SmartCare: A Mobile-Based Medication Adherence and Elderly Care Monitoring System

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Abstract: Medication adherence is an important aspect of healthcare, particularly among elderly individuals who may need to follow multiple medication schedules for managing health conditions. Forgetting scheduled doses, difficulty interpreting prescriptions, and limited caregiver availability can create challenges in maintaining consistent medication routines. This paper presents SmartCare, a mobile-based medication adherence and elderly care monitoring system designed to support medication management and improve communication between elderly users and their caregivers. The system integrates medication scheduling and reminders, dose-taking confirmation, caregiver monitoring, prescription image processing using Optical Character Recognition (OCR), voice-assisted interaction, and an emergency SOS mechanism. Elderly users can access medication-related information and interact with the application, while caregivers can monitor medication status and receive notifications when a scheduled dose remains unconfirmed beyond a defined interval. Prescription image processing is intended to reduce manual data entry, while voice assistance provides an alternative interaction method. The system is designed to combine routine medication management with caregiver support and emergency communication in a unified application. The implementation is evaluated through functional testing of its core modules and assessment of reminder delivery, adherence-status tracking, caregiver alert generation, OCR extraction, voice interaction, and SOS functionality. Quantitative performance results will be reported following systematic testing. The proposed system aims to provide an accessible and integrated technological approach to elderly medication management and caregiver coordination.

Keywords: Medication adherence, elderly healthcare, mobile health application, caregiver monitoring, Optical Character Recognition, voice assistance, emergency alert system.

I.INTRODUCTION

The growing need, for long-term healthcare management has made it important to focus on medication adherence for people who live on their own or depend on help from family members and caregivers. Many older people have to take medicines at set times in amounts and with certain frequencies. Keeping track of all these schedules can be hard. May lead to missing doses or taking them at the time. Not following the medicine schedule as prescribed can make treatments less effective and might cause health problems that could have been avoided. Common methods like written lists, pill boxes and simple alarm reminders can help with managing medicines. However these methods may not give information about whether a dose was taken making it hard for caregivers to know if a scheduled dose was taken. Caregivers and family members are not always there to watch over medicine routines. So tools that check on medicine status and tell caregivers when a dose hasn't been confirmed can be very helpful. Older people may also have trouble entering medicine details by hand understanding what their prescriptions say or using phone apps. These problems show that there is a

need for a system that's easy to use and helps with both medicine management and keeping caregivers involved. Mobile health tools offer ways to solve these problems by using medicine schedules, automatic reminders, remote checking and simple interfaces. Features like OCR for reading prescription pictures and emergency message systems can add more to what medicine apps can do. Putting all these features into one system can make it easier to handle health tasks without using different apps. To meet these needs this paper introduces SmartCare, a system for helping older people take their medicine on time and for monitoring their care. The system includes medicine management, scheduled reminders confirming that doses were taken features for caregivers, processing of prescription photos using OCR and an emergency SOS option. These parts are meant to help with medicine tasks and to give caregivers a view of how well medicines are being taken. This paper explains how the system was designed what the main parts do how it was built and how it was tested. The main contribution is showing a in-one way to help with medicine taking for people and supporting their caregivers along with a way to test how well the main parts work. Details, about how it was built and how it performed during testing are included.

II. LITERATURE REVIEW

2.1 Review of Existing Literature

1. The use of Internet of Things (technology, in healthcare has opened up possibilities for creating medication reminder tools and systems for remote monitoring. Earlier research has looked at ways to help patients stick to their medication schedules track when they take their medicine and make it easier for patients and caregivers to talk to each other.

2. Sung and Yun (2017) came up with a medication reminder system for ageing support using IoT platforms and devices that connect to each other. Their system used a way of working based on the oneM2M standard and connected smart devices with reminders for medicine. The research showed how connected devices could help older people keep up with their medicine routines [1].

3. Mat Nasir and others (2022) shared a based system for making sure elderly patients take their medicine correctly. The system used a device called NodeMCU a schedule that could be changed and sensors connected to a pillbox to track when medicine was taken. It also included a way for caregivers to communicate through a platform showing how connected systems can help watch over medicine use from a distance [2].

4. Liang and others (2023) created a Medication Adherence Management System for adults who are cared for at home. Their idea used a robot that helps and a wearable device. Their plan included reminders for medicine tracking if the medicine was taken, a way for caregivers to stay involved and talking with the user. The study stressed how important it is to have a system that helps both people and their caregivers [3].

5. A study called Medicine Reminder and Monitoring System for Secure Health Using IoT (2016) looked into using IoT technologies for reminders about medicine watching from a distance and updating information, about medicine through a website. This work shows how medicine management can be linked to healthcare services [4].

2.2 Comparison with Existing Systems

1. Existing research shows that medication reminders using the Internet of Things, connected devices and monitoring tools, for caregivers can help support care.. These solutions vary in how they're built the interfaces they use and the ways they track health data.
2. SmartCare uses an app approach where medication scheduling, dose confirmation and caregiver monitoring all work in one system. It is designed to work with hardware like an ESP32-based device, an OLED screen, GPS and an SOS button. The project also looks into processing images of prescriptions. Creating reports on whether patients take their medicine as directed.
3. Unlike systems that focus on pill dispensing or robotic assistance SmartCare focuses on connecting a caregiver app, a patient interface and a small bedside device. This setup aims to give access, to medication details while allowing patients to confirm doses and record emergency situations.

2.3 Research Gap

1. The studies we looked at show ways to give medication reminders use devices and monitor patients

from a distance. These ways give a base, for creating integrated elderly-care solutions.

2. SmartCare aims to combine medication scheduling, patient dose confirmation, caregiver monitoring, emergency SOS reporting, location data and adherence reporting into one app and IoT-based setup. SmartCare also uses role-based access so that patients and caregivers can see the information that fits their duties. I think SmartCare makes life easier for patients.

3. SmartCare's value comes from putting all these functions and making them work in practice. We must prove how well each function works by checking and testing the system. Prescription image processing and emergency SOS still need checking and voice assistance is not yet, among the verified features.

References

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III.PROBLEM STATEMENT AND OBJECTIVES

3.1 Problem Statement

Elderly people who have to take medications can find it hard to remember each dose keep a routine and note whether they have taken their medicine. Simple tools, like written lists and basic alarms may not give caregivers insight into the medication status when they cannot watch the person all the time. More problems happen when the user has to type medication details by hand or pull data from pictures of prescriptions. A quick way for a person to call for help is also an issue.

Thus we need a system that brings together medication management, timed reminders confirmation that a dose was taken, caregiver monitoring and extra tools for reading prescriptions and for emergencies. SmartCare solves this problem by putting all those functions into one elderly-care app. The parts of SmartCare that read prescriptions and send SOS signals are only partly finished. Need work and testing.

3.2 Objectives

The primary objectives of the SmartCare system are:

1. To create an app that helps manage medication schedules and keeps medication information.

2. To give timed medication reminders. Let patients confirm that they have taken their dose.

3. To help caregivers monitor whether the patient takes medications and to send notifications for events.

4. To add image processing of prescriptions so that medication details can be extracted, with the data checked for accuracy.

5. To offer an emergency SOS button that lets the patient request help when needed.

6. To keep records of medication and adherence that can be used for monitoring and reporting.

7. To look into linking devices that display medication details and send actions back, to the app. This system is meant to help elderly people manage their medication routines and to let caregivers see the information through a linked care-monitoring platform.

IV. PROPOSED SYSTEM AND METHODOLOGY

4.1 Proposed System

SmartCare is a system that helps older adults take their medicine on time and allows caregivers to keep track of their medication habits. It is built to make managing medicine easier, for seniors and give peace of mind to those who care for them. The system includes an easy-to-use app that lets users see their medicine schedule get reminders confirm when they've taken a dose and share

updates with caregivers. The system uses a connected-care model. This means all medication details and patient actions are recorded in form. Caregivers can set up. Adjust medicine plans and schedules. Patients can check what they need to take and confirm when they've taken their dose. The system also includes a feature to read prescriptions from images and an emergency SOS button. These parts are still being. Improved. The system's design can grow to include a device built around an ESP32 chip. This device would sit near the bed. Have a screen, a GPS unit and a physical button. It will show when medicine is due record when a patient takes it and send an alert if there's an emergency. By connecting the app with this hardware the system aims to give an smooth way to monitor health and support users.

4.2 System Components

The SmartCare system consists of the following components:

1. User Interface: The application offers screens, for medication management reminders, patient information and caregiver monitoring. The interface is built to make crucial information clear and easy to read.

2. Medication Management: This module lets you keep medication details dosage instructions and scheduled times. It lays the groundwork for generating reminders and logging medication activities.

3. Reminder and Adherence Tracking: The system sends scheduled medication reminders. Let's patients confirm if a dose has been taken. These actions help keep medication adherence records.

4. Caregiver Monitoring: Caregivers can view patient medication information. Receive alerts, about medication events. This feature is meant to help caregivers follow up quickly if a dose is missed or needs attention.

5. Prescription Image Processing: Prescription pictures can be scanned to pull out medicine information. Because OCR can be wrong the extracted data must be checked by hand before setting a medication schedule.

6. Emergency Assistance: An SOS button is built in to request help. The plan is to send your location and alert caregivers. The full emergency process still needs work and testing.

7. IoT Hardware Integration: The hardware uses an ESP32, an OLED display, a GPS receiver and a push button. It will show medication details let people press a button to confirm a dose and start emergency alerts.

4.3 Methodology

The methodology adopted for SmartCare involves application development, medication schedule management, event recording, caregiver monitoring, and the planned integration of IoT hardware.

Step 1: User Access and Profile Management

The system offers user access and profile management to help organize patient and caregiver information. Access, to patient-specific information must be limited by user roles and permissions.

Step 2: Medication Registration

Medication details such, as medicine name, dosage and scheduled times are entered into the application. The stored information is used to display medication details and to create reminders.

Step 3: Reminder Generation

The system uses the configured medication schedule to show reminders at the times. The reminder mechanism helps patients follow their routines and lowers the chance of forgetting scheduled doses.

Step 4: Dose Confirmation

After the patient takes a medicine the patient can confirm the dose via the application. The confirmation is recorded to keep a history of medication activity. The system can use these records to tell confirmed doses from doses that remain unconfirmed depending on the status-handling logic.

Step 5: Caregiver Monitoring

Medication records and confirmation information are provided to authorized caregivers. This allows caregivers to review activity and spot events that need follow-up. Notification delivery and missed-dose escalation rely on the configured and verified implementation.

Step 6: Prescription Processing

A prescription image may be uploaded for extraction of medication information. The extracted text is treated as

a suggestion not as a prescription. Manual verification is required before the information is used to create or modify a medication schedule.

Step 7: Emergency Assistance and Location

The SOS feature creates an emergency event and notifies designated contacts. In the proposed IoT extension the ESP32 can get GPS coordinates. Send the last-known location to the platform. The complete hardware-to-server workflow must be validated before it can be reported as operational.

Step 8: Record Review and Reporting

Medication records can help review adherence history and caregiver follow-up. The system design also allows generating reports that summarize medication activity and emergency events. Report generation and PDF export must be tested before the feature can be claimed complete.

4.4 Proposed Data Flow

The overall process starts when a caregiver or authorized user types, in medication details and sets up a schedule. The application then shows reminders to the patient. After a reminder the patient confirms the dose and the new record helps authorized caregivers monitor adherence. The proposed IoT extension links the bedside device to the medication process. The device asks for medication information shows the details and sends patient actions or SOS events to the server via secure endpoints. The server logs the events. Makes the needed information available to authorized users.

The overall process can be represented as:

User Access → Medication Registration → Schedule Configuration → Reminder Presentation → Dose Confirmation → Record Maintenance → Caregiver Monitoring

The proposed emergency workflow is:

SOS Activation → Event Transmission → Server-Side Recording → Caregiver Notification → Event Review

4.5 Security and Reliability Considerations

The system is built to protect information using authentication, role-based authorization and limited access to records. Device communication should use authenticated API calls and HTTPS in production. Medication and emergency events should be saved in a way that supports updates and stops duplicate records when requests are retried. Prescription information must be checked by a person before use. Likewise emergency notifications should be tested in network and GPS failure scenarios. These steps are key to keep the system reliable, private and usable, for elderly-care monitoring. I hope this helps.

V. SYSTEM ARCHITECTURE AND IMPLEMENTATION

5.1 System Architecture

SmartCare uses a design that supports medication management, patient interaction and caregiver monitoring. The system can be split into four layers: the presentation layer, the application layer, the data management layer and the IoT device layer. The presentation layer offers interfaces, for patients and caregivers to view medication information and monitoring features. The application layer manages medication scheduling, dose confirmation, user access and notification-related tasks. The data management layer keeps medication details, user information and adherence records.

The IoT device layer is meant to add an ESP32-based bedside device that shows medication events and lets users press a button. These layers are built to share information, via defined application interfaces, which lets SmartCare grow without needing every component to work completely on its own.

5.2 Application Implementation

The SmartCare application is built using Flutter. Flutter helps create a user interface that works well on devices. The app has sections, for home information, medication management, health-related details and user profiles. The medication management section lets users enter medicine information and keep track of their prescriptions. It includes reminders and a confirmation process. This helps users take their medicine at the time and records whether they have taken it. Caregivers can view the medication details. Get alerts when something needs attention. The app is made with adults in mind. It focuses on being simple and easy to use. The navigation is clear. The text is large and readable. Actions are straightforward. These choices help make healthcare apps more accessible for users.

5.3 Data Management and Backend Communication

The system needs a way to store and manage data. This includes user profiles, medication schedules, dose confirmations and caregiver links. The app and the backend must share information in a way. This ensures that changes to medicine schedules and patient responses are updated correctly. The system uses application programming interfaces or APIs to communicate. In the IoT setup the APIs let the device perform actions. These include getting medication events, recording dose confirmations sending SOS alerts and updating device status. The actual database technology, API setup and authentication services must be documented based on how the project's deployed. The endpoint details in the system-design report show the planned integration. They do not mean that all endpoints are already working.

5.4 IoT Hardware Design

The proposed bedside device includes an ESP32 microcontroller, an OLED display, a GPS receiver and a push button. The ESP32 allows the device to connect wirelessly to the SmartCare platform. The OLED screen shows the medicine name, dosage amount, time and any simple instructions. The push button has two functions: a press to confirm a dose and a long press to send an emergency alert. The GPS receiver gives location data when a satellite signal is found. The device communicates with the platform through secure authenticated requests. The server checks the device identity. Makes sure it is linked to the patient before accepting any updates. Handling network failures and retrying events is important for performance. This hardware setup describes the planned integration. The final paper must clearly state which parts were built and tested separately and which ones were connected to the application.

5.5 Medication Event Processing

Medication event processing links the set schedule with confirmation and caregiver updates. When a medicine is due the app shows the patient the information. After the patient confirms they took the medicine the system records the response. Updates their adherence history. In the hardware process the ESP32 gets the scheduled medication event. It shows this on the OLED display. A short press of the button sends a confirmation request with the dose ID. The server checks the request. Records the event. The updated status appears on authorized dashboards. A long press of the button triggers an SOS event. This includes the patient or device ID, timestamp and location if available. The server saves the emergency event before trying to send alerts. This helps keep a record even if the notification system fails.

5.6 Access Control and Data Security

SmartCare is designed to separate levels of access. There is platform-level administration, project-level administration and patient-level access. The planned role-based access model lets administrators control project access caregivers monitor assigned patients and patients view their data. The deployed system should include authentication, server-side authorization, protected API communication, input validation and restricted access, to data. Device credentials must be stored securely. Devices should be able to be revoked if they are compromised. Medication information, health records and location data need privacy protections. Access must be limited to authorized users. Prescription details should be reviewed by a person before being used to create a medication schedule.

5.7 Architectural Components

5.7.1 User Interface Layer

The user interface layer offers the screens and interaction points for the application. It includes features, like medication management, medication reminders, dose confirmation, health information, profile management and emergency SOS access. The goal is to make navigation easy and reduce the effort needed to reach used functions. The caregiver interface allows caregivers to view medication details and adherence status. Access to this information follows the permissions and data rules that are set up in the system.

5.7.2 Application Logic Layer

The application logic layer manages the core operations needed for medication management. It is responsible for:

- Creating and updating medication schedules.
- Starting reminders based on the set schedules.
- Recording when a user confirms they took their medicine.
- Checking if a scheduled dose has not been confirmed within the allowed time.
- Starting the process to notify caregivers when a dose is missed.

• Handling prescription images and voice inputs through the configured services.

• Sending emergency alerts using the SOS function. The way these tasks are carried out depends on how the system's built. For example reminders might be handled directly on the user's device while caregiver notifications could go through a cloud-based service.

5.7.3 Firebase Backend Layer

Firebase acts as the backend for the application. Based on the setup it supports user login, stores medication schedules and adherence data keeps user and caregiver information in sync and sends notifications. Since the app deals with health data, medication records and caregiver details must only be available to authorized users. Strong access controls and secure handling of data are essential.

5.7.4 Notification Layer

The notification layer supports two flows: medication reminders for users and alerts, to caregivers when a dose is not confirmed in time. When a reminder is due the app or its scheduling service creates a notification. After the reminder the user can mark the dose as taken. If no confirmation comes in within the set time the system checks the escalation rules. Sends a caregiver alert. The system must recognize that a notification being generated is not the same as it being delivered or seen by the user. These are stages. Should be tracked separately.

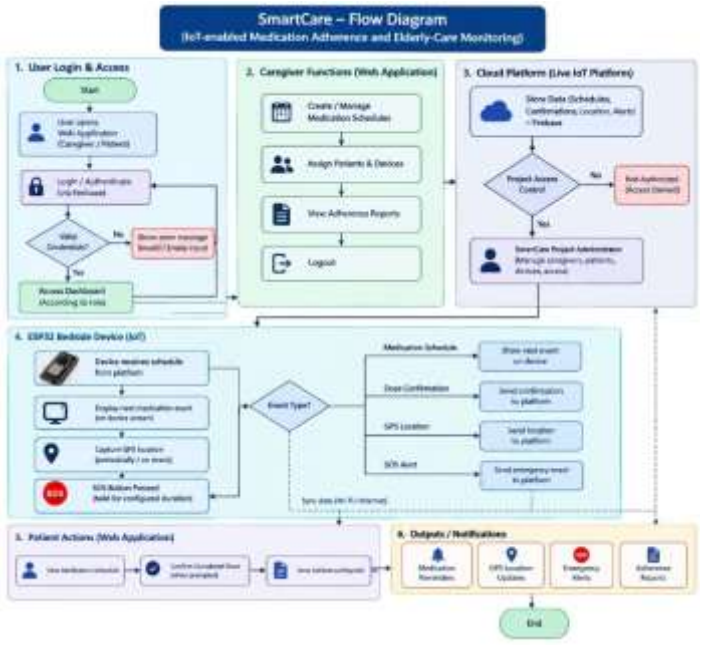


Figure 1. SmartCare Flow Diagram

5.8 Overall System Workflow

The general workflow of SmartCare is as follows:

1. The user or the authorized caregiver enters the medication information and the schedule.

2. The application stores the medication record using the configured backend or storage mechanism.

3. The scheduling mechanism identifies when a medication reminder is due.

4. The elderly user receives the reminder. Can confirm the dose.

5. The application records the confirmation. Updates the medication status.

6. If the dose remains unconfirmed, beyond the configured interval the system initiates the caregiver-alert workflow.

7. The caregiver receives the notification through the configured notification mechanism.

8. The user can separately access the prescription OCR, voice-assistance and emergency SOS features. The workflow is intended to improve visibility into activities. An unconfirmed dose is treated as a status, than definitive evidence that the medicine was not taken.

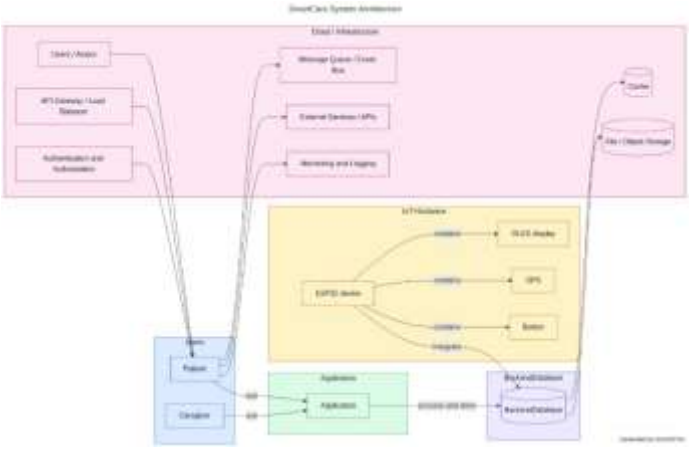


Figure 2. SmartCare system architecture

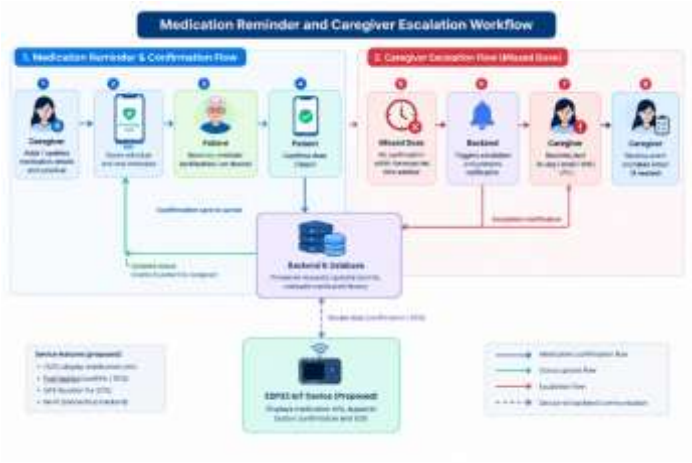


Figure 3. Medication reminder and caregiver escalation workflow

VI. RESULTS AND DISCUSSION

6.1 Overview of System Evaluation

I looked at the SmartCare application to see how well its parts work together and how the SmartCare application behaves in use. The main goal of this look was to see if the SmartCare application does what the SmartCare application is supposed to do when it comes to medication management and monitoring. I focused on medicine management, scheduled medication reminders, dose confirmation, caregiver monitoring, prescription image recognition emergency SOS function and voice assistance. I based my review, on how the SmartCare application behaved when I used the SmartCare application. I paid attention to whether the SmartCare application could store medicine information send notifications at the times and let users confirm that they took their medicine. I used what I saw to separate the features that work fine from those that still need work and testing. The current version of the SmartCare application shows that the SmartCare application can combine many medication management features into one app. Remember this review is a functional test of the software not a medical study. So the results do not prove that patients will feel better or that they will keep taking their medicine for a time.

6.2 Medicine Management

The medicine management module is one of the core components of SmartCare. It allows users to enter and manage medicine-related information, providing a structured way to organize daily medication requirements. This functionality reduces the need to rely entirely on handwritten notes or memory when keeping track of medicines.

The implemented module supports the addition and storage of medicine details. Users can maintain information required for medication management, such as the medicine name, dosage, and scheduled time, according to the available application fields. The ability to store and retrieve medicine information provides the foundation for the reminder and dose confirmation functionalities.

During functional evaluation, the medicine management feature was observed to operate as intended. The module provides a centralized interface for handling medication details and serves as the primary source of information for scheduled reminders.

This functionality is particularly relevant for elderly individuals who may need assistance in organizing multiple medicines throughout the day. It can also support caregivers by making medication information easier to access. Nevertheless, the correctness of the entered information remains important, as incorrect medicine names, dosages, or schedules may affect subsequent reminders.

6.3 Scheduled Medication Reminders

The medication reminder module is created to alert users when it is time to take their medicines. Users can set reminders based on the medication schedule they enter in the application. Once the medication reminder is set the application sends a notification at the chosen time. Functional testing shows that medication reminder notifications appear at the times that users set. The notifications also work when the application is closed. This behavior is important because users do not have to keep the application open to get medication reminder notifications, at least under the conditions that were tested. The medication reminder helps users organize their medication by linking medicine details to times. It reduces the need for manual checking. Gives users a prompt. The medication reminder is especially useful for people who have recurring medication schedules. However whether medication reminder notifications arrive can depend on operating-system permissions, device notification settings, battery saving policies and background limits. Therefore more testing on devices and operating-system settings is needed to see if medication reminder notifications are reliable in situations. The medication reminder is especially useful, for people who manage recurring medication schedules.

6.4 Medication Intake Confirmation

SmartCare has a feature that lets users confirm they have taken a scheduled medicine. This feature works with the reminder system by letting users record their response, to a medication prompt. The taken confirmation feature was seen to work as expected during the test. By letting users acknowledge medication intake SmartCare supports recording medication activities of sending notifications. The mix of scheduled reminders and intake confirmation gives a workflow. A reminder tells the user that a medicine's due. The confirmation feature records the user's reported response. This data can help the user or a caregiver review medication later depending on how SmartCare stores and monitors data. It is important to differentiate a dose, from a verified dose. SmartCare records the user's response. Does not check that the medicine was actually taken. Therefore the confirmation feature is a self-reported medication tracking tool.

6.5 Caregiver Monitoring

Caregiver monitoring is meant to help caregivers stay aware of what's happening with medication and offer help when needed. This is important, for people who get help from family, health workers or people who work in care facilities. The caregiver monitoring or alert system that was put in place was said to be working during the test. This shows that the app can support caregiver-focused monitoring as part of what it does Putting medication management with caregiver monitoring can create a way to handle daily care. Of looking at reminders about medicine as something SmartCare tries to link the users medicine activities to a bigger care plan. How well caregiver monitoring works depends on having the information making sure it is correct and getting it to the place on time. More tests are needed to check how reliable the alerts are, how well the data moves, between systems and what happens when the internet is not working. These things matter when the app is used to help people or when caregivers watch over medicine use from a distance.

6.6 Prescription Image Recognition

SmartCare includes a prescription image recognition feature that aims to lower the work needed to enter medicine information. The prescription image recognition feature is designed to pull text from prescription images and help users spot medicine details. The prescription image recognition module works partly in the version. Even though the prescription image recognition feature has been added it still needs work before it can be trusted for use. Prescription images can have words, abbreviations, blurry characters overlapping details or uneven formatting all of which can hurt the accuracy of text recognition. Wrong extraction of medicine names, dosages or frequency details can lead to medication records. Therefore the prescription image recognition feature must show the extracted information, for the user to review and confirm before it is saved or used to set reminders. Future work should concentrate on boosting the accuracy of the prescription image recognition feature dealing with prescription formats checking the extracted fields and giving error messages when the information cannot be read with confidence. The prescription image recognition feature should be seen as a data-entry tool, not a replacement, for a reading of a prescription.

6.7 Emergency SOS Functionality

The emergency SOS feature is designed to give an user a way to send an emergency alert when help is needed. This SOS feature can help people who live alone or who need help from a chosen caregiver. The SOS feature is only partly ready, in the version of SmartCare. Because the SOS feature is available this shows that progress is being made to add emergency support. The SOS feature is not yet fully proven as an emergency response system. More testing is necessary to check how the SOS feature creates alerts how the SOS feature sends alerts to the person, how the SOS feature uses location when it can and how the SOS feature behaves when the network is slow or down. The SOS feature should also let users know if the SOS feature alert was started successfully. Since the SOS feature can be used in moments the SOS feature reliability and how it handles failures need focus. Until the SOS feature is fully tested the SOS feature should not be counted as an emergency communication service.

6.8 Voice Assistance

Voice assistance can be an accessibility feature, in SmartCare. Voice assistance is meant to help people find medication information by speaking. Voice assistance could help people who find it hard to read text or move between many screens. The operation of voice assistance has not yet been fully checked. Because of that the usefulness of voice assistance cannot be proven by the test. More testing is needed to see if spoken commands or questions are understood correctly by

voice assistance and if voice assistance returns the answers. Future improvements could add voice-based questions about medicines, speech-to-text entry and text-to-speech replies. These features of voice assistance should be checked for how voice assistance recognizes speech, how correct the replies are how many languages voice assistance supports and how easy voice assistance is to use. Until those checks finish voice assistance stays a topic, for work, not a feature.

6.9 Results and Discussion

The results will be shown once the test cases are run under the documented conditions. Every module needs to be checked against what it's supposed to do with any problems and limits mentioned along, with the results. The evaluation needs to check if reminders came up when they were supposed to if changes in medication status were written down if alerts for caregivers followed the rules for getting more serious and if the OCR, voice and SOS modules gave the results. When there are numbers that show how well things work the discussion should have the size of the test set how the numbers were taken what was. What didn't work. Results from tests that were made up should be called testing, not proof that things work in life. The current testing is a starting point for checking if things work. More testing in internet setups with devices in real-life situations with medicine pictures and in real user experiences would show better proof, about how reliable everything is.

VII. SYSTEM EVALUATION AND TESTING

7.1 Evaluation Objective

The assessment is meant to check if the modules that SmartCare has put in place work the way they are supposed to. Because basic testing has already been done the next step is to take that testing by creating a test that can be repeated. This test should have test cases expected results, recorded observations and performance measures that can be measured. The first part of the evaluation should include medication management, reminder creation, dose checking, caregiver alerts, OCR processing, voice use and emergency SOS.

7.2 Functional Test cases

The following table summarizes the observed functional status of the major SmartCare modules.

Table 7.1. Functional Testing of SmartCare

Test ID	Test case	Expected result	Observed status
TC01	Add medicine details	Medicine information is saved successfully	Pass
TC02	Schedule a medication reminder	Reminder is configured for the selected time	Pass
TC03	Receive notification when the app is closed	Notification appears at the scheduled time	Pass
TC04	Confirm medicine as Taken	Intake confirmation is recorded	Pass
TC05	Caregiver monitoring	Caregiver-related monitoring	Pass
TC06	Recognize prescription image	Medicine information is extracted from the image	Partial
TC07	Trigger emergency SOS	Emergency alert workflow operates as intended	Pass
TC08	Use voice assistance	Voice-based interaction operates correctly	Partial

The results show that the main medicine management and reminder features are working, including when the app's closed and notifications are sent on schedule during testing. The caregiver monitoring feature and the intake confirmation tool also help with the planned way to manage medicines. At the time the table shows that it is important to tell the difference, between what has been built and what has been proven to work. Features that are partly working or not checked yet need work or

proper testing before they can be trusted. The statuses listed are observations. Should not be seen as numbers that measure how well something works.

7.3 Evaluation of Notification Functionality

Scheduled medication notifications are a part of SmartCare because they are meant to remind people when it's time to take their medication. The notification feature was checked by setting reminders for times and watching to see if the app sent the notifications. The results showed that notifications were sent at the times that were set even when the app was not open. This shows that the reminder system worked the way it was supposed to during the tests and did not need the app to be visible, on the screen. Sending notifications can be affected by phone settings like permissions rules from the operating system how the phone manages battery life and other rules about running apps in the background. More testing, on phones and different versions of the operating system is needed to see if notifications keep working the way in different situations.

7.4 Evaluation of Implemented Features

The evaluation found two features that need work: prescription image recognition and emergency SOS. The prescription image recognition feature is meant to help pull medicine details from pictures of prescriptions. Its current partial work shows that more effort is needed to make extraction more reliable and to handle picture and prescription styles. The emergency SOS feature is meant to start an alert when an older user needs help. Because this feature is only partly done extra end-to-end tests are needed to check that alerts are made sent to the person and that location is used when necessary. Until these tests pass the emergency SOS feature should not be called a checked emergency response tool. Voice assistance also needs checking. Future tests should look at how it hears speech how correct the replies are, how easy it is to use and whether it supports the languages it is supposed to. Only after these checks can the voice assistance feature be called working.

7.5 Discussion of Testing Results

The functional evaluation shows that SmartCare works as a tool, for managing medicine. It can handle medication details send reminders confirm when users take their medicine and let caregivers keep an eye on the process. Putting these parts together creates a step-by-step flow. Users can enter their medicine info get alerts and log when they actually take their pills. One key point is that the app sends reminders even when it's closed. That's important because it means SmartCare can still do its job. Reminding people to take their medicine. Under the conditions we tested.Just because it works now doesn't mean it will work well over time or on every device it's supposed to run on. Some features are not fully finished yet. That means there's room to make things better. Thorough testing, ways to handle errors and checking how data moves between parts of the app and how notifications get sent would make SmartCare more dependable. On we could run tests with plans and numbers to measure things, like how often notifications reach users how fast the app responds and how well it recognizes prescriptions. In total the tests show where SmartCare stands now and point out what still needs work. But keep in mind. This review only looks at how the software functions. It doesn't prove the app helps people take their medicine better over the term or if it's effective in medical situations.

VIII. LIMITATIONS

Although SmartCare offers a base, for handling medications and supporting care some issues still exist in the way it works now. Some advanced features are not fully done. The ability to recognize prescriptions from pictures and the emergency SOS feature are only partly working. Voice help has not been completely checked yet. So these features need work and testing before they can be trusted. The system relies on the information that users or caregivers type in. If the medicine names, amounts or times are wrong the reminders might not be correct. Prescription details should be checked carefully before using them to set up medication schedules. Notifications seem to work at the times set even when the app is not open based on what was tested.The app hasn't been tested fully on different devices, operating systems, battery settings and permission setups. The current testing only looks at how the app functions. There are no numbers for things like how notifications are delivered how fast the system responds, how well it recognizes prescriptions or how reliable the app is over time. Some parts of the app, the ones, for caregivers to watch over and send alerts depend on the device setup, the internet connection and how well data syncs. How these parts work when there is no internet is not clear yet. The app hasn't been proven to help in life through a study or trial. It's not known how well it helps people take their medicine how it affects their health or how it impacts the people who

care for them. These issues show what SmartCare can do now and where more work is needed before it can be used widely.

XI. ETHICAL CONSIDERATIONS

SmartCare is built to help elderly people manage their medicines and coordinate with caregivers. Because SmartCare handles medication data SmartCare must focus on privacy, security, user choice and responsible use.

• Privacy and confidentiality: SmartCare must keep data and medication records for people who are allowed to see them. SmartCare should use access controls and secure ways to handle data so that no one else can get or share information.

• Consent: SmartCare must tell users why SmartCare is used, what data SmartCare gathers and when SmartCare might share data with caregivers. SmartCare must get permission from users when needed and SmartCare must let them keep control over their data.

• Data security: SmartCare should use login, clear permissions, safe communication and good data protection to keep out access, data loss or misuse. SmartCare must. Test these safety steps before SmartCare is used in care places.

• User autonomy and dignity: SmartCare must help elderly users stay independent not block their choices. SmartCare should use caregiver monitoring and medication records when SmartCare has the permissions and respects what each elderly person wants.

• Accuracy and medication safety: SmartCare is not a doctor. Should never decide medicine doses by itself. SmartCare must let users or caregivers double-check medicine facts and times against a doctor's notes. SmartCare should also make sure that any data taken from prescription pictures is checked before it is used.

• Transparency about limits: SmartCare must tell users that a reminder does not prove a medicine was taken. A "Taken" mark is a person's report, not a test that the medicine was really taken. SmartCare must also warn that emergency alerts are not certain until the whole alert system has been tested and proven.

• Responsible evaluation: When SmartCare does tests with people SmartCare must follow the rules of the institution get clear consent and keep their data safe. SmartCare must back up any claims about health or better medicine habits with studies that are designed correctly.

These points are key, to making SmartCare safe and fair. SmartCare must keep privacy give talk and honor people in every step of SmartCare's build and review.

X. CONCLUSION

SmartCare is a Smart Medication and Care Monitoring application that was created to help older people keep track of their medicines and to help caregivers watch over their patients. SmartCare brings together medicine lists, timed reminders, confirmation of medicine taken and caregiver alerts all, in one easy-to-use app. The aim of SmartCare is to give adults a simple way to manage their health needs when they need help. The test of SmartCare showed that the medicine management part works well. Users can keep medicine details in SmartCare. The reminder part of SmartCare sends notifications at the times that users set even when the app is closed during the test. The feature that lets users confirm they have taken their medicine is also working inside SmartCare. The caregiver monitoring part of SmartCare helps caregivers coordinate care just as it was meant to. Together these parts give SmartCare a base for mixing scheduling and monitoring into one place. The test also found some parts of SmartCare that need work. The picture recognition for prescriptions in SmartCare is not.

The emergency SOS button in SmartCare is only partly ready. Voice help in SmartCare still needs checks. SmartCare also needs picture recognition, reliable emergency alerts, easier use for everyone and more systematic tests before it can be used widely in real life. Overall SmartCare shows that putting medication management and caregiver support together in a platform is possible. Future work on SmartCare should look at making the system more reliable protecting data better making it easier to use and testing SmartCare on devices and operating systems. While SmartCare gives a start, for organized medicine routines we still need designed studies to know how well it works for long-term medicine adherence.

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