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Assistant Technology for Alzheimer's Patient: A Survey

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Abstract: *Alzheimer, a common form of dementia causes deterioration of cognitive abilities of an individual which results in difficulty in carrying out their routine activities. It is a type of dementia that causes problems with thinking, remembering things, and even change in behavior. However, the progression of the disease can be slowed down by improving the patient's quality of life, providing a solution for enhancing the cognitive abilities of the patient. One of the possible solutions is to motivate the use of Smartphone by the patient. Smart phones play a crucial role for the family members of the Alzheimer patients as it helps the patients in carrying out their routine activities by providing time to time notifications about them. In this paper, we have reviewed android applications that help in the assistance of Alzheimer's patients in their day-to-day lives and make their living easier.*

Key Word: *Natural Language Processing, Machine Learning, Artificial Intelligence, Navigation Tracking.*

I.INTRODUCTION

Alzheimer is a type of dementia that causes problems with thinking, remembering things, and even change in behavior. Our main aim of this project is to help Alzheimer's patients diagnosed with early and moderate level. The problem we are trying to solve is to give the patients a way to communicate, and share their experiences and memories.Our application will help patients add activity log, which logs all the activities performed by the patient, a to-do list and a medicine reminder, which will notify the patients about their prescribed medicines. The application will contain a conversational chatbot which will act as a friend to our patient and will record conversations shared by the patient. The AI bot will initiate conversations and talk to the patients. The patients can also initiate a conversation when lonely or to perform any other operations as specified above. The application will finally consist of a caretaker module which will provide personal information about the patient like medicines prescribed, other medical conditions, etc. This module will contain a navigation tracker which will track the patient's location and alert the caretaker if the patient has not responded for a long time. The caretaker module will also contain the emergency contacts of the near and dear of the patients which can be contacted during an emergency.

II.LITERATURE SURVEY

Living with Alzheimer's disease is not easy, for the person with the disease, his or her family and caregivers. With the advances in technology, new practices and innovative devices can now facilitate the care of Alzheimer's patients in order to provide them with quality care and a better living condition.
Following are the various technologies available to assist the patients:

1. Smart Watches

Watches specially designed for Alzheimer's are practical gadgets for everyday use. Worn by the patient, they are smart watches that help to situate oneself in time and to distinguish between day and night. They can also help with taking medication. Depending on the model, the watch can be connected to a mobile application installed on the smart phones of family caregivers. Intelligent, it can also warn loved ones in case of a fall or wandering.

2. Smart phones

Smart phones for patients are equipped with a pre-programmed phone book, a voice assistant that will allow patients to call without dialing a number, or applications that allow them to share emotions and feelings. People suffering from Alzheimer's disease need more than support, exchange and relational life to stimulate their brain.

3. Tracking and GPS devices

People suffering from Alzheimer's are the most at risk of getting lost. Tracking devices are systems that ensure the safety of the patient. They can give the alert and allow caregivers or family to find the patient in case of loss. Among other things, they can locate the person in real time. These devices can be worn as a bracelet or as part of a smart watch, phone or sensor.

4. Robotic Assistants

To help caregivers take care of patients, robot assistants are designed to perform recurring tasks on a daily basis. They are not there to replace humans, but they can perform certain tasks when caregivers are busy or absent at times. For example, they can remind patients to take their medication, alert them to danger, call caregivers in case of emergency, etc.

5. Pillboxes

Pillboxes offer better medication management. While the classic models offer a weekly schedule, others are equipped with innovative technology, capable of emitting a signal to remind people to take their medication or transmitting a signal to the smart watch. This type of technology can both help the caregiver who may be busy with other things. It can remind the patient of the administration of care. In case of forgetfulness, the pillboxes can emit a sound or send light signals.

6. In-home cameras

This is one of the remote security devices that allow caregivers and family to keep an eye on the patient. This system monitors the movements, actions and gestures of the Alzheimer patient and can alert in case of harmless situation. Some cameras are equipped with an innovative technology, they can have a voice assistant. Generally, they are installed in the patient's room or in the living area.

III.VARIOUS ASSISTANCE APPLICATIONS FOR ALZHEIMER'S PATIENTS

1. IntelliDoctor – AI based Medical Assistant (2019)

IntelliDoctor is an Artificial Intelligence (AI) based personal medical assistant. In an attempt to provide smart healthcare and making it more accessible, this interactive application analyzes symptoms to diagnose, predict medical conditions, generates treatments and suggestions based on the inputs provided by the user. It incorporates various fitness activities tracked and other factors like their age, gender, location, past medical records, and calories intake to perform a more accurate analysis. It performs accurate comprehensive diagnosis, which also serves as a pre-screening device for Doctors.

2. Alzimio: A mobile App with Geo fencing, Activity-recognition and Safety Features for Dementia Patients(2017)

This work develops the Alzimio mobile app, to provide safety functions to these patients; including safe-zone geo fencing, activity-based alarms, take-me-home, navigate to nearest friend, and check-on-me. Alzimio is able to achieve over 95% accuracy in less than 30 sec in most scenarios. The optimal threshold was found to be 65, to achieve best accuracy and delay. The phone was able to last throughout the day in their tests, which is very promising.

3. Personal Assistance For Alzheimer's Patient(2020)

This application includes face recognition, wandering and fainting detection, assistance to find a way home, reminders to daily chores and past life, organizing, and planning jobs. This can be implemented by using the sensors and GPS in smart phones to sense the actions of the patients.

4. Medbot: Conversational Artificial Intelligence Powered Chatbot for Delivering Tele-Health after COVID-19(2020)

This application is based upon a server less architecture and it aggregates the services of a doctor by providing preventive measures, home remedies, interactive counseling sessions, healthcare tips, and symptoms covering the most prevalent diseases in rural India.

IV.METHODOLOGY

The current market does not have an application which can cater to all the needs of an Alzheimer's patient. There are apps which provide To-do List or there are apps which provide medicine reminder but none of them provide all the features in a single application.

Therefore, we created an app which has all the features. These features are divided into the modules. The modules in our project will consist of:

4.1 Routine Activities

4.1.1 Activity Log

The activity log page contains a button to add a new activity and a list that shows the activities performed by the user. When the user clicks on the Add Activity button they will be directed to a new page and will be requested to input the name of the activity performed and the date and time at which that particular activity was executed. Due to the tendency of Alzheimer's patients to forget what they did in the past, this feature will allow them to remember all the activities as well as things they did in the past. The user will then click the add button and then will get redirected to the home page where they can see the activity being shown to them in a list order. The user need not input the date and time of the activity as the app allows then to input the current date and time by default making the user interface a lot easier to use.

4.1.2 To-do List

The To-do list page is used when the patient needs to do some activity in the future but due to their disability, they forget what they wanted to do. Thus, the user can add a to-do list which will remind them every hour about the things they wish to do with a simple notification. This feature will help the user remember all the tasks they wanted to perform throughout the day. The user will get a notification every hour reminding them about checking the app and reminding them about the tasks they are going to do. The user can update or delete a particular task if they wish so.

4.1.3 Medicine Reminder

Almost all the Alzheimer's patients are under some medication which can help them in battling the disease. These can be different types of medicines with different doses during the day and can confuse the patient when to take the particular medicine and at which time. Therefore, to remind each and every medicine the patient will need to take during the day, this

feature was implemented. The user will add a medicine with specific time on which they will get a reminder to take the medicine. The UI is created such that the user will be able to see the medicine name and time clearly and use the interface with ease. The user can set the timer at any time and they will get the notification of the medicine with the name of the medicine specified in the notification. Due to the condition of the patient, they might forget to take the medicine so this feature will help them remind their medication.

4.1.4 Emergency Contacts

There may be time when the user may get lost due to their condition and can get into dangerous situations. As Alzheimer's Disease causes the patient to forget their memory, it can lead to the loss of important information such as contact number or name of their loved ones or caretakers. To help them in this situation, we have developed an emergency contacts section which will enable the user to add emergency contacts which the user can use when they are in an alarming situation to alert their caretaker and loved ones. The user can add as many contacts as possible in this section.

4.2 Conversational Artificial Intelligence

Conversational AI is the set of technologies behind automated messaging and speech-enabled applications that offer human-like interactions between computers and humans. Conversational AI can communicate like a human by recognizing speech and text, understanding intent, deciphering different languages, and responding in a way that mimics human conversation. Applied Conversational AI requires both science and art to create successful applications that incorporate context, personalization and relevance within human to computer interaction. Conversational design, a discipline dedicated to designing flows that sound natural, is a key part of developing Conversational AI applications.

Machine Learning (ML) is a sub-field of artificial intelligence, made up of a set of algorithms, features, and data sets that continuously improve themselves with experience. As the input grows, the AI platform machine gets better at recognizing patterns and uses it to make predictions.

Natural language processing is the current method of analyzing language with the help of machine learning used in conversational AI. Before machine learning, the evolution of language processing methodologies went from linguistics to computational linguistics to statistical natural language processing. In the future, deep learning will advance the natural language processing capabilities of conversational AI even further.

NLP consists of four steps: Input generation, input analysis, output generation, and reinforcement learning. Unstructured data transformed into a format that can be read by a computer, which is then analyzed to generate an appropriate response. Underlying ML algorithms improve response quality over time as it learns. These four NLP steps can be broken down further below:

- **Input generation**: Users provide input through a website or an app; the format of the input can either be voice or text.
- **Input analysis**: If the input is text-based, the conversational AI solution app will use natural language understanding (NLU) to decipher the meaning of the input and derive its intention. However, if the input is speech-based, it'll leverage a combination of automatic speech recognition (ASR) and NLU to analyze the data.
- **Dialogue management**: During this stage, Natural Language Generation (NLG), a component of NLP, formulates a response
- **Reinforcement learning**: Finally, machine learning algorithms refine responses over time to ensure accuracy

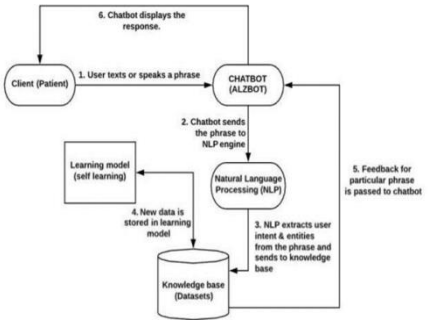

Fig. 1. Architecture of AI Chat Bot

4.3 Navigation Tracking

One of the unique features of mobile applications is location awareness. Mobile users take their devices with them everywhere, and adding location awareness to your app offers users a more contextual experience. The location APIs available in Google Play services facilitate adding location awareness to your app with automated location tracking, wrong-side-of-the-street detection, geo fencing, and activity recognition.

To protect user privacy, apps that use location services must request location permissions. One important difference when it comes to location permissions is that the system includes multiple permissions related to location. Which permissions you request, and how you request them, depend on the location requirements for your app's use case.

Appropriate use of location information can be beneficial to users of your app. For example, if your app helps the user find their way while walking or driving, or if your app tracks the location of assets, it needs to get the location of the device at

regular intervals. As well as the geographical location (latitude and longitude), you may want to give the user further information such as the bearing (horizontal direction of travel), altitude, or velocity of the device.

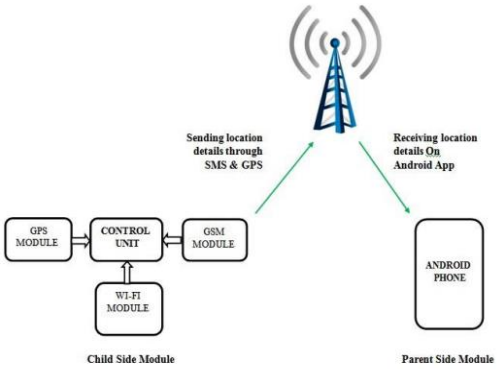

Fig. 2 Navigation Tracker

V.CONCLUSION

The proposed system planned after extensive research during the literature survey includes the implementation of Activity Log section, Todo List section, Medicine Reminder section along with a voice bot which will help in aiding the Alzheimer's patient. Easy user interface has been designed keeping the user's convenience in mind. In this survey, we were able to identify the drawbacks of existing systems and implement better solution for our project. The various applications discussed above gave us an understanding about how to build Alzheimer's patients assistance application.

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