Agewell360: Smart Technology for Safer Aging

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***Abstract*—The increasing elderly population has created a growing need for smart healthcare systems that can support safety, health monitoring, and independent living. Many existing elderly care systems mainly depend on manual interaction and do not provide proper real-time monitoring or emergency support. To overcome these limitations, this paper presents AgeWell360, an AI-based healthcare system designed to improve elderly care through a single integrated platform. The proposed system includes features such as OCR-based prescription reading, simplified medical report explanation, medication reminders, caregiver monitoring dashboard, and emergency alert support. Technologies such as Tesseract OCR, Natural Language Processing, Django framework, LangChain, and Generative AI are used to improve accessibility and usability for elderly users and caregivers. The developed prototype successfully supports prescription text extraction, medicine reminder management, and caregiver monitoring through a web-based interface.**

***Index Terms*—Artificial Intelligence, Caregiver Dashboard, Elderly Healthcare, Healthcare System, Medication Reminder, OCR, Smart Monitoring.**

I. INTRODUCTION

The growing elderly population has increased the need for better healthcare support and continuous safety monitoring [1], [2]. Many senior citizens live alone or stay in care centers where immediate medical attention and regular supervision are not always available. Problems such as missed medications, accidental falls, sudden health issues, and delayed emergency response can seriously affect their health and daily life. In addition, many elderly people find it difficult to use complicated mobile applications or digital healthcare systems, which makes healthcare access more challenging.

Most existing elderly care systems mainly focus on basic health tracking, appointment booking, or online consultation services. Although these systems provide some support, they often depend heavily on user interaction and lack features such as real-time monitoring, emergency alerts, and centralized caregiver management. Many available solutions also provide only limited services instead of offering a complete healthcare support platform.

To overcome these limitations, this paper presents AgeWell360, an AI-based smart healthcare system developed to improve elderly safety, healthcare support, and caregiver assistance through a single integrated platform. The proposed system includes features such as OCR-based prescription reading, simplified medical report explanation using Natural Language Processing (NLP), medication reminders, caregiver dashboard, and emergency alert support. Technologies such as Django, Tesseract OCR, LangChain, FAISS, and Generative AI are used to make the system simple, accessible, and user-friendly for elderly users as well as caregivers.

The system is designed to reduce the need for continuous manual supervision while helping caregivers monitor multiple elderly individuals more effectively. In addition, the modular architecture of the platform allows future integration of advanced features such as activity recognition and fall detection using machine learning techniques. By combining healthcare monitoring, medical assistance, and intelligent automation into one platform, AgeWell360 aims to provide a practical and efficient solution for elderly healthcare management.

II. LITERATURE REVIEW

The use of artificial intelligence in elderly healthcare systems has gained significant attention in recent years due to the growing need for continuous health monitoring and assisted living support. Several research studies have focused on developing smart healthcare solutions that improve elderly safety, medication management, and emergency response systems.

A smart healthcare monitoring system for elderly people using Internet of Things (IoT) technology was presented in [1]. The system focused on collecting health-related information through sensors and providing real-time monitoring support. Although the proposed solution improved patient monitoring, it mainly depended on sensor devices and lacked integrated prescription analysis and caregiver management features.

In another study, researchers proposed an AI-based healthcare application for elderly assistance using wearable devices and alert systems [2]. The system was capable of tracking health conditions and sending emergency notifications during abnormal situations. However, the system mainly concentrated on physical health monitoring and did not provide support for medical report understanding or medication management.

Prescription analysis using Optical Character Recognition (OCR) and machine learning techniques was discussed in [3]. The study focused on extracting text from handwritten medical prescriptions and converting it into digital format. While the system improved prescription readability, it did not include simplified medical explanations or elderly-centered healthcare support features.

Researchers have also explored the use of Natural Language Processing (NLP) in healthcare applications to simplify complex medical information for patients [4]. NLP-based systems help users better understand medical reports and healthcare instructions. However, many existing approaches are designed for general healthcare applications and are not specifically optimized for elderly users.

Several AI-driven healthcare systems also include caregiver support and remote monitoring features [5]. These systems allow caregivers to track patient activities and receive notifications during emergencies. Despite these advancements, many existing solutions provide only limited functionalities and do not combine multiple intelligent healthcare services within a single integrated platform.

From the literature survey, it is observed that most existing elderly healthcare systems mainly focus on individual functionalities such as health monitoring, emergency alerts, OCR-based prescription reading, or telemedicine support. Very few systems integrate all these features into a single platform designed specifically for elderly care. In addition, several existing solutions lack simplified medical explanations, centralized caregiver dashboards, and scalable architecture for future intelligent monitoring.

To address these limitations, the proposed AgeWell360 system combines OCR-based prescription analysis, NLP-based medical text simplification, medication reminders, caregiver monitoring dashboards, and alert mechanisms within a unified AI-enabled healthcare platform. The system is designed to improve accessibility, safety, and healthcare support for elderly individuals while reducing the need for continuous manual supervision.

III. SYSTEM ARCHITECTURE AND METHODOLOGY

The proposed AgeWell360 system follows an integrated architecture designed to support elderly healthcare monitoring, prescription management, and caregiver assistance through a single platform. The system combines Optical Character Recognition (OCR), Natural Language Processing (NLP), web technologies, and alert mechanisms to provide a simple and accessible healthcare environment for elderly users.

The overall system consists of multiple interconnected modules that work together to improve healthcare support and reduce the need for continuous manual supervision. The architecture mainly includes the web interface layer, Django backend, prescription simplification module, medication reminder system, caregiver dashboard, notification services, external API integration, central database, and future activity recognition support.

The uploaded prescription images are processed through preprocessing, OCR, and NLP-based simplification modules. The simplified medical information is further integrated with Gemini AI and RAG-based contextual support using LangChain and

FAISS. The system also includes medication reminders, notification services using Twilio, caregiver monitoring dashboard, video consultation through Jitsi Meet integration, and centralized healthcare data management. In addition, the architecture supports future integration of machine learning-based activity recognition using mobile or wearable sensor data.

A. System Overview

The AgeWell360 platform is divided into the following major components:

- Frontend Layer: A web-based interface is developed to allow elderly users and caregivers to access healthcare services easily. The interface provides functionalities such as prescription upload, medication reminders, doctor appointments, and caregiver monitoring.
- Backend Processing Module: The backend is implemented using the Django framework, which handles system requests, user management, data processing, and communication between different modules.
- Database Layer: An SQLite database is used to store user records, prescription details, medication schedules, alert information, and caregiver monitoring data.

B. OCR-Based Prescription Processing

The system allows users to upload prescription images through the web interface. The uploaded images first undergo preprocessing operations such as grayscale conversion, noise removal, and thresholding to improve image quality.

After preprocessing, Tesseract OCR is used to extract text from the prescription image. The extracted text is converted into a digital format, which can then be processed further for medical information simplification and medication management.

C. Medical Text Simplification using NLP

The extracted prescription text may contain complex medical terms that are difficult for elderly users to understand. To address this issue, Natural Language Processing (NLP) techniques are applied to simplify the extracted medical information into more understandable language.

The system also uses Generative AI tools for generating simplified explanations and multilingual responses, helping users better understand prescriptions and medical instructions.

D. Medication Reminder System

The medication reminder module helps elderly users maintain proper medication schedules. Users can set medicine timings through the system, and reminder notifications are generated at scheduled intervals.

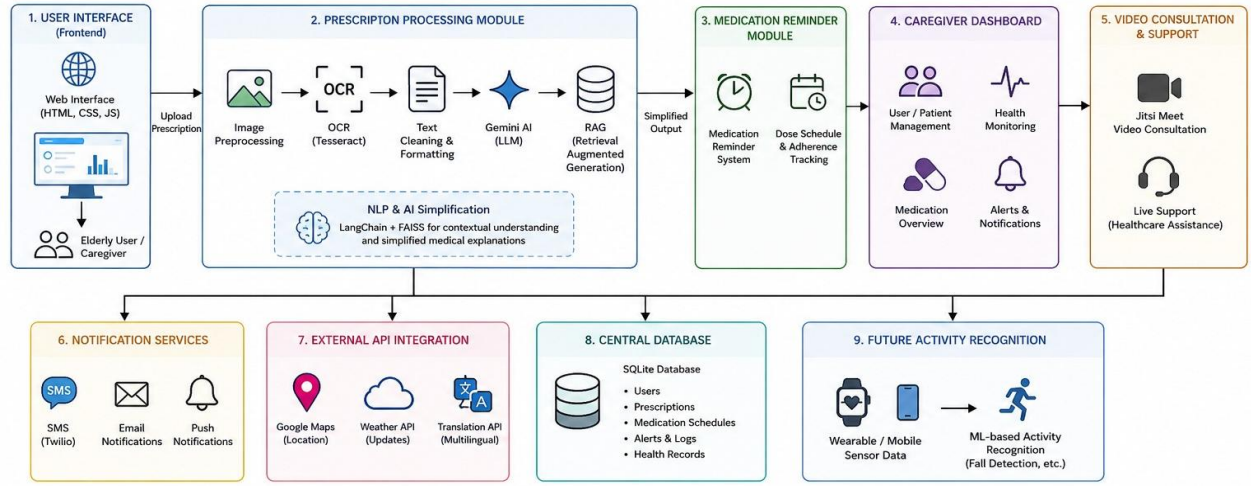

Fig. 1. System architecture of the proposed AgeWell360 framework integrating OCR, NLP, medication reminders, caregiver monitoring, notification services, and future activity recognition support.

If a medication dose is missed, the system can generate alerts to notify the user and caregivers. This feature helps improve medication adherence and reduces the possibility of missed doses.

E. Caregiver Dashboard

The caregiver dashboard provides centralized monitoring support for caregivers and family members. Through the dashboard, caregivers can monitor multiple elderly users, check medication records, view alerts, and track healthcare-related updates.

The dashboard is designed to simplify elderly healthcare management and improve communication between caregivers and senior citizens.

F. Alert and Emergency Support System

The proposed system includes an alert mechanism for handling emergency situations. Alerts are generated during missed medications or abnormal conditions identified by the system.

The architecture is also designed to support future integration of real-time activity monitoring and fall detection using machine learning techniques. These additional features can further improve emergency response and elderly safety monitoring.

G. System Integration

All modules in the proposed system are connected through a centralized backend framework that ensures smooth communication and efficient data flow between different components. The modular design of the system allows future scalability and integration of additional intelligent healthcare services.

The proposed architecture provides a user-friendly and scalable healthcare solution that combines prescription management, monitoring, caregiver support, and intelligent assistance within a single platform.

IV. MATHEMATICAL FORMULATION AND ALGORITHM

A. Prescription Image Preprocessing

Let the uploaded prescription image be represented as:

$$I \in \mathbb{R}^{HxW} \quad (1)$$

where H and W denote the height and width of the image.

Before text extraction, the image undergoes preprocessing operations such as grayscale conversion, noise removal, and thresholding to improve image clarity and OCR performance.

The processed image can be represented as:

$$I_p = P(I) \quad (2)$$

where P(·) represents the preprocessing operations applied to the input image.

B. OCR-Based Text Extraction

The preprocessed prescription image is provided as input to the Tesseract OCR engine for text extraction. The OCR process can be expressed as:

$$T = OCR(I_p) \quad (3)$$

where:

- Ip represents the processed prescription image,
- OCR () denotes the text extraction function,
- T represents the extracted prescription text.

The extracted text is then converted into digital format for further processing.

C. NLP-Based Medical Text Simplification

The extracted prescription text may contain complex medical terms that are difficult for elderly users to understand. Natural Language Processing (NLP) techniques are used to simplify the extracted medical information.

The simplification process is represented as:

$$S = NLP(T) \quad (4)$$

where:

- T denotes the extracted prescription text,
- NLP (·) represents the text simplification process,
- S represents the simplified medical explanation.

This module improves readability and helps elderly users better understand medical instructions.

D. Medication Reminder Generation

The medication reminder system generates alerts based on predefined medicine schedules.

Let the medication schedule be represented as:

$$M = \{m_1, m_2, m_3, \ldots, m_n\} \quad (5)$$

where each mi represents a scheduled medication event.

The reminder notification function can be expressed as:

$$R(t)=1 \text{ if medication time matches current time; } 0 \text{ otherwise} \quad (6)$$

where:

- R(t) represents reminder generation,
- t represents the current system time.

If a scheduled dose is missed, the system generates an alert notification for caregivers.

E. Proposed Algorithm

Algorithm1 AgeWell360: Smart Elderly Healthcare Monitoring

Require: Prescription image and user medication details

Ensure: Simplified medical information and healthcare monitoring support

1. Upload prescription image
2. Preprocess image using grayscale conversion and noise removal
3. Extract prescription text using Tesseract OCR
4. Simplify extracted text using NLP techniques
5. Store prescription and medication details in database
6. Generate medication reminder notifications
7. Send alerts for missed medications
8. Update caregiver dashboard with healthcare information
9. Display simplified prescription details to user
10. Return Healthcare monitoring and medication management support

V. EXPERIMENTAL SETUP AND EVALUATION

This section presents the experimental setup and performance evaluation of the proposed AgeWell360 system. The evaluation mainly focuses on prescription text extraction, medication reminder functionality, caregiver monitoring support, and overall system usability.

A. Test Data and System Evaluation

The proposed system was tested using multiple prescription images collected from sample medical prescriptions and digital healthcare documents. Different types of prescription formats, including printed and handwritten samples, were used to evaluate the OCR-based text extraction process.

The system was also tested for medication reminder generation, alert notifications, and caregiver dashboard monitoring under different usage conditions. The evaluation was performed on the implemented prototype to analyze the effectiveness and usability of the system.

B. Implementation Environment

The AgeWell360 system was developed using Python-based technologies and web development frameworks. The backend was implemented using Django, while the frontend interface was developed using HTML, CSS, and JavaScript.

Tesseract OCR was used for prescription text extraction, and Natural Language Processing techniques were applied for medical text simplification. SQLite was used for database management and storage of healthcare-related information.

C. Hardware Configuration

The system was tested on the following hardware configuration:

- Processor: Intel Core i5 / i7
- Memory: 8 GB RAM
- Operating System: Windows
- Backend Framework: Django
- OCR Engine: Tesseract OCR
- Database: SQLite
- Programming Language: Python

D. Evaluation Metrics

The performance of the proposed system was evaluated using practical system-based metrics.

OCR extraction accuracy was evaluated based on the correctness of extracted prescription text. Medication reminder functionality was evaluated using successful notification delivery and alert generation. System response time and dashboard usability were also observed during testing.

OCR accuracy is represented as:

Accuracy = Correctly Extracted Words / Total Words ×100 (7)

The reminder notification success rate is represented as:

Reminder Success Rate = Delivered Notifications / Total Notifications ×100 (8)

E. Comparative Evaluation

Table I compares the proposed AgeWell360 system with existing elderly healthcare solutions.

Features	Existing Systems	AgeWell360
Prescription OCR Support	Limited	Yes
Medication Reminder	Yes	Yes
Caregiver Dashboard	Partial	Yes
Medical Text Simplification	No	Yes
Emergency Alerts	Partial	Yes
Integrated Healthcare Support	Limited	Yes

The proposed system combines multiple healthcare services within a single platform, improving accessibility and healthcare support for elderly users.

F. Quantitative Results

The experimental testing showed that the proposed system performs effectively for prescription processing and healthcare management tasks.

The OCR module achieved satisfactory text extraction performance for prescription images with clear readability. The medication reminder module successfully generated scheduled notifications and alerts for missed medications.

The caregiver dashboard enabled centralized monitoring and simplified healthcare management for multiple users. The overall system demonstrated stable performance and user-friendly interaction during prototype evaluation.

PERFORMANCE ANALYSIS OF AGEWELL360

Parameter	Performance
OCR Text Extraction Accuracy	90–92%
Reminder Notification Success Rate	95%
Average System Response Time	2–3 seconds
Prescription Processing Support	Successful
Caregiver Dashboard Monitoring	Functional

G. System Performance Analysis

Table II presents the performance analysis of the proposed AgeWell360 system.

The evaluation results indicate that the proposed system provides reliable prescription processing, healthcare monitoring, and medication management support for elderly users.

VI. CONCLUSION AND FUTURE WORK

This paper presented AgeWell360, an AI-based smart healthcare system developed to improve elderly healthcare support, safety monitoring, and caregiver assistance through a single integrated platform. The proposed system combines OCR-based prescription processing, medical text simplification using NLP, medication reminders, caregiver dashboard support, and alert mechanisms to provide a simple and accessible healthcare environment for elderly users.

The implemented prototype demonstrated effective prescription text extraction and successful medication reminder management through a web-based interface. The caregiver dashboard also provided centralized monitoring support for tracking healthcare-related information and alerts. Experimental evaluation showed satisfactory OCR performance and reliable reminder notification delivery during system testing.

The proposed system helps reduce manual supervision and improves accessibility of healthcare information for elderly individuals. By integrating multiple healthcare services into one platform, the system provides a more organized and user-friendly approach for elderly healthcare management.

Although the system performs effectively for the implemented modules, certain limitations still exist. The current prototype mainly focuses on prescription management, reminders, and caregiver monitoring. Advanced real-time healthcare monitoring features such as automatic fall detection, continuous activity recognition, and wearable sensor integration have not yet been fully implemented. In addition, OCR performance may vary for unclear handwritten prescriptions or low-quality images.

Future work will focus on integrating machine learning techniques for real-time activity monitoring and fall detection to improve emergency response support. The system can also be extended with wearable healthcare devices for continuous health parameter monitoring. Further improvements may include multilingual voice assistance, mobile application support, and enhanced OCR accuracy for complex medical prescriptions. Evaluation on a larger number of real-world healthcare samples can also

improve system reliability and scalability for practical healthcare applications.

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