

SOEN 6481
Software Systems Requirements Specification
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**Ticket Vending Machine
Requirements Specification**

TEAM F

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1 Introduction

1.1 Description

The primary functionality of TVM (Ticket Vending Machine) is to accept request from the user and to print out a ticket[4]. Taking inspiration from the current version of the TVM that has been implemented by STM, in our TVM we decided to give options for purchasing a ticket in five different possibilities. One trip ticket, Two trip Ticket, One day pass, Weekly Pass and Monthly Pass. At the end of our project, our main goal is to develop functional software which offers functionalities similar to the Montreal metro TVM[6]. Our secondary goal is to propose upgradation(if any) upon the functional or non-functional requirements implementation of Montreal metro TVM.

1.2 Why we chose this Project?

At the inception, the Montreal metro-line only covered 26 stations with 3 lines[2]. But today, it connects 68 stations with five different lines. The number of stations has been more than doubled. They added these stations without affecting the established stations. In accordance with the physical changes in the metro lines, there needs to add more requirements in the ticketing software. In other words ticketing software has also evolved with the Montreal Metro transportation system. In this way, TVM ticketing software, had mimicked the software development evolution life-cycle. As the software evolves with time, there needs to be taken care of the current requirements and adding more without affecting the functionalities of the current version. One of the best approach which can define this process is the 'Iterative Software Development Model'. Planning, Requirements gathering, Design, Implementation, Testing and Evaluation are the important stages in this development model. These stages not only correlates to the software system but also it applies similarly to the growth pattern of Metro in physical world.

Moreover, looking at the complexity and the scale of the project, it would be interesting to analyze all the functional, nonfunctional requirements and design TVM Software[1].

1.3 The Future

From the past, what we can predict is that with the economic growth of Montreal, there will be more stations to be added in upcoming years. Keeping these modifications in mind, we will try to design the TVM software which will be easy to maintain as well as easy to add new requirements[7].

2 Context of Use Model

Types of factors[3]	Attributes
User	<ul style="list-style-type: none">• Age• Past Usage• Language• Skills• Mental/Physical Capabilities• Other Requirements
User Task	<ul style="list-style-type: none">• Criticality of Task• Task-Specific Goals• Dependency• Usage Time• Risks
User Activities	<ul style="list-style-type: none">• Constraints
User Task	<ul style="list-style-type: none">• Criticality of Task• Task-Specific Goals• Dependency• Usage Time• Risks
Location and Time	<ul style="list-style-type: none">• Time-Zone• Location

Issues due to Nature	<ul style="list-style-type: none"> • Light • Temperature
Technical Requirements	<ul style="list-style-type: none"> • Hardware <ul style="list-style-type: none"> – Processor Speed – Screen – Keyboard • Software <ul style="list-style-type: none"> – Operating System – Server
Social Environment	<ul style="list-style-type: none"> • Legal Constraints

2.1 Description of contextual Use factors

1. User

- **Age** : Age is one of the constraints for the user since children under 10 years old cannot travel on their own.
- **Past usage** : No need of using the TVM previously since the machine displays all the commands to be followed by the user.
- **Language** : User should be able to read either English/French.
- **Skills** : User can use the machine even though; he does not have command on computer language.
- **Mental/Physical capabilities** : A person should be mentally stable and should be able to use his/her hand. But a blind person can use the TVM with the help of braille script on the keys.
- **Other Requirements** : A person should have the patience to stand in the queue.

2. User Task

- **Criticality of Task** : The process is followed in steps one followed by another so that it becomes easier for the user. In addition, there should be clarity about the task.
- **Task-Specific Goals** : Firstly, accept the money from the user in the form of cash or card payment then ticket is generated after the card is recharged.
- **Dependency** : Connections at the backend with the network in order to process the bank transactions, power connection and the paper to print the details of the payment.
- **Usage Time** : User can buy a ticket from 5:30am to 11pm according to the stm rules. Exclusion of standing in the line a user requires two minutes for the complete successful process.
- **Risks** : There are few risks involved like entering the wrong details of the card by user, during payment by the bank.

3. User Activities

- **Constraints** : User must be more than 4 feet in order to use the TVM and he/she needs to tilt the screen in order to use it sitting in the wheelchair.

4. Location and Time

- **Time-zone** : TVM follows eastern time zone since it is installed in Montreal.
- **Location** : TVM should be placed in a bigger space so that there won't be any problem even though people stand in queue. In addition, it should be placed at the entrance.

5. Issues due to Nature

- **Light** : TVM screen adjust the screen even when it is dark.
- **Temperature** : Machine should be able to work in any climate regardless of sunny or windy or rainy.

6. Technical Requirements

- **Hardware**
 - **Processor speed** : Should be fast enough so that TVM handles all the processes efficiently.
 - **Screen** : Touch screen with proper LED display.
 - **Keyboard** : Interactive keyboard that has the numbers and other buttons. It has an added advantage of braille script for the blind.
- **Software**

- **Operating System** : software should be user friendly and reliable.
- **Server** : Requires server in order to backup the data.

7. Social Environment

- **Legal constraints** : Installation and utilization of TVM must be approved by the government.

3 Problem Domain model

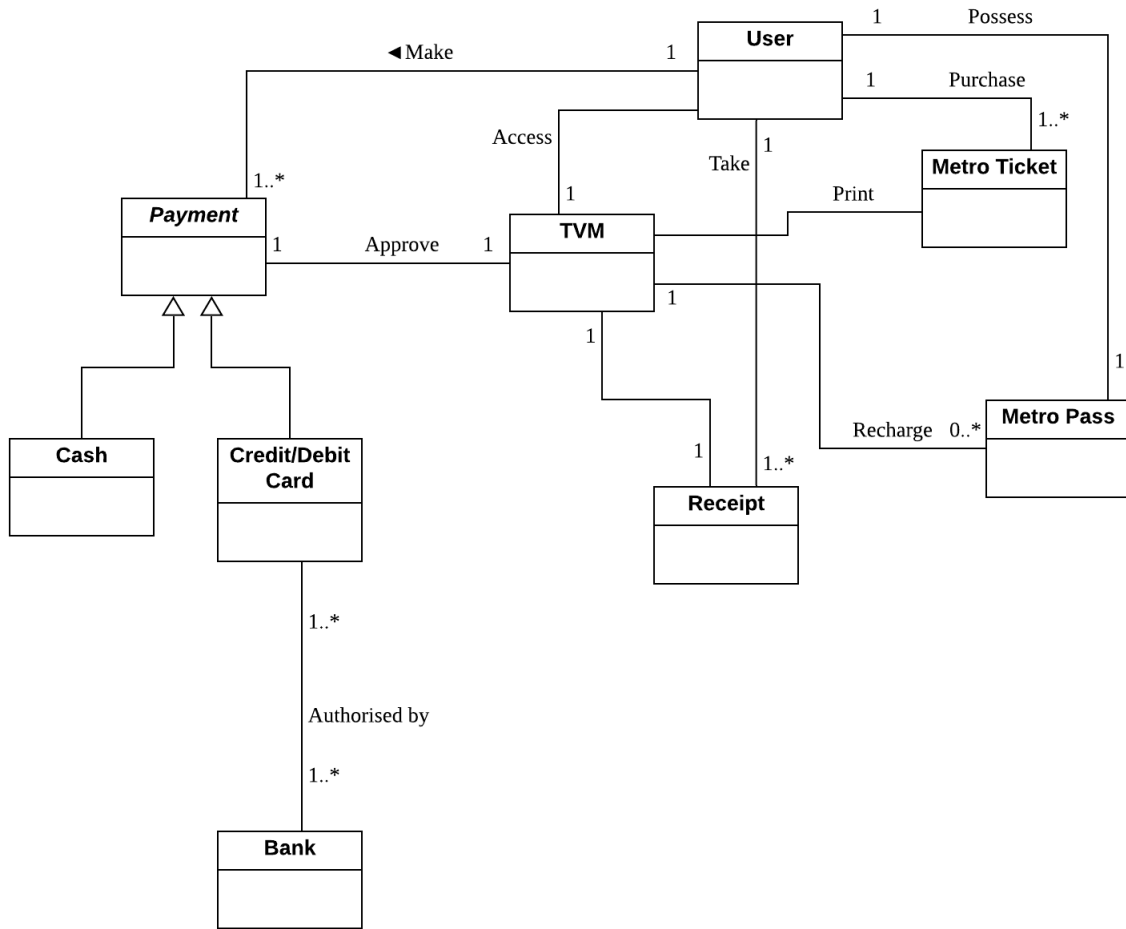


Figure 1: Problem Domain Model[8]

3.1 Description of TVM concept

- **User** : The person who uses the ticket vending machine to buy the desired metro ticket or recharge the metro pass.
- **Bank** : An external system authorise the debit/credit used by the user.
- **Payment** : The user pays through this concept, have two options that pay in cash and pay in credit or debit card.
- **TVM** : TVM is a ticket vending machine, which is a system for users to purchase metro tickets.
- **Metro Ticket** : Tickets for users to take the metro, there are four types:one-trip, two-trip, day pass and weekly pass.
- **Metro Pass** : This is the metro recharge card, which is a chip integrated plastic made. Users can directly use the metro card to enter the metro station ticket, and it is recharged through TVM.

- **Receipt** : Receipt of the purchase printed by TVM after payment by the user.

3.2 Description of relationship between the concepts

- **User - TVM** : A user access only one ticket vending machine and purchase follow the system's process.
- **User - Receipt** : A user can take one to many receipts for one day pass, weekly pass.
- **User - Metro Ticket** : A user can take one to many tickets.
- **User - Metro Pass** : A user can take only one metro pass. As he/she can recharge it anytime when required.
- **User - Payment** : A user can do one to many payments.
- **TVM - Metro Ticket** : One to many tickets can be printed by TVM.
- **TVM - Metro Pass** : There can only be one pass per user.
- **TVM - Receipt** : One to many tickets can be generated.
- **TVM - Payment** : One to many payments can be done.
- **Payment - Cash** : A Cash payment is a subclass of payment and it adds behaviour to payment class to pay by Cash.
- **Payment - Credit/Debit Card** : A Credit/Debit Card payment is a subclass of payment and it adds behaviour to payment class to pay by Credit/Debit Card.
- **Credit/Debit Card - Bank** : Credit/Debit card is inherited from bank.

4 Use Case Diagram

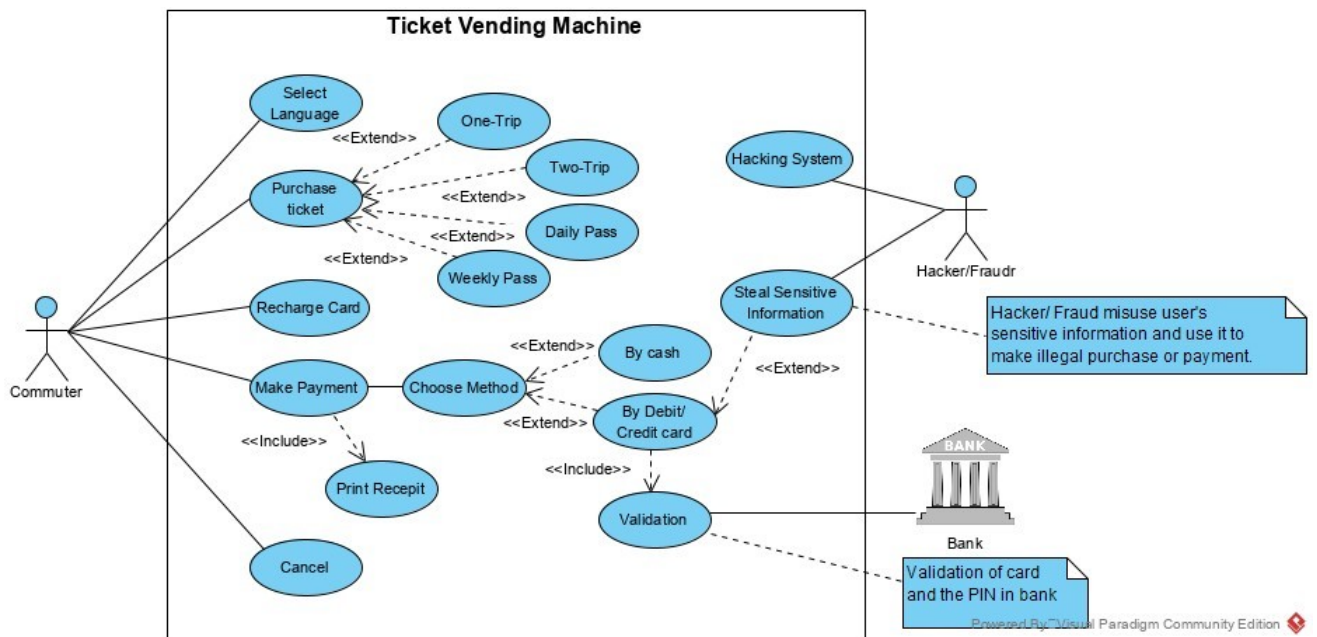


Figure 2: Use Case Diagram[5]

Use case model involves mainly two actors namely Commuter and Ticket Vending Machine. Commuter use cases involve selection of language, purchasing of ticket, recharging of card, make payment for ticket/card. Whereas, TVM takes care of the displaying types of tickets, internal connection to the bank. Apart from these actors, there are two more actors namely Bank which takes care of the payment transactions and a negative use case actor, Hacker who hacks the system and steals the user data.

4.1 Fully Dressed Use case Scenarios

- 1. Language Selection :** Commuter upon reaching the TVM selects his/her required language from the available languages and TVM displays the language chosen by Commuter.

Use Case	UC01 Language selection
Priority	High
Primary Actor	User
Secondary Actor	TVM
Pre-Condition	
	(a) Display the instructions to select a language to continue by the languages supported by the TVM.
Post-condition	
	(a) The interface will display the ticket selection information in selected language.
Steps/ Flow	
	(a) TVM displays the instructions to select a language.
	(b) TVM user selects a language to continue.
Additional or Exception flow/s	
	(a) Cancel process.
Success Scenario	
	(a) The user selects his/her preferred language on the menu.
	(b) TVM displays ticket selection information in the selected language.

2. Ticket Selection Mode : After the selection of language TVM displays a message whether to purchase the ticket or recharge the card.

Use Case	UC02 Select Purchase ticket or Recharge card
Priority	High
Primary Actor	User
Secondary Actor	TVM
Pre-Condition	(a) The user has selected the language.
Post-condition	(a) User has opted either to purchase ticket or recharge card.
Steps/ Flow	(a) TVM displays the instructions to select a language. (b) The user selects the preferred language. (c) TVM displays options to purchase ticket and recharge card in the selected language. (d) The user selects either purchase ticket or recharge card.
Additional or Exception flow/s	(a) Cancel process.
Success Scenario	(a) The user opts to purchase his/her ticket, or to recharge card. (b) TVM displays an interface for purchase tickets or recharge cards.

3. Purchasing a ticket : TVM displays available tickets from where he/she can select the ticket from the available options.

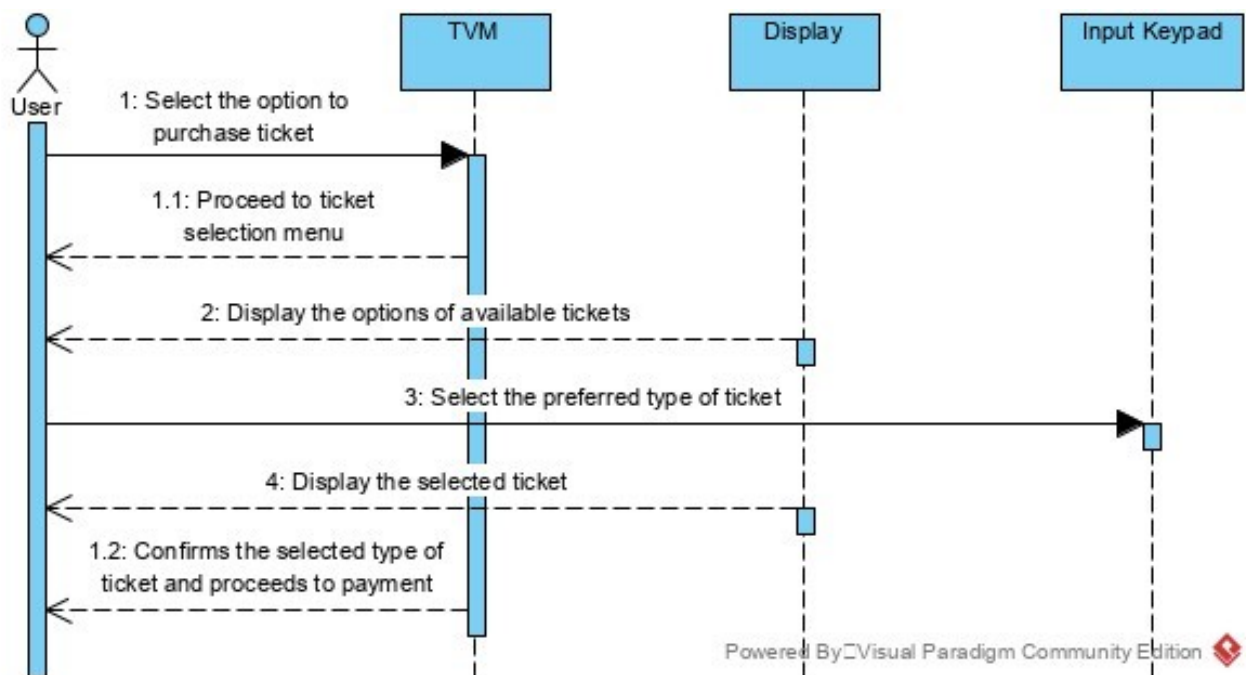


Figure 3: Purchase Ticket Sequence Diagram

This sequence diagram shows the sequence of actions between the objects in order to purchase a ticket by Commuter.

Use Case	UC03 Purchase Ticket
Priority	High
Primary Actor	User
Secondary Actor	TVM
Pre-Condition	(a) The user has opted to purchase the ticket.
Post-condition	(a) The user has selected his/her preferred type of ticket and proceeds to pay for the ticket.
Steps/ Flow	(a) TVM displays options to purchase ticket or recharge card. (b) The user selects the option to purchase the ticket. (c) TVM displays options to buy a ticket for either one-trip, 2-trip, daily or weekly pass. (d) The user selects his/her preferred ticket. (e) The user proceeds to make payment.
Additional or Exception flow/s	(a) Change selected ticket type. (b) Change the ticket selection mode to recharge card. (c) Cancel process.
Success Scenario	(a) Preferred ticket selected successfully. (b) Proceeds to make payment.

4. Recharging the card : In this Use Case Commuter inserts the card after the selecting purchase ticket option, TVM starts the payment process for the commuter.

Use Case	UC04 Recharge card
Priority	Medium/ Moderate
Primary Actor	User
Secondary Actor	TVM
Pre-Condition	
	<ul style="list-style-type: none"> (a) The user inserts the card. (b) Selects the option to recharge card.
Post-condition	<ul style="list-style-type: none"> (a) The user confirms to recharge card and proceeds to make payment.
Steps/ Flow	<ul style="list-style-type: none"> (a) TVM display the option to purchase ticket or recharge card. (b) The user selects the option to recharge card. (c) TVM displays the option to recharge card. (d) The user confirms to recharge card. (e) The user proceeds to make payment.
Additional or Exception flow/s	<ul style="list-style-type: none"> (a) Change the ticket selection mode to purchase the ticket. (b) Cancel process.
Success Scenario	<ul style="list-style-type: none"> (a) The user confirmed to recharge the card. (b) Proceeds to make payment.

5. Selecting the Payment option : From the options available like payment by cash or payment by card commuter chooses his/her mode of payment.

Use Case	UC05 Select Payment Mode
Priority	High
Primary Actor	User
Secondary Actor	TVM
Pre-Condition	<p>(a) The user has selected their ticket type or to reload the card.</p> <p>(b) Confirms for payment.</p>
Post-condition	<p>(a) The user has selected the mode of payment and proceeds to pay in the chosen method.</p>
Steps/ Flow	<p>(a) TVM displays the options for different modes of payment by cash or debit/credit card.</p> <p>(b) The user select his/her preferred option of payment.</p> <p>(c) The user proceeds to make payment by cash or by debit/credit card.</p>
Additional or Exception flow/s	<p>(a) Change payment mode.</p> <p>(b) Cancel process.</p>
Success Scenario	<p>(a) Confirms payment mode and proceeds to make payment.</p>

6. Payment by Cash : Commuter chooses the option to pay by cash.

Use Case	UC06 Pay by Cash
Priority	High
Primary Actor	User
Secondary Actor	TVM
Pre-Condition	(a) The user has opted to make payment by cash.
Post-condition	(a) Payment made successfully. (b) Dispense ticket and payment receipt.
Steps/ Flow	(a) TVM displays a message to make payment by cash. (b) User makes payment by inserting cash into the TVM. (c) TVM confirms payment has been done. (d) TVM dispense ticket and payment receipt.
Additional or Exception flow/s	(a) TVM returns the difference amount back to the user.
Success Scenario	(a) Payment made successfully. (b) Ticket and payment receipt is dispensed. (c) In case of return change, it is returned back to the user.

7. Payment by Card : Commuter chooses the option to pay by either credit or debit card.

Use Case	UC07 Pay by Debit/Credit card
Priority	High
Primary Actor	User
Secondary Actor	TVM and Bank
Pre-Condition	
	(a) The user has opted to make payment by Debit/Credit card.
Post-condition	
	(a) Payment made successfully. (b) Dispense ticket and payment receipt.
Steps/ Flow	
	(a) TVM displays a message to make payment by card. (b) User makes payment by inserting Debit/Credit card into the TVM. (c) TVM communicates with bank to validate the card. (d) TVM asks the user to enter the PIN to complete the payment. (e) The user enters the PIN. (f) Once again, TVM communicates with bank to validate the PIN. (g) TVM confirms payment has been done. (h) TVM dispense ticket and payment receipt. (i) The user takes back his/her card.

Additional or Exception flow/s	(a) TVM cancels payment and transactions in case of failed validation.
Success Scenario	(a) Payment made successfully. (b) Ticket and payment receipt is dispensed. (c) In case of return change, it is returned back to the user.

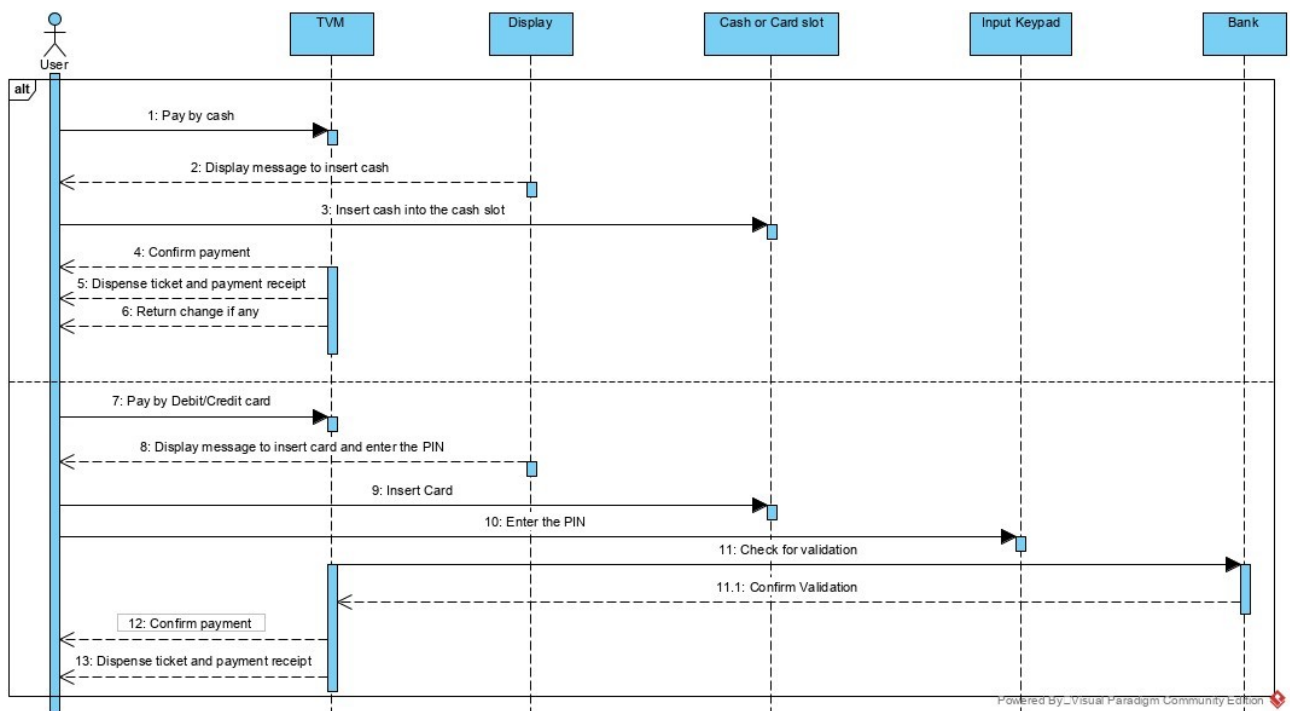


Figure 4: Payment Sequence Diagram

This sequence diagram shows how the sequence of actions carried out in order for the Commuter to pay the amount either by cash or a card.

8. Cancel Transaction Process : Transaction may get cancelled if the user does not have enough balance or entered an incorrect pin.

Use Case	UC08 Cancel transaction process
Priority	High
Primary Actor	User
Secondary Actor	TVM
Pre-Condition	<ul style="list-style-type: none"> (a) The user is not on the homepage. (b) The user is unaware of the transaction process
Post-condition	<ul style="list-style-type: none"> (a) The transaction process is canceled and return to the homepage.
Steps/ Flow	<ul style="list-style-type: none"> (a) User is currently not in Homepage. (b) The user clicks cancel button. (c) TVM cancels the transaction and takes the user back to Homepage.
Additional or Exception flow/s	<ul style="list-style-type: none"> (a) The user decides not to use TVM, cancels process and walks away.
Success Scenario	<ul style="list-style-type: none"> (a) User is unaware about transaction or want to change selection. (b) The transaction is cancelled. (c) TVM takes the user back to the homepage.

9. Misuse of User Sensitive Information : This is a special use case where a new actor named Hacker is involved where he/she retrieves the TVM data in order to misuse the user data.

Use Case	UC09 Theft/ Misuse of user's sensitive information
Priority	High
Primary Actor	Hacker
Secondary Actor	TVM
Pre-Condition	(a) The user has inserted the card and entered the PIN.
Post-condition	(a) The TVM system is hacked and user's privacy is violated.
Steps/ Flow	(a) Enters and runs in the system unethically. (b) Performs operations to retrieve user's sensitive information. (c) Violate user's privacy.
Additional or Exception flow/s	(a) Perform illegal operations and steal data.

10. Payment Fraud : It is similar to Misuse use case. Upon retrieving the user banking information, hacker move the money paid by Commuter to a third party.

Use Case	UC10 Payment Fraud
Priority	High
Primary Actor	Hacker
Secondary Actor	TVM
Pre-Condition	(a) The user has inserted the card and entered the PIN.
Post-condition	(a) The TVM system is hacked and money is stolen.
Steps/ Flow	(a) Enters and runs in the system unethically. (b) The system is hacked and the user's banking information is stolen. (c) A 3rd-party/ hacker receives the payment.
Additional or Exception flow/s	(a) Perform illegal operations and steal money.

4.2 Activity Diagram

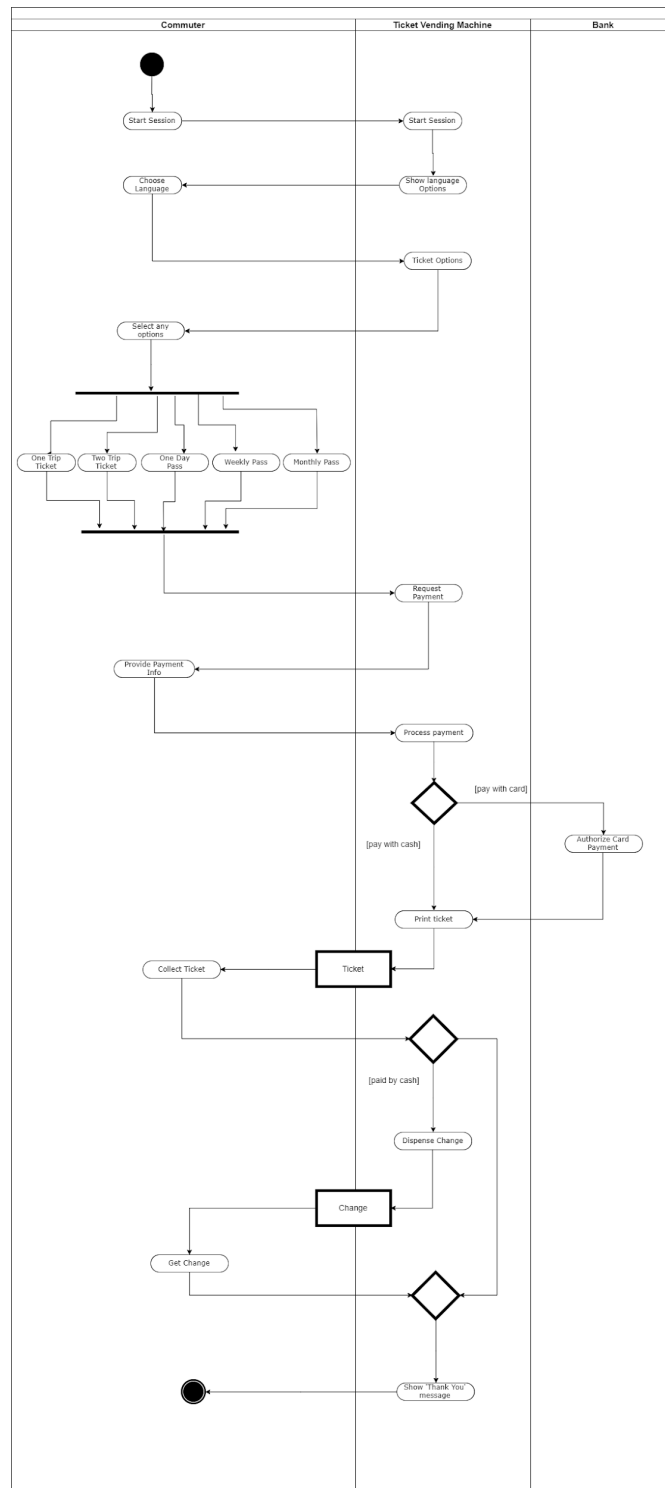


Figure 5: Activity Diagram

In the above given activity diagram, Commuter is the one who will start the activity. After the session has been started, he/she will request for the trip information from the TVM on the screen, it will show different options in which a user can purchase a ticket. For our scenario, he/she will be shown five different options. According to the needs of the commuter, he/she will choose

the option. Based on the selection, TVM calculates the amount to be paid. It will then after shows different options using which a commuter can pay for the ticket. If he/she pays by cash, he will get back the change. And if he/she chooses to pay by card, bank intervention is needed to confirm if the payment is successful or not. After the successful payment, TVM will print out the ticket. At the end of this activity, TVM shows ‘Thank You’ message.

Appendices

Interview Transcript

1. Interview with Runsen Tian

- (a) Which language do you prefer to operate the TVM?
 - I prefer English.
- (b) How often do you commute in the metro?
 - I travel for my school and for my work too. So, usually on a daily basis I commute.
- (c) Do you prefer using a rechargeable card or purchasing tickets?
 - According to me, Rechargeable card will be preferable.
- (d) Which type of ticket do you prefer, one-trip, 2-trip, daily pass, weekly pass?
 - I prefer daily pass.
- (e) Why this particular type of ticket?
 - As I commute daily, so I prefer the daily pass.
- (f) In your opinion, how easy or difficult is the TVM to operate?
 - I feel it is quite easy as it does not have any other features.
- (g) Which mode of payment do you prefer, by cash or by debit/credit card?
 - I prefer the credit/debit card.
- (h) Have you faced any issues when making the payment?
 - No, I have not faced any issues till now.
- (i) Have you ever had a feeling of not using the TVM, so you canceled your transaction and walked away?
 - Yes, it happened one time when there was a long queue.

2. Interview with Shreya Monpara

- (a) Which language do you prefer to operate the TVM?
 - I prefer French.
- (b) How often do you commute in the metro?
 - I travel for my work. So, usually on a daily basis I commute.
- (c) Do you prefer using a rechargeable card or purchasing tickets?
 - Recharging a card is a good idea.
- (d) Which type of ticket do you prefer, one-trip, 2-trip, daily pass, weekly pass?
 - I prefer daily pass.
- (e) Why this particular type of ticket?
 - I feel it is quite easy as it does not have any more steps.
- (f) In your opinion, how easy or difficult is the TVM to operate?
 - I feel it is quite easy as it does not have any other features.
- (g) Which mode of payment do you prefer, by cash or by debit/credit card?
 - I prefer the credit/debit card.
- (h) Have you faced any issues when making the payment?
 - No, I have not faced any issues till now.
- (i) Have you ever had a feeling of not using the TVM, so you canceled your transaction and walked away?
 - No, I always recharge my card one day prior to the new month so I never came across rushing through TVM.

3. Interview with TA

- (a) Which language do you prefer to operate the TVM?
 - I prefer English.
- (b) How often do you commute in the metro?
 - I do not commute via metro.
- (c) Do you prefer using a rechargeable card or purchasing tickets?
 - Purchasing a ticket as I do not commute by metro.

- (d) Which type of ticket do you prefer, one-trip, 2-trip, daily pass, weekly pass?
 - I prefer one day pass.
- (e) Why this particular type of ticket?
 - I do not travel in metro.
- (f) In your opinion, how easy or difficult is the TVM to operate?
 - I feel it as easy going work.
- (g) Which mode of payment do you prefer, by cash or by debit/credit card?
 - I prefer cash.
- (h) Have you faced any issues when making the payment?
 - No, I have not faced any issues till now.
- (i) Have you ever had a feeling of not using the TVM, so you canceled your transaction and walked away?
 - No, As I am not using that much of commuting through metro.

4. Interview with Sukesh Mudrakola

- (a) Which language do you prefer to operate the TVM?
 - I prefer English.
- (b) How often do you commute in the metro?
 - I commute a lot in metro. As I have my residence, school and metro everything near metro station.
- (c) Do you prefer using a rechargeable card or purchasing tickets?
 - Recharging a card is the best option for me.
- (d) Which type of ticket do you prefer, one-trip, 2-trip, daily pass, weekly pass?
 - I prefer daily pass.
- (e) Why this particular type of ticket?
 - As said, I travel a lot.
- (f) In your opinion, how easy or difficult is the TVM to operate?
 - I feel it as a very easy task.

- (g) Which mode of payment do you prefer, by cash or by debit/credit card?
 - I prefer debit card.
- (h) Have you faced any issues when making the payment?
 - No, I have not faced any issues till now.
- (i) Have you ever had a feeling of not using the TVM, so you canceled your transaction and walked away?
 - Yes, As people are always in a hurry for the metro so many times I come again in the late night or early morning to recharge my card.

5. Interview with Devarsh Modi

- (a) Which language do you prefer to operate the TVM?
 - I prefer English.
- (b) How often do you commute in the metro?
 - I commute daily either for my work or my school.
- (c) Do you prefer using a rechargeable card or purchasing tickets?
 - I recharge my card every time.
- (d) Which type of ticket do you prefer, one-trip, 2-trip, daily pass, weekly pass?
 - I prefer daily pass.
- (e) Why this particular type of ticket?
 - It is cheaper so I prefer daily pass.
- (f) In your opinion, how easy or difficult is the TVM to operate?
 - There is no any issues in operating TVM.
- (g) Which mode of payment do you prefer, by cash or by debit/credit card?
 - I prefer credit card.
- (h) Have you faced any issues when making the payment?
 - No, I have not faced any issues.
- (i) Have you ever had a feeling of not using the TVM, so you canceled your transaction and walked away?

- Yes, I think it's easy but it's tedious sometimes so I go to Ticket Vendors.

6. Interview with Jaldhi Prajapati

- (a) Which language do you prefer to operate the TVM?
 - I prefer English.
- (b) How often do you commute in the metro?
 - I commute daily for my school.
- (c) Do you prefer using a rechargeable card or purchasing tickets?
 - I recharge my card every time.
- (d) Which type of ticket do you prefer, one-trip, 2-trip, daily pass, weekly pass?
 - I prefer daily pass.
- (e) Why this particular type of ticket?
 - It is cheaper so I prefer daily pass.
- (f) In your opinion, how easy or difficult is the TVM to operate?
 - There is no any issues in operating TVM.
- (g) Which mode of payment do you prefer, by cash or by debit/credit card?
 - I prefer credit card.
- (h) Have you faced any issues when making the payment?
 - I never faced any issues while operating TVM.
- (i) Have you ever had a feeling of not using the TVM, so you canceled your transaction and walked away?
 - Yes, because sometimes I think that recharging a card is a bad idea else do Uber and commute.

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