

Session 6

User interface design of the Railway Reservation System with screen inventory, navigation map, wireframes, and field validation

This session designs what the Passenger, Reservation Clerk and Administrator of the Railway Reservation System (RRS) actually see: which screens exist, how a user moves between them, what each screen shows and asks for, and what the system says when the input is wrong. The manual asks for an easy-to-follow interface with no hidden buttons, little graphics, and proper error messages, and every screen here is drawn to those rules. The business rules of Session 1 (max 6 passengers per PNR, no booking after departure, refund by hours before departure) become validation rules on specific fields, so the interface enforces the same rules the design in Session 5 enforces in code.

Objectives

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- List every screen of the RRS with its actor, purpose and entry point.
- Draw a navigation map showing how a user moves from login to booking, cancellation and admin tasks.
- Draw text wireframes for the seven main screens.
- Specify every input field with type, validation rule and exact error message.
- Apply the manual's interface rules (easy to follow, no hidden buttons, proper error messages) and show where each one is used.

Problem Statement

■ Write in lab record

Session 6: Develop user interface design for RRS.

Concept

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Screen inventory and navigation map

Start by listing screens, not drawing them. A screen is one page the user sees with one purpose. If a page has two purposes (search and book), split it. The inventory gives each screen an id (S1, S2, ...) that the navigation map and field tables refer to. A navigation map is then a graph: screens are nodes, user actions are edges. It shows the happy path (login, search, select, enter passengers, pay, see PNR) and the side paths (cancel, admin). The rule from the manual is “no hidden buttons”: every edge in the map must be a visible button or link on the source screen.

Wireframes, validation and error messages

A wireframe is a box drawing of a screen with labels, input fields, buttons and messages, and no colours or graphics. Draw fields as underlined blanks, buttons in square brackets, and the error message area as a fixed line so the student knows where feedback appears. The manual says “proper error messages” and “you must do the type checking”. For each field write three things: the type, the rule, and the exact text the user reads. A message must say what is wrong and what to do: “Journey date cannot be in the past” is proper; “Invalid input” is not.

Screen Inventory

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Screen id	Name	Actor	Purpose	Reached from
S1	Login	All	Verify email and password; route to the role's home	Application start, S2 Register
S2	Register	Passenger	Create a Passenger account	S1 link "New user? Register"
S3	Passenger Home	Passenger, Reservation Clerk	Menu: Search Trains, Cancel by PNR, My Bookings, Logout	S1 after login
S4	Search Trains	Passenger, Reservation Clerk	Enter source, destination, date	S3 button "Search Trains"
S5	Availability and Fare	Passenger, Reservation Clerk	Show matching trains, seats per class, fare; pick one	S4 button "Search"
S6	Passenger Details	Passenger, Reservation Clerk	Enter 1 to 6 passengers with berth preference	S5 button "Book" on a row
S7	Payment and Confirmation	Passenger, Reservation Clerk	Choose payment mode, pay, see PNR and status	S6 button "Proceed to Pay"
S8	Cancel by PNR	Passenger, Reservation Clerk	Look up PNR, show refund amount, confirm cancellation	S3 button "Cancel by PNR"
S9	My Bookings	Passenger	List own bookings with status	S3 button "My Bookings"
S10	Admin Home	Administrator	Menu: Add Train, Add Schedule, Set Fare, Reports, Logout	S1 after admin login

Screen id	Name	Actor	Purpose	Reached from
S11	Admin Add Train	Administrator	Enter train number, name, type, coaches	S10 button "Add Train"
S12	Admin Add Schedule	Administrator	Create a run of a train on a date	S10 button "Add Schedule"
S13	Admin Reports	Administrator	Occupancy, revenue, cancellation report for a date range	S10 button "Reports"

Navigation Map

Write in lab record

```

1          Register          +-----+ Administrator
2  +-----+ S1 Login |-----+
3  |          +-----+ |
4  v          Passenger/Clerk | v
5  +-----+ v +-----+
6  | S2 Register |--Register-->(S1) | | S10 Admin Home |
7  +-----+ +-----+ +-----+
8          | S3 Passenger | | |
9          | Home | Add |Add |Reports
10         +---+-----+---+ Train |Sch.|
11         Search Trains | | | My Bookings v v v
12         v | v +---+ +---+ +---+
13         +-----+ | +-----+ |S11 | |S12 | |S13 |
14         | S4 Search | | | S9 My | +---+ +---+ +---+
15         +-----+ | | Bookings | | |
16         Search | | +-----+ +---Save-->(S10)
17         v | Cancel by PNR
18         +-----+ |
19         | S5 Availability | v
20         | and Fare | +-----+
21         +-----+ | S8 Cancel by |
22         Book (row) | | PNR |
23         v +-----+
24         +-----+ | Confirm Cancel -> refund s
25         | S6 Passenger |
26         | Details |
27         +-----+
28         Proceed to Pay |
29         v
30         +-----+--- Pay OK: PNR shown, Done -> (S3)
31         | S7 Payment and |
32         | Confirmation |-- Pay FAILED: Retry, stays on S7
33         +-----+
34         Logout in the top bar of every screen returns to S1.

```

Edge (from, to)	Trigger on source screen	Guard
S1 to S3 or S10	Button "Login"	S3 for Passenger or Reservation Clerk; S10 for Administrator
S1 to S2	Link "New user? Register"	none
S2 to S1	Button "Register"	All fields valid; account created
S3 to S4, S8, S9	Buttons "Search Trains", "Cancel by PNR", "My Bookings"	none
S4 to S5	Button "Search"	All three fields valid
S5 to S6	Button "Book" on a train row	Departure time is in the future
S6 to S7	Button "Proceed to Pay"	1 to 6 valid passengers
S7 to S3	Button "Done" after PNR shown	Payment SUCCESS
S7 to S7	Button "Retry"	Payment FAILED; booking not created
S8 to S3	Button "Done" after refund shown	Cancellation saved
S10 to S11, S12, S13	Buttons "Add Train", "Add Schedule", "Reports"	none
S11, S12 to S10	Button "Save"	Record saved

Wireframes

■ Write in lab record

Conventions: is a text field, is a button, ☐ item is a radio option, is a drop-down. The line starting with is the fixed message area where errors and confirmations appear.

S1 Login

1

2

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4

5

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9

Railway Reservation System

Email

Password

[Login]

New user? Register

!

Field	Type	Validation rule	Error message
Email	text, max 100	Required; must contain one @ and a dot after it	Enter a valid email address such as <u>name@example.com</u>
Password	password, 8 to 32	Required	Enter your password
Login (action)	button	Email and password must match a User row; 3 attempts, then 5 minute lock	Email or password is incorrect. Attempts left: 2

S4 Search Trains

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RRS | Home | Logged in: Asha Verma (Passenger) [Logout] |

Search Trains

From station [v] NDLS - New Delhi

To station [v] BCT - Mumbai Central

Journey date ____/____/____ (DD/MM/YYYY)

[Search] [Clear]

!

Field	Type	Validation rule	Error message
From station	drop-down of Station	Required	Select a source station
To station	drop-down of Station	Required; not equal to From station	Source and destination cannot be the same
Journey date	date DD/MM/YYYY	Required; today or later; at most 120 days ahead	Journey date must be between today and 120 days from today
Search (action)	button	At least one Schedule matches	No trains found between these stations on this date. Try another date

S5 Availability and Fare

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14

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RRS		Home		Asha Verma (Passenger)				[Logout]
NDLS → BCT on 14/10/2026						[Change search]		
Train	Name		Dep	Arr	Class	Avail	Fare	
_____	_____		_____	_____	_____	_____	_____	
12952	Mumbai Rajdhani		16:25	08:15	3A	AVL 42	Rs 3,055	
					2A	AVL 6	Rs 4,270	
					1A	WL 3	Rs 5,480	
							[Book]	
12138	Punjab Mail		05:10	07:35	SL	AVL 118	Rs 745	
							[Book]	
Class to book () SL (o) 3A () 2A () 1A								
! -----								

Field	Type	Validation rule	Error message
Train row	read-only list	One row per Schedule from search_trains	none
Avail	read-only, AVL n or WL n	From check_availability; WL shown when 0 seats free	none
Class to book	radio SL, 3A, 2A, 1A	Required; class must exist on the chosen train	Select a class available on this train
Book (action)	button per row	Departure time must be later than now (no booking after departure)	This train has already departed and cannot be booked

S6 Passenger Details

```

1 | _____
2 | RRS | Home | Asha Verma (Passenger) [ Logout ] |
3 | _____
4 | 12952 Mumbai Rajdhani NDLS → BCT 14/10/2026 Class 3A |
5 | # Name Age Gender Berth preference |
6 | 1 _____ [v] F [v] LOWER |
7 | 2 _____ [v] M [v] NONE |
8 | [ + Add passenger ] |
9 | Passengers: 2 of 6 |
10 | Contact mobile _____ Contact email _____ |
11 | Fare: 2 x Rs 3,055 = Rs 6,110 |
12 | [ Back ] [ Proceed to Pay ] |
13 | ! _____ |
14 | _____

```

Field	Type	Validation rule	Error message
Name	text, 2 to 50 letters and spaces	Required for every row	Passenger 2: enter the name as on ID proof
Age	integer, 1 to 120	Required	Passenger 2: age must be between 1 and 120
Gender	drop-down M, F, O	Required	Passenger 2: select a gender
Berth preference	drop-down LOWER, MIDDLE, UPPER, SIDE_LOWER, SIDE_UPPER, NONE	Optional, default NONE	none
Add passenger (action)	button	Disabled when 6 rows exist (max 6 passengers per PNR)	Maximum 6 passengers are allowed on one PNR
Contact mobile	text, 10 digits	Required; starts with 6 to 9	Enter a 10-digit mobile number
Contact email	text, max 100	Required; valid email format	Enter a valid email address
Proceed to Pay (action)	button	At least 1 passenger; every row valid; departure still in the future	Add at least one passenger before proceeding

S7 Payment and Confirmation

```
1 |
2 | RRS | Home | Asha Verma (Passenger) [ Logout ] |
3 |
4 | Payment
5 | Amount payable Rs 6,110
6 | Mode (o) UPI ( ) Card ( ) Net banking
7 | UPI ID -----
8 | [ Pay Rs 6,110 ] [ Cancel booking ]
9 |
10 | Booking Confirmed
11 | PNR 4521098763
12 | Train 12952 Mumbai Rajdhani 14/10/2026 Dep 16:25
13 | From / To NDLS New Delhi → BCT Mumbai Central
14 | 1. Asha Verma 34 F B2 / 21 LOWER CONFIRMED
15 | 2. Rohan Verma 36 M B2 / 22 MIDDLE CONFIRMED
16 | Paid Rs 6,110 by UPI Txn UPI2026101416251234
17 | SMS and email sent to 98xxxxxx21 and as**@gmail.com
18 | [ Print ticket ] [ Done ]
19 | ! -----
20 |
```

Field	Type	Validation rule	Error message
Mode	radio UPI, Card, Net banking (Cash shown only to Reservation Clerk)	Required	Select a payment mode
UPI ID	text, max 50	Required when mode is UPI; must contain one @	Enter a valid UPI ID such as name@bank
Card number	text, 16 digits	Required when mode is Card; passes Luhn check	Enter a valid 16-digit card number
Pay (action)	button	Gateway returns SUCCESS; on FAILED no booking is saved	Payment failed. No amount was deducted. Press Retry or choose another mode
PNR (output)	read-only, 10 digits	Shown only after SUCCESS	none
Status (output)	read-only CONFIRMED or WAITLISTED per passenger	From book_ticket	none

S8 Cancel by PNR

```

1 |
2 | RRS | Home | Asha Verma (Passenger) [ Logout ] |
3 |
4 | Cancel Ticket
5 | PNR ----- [ Look up ] |
6 | Booking found
7 | 12952 Mumbai Rajdhani 14/10/2026 Dep 16:25 Class 3A
8 | 1. Asha Verma CONFIRMED B2/21
9 | 2. Rohan Verma CONFIRMED B2/22
10 | Total fare Rs 6,110
11 | Time to departure 72 h 10 m (more than 48 h: 100% less Rs 60)
12 | Refund amount Rs 6,050
13 | Reason (optional) -----
14 | [ Back ] [ Confirm Cancel ]
15 | ! -----
16 |

```

Field	Type	Validation rule	Error message
PNR	text, exactly 10 digits	Required; digits only	PNR must be a 10-digit number
Look up (action)	button	PNR exists; belongs to logged-in user or user is Reservation Clerk; status not CANCELLED	No booking found for this PNR, or: This PNR is already cancelled
Refund amount (output)	read-only	100% minus flat clerkage if more than 48 h before departure; 50% between 48 and 12 h; 0 under 12 h	none
Reason	text, max 100	Optional	none
Confirm Cancel (action)	button	Second confirmation dialog: "Cancel PNR 4521098763? Refund Rs 6,050. This cannot be undone."	Cancellation could not be saved. Try again

S12 Admin Add Schedule

```

1  |
2  |  RRS   |  Admin Home   |  Suresh Nair (Administrator)   [ Logout ] |
3  |
4  |  Add Schedule
5  |  Train           [v] 12952 Mumbai Rajdhani
6  |  Run date        ____/____/____ (DD/MM/YYYY)
7  |  Status           (o) ACTIVE   ( ) CANCELLED
8  |  Route preview (read-only, from Route table)
9  |  Seq  Station  Arr    Dep    Km
10 |  1    NDLS     --     16:25  0
11 |  2    KOTA     21:00  21:05  465    ...  4  BCT  08:15  --  1384
12 |                [ Back ]                [ Save ]
13 |  !  -----
14 |

```

Field	Type	Validation rule	Error message
Train	drop-down of Train	Required; train must have at least one Route row and one Coach	Train 12952 has no route defined. Add the route first
Run date	date DD/MM/YYYY	Required; today or later; no existing Schedule for same train and date	A schedule for 12952 on 14/10/2026 already exists
Status	radio ACTIVE, CANCELLED	Required; default ACTIVE	none
Save (action)	button	All rules pass; on success message "Schedule 3107 created" and Seat rows generated from Coach	Schedule could not be saved. Check the fields marked in red

UI Design Principles Applied

■ Write in lab record

Principle	Rule from the manual	Where it is applied in the RRS
Consistency	Easy to follow interface	Every screen has the same top bar (system name, Home, logged-in user, Logout), the same message line at the bottom, and the primary button always at the bottom right (Search, Proceed to Pay, Pay, Confirm Cancel, Save)
Feedback	Proper error messages	S7 prints the PNR, seat numbers and transaction reference on the same screen after payment; S8 shows the computed refund amount before the user confirms; every action button reports success or failure in the message line
Error prevention	Type checking, field overrun	S4 stations are drop-downs so a code cannot be misspelt; S6 "Add passenger" is disabled at 6 rows; S5 "Book" is hidden for departed trains; S8 asks a second confirmation before an irreversible cancellation
Visibility	No hidden buttons	Every edge in the navigation map is a labelled button or link on the source screen; there are no keyboard-only or menu-only actions
Accessibility	Easy to follow	Every field has a text label to its left, not a placeholder that disappears; error messages name the field and row ("Passenger 2: age must be between 1 and 120"); colour is never the only signal, the message line carries the text
Mobile	Easy to follow	Fields stack in one column under 600 px width; the S5 table collapses to one card per train with class rows below it; buttons are full width and at least 44 px tall

Viva Questions

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- **Q:** Why is the PNR shown on the Payment screen instead of a separate screen? **A:** The user has just waited for the gateway; showing the PNR immediately, with the transaction reference, is direct feedback and avoids a page where the PNR could be lost if the connection drops.
- **Q:** How does the interface enforce the six-passenger limit? **A:** The "Add passenger" button is disabled at six rows and the counter reads "6 of 6"; the server checks again in `book_ticket`.
- **Q:** How does the interface stop a booking after departure? **A:** S5 hides the "Book" button when departure time has passed, and S6 "Proceed to Pay" re-checks it, because the user may have kept the page open.
- **Q:** What makes an error message "proper"? **A:** It names the field, says what is wrong, and says what to do, such as "Journey date must be between today and 120 days from today".
- **Q:** Why are stations drop-downs and not text boxes? **A:** Error prevention: the user cannot type a code that is not in the Station table, so `search_trains` never raises `UnknownStationError` from the UI.
- **Q:** Where does the Reservation Clerk's interface differ from the Passenger's? **A:** Only on S7, where Cash appears as a payment mode, and on S8, where the clerk can look up any PNR, not only their own.

Common Mistakes

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- Drawing screens with logos, colours and icons. The manual asks for zero or very little graphics; marks go to fields, buttons and messages.
- Writing "Invalid input" as the error message for every field. Each message must name the field and the fix.
- Putting a validation rule in the table without a matching element on the wireframe, or a button on the wireframe that has no edge in the navigation map.
- Showing a booking as confirmed before payment succeeds. The PNR appears only after the gateway returns SUCCESS.
- Copying the passenger limit or departure rule into prose only. Put them on the specific field and button where they are enforced.

Session Summary

■ Write in lab record

- Screen inventory table with 13 screens, navigation map diagram and its edge table.
- Seven wireframes: Login, Search Trains, Availability and Fare, Passenger Details, Payment and Confirmation with PNR, Cancel by PNR, Admin Add Schedule.
- One field table per wireframe with type, validation rule and error message, including the six-passenger limit and the no-booking-after-departure rule.
- Principles table tying consistency, feedback, error prevention, accessibility and mobile to named screen elements.

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