International Journal of Information Technology & Computer Engineering

ISSN 2347–3657

Volume 13, Issue 2s, 2025

MEDILINK

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ABSTRACT

Medilink is one of the most innovative health platforms that brings all the healthcare solutions together into one accessible interface. Unlike traditional systems that are different and manual in handling records, reminders, and diagnostic tools, Medilink has been brought together in one approach that makes healthcare easy to manage and more efficient.

One of its stand out features is digital prescription storage to ensure patients have their medical history available at a moment's notice, loss of paper prescriptions is thus eliminated. This is really helpful in case of emergency as all health-related information is readily available. Moreover, Medilink offers a global prescription database wherein every user can browse anonymized treatment data from all over the world. This, indeed, makes decisions in a much more informed way based on real-world evidence for appropriate treatments for most conditions. It further assists patients in adhering to their prescribed regimens, thus eliminating the most common problem of missed doses and thus leads to faster recovery. Besides, Medilink's key flagship feature is MED-GPT, which is designed using cutting-edge AI technologies such as machine learning and natural language processing to ensure accurate and dependable diagnostic suggestions. It is particularly helpful in emergencies when a patient needs urgent medical advice and creates a gap in accessibility to professional healthcare. Another feature of Medilink is Tools for Analysts which is the most impressive capabilities when it comes to this learning module is that it provides the possibility to maintain the data's purity in the field of healthcare. It has been equipped for analysts to remove the improper records so they keep the data free from the mistakes. For instance, the system can identify some variations in the class labels or other key additive features that leads to biased analysis results or finally a flawed treatment. This way, Medilink contributes to sustaining the quality and non-variability of data and contributes to the firm's correct decision-making processes.

Tech stack includes Golang, AngularJS, PostgreSQL, Python FastAPI, and Hugging Face's Transformers, Vectordb , natural language processing, machine learning, LLM, Langchain, sentence-transformers, streamlit, pandasai, google gemini api, google cloud storage, yahoo finance connector tiktoken, Medilink allows the service to be secure, efficient, and scalable. And in turn, Medilink rewrites healthcare's management and delivery to be streamlined, reliable, and accessible to all.

INTRODUCTION

Medilink is a unique Digital health care system, developed to cater the ever emerging problems in the health care sector by one stop solution. In contrast to traditional systems that so often employ partial and discrete procedures, Medilink integrates various crucial interrelated healthcare services into a single friendly panel. This meaning that the patients, the healthcare providers as well as the researchers who seek to access or create, store, transport and share patients' health records experience convenience, efficiency, and reliability in their endeavours as provided by the natural platform.

Another of Medilink major novelties is that prescriptions can be stored online safely. This feature helps to address one of the most prevalent problems of lost paper prescriptions with patients' data in hand. This makes it easy for any doctor whether in cases of a routine check-up or exigent circumstances to provide superior service given that vital paperwork is not a hinderance. Through the storage of prescriptions electronically, Medilink makes it possible for patients to have charge on their health process while the healthcare givers increase on their efficiency.

One other outstanding feature of Medilink is its Global Prescription Database. This source assembles prescribers' identity information from around the globe and makes the data available to both the patients and caretakers. They indicate that in this role the database is a valuable tool for identifying and comprehending the nature of treatments and approaches to enhance the medical decision-making process.

Medilink also goes further to tackle one of the biggest problems affecting healthcare today; compliance to medication schedules. It also has its own reminder system for taking medicines, which means that patients can unable to take their prescribed medicines as required and makes them to take longer time to recover. This system is particularly advantageous when the patient has a chronic disease or takes many medications; such patients need to maintain this level of compliance

DOI: https://doi.org/10.62647/IJITCE2025V13I2sPP219-224

International Journal of Information Technology & Computer Engineering

ISSN 2347–3657

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long-term. This way users are reminded of their adherence to their treatment regimens with a positive impact on health and reduced relapse in the health facilities.

One of its flagship technologies, Medilink has highlighted is AI-based diagnostic tool – Med-GPT. This feature goes a notch higher in adopting the state of art machine learning and natural language processing to offer efficient and effective diagnostic recommendations. It is most helpful in cases when medical consultation is needed urgently, but consultation with healthcare professionals is impossible. The necessity of the tool is to receive initial diagnostic information based on the inputs of patient symptoms and medical records and allow the user to make decisions regarding their health.

LITERATURE REVIEW

1. **Secure Electronic Prescription Systems**

Recent studies emphasize the importance of digital prescription systems that ensure confidentiality, integrity, and availability of prescription data. Key approaches include encryption, robust user authentication, and integration with existing healthcare infrastructure. These systems reduce manual errors, improve patient care, and support compliance with data protection laws, though challenges remain regarding initial costs, user training, and compatibility with legacy systems.

2. **Requirements for Electronic Prescription Systems**

A scoping review highlights the need for encryption, audit trails, and real-time prescription management. Successful systems are designed with both clinician and patient needs in mind, addressing legal and regulatory requirements. However, further research is needed on usability in low-tech settings and long-term maintenance1.

3. **De-identification and Anonymization of Health Data**

Effective de-identification methods are essential for protecting patient privacy while enabling research and policy analysis. Techniques must balance privacy with data utility and comply with regulations like HIPAA and GDPR. Challenges include computational costs, integration with diverse systems, and the risk of re-identification in specific datasets1.

4. **Aggregated, De-Identified Data for Pharmacosurveillance**

Aggregated, anonymized electronic health record data is valuable for monitoring drug safety and treatment patterns post-marketing. Such data enables near real-time detection of adverse drug reactions and supports multinational studies, though issues with data consistency and resource requirements persist1.

5. **Technologies for Medication Adherence Monitoring**

Various technologies, including digital reminders and integrated adherence systems, have been shown to improve medication compliance. Key success factors are user engagement and ease of integration with existing healthcare workflows. However, there is limited evidence on long-term outcomes and challenges with patient adoption and system interoperability.

6. **Artificial Intelligence for Medication Adherence**

AI-driven tools offer personalized interventions to improve adherence, especially for chronic diseases. These solutions provide real-time monitoring and tailored support but face limitations such as high development costs, potential biases, and the need for patient digital literacy

IMPLEMENTATION

The development of **Medilink** followed a modular, service-oriented approach to ensure scalability, maintainability, and ease of integration. Each functional unit was developed as an independent module using domain-specific technologies and later integrated through secure APIs and shared data layers. The implementation details are as follows:-

1. Development Environment

Modules were developed in isolated development environments using industry-standard frameworks. The backend services primarily used **Golang** for high performance and concurrency handling, while **Python** powered AI-related services like Med-GPT and Scan Analyzer. Web interfaces were built using **HTML**, **CSS**, and **AngularJS**, and Streamlit was employed for AI dashboards and analysis tools.

2. Backend Integration

All services communicate via RESTful APIs and FastAPI-based microservices. PostgreSQL and MongoDB handle structured and unstructured data, respectively. AI models were embedded using **Hugging Face Transformers**, **Sentence-Transformers**, and **LangChain**, with **FAISS** enabling efficient semantic search for diagnostic tasks.

3. Frontend and User Interaction

Modules such as prescription management, reminders, and the hospital locator feature user-friendly interfaces with real-time feedback. Inputs are validated on both frontend and backend to ensure data quality and security. Accessibility features such as multilingual support and voice-based queries were added where necessary.

4. Data Flow and Privacy

Patient data is encrypted at rest and in transit, adhering to industry standards. Sensitive data like

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ISSN 2347–3657

Volume 13, Issue 2s, 2025

prescriptions and medical history are stored using role-based access controls (RBAC). Anonymized data in the World Prescription Database supports research while ensuring privacy compliance through de-identification techniques.

5. AI and ML Deployment

Machine learning models were trained using public medical datasets such as MIMIC-CXR and MedPix, and integrated into the platform using **FastAPI** and **PyTorch**. Diagnostic outputs are generated using NLP pipelines that combine vector similarity search with fine-tuned transformer models. Continuous model validation is implemented to avoid bias and ensure reliability.

6. Cloud Integration

Services like Google Gemini API, Google Cloud Storage, and Yahoo Finance connectors are integrated into analytics and diet planning modules. APIs from 1mg, Netmeds, and PharmEasy provide real-time medicine data for the comparison tool. All cloud interactions are protected using secure tokens and audit logging.

7. Testing and Deployment

Each module underwent unit, integration, and user acceptance testing (UAT). Streamlit-based interfaces were tested for responsiveness and performance under real-world usage. Deployment was done in a Docker-based containerized setup, ensuring portability and ease of scaling on cloud environments.

METHODOLOGY

Medilink integrates a comprehensive suite of healthcare modules into a unified digital platform. It replaces fragmented, paper-based processes with smart, AI-enhanced tools that improve accessibility, efficiency, and clinical decision-making. Each module is built using a technology stack suited for performance, scalability, and interoperability.

1. Prescription Management

Medilink enables secure digital storage of prescriptions, eliminating reliance on physical documents. Patients can access their medical history anytime, aiding continuity of care, especially during emergencies.

Tech Stack: HTML, CSS (Frontend), Golang (Backend), PostgreSQL (Database)

2. World Prescription Database

An anonymized, global repository of real-world prescriptions enables clinicians and patients to reference treatment histories for various diseases, supporting informed decision-making and research.

Tech Stack: HTML, CSS, AngularJS, Golang, PostgreSQL

3. Medicine Reminder System

Automated reminders help patients adhere to medication schedules, minimizing missed doses and improving treatment outcomes.

Tech Stack: HTML, CSS, AngularJS, Golang, PostgreSQL

4. Med-GPT (AI Diagnosis Assistant)

Med-GPT uses NLP and machine learning to deliver instant diagnostic support when physicians are unavailable. It references verified sources like *Principles of Internal Medicine* and utilizes FAISS, LangChain, and Sentence Transformers for inference.

Tech Stack: Chainlit (Frontend), FastAPI (Backend), Hugging Face Transformers, FAISS, SQLite

5. Tools for Analysts

This module provides real-time healthcare analytics, forecasting, and data visualization to assist medical researchers and professionals in identifying trends, improving quality, and making data-driven decisions.

Tech Stack: Streamlit, PandasAI, Google Gemini API, GCS, Yahoo Finance Connector, Tiktoken

6. Custom Diet Plan

AI-powered, condition-specific diet charts are generated using medical data, lifestyle inputs, and preferences. The system supports multilingual output, calorie insights, and culturally relevant food suggestions.

Tech Stack: Streamlit, PandasAI, Google Gemini API, GCS, Yahoo Finance Connector, Tiktoken

7. Closest Hospital Locator

This real-time geolocation service guides users to verified hospitals based on proximity, traffic, service availability, and specialization—especially useful during emergencies.

Tech Stack: Mapping & Routing APIs, NLP, Cloud Storage, Geolocation APIs

8. Online Medicine Comparison

Enables cost-effective drug selection by comparing price, composition, availability, and safety across pharmacies. AI checks for drug interactions and offers alternative suggestions.

Tech Stack: Streamlit, PandasAI, Google Gemini API, APIs from 1mg, Netmeds, PharmEasy, Tiktoken, WHO & Medline databases

9. Scan Analyzer and Summarizer

Using deep learning and NLP, this module analyzes medical scans (X-ray, MRI, CT) and generates both technical and layman-friendly summaries. It simplifies radiology workflows and supports early diagnosis.

Tech Stack: Python, Streamlit, PyTorch, OpenCV, Hugging Face Transformers, Google Vision API, MongoDB, MedPix & MIMIC-CXR

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ISSN 2347–3657

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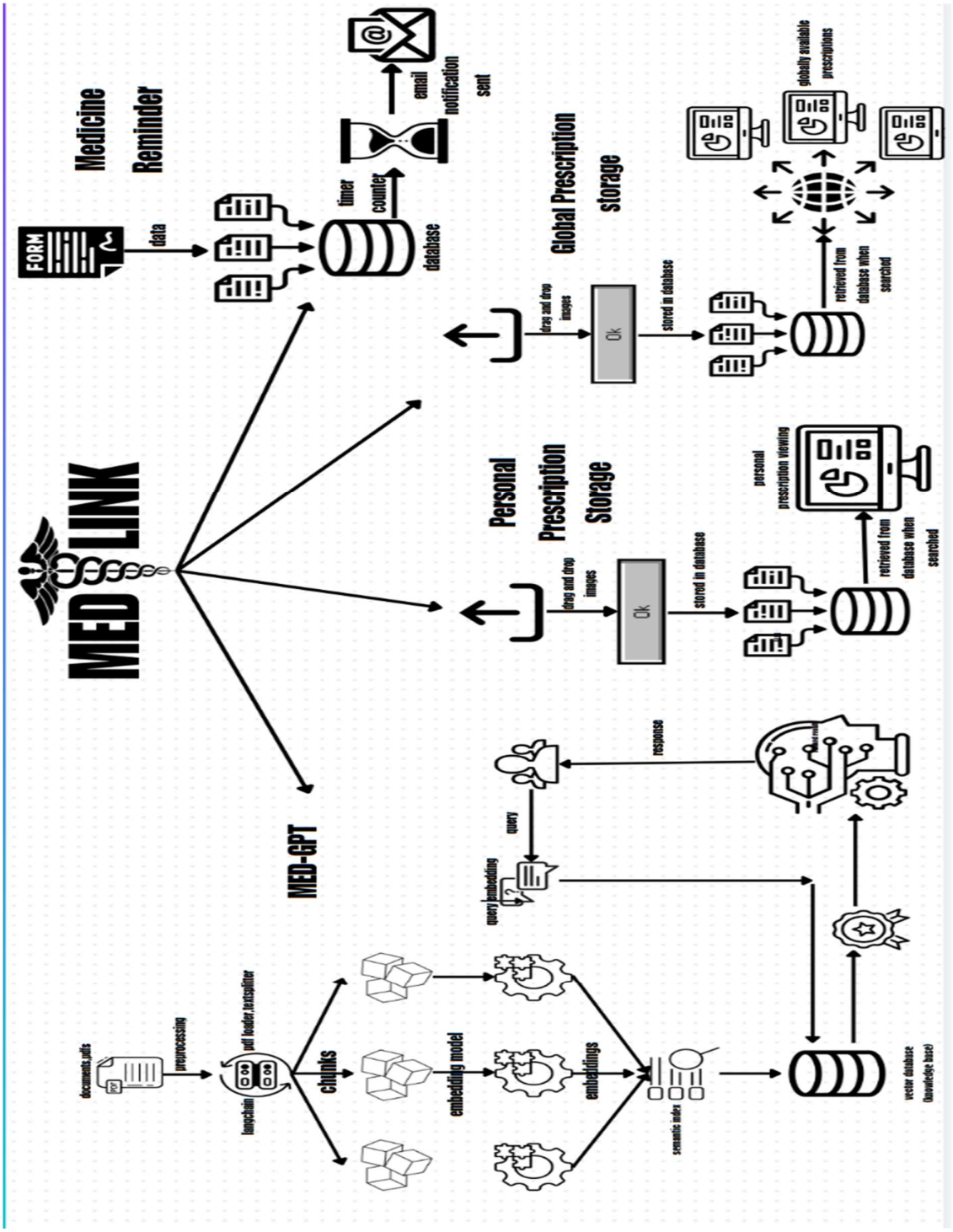
ARCHITECTURE



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FUTURE SCOPE

- **Healthcare Providers:** hospitals and clinics can enable the prescription management ease of Medilink. This keeps patient records easily accessible and minimizes errors in medication.
- **Pharmacies:** Pharmacies benefit from the global prescription database, which helps them understand patient needs and trends, improving service by ensuring accurate medication dispensing.
- **Telemedicine Services:** Telehealth platforms can use Medilink to give patients quick medication reminders and access to AI tools for diagnosis, improving care for patients at a distance.
- **Insurance Companies:** The prescribed trends can be studied with data from Medilink, making them customise their plans to lead to better health results.
- **Public Health Organizations:** These organizations can make use of the de-identified prescription database for studies and research on medication usage pattern, which later on informs the public health policy initiatives.
- **Home Healthcare Services:** Home healthcare providers can be benefiting from the solutions and services offered by Medilink such as accessing patient record through remote access and the adherence to treatment at home.
- **Diagnostic Centres:** Described integration can help centres to store and share diagnostic data and securely analyse test results for improved productivity.
- **Rehabilitation Centres:** They are also beneficial in patient tracking hence; helping in the constant tracking and updating on the patient's medication intake and therapy.
- **Pharmaceutical Companies:** The prescription data obtained from Medilink can be of great help in market research and new-pharmacy products development.
- **Fitness and Wellness Centres:** Enables tracking of the members' health information for development of target fitness and wellness plans.
- **Mobile Health Apps:** Medilink's APIs can be incorporated into mHealth apps to from where users can benefit from extra functionalities such as alerts on time to take the particular medicine, and e-storing of user's medical histories.
- **Health Tech Startups:** Offers a strong ground on which newly established enterprises can bring innovative solutions into healthcare industry more concurrently.
- **Clinical Trial Management:** Provides assistance to trial organizers by managing the information about participants and controlling the level of compliance with the assigned treatment.
- **Elderly Care Facilities:** It helps in easy management of senior citizens' health by recording their medication, health status and medical history.
- **Corporate Wellness Programs:** From an employer's perspective, organizations can access employees' health status and plan for wellness programmes in order to increase productivity using Medilink.
- **Medical Tourism Providers:** Helps providers by providing safe and available health records to patients seeking medical treatment in another country.
- **Academic Institutions:** Serves as a platform for obtaining highly sanitized health data for medical research and students' analysis.

CONCLUSION

Medilink presents a comprehensive and integrated digital healthcare ecosystem that addresses key challenges in modern medical practice, including fragmented data systems, limited diagnostic accessibility, and poor patient adherence. By unifying modules for prescription management, AI-driven diagnostics, dietary planning, medical analytics, and emergency response, Medilink ensures seamless interaction between patients, healthcare providers, and medical data.

The modular architecture, supported by a diverse technology stack ranging from web frameworks to advanced AI tools, demonstrates both scalability and adaptability across various healthcare use cases. Features such as Med-GPT, Scan Analyzer, and the World Prescription Database exemplify how AI and machine learning can be meaningfully applied to improve clinical decision-making, enhance patient engagement, and streamline operational workflows.

Overall, Medilink reflects a significant step toward democratizing healthcare access, improving treatment outcomes, and enabling data-informed medical practices. The system's design promotes future extensibility, making it a strong candidate for continued development and deployment in both clinical and research environments.

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