

One of the important and significant factors in the child's environment are his parents. Their coping with a child with special needs is a complex struggle, focusing on the child himself, the couple's relationship, the healthy siblings, and the reciprocal relationships between them.

Despite the many differences between families, there are also many commonalities in their responses, and much can be learned from the experiences of different families about coping. Different approaches describe similar emotional stages that parents of children with special needs go through in coping. Teller[4] (2001) mentions five stages. These stages occur throughout the life of the family at different rates and intensities, and it should be noted that not all parents experience all of these stages, and not necessarily in the order detailed below.

Collision stage - reactions of shock, sensory numbness, and disorganization.

Denial stage - searching for other explanations for the situation or other treatment that will "heal" the child.

Sorrow stage - feelings of sadness, helplessness, anger, and loneliness, which are considered a normal and natural response to a crisis situation. Sometimes they also talk about "chronic sorrow" that parents experience anew during normative developmental stages.

Focusing on the external world stage - accepting reality, searching for information and coping strategies, and formulating plans.

Completion stage - acceptance of the situation and recognition of the child's special needs.

Schreiber[5] (2014) defines the same stages but divides them slightly differently:

Shock and mourning - this stage is characterized by disorganization and confusion, and sometimes even physical reactions, such as dry mouth. After the shock comes the mourning for the situation. The duration of the mourning period varies from person to person.

Refusal to reconcile with the diagnosis - at this stage, parents try to avoid the situation and not recognize the new reality. There are parents who refuse to accept the diagnosis and turn to various experts.

Anger, frustration, guilt, anxiety, and depression - parents feel angry about the situation and ask various questions about the situation. They feel

[4] טלר, י' , "התמודדות המשפחה עם ילד חריג.מכון הנרייטה סאלד"
[5] חגי, ע', "ילד שלי מיוחד", מודן

frustration and a sense of guilt that they could have prevented the situation. Over time, various anxieties arise in the family and social spheres.

Investigation and acceptance - the process of reconciling with the new situation varies from family to family, and it requires acceptance of the child. At this stage, parents are looking for ways to promote the child and use professionals.

Parents develop, each in their own way, resilience mechanisms that they use to cope with the difficult challenges involved in caring for a child with special needs. Researchers[6] Peer and Hillman (2014) recently presented an interesting and comprehensive review of several resilience factors that promote good coping of parents with children with disabilities. The following resilience factors emerge from the research[7] (Hermati 2015):

Coping Style: Problem-focused coping, which mainly focuses on plans and goals that change the characteristics of the situation and help reduce future stress. For example, gathering relevant information, enlisting help from family members, choosing a suitable educational framework, dividing roles between parents, and more. Another coping style is emotion-focused coping, which mainly deals with reducing difficult feelings in the present, for example by sharing difficulties with close friends, a support group, personal treatment, yoga, and more. Each of the coping styles can assist in certain circumstances, but according to most researchers, problem-focused coping is more related to resilience and good adaptation to the pressures of parenting a child with special needs.

Optimism: Optimism is a tendency to expect good outcomes when dealing with difficulties. Optimism is not just focusing on the good, and it is not ignoring difficulties and difficult feelings, but it is a belief in good possibilities and striving for them. Optimism is [8]linked to positive feelings and motivation for action that promotes desirable outcomes. Optimism affects the resilience of parents in two main ways: (1) Positive feelings such as joy, pleasure, interest, and love. These feelings help to broaden thinking and action possibilities, to think creatively, and to expand personal and social resources for coping. (2) By influencing the child's feelings and behaviors, the parents' optimism helps him develop positive perceptions and positive feelings, and in this way influences his behavior and his adaptability.

Social Support: Accessibility and support from friends and family are a very significant factor in effective coping with raising a child with disabilities. Social support is expressed in accessibility to conversations and stress relief, advice, practical help, and nurturing social and family relationships. In several studies, it was found that social support affects the reduction of parental stress more than the severity of the child's problem. Social support helps not only in

[6] "Stress and Resilience for Parents of Children With Intellectual and Developmental Disabilities: A Review of Key Factors and Recommendations for Practitioners", Peer, J & Hillman, S.

[7] "הורים לילדים עם צרכים מיוחדים", אתר האינטרנט של ד"ר הרמתי

[8] סולומון, י' וזלצמן, נ', "הילד בעל צרכים מיוחדים והמשפחה – השלכות לאנשי המקצוע". פורום חינוך מיוחד ארצי. אתר שפ"ינט

raising the child, but also in maintaining and nurturing the relationships between the parents and their ability to nurture work life.

Sense of Control: A person perceives himself as having control over his life as much as he succeeds in influencing and believes that he can influence his lifestyle, his physical and mental state, and events and outcomes. Perceived control is a decisive factor in the effective coping of parents with children with special needs. The sense of control is influenced by two main forces: (1) Basic perceptions about oneself, the world, about others, and about relationships. A person with positive self-esteem and world perceptions of trust and curiosity tends to experience more control over his life. (2) Relevant information - as parents of children with special needs learn to know and understand the problems the child is dealing with, the treatment and assistance options, and the possible future developments, so they can achieve better control over their lives. The Internet age makes a wealth of information available on any problem and allows parents to collect information easily and quickly. However, an abundance of information[9] can also confuse and flood, and one of the important challenges is to navigate successfully in the accessible information world and to use what is especially relevant.

In general, there are parents who develop these resilience factors naturally and spontaneously, almost without the need for help and guidance, and feel that they are coping well with the pressures of raising a child with special needs. Other parents can seek counseling, accompaniment, and professional help.

Finally, as we have learned from articles[10] and research conducted on the subject, it is evident that parents of children with special needs experience difficulties on personal, familial, and societal levels. Parents often feel unheard, experiencing challenges throughout the upbringing of their children, both with and without special needs. They face the need to enable a child with special needs to lead their life, while also addressing their own emotional needs and managing their own lives. This includes the necessity for assistance.

[9] Hallahan, D. P., & Kauffman, J. M. Exceptional Children: Introduction

[10] Fine, M.J. The Handicapped Child and the Family: Implications for Professionals. In: Fine, M.J. (Ed.): Collaboration with Parents of Exceptional Children. Chap. 1. Clinical Psychology Publication, Vermont, USA

3. Research:

Children with special needs and the needs of their supporting surrounding:

During our research work from the beginning of our work on this project, we studied the field of supporting families with children with special needs. Initially, we wanted to understand the challenges faced by the parents/siblings of those children so that we could address some of their needs in our project. In addition to gathering information through various articles, we also created a questionnaire aimed at obtaining information through families' responses about the different challenges they experience. Furthermore, we conducted conversations with individuals and held in-depth discussions to utilize the information we received to find solutions that will be provided on our website for its users, with the goal of alleviating and assisting as much as possible due to the importance of this.

As an initial step in our information gathering process, we considered what the needs of those families serving as a supportive environment might be. We understood that there are different disabilities and levels, but parents may face similar challenges. In the questionnaire we created, we tried to think of questions that would guide us in understanding the need for an application like ours, what needs could be addressed on the website, and how it could assist those families, whether through emotional or physical support.

In addition, we received information from a kindergarten teacher who witnessed the inclusion of a girl with special needs in a kindergarten with children without special needs, and we learned from that. Through the teacher's stories about observing the girl's integration into the kindergarten, we understood that adapting the environment for her served as an important step in enabling her to integrate optimally into the social setting. For example, in the kindergarten, they ensured markings were made so that despite her visual impairment, she could integrate as much as possible in the kindergarten. It can be understood that through the guidance provided by the kindergarten teachers via a website that provides information to families, it will be possible to enable the inclusion of children with disabilities in society by assisting families who can translate their children's needs through receiving guidance, thereby allowing their children to integrate into society from an early age.

As part of the research and to get more information, we made a questionnaire to which several families answered to understand what they are suitable for and the needs of those families:

האם קיים צורך כלשהו (נפשי\פיזי) שאיננו נענה ע"י גורמים מוסמכים מטעם משרד הבריאות\עמותות וכו?ואם כן האם פנית אליהם?

4 תגובות

כן, טיפול ריגשי לבן שלי

לא

הרווחה לא מפ תפקדת אצלנו ואין מספיק מידע מה מגיע לנו

לי לא היה אבל מאמינה שיש הורים שזקוקים לזה

האם אתה סבור שקיים צורך במעגל תמיכה נוסף נגיש מעבר לעזרה שהינך מקבל ?(מעבר לתמיכה מגורמים רשמיים)

4 תגובות

כן

היה עוזר במידה והיה.

חד משמעית כן

ברור חד משמעית כן

מה הקושי המרכזי מבחינה חברתית בטיפול \התמודדות עם ילד עם צרכים מיוחדים?

4 תגובות

חוסר התחשבות בעבודה

הקושי להבין אותו ולחבר אותו לילדים אחרים

האי וודאות מהעתיד

חסר מידיה והכוונה

האם הינך חבר בקבוצות תמיכה אונליין או פרונטליות לילדים עם צרכים מיוחדים ?(ספר אודות החוויה אחת לכמה זמן נפגשים\מדברים)

4 תגובות

לא

לא

האם יצא לך בעבר לפגוש עוד הורים שגם הם הורים לילד עם צרכים מיוחדים שעמם יצרת קשרי חברות ?(ספר מתי ואיך היה המפגש)

4 תגובות

כן. בפעלויות של הגן..היה מאוד נחמד

כן בנופש לילדים עם צרכים מיוחדים וחוג מוזיקה

הורים במסגרות החינוכיות ...

כן

האם היה עוזר לך אם הייתה אפליקציה אזורית בה יכולת למצוא בייבסטר היודע להתנהל עם ילדים עם צרכים מיוחדים ועוד תמיכה

4 תגובות

כן

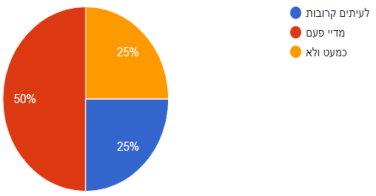
כן .

לא כי לא הייתי משאירה זה מפחיד

העתקה

באיזו תדירות אתה נוהג לבלות ללא הילדים

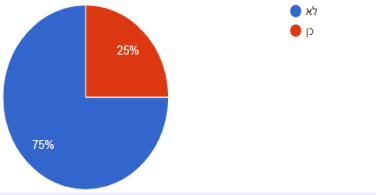
4 תגובות



העתקה

האם הינך מגדל ילדים ללא צרכים מיוחדים

4 תגובות



מה היית רוצה שיהיה באפליקציה שהיום אתה לא מקבל מענה עליו הן בפרט החברתי והן במקצועי

4 תגובות

ניסיון עם חינוך מיוחד

תכנים הקשורים לזכויות לילדים עם מוגבלות

תמיכה , הכלה, הכוונה

כן

Conclusions of the questionnaire:

1. A major difficulty for the parents that emerged from the questionnaire consisted of 4 major factors: lack of consideration from the employer in the workplace, difficulty in understanding the child's needs and social connection with other children his age, fear of uncertainty about the future and lack of information and guidance.

2. The parents who were asked were not members of any support group for parents with special needs.

3. Most of the parents who were asked to believe that they or other parents do not receive the required response from the authorities (Ministry of Welfare/non-profit organizations.

4. The parents who answered the questionnaire believe that there is a real need for another circle of support beyond what exists today.

5. About 50 percent of the parents who answered the questionnaire occasionally spend time without the children, 25% of the parents spend more frequently without the children and 25% of the parents almost never spend time without the children.

6. About 75% of the parents who answered the questionnaire are not raising another child without special needs 25% percent of parents are raising another child without special needs.

7. Most of the parents who answered the questionnaire would be happy for an app that includes mutual help such as a babysitter or other type of help, others expressed few concerns about providing help such as a babysitter by other people.

8. The main features that the parents would like included in the application are:

   Users with experience in special education.

   Content related to the rights of children with disabilities.

   Support, inclusion and guidance from parents and other professional bodies.

In this project we decided to focus on the main difficulty and that is providing help by creating communities that will include providing help and advice to the supportive environment of the child with special needs.

4. requirements

functional requirements:

The system allows users to register and log in
The system allows the user to look for answers to common questions
The system allows the user to have a chat with an expert
The system allows users to talk with other users via chat
The system allows the user to search for help by location and other features
The system allows the user to join a community
The system allows the user to offer help to other users
The system allows to register as a user who is a parent or expert

Nonfunctional requirements:

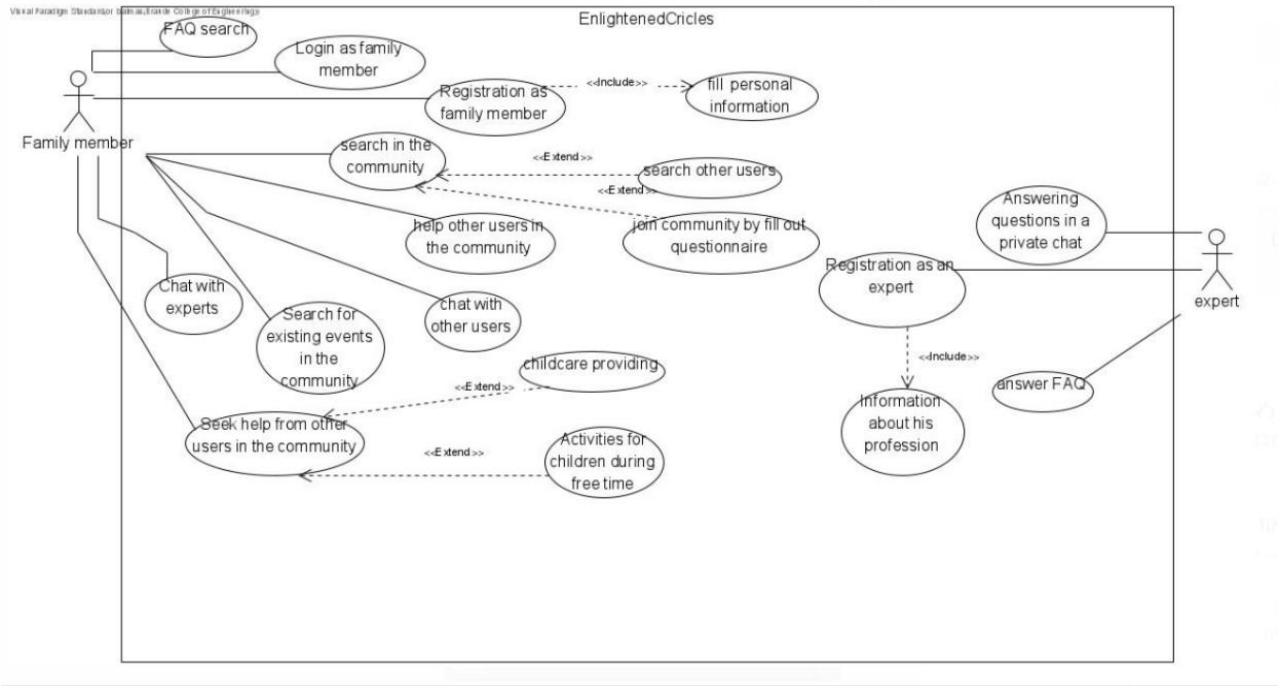
The user interface should be intuitive, with clear navigation and simple design, ensuring that both parents and experts can easily access and use the system without extensive training
Implement secure authentication and authorization mechanisms to protect user data by using a password and username
the system will have clear and informative error messages to guide users in case of mistakes or system errors
The system will alert the user about new messages received
Provide easy-to-follow onboarding tutorials or guides to help new users, both parents and experts, quickly understand and make use of the social network's features.
The system uses geolocation
Images will appear on the site for illustration

Use Case:

In this Use Case diagram, appear all the actions that can be performed by the different types of users of the application.

The actions that include as a continuation of an initial action and the extend actions that can be performed but do not have to be performed as a continuation of an initial action.

Figure 1: Use Case



5. Expected challenges:

Accessibility and Usability:

We want our application to be accessible and usable for all users. We want all the available features to be presented in an easy-to-understand manner, so that different types of users of all ages and with varying levels of technological knowledge can efficiently and conveniently operate and use the application.

relevant information:

1. Main Categories:
   Categorization into main categories. Each main category will include subcategories and relevant topics.
2. Clear Navigation Menu:
   A main menu displaying the various and diverse actions the application can perform in a clear and easy-to-understand manner, where each action leads to another screen.
3. Search and Sorting:
   Option to search specific topics by various parameters.
   Sorting results by relevance, date, geographic area.
4. Visual Presentation:
   Use of relevant icons, colors, and images to mark the different categories and topics. Organizing the information in a logical, visual and accessible way will make it easier for users to find the relevant information easily and enhance the usability of the application.
5. relevant information: We would also want the events displayed on the site to be up to always date with dates and times, and for the assistance provided by the supportive environment to also be relevant and updated at any given moment.

Privacy:

Collecting only essential information for defined purposes agreed upon in advance with the user.
We want to securely store personal information with high security, preventing unauthorized access, and a strong password that the user creates during the registration process. We need to ensure that our application does not expose the personal information of the various users, and that users do not have access to the private information of other users that they should not access. We also want to collect only the information required for using the application, and ensure the application is secure and safe for the user.

Algorithm: Our application uses an algorithm based on geographic location and other features that allows each user to join a community. The challenge is to find the best community for them.

Also provide them with relevant information regarding the various activities available on the application based on that location.

Experts: Another challenge for us is the option available in the application for consultation with an expert, and therefore we would want to ensure that experts agree to register on our application and assist those families.

6. Criteria for the success of the project:

1. The application should have a user-friendly interface and design, with illustrative images and clear understandable text for all types of users.
2. The application store and handle user data and personal information.
3. Structured layout with clear headings to organize content sections.
4. Families with children with special needs are registered for the application and utilize its services.
5. The content and services are specifically tailored to the unique challenges that these families face in raising children with special needs.
6. The application likely aims to provide helpful resources, information, and support such as expert guidance tailored for families raising children with special needs.
7. The app should be compatible and function properly across different devices (at this point for Android devices) and hardware configurations.
8. Should run smoothly without lags or crashes on both high-end and low-end devices within the targeted range.
9. Efficient data management techniques.

A successful final product is an application that functions well across at this point for Android devices and allows families with children with special needs to receive support of the challenges they face in daily life. Through the application, families will be able to receive assistance based on their geographic location and other features if they added themself to a community like available and nearby help, attend events in their vicinity, receive support or counseling from experts or other families, and consequently improve their quality of life.

7. Architecture:

In this diagram, we can see the connection between the client and the server.

In this product we will use the Android studio for the application. Also, we will use the Flutter App and the Firebase.

Flutter App: Flutter is a software development kit for open-source user interfaces created by Google. It is used to develop applications for mobile devices, web, and desktop from a single source code. It allows for the development of beautiful user interfaces, fast performance, and efficient development workflows.

Firebase: Firebase is a comprehensive platform developed by Google for the development of mobile and web applications. It offers a comprehensive set of tools and services for application development, improving application quality, and promoting its growth. It is widely used by developers and businesses due to its ease of use, scalability, and integration with other Google services.

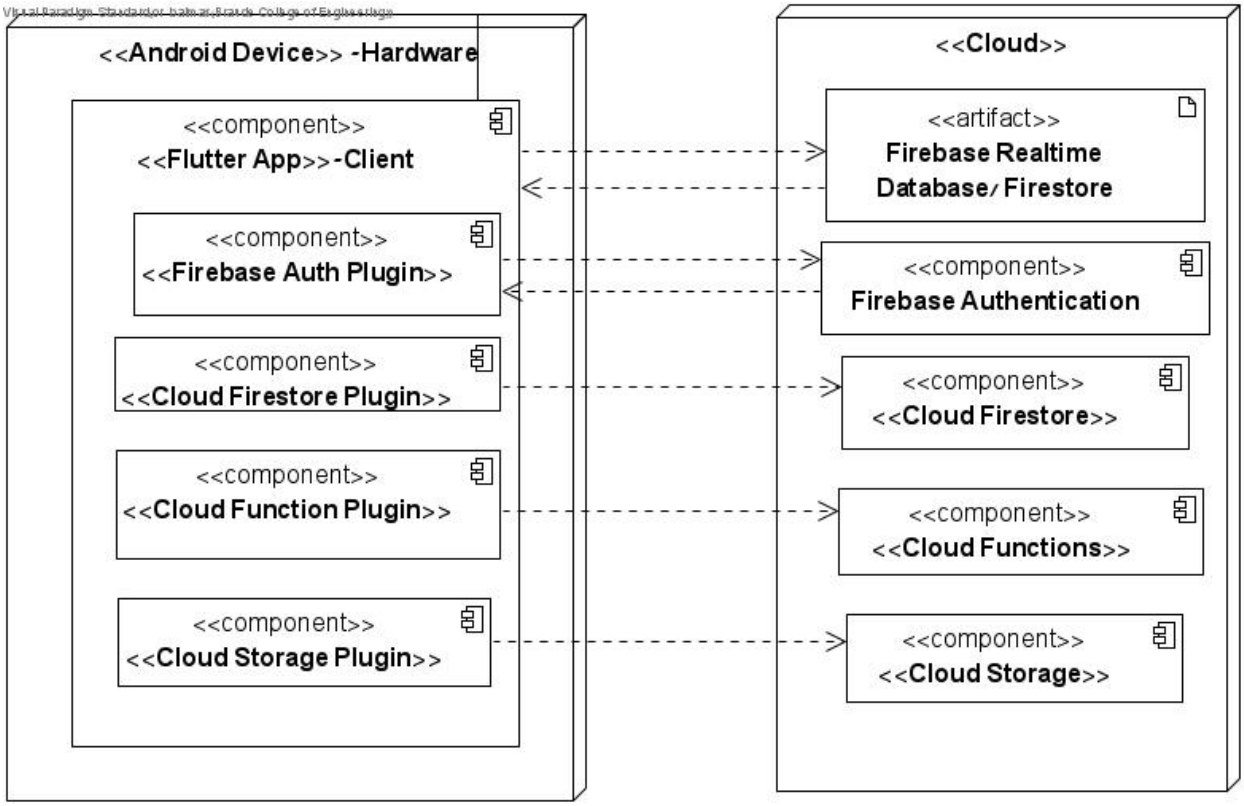


Figure 2: System architecture

8. development process:

In our development process, we would like to work according to the requirements we defined after the research work. We will use the AGILE work method. The work will be carried out in several stages, and tests will take place after each stage in order not to carry over errors to the next stages. Additionally, we would like to receive feedback from users on the application's operations at different stages during the development, as we did during the research work.

The Implementation of the project process:

1. Building the app using Android studio (development environment).
2. All the screens of the app will be develop using android studio.
3. Start from the main actions: Adding authentication, sign in, log in.
4. Getting / setting all the data using Fire base DB.
5. Using the algorithm Dynamic community detection for a small dataset.
6. The use of the algorithm will be based on geographic location with additional features that each user will input by answering a short questionnaire when choosing to join a community for chat with users who share a common denominator are beneficial for assistance with various tasks, such as helping with a pet, discussing a common topic, etc.
7. Join to community according to what the app offers – by the output of the algorithm.
8. adding an expert, helping in community, chats, events based on geographic location.
9. Getting feedback from real users (simulation).
10. Making changes based on feedback received from users and according to bugs that discovered during the development process.
11. Launching the final application.

About our dynamic community detection:

Sometimes families of children with special needs feel loneliness, lack of understanding from their surroundings, lack of knowledge, frustration, and more because there are no people around them which they know with the same experiences. Therefore, we have added the option to join a community to our application.

The community will be based on maximum similarity among all the options available to it (location, hobbies, etc), users will input these features by completing a short questionnaire if they want to join a specific community. This way, communities based on similarity will be created, allowing each user

to join a group of people with similar characteristics and receive support and assistance in a variety of areas. Therefore, we want to use an algorithm that creates communities dynamically. This algorithm will need to perform actions such as building graphs, adding nodes, and removing nodes from existing graphs.

In our development process we will use Dynamic community detection in evolving networks using locality modularity optimization to create communities based on features like location and features like age/pet/etc.

We will create a graph where each participant will be represented as a node. Edges will be defined between participants if the similarity between their features is above a threshold TH. We will look for communities in the resulting graph.

Activity:

This Activity diagram shows the flow of the actions when the user selects the community search option in the menu. The actions in the application and in the data base.

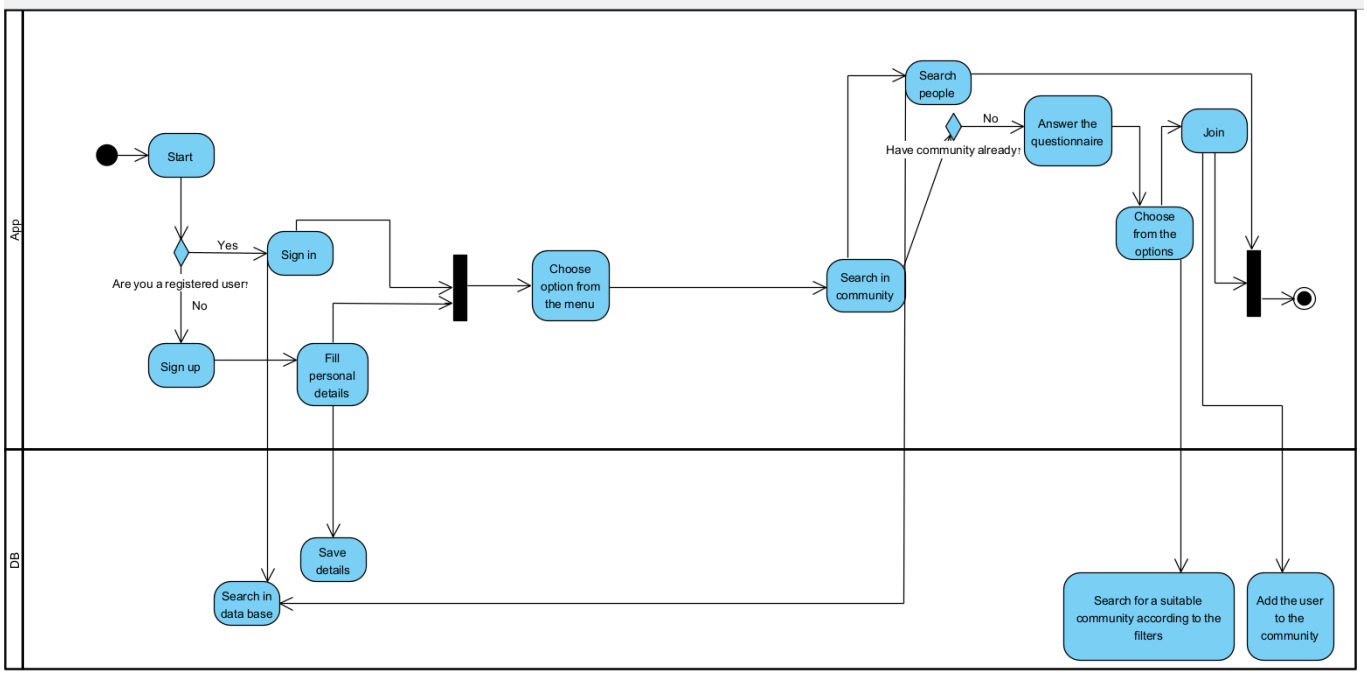


Figure 3: Activity diagram

Dynamic community detection:

Community detection methods can be classified into two types: Agglomerative methods and Divisive methods. In Agglomerative methods, edges are added one after the other to a graph that contains only nodes. The edges [11]are added from the stronger edge to the weaker edge. In Divisive methods, the opposite of Agglomerative methods found. In these methods, edges are removed one after the other from a complete graph. In our project, different communities will consist of groups of nodes representing different users in varying quantities. Therefore, the learning process is not easy. In the algorithm [12]we will use, we will make use of two main components:

1. The Louvain Algorithm - An iterative method that attempts to optimize the modularity of network partitions into communities in two steps - forming small communities first, then aggregating them into larger ones.
2. Procedures to handle addition/removal of edges and nodes dynamically - This involves identifying affected communities, disbanding them into individual nodes, updating community structures accordingly, and synchronizing changes.

The algorithm maintains two network representations:

Lower level (Cll) with original nodes and final communities.

Upper level (Cul) which is a smaller/compressed representation of the original network Cll. It is used to run the iterations of the Louvain algorithm for community detection.

1. Louvain Algorithm:

An iterative and greedy technique that initially finds small optimal communities locally, and then aggregates them into higher-level communities. Multiple runs on the same network may lead to different final community structures.

The algorithm has two main steps that repeated iteratively:

[11] "Community Detection Algorithms" Published in Towards Data Science [Jan 29, 2021]

[12] "Dynamic community detection in evolving networks using locality modularity optimization" [24 March 2016]

Local Modularity Optimization: Small communities formed by optimizing modularity locally, only local changes to communities allowed in this step.

Community Aggregation:

Nodes belonging to the same community united into a single node representing that community. This creates a new network of communities for the next iteration.

These two steps are repeated until no further increase in modularity is possible through additional community changes.

The process produces a hierarchical structure of communities-within-communities in the network. It repeats this process until maximum modularity achieved across the entire network.

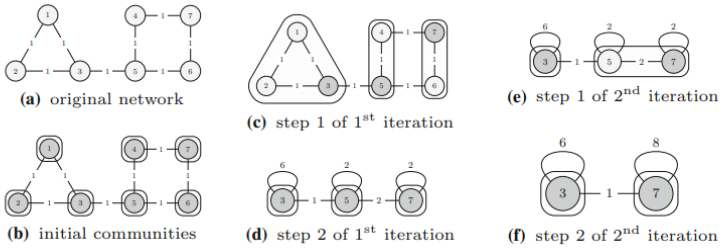


Figure 5: Louvain algorithm steps

2. **Addition/Removal of Edges:**
   Addition or removal of edges, the algorithm operates according to the following steps:
   1. Identification of affected communities (nodes) through AffectedByAddition() or AffectedByRemoval() and returns a list of affected nodes/communities.
   2. Disbandment of affected communities into individual nodes - DisbandCommunities().
   3. Update of upper level to show changes in lower level - SyncCommunities().
   4. Execution of the first phase of Louvain (local optimization) on upper level.
   5. Update of lower level with the new assignments to communities from upper level.
   6. Execution of the second phase of Louvain (community merging) on upper level.

We can see the different operations:

Illustrates the key steps involved when adding:

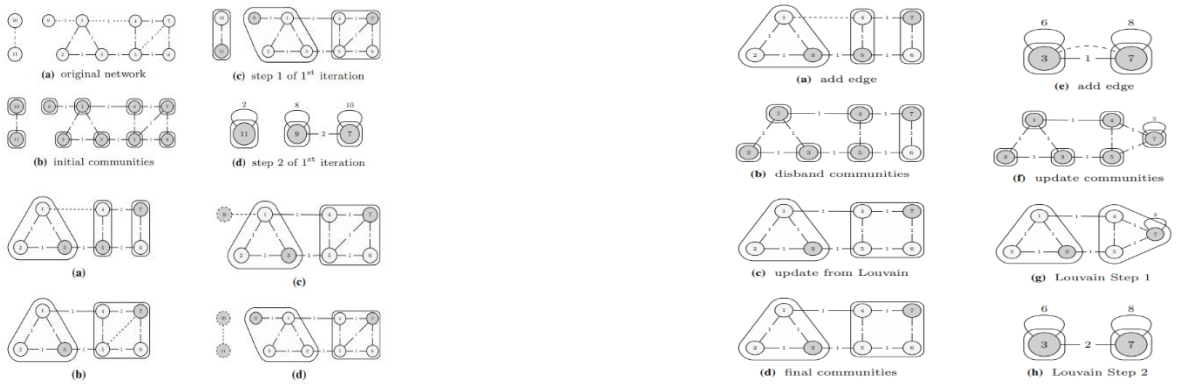


Figure 6: Key steps involved when adding

Shows the steps for adding a new cross-community edge between nodes belonging to different communities:

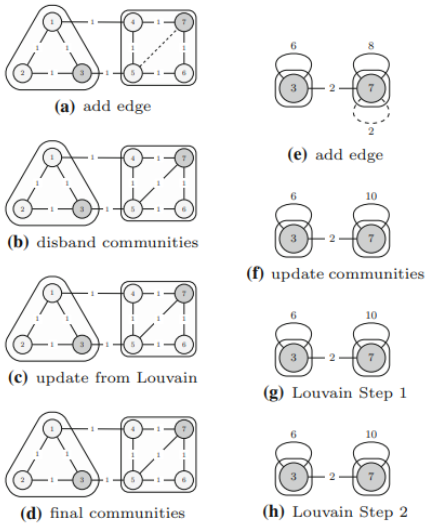


Figure 7: Adding a new cross-community edge between nodes of different communities

Illustrates adding an inner-community edge between nodes that already belong to the same community:

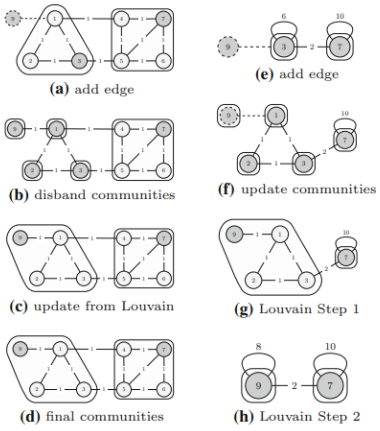


Figure 8: Adding an inner-community edge between nodes of same community

Adding a "half-new" edge where one node already exists in the network while the other is a new node:

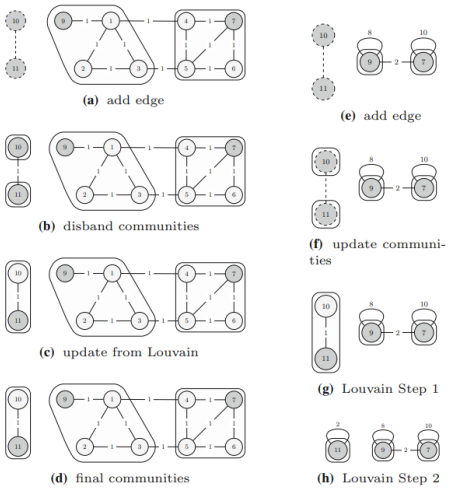


Figure 9: Adding a "half-new" edge where one node already exists in the network

Removing a cross-community edge between nodes belonging to different communities initially:

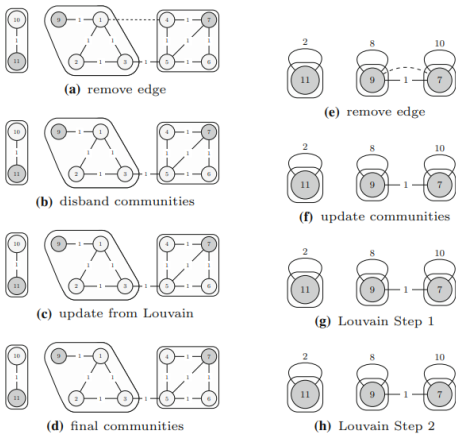


Figure 10: Removing a cross-community edge between nodes of different communities

Removing an inner-community edge between nodes belonging to the same community:

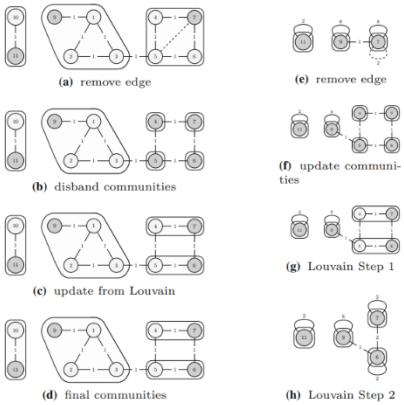


Figure 11: Removing an inner-community edge between nodes of the same communities

screens of the application:

In our application, it is important that the screens are clear, user-friendly, with illustrations that create a pleasant atmosphere for the different users while using it. Additionally, we want users to be encouraged to log in and register and to seek assistance in all the areas in which it provides support. Therefore, it is important for us to make it accessible to the public in a beautiful and efficient way.

Figure 12: Opening screen

Login screen - the first screen that appears when you enter the application.

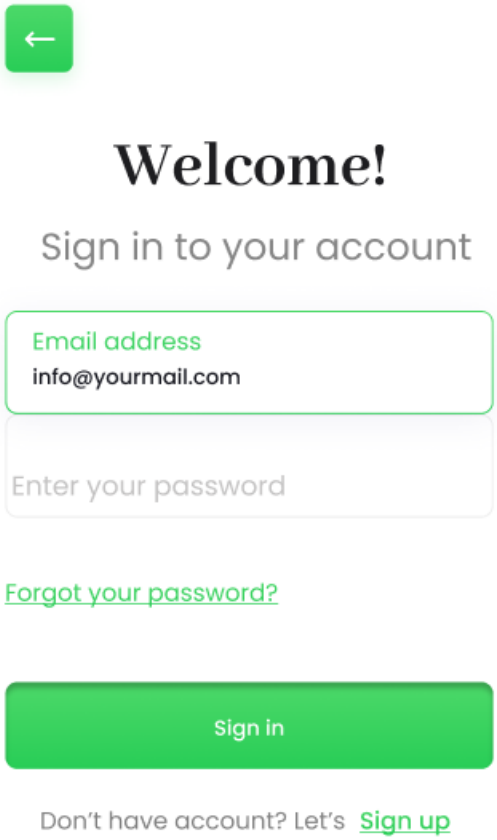


Figure 13: screen number 2

Login screen – The user can log in with an email and password. If he is not yet a registered user, he must register.

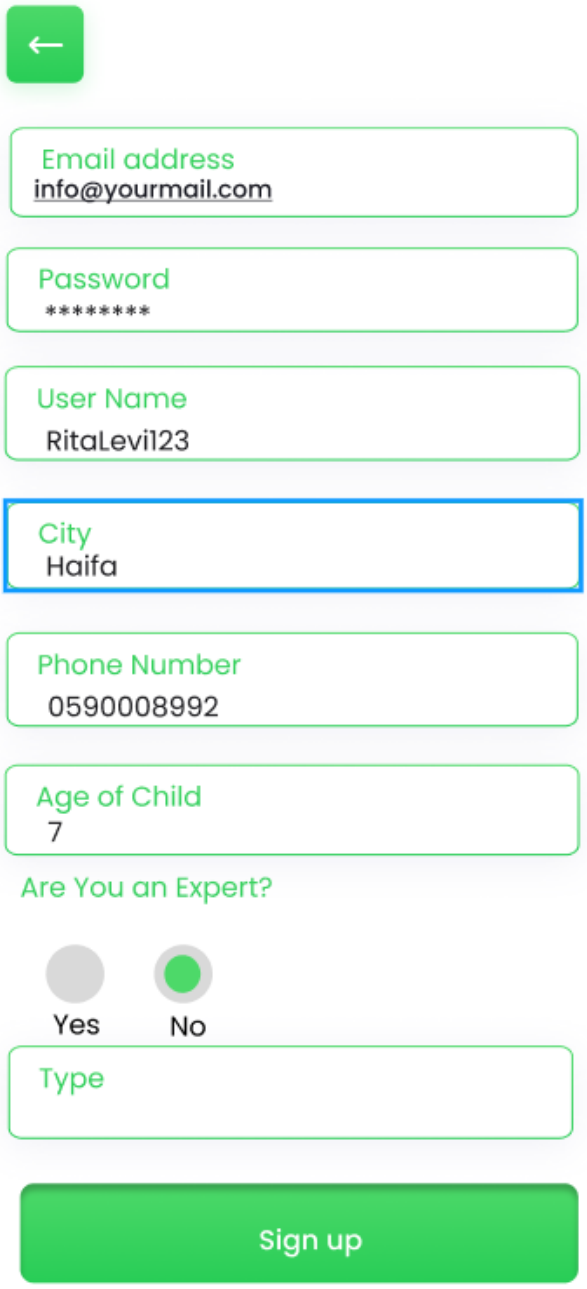


Figure 14: Registration screen

Registration for the application - the details must be entered to register. If the user is an expert, fill in the field of the type of expertise.

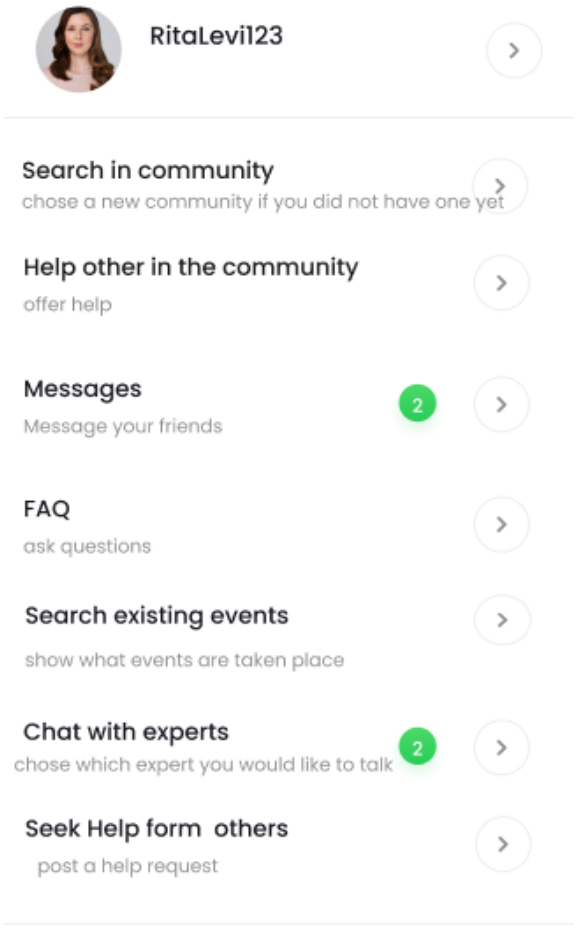


Figure 15: Menu screen

Menu screen - choose the option he wants from among all the options for the various actions on the site.

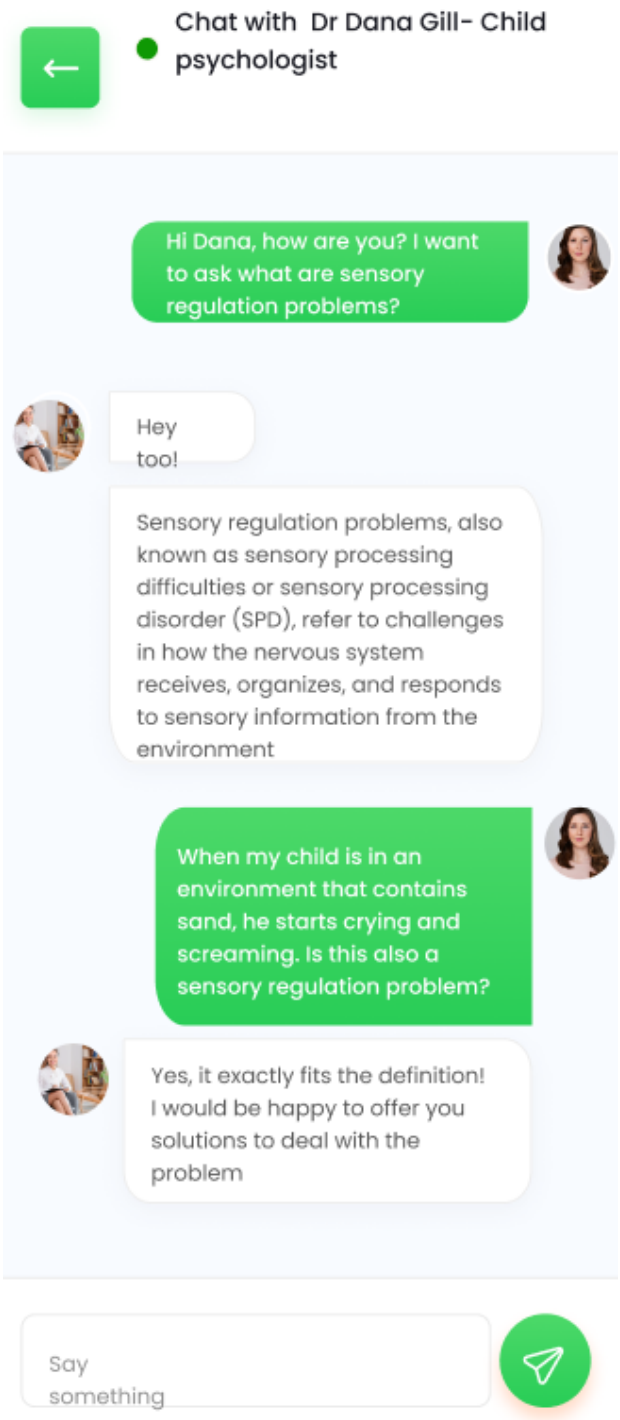


Figure 16: Chat with an expert screen

Chat with an expert – the user can ask questions, continue a conversation that has started or start a new conversation with an expert.

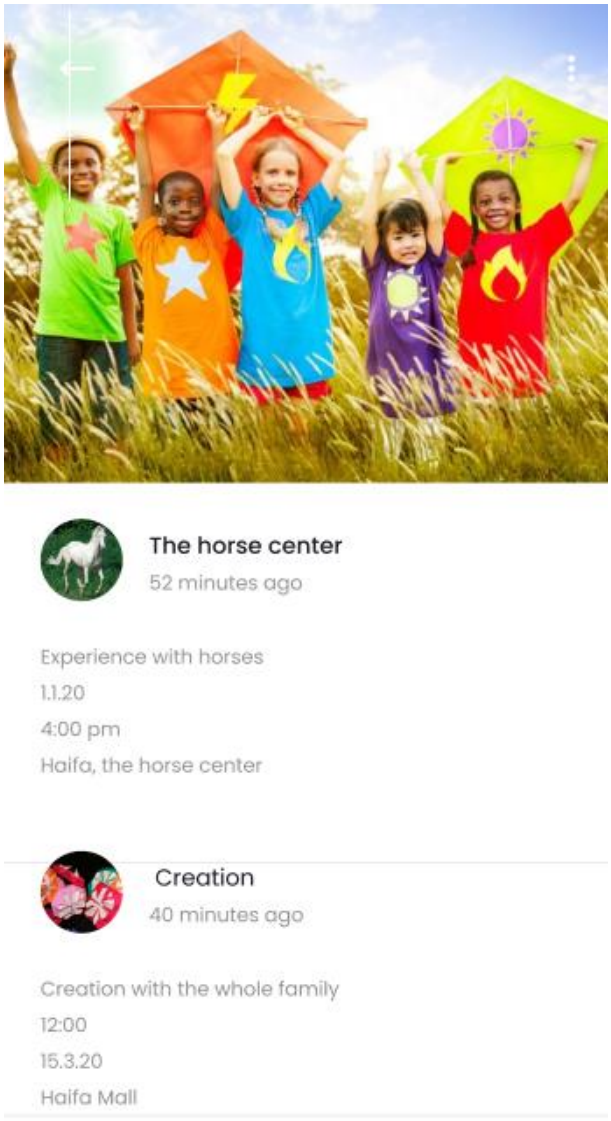


Figure 17: Events screen

Search existing events – the user can see all the details about events in his surrounding.

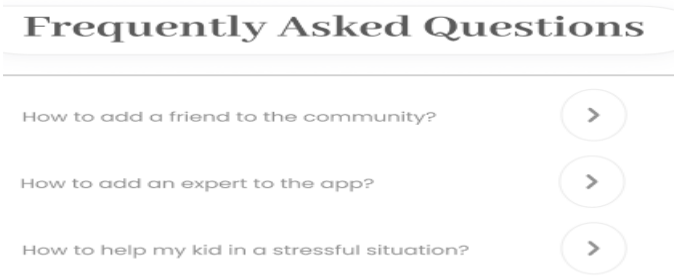


Figure 18: FAQ screen

In this screen, the user can view answers to frequently asked questions that will be updated.

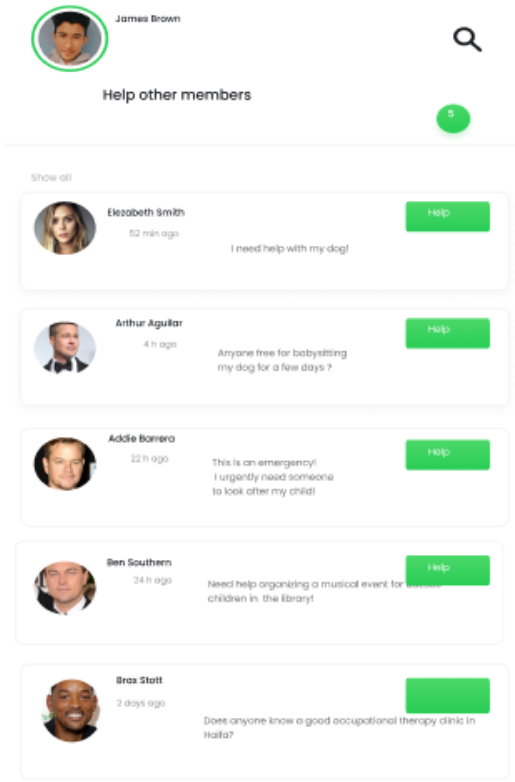


Figure 19: Help other members screen

The user can request help from others by posting a message with the details of the request from other users in his city.

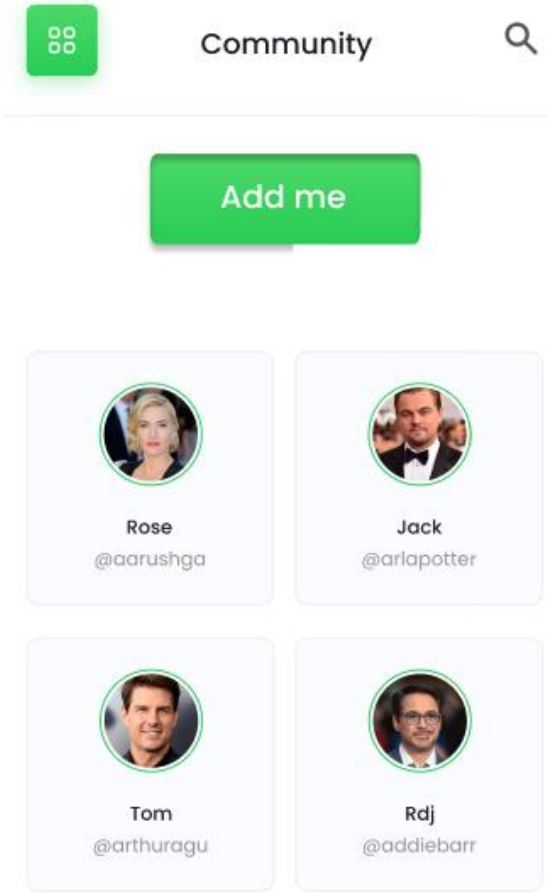


Figure 20: Community screen

Search in community – the user can search people.

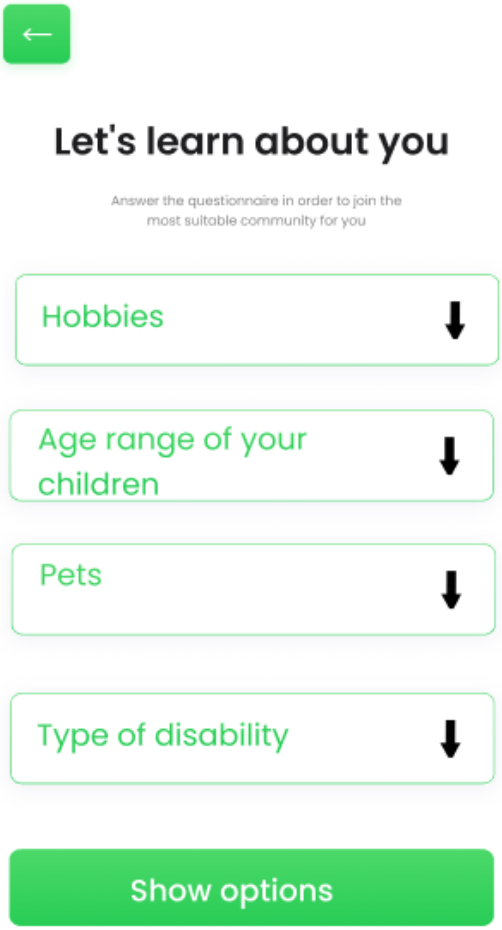


Figure 21: Questionnaire screen

After the user has clicked on the button – Add me, if he has not yet been assigned to the community and has not filled out the questionnaire, he will be transferred to this page where he will be asked to fill out a questionnaire with several features options so that the application can offer him the most suitable community based on the highest similarity with those community members based on the location and the features.

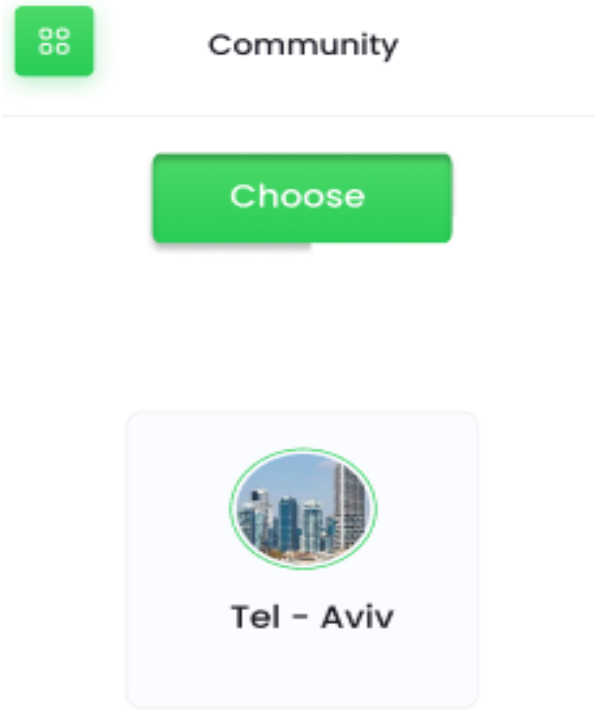


Figure 22: Join to community screen

community – the user can choose which community to join from among the communities that the site's algorithm offers, he can join only once.

9. Verification and Evaluation:

Evaluation – Usability testing:
We want to evaluate our final product in several stages throughout the development process. At each stage, different users can use the partial product, after adjustments and drawing conclusions from all the feedback received, they can use the final product. We will only release the final product version after receiving feedback on a quality and efficient product.

As an initial stage, we will build a basic prototype that includes several key functional actions such as joining a community, chatting with another user, and other key actions. After receiving feedback from this stage, we will proceed to the next stages in the development of the application. We will add secondary actions, design the application at a more professional and polished level, and finally, after all the stages and adjustments, we will have our final product.

We will also use at the final Evaluation stage the SUS questionnaire (System Usability Scale). It's a widely used questionnaire-based method for measuring the perceived usability of a system or product. The SUS consists of a 10-item questionnaire with five response options ranging from strongly agree to strongly disagree. Users rate the system based on these questions, and the results are then used to calculate a usability score. The SUS provides a quick and reliable way to assess the overall usability of a system, with higher scores indicating better usability.

Usability of our application is of great importance in this project, as user-centered design is the heart of the current project. We want all the actions and options available in the application to be clear, efficient, and convenient for the user.

Verification:

Test number	Test	Expected result
1	Input validation test at registration	Valid email and password
2	Database connection test	Data retrieved from the database is indeed correct and suitable for any type of user
3	Successful registration test	The user can log in to their account after successful registration
4	Error handling test	The user receives a relevant error message if there is invalid input
5	FQA functionality test	All common questions and their answers are shown for each user
6	Chat Interface Availability Test	The chat interface is accessible from the user interface
7	Chat Initiation Test	Attempt to initiate a chat session with an expert/user and verify that it is successfully established
8	Chat Features Test	Various features of the chat interface such as sending messages and receiving responses successfully work
9	Search Result Display Test	The search results include information such as nearby help centers, services, or experts available in the specified location
10	Questionnaire Access Test	The user can access the questionnaire through the user interface
11	Data Saving	The data entered by the user in the questionnaire is saved properly in the system
12	Test the Dynamic community detection	All the function are working well (add edges and nodes, remove, create graphs and more

10. References:

"isolation and exclusion: the parents' experience of caring for children with rare neurodevelopmental disorders", Genevieve Currie and Joanna Szabo, [2020].

"Parents of Children with Developmental Difficulties and Parents of Typically Developed Children: What Happens in a Year?", Lana Lučić, [2020].

"Singer G.H. Meta-analysis of comparative studies of depression in mothers of children with and without developmental disabilities", Am. J. Ment. Retard. 2006;111:155–169. doi: 10.1352/0895-8017[2006]111[155:MOCSOD]2.0.CO;2. [PubMed] [CrossRef] [Google Scholar].

הרמתי, ה' [2015], "הורים לילדים עם צרכים מיוחדים". אתר האינטרנט של ד"ר הרמתי.

חגי, ע' [2005], "ילד שלי מיוחד". מודן.

טלר, י' [2001], "התמודדות המשפחה עם ילד חריג". מכון הנרייטה סאלד.

סולומון, י' וזלצמן, נ', (תרגום ועיבוד). "הילד בעל צרכים מיוחדים והמשפחה – השלכות לאנשי המקצוע". פורום חינוך מיוחד ארצי. אתר שפ"ינט.

Fine, M.J. [1991], The Handicapped Child and the Family: Implications for Professionals. In: Fine, M.J. (Ed.): Collaboration with Parents of Exceptional Children. Chap. 1. Clinical Psychology Publication, Vermont, USA.

Hallahan, D. P., & Kauffman, J. M. [2006], Exceptional Children: Introduction.

Peer, J & Hillman, S. [2014], "Stress and Resilience for Parents of Children With Intellectual and Developmental Disabilities: A Review of Key Factors and Recommendations for Practitioners". Journal of Policy and Practice in Intellectual disabilities.

"Community Detection Algorithms" Published in Towards Data Science [Jan 29, 2021].

"Dynamic community detection in evolving networks using locality modularity optimization" [24 March 2016].

11. AI tools:

During the writing of the book, we utilized various tools:

1. Chat GPT
2. Perplexity