

# AutiMS: A Therapy Documentation Tool for Individuals Living with Autism

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**Abstract:** Autism Spectrum Disorders are usually managed with the administration of different kinds of therapy. Platforms to aid proper documentation of the therapy reports of patients are not free or readily available for use by Nigerian therapists. Parents and caregivers of the autistic patients also do not have complete access to these reports and no platform to promptly document their observations. This paper focuses on the development of a system that addresses these problems. Research and literary works were reviewed to gain knowledge on the prevalence of Autism in Nigeria as well as existing platforms for therapy reports documentation. Interviews were also conducted to gather insights on types and structure of reports issued for the therapies of focus. The application was designed and implemented using appropriate tools. It was tested by therapists specialised in at least one of the selected therapies and family members with an autistic patient undergoing any of the therapies. Responses and suggestions were collated via an online survey platform and the application was evaluated on interface design, ease of use and relevance. The application is available as a Progressive Web App (PWA) and can be added as an app on the home screens of Android and iOS phones.

**Keywords:** progressive web apps, web application, autism spectrum disorders, autism, documentation tools, therapy reports, assistive technologies for persons with disabilities.

## 1 INTRODUCTION

Autism spectrum disorders (ASD) are developmental disorders that affects communication and behavior. Autism is frequently interchanged with ASD but is however, only one of the four disorders categorised under ASD. Although it can be diagnosed at any age, it is described as a “developmental disorder” because symptoms generally appear in the first two years of life (The National Institute of Mental Health, 2018). Autism is a spectrum disorder because there are very wide variations in how it affects different people, hence there are several ways to treat and manage the disorder. This usually includes the use of medication and therapy.

(Legg & Osborn, 2018) outlined the different types like Applied Behavioral Analysis (ABA), Speech and language therapy, Cognitive behavioral therapy, Occupational therapy, Social skills therapy and a host of others. A review of an article by Prospero (2014) highlighted 13 best Autism apps for iPhones and iPads. Some of them like Proloquo2Go and TouchChat HD helped in speech and language impairments, Pictello and ABA Flash cards help to improve recognition and self-care patterns, EASE personal listening therapy and Autism Tracker monitors and documents moods and behaviors of patients and Kid in Story helps improve social interaction. It was however noted that these apps were mostly paid subscriptions in foreign currency and were only available on iOS. Some apps also had Android versions, however they still all had limitations and none addressed exactly documentation of therapy reports.

This creates a need to develop a system that allows proper documentation of patient’s therapy progress through reports, grants full access of the documentation to families of the patients and also provides a communication platform for therapists and families of the patients where observations and concerns about the patients could be addressed.

The focus of this paper is to discuss the design and the development of AutiMS, a web application which can be used as a documentation tool by therapists, parents and caregivers of individuals with autism, undergoing therapy.

The paper is organised as follows: Section 2 specifies the background research and literature review of ASD and related applications for supporting ASD. Section 3 describes the methodology used to outline features of the application. Section 4 describe the overview of the AutiMS application including its features and system architecture. Section 5 describes results and evaluation of the app and Section 6 provides the conclusion and recommendations.

## 2 BACKGROUND RESEARCH

King et al (2014) also described ASD as a lifelong developmental disability characterised by difficulties in social interaction and social communication, and restricted and repetitive behavior. Early intervention helps in learning critical social, communication, functional and behavioral skills. Treatment usually is in form of therapy and medications. Medications basically help control symptoms and reduce problems with irritability, hyperactivity, attention problems, and repetitive behavior amongst others. Legg & Osborn (2018) outlined some medications used to control conditions associated with autism and they include antipsychotics, antidepressants, stimulants and anticonvulsants.

People with ASD may also be referred to doctors who specialize in providing behavioral, psychological, educational, or skill-building interventions. Bertin (2016) in his article suggested that behavioral and speech language therapy are typically the foundation of intervention and that the most proven approach for children with autism is behavioral therapy. Geraldine Dawson, Chief Science Officer of Autism Speaks stated that early intensive behavioral treatments can help guide brain and behavioral development back toward a normal pathway (Dawson, 2008).

Applied Behavior Analysis (ABA) is the most studied and commonly used behavioral intervention and has been around for more than 50 years (Bertin, 2016) and it investigates environmental variables influencing socially important behaviors and uses those findings to implement interventions that will improve such behaviors (Cooper et al, 2007).

Speech-language therapy can also help people with autism spectrum disorder (ASD) improve their abilities to communicate and interact with others (Paul, 2008). Speech and language therapists help to assess, diagnose, and support autistic people by working to enhance their communication skills, so that individuals with autism can effectively communicate their thoughts, needs and feelings (RCSLT, 2009). They can help improve their spoken or verbal skills as well as their non-verbal communication. Some children on the spectrum are non-verbal, hence therapists focus on the teaching of non-verbal communication skills like the use of hand signals or sign language and also the use of picture symbols. It could also include improving on social skills and normal social behaviors like learning to make eye contact with other persons, sit and stand in close proximity with “strangers”.

Grigore (2015) proposed an app, Chartered Minds, to aid documentation of therapy reports. It implements a digitized-datasheet approach in which therapists use to assess patients during sessions, upload the datasheets to the app and graphs, statistics and reports are generated. The generated materials can be used to review the patient's progress and provide recommendations on how to improve upon therapy sessions. It was reviewed as a tool that aids all-round communication amongst everyone involved the patient's therapy and also reduces the stress of manual documentation of each therapy session. However, it was only a proposed project and was never built due to lack of funding.

Voon et al (2015) worked on the design and development of a mobile communication platform, AutiSay, to be used by autistic children and their caregivers, parents, teachers and therapists. The aim was to make use of advanced mobile and ubiquitous technologies to develop a communication tool to improve the social communication of the autism child and therefore alleviate the quality of life for the child and those around him/her. Similar apps for autism in the communication category were reviewed as well as the limitations on which AutiSay was to improve upon. The app was designed based on the Picture Exchange Communication System (PECS) and a beta version was used to test and note areas of improvement. The feedbacks were used in the development of AutiSay and it had about four features available for use. The benefits were reviewed, from its portability, ease of customization and relatively inexpensive costs. However, it was recommended that other content options should be made available for adults with autism, in place of the pictures. The app was also developed only for iOS and was recommended that an android version be made available.

Eder et al (2016) developed an interactive mobile game application for autistic children. The app was named “Fill Me App” and was primarily focused on the identification of human body parts and a centralized database that could be accessed by parents and caregivers of the child for progress. Existing applications that were

useful in the development of social skills and emotional connections were reviewed along with games that were built for education for children with ASD. The features of this game application included a scoring system for focus monitoring, eye-catching graphics, simple level of exercises, video tutorial and background music that coincide with the current educational teachings. Data on the attention span of children in different age groups was collected and analysed. It was concluded that the app was effective in improving the attention span of autistic children and keep them more motivated than traditional methods.

Gang et al (2017) developed an interactive story books app (ISB) as a speech-language therapy tool for special needs children in Malaysia. It was designed for Malaysian children with cognitive disabilities and speech-language impairments. The app was developed using the Android platform and included three parts (ISB, speech exercise and animated songs). Although the speech technology in computer-assisted language learning is also widely used in Malaysia, this app is aimed at being a form of interactive entertainment, in which the player can explore, learn and practice by themselves. The platform was developed using JavaScript with a Graphical User Interface (GUI) in HTML, hence it is platform independent and can run on all mobile operating systems. Information required to develop the app was gathered through the use of survey questionnaires on parents and children in the speech-language therapy area of a Malaysian clinic. The app was then evaluated by experts, parents and children on its usefulness and contribution to ease of learning. Conclusions showed that parents as well as therapist experts agreed the app was a speech-language therapy tool for the children and suggested on improvements.'

The literary works reviewed showed that there was still need to educate and create more awareness about ASD and it also highlighted that mobile technology is now being used to aid development and progress of interventions in ASD patients. Although the reviewed technologies tackled specific areas of interventions, there was a lack of technology to provide full access to records of progress and trainings by therapists for parents and caregivers of children with ASD.

### **3 METHODOLOGY**

#### **3.1 Research Analysis**

Data used in outlining major systems requirements and features were collected via research and reviews of existing platforms as well as correspondence with specialists and family members. The research conducted revealed the low levels of awareness of the disorder, the stigma still being associated with it and how the patients, their family members and care providers have to cope with this stigma in their daily lives. The research also revealed the efforts being made to increase awareness about these disorders in order to reduce and eventually end the stigma associated with them. Several types of therapy can be used to manage autism and ASD. However, from reviews of several publications by Nigerians, it showed three common therapies for Nigerian patients. These therapies were referred to in different but similar terms to:

- i. speech and language therapy,
- ii. behavioral therapy and
- iii. social skills therapy.

Speech and Language therapy addresses communication problems, either through specialist approaches on the speech organs or training patients on alternative form of language, most common being the sign language. Behavioral therapy summarily focuses on correcting unwanted behaviors by reinforcing desired behaviours through incentives, encouragement and other specialist approaches. It is a very wide field and split into different categories depending on the patient. Social skills therapy attempts to improve patient's interactions with external factors like the environment, family members and people generally.

The reviews of applications focused on therapy management showed that there were several mobile apps built over time that addressed different aspects of therapy, from teaching patients using Picture Exchange Communication System (PECS), speech therapy tools to documentation apps for reporting daily moods, behaviours and eating habits of patients. Only one app, Chartered Minds, by Grigore (2015) targeted online documentation of therapy reports by taking snapshots of therapy session notes, uploading and other premium features. The app was however never built due to no fundings.

### 3.2 Interviews

A semi-structured interview was conducted with an autism specialist of the Patrick Speech and Language Centre, Ikeja, Lagos. The interview was via email correspondence and featured questions targeted at the kinds of reports kept for the selected therapies. Some of the questions included:

- i. Areas of specialization,
- ii. How do you track the progress therapy training on a patient?
- iii. What are the different kinds of progress reports provided for these therapies?
- iv. What are the details included/required in these reports?
- v. Please give a brief summary of the general course of actions in a typical therapy session.

The full interview structure and respondent's answers are included in Table 1. The responses revealed that reports were indeed sent manually, in hard copy format to parents of patients and that other family members are not usually actively involved in these therapies because they are not constantly up-to-date on the patient's progress.

Unstructured online interactions with family members of patients living with autism also further emphasized the fact that families of these patients face a lot of stigma and do not often interact with society. However, after being assured of confidentiality, it was gathered that a large percentage of the parents and family members don't have a proper and well-updated knowledge of treatments. Also, progress reports and other documentations are also not readily available and accessible to them. The correspondents agreed that a platform to help them gain easy access to reports provided by therapists would help keep them up-to-date about the patient's progress without having to be physically present during therapy sessions. They also expressed that they'd love to have a platform with a means where they can easily document and send reports of observations or concerns about the patient. Coupled with the knowledge gained from research, these details were used to define a formal user specifications of the system.

## 4 Overview of the AutiMS application

There are three users of the system: Therapist, Parent and Caregiver. The Caregiver is a sub-user to the Parent and they are both categorized as Families of the patient. The system flow was structured to focus on the patient (a non-user of the system). Users are required to sign up for respective accounts on the platform or log in if they already have accounts. Figure 1 shows the login page and signup forms for therapists and parents.

### 4.1 Features

The features accessible to the therapists are outlined below:

- i. **Account registration and verification:** This includes obtaining personal and professional information of the therapist and a verification of the account is sent via email.
- ii. **Patient registration:** This logs information required about the patient and the parent/guardian's basic information. Only parents with parent accounts on the platform can be attached to patients and this is done via their email addresses. The parent is sent a verification email to confirm relationship to the patient.
- iii. **Activity Lists creation:** This involves creating a document for each patient that highlights activities for the patients at different periods of the day and it is to be assessed and used by parents/caregivers daily.
- iv. **Session reports creation:** This involves creating reports about each therapy session, includes all necessary details on the concluded session and is also accessible by parents/caregivers. It is outlined to feature before-session assessment, session summary, after-session assessment and optional comments.
- v. **Monthly Reports creation:** This gives a detailed summary of the work done over the month, progress achieved and it's accessible to parents/caregivers. It is outlined to

- feature baseline and improvement comments on receptive language, alternative communication, fine motor, self-care and behavior.
- vi. Therapists also have access to observations reports to be created by parents and caregivers.

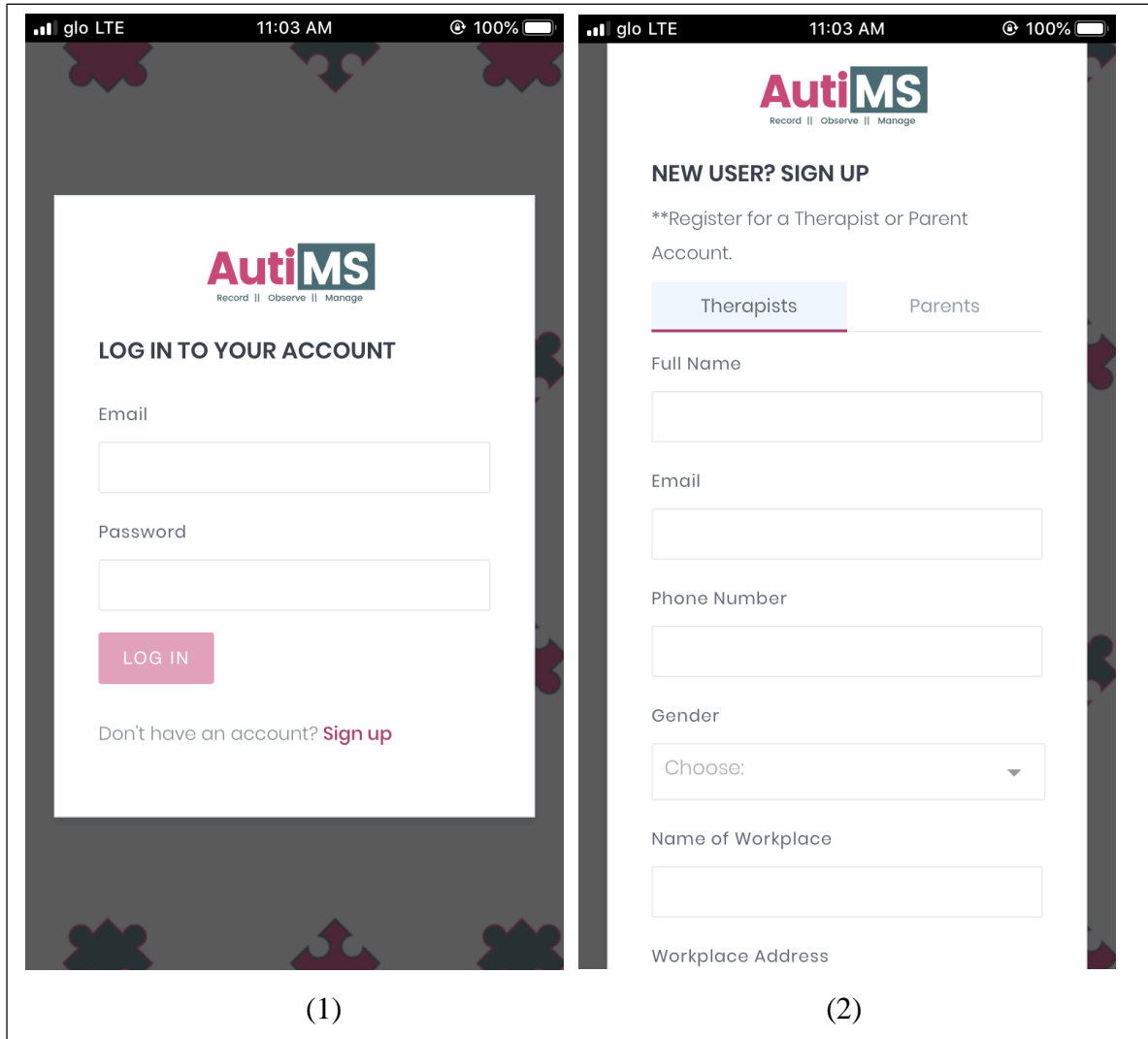


Figure 1: (1) shows the login screen for all users, (2) shows the signup page for therapists and parents.

Parents' features are outlined below:

- i. **Account registration and verification:** This includes obtaining personal information about the parent and a verification of the parent account is sent via email. Parents are also required to confirm relationship to patients when they get a notification email.
- ii. **Caregivers Account creation:** Caregivers accounts are to be created using this feature. This gives the added caregiver access to all the documentation available on the patient. Caregivers will receive emails with instructions on creating their passwords and account activation.
- iii. **Observations Reports creation:** This includes creating reports with details on concerns and observations about the patient and can be accessed by the intended therapist. It is outlined to feature the topic of concern, a summary and suggestions to therapists on how to approach the observations.

Parents also get access to activity list of patient, all session and monthly reports created by the therapists.

Caregivers' features are outlined below:

- i. **Activation and Login:** This involves activation of the account via the email sent as well as password creation for the new account.
- ii. Caregivers also get access to activity list of patient, all session and monthly reports created by the therapists and can create observation reports like parents.

## 4.2 System Architecture

Figure 3 shows how a therapist can utilize the application. The therapist can register for a therapist account on the app and login after confirmation. The therapist has a profile section which can be edited to update profile information. The therapist can also add patients, add activity list, session and monthly reports for patients. The therapist is able to add new patients with needed information and link the patient to an existing parent account on the platform using the parent's email. A new patient cannot be added by the therapist without an already-existing parent account. The therapist can also view and edit existing patient's information. After successful addition, the therapist can create a specialized activity list for each patient, this activity list features tasks and to-dos for every section of the day (morning, afternoon, evening). The activity list for each patient can be edited and updated with more tasks. The therapist can also add several session reports for each patient as well as monthly reports. These reports can be edited for corrections. The therapist can also view all observation reports added by the parent and caregivers of the patient, if any.

Figure 4 shows the actions that can be performed on the platform as a parent user. The parent can register for a parent account, gets confirmation and logs in. The parent has a profile section which can be edited to update profile information and can view all the monthly and session reports added for the patient by a therapist. Different therapists can add the parent and the parent can also view the activity lists added by each of the therapists. The parent adds up caregivers and grants caregivers access to all reports available on the patients. The parent can also add observation reports for specified therapists.

Figure 5 shows how a caregiver can interact on the application. The caregiver is added by a parent account, confirms the relationship and sets password for the new account. The caregiver has access to all the features of the parent account with the exception of adding more caregivers.

Figure 6 shows the work flow of the system and how the users relate and interact with one another on the application.

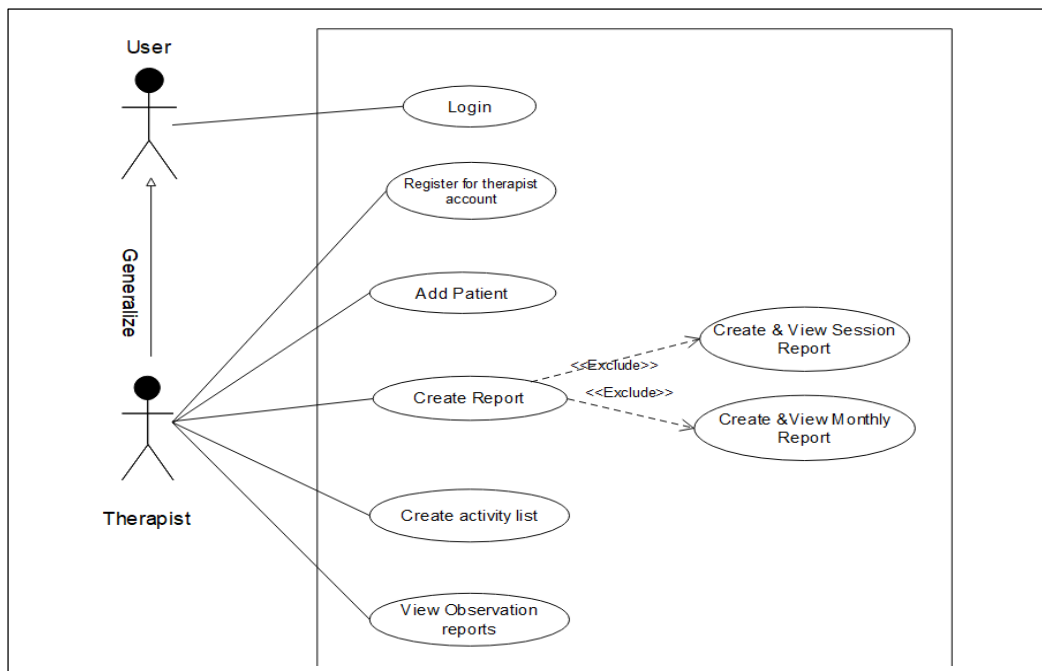


Figure 2: Use case diagram - Therapist user

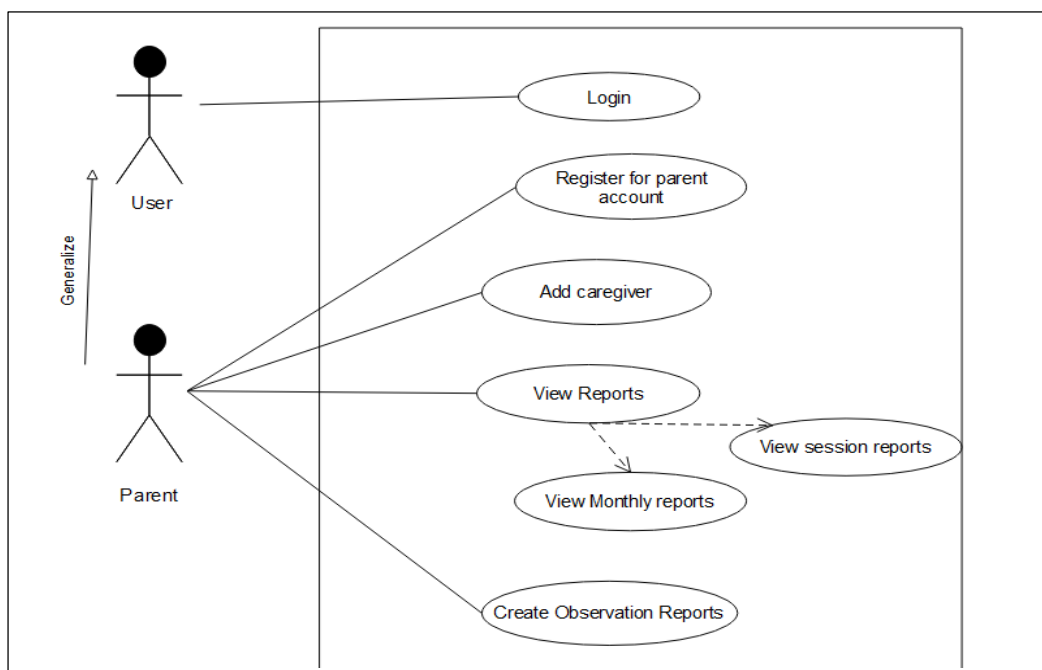


Figure 3: Use case diagram - Parent user

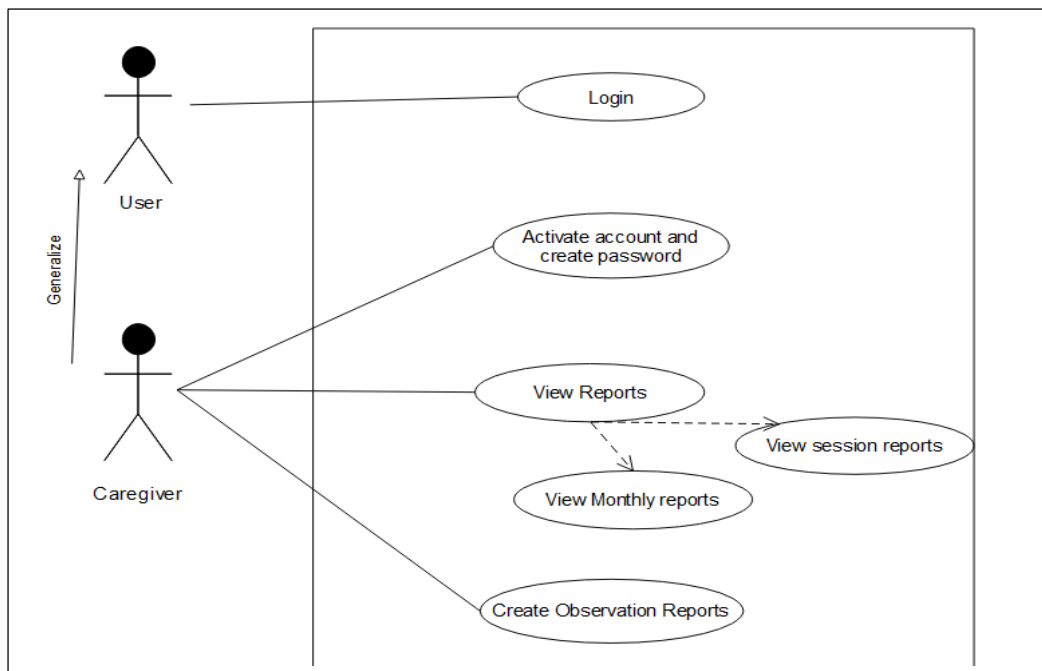


Figure 4: Use case diagram - Caregiver user

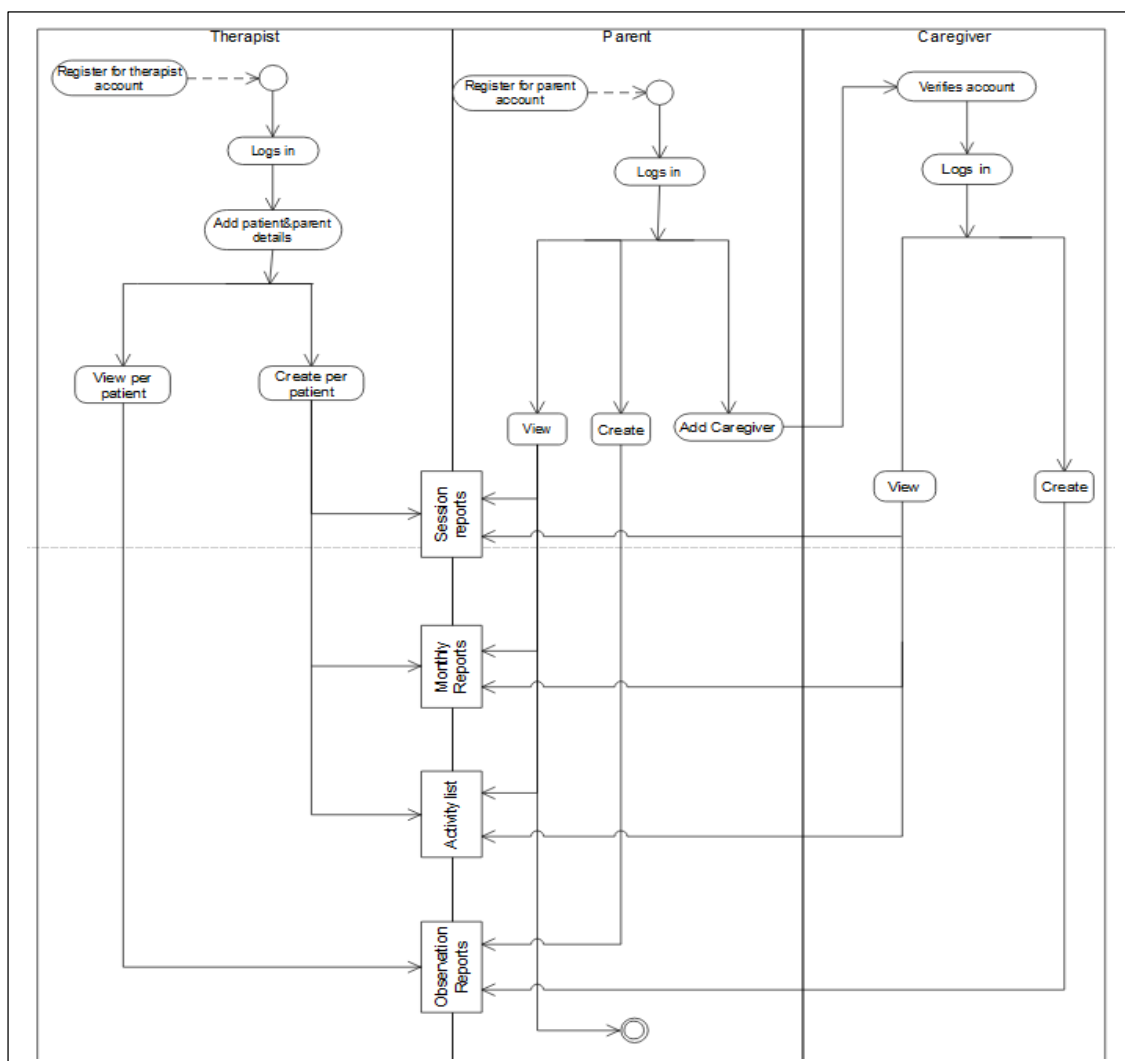


Figure 5: System Workflow



## **5 Results and Discussions**

### **5.1 Evaluation of the app by Therapists**

### **5.2 Evaluation of the app by Family members**