Smartel - AI Powered Telemedicine platform

Team:

- Aknur Kassym (ak8827) - Full-stack developer
- Shawn Nassabi (san7522) - UX/UI designer, Full-stack developer
- Wei Kuo (ck3294) - Backend developer, Data Engineer
- Alex Ma (am11351) - Backend developer, AI expert

Project Description

Smartel is an AI-powered healthcare platform that allows patients to book appointments with healthcare providers and securely share medical information. For doctors, it provides the ability to transcribe the conversation with the patient, automatically generate the medical report/summary of the consultation session, and fill out necessary medical forms. Thus, our platform provides value for both patients and doctors. Smartel will simplify the appointment process for patients and take care of the paperwork for the doctors, thereby increasing the efficiency of the healthcare industry.

Business Goals

- Enable patients to easily schedule appointments with healthcare professionals, reducing wait-times, ensuring a timely access to medical consultations and optimizing the overall appointment booking process
- Increase doctor's efficiency by providing a detailed summary of the conversation with the patient and eliminating the manual documentation, allowing the doctor to focus on a quality patient care and increase the daily volume of consultations

Main Features (Engineering Objectives):

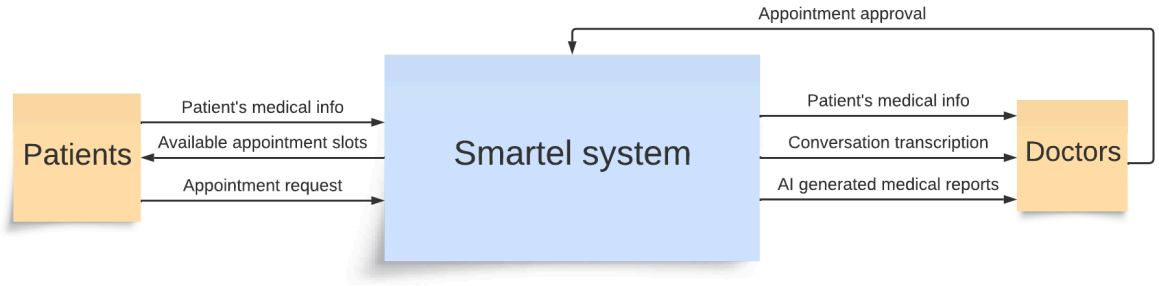
- User login and authentication
    - Doctors and patients can login to their accounts to access catered user pages
    - Login will be done using username and password

    - Will use JWT tokens on the backend to implement user authentication
    - User credentials are securely stored using encryption, salting, and hashing
- Appointment scheduling and booking
    - Patients can register and log in to the platform to view available appointment slots with healthcare professionals, categorized by specialty and availability.
    - Healthcare professionals can specify availability on their dashboard page
    - Scheduled appointments will be shown on each user's "Appointments" page
- Consultation transcription
    - The doctor-patient consultations will be recorded and transcribed
    - The software will use the Whisper API for audio transcription in the backend
    - The recorded audio will then be used by the AI summary generator component
- Automated AI summary document generation
    - Use ChatGPT API to analyze transcribed conversations to generate concise summary documents summarizing the diagnosis, symptoms, treatment plan, prescriptions, and follow-up recommendations, based on the conversation between a patient and a healthcare professional
- Patient medical data sharing
    - Patients will be able to securely input required medical data onto the platform after signing up and logging in
    - This will be done using a form, and the data will be stored on a database in the backend

Scope:

System Boundaries: The telemedicine platform serves as an intermediary between patients and healthcare professionals, facilitating virtual consultations and medical record management. External to the system are physical healthcare facilities, external databases (such as pharmacies or laboratory databases), and third-party applications not integrated with the platform. The system does not include physical medical devices or equipment used for diagnosis and treatment, nor does it provide emergency medical services. Below is a context diagram

illustrating the system's scope:



Stakeholders

1. **Patients:** Users on the platform seeking a healthcare service, who sign up for appointments and share medical information
2. **Healthcare professionals:** Doctors, nurses, and other medical practitioners, who will the using the platform to schedule the appointments, record and transcribe the conversations, access the patient's information and the AI-generated summary
3. **Healthcare institutions:** Hospitals, clinics and other healthcare facilities, paying and integrating the platform into their system
4. **Development team**: The engineers, designers and quality assurance specialists responsible for designing, developing, and maintaining the telemedicine platform.
5. **Insurance Providers**: Entities that may be involved in covering the healthcare expenses
6. **Third-Party Service Providers**: Such as cloud hosting providers, transcription services, or AI/ML solution providers, whose technologies or services may be integrated into the telemedicine platform
7. **Patients' Families or Caregivers**: People who may be involved in facilitating patients' access to the platform and managing their healthcare needs
8. **Government Agencies**: Responsible for healthcare policy-making and regulation, who may have an interest in promoting telemedicine initiatives and ensuring their alignment with public health goals

Constraints

There are several constraints that can impact the development of Smartel. The first constraint is monetary. Some of the artificial intelligence APIs that we are planning to use are not free. However, the functionality of our project is based on utilizing those tools. The second constraint is time. Our team will have about 8 weeks to implement the stated features on a part time schedule. Finally, a design constraint has been imposed, which requires our project to be implemented in an object oriented manner (have classes).

Risks

The risks for this project can be roughly divided into four categories, namely technical, security, schedule, and ethical risks.

Technical Risks: Potential technical challenges include frontend and backend compatibility issues, APIs' failure, high complexity in implementation, improper integration of modules, limited use of up-to-date technologies, and frequent changes in requirements. To avoid technical risks, it is essential to conduct regular code reviews and test. Additionally, creating an adaptable development environment can help mitigate potential technical risks as the project progresses.

Schedule Risks: This project also involves scheduling related risks, as our team only has 14 weeks to complete implementing a minimum of 5 features. Possible schedule risks we might encounter include: improper resource allocation, frequent project changes such as adding more features, and failure to complete required features. To mitigate schedule risk, our team will need to monitor progress frequently and adjust project timelines and scope as needed. If possible, seek additional resources or newer technologies if that helps speed up the completion of the project.

Security Risks: The major security risk involves patient data and privacy breaches. Other security risks, though not likely considering the scope of this project, might include, but are not limited to unauthorized access or cyberattacks. Some mitigation strategies we plan to implement in this project include utilizing JWT tokens and possible encryption protocols.

Ethical Risks: Some ethical concerns we consider in this project include patient data privacy and debiasing machine learning algorithms in automated summary document generation. The team will ask for patients' consents for data use that adheres to ethical guidelines.

Appendix

- JWT Tokens - https://jwt.io/
- Whisper API - https://github.com/openai/whisper
- ChatpGPT API - https://openai.com/blog/introducing-chatgpt-and-whisper-apis