

OOP LAB**Project Report****SUBMITTED BY:**

- Name: Muhammad Maaz Abbasi
- Reg ID: 242308
- Class: BSCYSev-F24-A

SUBMITTED TO:

Iram Fatima Hashimi

Intelligent Clinic Scheduling and Advisory System

The Intelligent Clinic Scheduling and Advisory System is a modern healthcare web application that leverages advanced AI (Google Gemini) to provide users with instant, personalized medical symptom analysis and doctor recommendations. Built entirely in C++ for the backend and using pure HTML/CSS for the frontend, the system demonstrates robust object-oriented programming, secure data handling, and seamless AI integration.

Key Features

- **AI-Powered Symptom Analysis:**
Users can submit their symptoms, duration, and severity through a web form. The backend sends this data to the Gemini AI API, which returns a detailed analysis including possible conditions, recommendations, warning signs, and suggested medical specialties.
- **Doctor Recommendation and Scheduling:**
Based on the AI's suggested specialties, the system recommends the most suitable doctors that are available. Users can view doctor profiles and book appointments directly through the web interface.
- **Appointment Management:**
The system allows users to book appointments with recommended doctors, capturing all necessary details and storing them securely in a text as no medical information is stored online.
- **Emergency Support:**
Prominent emergency banners and warnings are displayed to guide users in urgent situations
- **Security & Privacy**
For security reasons, no personal medical information is stored. We understand how sensitive and confidential health data is, which is why only basic appointment details — such as date, time, and booking status — are securely stored. Information related to symptoms, severity, or any personal medical records is never collected or saved, ensuring complete protection of users' medical privacy.

How It Works

1. **User Input:**
The user visits the homepage and inputs their symptoms, duration, and severity.

The screenshot shows a web application interface with a purple background. The top section is titled "Describe Your Symptoms" and contains a form with the following fields:

- Primary Symptoms ***: A text input field containing "fatty liver, pain in neck".
- Duration**: A dropdown menu showing "1 day".
- Severity (1-10)**: A range slider from 1 to 10, currently set at 5.
- ANALYZE SYMPTOMS WITH AI**: A blue button.

The bottom section is titled "System Features" and contains four cards:

- AI-Powered Analysis**: Advanced Gemini AI analyzes your symptoms and provides intelligent medical insights and recommendations.
- Expert Doctor Matching**: Get matched with the most suitable specialists based on your specific symptoms and medical needs.
- Easy Appointment Booking**: Book appointments seamlessly with recommended doctors based on availability and specialization.
- Secure & Private**: Your medical information is protected with enterprise-grade security and privacy measures.

2. AI Analysis:

The backend C++ server receives the form data and sends it to the Gemini AI API. The AI's response is parsed to extract the main analysis text, which is then formatted and displayed to the user in a readable HTML report. Both responses are shown, hardcoded and response from Gemini.

```
std::unique_ptr<SymptomAnalysis> AIService::analyzeSymptoms(const std::string& symptoms,
                                                            const std::string& duration,
                                                            int severity) {
    auto analysis = std::make_unique<SymptomAnalysis>(symptoms, duration, severity);

    // Create Gemini API request payload
    std::ostringstream payload;
    payload << "{\n";
    payload << "  \"contents\": [{\n";
    payload << "    \"parts\": [{\n";
    payload << "      \"text\": \"As a medical AI assistant, analyze these symptoms:\\n\\n\";
    payload << "Symptoms: \" << symptoms << "\\n\";
    payload << "Duration: \" << (duration.empty() ? \"Not specified\" : duration) << "\\n\";
    payload << "Severity (1-10): \" << severity << "\\n\\n\";
    payload << "Provide analysis with possible conditions, recommendations, warning signs, and suggested specialties.\\n\\n\";
    payload << "    }]\n";
    payload << "  }]\n";
    payload << "}";
```

```
// Parse response and extract medical insights
if (response.find("respiratory") != std::string::npos ||
    symptoms.find("cough") != std::string::npos ||
    symptoms.find("breathing") != std::string::npos) {
    analysis->addCondition("Respiratory Infection", "Possible viral or bacterial respiratory infection", 75);
    analysis->addSuggestedSpecialty("Pulmonology");
    analysis->addSuggestedSpecialty("Internal Medicine");
}

if (symptoms.find("headache") != std::string::npos ||
    symptoms.find("head") != std::string::npos) {
    analysis->addCondition("Tension Headache", "Common type of headache caused by stress or muscle tension", 80);
    analysis->addSuggestedSpecialty("Neurology");
    analysis->addSuggestedSpecialty("Family Medicine");
}

if (symptoms.find("chest") != std::string::npos ||
    symptoms.find("heart") != std::string::npos) {
    analysis->addCondition("Chest Discomfort", "Could be related to cardiac or respiratory issues", 70);
    analysis->addSuggestedSpecialty("Cardiology");
    analysis->addSuggestedSpecialty("Internal Medicine");
}

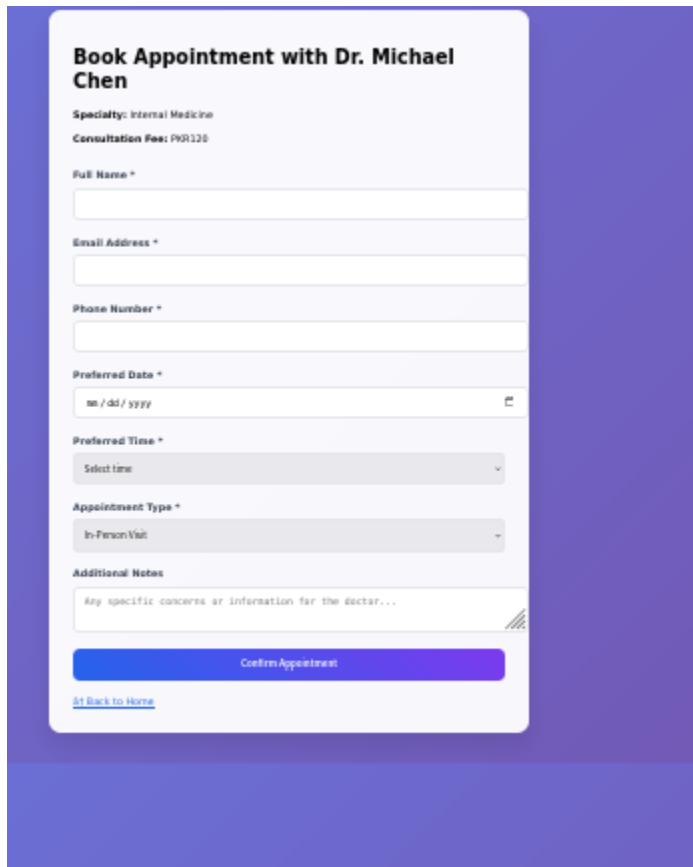
if (symptoms.find("fever") != std::string::npos ||
    symptoms.find("temperature") != std::string::npos) {
    analysis->addCondition("Viral Infection", "Common viral illness with fever symptoms", 85);
    analysis->addSuggestedSpecialty("Internal Medicine");
}
```

3. Doctor Matching:

The system matches the AI's suggested specialties with its internal doctor database, recommending the top specialists for the user's case.

4. Appointment Booking:

Users can book appointments with recommended doctors by filling out a secure form. Appointment details are saved for future reference in a txt file.



The screenshot shows a web form titled "Book Appointment with Dr. Michael Chen". Below the title, it lists "Specialty: Internal Medicine" and "Consultation Fee: PKR120". The form contains several input fields: "Full Name *" (text), "Email Address *" (text), "Phone Number *" (text), "Preferred Date *" (date picker showing "mm / dd / yyyy"), "Preferred Time *" (dropdown menu showing "Select time"), and "Appointment Type *" (dropdown menu showing "In-Person Visit"). There is also a text area for "Additional Notes" with the placeholder text "Any specific concerns or information for the doctor...". At the bottom of the form is a blue button labeled "Confirm Appointment" and a link labeled "Go Back to Home".

5. Results Display:

The user receives a comprehensive report including:

AI Analysis Results

AI Main Response:
 Analysis of Symptoms: Fatty Liver and Neck Pain (1-day duration, Severity 5/10)/n/nAnalysis/n/nThe presentation of fatty liver alongside neck pain, especially with a sudden onset (1-day duration), is unusual and doesn't suggest a direct causal relationship. Fatty liver is typically a chronic condition developing over time, not manifesting acutely with neck pain. Therefore, it's crucial to consider these symptoms as potentially unrelated or indicative of separate underlying conditions./n/nPossible Conditions:/n/n* Unrelated Conditions: The most likely scenario is that the fatty liver is a pre-existing, possibly undiagnosed, condition, and the neck pain is due to a separate issue. Possible causes of neck pain include:/n * Musculoskeletal: Muscle strains, cervical spondylosis (degenerative changes in the neck), whiplash (if a recent injury occurred), torticollis (muscle spasm), pinched nerve./n * Inflammatory: Infections (viral or bacterial), arthritis./n * Other: Referred pain from other organs (though less likely given the location and sudden onset), stress, anxiety./n/n* Less Likely, but Possible Connections (requiring further investigation):/n * Metabolic Syndrome: Fatty liver is a key component of metabolic syndrome. While not directly causing neck pain, severe metabolic derangements could theoretically contribute to inflammation affecting multiple systems./n * Autoimmune Disease: Some autoimmune disorders can affect both the liver and musculoskeletal system, although this is less likely given the short duration of the neck pain./n/nRecommendations:/n/n1. Detailed history: A thorough medical history is necessary, including details about:/n * Onset and nature of the neck pain (sudden, gradual, constant, intermittent)./n * Any recent injuries, activities, or illnesses./n * Past medical history (including any known liver conditions)./n * Lifestyle factors (diet, alcohol consumption, exercise)./n2. Physical Examination: A doctor needs to perform a physical exam focusing on the neck and abdomen. This will assess range of motion, palpation for tenderness, and other relevant findings./n3. Investigations: Depending on the physical exam findings, the following investigations may be ordered:/n * Blood tests: Liver function tests (LFTs), complete blood count (CBC), inflammatory markers (CRP, ESR)./n * Imaging: X-ray of the cervical spine, possibly an MRI or CT scan if indicated by neurological symptoms or concerning findings on the X-ray. Abdominal ultrasound to assess the fatty liver and rule out other liver pathologies./n/nWarning Signs:/n/nSevere or worsening neck pain: Pain radiating down the arms or legs, numbness, weakness, difficulty swallowing or breathing./n Fever, chills, or other signs of infection./n Jaundice (yellowing of skin and eyes)./n Significant changes in bowel or bladder function./n Sudden onset of intense abdominal pain./n/nSuggested Specialties:/n/nPrimary Care Physician (PCP): The initial point of contact for evaluation and further referral./n Rheumatologist: If inflammatory conditions are suspected./n Neurologist: If neurological symptoms are present or neck pain is severe and debilitating./n Gastroenterologist: For further evaluation of the fatty liver and any associated gastrointestinal issues./n/nDisclaimer: This analysis is for informational purposes only and does not constitute medical advice. It is crucial to seek in-person evaluation from a qualified healthcare professional for diagnosis and treatment of your symptoms. The severity rating (5/10) is subjective and needs professional assessment./n

+ Show AI Raw Response (for debugging)

85% Possible Conditions

General Medical Assessment
 Symptoms require professional medical evaluation 79%


AI Recommendations

- Consult with a healthcare professional for proper diagnosis
- Monitor symptoms closely and note any changes
- Rest and stay hydrated
- Take over-the-counter medication if needed for symptoms relief


Seek Immediate Care If:

Recommended Doctors

Based on your symptoms, these specialists are best suited to help you.



Dr. Michael Chen RECOMMENDED
Internal Medicine
 4.9 (127 reviews) · 15 years experience
 Specializes in respiratory infections, general internal medicine, and preventive care. Excellent track record with viral infections and symptom management.
 PKR120 consultation Book Appointment



Dr. Sarah Williams
Family Medicine
 4.7 (88 reviews) · 12 years experience
 Comprehensive family medicine with focus on holistic care and patient education. Experienced in treating common illnesses and wellness management.
 PKR100 consultation Book Appointment

- AI-generated analysis (with possible conditions, recommendations, and warning signs)
- Recommended doctors that
- Option to view the raw AI response for transparency/debugging

Technical Architecture

- **Backend:**
 - Written in C++ (object-oriented design)
 - Handles HTTP requests, form parsing, AI API integration, and HTML response generation
 - Uses libcurl for HTTP communication with Gemini AI
- **Frontend:**
 - Pure HTML and CSS
 - Responsive, modern design with medical-themed styling
- **AI Integration:**
 - Communicates with Google Gemini API for advanced medical analysis
 - Extracts and formats the AI's main response for user-friendly display
- **Security and Privacy:**
 - All sensitive operations are handled server-side
 - No client-side scripting or data exposure

Object-Oriented Design

- **Doctor Class:** Encapsulates doctor details and provides HTML rendering for profiles.
- **SymptomAnalysis Class:** Stores AI analysis results and generates HTML reports.
- **AIService Class:** Handles communication with the Gemini API and response parsing.
- **HttpServer Class:** Manages HTTP routing, form handling, and overall application flow.

Usage

1. Start the C++ server.
2. Access the system via a web browser at <http://localhost:8080>.
3. Submit symptoms and receive instant AI-powered analysis and doctor recommendations.

4. Book appointments as needed.

Novelty

The novelty of this **Intelligent Clinic System** project lies in its integration of advanced AI-driven symptom analysis with intelligent clinic scheduling and advisory features, all within a user-friendly web interface. Here are the key novel aspects:

1. AI-Powered Symptom Analysis

- Uses advanced AI (e.g., Gemini AI) to interpret user-described symptoms, duration, and severity, providing personalized medical insights and recommendations.

2. Intelligent Doctor Matching

- Matches patients with the most suitable specialists based on their specific symptoms and medical needs, improving the accuracy and efficiency of referrals.

3. Seamless Appointment Scheduling

- Integrates appointment booking directly after AI analysis and doctor matching, streamlining the patient journey from symptom input to consultation.

4. Emergency Awareness Integration

- Prominently features emergency guidance (e.g., call 1122, find nearest ER) to ensure user safety and responsible AI use.

5. Modern, Accessible Design

- Offers a visually appealing, mobile-responsive interface that lowers barriers for users of all ages and backgrounds.

6. Privacy and Security Emphasis

For security reasons, no personal medical information is stored. We understand how sensitive and confidential health data is, which is why only basic appointment details — such as date, time, and booking status — are securely stored. Information related to symptoms, severity, or any personal medical records is never collected or saved, ensuring complete protection of users' medical privacy.

Conclusion

This project demonstrates a secure, modern, and intelligent clinic advisory and scheduling system, combining the power of AI with robust C++ backend engineering and a clean, accessible frontend. It is suitable for educational, demonstration, or prototype healthcare applications.