Multi Agent based Medical Assistant for Edge Devices

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Abstract

Large Action Models (LAMs) have revolutionized intelligent automation, but their application in healthcare faces challenges due to privacy concerns, latency, and dependency on internet access. This report introduces an on-device, multi-agent healthcare assistant that overcomes these limitations. The system utilizes smaller, task-specific agents to optimize resources, ensure scalability and high performance. Our proposed system acts as a one-stop solution for health care needs with features like appointment booking, health monitoring, medication reminders, and daily health reporting. Powered by the Qwen Code Instruct 2.5 7B model, the Planner and Caller Agents achieve an average RougeL score of 85.5 for planning and 96.5 for calling for our tasks while being lightweight for on-device deployment. This innovative approach combines the benefits of on-device systems with multi-agent architectures, paving the way for user-centric healthcare solutions. Check our code here.

1 Introduction

Large Action Models (LAMs) have emerged as a groundbreaking paradigm in intelligent automation, enabling systems to execute complex tasks by dividing them into modular, agent-specific components. These systems excel in domains like e-commerce and logistics, where cloud-based architectures leverage vast computational resources to deliver high precision and scalability. However, applying this framework to healthcare poses unique challenges that cloud-centric systems are ill-suited to address.

Healthcare applications require handling sensitive personal data, ensuring real-time responsiveness, and maintaining uninterrupted functionality, even in offline scenarios. Cloud-based solutions, while powerful, are often constrained by privacy

risks, latency issues, and dependency on continuous internet access. These challenges necessitate a shift toward on-device implementations, where user data remains **private**, and operations are optimized for local execution.

The computational limitations of edge devices pose an additional challenge when deploying large, monolithic models. This is where the power of multi-agent systems comes into play. By utilizing smaller, task-specific agents, we can effectively **distribute workloads**. This leads to optimized **resource allocation**, where compact models are designed to operate within the constraints of edge devices, ensuring efficient use of available computational resources. Moreover, the system's functionality can be easily **scaled** by introducing additional agents, allowing for incremental growth and adaptation. This setup fosters "modular collaboration", where each agent functions independently, focusing on its specific task, while also working in harmony with others to manage more complex workflows.

Our solution uses a multi-agent architecture with on-device data and specialized models for intelligent diagnosis, appointment booking, emergency services, etc. It is integrated with a user-friendly application, enabling seamless interaction and personalized data retrieval, enhancing agent capabilities through retrieval augmented generation.

In this project, we contribute the following:

1. A multi-agent healthcare assistant designed for **edge devices**, ensuring **privacy** and **scalability** (refer section 4).

2. A **data creation pipeline** that generates **synthetic data** and enhances it to address challenges relevant to AI agents (refer section 6).

3. The fine-tuned planner and caller agents that achieve an average RougeL score of **85.5 for**

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*Equal Contribution

planning and 96.5 for calling using our generated data, demonstrating effectiveness for our target use cases (refer to section 7).

4. An **application** that connects users with the multi-agent system, enabling **personalized data interaction** (refer section 5).

2 Motivation

In the midst of today's hectic lifestyle, staying on top of one's health can feel like an uphill battle. Juggling medications, monitoring vital signs, and keeping track of appointments can easily become overwhelming, especially for vulnerable groups such as children and the elderly, who often require more frequent medical attention. Our multi-agent healthcare assistant is designed to simplify and streamline this process, empowering users of all ages to take charge of their health journey while ensuring the utmost privacy. By harnessing the power of local, on-device processing and seamless integration with smartwatches, we offer a secure, user-friendly solution that makes health management efficient and accessible for everyone, regardless of age or technological expertise.

3 Problem Statement and Use-cases

We develop a multi-agent system that manages personal health data securely and efficiently while providing users with timely reminders, monitoring vitals, and handling appointment requests based on symptoms. It operates locally on the user's device, ensuring data privacy and seamless integration with smart watches for enhanced user experience.

The primary usecases for the project are:

Intelligent Diagnosis and Appointment Scheduling: The healthcare assistant engages in multi-turn conversations with the user, allowing for intelligent diagnosis by gathering comprehensive information about the user's health concerns. This iterative questioning process is key to accurately identifying the most appropriate medical specialist, ensuring targeted and effective care. It also uses past interactions and profile information to identify the right specialist. The aim is not to diagnose or provide remedies, but to identify the most suitable specialist based on the user's needs and availability. This end-to-end functionality reduces user burden and ensures timely consultations without unnecessary hassle.

Emergency SOS: The system is equipped to handle critical emergency situations where imme-diate assistance is required. Users can manually trigger an SOS signal, which prompts the system to take swift action. We call this as Hard SOS where we are sure of an emergency situation. These actions may include notifying emergency services (e.g., calling an ambulance), contacting the user's designated emergency contacts, and providing real-time updates to responders. The system is designed to ensure prompt escalation of emergencies, enhancing the user's safety and response time during life-threatening scenarios.

**Vitals Tracking and Abnormality Detection:** The system continuously monitors the user's vital signs through smart devices like wearable health trackers or smartphones. This feature ensures proactive health management by identifying anomalies or irregularities in real time, such as abnormal heart rate, irregular blood oxygen levels, or deviations in other key health metrics. When a abnormal situation is detected, a SOS is triggered, alerting the user and providing actionable recommendations. We call it Soft SOS as unlike Hard SOS, it only alerts the user. For this project, we integrate with a simulator smart watch.

Schedule Reminders: Managing healthcare routines can be challenging, especially for users with multiple prescriptions or treatment plans. The system automates this process by extracting relevant details from prescriptions or user inputs and setting personalized reminders.

Daily Health Report: The system generates a comprehensive daily report to enhance health tracking, summarizing the user's essential health metrics and any detected anomalies throughout the day. This report is provided to the user each evening, presenting a clear overview of their health status. Furthermore, the reports are stored long-term, allowing users and healthcare providers to review historical data for well-informed decisions and trend analysis.

4 System Architecture

In our proposed architecture, three key components collaborate to deliver a comprehensive healthcare assistance experience: the Action Manager, Health Manager, and Memory Unit. Figure 1a show the interaction between these three modules. The Health Manager's agents independently handle scheduling reminders, monitoring vitals, and generating reports. It connects with the Action Manager for user interaction and tool execution, utilizing the
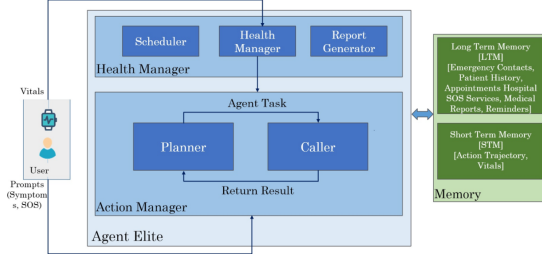
(a) Communication in the multi-agent system
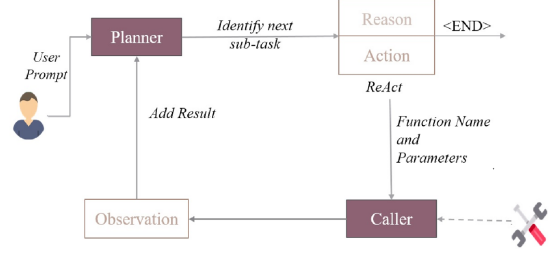
(b) Communication between the planner and caller in Action Manager

Figure 1: Multi-Agent Design for Healthcare Assistant

Action Manager's agents for planning and execution. The Memory Unit enables user-agent and agent-agent interaction, personalizing the system. We chose the Qwen 2.5-Coder-7B-Instruct model [1] as the backbone model for our architecture due to its size which can fit in a flash memory and performance(Alizadeh et al., 2023). The following subsections delve into the details of each component.

4.1 Health Manager

The Health Manager is a crucial component of our multi-agent healthcare system that uses multiple agents to monitor user health, generate reports, and manage medication schedules. It consists of three key sub-components: the Report Generator, Health Monitor, and Scheduler.

4.1.1 Report Generator

The Report Generator creates a comprehensive summary of each session using Qwen7B. It processes session data, including user queries, executed actions, vital health data, medicine prescriptions, and key insights gathered during the session, to generate a detailed and coherent report. This ensures that the session's key details are accurately captured and presented in a user-friendly format, enhancing the overall effectiveness and reliability of the system.

4.1.2 Health Monitor

The Health Monitor continuously analyzes vital signs from the user's wearable devices, such as smartwatches or smart rings, which provide real-time data on key health metrics like heart rate, blood pressure, and oxygen saturation. If the vitals deviate significantly from normal ranges, the system automatically triggers a soft SOS alert, serving

as an early warning mechanism and ensuring that appropriate measures can be taken promptly.

4.1.3 Scheduler

The Scheduler assists users in managing their medication schedules effectively by analyzing the user's prescription and automatically extracting essential details such as medicine names, dosage timing, frequency, and duration. Using this information, the Scheduler creates personalized reminders that are sent to the user, helping them adhere to their prescribed treatment plan.

4.2 Action Manager

The role of Action Manager is to execute a task using available tools. This task is accomplished by two agent models, planner and caller. Since a model trained on code has function knowledge and improved reasoning (Ma et al., 2023; Zhang et al., 2024b), we choose an instruct finetuned model which has been also finetuned on coding tasks. We LoRA finetune it for planning and calling to incorporate planning and function calling abilities into the model and align with our usecases.

4.2.1 Planner

The planner takes the user's query and based on the information of the tools, it generates an action along with its reasoning (ReAct framework (Yao et al., 2022)). After the action is executed, the result along with the trajectory is passed to the planner, and the subsequent action and its reasoning is generated. Based on the results of the actions, next action is generated until the task is completed. This style of planning is called interleaved planning ((Huang et al., 2024)). We chose this over generating plan in a single-go for robustness in task execution. We LoRA finetune the Instruct-LLM model using our synthetic planning data (refer section 6).

4.2.2 Caller

The Caller is responsible for identifying the correct parameters to be passed to the tool call. Our experiments revealed that function calling models perform poorly when dealing with a large number of tools (examples in section B). The Caller acts as the execution engine for various tasks, dynamically invoking appropriate functions based on instructions generated by the Planner (Zhang et al., 2024a; Schick et al., 2023). These tasks may include interacting with external APIs, retrieving or updating user-specific data, engaging with the user, and performing actions such as scheduling reminders, sending alerts, or interfacing with wearable devices.

4.3 Memory

The Memory Component is a crucial element in our multi-agent healthcare system, enabling a personalized user experience by storing and managing both long-term and short-term information. This component allows the system to tailor its interactions and provide more accurate, context-aware assistance (Sumers et al., 2024; Zhang et al., 2024c).

4.3.1 Short-Term Memory

The Short-Term Memory (STM) maintains context and temporary data during active sessions, such as the user's current symptoms and ongoing interactions. This enables the agents to maintain a coherent conversation and adapt to the user's immediate needs, ensuring a seamless and responsive experience.

4.3.2 Long-Term Memory

The Long-Term Memory (LTM) stores the user's personal information, previous symptoms, and other relevant data that can be retrieved by the Planner agent for improved decision-making. By leveraging this historical information, the Planner can better identify underlying issues and make more informed decisions when generating plans for the user's healthcare needs (Jiang et al., 2024). For example, knowing a patient's past complaints and vital history can help the Planner refer to the correct specialist, resulting in more targeted and effective care.

For retrieving relevant information from the Long-Term Memory (LTM), we employ the retrieval model from the Spacy library's en_core_web_trf [2] to extract pertinent data based on user queries and context. To parse the retrieved information, we utilize the EasyOCR library[3], which enables text recognition and extraction from various documents such as prescription.

5 Application Design
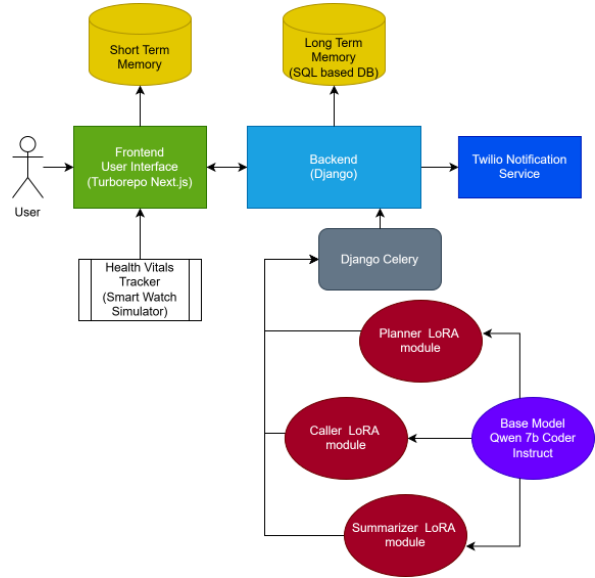
Figure 2: System flow diagram of the E2E application

Our application follows a three-tier architecture, as illustrated in Figure 2. The user interacts with the system through the frontend, which serves as the topmost layer of the application. All user actions are processed at the backend, where appropriate responses are generated based on the specific action. The data layer, which consists of a SQLite database, handles data storage and retrieval for various queries and functionalities.

Following are the main components of app architecture:

- Frontend – provides UI interface to the user for app interaction

- Backend – Intermediate processor between application services and frontend

- SQLite – SQL db to store necessary data

- Celery – Task queue to process async tasks

- Twilio – Sending messages to ambulance and emergency contacts

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[2]Spacy's en_core_web_trf

[3]EasyOCR: https://github.com/JaidedAI/EasyOCR

5.1 Backend

The Django backend serves as the core of the application, handling various tasks such as processing user queries, managing user data, creating reminders based on uploaded prescriptions, triggering SOS calls, and interacting with the agent models. User interactions and histories are stored in a SQLite database, with Django ORM facilitating seamless data operations.

The backend provides several key endpoints, including:

- Receiving user input for the agent model

- Presenting a summary of tracked vitals and suggestions

- Triggering SOS calls in case of abnormality detection

- Reminding users to take medication based on their prescription

The primary responsibilities of the backend include:

- Hosting multiple large action models

- Managing API endpoints for model interactions

- Providing a secure and scalable backend for the chat system and managing each user's history

- Analyzing recorded user vitals and providing suggestions based on the analysis

- Sending SMS to friends and ambulance services based on the severity of the detected abnormality

5.2 Frontend

The frontend leverages Next.js[4] for dynamic and responsive user interactions, managed under a Turborepo structure to streamline development across teams. Next.js, a React-based framework provides server-side rendering and client-side interactions for optimal user experience and at the same time provides room for scalability and improvement with well defined structure. Turborepo is used to manage multiple repositories under a single structure, optimizing builds and deployments, reducing development overhead for future.

5.2.1 UI Interface

The visual components are styled using tailwind CSS and styled-components, which provides predefined styling framework for fast as well as responsive development.

The functional components present in the UI are as follows:

- A real-time chat-like setup for users to interact with the planner model.

- Powered by httpx and websockets for live updates and responsiveness.

- Utilizes Fetch API to call Django REST endpoints.

- Error handling and loading states ensure a smooth user experience.

- Watch and SOS simulator have been included for demo purpose.

- Agent logs are added to help understand the logic behind agent's inference for user input.

5.2.2 State Management

- State is managed using React Context API for lightweight and efficient state sharing.

- Server-side rendering (SSR) for initial page load and client-side fetching for subsequent interactions to save on data and improve response time.

6 Data Creation

We curate a synthetic dataset to LoRA finetune the planner and caller (refer table 1). We present our data generation process in the following subsections.
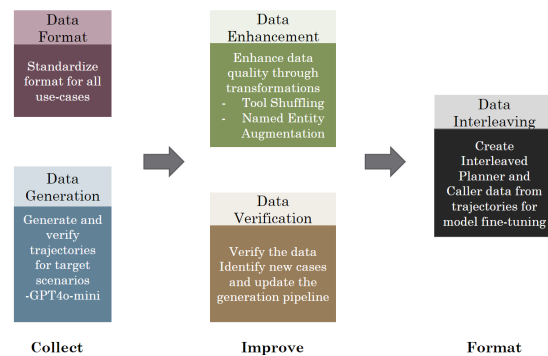
Figure 3: Data Creation Process

Task	Usecase	Planner	Caller
Train	Combined	374,000	328,000
Test	General	700	800
	Counter	876	976
	Negative	492	589
	Dietician	1,273	1,423
	Soft SOS	200	100
	Hard SOS - Start	700	600
	Hard SOS - End	600	500

Table 1: Statistics of Synthetic Data Created for Planner and Caller agents. Combined indicates mixture of appointment usecases (general, counter, negative, dietician), hard SOS (start and end) and soft SOS. General: Appointment booked after finding specialist for the symptoms, Counter: Follow-up questions asked to understand symptoms better, Negative: User declines the appointment, Dietician: Use is referred to dietician based on the symptoms

6.1 Data Gathering

We first begin by standardizing the format of the data. We create a trajectory containing communication between the planner and caller to complete the task. The planner uses the ReAct framework where based on the task the next action and its reasoning is generated. The caller generates the function call along with appropriate parameters. After finalizing format of trajectory, we generate data using OpenAI's gpt-4o-mini.

6.1.1 Data Format

This section introduces the data format used in our multi-agent healthcare system. A trajectory represents an interleaved history of the interaction between the user, multiple agents, and the environment to complete a task. Following is the format of each state in the trajectory:

1. System

```
{
 "from": "system",
 "value": {
  "user_details": {
   "user_id": "BKYA569367",
   "name": "John Doe",
   "timestamp": "2024-12-17T23
       :59:59"
  } } }
```

2. User

```
{
 "from": "user",
 "value": "Natural language input
     from user"
}
```

3. Planner

```
{
 "from": "planner",
 "value": {
  "reason": "Reasoning Generated
      by LLM based on previous
      actions",
  "action": "Next action based on
      LLM's reasoning. <END> for
      completed task"
 } }
```

4. Caller

```
{
 "from": "caller",
 "value": {
  "tool": "function_name",
  "parameters": {
   "param1": "value1",
   "param2": "value2",
   ...
   "paramN": "valueN"
  } } }
```

5. Observation

```
{
 "from": "observation",
 "value": {
  "result":
      Object_returned_by_function
 } }
```

Consolidating the states, the format of trajectory looks as follows:

```
{
 "from": "system",
 "value": {...}
},
{
 "from": "user",
 "value": ""
},
{
 "from": "planner",
 "value": {...}
},
{
 "from": "caller",
 "value": {...}
},
{
 "from": "observation",
 "value": {...}
}
...
{
 "from": "planner",
 "value": {
```

```
    "reason": "The task is
        sucessfully completed.",
    "action": "<END>"
} }
```

For our usecases, examples of trajectories are shown in section D.

6.1.2 Data Generation

To generate data for our multi-agent healthcare system, we use a 1-shot prompt with OpenAI's gpt-4o-mini, providing a list of tools, a description of the use case, and an example trajectory. For instance, when generating appointment data, we want the Planner to suggest a specialist without diagnosing a disease while maintaining data diversity. To achieve this, we include a specific disease in the prompt and instruct the LLM to generate symptoms for that disease and suggest a specialist accordingly.

6.2 Data Enhancement

After generating the data, we noticed that it had repetitive names, dates, and times. To fix this, we replaced them with random values. Since the input and output formats of tools for the named entities are standard (e.g. YYYY-MM-DD for date), we used regular expressions to find these entities. For dates and times, we made sure that in cases like appointments, the date of past symptoms comes before the user's query date, and the suggested appointment is within a reasonable time after the user's query.

The tools and their descriptions in the input to the Planner serve as premises for reasoning and generating the next action. As demonstrated by (Chen et al., 2024), shuffling the premises can hinder the model's reasoning ability. Therefore, we shuffle the tools for each sample to enhance the model's robustness and adaptability..

6.3 Data Verification

We analyze the generated data for each usecase and identify the scope of improvements. Apart from data augmentation, we check cases where the trained models might fail with the current data and adapt it for such exigencies. For example, when user gives a few symptoms and planner might select an incorrect specialist for appointment. To tackle this, we allow the planner to counter questions and prompt gpt-4o-mini to generate data where user inputs vague symptoms at first.

6.4 Data Interleaving

The trajectory consists of a sequence of states that include system, user, planner, and caller interactions. To create datasets for the Planner and Caller agents, we employ data interleaving. For each Planner state in the trajectory, we select the tools, previous interactions, and observations from function calls as input, while the reason and action are chosen as output. Similarly, for each Caller state, the function call and its parameters are set as output.

In simpler terms, we extract relevant information from the trajectory to create training data for the Planner and Caller agents. This process involves identifying the appropriate input and output for each agent based on their specific roles within the sequence of states. By creating these datasets, we enable the fine-tuning of the Planner and Caller models to improve their performance in generating accurate reasoning, actions, and function calls.

We enclose the reason, action, function and parameters in tags for convenient post-processing. We also add these as special tokens in the model. For example, the output of planner for booking a specialist for the user:

```
<reason>Dr. Gabriel Lopez (Neurologist
    ) is available on the user's
    preferred date and time.</reason>
<action>Suggest the appointment to the
    user and proceed with booking if
    confirmed. Dr. Gabriel Lopez (
    Neurologist) on 2024-12-01 between
    10:00-10:30</action>
```

7 Experimental Setup and Results

We fine-tuned the Qwen2.5-Coder-7B-Instruct model for our multi-agent healthcare assistant using synthetic data and LoRA adaptation with rank 8 and alpha 16. Context length was set to 4,096 tokens. The model was trained for 5,000 steps with a batch size of 64. By fine-tuning on separate Planner and Caller datasets, we achieved a modular system for edge device deployment, with each LoRA adapter taking only 10MB before compression.

We evaluate the performance of our multi-agent healthcare system using distinct metrics for the Planner and Caller agents. For the Planner, we assess the correctness of its reasoning and action using BLEU and ROUGE scores. ROUGE and BLEU scores are apt for checking the correctness of the Planner's reasoning and action as they quantitatively assess the similarity between the generated text and reference text, providing a standardized way to evaluate the quality of the Planner's

Category	BLEU	Rouge1	Rouge2	RougeL
General	94.79	0.97	0.95	0.97
Counter	78.97	0.84	0.76	0.83
Negative	78.05	0.86	0.76	0.84
Dietician	74.44	0.80	0.71	0.78

Table 2: Evaluation results of Planner for appointment usecase. General: Appointment booked after finding specialist for the symptoms, Counter: Follow-up questions asked to understand symptoms better, Negative: User declines the appointment, Dietician: Use is referred to dietician based on the symptoms

Category	BLEU	Rouge1	Rouge2	RougeL	ToolAcc	ParamAcc	ValuesAcc
General	98.88	1.0	0.99	0.99	1.0	1.0	0.9
Counter	96.95	0.98	0.96	0.98	1.0	0.99	0.77
Negative	89.64	0.92	0.88	0.92	1.0	0.93	0.57
Dietician	96.06	0.98	0.95	0.97	1.0	1.0	0.76

Table 3: Evaluation results of Caller for appointment usecase. General: Appointment booked after finding specialist for the symptoms, Counter: Follow-up questions asked to understand symptoms better, Negative: User declines the appointment, Dietician: Use is referred to dietician based on the symptoms

responses. In the case of the Caller, we measure the accuracy of the tool called (ToolAcc), parameters passed to the tool (ParamAcc) and values of the parameters (ValuesAcc). We also employ BLEU and ROUGE scores for the Caller, as they prove valuable when a natural language sentence is provided as input to the tool.

On our test set, we achieve an average RougeL score of 85.5 for planner and 96.5 for caller for the appointment usecase. Notably, the Caller consistently predicts the correct tool. For detailed scores for appointment usecase, refer to Table 2 and Table 3. For SOS usecases, we observe 100% scores for both planner and caller because of a fixed sequence of actions.

8   Conclusion

Our multi-agent healthcare system demonstrates the potential for AI-powered assistants to revolutionize personal health management. By leveraging the power of large language models and fine-tuning them for specific tasks, we have created a modular and efficient system that can effectively support users in managing their health and well-being.

The Action Manager, Health Manager, and Memory Unit work together to provide a personalized healthcare experience. The Action Manager coordinates tasks, the Health Manager monitors health and manages schedules, while the Memory Unit stores and retrieves user-specific information for context-aware assistance.

Through extensive data generation, enhance-

ment, and fine-tuning, we have achieved a RougeL scores of 85.5 for planning and 96.5 for calling. This demonstrates the system's ability to generate relevant and accurate responses, while the Caller's consistent prediction of the correct tool showcases its reliability in executing tasks.

9   Future Work

We plan to enhance our multi-agent system by converting the trained modules into on-device compatible formats like ONNX/GGUF, enabling smooth system integration into mobile devices and lower latency. We'll also integrate the system with various health monitoring devices and provide support for user onboarding of additional devices like smart rings and smart weighing scales. To enhance healthcare capabilities, we'll extend the system into a multimodal understanding engine, empowering it to perform image-based diagnosis. Furthermore, we aim to expand the system to cover additional targeted scenarios, such as women's health tracking and post hospitalization care.

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A Snapshots of Application

In this section, we present snapshots showcasing the key features of our application. These include intelligent appointment scheduling based on user symptoms, reminder scheduling by extracting prescription information, soft SOS triggers for abnormal vitals, and user-initiated hard SOS with location tracking and emergency notifications.

A.1 Intelligent Appointment Scheduling

Figure 4 shows the appointment booking use case where the user complains about having abdominal pain and feeling feverish. The Planner and Caller ask follow-up questions and find a specialist that fits the user's schedule.

A.2 Reminder Scheduling from Prescription

As shown in figure 5a, the user can upload a prescription. The prescription is parsed and analyzed by LLM to extract information about medication such as medicine name, time, and duration. This information is then added to the user's list of reminders, as shown in figure 5b.

A.3 Soft Trigger from Abnormal Vitals

If a user's vitals are abnormal, the monitor agent triggers a soft SOS. At that time, the user's vitals are fetched (simulated for our demo) and a small report is displayed to the user (refer to figure 6).

A.4 Hard SOS Triggered by User

The user can trigger a Hard SOS as shown in figure 7a. The user's location is fetched and the nearest ambulance is identified. The location is then sent to the nearest ambulance and emergency contacts. A sample of the message sent to an emergency contact is shown in figure 7b.

B Experimentation with function calling models

We conducted experiments with xLAM 1B and 7B models to assess their suitability for planning and calling tasks. As illustrated in Figure 10, we provided a list of 28 tools for the task of finding good movies in nearby theaters. However, both the 1B and 7B models failed to identify the correct function calls in steps 1 and 2, respectively (refer figure 8 and 9). Specifically, the 7B model attempted to check movie availability before fetching the list of movies. To address these issues, we fine-tuned the Qwen model to improve its performance and avoid such situations.

C List of Diseases

During data generation, the prompt instructs to generate symptoms based on a given disease. We
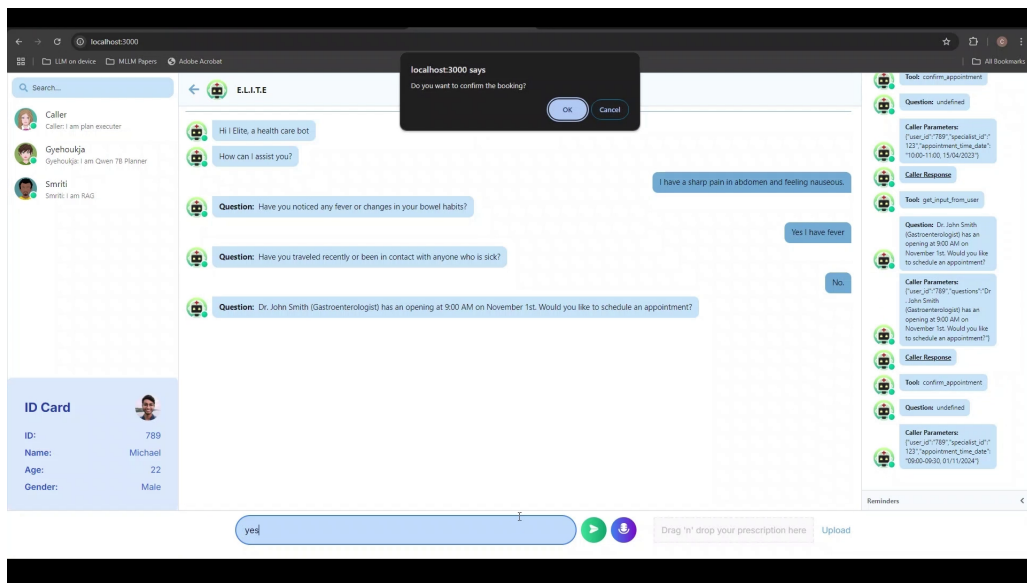
Figure 4: Appointment Booking
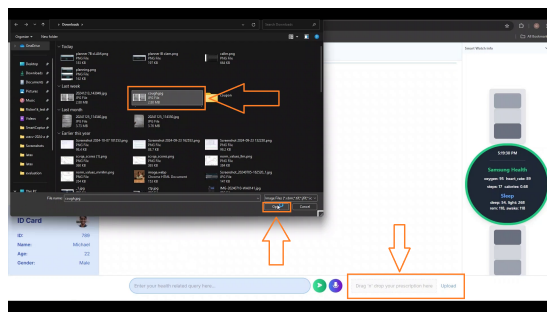
(a) Medication Uploaded schedule Reminders
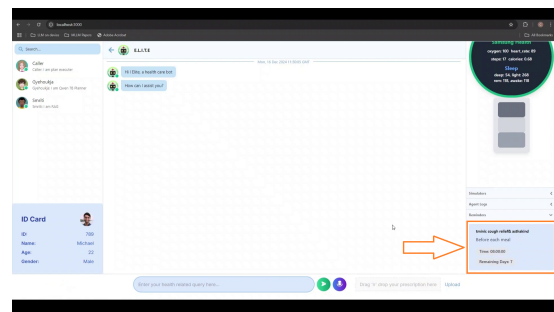
(b) Reminder Added

Figure 5: Adding Reminder from Prescription

(a) Soft SOS triggered due to abnormal vitals (simulated)

(b) User's vitals analyzed

Figure 6: Soft SOS triggered and vitals analyzed

(a) Hard SOS-Interface

(b) Hard SOS-SMS

Figure 7: Triggering Hard SOS and notifying emergency contacts with GPS

Figure 8: Planning and function calling using xLAM 1b

Figure 9: Planning and function calling using xLAM 7b

Task

Prompt: [BEGIN OF TASK INSTRUCTION]
Based on the previous context and API request history, generate an API request or a response as an AI assistant.
[END OF TASK INSTRUCTION]

Tools

[BEGIN OF AVAILABLE TOOLS]
[{"name": "get_movie_avail", "description": "Get availability of a movie in theatres", "parameters": {"movie_title": {"type": "string", "description": "The title of the movie"}, "location": {"type": "string", "description": "Location of the user to check movie availability in theatres"}}}, {"name": "search_query", "description": "Use search engine to get information", "parameters": {"query": {"type": "string", "description": "The query to search"}}}, {"name": "get_temperature", "description": "Get the current temperature for a location", "parameters": {"location": {"type": "string", "description": "The city and state, e.g. San Francisco, New York"}, "unit": {"type": "string", "enum": ["celsius", "fahrenheit"], "description": "The unit of temperature to return"}}}, {"name": "get_humidity", "description": "Get the current humidity percentage for a location", "parameters": {"location": {"type": "string", "description": "The city and state, e.g. San Francisco, New York"}}}, {"name": "get_wind_speed", "description": "Get the current wind speed for a location", "parameters": {"location": {"type": "string", "description": "The city and state, e.g. San Francisco, New York"}, "unit": {"type": "string", "enum": ["km/h", "mph"], "description": "The unit of wind speed"}}}, {"name": "get_air_quality", "description": "Get the air quality index (AQI) for a location", "parameters": {"location": {"type": "string", "description": "The city and state, e.g. San Francisco, New York"}}}, {"name": "get_currency_conversion", "description": "Convert between two currencies", "parameters": {"from_currency": {"type": "string", "description": "The currency you are converting from, e.g. USD"}, "to_currency": {"type": "string", "description": "The currency you are converting to, e.g. EUR"}, "amount": {"type": "number", "description": "The amount to convert"}}}, {"name": "get_stock_price", "description": "Get the current stock price for a company", "parameters": {"symbol": {"type": "string", "description": "The stock symbol (ticker), e.g. AAPL for Apple"}}}, {"name": "get_news", "description": "Get the latest news articles based on a keyword or topic", "parameters": {"topic": {"type": "string", "description": "The topic or keyword to search news for"}, "language": {"type": "string", "description": "The language of news articles"}}}, {"name": "get_movie_info", "description": "Get details of a movie including title, release date, and cast", "parameters": {"movie_title": {"type": "string", "description": "The title of the movie"}}}, {"name": "get_forecast", "description": "Get the weather forecast for the next few days for a location", "parameters": {"location": {"type": "string", "description": "The city and state, e.g. San Francisco, New York"}, "days": {"type": "integer", "description": "Number of days for the forecast"}, "unit": {"type": "string", "enum": ["celsius", "fahrenheit"], "description": "The unit of temperature to return"}}}, {"name": "get_current_location_api", "description": "Get my current location using GPS", "parameters": {}}]
[END OF AVAILABLE TOOLS]

Format

[BEGIN OF FORMAT INSTRUCTION]
The output should be of the JSON format, which specifies a list of generated function calls. The example format is as follows, please make sure the parameter type is correct. If no function call is needed, please make tool_calls an empty list "[]".
```
{"thought": "the thought process, or an empty string", "tool_calls": [{"name": "api_name1", "arguments": {"argument1": "value1", "argument2": "value2"}}]}
```
[END OF FORMAT INSTRUCTION]

Query

[BEGIN OF QUERY]
Suggest me some good movies in theatres at my location?
[END OF QUERY]

Figure 10: Prompt to xLAM 7b

randomly sample from a list of 153 diseases. The list was created based on different specialization such as orthologist, cardiologist, gastroenterologists, etc. They are as follows: Influenza, Diabetes Mellitus, Hypertension, Asthma, Coronary Artery Disease, Stroke, HIV/AIDS, Tuberculosis, Hepatitis B, Hepatitis C, Dengue Fever, Malaria, Chickenpox, Measles, Mumps, Rubella, Zika Virus, Ebola, COVID-19, Cancer, Alzheimer's Disease, Parkinson's Disease, Arthritis, Lupus, Multiple Sclerosis, Crohn's Disease, Ulcerative Colitis, Ga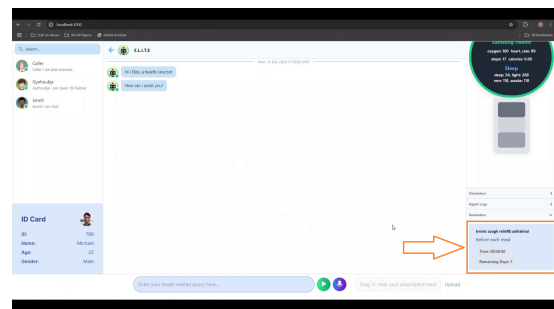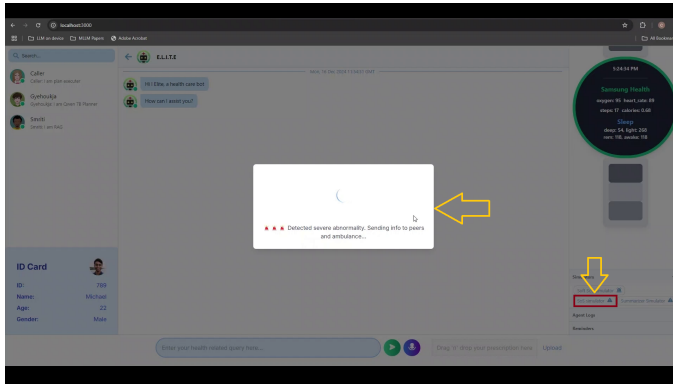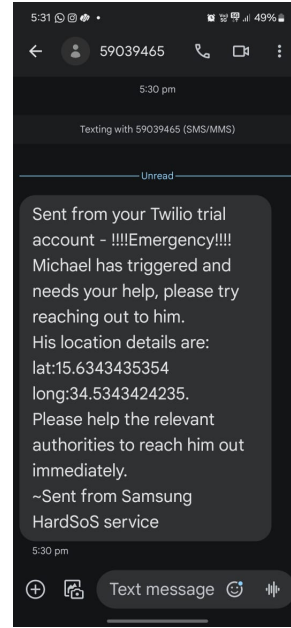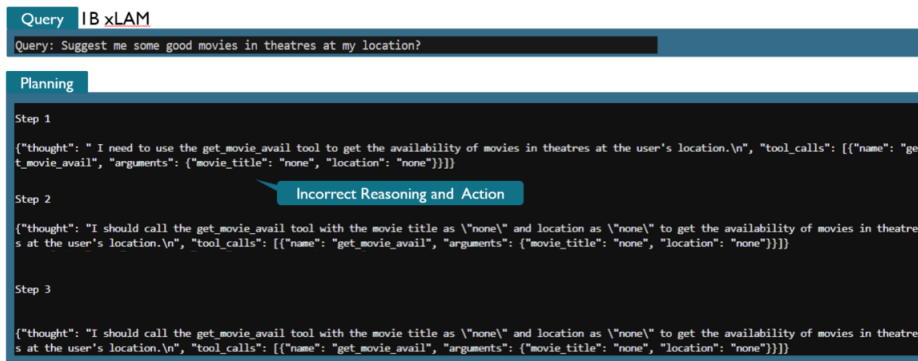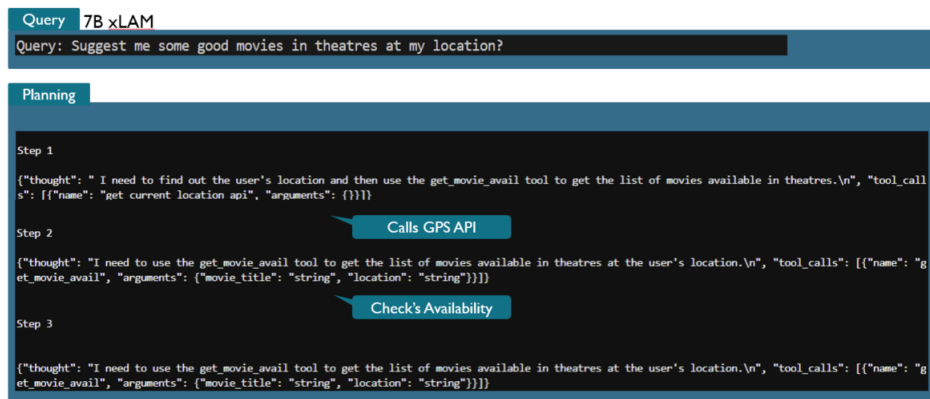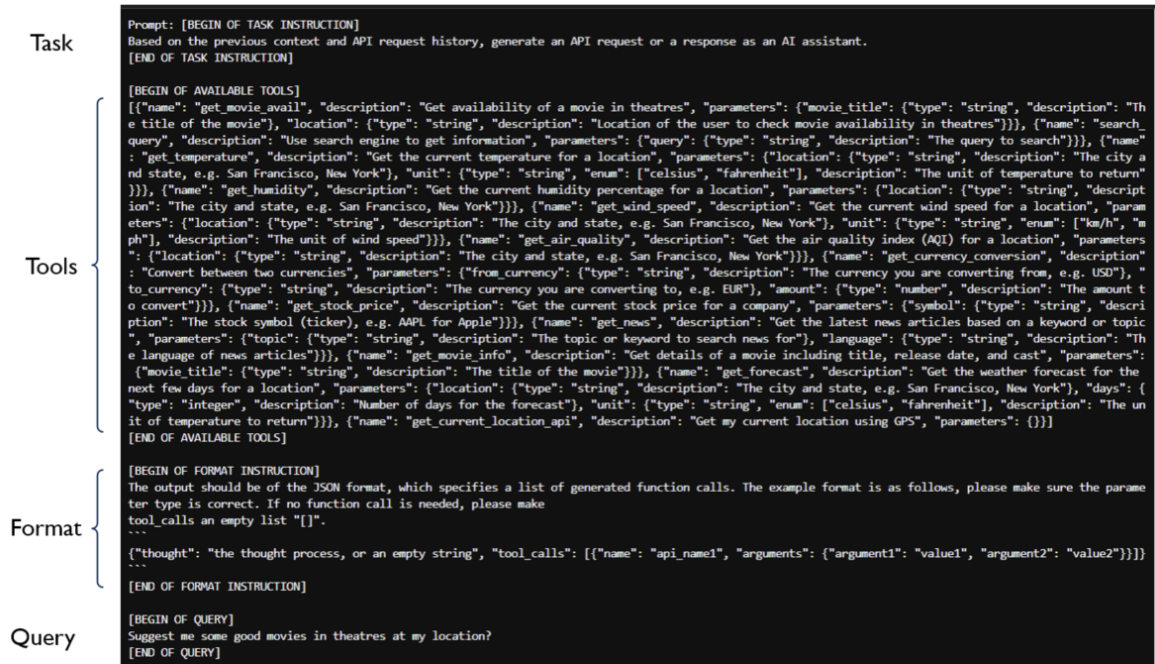stroesophageal Reflux Disease (GERD), Celiac Disease, Anemia, Bronchitis, Pneumonia, Sinusitis, Chlamydia, Gonorrhea, Syphilis, Herpes, Human Papillomavirus (HPV), Tetanus, Rabies, Polio, Yellow Fever, Smallpox, Typhoid Fever, Leprosy, Plague, Hemophilia, Sickle Cell Disease, Thalassemia, Hemochromatosis, Meningitis, Encephalitis, Glaucoma, Cataracts, Macular Degeneration, Otitis Media, Tonsillitis, Appendicitis, Hemorrhoids, Diverticulitis, Irritable Bowel Syndrome (IBS), Kidney Stones, Chronic Kidney Disease, Renal Failure, Osteoporosis, Osteopenia, Rheumatoid Arthritis, Gout, Psoriasis, Eczema, Vitiligo, Alopecia, Hypothyroidism, Hyperthyroidism, Cushing's Syndrome, Addison's Disease, Prostate Cancer, Breast Cancer, Lung Cancer, Colorectal Cancer, Pancreatic Cancer, Liver Cancer, Skin Cancer, Melanoma, Leukemia, Lymphoma, Myeloma, Basal Cell Carcinoma, Squamous Cell Carcinoma, Esophageal Cancer, Gastric Cancer, Ovarian Cancer, Cervical Cancer, Endometrial Cancer, Bladder Cancer, Kidney Cancer, Testicular Cancer, Thyroid Cancer, Mesothelioma, Brain Tumors, Spinal Cord Tumors, Heart Failure, Atrial Fibrillation, Cardiomyopathy, Angina, Atherosclerosis, Pericarditis, Myocarditis, Endocarditis, Congenital Heart Disease, Valvular Heart Disease, Peripheral Artery Disease, Deep Vein Thrombosis, Pulmonary Embolism, Varicose Veins, Hypertensive Heart Disease, Coronary Microvascular Disease, Dyslipidemia, Familial Hypercholesterolemia, Hypertrophic Cardiomyopathy, Dilated Cardiomyopathy, Restrictive Cardiomyopathy, Takotsubo Cardiomyopathy, Sleep Apnea, Insomnia, Narcolepsy, Restless Leg Syndrome, Epilepsy, Migraine, Cluster Headache, Tension Headache, Trigeminal Neuralgia, Multiple System Atrophy, Amyotrophic Lateral Sclerosis (ALS), Huntington's Disease, Dystonia, Myasthenia Gravis, Guillain-Barre Syndrome, Spinal Muscular Atrophy, Muscular Dystrophy, Fibromyalgia, Chronic Fatigue Syndrome, Complex Regional Pain Syndrome, Temporomandibular Joint Disorders, Sjogren's Syndrome, Raynaud's Disease, Scleroderma, Mixed Connective Tisse Disease, Behcet's Disease, Wegener's Granulomatosis, Giant Cell Arteritis, Polyarteritis Nodosa and Sarcoidosis.

D Example of Trajectory

D.1 Appointment - Generic

```
{
 "interaction_trajectory": [
 {
  "from": "system",
  "value": {
   "user_details": {
    "user_id": "JICC571413",
    "name": "Sakura Tominaga",
    "timestamp": "2024-09-02T10:57:00"
   }
  }
 },
 {
  "from": "user",
  "value": "I've been feeling
      extremely fatigued with chills,
      body aches, and a sore throat.
      It's becoming hard to get
      through the day."
 },
 {
  "from": "planner",
  "value": {
   "reason": "User reports fatigue,
       chills, body aches, and a sore
       throat which could indicate a
       viral infection such as
       influenza.",
   "action": "Check for past similar
       complaints using the
       retrieve_past_complaints tool."
  }
 },
 {
  "from": "caller",
  "value": {
   "tool": "retrieve_past_complaints",
   "parameters": {
    "user_id": "JICC571413",
    "symptoms": "fatigue, chills, body
        aches, sore throat"
   }
  }
 },
 {
  "from": "observation",
  "value": {
   "result": [
    {
     "date": "2024-06-02",
     "symptoms": "mild body aches,
         slight fever"
    }
   ]
  }
 },
 {
  "from": "planner",
  "value": {
   "reason": "Past records indicate a
       mild common cold, but the
       current symptoms are more
       severe. A consultation with a
       general physician is advisable
       .",
```

```
   "action": "Use the
       get_available_specialists tool
       to find a general physician
       available for an appointment."
  }
 },
 {
  "from": "caller",
  "value": {
   "tool": "get_available_specialists
       ",
   "parameters": {
    "symptoms": "fatigue, chills, body
        aches, sore throat",
    "specialization": "general
        physician"
   }
  }
 },
 {
  "from": "observation",
  "value": {
   "result": {
    "specialist_id": "AECJ317777",
    "name": "Dr. Diego Arroyo (General
        Physician)",
    "available_slot": {
     "date": "2024-11-30",
     "time": "11:00-11:30"
    }
   }
  }
 },
 {
  "from": "planner",
  "value": {
   "reason": "Dr. Diego Arroyo (
       General Physician) is available
        on the user's preferred date
       and time.",
   "action": "Suggest the appointment
       to the user and proceed with
       booking if confirmed. Dr. Diego
        Arroyo (General Physician) on
       2024-11-30 between 11:00-11:30"
  }
 },
 {
  "from": "caller",
  "value": {
   "tool": "get_input_from_user",
   "parameters": {
    "user_id": "JICC571413",
    "questions": "Dr. Diego Arroyo (
        General Physician) has an
        opening at 11:00 AM on
        November 30th. Would you like
        to schedule an appointment?"
   }
  }
 },
 {
  "from": "observation",
  "value": {
   "result": "Yes, please"
  }
 },
 {
  "from": "planner",
  "value": {
```

```
        "reason": "User has confirmed the
            appointment",
        "action": "I should confirm the
            appointment"
      }
    },
    {
     "from": "caller",
     "value": {
      "tool": "confirm_appointment",
      "parameters": {
       "user_id": "JICC571413",
       "specialist_id": "AECJ317777",
       "appointment_time_date":
           "11:00-11:30, 30/11/2024"
      }
     }
    },
    {
     "from": "observation",
     "value": {
      "result": true
     }
    },
    {
     "from": "planner",
     "value": {
      "reason": "Appointment confirmed.
          Next, I should save the
          appointment history.",
      "action": "Save the appointment
          history."
     }
    },
    {
     "from": "caller",
     "value": {
      "tool": "save_appointment_history",
      "parameters": {
       "user_id": "JICC571413",
       "symptoms": "fatigue, chills, body
           aches, sore throat",
       "specialist_id": "AECJ317777",
       "appointment_time_date":
           "11:00-11:30, 30/11/2024"
      }
     }
    },
    {
     "from": "observation",
     "value": {
      "result": true
     }
    },
    {
     "from": "planner",
     "value": {
      "reason": "Appointment confirmed
          and stored.",
      "action": "Also store the current
          symptoms for future reference."
     }
    },
    {
     "from": "caller",
     "value": {
      "tool": "store_symptoms",
      "parameters": {
       "user_id": "JICC571413",
```

```
       "symptoms": "fatigue, chills, body
           aches, sore throat",
       "timestamp": "2024-09-02T10:57:00"
      }
     }
    },
    {
     "from": "observation",
     "value": {
      "result": true
     }
    },
    {
     "from": "planner",
     "value": {
      "reason": "Appointment confirmed
          and symptoms stored.",
      "action": "Inform the user of the
          successful booking."
     }
    },
    {
     "from": "caller",
     "value": {
      "tool": "notify_user",
      "parameters": {
       "user_id": "JICC571413",
       "message": "Your appointment with
           Dr. Diego Arroyo (General
           Physician) is confirmed for
           11:00 AM on November 30th.
           Your symptoms have been
           recorded for future reference
           ."
      }
     }
    },
    {
     "from": "observation",
     "value": {
      "result": true
     }
    },
    {
     "from": "planner",
     "value": {
      "reason": "The task is completed
          successfully.",
      "action": "<END>"
     }
    }
   ]
  }
```

D.2   Appointment - Reject Appointment

```
{
 "interaction_trajectory": [
  {
   "from": "system",
   "value": {
    "user_details": {
     "user_id": "BKYA569367",
     "name": "Tomomi Gao",
     "timestamp": "2023-11-08T10:54:00"
    }
   }
  },
  {
```

```
  "from": "user",
  "value": "I've been feeling very
      unwell with a high fever, body
      aches, constant coughing, and
      sore throat for the past few
      days."
},
... (similar to Appointment
    Trajectory)
{
 "from": "observation",
 "value": {
  "result": {
   "specialist_id": "CXAE230642",
   "name": "Dr. Diego Perez (General
       Practitioner)",
   "available_slot": {
    "date": "2024-11-30",
    "time": "10:00-10:30"
   }
  }
 }
},
{
 "from": "planner",
 "value": {
  "reason": "Dr. Diego Perez (General
      Practitioner) is available on
      the user's preferred date and
      time.",
  "action": "Suggest the appointment
      to the user and check if they
      want to schedule it. Dr. Diego
      Perez (General Practitioner) on
      2024-11-30 between
      10:00-10:30"
 }
},
{
 "from": "caller",
 "value": {
  "tool": "get_input_from_user",
  "parameters": {
   "user_id": "BKYA569367",
   "questions": "Dr. Diego Perez (
       General Practitioner) has an
       opening at 10:00 AM on
       November 30th. Would you like
       to schedule an appointment?"
  }
 }
},
{
 "from": "observation",
 "value": {
  "result": "No, not at this time."
 }
},
{
 "from": "planner",
 "value": {
  "reason": "User has declined the
      appointment.",
  "action": "Proceed to store the
      symptoms for future reference
      without scheduling an
      appointment."
 }
},
{
```

```
  "from": "caller",
  "value": {
   "tool": "store_symptoms",
   "parameters": {
    "user_id": "BKYA569367",
    "symptoms": "high fever, body
        aches, cough, sore throat",
    "timestamp": "2023-11-08T10:54:00"
   }
  }
},
{
 "from": "observation",
 "value": {
  "result": true
 }
},
{
 "from": "planner",
 "value": {
  "reason": "Symptoms stored
      successfully.",
  "action": "Inform the user that the
      symptoms have been recorded
      for future reference."
 }
},
{
 "from": "caller",
 "value": {
  "tool": "notify_user",
  "parameters": {
   "user_id": "BKYA569367",
   "message": "Your symptoms have
       been recorded for future
       reference. Please don't
       hesitate to reach out if you
       decide to see a doctor."
  }
 }
},
{
 "from": "observation",
 "value": {
  "result": true
 }
},
{
 "from": "planner",
 "value": {
  "reason": "The process is completed
      with symptoms stored and user
      notified.",
  "action": "<END>"
 }
}
]
}
```

D.3 Appointment - Follow-up for Unclear Symptoms

```
{
 "interaction_trajectory": [
 {
  "from": "system",
  "value": {
   "user_details": {
    "user_id": "BLTA888285",
```

```json
    "name": "Juan Martinez",
    "timestamp": "2024-08-05T04:20:00"
   }
  }
 },
 {
  "from": "user",
  "value": "I've been having some
      trouble with my movement lately
      ."
 },
 {
  "from": "planner",
  "value": {
   "reason": "User reports movement
       issues, but I need to clarify
       if it's weakness, stiffness, or
       something else.",
   "action": "Ask user if they are
       experiencing weakness,
       stiffness, or difficulties in
       coordination."
  }
 },
 {
  "from": "caller",
  "value": {
   "tool": "get_input_from_user",
   "parameters": {
    "user_id": "BLTA888285",
    "questions": "Could you describe
        if you're feeling weakness,
        stiffness, or issues with
        coordination?"
   }
  }
 },
 {
  "from": "observation",
  "value": {
   "result": {
    "user": "I feel a bit weak and
        sometimes my hand shakes."
   }
  }
 },
 {
  "from": "planner",
  "value": {
   "reason": "User mentions weakness
       and hand shaking, which could
       indicate a need for
       rehabilitation.",
   "action": "Ask if they are
       experiencing any pain or if the
       weakness is constant."
  }
 },
 {
  "from": "caller",
  "value": {
   "tool": "get_input_from_user",
   "parameters": {
    "user_id": "BLTA888285",
    "questions": "Are you experiencing
         any pain, or is the weakness
         constant throughout the day?"
   }
  }
 },
```

```json
{
  "from": "observation",
  "value": {
   "result": {
    "user": "There's no pain, but the
        weakness seems to come and go
        ."
   }
  }
 },
 .... (Rest similar to Appointment
     Trajectory)
 ]
}
```

D.4 Soft SOS

```json
{
 "interaction_trajectory": [
  {
   "from": "system",
   "value": {
    "user_details": {
     "user_id": "PKFG301655",
     "name": "Aaliyah Sousa",
     "timestamp": "2025-02-01T08:11:00"
    }
   }
  },
  {
   "from": "user",
   "value": "Soft SOS triggered.
       Abnormal Vitals: {'oxygen': 85,
       'heart_rate': 41, 'sleep': {'
       deep': 75, 'light': 238, 'rem':
       94, 'awake': 44}}"
  },
  {
   "from": "planner",
   "value": {
    "reason": "User has triggered a
        soft SOS, so the system needs
        to notify the user about
        abnormal vitals",
    "action": "Call notify_user to
        inform the user that the SOS
        process is being triggered."
   }
  },
  {
   "from": "caller",
   "value": {
    "tool": "notify_user",
    "parameters": {
     "user_id": "PKFG301655",
     "symptoms": "Soft SOS triggered.
         Abnormal vitals detected.\nIf
         you are feeling unwell,
         contact emergency services or
         book an appointment.\n\nYour
         Vitals-\nHeart Rate: 41 bps\
         nOxygen: 85%\nDeep Sleep: 75
         minutes\nLight Sleep: 238
         minutes\nREM: 94 minutes\
         nAwake: 44 minutes"
    }
   }
  },
  {
```

```
  "from": "planner",
  "value": {
   "reason": "The user has been
       informed about the abnormal
       vitals. The Soft SOS process is
       completed successfully.",
   "action": "<END>"
  }
 }
 ]
}
```

D.5 Hard SOS - Start

```
{
 "interaction_trajectory": [
 {
  "from": "system",
  "value": {
   "user_details": {
    "user_id": "HNNT232992",
    "name": "Jace Cardoso",
    "timestamp": "2024-03-13T06:59:00"
   }
  }
 },
 {
  "from": "user",
  "value": "Hard SOS triggered"
 },
 {
  "from": "planner",
  "value": {
   "reason": "User has triggered a
       hard SOS, so the system needs
       to notify the user that the SOS
       process is starting.",
   "action": "Call notify_user to
       inform the user that the SOS
       process is being triggered."
  }
 },
 {
  "from": "caller",
  "value": {
   "tool": "notify_user",
   "parameters": {
    "user_id": "HNNT232992",
    "symptoms": "Hard SOS triggered.
        We are initiating emergency
        response procedures."
   }
  }
 },
 {
  "from": "observation",
  "value": {
   "result": true
  }
 },
 {
  "from": "planner",
  "value": {
   "reason": "The user has been
       notified about the SOS
       initiation. The system now
       needs to retrieve the user's
       location to proceed with the
       emergency response.",
```

```
   "action": "Call get_location to
       fetch the user's current
       coordinates."
  }
 },
 {
  "from": "caller",
  "value": {
   "tool": "get_location",
   "parameters": {}
  }
 },
 {
  "from": "observation",
  "value": {
   "result": {
    "latitude": 23.5326,
    "longitude": 139.7524
   }
  }
 },
 {
  "from": "planner",
  "value": {
   "reason": "The user's current
       location has been retrieved.
       Next, the system needs to find
       the nearest ambulance based on
       this location.",
   "action": "Call search_ambulance
       with the location to find the
       nearest available ambulance."
  }
 },
 {
  "from": "caller",
  "value": {
   "tool": "search_ambulance",
   "parameters": {
    "location": {
     "latitude": 23.5326,
     "longitude": 139.7524
    }
   }
  }
 },
 {
  "from": "observation",
  "value": {
   "result": {
    "ambulance_id": "AMBpF0E",
    "phone_no": "+146910850030"
   }
  }
 },
 {
  "from": "planner",
  "value": {
   "reason": "The nearest ambulance
       has been identified. The system
        needs to notify the ambulance
       about the user's location and
       details.",
   "action": "Call send_message to
       notify the ambulance with the
       user's location and details."
  }
 },
 {
  "from": "caller",
```

```
      "value": {
       "tool": "send_message",
       "parameters": {
        "phone_no": "+146910850030",
        "text": "Ambulance needed at
            location {latitude: 23.5326,
            longitude: 139.7524} by user
            HNNT232992 - Jace Cardoso"
       }
      }
     },
     {
      "from": "observation",
      "value": {
       "result": true
      }
     },
     {
      "from": "planner",
      "value": {
       "reason": "The ambulance has been
           notified. Next, the system
           needs to alert the user's
           emergency contacts about the
           SOS.",
       "action": "Call send_message to
           notify emergency contacts about
           the SOS and user's location."
      }
     },
     {
      "from": "caller",
      "value": {
       "tool": "send_message",
       "parameters": {
        "text": "SOS triggered by Jace
            Cardoso at location {latitude:
             23.5326, longitude:
            139.7524}",
        "to_emergency_contacts": true
       }
      }
     },
     {
      "from": "observation",
      "value": {
       "result": true
      }
     },
     {
      "from": "planner",
      "value": {
       "reason": "The emergency contacts
           have been notified. The system
           now needs to inform the user
           about the actions taken,
           including ambulance and
           emergency contact notifications
           .",
       "action": "Call notify_user to
           inform the user about the
           completion of the SOS process."
      }
     },
     {
      "from": "caller",
      "value": {
       "tool": "notify_user",
       "parameters": {
        "user_id": "HNNT232992",
```

```
        "symptoms": "Ambulance (AMBpF0E)
            with contact HNNT232992 has
            been informed and is on its
            way. Your emergency contacts
            have also been notified."
       }
      }
     },
     {
      "from": "observation",
      "value": {
       "result": true
      }
     },
     {
      "from": "planner",
      "value": {
       "reason": "The user has been
           informed about the actions
           taken. The SOS process is
           completed successfully.",
       "action": "<END>"
      }
     }
    ]
   }
```

D.6 Hard SOS - End

```
   {
    "interaction_trajectory": [
     {
      "from": "system",
      "value": {
       "user_details": {
        "user_id": "EORZ618635",
        "name": "Leah Lima",
        "timestamp": "2023-11-29T01:52:00"
       }
      }
     },
     {
      "from": "user",
      "value": "End SOS triggered"
     },
     {
      "from": "planner",
      "value": {
       "reason": "User has triggered an
           End SOS. The system needs to
           notify the user that the End
           SOS process is being initiated
           .",
       "action": "Call notify_user to
           inform the user about the
           initiation of the End SOS
           process."
      }
     },
     {
      "from": "caller",
      "value": {
       "tool": "notify_user",
       "parameters": {
        "user_id": "EORZ618635",
        "symptoms": "End SOS triggered. We
            are notifying all relevant
            parties."
       }
```

```
        }
    },
    {
        "from": "observation",
        "value": {
            "result": true
        }
    },
    {
        "from": "planner",
        "value": {
            "reason": "The user has been
                informed about the initiation
                of the End SOS process. The
                system now needs to get the
                assigned ambulance details.",
            "action": "Call
                get_assigned_ambulance to
                retrieve the ambulance details
                ."
        }
    },
    {
        "from": "caller",
        "value": {
            "tool": "get_assigned_ambulance",
            "parameters": {
                "user_id": "EORZ618635"
            }
        }
    },
    {
        "from": "observation",
        "value": {
            "result": {
                "ambulance_id": "AMBUaTg",
                "phone_no": "+235135781046"
            }
        }
    },
    {
        "from": "planner",
        "value": {
            "reason": "The assigned ambulance
                details have been retrieved.
                The system now needs to notify
                the ambulance about the SOS
                being ended.",
            "action": "Call send_message to
                inform the ambulance about the
                End SOS."
        }
    },
    {
        "from": "caller",
        "value": {
            "tool": "send_message",
            "parameters": {
                "phone_no": "+235135781046",
                "text": "The SOS triggered by user
                    EORZ618635 - Leah Lima has
                    been resolved. Ambulance
                    services are no longer
                    required."
            }
        }
    },
    {
        "from": "observation",
        "value": {
```

```
            "result": true
        }
    },
    {
        "from": "planner",
        "value": {
            "reason": "The ambulance has been
                notified about the End SOS.
                Next, the system needs to
                notify the user's emergency
                contacts about the resolution
                .",
            "action": "Call send_message to
                inform emergency contacts about
                the SOS resolution."
        }
    },
    {
        "from": "caller",
        "value": {
            "tool": "send_message",
            "parameters": {
                "text": "The SOS triggered by Leah
                    Lima has been resolved. No
                    further assistance is required
                    .",
                "to_emergency_contacts": true
            }
        }
    },
    {
        "from": "observation",
        "value": {
            "result": true
        }
    },
    {
        "from": "planner",
        "value": {
            "reason": "The emergency contacts
                have been notified about the
                SOS resolution. The system now
                needs to inform the user that
                the End SOS process is
                completed.",
            "action": "Call notify_user to
                inform the user about the
                successful completion of the
                End SOS process."
        }
    },
    {
        "from": "caller",
        "value": {
            "tool": "notify_user",
            "parameters": {
                "user_id": "EORZ618635",
                "symptoms": "The SOS process has
                    been successfully ended.
                    Ambulance and emergency
                    contacts have been informed."
            }
        }
    },
    {
        "from": "observation",
        "value": {
            "result": true
        }
    },
```

```
      {
       "from": "planner",
       "value": {
        "reason": "The user has been
             informed about the successful
             completion of the End SOS
             process. The task is completed
             .",
        "action": "<END>"
       }
      }
     ]
    }
```

E   List of Tools

Following is a list of tools for which planner and
caller is trained:

```
[
{
 "Name": "get_location",
 "Description": "Fetches the GPS
     coordinates of the user's current
     location.",
 "Parameters": [],
 "Required Parameters": [],
 "Returns": {
  "type": "dictionary",
  "description": "Returns the user's
      current location as {latitude:
      float, longitude: float}."
 }
},
{
 "Name": "search_ambulance",
 "Description": "Finds the nearest
     available ambulance based on the
     given location.",
 "Parameters": [
 {
  "param_name": "location",
  "type": "dictionary",
  "default": "None",
  "description": "The user's current
      location as {latitude: float,
      longitude: float}."
 }
 ],
 "Required Parameters": [
 "location"
 ],
 "Returns": {
  "type": "dictionary",
  "description": "Returns the
      ambulance details {ambulance_id:
      string, phone_no: string}."
 }
},
{
 "Name": "send_message",
 "Description": "Sends a text message
     to a specified phone number or
     emergency contacts.",
 "Parameters": [
 {
  "param_name": "phone_no",
  "type": "string",
  "default": "None",
```

```
  "description": "The phone number to
      send the message to."
 },
 {
  "param_name": "text",
  "type": "string",
  "default": "None",
  "description": "The message text to
      send."
 },
 {
  "param_name": "to_emergency_contacts
      ",
  "type": "boolean",
  "default": "False",
  "description": "Whether to send the
      message to all emergency
      contacts."
 }
 ],
 "Required Parameters": [
 "text"
 ],
 "Returns": {
  "type": "boolean",
  "description": "Returns True if the
      message was sent successfully."
 }
},
{
 "Name": "get_available_specialists",
 "Description": "Fetches a list of
     specialists and their
     availability.",
 "Parameters": [
 {
  "param_name": "symptoms",
  "type": "string",
  "default": "None",
  "description": "List of symptoms
      derived from user input."
 },
 {
  "param_name": "specialization",
  "type": "string",
  "default": "None",
  "description": "Specialization name
      for the appointment."
 },
 {
  "param_name": "user_schedule",
  "type": "object",
  "default": "None",
  "description": "User's preferred
      schedule for appointments in key
      -value pairs (e.g., {'date': '
      YYYY-MM-DD', 'time_range': 'HH:
      MM-HH:MM'})."
 }
 ],
 "Required Parameters": [
 "symptoms",
 "user_schedule"
 ],
 "Returns": {
  "type": "dictionary",
  "description": "Returns single best
      schedule {specialist_id: string,
       name: string, available_slot:
      string, date: string}."
```

```
                    }                                         "description": "Unique identifier
                },                                                 for the chosen specialist."
                {                                            },
                  "Name": "confirm_appointment",             {
                  "Description": "Confirms an                  "param_name": "appointment_time_date
                      appointment slot and stores it in           ",
                      the hospital's database.",               "type": "string",
                  "Parameters": [                              "default": "None",
                {                                              "description": "The selected time
                  "param_name": "user_id",                         slot for the appointment as time
                  "type": "string",                               in HH:MM-HH:MM format and date
                  "default": "None",                              in DD/MM/YY format."
                  "description": "Unique identifier          }
                      for the user."                          ],
                },                                            "Required Parameters": [
                {                                             "user_id",
                  "param_name": "specialist_id",              "symptoms",
                  "type": "string",                           "specialist_id",
                  "default": "None",                          "appointment_time_date"
                  "description": "Unique identifier          ],
                      for the chosen specialist."             "Returns": {
                },                                             "type": "boolean",
                {                                              "description": "Always returns True
                  "param_name": "appointment_time_date           ."
                      ",                                     }
                  "type": "string",                         },
                  "default": "None",                        {
                  "description": "The selected time           "Name": "get_available_specialists",
                      slot for the appointment as time        "Description": "Fetches a list of
                       in HH:MM-HH:MM format and date             specialists and their
                      in DD/MM/YY format."                        availability.",
                }                                             "Parameters": [
                ],                                          {
                "Required Parameters": [                      "param_name": "symptoms",
                "user_id",                                    "type": "string",
                "specialist_id",                              "default": "None",
                "appointment_time_date"                       "description": "List of symptoms
                ],                                                derived from user input."
                "Returns": {                                 },
                  "type": "boolean",                         {
                  "description": "Always returns True          "param_name": "specialization",
                      ."                                       "type": "string",
                }                                              "default": "None",
                },                                            "description": "specialization name
                {                                                 for the appointment"
                  "Name": "save_appointment_history",       },
                  "Description": "Saves appointment          {
                      information in the user's                "param_name": "user_schedule",
                      database for later reference and         "type": "object",
                      recurring use cases.",                   "default": "None",
                  "Parameters": [                             "description": "User's preferred
                {                                                 schedule for appointments in key
                  "param_name": "user_id",                        -value pairs (e.g., {'date': '
                  "type": "string",                               YYYY-MM-DD', 'time_range': 'HH:
                  "default": "None",                              MM-HH:MM'})."
                  "description": "Unique identifier          }
                      for the user."                          ],
                },                                            "Required Parameters": [
                {                                             "symptoms",
                  "param_name": "symptoms",                   "specialization"
                  "type": "string",                          ],
                  "default": "None",                          "Returns": {
                  "description": "The symptoms                 "type": "dictionary",
                      described by the user."                  "description": " returns single best
                },                                                 schedule {specialist_id,name,
                {                                                 available_slot including time in
                  "param_name": "specialist_id",                 HH:MM-HH:MM format and date in
                  "type": "string",                             DD/MM/YY format}."
                  "default": "None",                          }
                                                            },
```

```
{
 "Name": "confirm_appointment",
 "Description": "Confirms an
     appointment slot and stores it in
     the hospital's database.",
 "Parameters": [
 {
  "param_name": "user_id",
  "type": "string",
  "default": "None",
  "description": "Unique identifier
      for the user."
 },
 {
  "param_name": "specialist_id",
  "type": "string",
  "default": "None",
  "description": "Unique identifier
      for the chosen specialist."
 },
 {
  "param_name": "appointment_time_date
      ",
  "type": "string",
  "default": "None",
  "description": "The selected time
      slot for the appointment as time
       in HH:MM-HH:MM format and date
      in DD/MM/YY format."
 }
 ],
 "Required Parameters": [
 "user_id",
 "specialist_id",
 "appointment_time"
 ],
 "Returns": {
  "type": "boolean",
  "description": "Always returns True
      ."
 }
},
{
 "Name": "save_appointment_history",
 "Description": "Saves appointment
     information in the user's
     database for later reference and
     recurring use cases.",
 "Parameters": [
 {
  "param_name": "user_id",
  "type": "string",
  "default": "None",
  "description": "Unique identifier
      for the user."
 },
 {
  "param_name": "symptoms",
  "type": "string",
  "default": "None",
  "description": "The symptoms
      described by the user."
 },
 {
  "param_name": "specialist_id",
  "type": "string",
  "default": "None",
  "description": "Unique identifier
      for the chosen specialist."
 },
```

```
{
 "param_name": "appointment_time_date
     ",
 "type": "string",
 "default": "None",
 "description": "The selected time
     slot for the appointment as time
      in HH:MM-HH:MM format and date
     in DD/MM/YY format."
}
],
"Required Parameters": [
"user_id",
"symptoms",
"specialist_id",
"appointment_time_date"
],
"Returns": {
 "type": "boolean",
 "description": "Always true"
}
},
{
 "Name": "get_appointment_history",
 "Description": "Retrieves the user's
     appointment history for analysis
     and reminders.",
 "Parameters": [
 {
  "param_name": "user_id",
  "type": "string",
  "default": "None",
  "description": "Unique identifier
      for the user."
 }
 ],
 "Required Parameters": [
 "user_id"
 ],
 "Returns": {
  "type": "array",
  "description": "Array containing
      past appointment records."
 }
},
{
 "Name": "retrieve_past_complaints",
 "Description": "Fetches the user's
     past complaints matching the
     given symptoms for analysis and
     reference.",
 "Parameters": [
 {
  "param_name": "user_id",
  "type": "string",
  "default": "None",
  "description": "Unique identifier
      for the user."
 },
 {
  "param_name": "symptoms",
  "type": "string",
  "default": "None",
  "description": "List of symptoms to
      search for in past complaints."
 },
 {
  "param_name": "date_range",
  "type": "object",
  "default": "None",
```

```
      "description": "Optional date range          "Description": "Sends a notification
          filter in the format {'                       to the user ",
          start_date': 'YYYY-MM-DD', '              "Parameters": [
          end_date': 'YYYY-MM-DD'}."                 {
    }                                                 "param_name": "user_id",
  ],                                                  "type": "string",
  "Required Parameters": [                            "default": "None",
  "user_id",                                          "description": "Unique identifier
  "symptoms"                                              for the user."
  ],                                                 },
  "Returns": {                                       {
   "type": "array",                                   "param_name": "message",
   "description": "Array of past                      "type": "string",
       complaints related to the                      "default": "None",
       specified symptoms."                           "description": "The notification
  }                                                       message to send."
},                                                   }
{                                                  ],
  "Name": "follow_up_with_user",                   "Required Parameters": [
  "Description": "Initiates a follow-up            "user_id",
      interaction with the user based              "message"
      on their past complaints and                 ],
      current symptoms.",                           "Returns": {
  "Parameters": [                                    "type": "boolean",
  {                                                  "description": "Always returns
   "param_name": "user_id",                             status as True"
   "type": "string",                               }
   "default": "None",                            },
   "description": "Unique identifier             {
       for the user."                              "Name": "get_input_from_user",
  },                                               "Description": "Collects input from
  {                                                    the user for specified parameters
   "param_name": "past_complaints",                   .",
   "type": "array",                                "Parameters": [
   "default": "[]",                                {
   "description": "List of past                     "param_name": "user_id",
       complaints to reference during               "type": "string",
       the follow-up."                              "default": "None",
  },                                                 "description": "Unique identifier
  {                                                      for the user."
   "param_name": "current_symptoms",              },
   "type": "string",                              {
   "default": "None",                              "param_name": "questions",
   "description": "Current symptoms                "type": "string",
       reported by the user."                      "default": "[]",
  },                                                "description": "Question to ask the
  {                                                     user."
   "param_name": "                                 }
       preferred_contact_method",                 ],
   "type": "string",                              "Required Parameters": [
   "default": "None",                             "user_id",
   "description": "User's preferred               "questions"
       method for follow-up (e.g., '              ],
       call', 'email', 'chat')."                  "Returns": {
  }                                                 "type": "string",
  ],                                                "description": "User's response to
  "Required Parameters": [                             the specified questions."
  "user_id",                                       }
  "current_symptoms"                             },
  ],                                             {
  "Returns": {                                     "Name": "store_symptoms",
   "type": "object",                               "Description": "Stores the symptoms
   "description": "Details of the                      reported by the user and
       follow-up initiated, including                  initiates a follow-up process to
       method and next steps."                         gather additional details for a
  }                                                     more accurate analysis.",
},                                                 "Parameters": [
{                                                  {
  "Name": "notify_user",                            "param_name": "user_id",
                                                    "type": "string",
```

```
    "default": "None",
    "description": "Unique identifier
        for the user."
  },
  {
   "param_name": "symptoms",
   "type": "string",
   "default": "None",
   "description": "Symptoms of user."
  },
  {
   "param_name": "timestamp",
   "type": "object",
   "default": "None",
   "description": "Save date and time
        of the event",
   "Required Parameters": [
   "user_id",
   "symptoms",
   "timestamp"
   ],
   "Returns": {
    "type": "boolean",
    "description": "Status always true"
   }
  }
  ]
}
]
```