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EarlyModern: An All-In-One Platform For Old Age Homes

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Abstract— The Old Age Home industry is largely untapped and has the potential for a massive improvement in terms of technological integration. One of the aims of the solution proposed in this paper is to equip senior citizens residing in Old Age Homes with emotional support. This will be achieved by integrating a voice assistant chatbot whose voice can be cloned to that of a loved one. Apart from this, the proposed solution can help in maintaining and tracking the health records of residents, pushing notifications, and scheduling essential daily activities.

Keywords—Old Age Home, Assisted Living, Senior Citizens, Elderly, Chatbot, Voice Assistant, MIS, Social platform

I. INTRODUCTION

The Old Age Home industry is one the most neglected industries present today, despite the philanthropic nature of its profession. There are very few services available for the management of day-to-day functions of an Old Age Home.

Senior citizens reside at such Old Age Homes either voluntarily or due to their misfortunes. Irrespective of their reason for resorting to Old Age Homes, they often encounter loneliness. This at times also leads to depression, making their final years torturous. Furthermore, due to health concerns, they are often unable to socialize with one another physically. Lack of movement and contact with the outside world further deteriorates their physical and mental health. As their age increases, some senior citizens are faced with forgetfulness, and they tend to neglect taking their meals and prescriptions and even sleep on time.

In addition, either due to lack of helpers or neglect by family members, senior citizens on account of not being technologically advanced, are unable to schedule their own appointments with ease. Existing services [1] for the same have a complex user interface that creates confusion, and they are still inaccessible to much of the population; senior citizens end up not going forward with them.

Therefore, there is a need for a system that can help manage the functioning of Old Age Homes, as well as act as a relief for senior citizens from loneliness and neglect.

A. Problem Statement

We aim to design an efficient and user-friendly Chatbot-based Old Age Home management system.

The proposed solution, *EarlyModern*, is an efficient and user-friendly application making use of a voice assistant chatbot to establish two-way communication between the residents and the management at an Old Age Home. The proposed solution also features an appointment scheduling system, a social platform, reminders for timely prescriptions, meals, and sleep cycles, as well as an emergency contact system.

A user (resident) can access the system and communicate using the chatbot for real-time physical help/service easily using minimum parameters; the USP of this chatbot will be a voice-based assistant who can clone the voice of a loved one and can casually converse with the user.

II. LITERATURE REVIEW

Almost 15 percent of adults over the age of 60 (senior citizens) live in precarious situations and suffer from mental illnesses [2], which makes psychiatric care wanting. With neglect, these numbers start burgeoning and proper care should be taken to mitigate loneliness because many psychiatric illnesses aren't conspicuous [3]. In fact, there are many chatbots developed to emulate a therapist. iHelpr [4] is one of those which helps us access areas that deal with stress, sleep, depression, self-esteem, and anxiety, on our own. Nevertheless, iHelpr needs improvements in two main areas, Intelligence and Handling Errors. A lot of research, in the past, was done on the textual channels and not on the audio or the spoken channel. However, Cortona by Microsoft, Siri by Apple, Google Assistant, and Amazon's Alexa have pioneered the domain of audio [5]. Chatbot with personalized audio for the elderly can revolutionize how loneliness is dealt with and treated by many other apps that are currently in use [6][7]. Another research [8] shows that many students felt more comfortable talking to the chatbot especially about the areas that dealt with anxiety and depression. The main cause behind the comfort was because the students felt "secure" talking to a machine rather than a human.

Further research states that Web-based cognitive-behavioral therapeutic (CBT) was effective and conversational agents are nothing but futile. Woebot [8], a chatbot that receives more than 8 million messages per month, was tested in a randomized control trial. The results were incredulous because the Woebot successfully ameliorated symptoms that caused depression within a span of 2 weeks. Chatbots are of extreme importance in India, primarily because Asia is likely to become the oldest region in the world. While old age homes in India are relentlessly trying to vindicate the needs that the elderly face at the old age homes, there is no medium for them to communicate and express themselves [9]. Chatbots have proven to be useful in the medical domain as well wherein studies such as [6][10][11][12][13][14] refer further chatbots which motivate users to exercise more and start inculcating good habits into their quotidian lifestyles. Hence, for long, very few have contributed to the area mitigating loneliness which motivates us to develop an application that sheds light on the area.

III. PROPOSED SOLUTION

The proposed system, *EarlyModern*, is a chatbot-based MIS cum social platform. It aims to monitor the functioning of old age homes while also acting as a means for social interaction among senior citizens. The proposed system displays functionality based on the roles assigned to each individual, which are further described below.

A. Old Age Home Resident

The proposed application interface for Residents consists of four primary features:

1) Appointment Scheduling and Reminders

This feature allows residents to schedule regular appointments for medical check-ups with their consultants. Senior citizens are given reminders of due appointments and are prompted for further consultations. This feature also sends them reminders to take their prescriptions on time when a member of the staff is not present.

2) Emergency Contact

In case of any emergency, residents can make use of this feature to notify contact emergency services and notify their doctors, family, and staff members. Residents will be able to always access the emergency button on the application to expedite getting help when required.

3) Social Platform

This feature acts as a forum for residents to share their thoughts, memories, media and discuss any grievances among themselves. This social platform will serve to assist senior citizens in mitigating loneliness and anxiety.

4) Health Reminders

This feature will allow residents to get timely reminders to drink water and go to sleep on time. The system will also track their water intake, calories consumed, and sleep cycles to make appropriate suggestions for improving their well-being.

5) Chatbot

Residents can make use of the chatbot to communicate with the system. Senior citizens who are unable to or unwilling to access other features of the system via the visual interface can do so through the audio or text interface of the chatbot. Further, the voice used by the system to communicate with the residents can be customized to provide senior citizens company of their loved ones.

B. Old Age Home Staff

The proposed application interface for the Staff consists of the following features:

1) Background Information

The staff members will be able to view the complete background of residents. This includes their medical history, allergies, routine, and contacts of their family members.

2) Appointment Schedules and Reminders

The staff members can view all appointments scheduled by the residents so that they can assist them wherever required. They can also schedule appointments for residents on their behalf. In addition, they will also receive reminders of due appointments and any medication to be given to the residents. Thus, they will be able to minimize the risk of skipped doses.

3) Emergency Contact

If a resident is unable to use the emergency contact feature due to any reason, staff members can do so on their behalf. They can use the emergency button on their respective interfaces to contact emergency services and notify the residents' family members.

C. Medical Practitioner

The proposed application interface for medical practitioners consists of three features:

1) Appointment Scheduling

Medical practitioners can suggest a consultation to residents and can confirm appointments scheduled by them. They will also receive a reminder about due appointments.

2) Medical History

Medical Practitioners will have access to the complete medical records of residents undergoing consultation by them. These include their past surgical procedures, prescription history, past ailments, and their family history. This will assist them in providing the most accurate diagnoses and prevent any further ailments.

3) Emergency Alerts

In the event that an emergency procedure is required, medical practitioners can notify the staff members as well as family members of a resident.

D. Administrator

The administrators can monitor and manage the entire functioning of the old age home. They can add, remove, and edit details of residents, staff, and medical practitioners in the system. They can closely monitor all appointments scheduled and can address any grievances. The administrators can also send notifications through the application to the residents, staff members, and medical practitioners.

IV. SYSTEM DESCRIPTION

A. Technologies Used

For the web application interface designing and validation, we have made use of HTML5, CSS3, React.js, and Material UI. To make the proposed solution accessible to all, we have made use of PWA (Progressive Web Application) technology; thus, it is supported on the web as well as Android and iOS devices. For database storage, we have relied on MongoDB (for easy storage and image uploads). For storing audio files sent by residents' loved ones, we will make use of Amazon S3. For the backend of the proposed solution, we have used Node.js and Express.js.

We have made use of the DialogFlow API/Rasa chatbot framework for machine learning. NLP (Natural Language Processing) is used for the chatbot system to efficiently resolve ambiguity in language and to add speech recognition (voice input - speech to text). For processing audio clips and adding the voice to the voice assistant chatbot, we have made use of Ableton Live. We have automated this process using Selenium.

For ensuring security we have used SHA 256 (Secure Hash Algorithms) algorithms, rate limiter to prevent DDOS (Distributed Denial of Service) attacks, and JWT (JSON Web Token) for session management.

B. Audio Processing

To customize the voice used by the chatbot according to the voice of the residents' loved ones, audio clips in their voice must be recorded first. The audio clips will consist of a list of words to be recorded by the residents' loved ones. The list consists of different words like *Good, Morning, Afternoon, Evening, and Night* for the greeting audio along with a list of Months, Numbers, and few phrases. This audio should be recorded with subtle pauses which will make the processing easier. This audio will then be normalized, processed, and gain-staged accordingly. Before the final .wav file is exported and stored into the database, the audio will be mixed and mastered using an AI (Artificial Intelligence)-based audio plugin that removes background noise, if any. It also takes care of excess sibilance, because the plurality of samples provided will be recorded using the built-in microphones of their smartphones which accentuates sibilance, and not using condenser microphones. Finally, all the exported .wav files will be stored in the database such that they can be easily accessed by the chatbot at all times.

V. DISCUSSION

The proposed solution, *EarlyModern*, will coalesce existing applications [1][6][7][8][11] with distinct uses into a single application acting as a panacea for Old Age Homes.

A. Future Scope

The utility of the proposed solution can be further improved by adding new features such as:

- A private messaging interface with end-to-end encryption for residents to communicate privately
- A video calling service for residents to communicate with each other or with their family members
- A calorie-monitoring service for medical professionals to track and plan the calorie-intake of residents
- Integrating national digital health IDs provided by the government

VI. CONCLUSION

The solution proposed in this paper will not only help in the efficient management of Old Age Homes but will also help in ameliorating loneliness and related mental conditions among senior citizens by giving them company via a voice assistant chatbot.

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