

Finite State Machine (FSM) for Order Placement and Tracking

States (Q)

The states are represented by q

- q0 (idle): The initial state, where the customer is logged in but has not started placing an order.
- q1 (BrowseMenu): Customer is actively Browse restaurant menus and items.
- q2 (CartUpdated): Customer has added or modified items in the cart, and the total cost is calculated.
- q3 (ReviewingCart): Customer is reviewing the items in their cart.
- q4 (ConfirmingOrder): Customer has proceeded from the cart and is confirming order details like address, delivery time, etc.
- q5 (ProcessingPayment): The system is processing the customer's payment through the payment gateway
- q6 (OrderConfirmed): Payment was successful, the order is confirmed, and a receipt is generated. The customer is awaiting restaurant confirmation.
- q7 (PaymentFailed): The payment transaction failed.
- q8 (OrderInPreparation): The restaurant has confirmed the order and is preparing it. The customer is updated on this status.
- q9 (OrderCancelled): The order has been cancelled at some point before delivery.
- q10 (OrderOutForDelivery): The order has been handed over to a delivery agent and is on its way. The customer can track it in real-time.
- q11 (OrderDelivered): The order has been successfully delivered to the customer.

Input/Output (Event)

These are the actions that trigger transitions between states, represented by s

- s1 (selectRestaurant): Customer chooses a restaurant to browse.
- s2 (browseMenu): Customer starts Browse.
- s3 (addItemToCart): Customer adds an item to their shopping cart.
- s4 (viewCart): Customer decides to view the contents of their cart.
- s5 (modifyCart): Customer makes changes to the items or quantities in the cart.
- s6 (continueShopping): Customer chooses to go back to Browse from the cart.
- s7 (proceedToCheckout): Customer moves from reviewing the cart to confirming order details.
- s8 (confirmDetails): Customer confirms all details and address.
- s9 (backToCart): Customer navigates back to the cart from the order confirmation screen.
- s10 (initiatePayment): Customer proceeds to payment.

- s11 (paymentSuccessful): Notification from the payment gateway that the transaction was successful.
- s12 (paymentFailed): Notification from the payment gateway that the transaction failed.
- s13 (retryPayment): Customer chooses to try paying again after a failure.
- s14 (abandonPayment): Customer chooses to cancel or go back after a payment failure.
- s15 (orderStatus_Preparing): An event which is triggered by the restaurant indicating the order is being prepared.
- s16 (orderHandedToDeliverPerson): Restaurant gives the order to a delivery agent.
- s17 (orderStatus_OutForDelivery): An event indicating the order is now out for delivery.
- s18 (cancelOrder (Customer)): Customer cancels the order.
- s19 (orderStatus_Delivered): An event indicating the order has been delivered.
- s20 (startNewOrder): Customer initiates a new order after completing or abandoning one.

Five-Tuple Definition of the FSM

A finite-state machine M is defined by a five-tuple (Q, S, q_0, F, δ) where:

- Q is a finite set of states: $Q=\{q_0, q_1, q_2, q_3, q_4, q_5, q_6, q_7, q_8, q_9, q_{10}, q_{11}\}$
- S is an input/output alphabet (events): $S=\{s_1, s_2, s_3, s_4, s_5, s_6, s_7, s_8, s_9, s_{10}, s_{11}, s_{12}, s_{13}, s_{14}, s_{15}, s_{16}, s_{17}, s_{18}, s_{19}, s_{20}\}$
- q_0 is the single start state in Q: $q_0 = \text{idle}(q_0)$
- F is a subset of final (accepting) states of Q: $F= \{q_9(\text{OrderCancelled}), q_{11}(\text{OrderDelivered})\}$
- δ is the state transition function, represented by the following table:

State Transition Table ($\delta: Q \times S \rightarrow Q$):

Current State ($q \in Q$)	Input Event ($s \in S$)	Next State ($\delta(q, s) \in Q$)
$q_0 (\text{idle})$	$s_1 (\text{selectRestaurant})$	$q_1 (\text{BrowseMenu})$
$q_0 (\text{idle})$	$s_{20} (\text{startNewOrder})$	$q_1 (\text{BrowseMenu})$
$q_1 (\text{BrowseMenu})$	$s_3 (\text{addItemToCart})$	$q_2 (\text{CartUpdated})$
$q_1 (\text{BrowseMenu})$	$s_{18} (\text{cancelOrder (Customer)})$	$q_9 (\text{OrderCancelled})$
$q_2 (\text{CartUpdated})$	$s_4 (\text{viewCart})$	$q_3 (\text{ReviewingCart})$
$q_2 (\text{CartUpdated})$	$s_5 (\text{modifyCart})$	$q_2 (\text{CartUpdated})$
$q_2 (\text{CartUpdated})$	$s_6 (\text{continueShopping})$	$q_1 (\text{BrowseMenu})$
$q_2 (\text{CartUpdated})$	$s_{18} (\text{cancelOrder (Customer)})$	$q_9 (\text{OrderCancelled})$
$q_3 (\text{ReviewingCart})$	$s_7 (\text{proceedToCheckout})$	$q_4 (\text{ConfirmingOrder})$
$q_3 (\text{ReviewingCart})$	$s_5 (\text{modifyCart})$	$q_2 (\text{CartUpdated})$

q3 (ReviewingCart)	s6 (continueShopping)	q1 (BrowseMenu)
q3 (ReviewingCart)	s18 (cancelOrder (Customer))	q9 (OrderCancelled)
q4 (ConfirmingOrder)	s8 (confirmDetails)	q5(ProcessingPayment)
q4 (ConfirmingOrder)	s9 (backToCart)	q3 (ReviewingCart)
q4 (ConfirmingOrder)	s18 (cancelOrder (Customer))	q9 (OrderCancelled)
q5(ProcessingPayment)	s11 (paymentSuccessful)	q6 (OrderConfirmed)
q5(ProcessingPayment)	s12 (paymentFailed)	q7 (PaymentFailed)
q5(ProcessingPayment)	s18 (cancelOrder (Customer))	q9 (OrderCancelled)
q6 (OrderConfirmed)	s15 (orderStatus_Preparing)	q8 (OrderInPreparation)
q6 (OrderConfirmed)	s18 (cancelOrder (Customer))	q9 (OrderCancelled)
q7 (PaymentFailed)	s13 (retryPayment)	q5(ProcessingPayment)
q7 (PaymentFailed)	s14 (abandonPayment)	q0 (idle)
q7 (PaymentFailed)	s18 (cancelOrder (Customer))	q9 (OrderCancelled)
q8 (OrderInPreparation)	s16(orderHandedToDeliverPerson)	q10(OrderOutForDelivery)
q8 (OrderInPreparation)	s18 (cancelOrder (Customer))	q9 (OrderCancelled)
q10(OrderOutForDelivery)	s19 (orderStatus_Delivered)	q11 (OrderDelivered)
q10(OrderOutForDelivery)	s18 (cancelOrder (Customer))	q9 (OrderCancelled)
q11 (OrderDelivered)	s20 (startNewOrder)	q0 (idle)
q9 (OrderCancelled)	s20 (startNewOrder)	q0 (idle)

Finite State Machine:

