

Ai-Based Patient Health Monitoring with Real Time Alert and Rescue System

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Abstract- This paper presents the design and implementation of an AI-based Patient Health Monitoring System that integrates symptom prediction, appointment and specialist mapping, OCR-based prescription parsing, medication reminders, and an auto-mated emergency alert-and-rescue mechanism with live location sharing. The system employs NLP for symptom understanding, machine learning classifiers for disease probability estimation, OCR for prescription digitization, and an event-driven notification architecture for fast emergency response. Emphasis is placed on real-time capability, data security, and practical integration with healthcare workflows. We demonstrate the system architecture, algorithms, implementation details, and an evaluation plan for accuracy and responsiveness.

Keywords: AI healthcare, symptom prediction, OCR prescriptions, emergency alert, ambulance automation, NLP, notification system.

I. INTRODUCTION

Timely identification of health issues and rapid emergency response are critical to improving patient outcomes. Users frequently rely on search engines for symptom checking, often leading to confusion and delays. This project develops an integrated platform that leverages artificial intelligence (AI), natural language processing (NLP), and real-time communications to deliver: (1) symptom prediction via an AI chatbot, (2) smart specialist mapping and appointment booking, (3) OCR-driven prescription handling and medication reminders, and (4) automated SOS alerts and ambulance coordination with live GPS and indoor guidance.

II. RELATED WORK

Existing solutions address individual problems: symptom checkers, appointment portals, reminder apps, and SOS services. However, most lack comprehensive integration, intelligent specialist mapping, accurate OCR for prescriptions, and automated ambulance connectivity. Our solution fills these gaps by combining robust NLP, probabilistic prediction models, reliable OCR pipelines, and event-driven emergency notifications in a unified platform.

This work was carried out as part of an academic project at Veltech Multitech Dr.Rangarajan Dr.Sakunthala Engineering College.

III. SYSTEM OVERVIEW AND REQUIREMENTS

Functional Requirements

- Accept natural-language symptom input and return disease probabilities.
- Map predicted conditions to appropriate specialists and enable appointment booking.
- Accept prescription images, extract medication schedules, and schedule reminders.
- Detect emergency keywords, send SOS alerts to family, and contact nearest ambulance with live location sharing.
- Generate a doctor-ready symptom summary (Symptom Story).

Hardware and Software Requirements

Minimal (development/testing): Intel Core i5, 8–16 GB RAM, optional GPU for model training. Software: Python 3.8+, TensorFlow/PyTorch, spaCy/BERT for NLP, Tesseract for OCR, FastAPI/Flask backend, Flutter/React frontend, MySQL/MongoDB, Twilio/FCM for notifications.

IV. ARCHITECTURE

The system uses a modular microservice-inspired architecture:

- Frontend (mobile/web) — user interface for chat, uploads, booking and SOS.
- API Gateway / Backend — FastAPI/Flask for orchestrating requests.
- AI Services — NLP component for intent/entity extraction, symptom prediction model, and text summarization service.
- OCR Service — OpenCV + Tesseract pipeline for extracting prescription text.
- Notification Service — Twilio/FCM for SMS/push notifications and email (SMTP).
- Database — relational (MySQL) or document (MongoDB) for users, logs, appointments and prescriptions.
- Emergency Integration — API connections to local ambulance services (where available) and live-tracking module.

ARCHITECTURE OF PROPOSED WORK

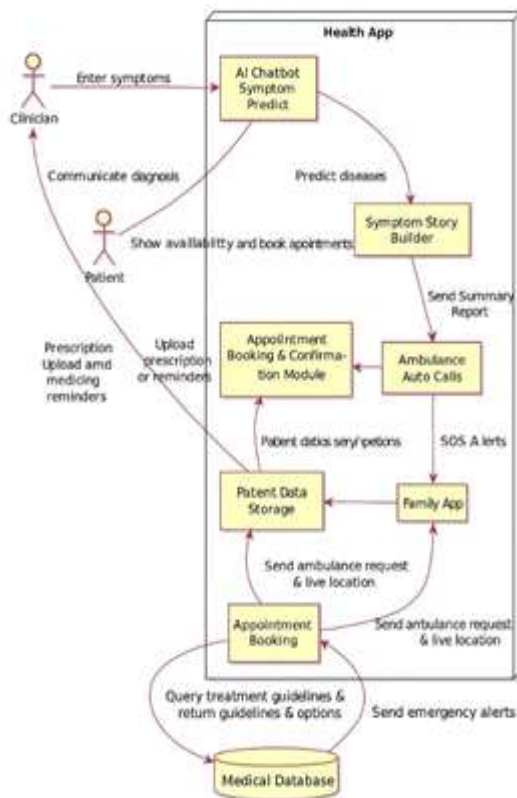


Fig. 1. High-level system architecture.

V. MODULES AND ALGORITHMS

AI Chatbot & Symptom Prediction

The chatbot uses NLU (spaCy/BERT) to extract entities: symptoms, duration, severity. Extracted features feed a probabilistic classifier (Naïve Bayes or Multiclass Logistic Regression) that computes posterior probabilities for candidate diseases.

Naïve Bayes formula:

$$P(D|S) = \frac{P(S|D)P(D)}{P(S)}$$

where D is disease and S is observed symptom set.

Specialist Mapping

A rule-based engine maps predicted diseases to specialists using IF-THEN rules and priority weights:

$$A^* = \arg \max(w_i \times P(D_i))$$

where

where w_i is rule weight and $P(D_i)$ is disease probability.

Prescription OCR and Reminder Scheduler

OCR pipeline: convert to grayscale, denoise, threshold, segment, then apply Tesseract. Extracted text undergoes token matching and spell correction; medicines, dosage, and timing are parsed and stored. A scheduler issues reminders via FCM/Twilio based on parsed timings.

Emergency Detection and Alerting

A keyword-based detector (with KMP/Rabin-Karp optimizations) monitors user messages and sensor feeds. On detection:

1. Fetch user location and indoor details if available.
2. Publish an event to Notification Service (family, ambulance).
3. Log the alert for audit and follow-up.
4. Event-driven publish-subscribe ensures low latency and decoupling.

Symptom Story Builder

All interactions are logged with timestamps. The summary generator aggregates logs and applies extractive NLP summarization (TF-IDF or BERT-based) to create a concise, clinician-friendly report.

VI. IMPLEMENTATION DETAILS

Data Preparation

Training data comprises labeled symptom-disease pairs (sourced from public datasets, synthetic annotations, and clinician-provided records). Text preprocessing steps: tok- enization, lowercasing, stopword removal, lemmatization, and encoding (TF-IDF or embeddings).

Model Training

For symptom-prediction:

- **Baseline:** Multiclass logistic regression with TF-IDF fea- tures.
- **Advanced:** Transformer-based classifier (fine-tuned BERT) when sufficient labeled data exists.

Training uses Adam optimizer with early stopping, and eval- uation via k-fold cross-validation.

OCR Pipeline

Steps:

- 1) Read image (OpenCV).
- 2) Preprocess: grayscale → denoise → adaptive threshold- ing.
- 3) Apply Tesseract OCR.
- 4) Postprocess: regex extraction for medicine names/dosages/timings.

VII. TESTING AND EVALUATION

Evaluation Metrics

- Symptom Prediction: Accuracy, Precision, Recall, F1- score, ROC-AUC.
- OCR: Character Error Rate (CER), Word Error Rate (WER), extraction precision for medication fields.
- Emergency Module: Detection latency, notification de- livery success rate, ambulance response integration suc- cess.

Sample Training Metrics (Illustrative)

TABLE I
MODEL TRAINING AND VALIDATION (ILLUSTRATIVE)

Epoch	Train Loss	Val Loss	Train Acc	Val Acc
0	0.72	0.70	0.65	0.63
10	0.55	0.58	0.70	0.68
20	0.42	0.50	0.74	0.72
30	0.38	0.46	0.77	0.75
50	0.30	0.40	0.80	0.79

VIII. ALGORITHMIC DESCRIPTIONS (SELECTED)

Naïve Bayes / Logistic Regression

The Naïve Bayes classifier computes posterior probabilities using Bayes' theorem; logistic regression uses the softmax function for multi-class classification:

$$P(y_i) = \frac{e^{w_i \cdot x}}{\sum_j e^{w_j \cdot x}}$$

Keyword Detection

Match function:

Match(Q, D) = 1 if $\exists q_i \in Q$ such that $q_i \subset D$

Trigger: If match then publish alert event.

OCR Character Confidence

For character c with image features f, OCR confidence:

$$P(c|f) = \frac{\exp(s_c)}{\sum_k \exp(s_k)}$$

where s_c is the classifier score for character c.

IX. PRIVACY AND SECURITY

Patient data confidentiality is enforced using:

- TLS for all network traffic (HTTPS).
- JWT-based authentication and role-based access control.
- Database encryption at rest and field-level encryption for sensitive attributes.
- Audit logs for all emergency events and data accesses.

X. DEPLOYMENT PLAN

Use Docker for containerization and Kubernetes (or cloud services such as AWS/GCP/Render) for scalable deployment. Critical services (notification, emergency) will be deployed with high-availability (replica sets and health checks).

XI. DISCUSSION

The integrated system reduces time-to-action for patients, improves appointment routing, and enhances medication ad- herence while providing a

reliable automated emergency response. Limitations include dependency on local ambulance APIs and OCR accuracy for poor-quality prescriptions; these are mitigated through fallback manual review and improved preprocessing.

XII. CONCLUSION AND FUTURE WORK

We presented a unified AI-based patient monitoring system with real-time alert and rescue features. Future work includes:

- Clinical trials to validate real-world effectiveness.
- Multilingual support for OCR and chatbot.
- Integration with hospital information systems (HL7/FHIR).
- Adding wearable sensor integration for physiological triggers.

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