Usability Study Report

CS5610_Web Development
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Video Link:
https://drive.google.com/drive/folders/1mwUnktTJZyilhp1doS2gt08FKwBeiCFT?usp=drive_link

Application scope

<u>Application Description</u>
MedLink is a full-stack clinic appointment management system that streamlines communication between patients and healthcare providers. Patients can discover available doctors, book appointments, manage visit history, and reschedule or cancel appointments. Doctors configure weekly availability schedules, review upcoming patient visits, and monitor past appointment records. The system includes conflict detection to prevent double-booking and implements JWT-protected, role-based user experiences.

<u>Key Features</u>
- Role-based authentication with separate dashboards for patients and doctors
- Availability management with conflict-free time slot display
- Complete appointment lifecycle: booking, rescheduling, cancellation, and status tracking
- Automatic conflict prevention for both patients and doctors
- Filterable appointment history with date ranges, status filters, and pagination
- JWT authentication with bcrypt password hashing and role-based authorization

<u>Users - Target Audience (User Personas)</u>
1. Patient Persona

Demographics: Adults 18+ seeking healthcare appointment scheduling services with basic to intermediate web browsing skills.

Goals:
- Browse doctors by specialty or name
- Book medical appointments at convenient times
- View and manage upcoming appointments
- Access filtered appointment history
- Reschedule or cancel appointments

Primary Use Cases:

- First-time registration and booking initial appointment via "Book Visit" page
- Searching for doctors by specialty and viewing available time slots
- Managing upcoming appointments from dashboard with quick reschedule/cancel actions
- Reviewing historical appointments filtered by status, date range, and doctor
- Modifying appointments (must be at least 1 hour in advance)

Pain Points Addressed:
- Difficulty finding available appointment times
- Need for easy appointment management
- Desire for complete visit history visibility
- Requirement for flexible scheduling options

2. Doctor Persona

Demographics: Healthcare professionals managing their own appointment schedules, typically 30+ years old with intermediate to advanced computer skills.

Goals:
- Configure weekly availability schedules
- Review upcoming patient appointments with details
- Monitor past appointment records and outcomes
- Track appointment statuses (completed, cancelled, no-show)
- Manage patient visit workflow

Primary Use Cases:
- Setting weekly availability windows (Monday-Sunday) with specific time slots (typically 9:00 AM - 5:00 PM)
- Viewing all future appointments with patient names, scheduled times, and visit reasons
- Reviewing historical appointments filtered by status and date range
- Marking appointments as completed, cancelled, or no-show
- Updating availability to reflect changes in working hours

Pain Points Addressed:
- Need for efficient schedule management
- Requirement to track patient visit history
- Desire for clear visibility into upcoming workload
- Need to prevent double-booking conflicts

3. User Roles

Patient Role: Can create, view, reschedule, and cancel own appointments; search and browse doctors; view personal appointment history. Cannot access doctor-specific features or other patients' data.

Doctor Role: Can manage weekly availability schedules; view all appointments assigned to them; update appointment statuses; access patient information for their appointments. Cannot book appointments or access other doctors' schedules.

Data Description
Database Collections
1. `users` Collection

Purpose: Stores all user accounts (patients and doctors)

Stored Fields:
- User ID, email (unique), hashed password, role (patient/doctor), name, phone (optional), date of birth (optional), specialty (doctors only), creation timestamp

Doctor Specialties: General Practice, Internal Medicine, Pediatrics, Cardiology, Dermatology, Orthopedics, Neurology

Displayed Data:
- Doctor lists: Name, specialty, email
- Appointment cards: Doctor/patient name, specialty
- User profiles: Name, email, phone, date of birth
- Navigation: User name in welcome messages

2. `appointments` Collection

Purpose: Stores all appointment records with scheduling and status information

Stored Fields:
- Appointment ID, patient ID, doctor ID, start date/time, end date/time, reason (optional), status, creation timestamp

Status Values:
- `upcoming`: Future appointment not yet occurred
- `completed`: Successfully completed appointment
- `cancelled`: Cancelled appointment (hard deleted from database)
- `no-show`: Patient did not attend scheduled appointment
Common Visit Reasons:Annual checkup, flu symptoms, cough and cold, back pain, headache, skin rash, follow-up appointment, vaccination, blood pressure check, medication refill

Displayed Data:
Patient Dashboard:Doctor name and specialty, appointment date/time, visit reason, status badge, reschedule/cancel actions
Patient History: All historical appointments filterable by status (upcoming, completed, cancelled, no-show), date range (from/to dates), paginated (20 per page), sorted by date (newest first)
Doctor Upcoming: Patient name, appointment date/time, visit reason, status
Doctor Past:Patient name, appointment date/time, visit reason, final status

Business Rules:
- Appointments must be booked at least 1 hour in advance
- Conflict detection prevents overlapping appointments for both patients and doctors
- Cancelled appointments are hard-deleted
- Status transitions: upcoming → completed/cancelled/no-show

3. `availability` Collection

Purpose: Stores weekly availability schedules for doctors

Stored Fields:- Availability ID, doctor user ID, availability object with days of week (Monday-Sunday) containing arrays of time slots

Time Slot Format:24-hour format (HH:MM), typically 9:00 AM to 5:00 PM in 30-minute intervals

Displayed Data:
Doctor Availability Management:Editable weekly schedule with day-by-day time slot configuration and save functionality
Patient Booking Flow:Available time slots for selected doctor and date, automatically filtered to exclude past slots, slots less than 1 hour away, slots already booked by doctor, and slots already booked by current patient. Displayed in 12-hour format with AM/PM and EST timezone.

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4. Data Relationships

- User → Appointments: One-to-many (one user can have multiple appointments)
- Doctor → Availability:One-to-one (each doctor has one availability record)
- Appointments: Many-to-many relationship between patients and doctors through appointment records

Data Validation and Business Logic

Appointment Booking: Minimum 1-hour advance booking required; conflict detection prevents overlapping appointments for same patient or doctor; time slots must match doctor's availability schedule.

Data Integrity: Email uniqueness enforced; ObjectId validation for all ID references; date/time validation for scheduling; role-based data access restrictions.

Seed Data: 1 test patient, 50 additional patients, 15 doctors across various specialties, 1,000+ synthetic appointment records, availability records for all doctors (default: Monday-Sunday, 9:00-17:00).

Main tasks - use cases: (specific, measurable, concrete)
- T1: Log in or Create Account
- T2: Book an appointment for tomorrow(patient)
- T3: Reschedule the appointment(patient)
- T4: Delete the appointment(patient)
- T5: Please start on the homepage in a logged-out state(patient)
- T6: Delete an appointment(doctor)
- T7: Edit Sunday morning availability(doctor)
- T8: Review appointment history(doctor)
- T9: Log Out

Experiment

Preparation

START OF SESSION – INTRODUCTION
Hi, thank you for joining this MedLink usability study.
Today, we will walk through several tasks using the MedLink system.
This study evaluates the interface — not your skills — so there are no right or wrong actions.
Anything that confuses you is valuable feedback for us.

CONSENT
Before we begin, I want to go over the consent information.
Your participation is voluntary, and you may stop at any time.
We are not collecting personal information, and your results will remain confidential.

For this session, we provide two sample accounts:

A patient account with past appointment history
Account: emily@patient.com
Password: password123

A doctor account with appointment requests and past bookings
Account: doctor1@example.com
Password: password123

These accounts are for testing only.

Is it okay if I record this session for research purposes only?"

(Wait for a verbal yes/no.)
If yes: "Thank you. I'm starting the recording now."

THINK-ALOUD INSTRUCTIONS

During the study, please think aloud.
This means saying what you expect to happen, what you are looking for,
and anything that feels confusing or surprising.

PRE-TEST QUESTIONS
Have you used online appointment systems before?
How comfortable do you feel booking appointments online?
What device do you normally use for these tasks?

We will begin by logging into or creating an account.
Then you will complete three tasks as a patient and three tasks as a doctor.
At the end, you will log out of the system.

INITIAL TASK (Both Roles)
Task 1 — Log in or Create Account
Task 1: Please log into the sample account or create a new account if needed.
As you complete the task, please think aloud.

PATIENT TASKS
Switch to a patient account if needed.
Task 2 — Book an appointment for tomorrow
Patient Task 1:
Please book a new appointment for tomorrow with any available doctor.
(Neutral prompts only: "Please continue thinking aloud.")

Task 3 — Reschedule the appointment
Patient Task 3:
Please locate the appointment you just booked and reschedule it to next week.
Neutral prompt: "What are you expecting to find here?"

Task 4 — Delete the appointment
Patient Task 4:
Please delete or cancel the appointment that you just rescheduled.

Task 5:Please start on the homepage in a logged-out state.
From here, try to **book a new appointment** as a visitor.

Continue until the system asks you to sign in or create an account.
 Please think aloud as you work through what the system presents."

DOCTOR TASKS
Switch to doctor account if needed.
Task 6 — Delete an appointment
Doctor Task 1:
Please find and delete an appointment from your schedule.

Task 7 — Edit Sunday morning availability
Doctor Task 2:
Please update your schedule so that every Sunday morning is unavailable
because you have other commitments at that time.

Task 8 — Review appointment history
Doctor Task 3:
Please review your past appointment history.

FINAL TASK
Task 9 — Log Out
Task 9:
Please log out of the system.

POST-TEST QUESTIONS
- What part of the process felt easiest?
- What part felt confusing or frustrating?"
- Was anything missing that you expected to see?
- If you could improve one thing, what would it be?
- Would you use MedLink in real life?

POST-STUDY 5-POINT LIKERT SURVEY
I will now read several statements.
Please rate each one from 1 to 5, where 1 means strongly disagree and 5 means strongly agree.
- The interface was easy to navigate.
- I could find information quickly.
- Booking or editing appointments felt straightforward.
- I felt confident the system saved my changes correctly.
- The design felt intuitive.
- I understood how to edit or change schedules.
- I would use MedLink for real appointments.

CLOSING SCRIPT
Thank you for participating in this MedLink usability study.
Your feedback is extremely valuable and will help us improve the system.
This concludes the session. Thank you again for your time.

Experiment Notes

*After finishing running the experiment for each participant, make sure to write down right away all the notes you remember from the session. Then, **rewatch the session** video looking for parts on which the participants were frustrated or struggling to complete a task, and write notes for that. Using that information identifies issues, bugs and other points of improvements.*

Participant 1: Nemo
Initial Approach
Nemo has never used an online appointment system before.

T1: Log In or Create Account
Nemo created a new account smoothly and did not encounter any difficulties during registration.

T2: Book an Appointment
From a brand-new account, the dashboard link directed him straight to the appointment confirmation page. Booking directly through this page felt confusing to him because he could immediately choose a doctor from a very long and unorganized list with no sorting options. He also found it difficult to select start and end times, as the system required minute-level precision and forced him to manually set an end time, which made the process feel unintuitive and hard to use.

T3: Reschedule an Appointment
The rescheduling flow worked smoothly, and the new appointment time was updated correctly in the interface.

T4: Delete an Appointment
The deletion process worked well. Nemo appreciated that a confirmation message appeared before the appointment was removed.

T5: Starting Logged Out (Patient Booking)
Booking while logged out was still manageable. After choosing a time slot, the interface redirected him immediately to the login page. This initially caused brief confusion, but he quickly understood the need to log in before confirming the appointment. Once logged in, he saw that the confirmation page accurately reflected the doctor and time slot he selected earlier.

T6: Delete an Appointment (Doctor View)
The delete function worked as expected, and Nemo did not encounter issues.

T7: Edit Sunday Morning Availability (Doctor View)
Even without explicit instructions, Nemo immediately understood that green blocks represented available times and white blocks represented unavailable times. However, the system provided no confirmation after saving changes, which he felt should be added.

T8: Review Appointment History (Doctor View)
Nemo suggested adding sorting or filtering features so doctors could better analyze past appointments.

T9: Log Out
The logout action worked but lacked a confirmation message, which he recommended adding.

Post-Test Questionnaire Results

Nemo rated navigation, finding information, booking, and editing appointments all as 5. He rated design intuitiveness as 4 and said he would use MedLink for real appointments.

- The interface was easy to navigate. 5
- I could find information quickly. 5
- Booking or editing appointments felt straightforward. 5
- I felt confident the system saved my changes correctly. 5
- The design felt intuitive. 4
- I understood how to edit or change schedules. 5
- I would use MedLink for real appointments. 5

Participant 2: Zoe
Initial Approach
Zoe has experience using online appointment systems.

T1: Log In or Create Account
Account creation was smooth and straightforward.

T2: Book an Appointment
Like Nemo, she found it confusing that the dashboard link for new users led directly to the appointment confirmation page. After selecting a doctor, she questioned whether the chosen time was actually available because the interface allowed selecting any future minute. Her prior experience made her expect more clear restrictions on available time slots.

T3: Reschedule an Appointment
The rescheduling process was smooth and updated correctly. Zoe noticed an inconsistency: booking through the time-slot page enforced fixed 30-minute intervals, but booking through the confirmation page allowed selecting arbitrary start times, including minute-level precision.

T4: Delete an Appointment
She felt the deletion process worked well, especially with the confirmation step.

T5: Starting Logged Out (Patient Booking)
Booking while logged out remained smooth, although the transition from choosing a time slot to the login page caused momentary confusion. She also expected the ability to book as a guest. When attempting to return to the homepage for the next task, she clicked the logo, expecting it to function as a home button. Instead, she discovered that logging out was the only way back, which felt unintuitive.

T6: Delete an Appointment (Doctor View)
This task worked well with no issues noted.

T7: Edit Sunday Morning Availability (Doctor View)
Zoe correctly interpreted green as available and white as unavailable. Like Nemo, she noticed that saving availability changes produced no confirmation.

T8: Review Appointment History (Doctor View)
No comments were provided for this task.

T9: Log Out
No specific feedback was given.

Post-Test Questionnaire Results

Zoe rated nearly all items as 5, except for confidence in saved changes, which she rated as 4.

- The interface was easy to navigate. 5
- I could find information quickly. 5
- Booking or editing appointments felt straightforward. 5
- I felt confident the system saved my changes correctly. 4
- The design felt intuitive. 5
- I understood how to edit or change schedules. 5
- I would use MedLink for real appointments. 5

Participant 3: Jerry (Using Updated Version)
Initial Approach
Jerry has used online appointment systems, including systems similar to Apple's scheduling interface.

T1: Log In or Create Account
When attempting to log in without an existing account, he received an appropriate error message. Registering a new user was smooth, and he noted the password length requirement.

T2: Book an Appointment
Jerry found the doctor list messy and unsorted. He recommended sorting by doctor name or specialty, or even filtering based on the patient's chosen reason for visit. He felt the list could be overwhelming in its current state.

T3: Reschedule an Appointment
The rescheduling flow worked smoothly and updated correctly. He confirmed that previously booked time slots were grayed out, preventing overlapping bookings.

T4: Delete an Appointment
The deletion process was smooth, and the confirmation message worked well.

T5: Starting Logged Out (Patient Booking)
Jerry noticed a date mismatch bug where the time-slot selection displayed a day off from the actual date. He also noted the same confusion others experienced when the system automatically redirected to the login page after selecting a time slot.

T6: Delete an Appointment (Doctor View)
This task functioned properly.

T7: Edit Sunday Morning Availability (Doctor View)
Editing availability was smooth, and Jerry did not report issues.

T8: Review Appointment History (Doctor View)
No additional comments.

T9: Log Out
No issues reported.

Post-Test Questionnaire Results

Jerry gave strong ratings overall. He rated booking/editing as slightly less straightforward (4) and indicated he would likely use MedLink, though not as strongly as the other participants.

- The interface was easy to navigate. 5
- I could find information quickly. 5
- Booking or editing appointments felt straightforward. 4
- I felt confident the system saved my changes correctly. 5
- The design felt intuitive. 5
- I understood how to edit or change schedules. 5
- I would use MedLink for real appointments. 4

Prioritized list of issues and corresponding changes:

Summarize the most crucial issues and changes proposed

Issue 1: Doctor List Is Long, Unorganized, and Lacks Sorting/Filtering

Change: Add sorting (e.g., by name or specialty) and filtering options; consider showing only doctors relevant to the patient's selected reason for visit.
Priority: Must
Was it implemented? How?
Not yet fully implemented. Initial restructuring of the doctor data model has begun, but sorting and filtering logic still needs to be added on both frontend and backend.

Issue 2: Booking From the Confirmation Page Allows Arbitrary Time Selection (Minute-Level), Causing Confusion and Inconsistency

Change: Restrict time selection to match the predefined 30-minute slots; unify booking logic across all entry points so users cannot choose invalid or unrealistic times.
Priority: Must
Was it implemented? How?
Partially. Time slot validation has been updated in the backend, but the confirmation page UI still allows flexible selection and needs alignment with the main time-slot component.

Issue 3: No Confirmation Message When Saving Doctor Availability or Logging Out

Change: Add clear confirmation messages after saving availability and after logging out to reassure users their actions were successful.
Priority: Should
Was it implemented? How?
Availability confirmation has been added in the updated version; logout confirmation is still pending.

Issue 4: Booking While Logged Out Redirects Suddenly to the Login Page, Causing Momentary Confusion

Change: Add a small message explaining: "Please log in to complete your booking," or include a transitional screen to clarify the required step.
Priority: Should

Was it implemented? How?
 Not implemented yet. The redirect behavior remains the same, though UI messaging is planned for the next update.

Issue 5: Date Mismatch Bug in Time Slot Selection (One-Day Difference Noticed)

Change: Fix date-handling logic in the component that displays available time slots to ensure consistent formatting and timezone alignment.
 Priority: Must
 Was it implemented? How?
 Yes. Date handling was corrected in the updated version by fixing the moment.js/Date object conversion to ensure consistent local date formatting.