Dhirubhai Ambani University

IT-561

Advanced Software Engineering

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Problem Specification:

Below is the problem specification of “NewYork TicketDistributor System”.

NewYork Metro station wants to establish a TicketDistributor machine that issues tickets for passengers travelling in metro rails. Travelers have options of selecting a ticket for a single trip, round trips or for multiple trips. They can also issue a metro pass for regular passengers or a time card for a day, a week or a month according to their requirements. The discounts on tickets will be provided to frequent travelling passengers. The machine is also supposed to read the metro pass and time cards issued by the metro counters or machine. The ticket rates differ based on whether the traveler is a child or an adult. The machine is also required to recognize original as well as fake currency notes. The typical transaction consists of a user using the display interface to select the type and quantity of tickets and then choosing a payment method of either cash, credit/debit card or smartcard. The ticket or tickets are printed and dispensed to the user. Also the messaging facilities after every transaction are required on the registered number. The system can also be operated comfortably by a touch-screen. A large number of heavy components are to be used. We do not want our system to slow down, and also usability of the machine. The TicketDistributor must be able to handle several exceptions, such as aborting the transaction for incomplete transactions, insufficient amount given by the travelers to the machine, money return in case of aborted transaction, change return after successful transaction, showing insufficient balance in the card, updated information printed on the tickets e.g. departure time, date, time, price, valid from, valid till, validity duration, ticket issued from and destination station. In case of exceptions, an error message is to be displayed. We do not want user feedback after every development stage but after every two stages to save time. The machine is required to work in a heavy load environment such that at the morning and evening time in weekdays, and in weekends performance and efficiency would not get affected.

Questions

1. Considering the given problem description of the NewYork TicketDistributor system, identify the stakeholders and end-users of the system. What kind of elicitation techniques will you apply to gather requirements from different stakeholders? Justify why and how the chosen elicitation techniques are helpful in gathering the requirements?

Ans:

- **Stakeholders and End-Users:**
    - Passengers(Regular and Irregular):Use the system to buy tickets.
    - Metro Staff : Manage customer queries
    - Maintenance Team : fixing technical issues
    - Payment Gateway (Banks,Digital Wallets) : Process Digital Transactions
    - Software Development Team : Design, Build , maintain and update the system.

- Security Team : Ensures Fraud prevention.
- Metro Administration: Manage policies , pricing and ticketing Rules.

- **Elicitation Techniques and Justification :**
  - Interviews:
    - Who will be interviewed? - Metro Administrative, Maintenance team, Payment Gateway
    - Justification : to gather detailed information directly from stakeholders through a structured conversation, allowing the interviewer to ask questions, probe for deeper understanding, and collect insights about needs, expectations, and requirements.
    - Example: Interview with the maintenance team highlight common machine failure, which help to auto-recovery feature in the system.
  - Surveys & Questionnaires:
    - Who Will Receive the Surveys? - Regular Metro passenger, Occasional passenger
    - Justification: Asking structured questions to a large number of stakeholders enables researchers to get information about their requirements, viewpoints, and opinions on a certain subject.
    - Example : A survey might reveal that 60% of passengers prefer using credit/debit cards.
  - Observation and Field Studies :
    - Who will be observed? - Passengers using this system
    - Justification : to gather information by directly watching and understanding how users interact with a system, process.
    - Example : Observing passengers using the machine may reveal that many of them struggle to locate the option for round-trip tickets, resulting in UI changes.
  - Prototyping :
    - Who will use the prototype? - All type of passengers, Metro staff, Metro Administrative
    - Justification : to create a visual representation of a potential solution, allowing stakeholders to provide early feedback and actively participate in the requirements gathering process.
    - Example : Passengers testing the prototype might find that the touchscreen buttons are too small, leading to a UI adjustment.
  - Workshops :
    - Who will participate? - Metro Administrators
    - Justification : to bring together various stakeholders in a collaborative environment to openly discuss, brainstorm, and gather detailed software requirements by facilitating open communication and ensuring a shared understanding of project needs.

- Example : The metro authority may seek a system with 0% downtime, as discussed in a workshop, which would prompt developers to include a failover option for peak hours.

2. Enlist all functionalities of the TicketDistributor system by each user of the system, in the form of user stories (both front and back of the card).

a. Prioritize them (using the requirement prioritization techniques, e.g., AHP, Numerical Assessment, MoSCoW method, etc.), keeping priorities of non-functional aspects into consideration? How? Provide details.

Ans:

User Story :

Front of the Card	Back of the Card
As a passenger, I want to buy a single-trip metro ticket so that I can travel once without hassle.	● Success : 1. The user selects the departure and destination stations correctly. 2. The system calculates the fare and displays the amount. 3. The passenger makes a successful payment (cash, card, or smart card). 4. The ticket is printed with journey details (departure, destination, fare, and validity). 5. A receipt is printed and an SMS confirmation is sent if requested. ● Failure: 1. Insufficient funds – Display message: "Payment unsuccessful. Please add more funds." 2. Invalid station selection – Display message: "Please select a valid station." 3. Payment timeout – Display message: "Transaction took too long. Please try again." 4. Printer failure – Display message: "Unable to print ticket. Please contact staff." 5. Card not recognized – Display message: "Smart card not detected. Please retry."
As a passenger, I want to buy a round-trip metro ticket so that I can return without buying another ticket.	● Success : 1. The user selects both onward and return journeys. 2. The system calculates the total fare, considering any applicable discounts. 3. Payment is processed, and two tickets are printed (one for each trip).

	4. An SMS confirmation is sent upon request. ● Failure: 1. Card declined – Display message: "Payment failed. Please use another method." 2. Incomplete transaction – Display message: "Transaction could not be completed. Try again." 3. Printer jammed – Display message: "Printing issue. Contact metro staff." 4. Mismatched ticket details – Display message: "Selected stations do not match return trip conditions."
As a frequent traveler, I want to buy a monthly metro pass so that I can travel unlimited times.	● Success : 1. The user selects a valid metro pass duration (weekly/monthly). 2. The system verifies eligibility and applies any discounts. 3. Payment is successfully processed. 4. The pass is activated and linked to the user's smart card. 5. An SMS confirmation is sent with validity details. ● Failure : 1. User not eligible – Display message: "You do not qualify for this pass." 2. Payment failure – Display message: "Transaction failed. Try again." 3. Card writing error – Display message: "Pass activation failed. Please retry."
As a frequent metro user, I want automatic discounts so that I save money on daily travel.	● Success : 1. The system detects frequent travel history. 2. The correct discount is applied automatically. 3. The final fare is displayed before payment. ● Failure: 1. Not enough trips for a discount – Display message: "You need X more trips to qualify." 2. Discount application error – Display message: "System issue. Discount not applied."
As a passenger, I want to pay using my credit/debit card so that I don't need cash.	● Success : 1. The user selects the card payment option. 2. The card is authenticated, and payment is processed. 3. The ticket is issued. ● Failure: 1. Card declined – Display message: "Payment failed. Please check with your bank."

	2. Incorrect PIN entered – Display message: "Wrong PIN. Try again."
As a passenger, I want the machine to return change when I overpay in cash.	● Success : 1. Cash amount inserted is verified, and the system calculates the required change. 2. The machine dispenses the correct amount of change and generates a ticket. ● Failure: 1. No change available – Display message: "Use exact amount or choose another method."
As a passenger, I want to check my metro card balance so that I know if I need to recharge.	● Success : 1. The system checks the smart card's balance against the stored information, displaying the available funds or remaining trips. 2. If applicable, it provides an option to recharge the card. ● Failure: 1. Card not detected – Display message: "Place your card properly on the scanner."
As a passenger, I want a transaction receipt via SMS so that I have a record of my purchase.	● Success : 1. The system generates a transaction receipt with details (ticket ID, amount, time, etc.) and sends it to the provided phone number. 2. The receipt is logged in the system for record-keeping. ● Failure: 1. Invalid phone number – Display message: "Incorrect number. Please re-enter."
As a metro staff, I want to cancel a ticket transaction so that I can refund a user in case of issues.	● Success: 1. The staff accesses the user’s transaction history and processes the cancellation. 2. The system refunds the amount to the original payment method (credit card, debit card, etc.). 3. The transaction status is updated to “cancelled” in the system. ● Failure: 1. Refund policy violation – Display message: "This transaction cannot be refunded."
As a metro staff, I want to monitor the health of ticket machines so that I can report issues early.	● Success : 1. The system monitors various parameters (e.g., machine temperature, connectivity status, error logs) and generates regular health reports.

	2. Any issues detected are logged and flagged for further investigation. ● Failure: 1. If the machine is unresponsive, the system raises a “machine down” alert to the monitoring staff and logs the failure.
As a ticket machine, I want to detect fake currency notes so that fraud is prevented.	● Success: 1. The ticket machine detects a fake note using its built-in sensors (UV light, magnetic, etc.). 2. The fake note is rejected, and the system alerts the user. ● Failure: 1. False detection – Show "Note is valid but not recognized."
As a metro pass holder, I want my account to auto-lock after multiple failed login attempts so that my card remains secure.	● Success: 1. The system tracks failed login attempts and automatically locks the account after 3 failed attempts. 2. A notification is sent to the user about the lockout, including a procedure for account recovery. ● Failure: 1. No notification sent – Show "Your account is locked but no SMS was sent."

Requirements Prioritization: (MoSCoW Method)

Priority	Featurer	Justification(Considering Non-functional Aspects)
Must Have	● Single, Round-trip, metro pass purchase ● Multiple payment Options ● Fake currency detection ● Machine maintenance and Health Monitoring	● must work under high load conditions (performance) ● system must be secure (security). ● Prevents fraud and financial loss (security, reliability). ● Keeps system operational under heavy usage(maintainability)
Should Have	● Transaction cancellation and Refunds ● Fare discount for frequent travelers ● SMS Receipts for transactions	● Improves user trust(Usability) ● must be processed efficiently (performance). ● Provides confirmation and security for transactions (usability, security).

Could Have	● Multi-language support ● Voice assisting for ticket	● Improves accessibility ● Enhances ease of use (usability)

3. Identify three different EPICs (or collection of user stories) where the conflicts between the requirements occur? Do you think that the conflicts can be resolved? How?
Ans:

➢ **EPIC1:**

- User Stories Involved:
  - Single trip ticket purchase
  - Round-trip ticket purchase
  - Metro pass purchase
  - Payment using Debit/Credit Card
  - Cash payment with change Return
- Conflict :
  - If a passenger's card is declined or the payment takes too long, they might leave the queue or switch to another method, causing congestion.
- Resolution Strategy :
  - Implement a "quick-pay" mode for smartcards and digital wallets to pre-approve small transactions, reducing wait times.
  - Notify staff before the machine runs out of change. Offer an e-wallet refund option where excess cash is credited to a passenger's metro card.
  - Instead of canceling, allow users to retry payment instantly or select an alternate payment method without restarting the transaction.

➢ **EPIC2:**

- User Stories Involved:
  - Transaction Cancellation & Refunds
  - Metro pass purchase
  - Payment using credit/debit card
- Conflict:
  - Passengers expect instant refunds, but card refunds take 3-5 days, leading to frustration.
  - Metro passes and unused tickets should be refunded immediately, but processing times differ.
- Resolution Strategy:
  - If a passenger cancels, allow them to choose between a bank refund (3-5 days) or instant metro wallet credit for future travel.

➢ **EPIC3:**

- User Stories Involved:
    - Automatic Discount for Frequent Travelers
    - Smart Card Balance
    - Check Metro Pass Purchase
- Conflicts:
    - If a passenger almost qualifies for a discount but doesn't have enough funds, they get charged full fare instead of being prompted to top-up.
- Resolution Strategy:
    - If a discount is about to apply, but the balance is low, show:
      "Top up ₹X more to receive your discount."
    - Offer an auto-top-up option so users never miss a discount due to low funds.