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Towards Intelligent Healthcare: Integrating AI for Pill Detection, Symptom Analysis, and Pharmacy Routing

Mr.Amol Bhausaheb Avhale[1], Mr. Gaurav Sopan Adke[2], Mr.Gautam Kiran Gosavi[3], Miss.Kimaya Mahesh Kurhe[4], Prof. Devyani Sharma[5]

Department of Computer Engineering Loknete Gopinathji Munde Institute of Engineering Education and Research, Nashik, Maharashtra, India

ABSTRACT

The integration of artificial intelligence (AI) into healthcare systems offers transformative potential, enabling enhanced patient care and operational efficiency. This paper presents a comprehensive AI-powered healthcare solution focusing on three core functionalities: pill identification, symptom-based consultations, and medical navigation. The pill identification module levennbn rages advanced image recognition algorithms to accurately classify medications, reducing the risks of incorrect drug administration. The symptom-based consultation system employs natural language processing (NLP) and machine learning models to provide personalized medical advice by analyzing patient-reported symptoms and cross-referencing medical databases. Lastly, the medical navigation tool assists users in efficiently locating nearby healthcare facilities, specialists, and pharmacies, ensuring timely access to critical services. This AI-driven approach streamlines healthcare delivery, improves diagnostic accuracy, and empowers patients with accessible, on-demand medical assistance.

Keywords: AI Healthcare System, Consultation Symptoms, Image Processing, Image reorganization, Pharmacy Navigation, Pill Contents, Pill Identification, Prescription and Usages

I. INTRODUCTION

In today's fast-paced world, access to quick and reliable healthcare information is crucial. the integrated system combines three essential healthcare services—pill identification, symptom- based medical consultation, and pharmacy map navigation—into a seamless, user-friendly platform. by leveraging advanced image processing and machine learning techniques, the system allows users to identify unknown pills simply by uploading an image. in addition, a powerful symptom-based consultation algorithm helps users determine potential diagnoses based on their input, guiding them toward the appropriate medication. what truly sets this system apart is its ability to connect users with nearby pharmacies, showing real-time availability of required medications or identified pills and providing step-by-step navigation to the nearest pharmacy. whether you're unsure about a pill, seeking a diagnosis, or looking for the closest pharmacy, our platform is designed to be an all-in-one solution for your healthcare needs. the integration of artificial intelligence (ai) into healthcare is revolutionizing the way medical services are delivered, offering immense potential for improving patient outcomes, streamlining processes, and enhancing overall efficiency. ai's significance lies in its ability to analyze large volumes of data quickly, provide accurate predictions, automate routine tasks, and assist healthcare professionals in making informed decisions. the adoption of artificial intelligence (ai) in medical practice is rapidly gaining momentum across the world. ai is becoming

an integral part of healthcare systems, driven by advancements in technology, increasing healthcare demands, and the need for more efficient and personalized care. the ai integrated healthcare solution is an advanced platform designed to revolutionize healthcare access and delivery. it provides seamless pill identification by scanning and recognizing medication details, reducing the risk of errors. the system also offers symptom-based consultations, using ai to analyze symptoms and suggest potential diagnoses, empowering users to take control of their health. additionally, the platform guides users to nearby pharmacies for quick access to prescribed medications. this all-in-one solution enhances healthcare convenience, accuracy, and efficiency, making it easier for individuals to manage their health from anywhere, anytime.

II. PROBLEM STATEMENT

AI-powered healthcare solution that integrates three key features: pill identification, symptom- based consultation, and pharmacy navigation. The system will leverage Convolutional Neural Networks (CNN) to accurately recognize pills based on visual input (such as images of tablets or capsules), while natural language processing (NLP) and machine learning algorithms will facilitate symptom analysis and consultation services. Additionally, a geo-location-based module will assist users in locating nearby pharmacies that stock required medications.

III. LITERATURE REVIEW

Table. 1

Year	Author(s)	Title	Focus	Key Findings	Result
2022	F. Rustam, Z. Imtiaz	Automated disease Diagnosis and Precaution recommender system using supervised machine learning.	Despite increased automation, such applications lack the desired accuracy and efficiency for healthcare problems.	Precaution recommender, healthcare problems.	Presents an automatic health care system that can effectively recommending the necessary precautions.
2023	Sandeep Kumar Panda	An Intelligent Disease Prediction and Drug Recommendation.	Probabilistic and weighted average methodologies utilized to recommend the medications.	Data mining, drug recommendation system, NLP, sentiment analysis.	created a medication recommendation system.
2023	Khalil Al Hussaeni	CNN-Based Pill Image Recognition for Retrieval Systems.	Medication should be consumed as prescribed with little to zero margins for errors	Image recognition, pill information retrieval, CNN.	This paper proposes a method for identifying pills from images.
2024	Mohan Wang	White Medication Pill Classification.	The identification and categorization of pills.	Near infrared images, pill categorization, feature fusion.	This paper presents an object detection algorithm with multiband image fusion.
2024	Bohua Zhang	Influence of Free Consultation Services on Patients.	Online medical platforms including paid Consultations.	Doctor performance; free online consultation; free service.	Explored the formation process of patients' willingness to pay.

IV. METHODOLOGY

The methodology for the AI-Integrated Healthcare Solution involves a multi-step process combining machine learning, natural language processing (NLP), and geo-location services. First, the system uses a Convolutional Neural Network (CNN) to handle pill identification. The CNN is trained on a dataset of pill images, including various shapes, sizes, colors, and imprints, allowing it to accurately classify different medications based on a user provided image. Preprocessing techniques, such as image resizing and normalization, improve the model's performance. For the symptom-based consultation feature, the system employs NLP algorithms to analyze user inputted symptoms and match them to potential medical conditions. It draws from a medical knowledge base, utilizing decision trees or more advanced models like neural networks to suggest possible diagnoses and recommendations. Machine learning models refine this process by incorporating feedback from user interactions, improving the accuracy of consultations over time.

Pharmacy navigation leverages geo-location services to identify pharmacies nearby that stock the required medications. The system uses an integrated API to fetch real-time pharmacy data and cross-references it with the pill identification and consultation outputs, guiding users to the nearest suitable pharmacy. Each module operates independently but is interconnected through a unified user interface, providing seamless transitions between pill identification, consultation, and pharmacy navigation. This integration ensures that users receive comprehensive and reliable healthcare assistance in a user-friendly, AI-powered platform.

Pill Identification

Pill identification is critical for preventing medication errors, particularly among patients who take multiple medications or have visual impairments. Traditional methods of identifying pills rely on reading labels and pill descriptions, which can be challenging for patients and healthcare providers. AI-based pill identification systems address this issue by using image recognition technology to accurately classify medications. Users should be able to upload images of pills for identification. The system should provide accurate identification based on visual characteristics. Include features for searching pills by name, shape, colour, and imprint. [4]

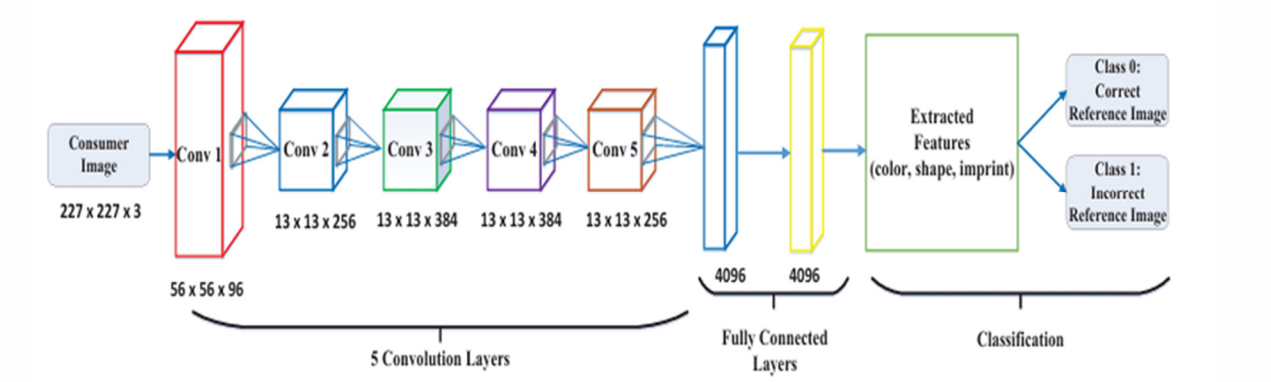


Fig 1. Consultation system

Input: Pill image

Step 1: Preprocess the image (resize, color normalizing, remove noise).

Step 2: Extract features (color, shape, size, imprint code). (Using Convolutional Neural Network (CNN) model, such as MobileNet.)

Step 3: Compare the extracted features with the pill database. (SQLite Database: Used for storing pill images and associated information (name, composition, etc.) in a structured format.)

Step 4: If a match is found, return the pill details (name, use case, etc.).

Otherwise, return a ”
Not Found” response.

Output:

Pill details or error message.

Input Image: The user provides an image of the pill. This could be uploaded via the front-end (built with HTML, CSS, JavaScript).

Image Processing: Prepare the pill image for optimal feature extraction.

Greyscale conversion: Before a pill image undergoes the preprocessing image is converted to a grayscale format.

Resize and Normalize: Resize the image to a standard size compatible with the CNN model, such as 227 x 227 pixels.

Feature Extraction: Extract distinctive features of the pill (e.g., shape, color, size, texture).

1. **Shape extraction of pill:**

2. **Colour extraction of pill:**

3. **Imprints extraction of pill:**

Database Query: Compare the extracted features with pre-stored pill images and data in the database. Querying the database with basic feature matching criteria.

Return Pill Information: Pill Name, Uses, Side effects etc. The result is a feature vector that captures the essential visual characteristics of the pill, enabling accurate matching with images in the database.

Technology used for Pill Identification

AI algorithms, particularly deep learning and image recognition models, are trained to identify pills based on their physical characteristics such as size, color, shape, and imprints. These models can be deployed through smartphone apps or integrated with hospital medication systems to verify the identity of medications in real time.

Applications of pill Identification:

- Pharmacy automation: AI can ensure correct medication dispensation by cross- referencing prescribed medications with physical pills.
- Home care: Patients, especially the elderly, can use pill-identification apps to avoid taking incorrect medications.
- Healthcare settings: Nurses and caregivers can quickly verify medication to avoid human errors, particularly in high pressure environments.

Benefits of Pill Identification:

- Reduced medication errors, improved patient safety, enhanced convenience for patients and caregivers, and minimized risk in polypharmacy cases.
- Challenges:
- Ensuring high accuracy across diverse pill datasets, especially in countries with different drug markings and the need for continuous system updates to include new drugs.

Symptom-Based Consultation

AI-powered symptom-based consultation systems are transforming how patients seek medical advice. These systems utilize natural language processing (NLP) and machine learning to assess symptoms reported by patients and provide recommendations or diagnoses. They can serve as the first line of consultation, guiding patients on the next steps to take, whether it be self-care, a doctor visit, or emergency care. Users should be able to input symptoms and receive potential diagnoses. The system should provide guidance on next steps (e.g., when to seek medical attention). Include a database of common symptoms and associated conditions.

1.User Selects Symptoms (Frontend)

The user interface (likely a webpage using Flask) provides dropdowns to select up to 3 symptoms.

2. Preprocessing the Symptoms (Backend)

A symptom vector is prepared: This is a binary vector where each index corresponds to a known symptom from the dataset (say there are 132 symptoms).

The selected symptoms are set to 1, all others to 0.


```
input_vector = [0]*132
input_vector[symptom_index[sym1]] = 1
input_vector[symptom_index[sym2]] = 1
input_vector[symptom_index[sym3]] = 1
```

3.Model Prediction

- The input vector is fed into a pre-trained Machine Learning model (like Decision Tree, Random Forest, or Logistic Regression). Training Phase (Before Prediction) This happens before your app goes live — it's where the model "learns". Dataset:
- Rows: Patient records
- Columns: 132 symptoms (binary: 1 = present, 0 = absent), and the disease label. Example: The model learns relationships between patterns of symptoms and diseases. So it "learns":

Fever	Cough	Fatigue	Headache	...	Disease
1	1	1	0	...	Common Cold
0	1	0	1	...	Migraine

If Fever = 1, Cough = 1, Fatigue = 1 → Likely disease = Common Cold.

```
[0, 0, 1, 0, 1, ..., 1]  # Only selected symptoms set to 1
```

• How Does the Model "Decide"

```
User Input (Symptom1, Symptom2, Symptom3)
        ↓
Convert to Symptom Vector (0s & 1s)
        ↓
Feed into Trained ML Model
        ↓
Model Predicts Disease Label
        ↓
Fetch Details (Meds, Diet, Workout, etc.) from CSVs
        ↓
Show Results on Screen (Streamlit UI)
```

Once the disease is predicted, the system fetches related data:

• Description of disease
• Precautions
• Medications
• Workouts
• Diet plans

These are retrieved from separate files like: precautions.csv , medications.csv , workout.csv , diet.csv

Technology used for Consultation:
Natural Language Processing (NLP): NLP processes patient inputs (written or spoken) to understand symptoms and classify them into medical terms.
Machine Learning: Predictive models analyze symptom patterns and suggest likely diagnoses or further questions to refine diagnostic accuracy.
Chatbots and Virtual Assistants: AI-powered chatbots guide users through a structured symptom assessment, generating suggestions based on medical knowledge databases.
Applications of Symptoms Base Consultation:
Telemedicine: AI symptom-checkers can serve as the front-end to telehealth services, enabling efficient triaging of cases, Primary care triage: Clinics and hospitals can use AI for initial patient assessments, freeing up healthcare professionals for more complex cases, Self- diagnosis tools: Patients use symptom-checkers to receive early-stage advice or guidance before seeking formal medical care.
Benefits:
Increased access to preliminary medical advice, reduction in unnecessary hospital visits, faster triaging for critical cases, and empowerment for patients to manage their health.

Challenges:
Accuracy concerns: Symptom-based AI systems may struggle with rare conditions or complex cases that require human medical expertise, Ethical issues: Ensuring patient data privacy and avoiding bias in recommendations based on incomplete or non-diverse datasets, Patient trust: Gaining trust in AI-based consultations as complementary (not a replacement) to human medical professionals.

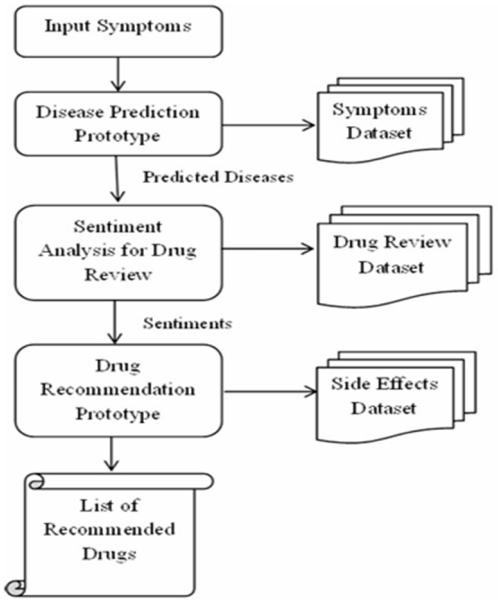


Fig 2. Consultation system

Medical Navigation

AI in medical navigation helps patients find the nearest and most appropriate healthcare services. These systems integrate geolocation data with healthcare information to guide users to hospitals, clinics, pharmacies, or specialists. This is particularly useful in emergency situations or for patients with chronic conditions who need regular care. Users should be able to find nearby healthcare facilities based on their location. The system shouldprovide information on available services and specialties. Include features for appointment scheduling and telehealth options. [5]

1.User Input

- The user opens the app or system interface.
- They type in the medicine name (e.g., "Paracetamol").
- The system may also ask for location permission or use previously stored user location.

2. Location Detection

- Using GPS or HTML5 Geolocation API (for web), the system detects the current latitude and longitude of the user.
- If location permission is denied, user can manually enter a location or pincode.

3.Backend Search Trigger

Once the input is received: Medicine Name User Location The backend triggers a pharmacy search query.

4. Pharmacy Search using API

The system calls a map or place search API like:

- Google Places API • OpenStreetMap Nominatim + Overpass API
- Yelp API (if local businesses are listed)
- It fetches nearby pharmacy stores within a certain radius (e.g., 5km).

Display on Map UI

Frontend (web or mobile) shows:

- A list view (with contact info, availability)
- A Google Map/OpenStreetMap view with pins
- Directions via map if the user clicks a pharmacy

Technology used for Pharmacy Navigation:

Geolocation and GPS: AI uses location data to determine a patient's position and map out the nearest healthcare facilities.

AI algorithms: These algorithms factor in variables like patient urgency, availability of healthcare services, and real-time traffic conditions to suggest the most efficient route.

Wearable Devices and IoT: AI-powered devices can track a patient's health metrics (e.g., heart rate, glucose levels) and proactively suggest medical navigation when abnormal readings are detected.

Applications:

Emergency services: AI helps patients or emergency responders quickly locate the nearest hospitals or trauma centers based on real-time conditions. Chronic care management: Patients with ongoing health issues can receive real-time recommendations for healthcare services, pharmacies, or specialists in their vicinity, Personalized navigation: AI can take into account patient preferences (e.g., preferred hospitals, insurance coverage) to suggest relevant healthcare providers.

Benefits:

Faster access to care: Especially crucial in emergency situations, AI-driven navigation can save lives by directing patients to the right facility quickly. Enhanced patient experience: By guiding patients through the often complicated healthcare system, AI reduces the stress of finding suitable services, Optimized care delivery:Healthcare providers can use AI data to optimize facility locations, resource allocation, and patient traffic management.

Challenges:

Data privacy: Handling sensitive location data in compliance with healthcare data regulations (e.g., HIPAA) is crucial, Infrastructure limitations: In remote areas, AI systems may not have the necessary data or connectivity to provide accurate navigation services., Integration with real-time data: Ensuring real-time accuracy of facility availability, service delays, or traffic conditions can be technically challenging.

V. SYSTEM ARCHITECTURE

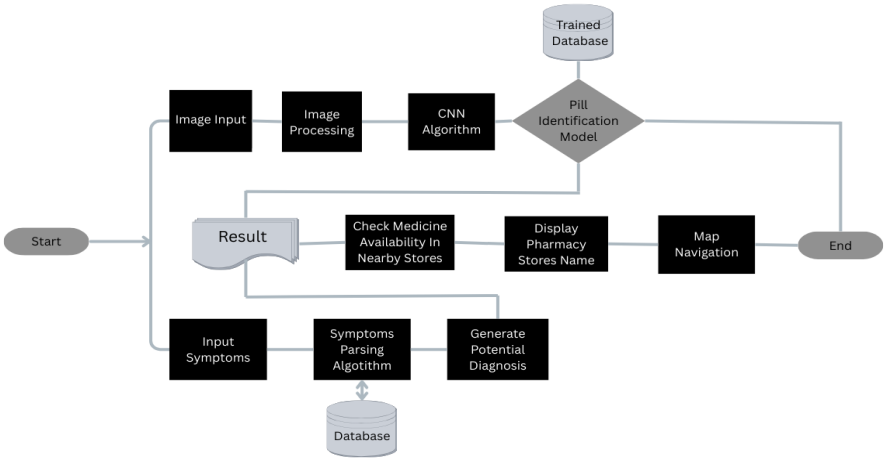


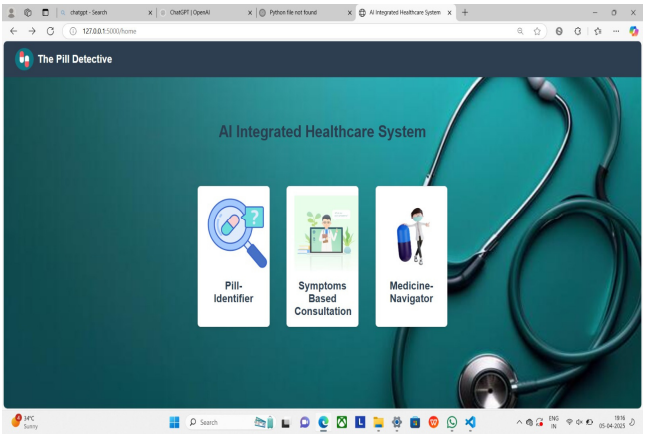
Fig 3. system architecture

The system architecture for the Integrated Pill Identification, Medical Consultation, and Pharmacy Navigation System can be broken down into several key components:

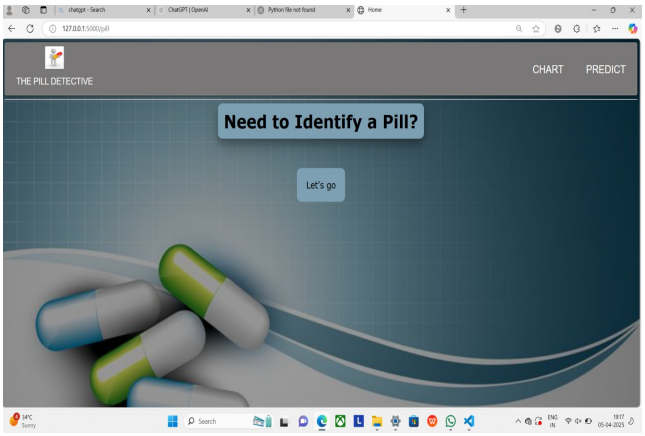
1. User Interface: This is where users interact with the system, either by uploading an image for pill identification or entering symptoms for consultation. The system will also display results like pill identification, potential diagnoses, and available pharmacies.
2. Pill Identification Module: Processes the uploaded pill image, identifies the pill using its characteristics (shape, color, markings), and then provides relevant details to the user.
3. Symptom-Based Medical Consultation Module: Users input symptoms, and the system analyzes this information to suggest potential diagnoses based on established medical guidelines.
4. Pharmacy Locator and Navigation: Once a pill is identified or a diagnosis is made, the system checks nearby pharmacies for availability of the relevant medicine and provides navigation to the nearest store.
5. Backend Services: Handles the main operations of the system, including processing pill data, generating diagnoses, managing user data, and connecting with pharmacy databases for real-time availability of medicines.
6. Security and Data Management: Ensures that user data is securely handled, especially sensitive medical information, while managing and storing data like user profiles, pill images, and pharmacy details. This

system integrates pill identification, medical consultation, and real-time pharmacy navigation to provide users with a complete healthcare solution in one place.

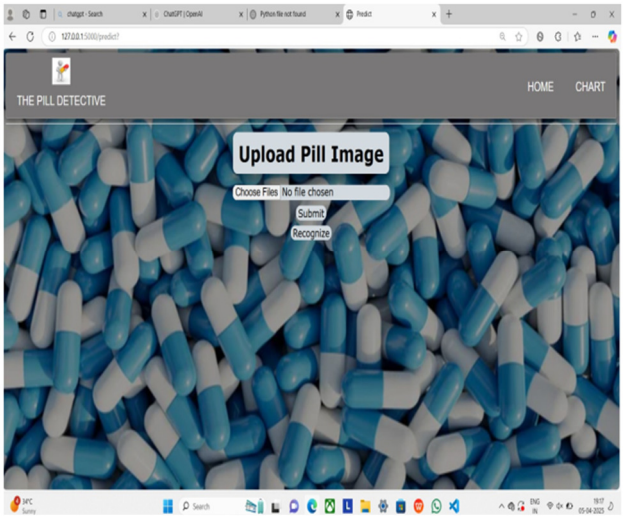
VI. RESULTS



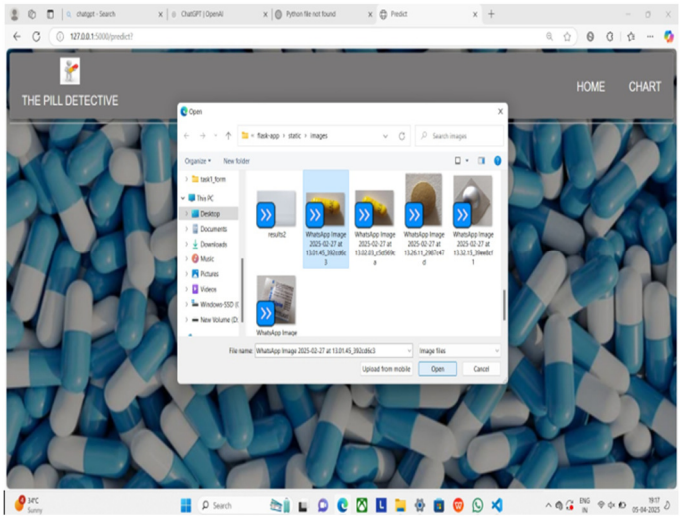
a) Select Option Identification)



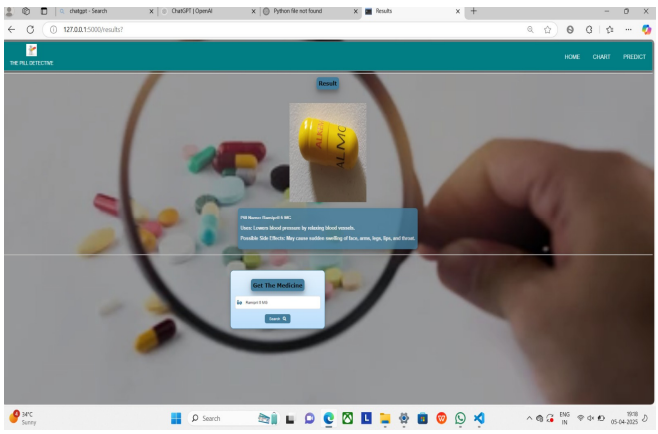
b) Select option(Pill



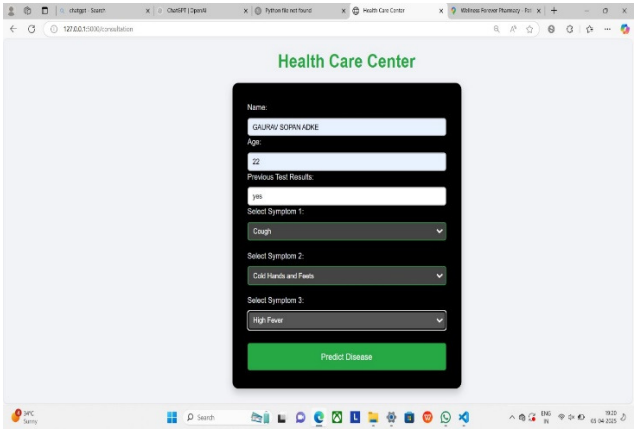
c)Upload the pill image



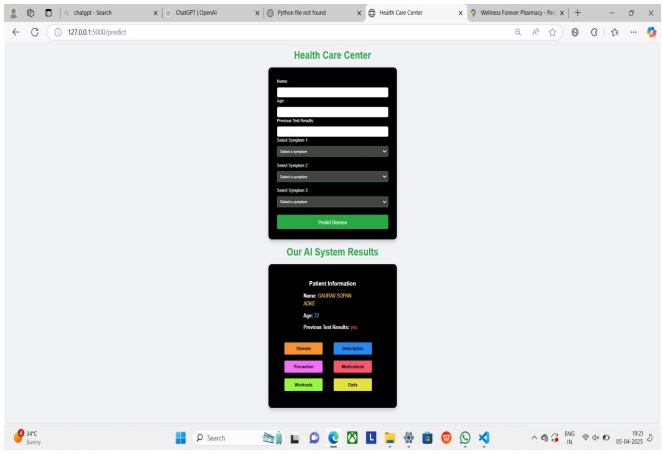
d)Select the image that need to identified



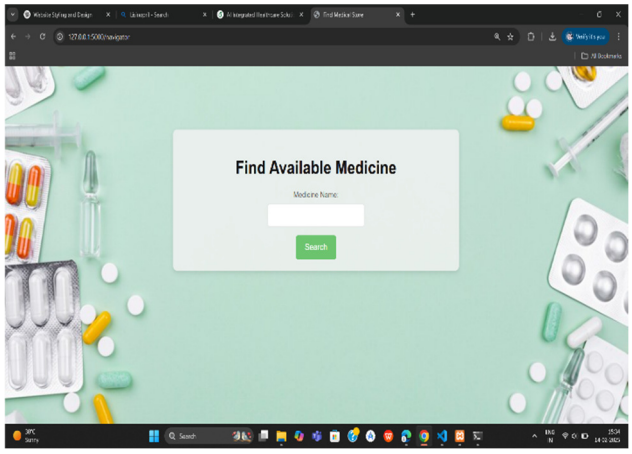
e) View Result and get Pill



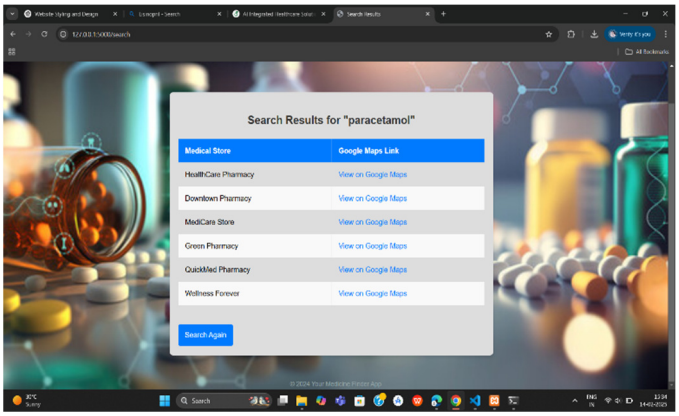
f) Enter Symptoms



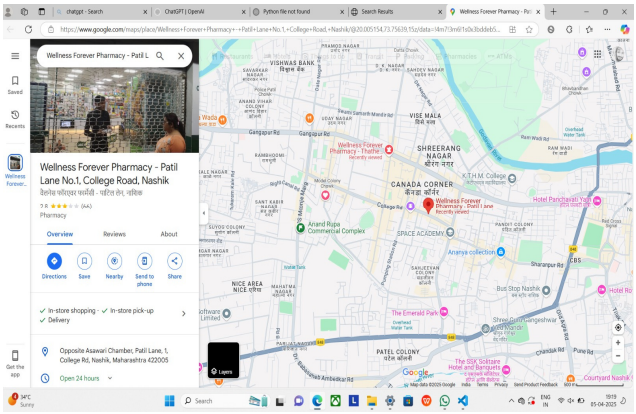
g) Get Consultation



h)Enter medicine name



i)Select Nearby Pharamcy



j)Get Location

VII. FUTURE SCOPE

The future of AI-integrated healthcare systems promises significant advancements that will revolutionize the way healthcare is delivered. As AI technology matures, its applications in pill identification, symptom-

based consultation, and pharmacy navigation will become more advanced, personalized, and accessible. Greater Accuracy and Drug Coverage: AI-powered pill identification systems will become more comprehensive, covering a wider range of medications, including newer formulations, generic drugs, and international variations. Continuous training of AI models with global datasets will enhance recognition accuracy. Integration with Wearables and IoT Devices: Future systems will connect with wearable health devices to track medication adherence. Devices like smart pillboxes or wristbands will identify pills in real-time, ensuring patients take the correct doses at the right times, reducing errors in medication regimens. Real-Time Drug Interaction Warnings: AI systems will analyze patients' medication lists and provide real-time alerts about potential drug interactions when identifying pills, helping to prevent adverse reactions. Symptom-based consultation systems will evolve to offer more precise diagnostics by incorporating AI models trained on vast datasets that include clinical, genetic, and environmental factors. AI will be able to cross-reference patient symptoms with their health history, genetic predispositions, and local disease outbreaks to generate highly accurate diagnosis predictions. Multilingual and Multimodal Interfaces: AI consultation tools will expand to support multiple languages and input modes (e.g., voice, text, images), making healthcare more accessible to non-English-speaking populations and patients with disabilities. Contextual Understanding and Emotional Analysis: Advanced NLP models will not only assess symptoms but also detect emotional cues from patient interactions, offering mental health insights and tailored recommendations for physical and psychological care.

VIII. CONCLUSION

The future of AI-integrated healthcare systems promises significant advancements in pill identification, symptom-based consultation, and pharmacy navigation, transforming patient care by making it more accurate, personalized, and accessible. These systems will work in tandem with emerging technologies, such as wearables and IoT devices, to deliver holistic, real-time healthcare solutions. With continuous technological, regulatory, and ethical improvements, AI will play a pivotal role in reshaping global healthcare and improving patient outcomes.

IX. REFRENCES

[1] V. Mudaliar, P. Savaridaasan, and S. Garg, ‘‘Disease prediction and drug recommendation Android application using data mining (virtual doc tor),’’ Int. J. Recent Technol. Eng. (IJRTE), vol. 8, no. 3, pp. 6996–7001, Sep. 2019.

[2] Larios Delgado, N.; Usuyama, N.; Hall, A.K.; Hazen, R.J.; Ma, M.; Sahu, S.; Lundin, J. Fast and accurate medication identification. NPJ Digit. Med. 2019, 2, 10.

[3] Madduri, A. Content based Image Retrieval System using Local Feature Extraction Techniques. Int. J. Compute. Appl. 2021, 183, 16–20.

[4] Healthline. Medication Safety: Pill Identification, Storage, and More. 2021. Available online: https://www.healthline.com/ health/pill identification (accessed on 31 July 2022).

[5] RxList. Pill Identifier (Pill Finder Wizard). 2022. Available online: https://www.rxlist.com/pill-identification tool/article.htm (accessed on 31 July 2022).

[6] Dubey, S.R. "A Decade Survey of Content Based Image Retrieval Using Deep Learning." *IEEE Transactions on Circuits and Systems for Video Technology*, 2022, 32(5), 2687–2704. DOI: 10.1109/TCSVT.2021.3080920 Typeset+2Cambridge University Press & Assessment+2SRS Journal+2

[7] Rustam, F., Imtiaz, Z., Mehmood, A., Rupapara, V., Choi, G.S., Din, S., & Ashraf, I. "Automated disease diagnosis and precaution recommender system using supervised machine learning." *Multimedia Tools and Applications*, 2022, 81(22), 31929–31952. DOI: 10.1007/s11042-022-12897-x ACM Digital Library

[8] Panda, Sandeep Kumar. "An Intelligent Disease Prediction and Drug Recommendation." *IEEE Access*, 2023. DOI: 10.1109/ACCESS.2023.3314332 ADS
[9] Zhang, Bohua, Yan, Zhijun, Song, Xiuwei, Liao, Yingguang, & Li, Peilun. "Influence of Free Consultation Services on Patients' Willingness to Pay in Online Medical Platforms." *International Journal of Crowd Science*, 2023. DOI: 10.26599/IJCS.2023.9100021 SciOpen+1Semantic Scholar+1
[10] Al-Hussaeni, Khalil, Karamitsos, Ioannis, Adewumi, Ezekiel, & Amawi, Rema M. "CNN-Based Pill Image Recognition for Retrieval Systems." *Applied Sciences*, 2023, 13(8), 5050. DOI: 10.3390/app13085050 MDPI+1OUCI+1
[11] Wang, Mohan, Jiang, Yang, Xu, Baohui, & Huang, Mengqiang. "MCIR-YOLO: White Medication Pill Classification Using Multi-Band Infrared Images." *IEEE Photonics Journal*, 2024. DOI: 10.1109/JPHOT.2024.3426929 RSC Publishing+1Semantic Scholar+1

