

MedPal: A Technological Cure for People with Parkinson's disease and Alzheimer's Disorder.

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Abstract

Parkinson, and Alzheimer disease are both neurological diseases caused by loss of neurons and highly affect the brain of people to impairs their ability to remember routine tasks and makes it difficult to perform these tasks, a lot of researchers are working to find the definite cure for these pernicious disorders but haven't found any potent cure although we can slow down the progression of these diseases by improving the quality of patient's life by encouraging them to use technology. This study aims at how technology can enhance the way of living without the memory load. These days technology mainly focuses on the young generation and leaving behind seniors of our society. To develop an interest in technology among seniors we are providing an application with a simple and interactive interface that projects their needs. As this disease affects the functions related to the brain that causes mental health issues, it hinders recalling and recollection that leads to Alzheimer's. In this paper we are presenting MedPal which is a technological solution for AD and PD patients to manage day-to-day tasks to achieve daily objectives, reducing the memory effort required to achieve those goals, improving patient's brain state by checking memory condition and lessen their stress or feeling of restlessness. Furthermore, this paper is presenting the implementation detail of MEDPAL and discusses results taken from both caregiver and patient after observing them for few days shows the importance of this application and how it is affecting the daily routine of patient and caregiver, s enhancing memory and living standards. This motivates us to build a simple and interactive platform to help to reduce the progression of mental disorders in seniors and to encourage them to use technology.

Key words:

Alzheimer's Disorder (AD), Parkinson's Disorder (PD), memory check, daily life management, dementia, memory simulation.

1. Introduction

Parkinson and Alzheimer's disorders are growing rapidly in seniors of age 60 and onwards and so as the technology is advancing, people suffering from these disorders and their caregivers are looking for efficient ways to get rid of these sufferings. Especially for people who need caregiver by their side all the time [1]. Alzheimer's Disorder (AD) and Parkinson's Disorder (PD) are movement and brain disorders. The most common characteristics of PD are impaired dexterity and difficulties in performing tasks, trembling, stiffness, and loss of efficiency in performing casual tasks. As the symptoms getting worse with age so it

may cause impaired walking and remembrance [2]. In recent research of Parkinson's association [3], PD patients are most likely to diagnose with Alzheimer's Disorder (AD) that undermines the capabilities of the brain [4, 5]. According to the Alzheimer association [6], the symptoms of this disease develops slowly with the age of people in their 60's and above, it gets worse with the time and results in lack of day-to-day tasks management and patient's brain simulation [7].

To treat PD and AD patients' researchers are working on providing technological solutions and awareness to develop the interest of patients in these technologies. Mobile phone-based applications are also playing a vital role in this domain. [8, 9]. For the betterment of patients, the use of application should be well aware of the technology and the good news is that nowadays almost 6 out of 10 elder people uses mobile phone and different devices, the interest of technology is growing gradually among people day by day this makes it easier to treat people with technology for better lifestyle [10]. In recent years, a lot of technological treatments are introduced for the people some are mentioned in the literature review section. Location tracing, Awareness, Reminding Medicines and Exercise related solutions are most common in mobile applications. But none of these applications provide daily routine management, memory and sensory stimulation in the single-handed application.

Our contribution is to make an application that can make elder people life easier who has PD and AD. By providing them this technological treatment having features like medicine reminders, soothing their mind through music to help them maintain their memory and to fight depression because music can resonate with certain memories and makes it easier to remember certain aspects of an event and helps in recalling [11, 12], Alerts such as eating alerts, walking alerts and emergency alert. The unique feature of this application is a brain test where the application takes data from the patient's gallery asks them either they know the person in the picture or not and give them scores according to answers. This makes the patient updated about how they are doing in recognizing people. MedPal application also integrated the caregivers into this application by designing an understandable and intuitive interface for elderly people that will be helping the user to prioritize their daily routine and decrease the cognitive

struggle to complete standard tasks. This paper will provide all the details related to PD and AD, so it will be easier for other researchers to study these disorders and the solutions regarding these diseases and how people are dealing with it.

The main purpose of this paper is to provide a solution that is one-stop-shop of features for people suffering from AD and PD, in this case, smartphone applications are handy to monitor patients because cellphones are basic need of every age, but the problem is seniors use cellphone only for basic purposes not to enhance their daily life so to make it more useful we are introducing an application that deals with the people suffering from Alzheimer's and Parkinson with unique features.

The division of this paper is composed as follows Section 1 explains Parkinson's disease and Alzheimer's disorder, issues, usage of technology, features of MEDPAL and our contribution related to these disorders. Section 2 is about the literature review and survey of related applications for the mentioned disorder, Section 3 gives detail of the implementation and design of the application, Section 4 of the paper is about the experimentation and Section 5 is about results, discussion and conclusion of our application.

2. Literature Review

The researcher argued that how new modern technology especially mobile phones for people with AD and PD can change and improve their overall quality of life [13-18]. In 2016 a survey was taken that explained the difference in usage of technology between the younger and elder generations and the result of their survey concluded elder people used technology and were eager to understand new technology and how the younger generation embraced and adopted new technology more easily [19]. The impact of new technology was more on the younger generation then on seniors because the focus of development, projected the needs of youth [20, 21]. The major challenges for researchers and developers were to establish applications that could also satisfy the interest of seniors of our society and to provide opportunities for the seniors to learn more about technology.

In recent year the issue of increase in aging population and their needs were highlighted by [22], performed surveyed in his study, the results of survey researchers had done on seniors explained about senior's willingness of learning and how we could provide opportunities for them and social factors that actually influence their positive and negative attitude towards the learning of the new technology. The researcher developed a system of wandering people suffering from Alzheimer's that allows their caregivers to locate their location when they leave their homes. This system uses GPS for tracing and sends

location only when the GPS of the patient's device is on. Although the system was remarkable for AD patients it did not provide the location of the patient outside the house or either they have returned or not [23]. In 2015 Jonathan Stanford described the importance of technology to help people suffering from Parkinson's, how technology will improve self-management and enhance the quality of life by continuously monitoring the activities, monitoring the health and social life of PD people [14]. In 2010 Marwan N Sabbagh presented a study that explained about people who suffered from Parkinson's disease that leads to Alzheimer's because of loss of neurons, Parkinson's and Alzheimer's are a neurological disorder but Parkinson's is mainly a movement disorder and Alzheimer's is memory issue both caused by neurons [24].

Table 1 is showing the survey of some of the famous application that is for AD and PD patients, Table 1 includes Application Name, its cost, developer, platform and some major features of the application

Table 1 Related Applications.

Application Name	Cost	Developer	Platform	Features
Talking Tom Cat	Free	ITUNES	I pad or I phone	In this game, you can talk to Talking Tom Cat and he will repeat it. He has an entertaining voice to keep you interested.
Steady Type	\$1.99	ITUNES	IOS	Steady Type lets you type on your touchscreen, even if you have hand tremors. Type quickly, accurately, and comfortably.
Mind Mate	Free	App store, ITUNES	iPad	The Mind Mate app is perhaps the ultimate in dementia apps. It provides games to keep them active.
Lumosity	\$79.99	Lumos Lab	I pad or I phone	The Lumosity app features a combination of over 25 cognitive games that are aimed at "exercising" the brain.
It's Done!	\$2.99	App Store, iTunes, windows store	I pad or I phone	It's Done is essentially an app that provides a checklist for life's everyday critical tasks such as locking doors, feeding pets, taking medication, and turning off the stove.
Alzheimer's Society's Talking Point Forum	Free	iTunes	I pad or I phone	The app is an online support and discussion forum and was created for anyone affected by dementia.
9zest	Free	9zest Company	IOS and android	This application offers a complete exercise plan for people suffering from Parkinson
CogniFit	Free	Professor Shlomo Breznitz	Android	Assess and improve cognitive health. All of our exploration and brain function stimulation tools are scientifically validated.
Study My Tremor	\$3.99	ITUNES	IOS	StudyMyTremor lets users record, analyses and track their hand tremors through their iPhone
Parkinson Social Network	Free	ITUNES	IOS	This social network designed specifically for people with Parkinson's offers users a place to seek friendship and emotional support from likeminded people.

3. Design Methodology and Experiments

We designed MEDPAL by keeping in mind the limitation of users of the application and provides an interactive interface by carefully incorporating design guidelines given by [25, 26] and add features based on the suggestion of other researchers and properly analyzed through the survey. The overall goal is to improve and organize daily life activities. Such as brain stimulation is used to improve memory, increase learnability and problem-solving ability. Sensory stimulation to lighten up the mood of the patient and decrease depression by music, soothing sound. In addition to these recreational activities, different brainstorming games to boost their memory and online help of the doctor and the memory test to ensure how they are doing. The core services of our application are explained below. We used Human-Centered design guidelines [27, 28] and involve 5 educated patients from a local hospital and their caregiver to properly analyze the design and technical requirements



Fig. 1 Login for User

4. Core application services

This application provides easy login to the PD and AD. Memorizing email and password will increase the memory load [29]. Therefore, a single touch makes it easier for them to log in to the application. This reduces the effort to complete a task, just a single touch and you are ready to use the application. Figure 1 explains this login service of MEDPAL.

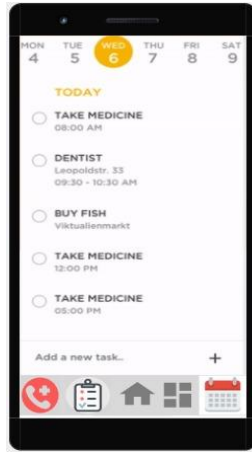


Fig. 2-Tasks Management

Task Management and Reminding features of the application provide special instructions to the patients which helps them to manage and organize their daily activities. It reduces the difficulty to remember things to do, reduces the risks of anxiety and depression of remembering things and not able to do them in time. It maintains the records of all the activities that need to perform and activities that are performed. Figure 2 explains when to visit the doctor, you ate lunch and now it's time to take medicine and go to the doctor and many activities that are arranged by the caregiver.

MEDPAL gives a reminder of tasks that needs to be achieved in a single day Figure 3. So you won't forget to take your medicines or miss your appointment. MEDPAL gives emergency alerts to the caregiver when PD and AD patients forget their way to home MEDPAL traces their location and send their accurate location to the caregiver so it will be easier to reach them. Figure 4 describes this feature.



Fig. 3 Reminders for medicines

The memory test feature is also included in MEDPAL, It takes elder person's data from their gallery and asks persons suffering from AD and PD either they know the person or not and give them a score of how many pictures they have recognized and sent that data of scores to the caregiver. So the caregiver will be aware of how the patient is doing as shown in Figure 4.



Fig. 4 Memory test

In brain simulation, we provide patients with the most interesting features to help them boost their memory by providing them different games of their interest, puzzles to see how they are doing in their current state of mind, information about diseases to make them understand about their selves better and help about their problems and difficulties they are facing in their daily lives, and in sensory stimulation, our application provides music, e-books of their interest to help them relax, reduces stress and the feeling of restlessness. Also, music can help them remember things it can enhance their learnability. Figure 5 explains how the brain and sensory simulations work.

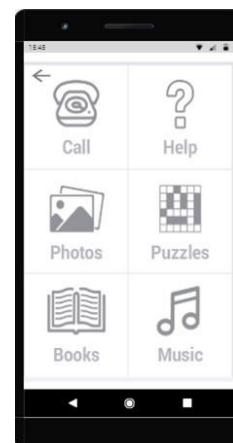


Fig. 5 Brain and Sensory Simulation.

Data collected from real-time testing and observing the patients and caregivers. We tested this application on 8 people in total. 4 of them were the caregivers and 4 were the patients suffering from AD and PD. Testing took place at their homes and hospitals sometimes in the presence of their caregivers but most of the time by themselves. We tested this application in two phases using real-time testing and observing them check how they are willing to use the application, either they are facing any difficulties to understand the interface or not? Testing took a month; in the first 10 days, we tested this application on caregivers to check how much it can help them and the patients whom they were taking care of and then further time was given to patients to make them familiar with the application.

In testing phase 1, we tested this application on caregivers, who spent most of their times with the patient, during evaluation caregivers gave proper feedback about the usage of the application. They used the application for 10 days and kept in mind what could be the needs of the patients. We take feedback from the caregiver because some time Patients are unable to tell the exact response due to lack of knowledge related to mobile usage. Figure 6 shows the feedback of the caregivers who participated in the user evaluation. Mostly caregivers liked brain and sensory stimulation that entertains the patients and keep on updating about their brain state. And reminders to keep them alert about taking medicines and doing daily activities. Caregivers favored the tracking feature the most as they can track the patient's location whenever and wherever they are.

In testing phase 2, we finally tested this application on the patients, patients took time in learning the usage of the

application and slowly showed interest and gave feedbacks. Patients participated with their caregivers. Patients loved the brain and sensory stimulation the most as that kept them entertained, they loved the feature of music and reading books, they found the songs resonating with the soothing memories of their past. Extensive results showed how patients completed tasks in this evaluation. The platform of the MedPal was designed keeping in mind the interests and needs of the patients, the main objective of this application is to provide usability, accessibility, simplicity, and ease of use to the patients.

5. Results and Discussions

After testing this application, we collected the data of how much time was taken by the patients and caregivers to understand this application, and what kind of difficulties they faced either they found it interesting, manageable, helpful or not. After the whole month of testing the results were astonishing. Numbers of tasks were given each day that vary from patient to patient such as responding to the alerts, listening to the music, having the memory test and playing the brain games. After learning and giving a response to the tasks, participants started taking interest and showed responsive feedback as mentioned in table 2 that explains almost all patients participated eagerly and tried to complete the tasks. After patients, our target was a caregiver and they gave positive results after testing and told us how this application actually helped them to take care of their patients.

Table 2: Results Taken from Patients after Testing Application

ID	Duration (Days)	Tasks completed	Cognitive simulation Completed	Sensory Simulation completed	Alerts Test completed	Memory Test completed	Easy features	Most difficult
P1	11	3	15	06	11	03	Sensory simulation	Memory test
P2	21	7	26	31	17	07	Cognitive simulation	Alerts
P3	17	9	23	17	07	11	Task management	Calling
P4	20	10	25	15	12	15	Cognitive simulation	Nil

The finding from this study suggests that to monitor patients of PD and AD mobile application may come handy to help them reduce the progress of these disorders by providing features that can help them maintain their life effectively. After the complete development of the application, we tested this application first on caregivers because they understand the needs of patients better than others and then finally, we tested it on patients. During the duration of testing all patients were with their caregivers, in the whole month of testing numbered of tasks were

recorded as mentioned in Table 2, caregivers and patients both took interest in this testing during testing feedback was taken regarding the application usage and its impact on the patients. As explained in figure 6, we obtain the desired results and feedback from this simple method. Table 2 presented the summary of the result taken during evaluation according to caregivers' overall patient's favored tasks management and sensory simulation the most as it helped them manage their tasks without much effort and music helps a lot for patients suffering from

Alzheimer's. This result ties well with previous studies wherein researchers demonstrated that music plays an important role in the people suffering from mild Alzheimer as it can make them remember the memory through music [18]. A similar conclusion was discussed by another researcher in his latest study that an interactive interface of smartphone applications can help the caregiver to keep a check on the patients from time to time by retrieving their location [30].

During evaluation, many obstacles were discovered such as freezing of the touchscreen because of lack of experience and knowledge to either touch the screen with the fingerprint or fingernail that can easily frustrated them and they concede using the application so the new interfaces became challenging for them, in addition to this some patients tested this application by using a prop or stand for holding the smartphone or smart tab because of their deteriorated muscles. as seniors aged their muscles started to aged too and lost its strength and mass to hold things properly and because of this holding the device and testing its features was burdensome, Considering this the issue of touchscreen can be managed by teaching them but the device should be light in weight and must have large screen so it is easy for them to use the touchscreen properly and easily. The operating system can be improved by vibrant colors to make it more attractive and useable. After further usage of application participants became confident about the working of the application.

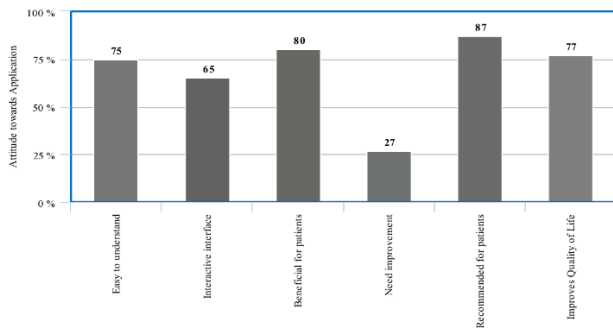


Fig. 6 Feedback of Caregiver

6. Conclusion

This technological solution that can make elder people life more manageable by providing different attributes, we have discussed in this paper. These core features are not commonly available in other applications available for elder people. Our application mainly focuses on managing daily activities easily and providing in an effective and effortless way to solve these tasks, furthermore it provides stimulation for the brain that keeps on monitoring the memory state of the patient. The feedback of patients and

caregivers were surprisingly amazing as they find the interface easier and interacting over the short period of time, the more they used the application, more they got addicted to the application and gave us amazing feedback on usage of the application. This results of testing shows how this application helps in remembering and recalling people and their surroundings through brain stimulation by showing pictures of the love ones and improving their brain state through the reduction of anxiety and depression by providing music, games and different entertaining features and how easy it is for caregivers to take care of their patients.

Future research will investigate the early symptoms of Parkinson's and Alzheimer's in people so that it can quickly warn the caregiver and patients early signs of the disease, accordingly receiving medical treatment. Moreover, the Authors are thankful for all the participants involved in that research and gave us precious feedback.

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