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MedSync-App and Device to Promote Medication Adherence

Adith Arun[1], Mohamed Bilal K H[2], Mohamed Sakir P N[3], Rohit Jaison[4], Sheena Kurian K[5]

[1,2,3,4,5]Department of Computer Science and Engineering, KMEA Engineering College, Kerala, India
[1]aditharun89@gmail.com

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Abstract

The need for MedSync mobile app and device stems from the challenges faced by elderly and busy people in medication management. Forgetfulness is a common problem among older adults who need to take multiple medications at different times of the day. Age-related cognitive decline makes it increasingly difficult to remember medication schedules. Similarly, busy people often juggle multiple responsibilities and may forget to take medication in the midst of their busy lives. In addition, the psychology of the human mind plays an important role in medication non-compliance. Some people have the mindset of not taking their medication due to side effects, forgetting, or simply not understanding the importance of taking their medication. The MedSync app and device address these needs by providing timely reminders and specific reminder systems. The app uses the convenience of mobile technology to send personalized notifications so that users never forget to take required medicines. The device developed complements by providing physical reminders that act as visual or auditory messages to take medication. By addressing forgetfulness and overcoming psychological barriers, MedSync offer practical solutions to improve medication adherence. These allow users, especially older and busy people, to stick to their medic tion regimens and improve their overall health and well-being.

Keywords

Healthcare, Medication Adherence, Compliance Improvement, Mobile app

1. Introduction

Medication use and compliance have become major challenges for individuals with complex medication use in today's Fas paced world. These challenges are taken care by providing medication recalls and compliance monitoring systems. The pro-

posed and implemented model consists of two parts: a mobile app and a device. The mobile app helps users remember to take their medications on time and track their compliance. The app aims to simplify the medication management process and pro-vides a user friendly interface that improves medication adherence. It acts as a digital assistant sending timely reminders to users to take prescription drugs and allowing them to track their medication history. The main features of this application are drug reminders, drug tracking, drug information, user profiles, data storage, and reports. The medication reminder feature notifies the user at a specific time through customizable notifications so that they never miss a dose. Users can easily mark medications as taken or missed in the app, allowing them to track medication adherence and maintain an accurate medication history. The app also provides important information about each drug, including dosage instructions, potential side effects, and potential interactions. A personalized user profile allows us to customize the medication schedule and preferences and improve the overall user experience. Additionally, the app ensures secure data storage for privacy and confidentiality, and reporting features enable compliance report generation and data export for medical professionals.

The Medicine Reminder Device is a physical device designed to complement the app and provide a tangible reminder to take your medication. It offers a convenient solution for individuals who prefer a standalone reminder system and to those who do not have access to a smartphone. The device includes a variety of features like medication reminders, scheduling, compliance monitoring, and customizing alarms. The device is designed with simplicity and usability in mind. It features an intuitive user interface consisting of buttons and a display that allows users to set their medication schedule and confirm reminders effortlessly. The device emits audible alerts or visual indicators to prompt users to take their medication at designated times. It also offers customization options such as adjustable alarm volume, snooze function and flexible reminder intervals according to individual preferences. The battery life ensures continuous operation, and its compact size and portability make it ideal for use at home. By combining the app and device, this model aims to provide users with a comprehensive solution to effectively manage their medication regimen. The app offers the flexibility and convenience of a digital platform, while the device provides a tangible reminder. Together, these components aim to improve medication adherence, improve the user experience, and ultimately contribute to better health outcomes.

The scope of this model extends to individuals of all ages who rely on medication to treat their health problems. The medication reminder and adherence tracking system aim to provide a practical and user-friendly solution to improve medication adherence. It serves a wide range of users, including those with complex medication regimens, the elderly, and individuals with memory related issues. By incorporating both a mobile app and a physical reminder device, the project aims to accommodate different user preferences and ensure accessibility. The scope also includes data protection and security considerations, as well as the potential for integration with healthcare systems to improve communication between users and healthcare providers. The model makes a significant impact on the lives of individuals by promoting better medication management and overall well-being.

2. Background

Many mobile applications have been developed to handle drug compliance and compliance tracking. Examples of popular apps in this category are Medisafe, Mango Health, and MyTherapy. Medisafe provides personalized alerts, reviews and medication management. Mango Health gamifies the medication treatment process and rewards users for taking their medication on time. MyTherapy provides users and their caregivers with medication alerts, symptom reviews, and medication history. In addition to applications, there are many stand-alone devices that can assist medications. Pill dispensers like the Hero and MedMinder are electronic devices that dispense pills at scheduled times, providing accurate and timely notifications. Smart bottles like Pillsy [9] and AdhereTech [10] use sensors to monitor medication intake and send alerts to users and caregivers when medication is missed. This tool is especially useful for people who enjoy physical reminders or need help man-

aging difficult medications. Although there are apps and devices for drug compliance and compliance, there is currently no unified solution in the market. Users can choose different applications and devices individually, but no single integrated product can provide the flexibility and integration of hybrid applications and devices and truly solve the problem. Integrations that combine personal app functionality with custom notification tools can improve user experience. This combination can meet the needs of different users, such as the elderly and those with limited access to smartphones, and ultimately bring health benefits like cleanliness and better medication management. The development of such solutions could revolutionize drug compliance and compliance monitoring in the healthcare industry.

3. Methodology

Medication adherence and compliance plays a significant role in health management. The apps and devices that already exist are designed to enhance medication adherence. Digging into their features and benefits, we also discuss the un-tapped potential of a unified solution combining apps and devices for a comprehensive medication management experience. Following are the features of the proposed mobile app and device:

- **Medication Reminder**: Provides a clear and flexible medication schedule that allows users to set personalized alarms based on specific time and dosage instructions.
- **Compliance History:** provides users with a comprehensive overview of their medication adherence by recording important information such as doses taken and missed doses.
- **Medicine Finder:** Allows users to access important information about their medicines, including medication details, dosage instructions, usage and purpose.
- **Side Effect Checker:** Provides users with easy access to information about side effects associated with certain drugs. This feature provides users with important insights that enable them to make informed decisions about their treatment.
- **Medicine History:** enabling users to store textual records and images related to medications, personal healthcare, and doc-tors' orders.
- **AI Medbot:** As a skilled virtual assistant, it provides accurate information regarding medicine, using the most advanced algorithms to solve user queries.
- Tangible Reminders: The device displays visual or audible alerts to remind the user to take their medication.
- **Alarm Device:** emits a distinct and attention-grabbing sound at set intervals, ensuring users are promptly reminded of their scheduled tasks or appointments.
- **Portability:** Compact and portable design makes this device suitable for use at home or while traveling.

3.1. Software Requirements

Software requirements define the software components required for project development. The software requirements of our application include Android Studio, Java programming language, Figma, Firebase and Arduino. These tools and plat-forms provide the development environment, programming language, design capabilities, backend functionality and hard-ware integration necessary to build our MedSync application.

- Android Studio is an integrated development environment (IDE) designed specifically for application development. It pro-vides a set of tools to simplify the development process, including code editors, debuggers, emulators, and performance testing. Android Studio has features like code execution, design and seamless integration with Android SDK, making it the IDE of choice for developing high-quality Android apps.
- Java is a popular programming language widely used in Android application development, and its features make it

ideal for building powerful and versatile applications. Platform independence, hardware features, rich libraries, memory management, community support, and focus on security make it suitable for building powerful and useful applications, including Android applications. Its versatility and widespread adoption make it a good choice for developers looking to build great apps across multiple platforms.

- Figma is a powerful design tool with many features especially useful for frontend application development and prototyping. Some of the core features including collaborative design, vector editing, prototyping design, interactive prototyping, and more, help it be more effective in frontend application development. These features of Figma make it useful for modeling work, good collaboration and good design. Build the end of the application. Designers can use the power of Figma to create visual and interactive UI designs that provide a seamless user experience in the final application product.
- The Arduino IDE is compatible with a wide variety of Arduino boards, including official and third-party options. It also pro-vides access to a rich ecosystem of libraries, enabling developers to incorporate advanced functionality into their projects. Arduino IDE 1.8.10 is an essential tool for beginners and seasoned developers alike, helping to create new Arduino projects. Arduino IDE 1.8.10 offers a number of features that help create Arduino-based projects: code editor, compiling and uploading, library manager, serial monitor, board manager, integrated examples, and debugger. These features make up the Arduino IDE 1.8. versatile Arduino board programming tools that provide a comprehensive development environment for beginners and experienced developers alike.

3.2. Hardware Requirements

- The Arduino Uno board is one of the most popular microcontrollers in the Arduino family. An Atmega328P microcontroller has digital and analog input/output pins and onboard communication interfaces such as USB and UART. This card is known for its simplicity and versatility, making it ideal for many projects. It is easily programmed using the Arduino IDE, is compatible with a variety of shields and sensors, and supports a strong community with extensive knowledge and resources. Arduino Uno board is a reliable and practical platform for designing and implementing new electronic devices.
- The RTC DS3231 module is a high-performance real-time clock that can provide uptime for electronic devices. It uses a DS3231 integrated circuit with a built-in crystal oscillator for accuracy. The module communicates with microcontrollers or other devices using the I2C protocol and can be easily integrated into various functions. With its low power consumption and battery backup, the RTC DS3231 module provides uptime even during power outages. It is often used in applications that need to achieve real-time synchronization, such as data logging, alarm, and IoT devices.
- LCD (Liquid Crystal Display) is a widely used device in many electronic devices. It has a liquid crystal whose light transmittance can change when an electric current is applied. LCD screens are known for their low power consumption, small size, and ability to display alphanumeric characters and images. They provide clear and transparent results and are suitable for applications such as digital clocks, calculators and data guides. LCD displays are widely used in electronics as they are inexpensive, versatile and easy to integrate into different devices.
- The Buzzer B-10 is a small electronic device that makes a sound when power is applied. It is frequently used in many applications such as alarm systems, electronic games and warning systems. The Buzzer B-10 is compact, easy to install and requires very little power to operate. It produces loud and clear sound, suitable for both indoor and outdoor environments. With its simplicity and reliability, the Buzzer B-10 is an essential tool in electrical projects that require sound or audio interaction.

3.3. Architecture

The development process for a drug notification and compliance tracking application follows a similar pattern to general application development. However, it contains special considerations for the adequacy and requirements of the drug declaration and compatibility specifications. The following are the main steps in developing a MedSync application:

- **Gathering Requirements:** Understanding the specific requirements for medication reminder and compliance tracking, medication schedules, reminders, user reports, medication history, and related features such as dosage Define other functions such as adjustments or drug interactions.
- **UI/UX Design:** Create an intuitive and easy-to-use interface for easy drug access, programming and tracking paying close attention to product information, user guide, and side effects. Consider factors such as visibility, ease of use for older users, and consistent access procedures.
- **Development:** Use the functionality of the application according to the requirements. Improved functionality for drug access, drug scheduling, reminders, adherence tracking, drug history, and integration with external databases or APIs for drug information or review interactions.
- **Testing:** Carefully test the app functionality and interactions to ensure proper medication planning, reminders, accuracy, and data synchronization. Test the apps on different devices and screen sizes to ensure compatibility and functionality.
- **Export:** Prepare the app for export by optimizing, completing the content and following the specific process on the platform. Publish the app to the app store or distribute it to other channels.
- **Monitoring and Updates:** Regularly monitor user feedback, address bug reports, and make necessary updates to improve app functionality, performance, and user experience. The app is regularly updated with new features, security improvements and social improvements based on user needs and platform updates.

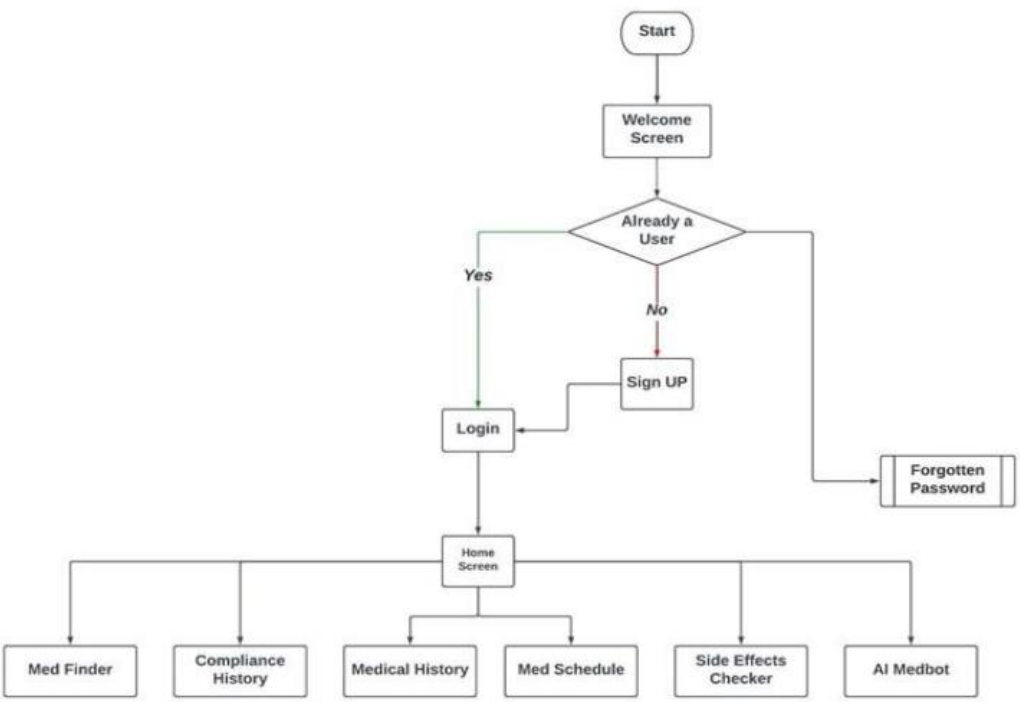

Figure 1. User Flow Diagram

The user flow diagram in Figure 1 shows the different screens and features of the Medsync mobile app, and how users can navigate through the app to access these features. The diagram starts with a Welcome Screen where users can either log in if they are already a user or sign up if they are new to the app. If a user forgets their password, they can use the 'Forgotten Password' feature to reset it. Once a user logs in or signs up, they are taken to the 'Home Screen' where they can access various features of the app. These features include 'Med Finder' which helps users find and identify medications; 'Compliance History' which tracks a user's medication adherence; 'Medical History' which stores a user's medical information; 'Med Schedule' which helps users schedule and manage their medications; 'Side Effects Checker' which allows users to check for potential side effects of their medications and 'AI Medbot' which functions as a virtual assistant that uses advanced techniques to answer user's medical questions, providing accurate and personalized information. The user flow diagram provides an overview of the different screens and features of the MedSync app, and how users can navigate through the app to access these features.

3.4. Main Features of the Proposed System

Medication Reminder: The app provides a flexible medication schedule that allows users to set personalized medication according to a specific schedule or multiple instructions. Through these features, users can customize their medication plans to suit their specific needs and preferences. The device can be used for many drugs, even if there are many drugs or complex drug instructions at different times of the day. The flexible schedule keeps users steady and ensures they never miss a single dose. By providing a convenient and easy-to-use medication planner, the device can contribute to wellness and overall health by helping improve medication adherence and help people manage their medication habits.

Compliance History: The mobile app diligently records crucial information such as doses taken, missed doses, and late doses, providing users with a comprehensive overview of their medication adherence. This feature empowers users to track their compliance with the prescribed regimen and gain valuable insights into their medication habits. By identifying patterns or trends in their medication-taking behavior, users can make informed decisions about their health and work towards improving their adherence. The compliance tracking functionality of the device serves as a valuable tool in promoting medication management and facilitating better communication with healthcare professionals, ultimately enhancing overall treatment outcomes and ensuring a higher level of patient engagement in their healthcare journey.

Medication Finder: This application provides users with medication information. It allows users to access important information about their medication, including drug names, dosage instructions, and usage. The tool displays this important information, allowing users to quickly and easily refer to important information about their medication. No matter how accurate the analysis or understanding of the drug plan, users can rely on the device to provide accurate and accessible information. This capability increases drug safety and awareness, keeping users fully aware of their prescriptions and enabling them to make informed decisions about their treatment.

Side Effect Checker: This new feature is very useful which allows users to get a complete picture of possible drugs by typing the name of the drug. Ranging from serious side effects to more serious side effects, this study treats and reports serious side effects, minor ailments, and even complications associated with the use of special medications. In addition, the chemical composition of the drug is explained and the drug in it is explained, and the understanding of the user is strengthened. The importance of this feature goes beyond simplicity, because it has a huge impact on patients and doctors. By fully understanding the potential side effects of prescribed medications, patients can make more informed decisions about their health. These features prevent surprises, make patients aware of symptoms, and increase self-care responsibility.

Medicine History: This feature has become an important tool in health management. This tool allows users, both pa-

tient or caregiver, to collect and organize massive amounts of information, including medical records, medication details, and professional treatment advice. It provides an easy-to-access storage area for important information, along with the ability to store text and images. Difficult medical guidance is very easy and ensures that relevant information is always available. This tool not only increases the effectiveness of health management, but also encourages a more holistic approach to patient care. By providing the foundation for important health-related concepts, expertise embodies an attitude of simplicity, organization and informed decision-making, ultimately empowering people to administer treatment and facilitating effective communication between patients and doctors.

AI MedBot: It is a virtual medical assistant that provides knowledge about medicine related topics. It uses artificial intelligence and large databases of drug information to help users better understand various drugs. Users can interact with AI MedBot via the user interface to ask questions about a particular drug, including its use, dosage, side effects, interactions with other drugs, and precautions. The advanced algorithms of AI MedBot ensure that users receive up-to-date and reliable information, enabling them to make informed decisions about their health and medication. Whether checking for potential interactions, understanding medication instructions or understanding side effects, AI MedBot is an essential tool that can increase drug safety and improve overall health.

4. Results and Discussion

The MedSync app, along with its medication reminder tool, has shown great results in improving medication ad-hence and solving medication administration issues. Below are key findings and discussions based on analysis and evaluation.

Increased Medication Adherence: Timely alerts and notifications from the mobile app combined with notifications from the device allow users to take their medication. This leads to greater compliance and less dosage.

User-friendly interface: Users found the app intuitive and easy to navigate. The user-friendly interface allows them to easily set medication schedules, track compliance and access medication information. Simple design tools and controls further enhance the user experience, especially for those who like physical notifications.

Personalization and Customization: The ability to customize medication alerts and preferences has been well received by users. They value the convenience of setting up multiple dosing schedules and customizing reminders. This personalization ensures user engagement and satisfaction.

Enhanced Drug Information: Drug information in the app has proven useful to users. They say that accessing detailed information about prescription drugs, including drug directions and side effects, enables them to make informed decisions and improve drug safety.

Compliance Tracking: users appreciated the compliance tracking app for allowing them to track their medication and track their compliance. This feature enables doctors to facilitate effective communication during medical appointments, resulting in better patient communication and better care coordination.

Future Enhancements: Based on user feedback, possible future improvements have been identified. These include integrating apps with devices for real-time monitoring, as well as connectivity options such as Bluetooth or Wi-Fi to connect to other devices. It is also recommended to add remote care and support to carers or family members to meet the needs of the elderly or their dependents.

The results and discussion together show that the MedSync application, along with medication reminder device, is useful and beneficial in improving medication adherence, improving user experience, and increasing medication safety. The app has user-friendly interface, personalized features, medication information, compliance tracking, and portable devices help provide a solution for effective medication management. These findings provide insight for further development and improvement to meet the changing needs of consumers and providers.

4.2. Conclusion

The MedSync mobile app and device offer a solution to the challenges of medication management and compliance. Leveraging the power of mobile technology and featuring user-centered features, the application aims to improve drug compliance and ultimately improve health outcomes. With its unique notification system, the app and device can send timely alerts and notifications to help users stay on the right track. This is especially helpful for people who tend to forget, such as the elderly or people with busy schedules. By receiving personalized reminders, users will not forget doses and will have the ability to better adhere to their medication routine.

In addition, the app's compliance tracking feature allows users to track their medication intake over time. Not only does this make their compliance visible to users, it also helps doctors track medication adherence to appointments, allowing for more informed decisions and self-care. The app also provides useful drug information allowing users to learn important details about their drugs, including dosage instructions and side effects. This information improves drug safety and enables users to make informed decisions about their treatment. MedSync aims to simplify the medication administration process, tackle mental health issues, and impact overall health of the people by combining these resources into a single user relationship. Overall, the app seeks to bridge the gap between prescribing and compliance by facilitating better medication management, improving health outcomes and improving user experience.

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