

CONCORDIA UNIVERSITY

SOEN 6481 - SOFTWARE SYSTEM REQUIREMENT
SPECIFICATION

Ticket Vending Machine

iGo

Deliverable 1

Team C

Student Name	Student ID
Ghalia Elkerdi	25162211
Kundana Gangam	40085658
Jatan Gohel	40078112
Surya Prakash Govindaraju	40085527
Ashutosh Ramesh Gunjal	40076838

Google Drive - https://drive.google.com/open?id=1WNd9Ek1jANVsaIyCfFcTqK_i2JnPf7qB

GitHub - <https://github.com/Surya64/SOEN-6481-SRS>

Contents

1	Introduction	2
2	Context of Use Model	3
3	Domain Model	5
4	Use Case Model	7
4.1	Positive Use Case Model	7
4.2	Negative Use Case Model	8
4.3	Activity Diagram	9
4.4	Description of Use Cases	10
	References	20
	Appendix	21

1 Introduction

A ticket vending machine (TVM) interacts with human users to produce physical tickets for public transportation, such as the metro. These self-service platforms are cost effective and particularly efficient for metropolitan communities. The TVM involves both hardware and software components. Below are some of the characteristics of TVM. For the purpose of the following document, "user", "traveller" and "commuter" are used interchangeably.

- The dimensions are 700 mm x 600mm x 1720mm and the platform includes some hardware components like a receipt printer, a ticket printer, 2D bar-code reader, RF-ID reader, display touch screen and WiFi Connector.
- The machine comes with a manually operated computer screen interface allowing the user to see all the available features.
- The machine supports a multilingual interface with English and French being the primary languages, as expected, to be able to legally operate in Quebec, Canada.
- The software involves an interface with touch display and a keypad to allow users to choose the type of ticket like day-pass, monthly pass, student pass and round trip tickets. Additionally the user can select the number of quantities requires.
- The TVM supports cancellation of tickets which are wrongly purchased and users can get a refund or repurchase the correct ticket.
- The TVM provides a summary of the user transaction before proceeding to the payment.
- The TVM provides different payment options, users may pay by cash, credit/debit card or interact method. The prices are shown in Canadian dollars and the machine accepts only the Canadian currency.

The machine is designed bearing in mind the breadth of diversity present in Quebec. It is meant to serve all kinds of users, including people with disabilities. The keypad height and inclination are mainly designed based on careful consideration of people with wheelchairs and includes voice assistance for visually impaired individuals.

The TVM conforms to the rules and regulations of provincial and federal laws and ensures security to its users by following all the legal banking rules and regulations that involve secured transactions.

2 Context of Use Model

Below are the proposed mind map diagram and context of use model CU_{IGO} for a TVM.

Mind Map Diagram :

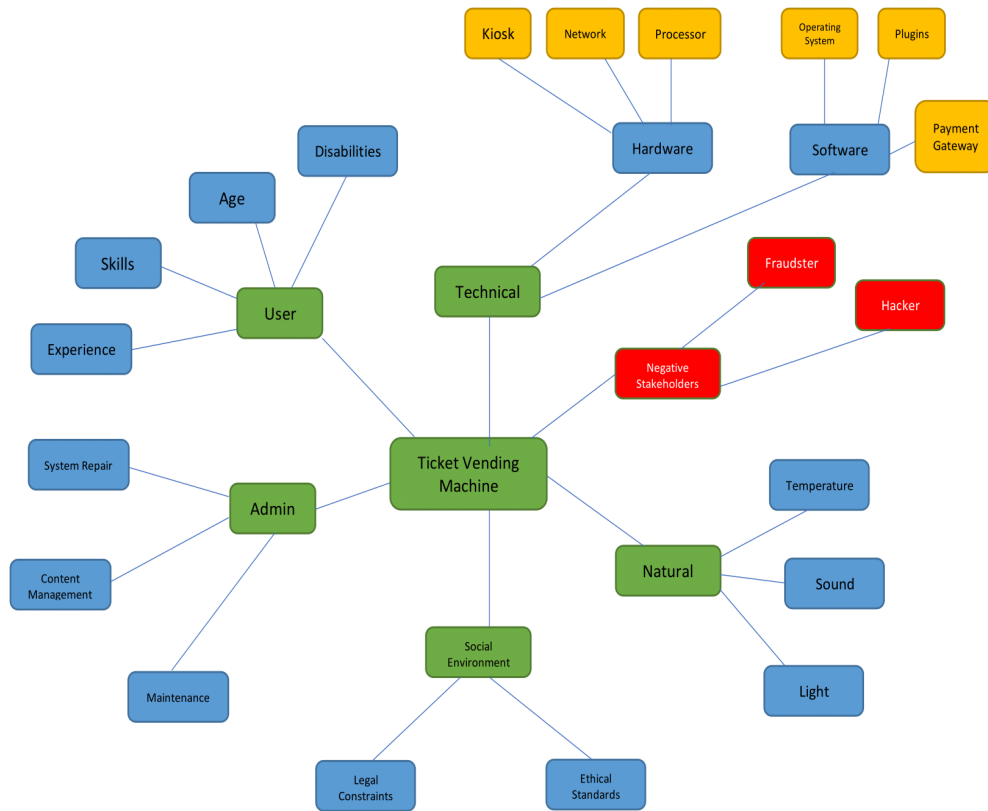


Figure 1: Mind Map of TVM

Types of Factors	Details
User	<p>Age: It is divided into 3 groups: minor, adult and senior. The minor should be above 12 years old and capable of travelling individually. The minor must not be travelling alone after 10PM.</p> <p>Skills: User should be able to read and understand either English or French.</p> <p>Experiences: Quick learning curve if the user has used a similar type of software previously.</p> <p>Disabilities: It is designed in such a way that a variety of disabilities are accounted for, including visual impairment and physical disabilities (users on wheelchairs).</p>
User Task	<p>Task-Specific goals: User will be able to perform all tasks such as selection of ticket, payment and ticket generation.</p> <p>Frequency of Use: TVM would be used on a regular basis</p> <p>Dependency of Use: Requires successful connectivity to a highly available payment system</p> <p>Risks: Machine should block the user from booking the ticket for particular duration, if the user enters wrong bank account pin number for 3 times. It should also show an error message to the user and ensure him that there is no loss in the above transaction.</p>
User Activity	<p>Sitting: User (physically impaired) will be able to use the TVM from the sitting position</p> <p>Standing: TVM is designed in such a way that any person(user) can access the machine regardless of the height of the person (short or tall).</p>
Technical	<p>Hardware: Keyboard should have big numbers with proper widths and color which makes it easy to use.</p> <p>Software: High level of design and maintainable.</p> <p>Operating System: Easy to use and user friendly</p> <p>Network: TVM networks are reliable so users get proper response from server</p>
Natural	<p>Temperature: Temperature controlled to work in both warm and cold.</p> <p>Sound: Place should be less noisy to access voice assistance</p> <p>Light: Color contrast should be normal and non reflective.</p>
Social Environment	<p>Legal Constraints: It should work under certain laws and regulations of Canada jurisdiction.</p> <p>Ethical Standards: Honest service and best user experience</p>

3 Domain Model

Below is the proposed Domain Model DM_{IGO} for a TVM.

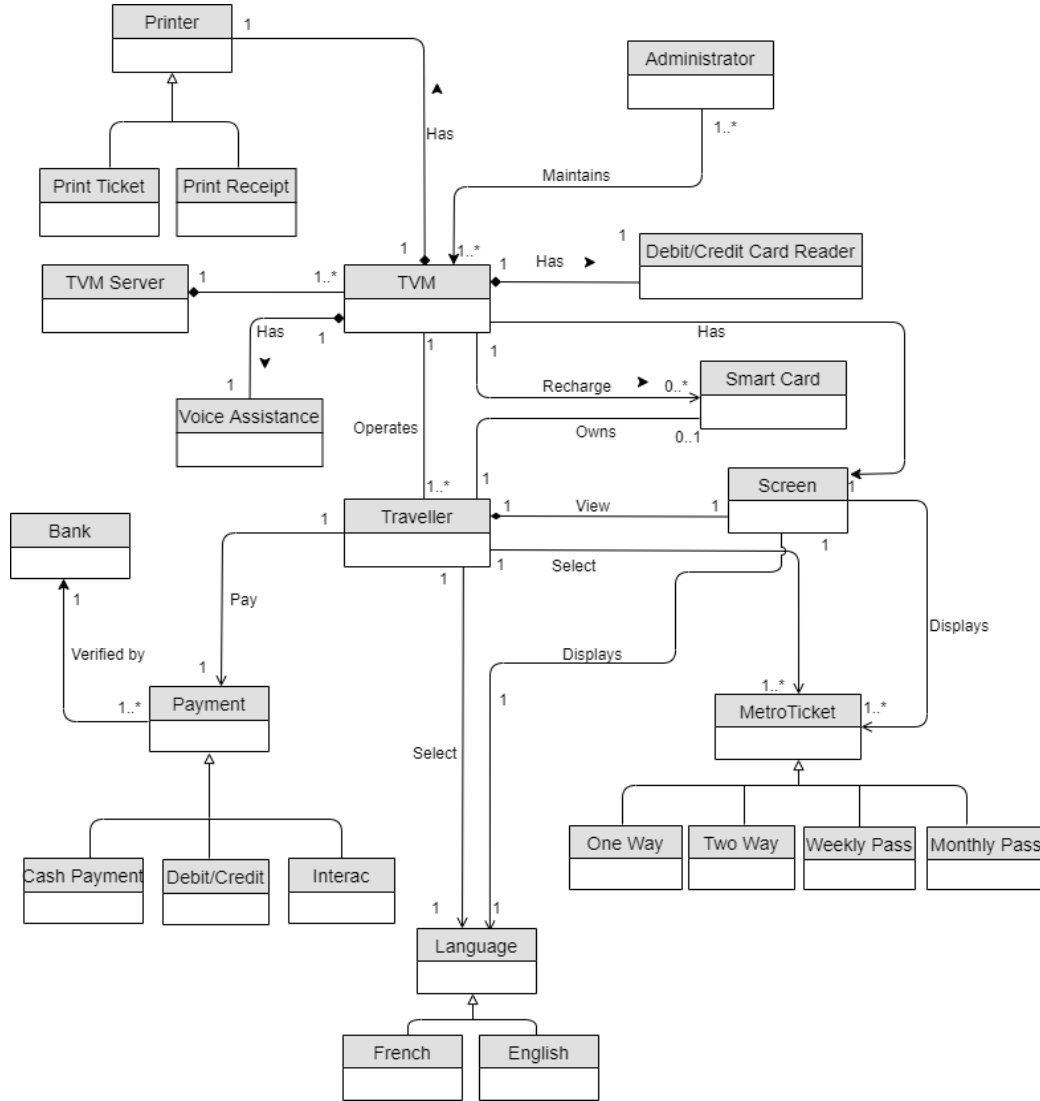


Figure 2: Domain Model

The above domain model is a conceptual portrayal of all the relevant components of the TVM system. The most pertinent attributes, entities, roles and relationships are graphically shown in the domain model and described in further detail below.

Sl No.	Concept	Description	Description of the Relationship
1	Traveller	The person that interacts with the system for the purpose of purchasing metro tickets and/or recharging metro cards	<ul style="list-style-type: none"> - One traveller can purchase one or many tickets from the TVM - One traveller can make one payment per operation (purchasing a ticket or recharge a TVM card) - One traveller Operates one TVM - One traveller can select Language.
2	TVM	The machine that allows users to buy ticket, purchase payment and print the receipts.	<ul style="list-style-type: none"> - One TVM can be operated by one or many travellers - One TVM has one Card reader and Screen. - One TVM has one Voice Assistance. - One TVM can recharge one or many TVM cards - One TVM can accept one debit card or one credit card or one inter-ac
3	Smart Card	Card with magnetic chip to store digital information for purchased metro tickets which avoid printing the ticket and can be reuse	<ul style="list-style-type: none"> - One traveller can own one TVM card - One or many TVM cards can be recharged through one or many TVMs
4	Payment	Money transaction transfer between the user and the transit company using cash, credit or debit cards or Inter-ac	<ul style="list-style-type: none"> - One traveller can make one payment - One payment can be done through cash, credit or debit cards or inter-ac - Payment can be verified by one Bank.
5	Ticket	It's a paper based card used for non regular users for a limited time	<ul style="list-style-type: none"> - One user can purchase one to many tickets
6	Printer	Used to print the ticket and receipt	<ul style="list-style-type: none"> - One TVM can have two printers
7	Bank	External entity that verifies the payment made by cards during transaction process	<ul style="list-style-type: none"> - One bank verifies one or many payments
8	Administrator	He is responsible for technical maintenance of the TVM	<ul style="list-style-type: none"> - One or many administrator can maintain one or many TVMs
9	TVM Server	Main Server for all communication and updates	<ul style="list-style-type: none"> - One or many TVMs connects to one TVM server

4 Use Case Model

4.1 Positive Use Case Model

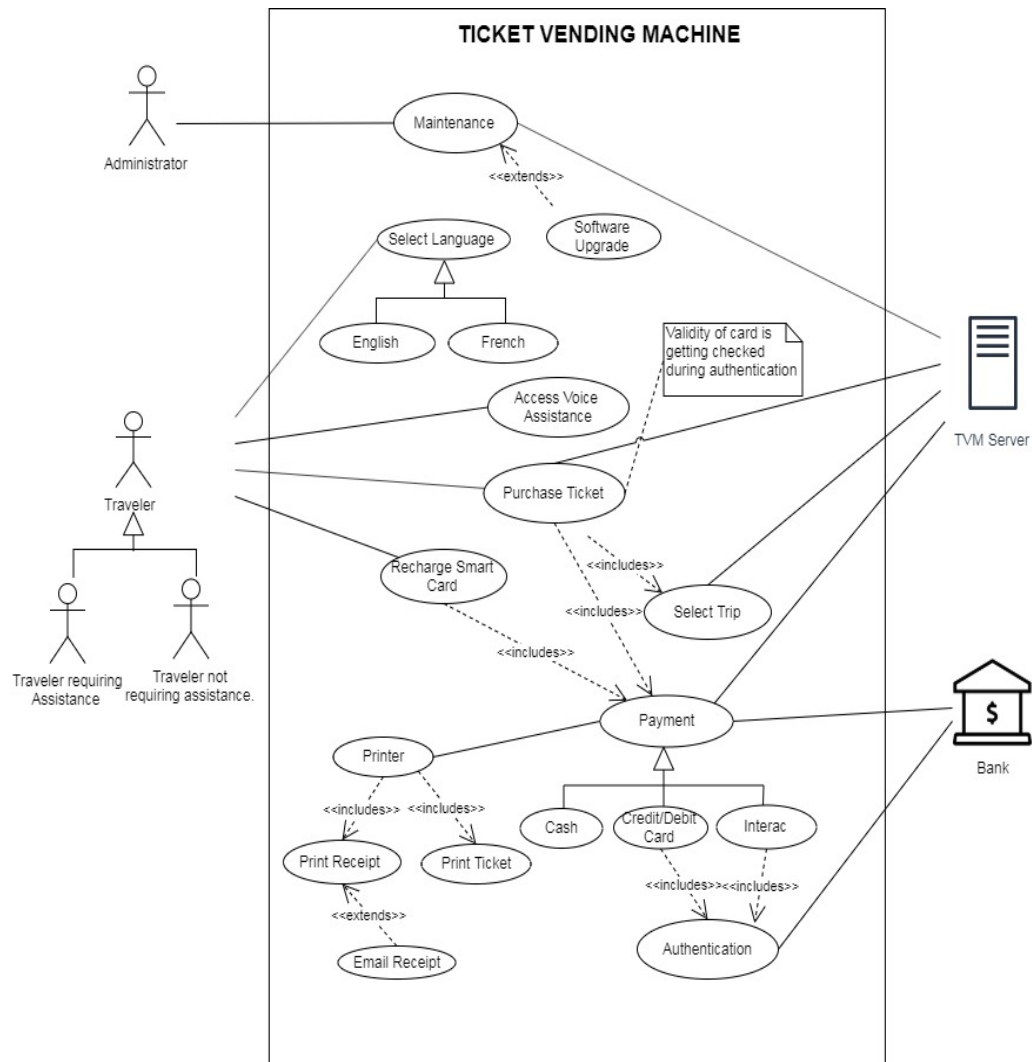


Figure 3: Positive Use Case Model Of TVM

4.2 Negative Use Case Model

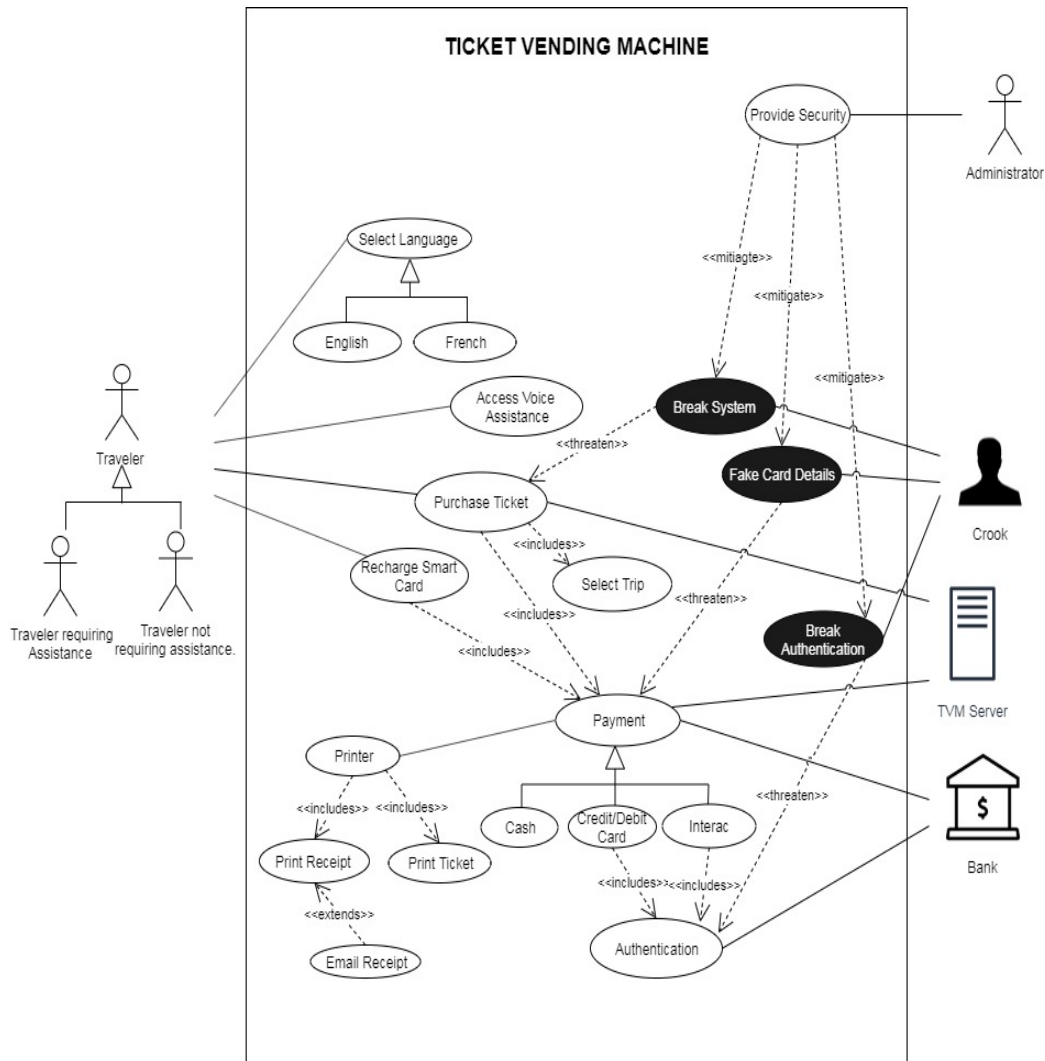


Figure 4: Negative Use Case Model of TVM

4.3 Activity Diagram

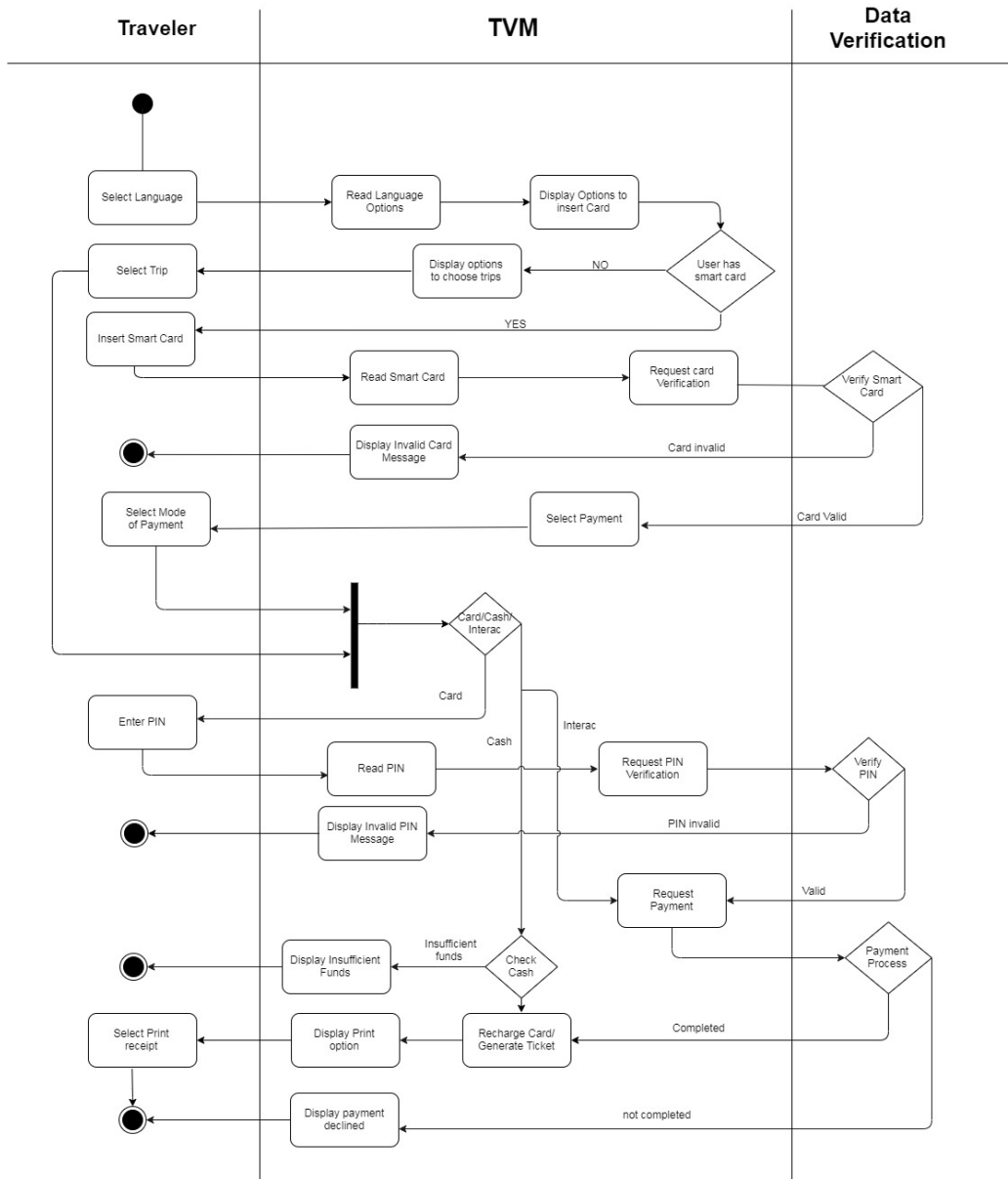


Figure 5: Activity Diagram of TVM

4.4 Description of Use Cases

Language Selection :

Use Case ID:	UC1
Use Case Name:	Select Language
Actors:	Traveler(Primary)
Priority:	low
Trigger:	User selects “Select Language Preference” option
Preconditions:	The System displays language option.
Post-conditions:	User Interface will appear in selected language.
Main Success Scenario:	<ol style="list-style-type: none">1. System shows the user an option to select a language either in French or English.2. User selects a language.3. TVM communicates with the server and changes the language.4. System displays all the options in the chosen language.

Select Trip:

Use Case ID:	UC2
Use Case Name:	Select Trip
Actors:	Traveler(Primary)
Priority:	medium
Trigger:	User selects “View trips” option
Preconditions:	System is running and the user has selected the preferred language
Post-conditions:	User is able to select the available trips.
Main Success Scenario:	<ol style="list-style-type: none">1. System shows the user all the available trips2. User have selects the trip option based on his\her choice.3. The system validates the user selection and calculate the trip price.

Purchase Ticket:

Use Case ID:	UC3
Use Case Name:	Purchase Ticket
Actors:	Traveler (primary), Bank (secondary)
Priority:	High
Trigger:	User Selects “Purchase Ticket” option
Preconditions:	1. The TVM server has started and functioning properly 2. User should have sufficient money to purchase tickets.
Post-conditions:	1. System prints and dispenses the receipt. 2. System prints and dispenses ticket/tickets.
Main Success Scenario:	1. System notifies user with selected trip. 2. System prompts a message to choose number of tickets. 3. User selects the number of tickets. 4. System calculates the fare and displays it to the user. 5. User confirms. 6. System displays a message to the user to choose the mode of payment. 7. User selects an option to pay. 8. Bank authorizes payment. 9. System notifies transaction completion. 10. Details are updated on or to the server. 11. User requests to print receipt and ticket/tickets. 12. System prints and dispenses receipt and ticket/tickets.

Recharge Smart Card

Use Case ID:	UC4
Use Case Name:	Recharge Smart Card
Actors:	Traveler (primary) , Bank(Secondary)
Priority:	High
Trigger:	User selects “Recharge Smart Card” option
Preconditions:	<ol style="list-style-type: none">1. User must be in possession of the physical smart card to be recharged.2. TVM server has started and functioning properly3. User should have sufficient money in their bank account.
Post-conditions:	<ol style="list-style-type: none">1. System prints and dispenses the receipt2. Card balance of user is updated successfully.
Main Success Scenario:	<ol style="list-style-type: none">1. User selects option to Recharge Smart Card and places the card on the slot.2. System displays available recharge fares to recharge card.3. User selects a fare.4. System displays a message to select mode of payment.5. User chooses a mode of payment.6. System directs the user to follow the instructions based on the mode of payment chosen.7. User provides necessary credentials.8. The system sends transaction request to the bank for approval.9. Bank authorizes the payment.10. System notifies transaction completion.11. Details are updated on the server.12. User requests to print receipt.13. System prints and dispenses receipt.

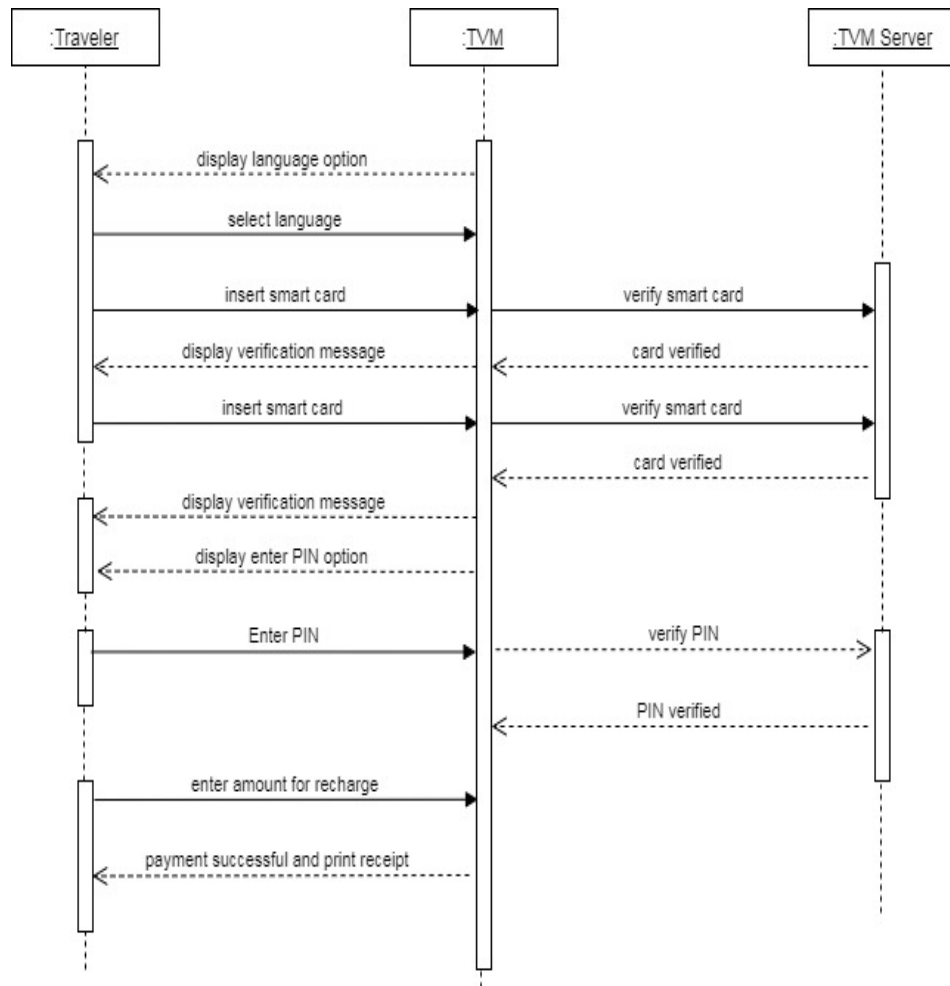


Figure 6: Sequence Diagram for Recharge Smart Card

Make Payment:

Use Case ID:	UC5
Use Case Name:	Make Payment
Actors:	Traveler (primary), Bank (secondary)
Priority:	High
Trigger:	User selects “Make Payment” option
Preconditions:	1. The TVM server is running and functioning properly 2. User should have sufficient money to purchase tickets.
Post-conditions:	1. System prints and dispenses the receipt 2. TVM receives transaction Complete status to generate ticket
Main Success Scenario:	1. User selects option to Purchase Ticket and places the card on the slot. 2. System displays available recharge fares to recharge card. 3. User selects a fare. 4. System displays a message to select mode of payment. 5. User chooses a mode of payment. 6. System directs the user to follow the instructions based on the mode of payment chosen. 7. User provides necessary credentials. 8. The system sends transaction request to the bank for approval. 9. Bank authorizes the payment. 10. System notifies transaction completion.

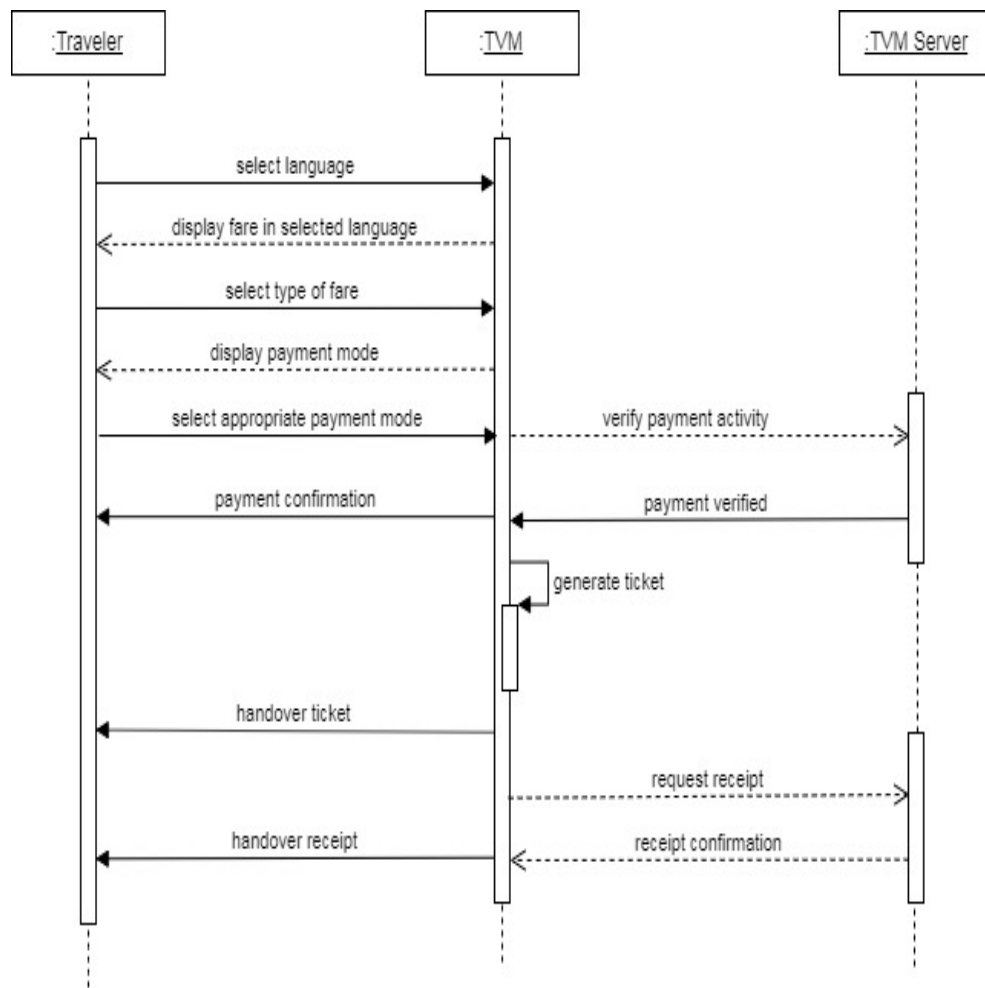


Figure 7: Sequence Diagram for Make Payment

Print Ticket:

Use Case ID:	UC6
Use Case Name:	Print Ticket
Actors:	TVM System (primary)
Priority:	Medium
Trigger:	TVM initiates “Print Ticket” option
Preconditions:	User has Completed the payment Transaction
Post-conditions:	System prints and dispenses ticket/tickets
Main Success Scenario:	<ol style="list-style-type: none">1. System displays a message to the user to choose the mode of payment.2. User selects an option to pay.3. Bank authorizes payment.4. System notifies transaction completion.5. Details are updated on or to the server.6. System generates the ticket.7. System prints and dispenses receipt and ticket/tickets.

Access Voice Assistance:

Use Case ID:	UC7
Use Case Name:	Access Voice Assistance
Actors:	Traveler (primary), TVM(Secondary)
Priority:	Low
Trigger:	User clicks on Audio Assistance button.
Preconditions:	Travelers must be able to speak at least one of the available options in the TVM.
Post-conditions:	User is able to interact with the system using voice assistance
Main Success Scenario:	<ol style="list-style-type: none"> 1. User requests TVM to enable Audio assistance. 2. System sets audio assistance preference and prompts a confirmation message to the user. 3. System starts playing the audio instructions for every available option. 4. User chooses one of the options. 5. System's Audio Assistance features plays the new instructions based on user's selection.

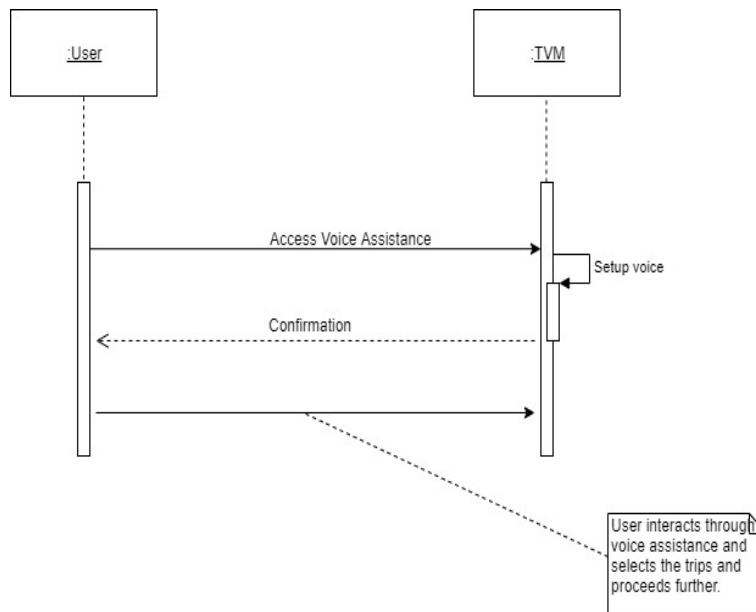


Figure 8: Sequence Diagram for Voice Assistance

Maintenance:

Use Case ID:	UC8
Use Case Name:	Maintenance
Actors:	Administrator
Priority:	Medium
Trigger:	Administrator selects settings and diagnostics options.
Preconditions:	1. Administrator provides necessary credentials. 2. System displays the admin interface, if Administrator's credentials are validated.
Post-conditions:	TVM is updated with latest software updates and functioning properly.
Main Success Scenario:	1. Administrator requests server to run the diagnostic tests. 2. Server accepts the request and runs the diagnostic tests. 3. Administrator runs the upgradation software. 4. System updates the software and reboots. 5. System generates the upgradation report and features are reflected.

Bibliography

- [1] Draw IO,
<https://www.draw.io/>
- [2] C. Köppe, M. van Eekelen, and S. Hoppenbrouwers, “Improving Student Group Work with Collaboration Patterns: A Case Study,” in Proceedings of the 37th International Conference on Software Engineering - Volume 2, Piscataway, NJ, USA, 2015, pp. 303–306.,
<http://dl.acm.org/citation.cfm?id=2819009.2819056>
- [3] Wikipedia,
https://en.wikipedia.org/wiki/Ticket_machine
- [4] UML Sequence Diagram,
<http://www.agilemodeling.com/artifacts/sequenceDiagram.htm>
- [5] T-12 -Transport Act - Government of Quebec,
<http://legisquebec.gouv.qc.ca/en/ShowDoc/cs/T12>
- [6] Quebec Public Transport Policy - Government of quebec.
<http://www.bv.transports.gouv.qc.ca/mono/0926032.pdf>
- [7] UML Activity Diagram,
https://www.tutorialspoint.com/uml/uml_activity_diagram.htm
- [8] ATM Stimulation by R. C. Bjork,
<http://www.cs.gordon.edu/courses/cs211/ATMExample/index.html>
- [9] The Art of Asking: Ask Better Questions, Get Better Answers. By T. J. Fadem. FT Press. 2009,

- [10] Object-Oriented Software Engineering: Practical Software Development using UML and Java. By T. C. Lethbridge, R. Laganière. McGraw-Hill. 2005.

Appendix A. Summary of Interviews Conducted as part of TVM

For the purpose of designing a system that is fit for purpose and beneficial to the community, a survey was performed in Montreal, Quebec, where five participants were asked questions ranging from a general scope to a more specialized context. The answers obtained from the interviews will not be publicly released or misused. They are solely meant to elicit enhancements for the TVM. A concise summary of said answers is shared below along with each of the questions asked. It is important to note that all participants in the survey are healthy individuals belonging to a certain age group (25-35 years old) who do not require any special assistance in their day-to-day life, meaning, for matters pertaining to accommodating disabilities, these responses should be taken with a grain of salt as we acknowledge this is not a sample that is reflective of the broader Montreal community.

Recordings are available in the link - <https://drive.google.com/open?id=1z6Eua7QFJzs-iR0wB8mYp80UEfG4WBda>

General Questions:

1. Do you use Public transport?
All participants surveyed use at least one means of public transport, including metro.
2. Which mode of transportation do you prefer?
Most participants agreed to prefer taking the metro, given rush hour traffic and occasional accidents on the road in the winter.
3. What kind of ticket do you purchase? Eg: Single/multiple journey, group tickets
Most participants purchase a monthly pass, some who use the metro less frequently purchase the round trip on a need basis.
4. Do you like to view your last 5 purchase history? Some participants were interested in this feature, but the majority did not find any value in having it.

Questions pertaining to present features and challenges:

1. Do you prefer textual or graphical based menu?
While the majority answered "graphical", a few candidates said they were comfortable with textual so long as the language (vocabulary and syntax) is clear.
2. Would you prefer to have an interaction with the system through voice control?
Most candidates surveyed were not comfortable interacting with the TVM via voice command.
3. Do you like to receive promotional discount ads during the purchase?
The candidates were divided between yes and no. Most admitted to being in a rush when purchasing a ticket and leaned towards a strong no.
4. What features you like in the current ticket vending machine?
The top two qualities highlighted are ease-of-use and efficiency. Many answers revolved around immediate recognition of the "ticket type" upon inserting their OPUS card. The general consensus is that the process of purchasing tickets using the current TVM does not involve any complex steps. Moreover, it does not involve too many steps.
5. What features you think that is missing in the current vending machine?
One candidate mentioned "tap payment", i.e the ability to recognize card chips and perform transactions using contact-less. Another candidate mentioned receiving payment confirmation and receipt by email. One candidate said that from a feature point of view, there isn't anything missing.
6. What are the challenges faced in Current vending machine?
Lack of feedback was one of the recurring themes for this question. In general, candidates did not feel the process to be as interactive, or responsive. There are moments of hesitation upon inserting their credit card and removing it as to whether the payment went through already or they need to take an additional step. In general, this aspect was identified as "laggy".
7. Do you like to view your purchase summary before proceeding to payment?

All participants preferred to have a final landing confirmation page before proceeding to payment.

Questions pertaining to payments:

1. Which type of payment do you use?
All participants use credit cards, none use cash.
2. How will it be if there is an inter-ac option to purchase a ticket?
All participants agreed an inter-ac option is needed.
3. Do you print the receipt every time you purchase a ticket?
The answers are divided, some participants admitted to printing their receipts every time out of "paranoia". But other candidates said they did not care for the receipt.
4. Would you prefer to have an option to receive receipt online?
All participants agreed that this option would be very useful (and Eco-friendly).

Cancellations/errors :

1. Have you ever purchased a wrong ticket by mistake?
Some participants admitted to accidentally purchasing the wrong ticket but also highlighted the fact that this may be a very rare occurrence.
2. Would you like to refund or re purchase the correct ticket?
All participants agreed this is a fair option to have.
3. Have you ever required any human intervention due to any failures (ticket printing/payment processing)
All participants have agreed to resorting to the human teller in the past for some failure. Most failures mentioned pertain to payments not going through.