Medi-Track

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Abstract - In modern healthcare, the emphasis is on promoting self-care and prioritizing patient autonomy over solely relying on therapy. Medication management plays a crucial role in comprehensive healthcare, and medication administration errors lead to significant financial losses each year. To combat these issues, the local app "Seeb" was developed to help Iranians manage their medications efficiently. Concurrently, the app "Medi-Track" was created using the Flutter framework for cross-platform mobile development and integrates Firebase for backend support. Medi-Track provides users with the ability to add their medications, schedule reminders, and track health records, thus streamlining medication management. The app extends beyond medication tracking by serving as a health journal for users to record key health information. Medi-Track aims to enhance efficiency and support individuals by transforming innovative healthcare concepts into practical applications.

Keywords: Statistically tracked particle swarm optimization (STPSO), Group statistical characteristics, Deregulated automatic generation control.

I. INTRODUCTION

Medi-Track is a cutting-edge Android application thoughtfully designed to be an essential companion in managing healthcare. Its key objective is to simplify the often challenging process of tracking medication and organizing doctor's appointments. With an easy-to-navigate interface and advanced features, the app offers users a centralized hub for efficiently overseeing and tracking their health-related data. No longer will users miss medication doses or forget appointments, as Medi-Track utilizes reminders to keep users consistently on schedule. This intuitive app excels in facilitating medication tracking and appointment management, creating a streamlined, centralized location for easy organization. Beyond its core capabilities, Medi-Track stands out by offering a unique pharmacy directory that assists users in identifying affordable medication options. We encourage you to embrace a more streamlined and accessible approach to healthcare with Medi-Track, your personalized health partner. In the Particle Swarm Optimization (PSO) algorithm, each particle's path is influenced by its velocity adjustments based on global and personal bests. Achieving an appropriate balance between these values is crucial for optimal performance and is influenced by parameters such as acceleration constants and inertia weight. A higher inertia weight encourages broader exploration, while a lower weight focuses on local search. The success of the algorithm hinges on the chosen strategy for selecting the population for the next iteration based on current iteration data.

II. LITERATURE SURVEY

Since the last ten years, there has been a lot of study done on the controller design issues for nonlinear systems that are susceptible to real-time complications like time delay, either in state or in input and actuator non linearities[1].Time delays cause complex behavior in nonlinear systems, such as limit cycles and chaotic behavior, and they can occasionally even cause instability[1-3]. There are two types of controller design for delayed systems: delay dependent and delay independent [4]. Practical actuator characteristics are typically nonlinear and are characterized by nonlinearities like saturation, hysteresis backlash [6], etc. The actuator's nonlinear behavior results in the controller and plant parameters being adjusted, which can cause the system to function poorly or even become unstable. Saturation is the most prominent nonlinearity between these It is difficult to build controllers for systems that include both time delay and actuator saturation; this can result in a conservative controller architecture with a small stability window [11]. This approach addresses the issue of easing conservatism by broadening the realm of stability [9]. To create a dependable state feedback control system, one must have a solid understanding of the states. The unmeasurable states are usually inferred from the already available measurements and our understanding of the physical system, since it is sometimes impractical to measure the states [8]. It has proven especially challenging to build a stable adaptive observer that estimates the unmeasurable states and unknown system dynamics for a class of nonlinear systems susceptible to actuator saturation and/or time delayed state/input [5].

People's inability to take prescription medications as prescribed can be attributed to a variety of factors, including busy schedules, forgetfulness, and laziness. Stopping the use of prescription medications can cause patients to heal more slowly or not at all. In addition to the patients, society as a whole also suffers greatly when patients take longer to recover [10]. A delayed recovery may have long-term psychological and physical impacts on patients. Extended periods of recovery also negatively impact patient-physician relationships, which mostly revolve around trust. Patients thus start to question their diagnoses and their doctors [7]. Moreover, the combination of protracted recuperation periods and inadequate medications may create the perception that pharmaceuticals have no positive effects at all.

III. PROPOSED WORK

By providing a wide range of capabilities, the proposed Medi Track application seeks to simplify medical management for users. Users will be asked to set up their profiles upon first login, providing important medical data like personal information, medical history, allergies, and current medications. The functionality of the application is built upon this [11].

System Architecture:

Mobile App (Android):
The Android-based mobile application provides a user-friendly, seamless experience for users. The front end comprises interactive elements such as screens, buttons, and forms, enabling users to input their data, access medication schedules, and receive timely reminders on their devices, including smartphones and tablets.

Backend Infrastructure (Firebase):
Firebase underpins the system, offering real-time data management through Realtime Database and efficient communication via push notifications. This technology allows for live updates and ensures a highly responsive experience for users.

Optimization Engine:
The Optimization Engine processes user inputs such as medication names, dosages, frequencies, preferred reminder times, and specific instructions from healthcare professionals. It also accounts for the user's health profile, including pre-existing conditions, allergies, and possible interactions between different medications.

Probabilistic Modeling and Optimization Techniques:
The application may utilize probabilistic modeling methods to forecast medication adherence based on a range of factors, including previous adherence behavior, medication attributes, and user demographics. By examining historical adherence data and contextual information, the app can predict users' likelihood of adhering to medication schedules and offer personalized strategies to enhance adherence.

A. Key Features:

1) Real-time Matching:

The application creates individualized medication schedules for users by considering factors such as prescribed medications, dosages, frequencies, and healthcare provider instructions. Real-time matching allows for dynamic adjustments to the user's schedule, ensuring it aligns with any updates to their medication regimen, health status, or treatment plan. This flexibility promotes accurate and up-to-date scheduling that accommodates ongoing changes in the user's healthcare needs [2].

2) Advanced Route Planning:

The application enables users to enter all the medications they are taking, including the dosage and schedule for each one. By utilizing advanced planning techniques, the app optimizes medication timing and order to avoid conflicts, enhance effectiveness, and streamline the user's overall medication routine.

3) Data Security and Privacy:

The application lets users enter the various medications they have been prescribed, along with their respective dosages and schedules. By employing sophisticated planning algorithms, the app optimizes the timing and sequence of medication doses, aiming to reduce conflicts, enhance efficacy, and streamline the user's medication regimen.

4) Sustainability Integration:

The application supports the shift from traditional paper health records to digital ones, thus cutting down the need for physical storage and reducing paper waste. Digital records offer improved accessibility and can be efficiently updated and shared with healthcare providers.

IV. ADVANTAGES AND DISADVANTAGES

Advantages of existing system:

1) Improved Medication Adherence: By reminding users and organizing medication information, the app helps users stick to their schedules, which improves medication adherence and results in better health.

2) Personalized Medication Management: By entering their prescription lists, dose amounts, and special instructions, users can enable the app to customize reminders and suggestions to meet their unique needs.

3) Tracking Health Data: The app might have tools for keeping track of symptoms, vital signs, and side effects. This information can give users and medical professionals important insights into each other's health.

4) Convenience and accessibility: People can use their smartphones or tablets to get their medication information and reminders at anytime, anywhere, which makes accessing healthcare services more convenient and accessible.

5) Integration with Healthcare Providers: By fostering dialogue and cooperation between users and healthcare professionals, the app may improve care coordination and enable prompt interventions.

6) User Empowerment: The app gives users the tools and knowledge they need to properly manage their prescriptions, enabling them to take charge of their health and make well-informed treatment decisions.

Disadvantages of existing system:

1) Technology Limitations: Some users may lack access to or struggle with using smartphones or apps, potentially excluding certain groups or individuals with limited digital literacy.

2) Data Privacy: Storing sensitive health data on a digital platform raises concerns about data security and potential privacy breaches, especially if the app's security protocols are inadequate or compromised.

3) Dependence on Technology: Users might become too dependent on the app for medication management, which could lead to complacency or neglect of other important aspects of their healthcare routine.

4) Technical Challenges: Like any software, the app may encounter technical issues such as bugs or compatibility problems, which could impact its reliability and overall user experience.

5) Cost Considerations: Although some medication tracking apps are free or offer basic features at no charge, others may require payment for premium features, which could pose a financial barrier for some users.

APPLICATIONS

Patient Medication Management:

The Medi Track app allows patients to track their adherence to prescribed medicine regimens, manage their medication schedules, and receive dose reminders. Better medication adherence may result in improved health and disease management.

Chronic Disease Management:

The Medi Track app helps people with chronic diseases like diabetes, hypertension, or asthma by collecting pertinent health data and managing their medications. Users of the app may keep an eye on changes in health measures, keep tabs on their symptoms, and have productive conversations with their medical professionals.

Elderly Care and Assistance:

The Medi Track app might be especially helpful for senior citizens who may have memory problems or complicated drug schedules. With the help of the app's medication management features and reminders, older folks can live more independently and have fewer drug errors.

Caregiver Support:

The Medi Track app allows caregivers to monitor their loved one's health, help with medication management, and schedule appointments with medical professionals. The communication tools within the app can help caregivers and medical professionals work together more effectively, guaranteeing that patients receive all the care and assistance they need.

Healthcare Provider Collaboration:

Medical professionals can suggest the Medi Track app to their patients as a tool for tracking their health and managing their medications. In order to maximize treatment outcomes, providers can monitor changes in health metrics, examine patient medication adherence data, and take appropriate action when needed.

Telemedicine and Remote Monitoring:

The Medi Track app can support telemedicine consultations and remote monitoring of patients' health status. Healthcare providers can use the app to remotely review patients' medication adherence, assess changes in symptoms, and adjust treatment plans as needed, reducing the need for in-person visits.

Clinical Research and Population Health:

Researchers and public health officials can use anonymized data collected through the Medi Track app for clinical research studies and population health monitoring. The app's data analytics capabilities can provide insights into medication adherence patterns, treatment outcomes, and healthcare utilization trends.

Health Education and Empowerment:

By informing users on their prescription drugs, medical issues, and self-care techniques, the Medi Track app can act as a platform for health education and empowerment. With the app, users can be more empowered to actively manage their health and make well-informed treatment decisions.

V. CONCLUSION

This user-friendly application simplifies medication tracking and doctor's appointments, providing a centralized hub for easy organization. With proactive reminders to prevent missed doses and appointments, Medi-Track ensures optimal health adherence. Beyond its efficiency, the app also offers a unique pharmacy directory for cost-effective medication options. Join us in embracing a smarter and more accessible approach to healthcare with Medi-Track – your personalized health companion.

VI. FUTURE SCOPE

Integration with Wearable Devices: The app can integrate with wearable health monitoring devices to collect real-time data on users' health metrics, such as heart rate, blood pressure, and activity levels. This integration enables more comprehensive health tracking and personalized medication management.

AI-Powered Personalization: Incorporating artificial intelligence (AI) algorithms can enable the app to analyze user data and provide personalized medication management recommendations tailored to each individual's health profile, preferences, and medication adherence patterns.

Predictive Analytics for Adherence: Implementing predictive analytics models can forecast medication adherence trends and identify users at risk of non-adherence. The app can proactively intervene with personalized interventions to improve adherence and prevent adverse health outcomes.

Gamification for Engagement: Introducing gamification elements, such as challenges, rewards, and leaderboards, can enhance user engagement and motivation to adhere to their medication schedules. Gamified features can make medication management more enjoyable and foster a sense of achievement for users.

Virtual Assistant Integration: Integrating a virtual assistant or chatbot feature into the app allows users to interact with an AI-powered assistant for medication-related queries, reminders, and health information. This feature enhances user experience and provides additional support for medication management tasks.

Blockchain for Data Security: Leveraging blockchain technology can enhance the security and integrity of user data by providing a decentralized and tamper-proof system for storing medication records, adherence data, and health information. Blockchain ensures data privacy and security while enabling seamless data sharing between users and healthcare providers.

Telehealth Integration: Integrating telehealth services directly into the app enables users to schedule virtual appointments with healthcare providers, receive remote consultations, and access telemedicine services for medication management.

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REFERENCES

[1] [1] J.P. Richard, "Time delay systems: an overview of some recent advances and open problems", Automatica, vol. 39, pp. 1667-1694, 2003. V.L. Khantonov and A.P. Zhabko,
[2] "Lyapunov-Krasovskii approach to robust stability analysis of time delay systems", Automatica, vol. 39, pp. 15- 20, 2003.
[3] Naeemul Islam, Asif Mohammad Arfi, "Design & Implementation of an Automated Reminder Medicine Box"
[4] Institute of Electrical and Electronics Engineers (IEEE),October 2018.
[5] Zhao XC (2010) A perturbed particle swarm algorithm for numerical optimization. Appl Soft Comput 10(1):119–124
[6] Sumar RR, Coelho AAR, dos Santos Coelho L (2010) Computational intelligence approach to PID controller design using the universal model. Inf Sci 180(20):3980–3991
[7] E. Fridman and U. Shaked, "An improved stabilization method for linear time delay systems", IEEE Transactions on Automatic Control, vol. 47, pp. 1931– 1937, 2002.
[8] V.L. Khantonov and A.P. Zhabko, "Lyapunov- Krasovskii approach to robust stability analysis of time delay systems", Automatica, vol. 39, pp. 15-20, 2003.
[9] C.H. Lien, Y.J. Sun and J.G. Hsieh, "Global stabilizability for a class of uncertain systems with multiple time varying delays via linear control", International Journal of Control, vol.72,pp.904-910,1999.
[10] F. Morabito, A. R. Teel, and L. Zaccarian, "Nonlinear antiwindup applied to Euler–Lagrange systems," IEEE Transactions on Robotics and Automation, Vol. 20, no. 3, pp. 526-537, June 2004.
[11] P. He and S. Jagannathan, "Reinforcement learning neural-networkbased controller for nonlinear discrete- time systems with input constraints," IEEE Transactions on Systems, Man, and Cybernetics— Part B: Cybernetics, Vol. 37, no. 2, pp.425-436, April 2007.