

AI Based Medicine Intake Tracker



Gulbakshee Dharmale, Dipti Patil, Swati Shekapure, and Aditi Chougule

1 Introduction

In this Android-based application an automated reminder system is built where patients can set a reminder for their medications. It emphasizes the contact between doctors and patients. Patients will be notified through a message within the system. They have the option of looking for a doctor for assistance. Patients will be provided with doctor contact information based on their availability. Also, patients will be notified about the expiry date of the medicine and the former history of the medicines can be stored for further reference [1, 2]. The proposed system prioritizes good user interface and easy navigation. We attempted to create a reminder system that is cost-effective, time-saving, and promotes medication adherence. Children, teenagers as well as all fall into the group of patients because we all have a rigorous schedule. If the patient's at home, someone may look after him or her, but if the patient is not at home, is out of the city or state, it is difficult for family members to contact and remind them of their dose schedules on a regular basis [3–5]. We rely entirely on devices, particularly smartphones, in our rapidly growing and technologically reliant lives. Everyone nowadays owns a smartphone. As a result, we will be able to make greater use of technology and make it more beneficial to us. It also plays a vital role in our daily lives, assisting us in remaining fit in a variety of ways. So, we're developing an android application whose goal is to use an alarm. This system is for folks who forget to take their medications on time. Users may establish

G. Dharmale (✉) · A. Chougule
Pimpri Chinchwad College of Engineering, Pune, India
e-mail: gulbakshi.dharmale@pccoepune.org

D. Patil
MKSSS's Cummins college of engineering for Women, Pune, India

S. Shekapure
Marathwada Mitra Mandal's College of Engineering, Pune, India

an alarm using the fields of date, time, and drug description, allowing them to set alarms for numerous medicines at different time intervals.

The problems we are working on:

1. Patients unable to take medicines on time due to their busy schedule.
2. Storing the prescriptions from doctors and health records like x-rays, reports of various tests.
3. Easy retrieval of previous health records.
4. Doctor assistance for patients with modest concerns (such as dosage/medication changes).

2 Related Work

Many different platforms and concepts have been used to construct medication systems. There are numerous worries regarding the functionality of healthcare-related apps, whose use is growing. My Therapy is an app for recording medications. This software not only monitors your medication consumption, but also your emotions and general health [6–8]. You may use the app to keep track of your symptoms and get specific treatment advice. My Therapy records your health data and creates a visual record that you can share with your doctor to help them figure out which aspects of your health need to be addressed [9–11, 17]. The Groove Health app is another. This app's built-in artificial intelligence engine helps you comprehend the medication you're taking by responding to any pharmaceutical or health-related questions a patient may have [18]. The app allows users to learn more about their medication, set personalized reminders to help them stay on track, and share their success with friends, family, or careers. Moreover, Round Health maintains a patient's prescription history, allowing them to keep track of how many pills they have taken and how many they have missed. The user will receive notifications from the Pill Reminder app until they mark the medication as taken [12, 13, 19]. Reminder systems now in use have various drawbacks. Here are a few illustrations: They don't offer any tools for tracking or checking a drug's expiration date. There is no option for automatically adding the medicine name after scanning the prescription. There are currently no facilities for storing patient medical histories and previous medications. Also, none of the systems hold health-related papers, such as maternity documents and various scan reports. Many of the systems need the purchasing of specialized hardware. Some systems include a built-in alert tone that users cannot change.

After comparing REMICARE system with few similar applications and studying the functionality of every module in those applications. It is observed that every application is User/Patient centric. There is no involvement of a doctor in the application. Whereas this application is Patient-Doctor centric. It is also observed that there is no facility of storing original documents on the cloud. And the facility of scanning prescription is not seen in any other similar application. The analysis of REMICARE with two other similar applications is described in the Table 1 below.

Table 1 Analysis of REMICARE

Functionality	REMICARE	My therapy	Care aid
Scanning prescription	Yes	No	No
Real time doctor support	Yes	No	No
Healthcare document Storage	Yes	No	No

3 REMICARE System

This REMICARE system offers a digital solution in the form of an Android application that can store personal health records and remind patients to take their medications on time. In this system, users are able to scan and upload the prescription image, which is then stored in the cloud. After scanning the prescription, the user will be able to set a reminder for the medication's name. The user can also add additional medications if he requires a reminder for his other medications. Additionally, he can manually enter the expiration date, and the application will send an alert message to the user prior to the expiration date. In addition, this application will provide a doctor's assistance for patients with trivial questions, such as dosage changes, the proper time to take a particular medication, and which medications can cause side effects when taken with specific foods, etc. Patients can also input their height and weight to calculate their BMI. Medical records storage is also essential for every individual. A woman can, for instance, store her maternity records. Additionally, it will be beneficial for patients with chronic diseases. During each visit, physicians can consult previous records. The REMICARE System Architecture as depicted in Fig. 1.

The REMICARE system, which runs on Android, uses automatic alarm buzzing and messaging to remind users to take their meds on schedule.

- OCR Technique is used to scan text from prescriptions.
- Patients can maintain their medical records on the cloud and access them when necessary.
- Patients and Doctors can communicate via the Chat-with-Doctor feature of this application to address any small problems.

3.1 Patient Login Module

If the patient needs something or has some inquiries, this app might be helpful. Even after the patient is released from the hospital, this application can remind him to take his medication on time. In order to communicate with their doctors, the user has the option. Doctors are able to modify anything. For instance, if the dosage of a certain medication needs to be altered. Also, it is possible to upload and amend the patient's nutrition record. With the app, the user can contact the doctor with queries

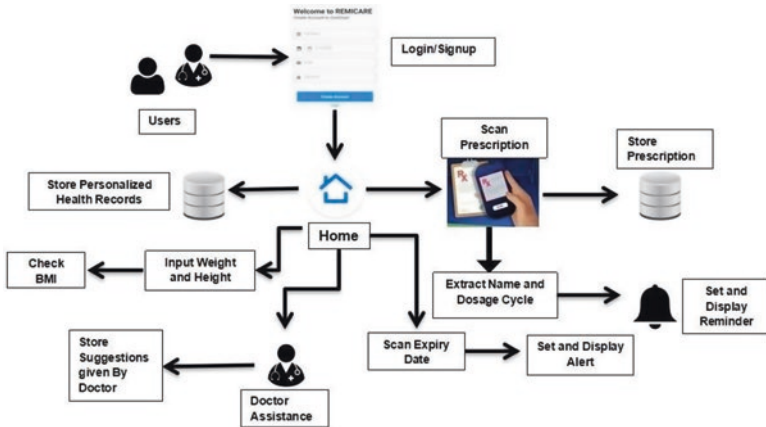


Fig. 1 REMICARE system architecture

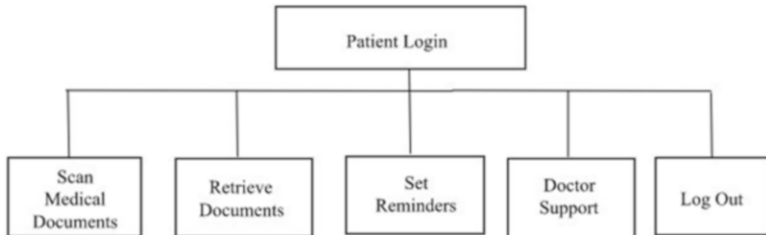


Fig. 2 Patient login module

and offer health and fitness information. If a patient is or was suffering from a sickness or illness, the physician can access the patient’s cloud-stored medical history and treat him or her accordingly.

Figure 2 illustrates the patient login module. After logging onto the REMICARE system, the user/patient will be able to view the many options, including scanning medications and necessary papers, create a reminder, receive physician help, retrieve previously stored documents, and log out. After scanning a medicine script, image processing will extract the drug’s name, and the remaining information will be set according to the medication schedule. Following this, the patient will receive timely medication reminders. Chat with Doctor Feature is helpful for the treatment of numerous serious illnesses, such as Covid-19. Doctors are able to converse with patients, suggest improvements, and modify doses of drugs based on their needs.

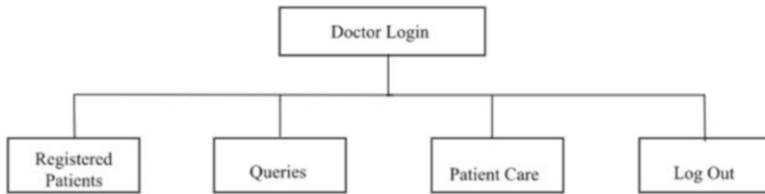


Fig. 3 Doctor login module

3.2 Doctor Login Module

Doctors can login into REMICARE system through doctor's login module. Doctor will keep track of patient's medication history. Doctors will provide suggestion to patient and solve their minor health issues using Chat with Doctor Feature. Notification of patient's medication will send to doctor.

Figure 3 illustrated the login module for physicians. After logging into the system, the doctor is able to view the list of registered patients. Physicians can respond to the questions listed in the questions section. In the patient care section, a physician can also provide recommendations to a specific patient and modify the drug schedule.

4 Result and Analysis

In this system, there are two logins, one for the patient and another for the doctor. For patient login, he/she needs to give some basic details like name, etc. and register first. We have provided different attributes in this application. Whenever a user will log into his account he will encounter the different features of the system. If the user wants to set-up a reminder for his medication, then he will have to enter details like the name of the medicine, time slot, days etc. User can select the notification tune as per his choice. Another feature of this application is that it will alert users about the expiry date of the particular medicine. When a user buys a new medicine, he can enter the medicine name and its expiry date. System can alert the user based on the date he has entered. Keeping medical records is essential for every person. There is one more feature in which we can scan and store all our medical prescriptions with the help of cloud storage. One could save their pregnancy records. During each visit, physicians can consult previous records. Additionally, it will be beneficial for patients with chronic diseases. Additionally, interaction between patient and doctor is also possible. The user can communicate with their doctors directly. Doctors can update everything for e.g.: if there is a need to change the dosage of a particular medicine. It is also accessible to update and upload a patient's diet chart. If a patient has questions, he can contact the doctor and provide wellness updates through the REMICARE system.

This system puts forward an automated solution to remind patients about their medications with the help of an android application. The real objective for creating this REMICARE system is to remind users to take their meds on schedule. User has to enter the time slot and the medicine name and it will set a reminder and alert the user on time. Additionally, it is possible for the user to add extra meds as well as make changes in the previous entries. Along with this, it will alert users about the expiry date of the medicine. Whenever a patient restocks his medicines, he/she can enter the name and expiry date of that particular medicine. Application will also store personal health records. Users have to scan and upload their old prescriptions and will be stored on cloud. Doctors can refer to these records in their further appointments with that particular patient. This will provide access to our medical history to us as well as our doctor.

The REMICARE system will also offer medical advice to patients with minor concerns, such as how often to take a medication, when it is best to take it, which medications may have unwanted side effects if taken with a specific food item, etc. The use of this app is not just limited to chronic diseases but we can also use this for the people suffering from covid-19 or omicron. Doctor – Patient Interaction proves to be very useful if the patient is suffering from Covid-19. All the health data, prescriptions and other reports or medical records can be stored and along with this patient can update the doctor about his/her improvements in health after getting discharged. Doctors can also update about the change in dose or diet if necessary. If a user wants to calculate his BMI, it is possible with the help of this application.

4.1 Login / Sign-Up Module

In this module, the user has to enter his details like email id and set a password. Login id will be registered and account will be created as shown in Fig. 4. For the sign-up page, the user has to enter the details like full name, date of birth, email id and password. Later on, after logging into the system, it will redirect to the home page. This page ensures the user registration and authentication with the firebase database. Users can register him/her on the application and later on they can log in to the application as given in Fig. 5.

4.2 Health Document Storage Module

This module ensures the important health documents of the user are stored safely to the cloud with easy access. These files uploaded to the cloud through the application can be available any time for the user to view and download. For storing documents, we use the Flutter Firebase Storage plugin. This plugin is used to use the Firebase Cloud Storage API. Users can access your files from both Firebase and Google Cloud thanks to Cloud storage for Firebase, which saves them in a Google Cloud

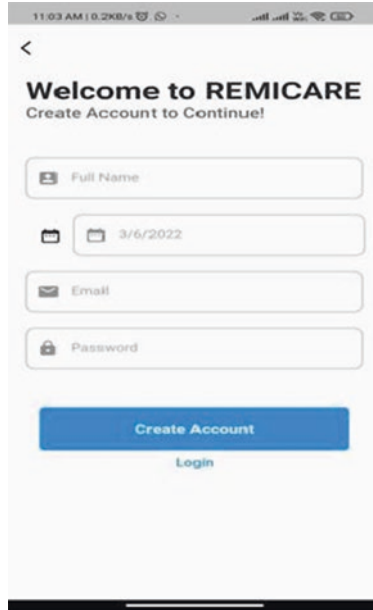


Fig. 4 Sign up page

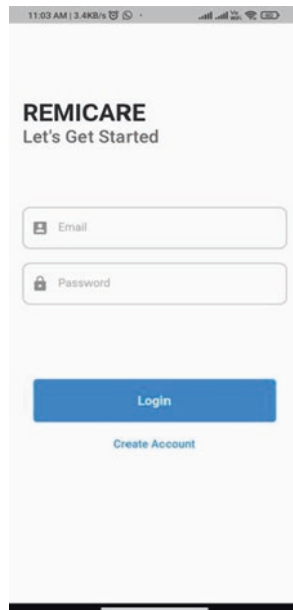


Fig. 5 Login page

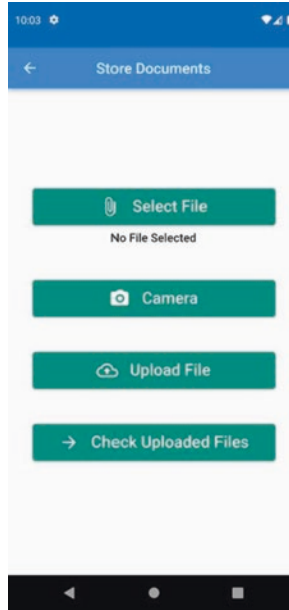


Fig. 6 Module for uploading documents module

Storage bucket. Users have the option to upload and download files from mobile clients thanks to the Firebase SDKs for Cloud Storage.

In this module, the user can scan the prescription, documents and upload it securely on the cloud as shown in Figure 6. Nowadays we tend to misplace the hard copy of the documents or healthcare records. In case of some chronic diseases, it's important to store all the records from the beginning so that the doctor can refer to it every time. Users can also scan the digital prescription printed by the doctor and this application will extract the medicine name, time and dosage from the prescription to set the reminder. It is also possible to store the maternity records so the mother can refer to them a second time if necessary.

Patients can also retrieve the documents uploaded as shown in Fig. 7. This is very beneficial for the user of the system since there is no need to store a bunch of old hardcopies. Users will have to just upload the prescription or reports and use these documents whenever needed. This is beneficial if the user forgets or misplaces the old records or if the user is in some other city.

4.3 Medication Reminder Module

The module is implemented for the patients to be able to set reminders for the tablets, syrups or injections they need to take. The user is supposed to enter the medicine name and the dosage of the medicine. Also, users can take a picture of the

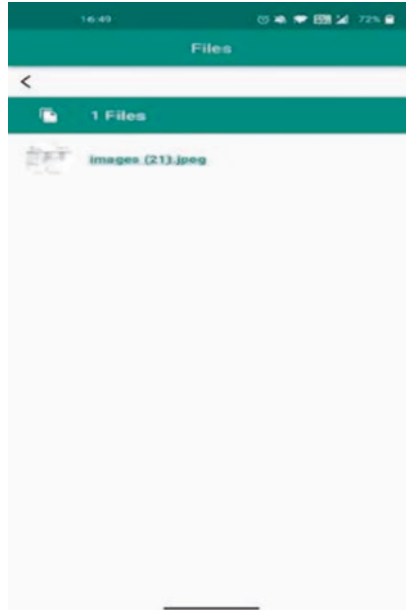


Fig. 7 Retrieve documents

prescription and the application will automatically extract the prescription details. This module uses Google ML Kit API for text recognition. This API works with the OCR algorithm for text recognition. Text is divided into blocks, lines, and elements by the Text Recognizer. In general, a block is a continuous group of text lines, like a paragraph or column [14, 15]. A Line is a continuous line of words arranged along a single axis. A continuous group of alphabetic symbols arranged along the same axis is known as an element. For every detected blocks, lines, and items, the API returns the bounding boxes, corner points, recognized languages, and recognized text [16]. After extracting all the details from the prescription, we can set the alarm by using the Flutter Alarm Clock plugin.

In this module, users can add the reminders shown in Fig. 8. User has to select the medicine type then enter the name of the tablet and dosage. Then the user can add the time, time interval and date so that the remainder will be set accordingly. Another facility for scanning the printed prescription and extracting the data is also provided. User will scan the prescription then the data will be extracted. Patients who frequently fail to take their medications on time are the target audience for this particular module.

Nowadays many doctors are switching to a digital prescription. This system can scan the text from the printed prescription as given in Fig. 9. Data like medicine name, dosage, time etc. will be extracted from the prescription and reminder will be added automatically.



Fig. 8 Add reminder

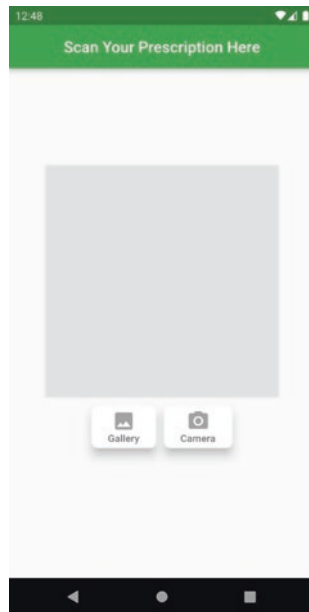


Fig. 9 Scan prescriptions

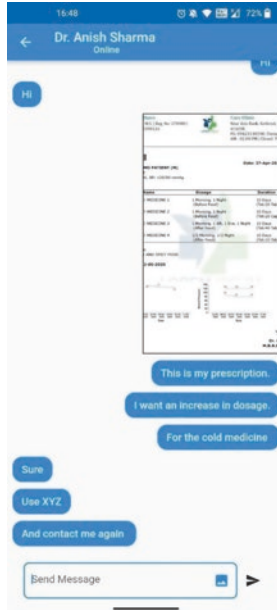


Fig. 10 Chat with Doctor

4.4 Doctor Support Module

This module focuses on the interaction between patients and doctors. The queries a patient has are solved by the doctor the patient trusts and has visited. The user will be able to take follow ups with the doctor through the application itself. Users can send images of their prescription and documents by using the Flutter Image Picker plugin. Users can send previously saved photographs from their Android smart-phone or snap real-time images with the aid of this plugin.

Users will be able to take follow-ups with the doctor through this application. Instead of waiting in the queue, the user can solve his trivial doubts directly. If a doctor wants to update the diet or dosage, then he can do it on the app itself. It can be helpful for some communicable diseases like Covid-19. Figure 10 depicts Chat with Doctor Feature of REMICARE system.

5 Conclusion

In this project we have put forward a digital solution to remind patients about their medications by developing an android application. This application has a unique feature which will remind us to take our medicines on time. Once the user enters the name and time slot of the medicine as prescribed by the doctor, it will set a reminder

and alarm the user at that particular time. Users can also select any alarm tone from the given options. Users can also add extra meds in case he needs a reminder for his other medications. If the user did not take his/her meds then it will send the notification to their emergency contacts provided by the user from the application itself. This system provides the feature in which it will alert us about the expiry date of the medicine. Whenever a patient restocks his medicines, he/she can enter the name and expiry date of that particular medicine. Once we enter all the details, the application will automatically remind us about the expiry date when it's near so there is no need to check the expiry date more often. Furthermore, this application also stores personal healthcare records. It is possible for users to scan and upload the image of the prescription which will be stored on the cloud. This will provide access to our medical history to us as well as our doctor if access is given by the patient. Doctors can refer to these records in their further appointments with that particular patient and assess the patient accordingly. In addition to this our application will also provide doctor's assistance for patients having trivial doubts such as change in dose or medicine, proper time to take the particular medicine, which medicine can cause some side effects when taken with a particular food item etc. The use of this app is not just limited to chronic diseases but we can also use this for the people suffering from Covid-19 or Omicron. Doctor – Patient Interaction which is possible during normal diseases impacts greatly in patients' recovery can also be very useful for a Covid-19 patient who is quarantined during treatment. All the health data, prescriptions and other reports or medical records can be stored and along with this patient can update the doctor about his/her improvements in health after getting discharged. Doctors can also update about the change in dose or diet if necessary.

6 Future Scope

- The developed product can be used in various healthcare domains such as:
Integration of IOT: Integrating IOT Devices with the current application will widen its usefulness. Various IOT Devices like smart watches and fitness bands can be integrated with the app and it can maintain the records such as stress level, SpO2 level, BPM, calories burnt, exercise time and all these records can be saved on the application.
- Diet Recommendation: Provision of doctors providing the patient a diet through the application is something which can be an addition to this solution. Doctors can update the diet chart depending on the patient's requirement.
- Video call: This feature can prove helpful for doctor patient interaction. Patients can arrange a video call instead of going to the clinic for follow-up.

References

1. Vyavahare, S., Sagade, M., Hajari, K., & Surwase, S. (2020). Handwritten cursive English text recognition using deep CNN-RNN based CT. *International Journal of Future Generation Communication and Networking*, 13(2s), 564–569.
2. Anter, A. M., Elaziz, M. A., & Zhang, Z. (2022). Real-time epileptic seizure recognition using Bayesian genetic whale optimizer and adaptive machine learning. *Future Generation Computer Systems*, 127, 426–434.
3. Gupta, A., Srivastava, M., & Mahanta, C. (2011). Offline handwritten character recognition using neural networks. In *ICCAIE 2011–2011 IEEE Conference on Computer Applications and Industrial Electronics*. IEEE. <https://doi.org/10.1109/ICCAIE.2011.6162113>
4. Olaleye, S. B. (2021). Security of sensitive data on android smartphones using cloud storage with reference to gravitational search algorithm. *International Journal of Computer Science and Mobile Computing*, 10(3), 72–82.
5. Anter, A. M., Mohamed, A. W., Zhang, M., & Zhang, Z. (2023). A robust intelligence regression model for monitoring Parkinson's disease based on speech signals. *Future Generation Computer Systems*, 147, 316–327.
6. Olaleye, S. B., & Kant, S. (2018). Secure use of cloud storage of data on smartphones using atomic AES on ARM architectures. *International Journal of Applied Engineering Research*, 13(5), 2569–2581.
7. Mehala, M., & Viji Gripsy, J. (2020). Voice based medicine reminder alert application for elder people. *International Journal of Recent Technology and Engineering (IJRTE)*, 8(6), 2284–2289. ISSN: 2277–3878.
8. Fang, K. Y., Maeder, A. J., & Bjerling, H. (2016). Current trends in electronic medication reminders for self care. *Studies in Health Technology and Informatics*, 231, 31–41.
9. Poonguzhali, P. K., Prajyot, D., Chaithanya, M. K., & Patil, M. U. (2016). Secure storage of data on android based devices. *International Journal of Engineering and Technology*, 8, 177–182.
10. Santo, K., Chow, C. K., Thiagalingam, A., et al. (2017). Medication reminder APPs to improve medication adherence in coronary heart disease (MedApp-CHD) study: A randomized controlled trial protocol. *BMJ Open*, 7, e017540. <https://doi.org/10.1136/bmjopen-2017-017540>
11. Hayakawa, M., Uchimura, Y., Omae, K., Waki, K., Fujita, H., & Ohe, K. (2013). A smartphone-based medication self-management system with real-time medication monitoring. *Applied Clinical Informatics*, 4, 37–52.
12. Zao, J. K. (SMIEEE), Wang, M. Y., Tsai, P., & Liu, J. W. (FIEEE) (2010, July). Smart phone based medicine in-take scheduler, reminder and monitor. *The 12th IEEE international conference on e-health networking, applications and services*. IEEE. 978-1-4244-6376-31101\$26.00 ©2010 IEEE
13. Ameta, D., Mudaliar, K., & Patel, P. (2015). Medication reminder and healthcare – An android application. *International Journal of Managing Public Sector Information and Communication Technologies*, 6, 39–48. <https://doi.org/10.5121/ijmpict.2015.6204.20>
14. Shi, B., Bai, X., & Yao, C. (2015, July). An end-to-end trainable neural network for image-based sequence recognition and its application to scene text recognition. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 39, 99.
15. Bagyalakshmi, N., Sai Adhitya, B. S., & Youvashree, K. M. (2019, March). A review on medicine reminder and adherence system. *International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering an ISO 3297: 2007 Certified Organization*, 8(1), 59.
16. Purohit, A. (2016). A literature survey on handwritten character recognition. (*IJCSIT*) *International Journal of Computer Science and Information Technologies*, 7(1), 1–5.

17. Anter, A. M., & Zhang, Z. (2023). RLWOA-SOFL: A new learning model-based reinforcement swarm intelligence and self-organizing deep fuzzy rules for fMRI pain decoding. *IEEE Transactions on Affective Computing*. <https://doi.org/10.1109/TAFFC.2023.3285997>
18. Anter, A. M., & Abualigah, L. (2023). Deep federated machine learning-based optimization methods for liver tumor diagnosis: A review. *Archives of Computational Methods in Engineering*, 30(5), 3359–3378.
19. Thakare, A., Anter, A. M., & Abraham, A. (2023). Seizure disorders recognition model from EEG signals using new probabilistic particle swarm optimizer and sequential differential evolution. *Multidimensional Systems and Signal Processing*, 34, 1–25.