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SOFTWARE SYSTEMS REQUIREMENTS SPECIFICATION

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Problem 1

1.1 Brief Description of TVM

A Ticket Vending Machine that is a TVM in this report, could be a stationary human interaction gadget established at places to grant unique set of services to users. A Ticket Vending Machine helps in buying tickets/travel pass for a mode of transportation. A Ticket Vending Machine assists in shopping for tickets/travel passes for a means of transportation and these tickets and passes can be utilized for both trains as well as buses.

We have viewed the ticket vending machine used in Metro stations for our project which is broadly used in Montreal (Quebec, Canada). The system serves the portability desires of local people and guests by advertising an effective and environmentally friendly public transit system. This TVM gives single way one-trip pass, two-way pass, round-trip pass, evening passes, weekly pass, monthly pass and numerous other passes to clients depending on the necessities. Customers are given the choices to pick the type of pass/ticket and thereafter the payment strategies. The TVM selected is of explicit interest for us because it manages different use cases like payment transaction, security, authorization and includes several stakeholders compared to the TVM's used for different functions.

The machine provides the services in a bilingual way i.e. French and English, by taking into the thought of National and common interest. A registered user is given an electronic card known as the E-Card that permits him/her to recharge or obtain tickets on-demand using the TVM. This card can be recharged once a month or in four months for its use. The commuters who do not have this E-Card, they can purchase a printed pass. They can pay for more than one pass by choosing the quantity of passes. The TVM has built-in capability to guarantee satisfactory security to avoid false utilization by consolidating security checks with monetary institutions for transaction. After the consumer makes payment and the financial institution verifies it, the client gets the printed pass(s). Also, the printed tickets have time constraint. It must be utilized within a week, after which the tickets are invalid.

In each metro station, there is a minimum of one Ticket Vending Machine. To shield the good thing about the client, it has a very robust safety and network stability. The network of systems builds a stable community to make certain that thousands of users can use the system and reliably count on its service.

Chapter 2

Problem 2

2.1 Context of Use Model (CUTVM)

Types of Factors	Attributes
User	• Age • Skills • Experience • Education/Training • Mental/Physical Attributes • Emotion
User Role	• Registered • Non-Registered
User Task	• Task-Specific Goals • Criticality of Tasks • Dependency • Duration of Use • Risk from Error
User Goal	• Overall Goal for Software System Use • Criticality of Goal
User Activity	• Standing • Siting
Spatiotemporal	• Time Zone • Current Time • Location • Direction
Natural	• Light • Temperature • Sound
Technical Environment	• Hardware (Screen Type, Keyboard Type) • System Software (Operating System, Server) • Network (Connectivity, Stability) • Reliability
Social Environment	• Legal Constraints/Ethical Standards

Figure 2.1: *List of Contextual Factors*

2.2 Details of Contextual Factors:

1. User:
   - Age: Minimum age of 10 years because of a person at this age capable of travel on an in-dividual basis.
   - Skills: An individual can understand French or English language. No programming lan-guage is required.
   - Experiences: No need of any involvement. It is a decent and positive point on the off chance that he/she utilizes a similar software system however not required.
   - Education/Training: No specific education and coaching are needed. But a person need to be capable to read in English or the French language.
   - Mental and Physical Attributes: It is suitable for humans in wheelchairs and a character have to also mentally stable. However blind people are also able to use it. (People apprehend 'Braille' letters as written on the keypad).
   - Emotion: No need for feelings but the individual has the staying power to continue to be in line.
2. User Role:
   - Registered: A registered User with STM Opus Charged Card can travel from one place to another without purchasing a ticket
   - Non Registered: A Non-Registered Client can too utilize the STM by buying the ticket from the STM TVM and after that can travel. He has numerous choices of se-lecting distinctive sorts of passes depending on his need.
3. User Task:
   - Task-Specific Goals: Accept ticket fair in the form of money (Canadian dollar), cred-it/debit card, generate ticket and also recharge Metro Card.
   - The Criticality of Tasks: Tasks should be clear (say ticket printing quality must be good enough) and in proper sequence (means selecting ticket type process comes first then the payment process).
   - Dependency: LAN, WAN (for bank and other processes at the back end), Power Connection, Ticket Paper (Paper on which ticket will be printed).
   - Duration of Use: TVM for metro tickets is located in the metro station, it is available from 5.30 am to 1 am according to Canada time zone. The whole process starting from se-lecting the ticket type, ticket payment and generation of the ticket will take a minimum time of 1min after that session expires. If TVM remains ideal for 30sec it shifts-to ideal mode to save energy.
   - Risks from Error: Error occurs in between payment process and ticket generation process may lead to deduction of money and no ticket generation. Invalid credit/debit card, wrong pin number and amount leads to a breakdown of the ticket generation process.
4. User Goal:
   - Overall Goal for Software System Use: Customer should complete the transaction of buying the ticket in an efficient manner.
   - The criticality of Goal: Ticket created ought to be of good quality, no wastage of paper by any means.
5. User Activity:

- Standing: System can be used in standing position. Minimum height of 3 - 3.5 feet require to operate.
- Sitting: Set screen and keyboard at a certain angle so it can be easily operated while sit-ting in a wheelchair if user is physically impaired.

6. Spatiotemporal:

   - Time zone: Every transaction carried out have to be saved on the server database in standard time (for eg. GMT)
   - Current time: Ticket is bought according to the local time
   - Location: Available nearly at every STM station
   - Direction: Located at the entrance or on departure side.

7. Natural:

   - Light: The machine does not affect by bright and dim light. The screen of machine ad-just according to surrounding light.
   - Temperature: The machine should have temperature control system so that able to work at any temperature (warm/cold).
   - Sound: Also have a sound mechanism so that blind people can use it.

8. Technical Environment:

   - Hardware:
     - Processor Speed: Enough speed so that handles all the processes efficiently.
     - Screen: VGA 10" touch and manual screen.
     - Keyboard: Interactive Number Keypad should be appropriate to be pressed and visible. Also with Braille Letters so that blind people use it.
   - System Software:
     - Operating System: Easy to use and user-friendly (such as Windows).
     - Server: Need server for backup
     - Cloud Service: It provides database backup if the case of network and system failure.
   - Reliability: Have the UPS system in case of power failure.

9. Social Environment:

   - Legal Constraints: installation and utilization must be approved and authorized by the government.

Chapter 3

Problem 3

3.1 Domain Model Introduction

A domain model in problem solving and software engineering is a conceptual model of all the topics related to a specific problem. It describes the various entities, their attributes, roles, and relationships, plus the constraints that govern the problem domain. It does not describe solutions to the problem. [1] It represents the environment in which a solution will have to operate, as well as the problem itself. [2]

3.2 Domain Model Diagram

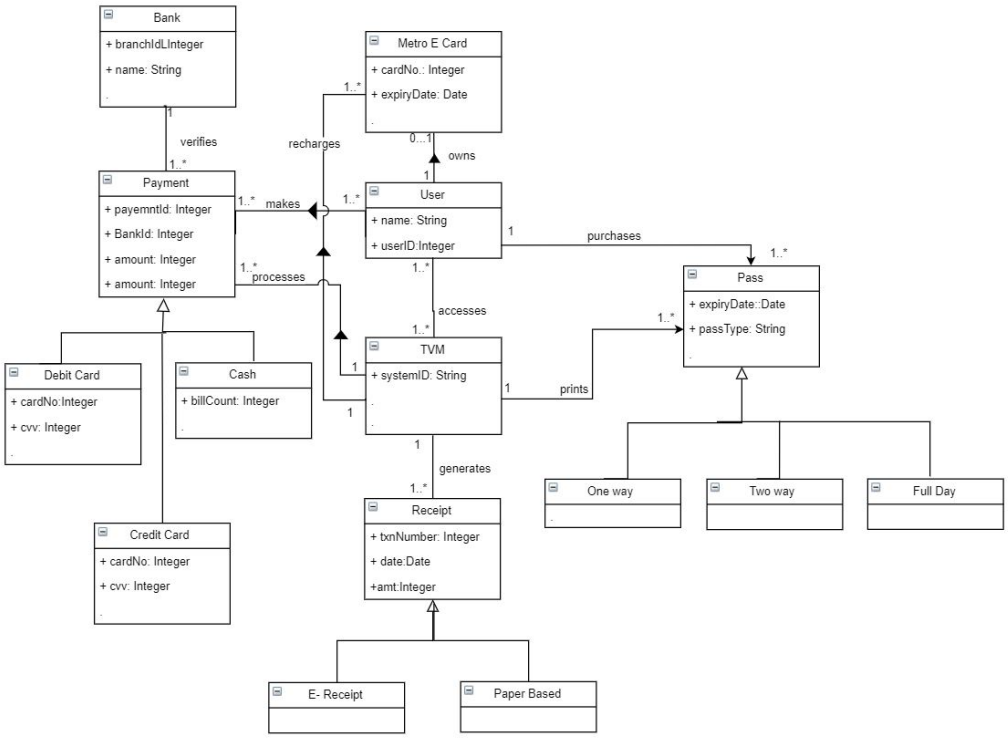


Figure 3.1: *Domain Model*

3.3 Domain Model Description

- Bank:
  Represents an entity which validates payments when the user performs a ticket pur-chasing transaction using cards (credit/debit).
- Payment:
  Represents different modes of payment which can either be Cash, Debit Card or Credit Card.
- Credit Card:
  Represents an electronic card associated with a credit account of user in a bank, which is used for buying tickets or to facilitate recharging of an OPUS card. It has a valid card number and a pin number.
- Debit Card:
  Represents an electronic card associated with a chequing or savings account of a us-er in bank, which is used for buying tickets or to facilitate recharging of an OPUS card. It has a valid card number and a pin number.
- Cash:
  Represents cash, as a mode of payment without interacting with the bank.
- Metro Opus Card:
  Represents a chip integrated plastic card used to store accounts and payments for users. Issued usually for regular users for purchase of tickets and travel.
- User:
  Represents a person/entity who interacts with the system and executes many actions like recharging metro cards or purchasing metro tickets. (eg. Traveller or commuter, etc.)
- TVM:
  Represents a machine that allows users to purchase tickets, process payment and print receipts. The machine consists of hardware and software components.
- Receipt:
  Represents a paper or email proof of the transaction result. It can be a success or a failure result.
- Pass:
  Represents a paper based card used for non regular users for a limited time. It can use for one way travel or two way travel, etc

3.4 Relationships

The relationships between classes need to be defined. Multiplicity describes how many instances of one class can be associated with one instance of the related class. Some of the multiplicity symbols, we used in our Domain Model are:

- 1 : Exactly one;
- 0..1 : Zero or one;
- 0..* : Zero or more;
- 1..* : One or more;

Source Concept	Target Concept	Relationship	Description
User	TVM	Association	User accesses a TVM to buy the passes or recharge his Metro OPUS Card
User	Payment	Association	User makes several payment for the pass(s) or OPUS Card by Cash or Card
User	Metro Opus Card	Association	User can own one OPUS Card or he/she does not have OPUS Card
User	Pass	Association	User can purchase several different pass(s) to travel
TVM	Payment	Association	TVM can process several payments
TVM	Receipt	Association	After completing the tasks of pass(s) or OPUS Card TVM generates receipts
TVM	Metro E Card	Association	Opus Card is inserted into TVM to get recharged
TVM	Pass	Association	One TVM can print several Passes as per User desired request. It is possible that TVM does not print any Passes.
Payment	Credit Card	Inheritance	Paying by Credit Card is one way to make payment.
Payment	Debit Card	Inheritance	Paying by Debit Card is one way to make payment.
Payment	Cash	Inheritance	Payment can also be paid by Cash
Bank	Payment	Association	Bank can verify a payment transaction

Figure 3.2: *List of All concepts and their Relationships*

Chapter 4

Problem 4

4.1 Different Views for Use Case

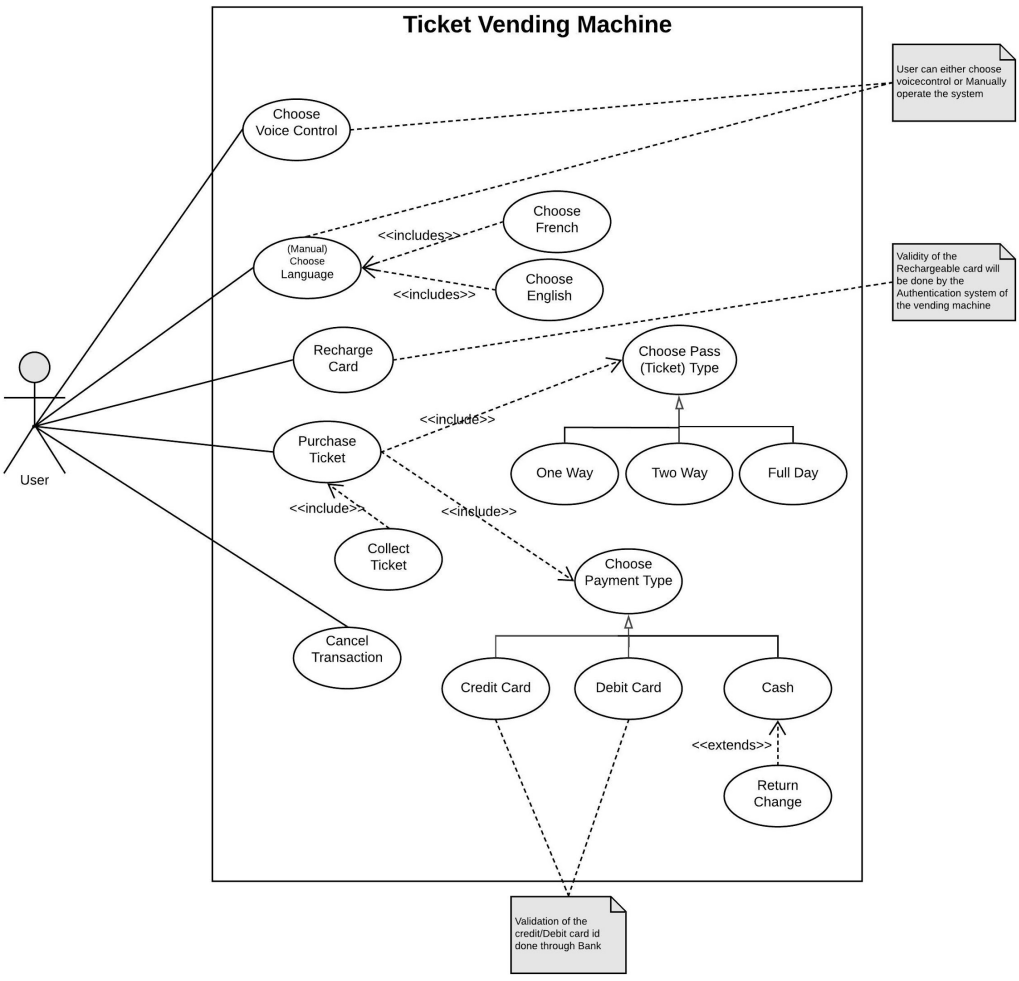


Figure 4.1: *Positive Use Case Scenario*

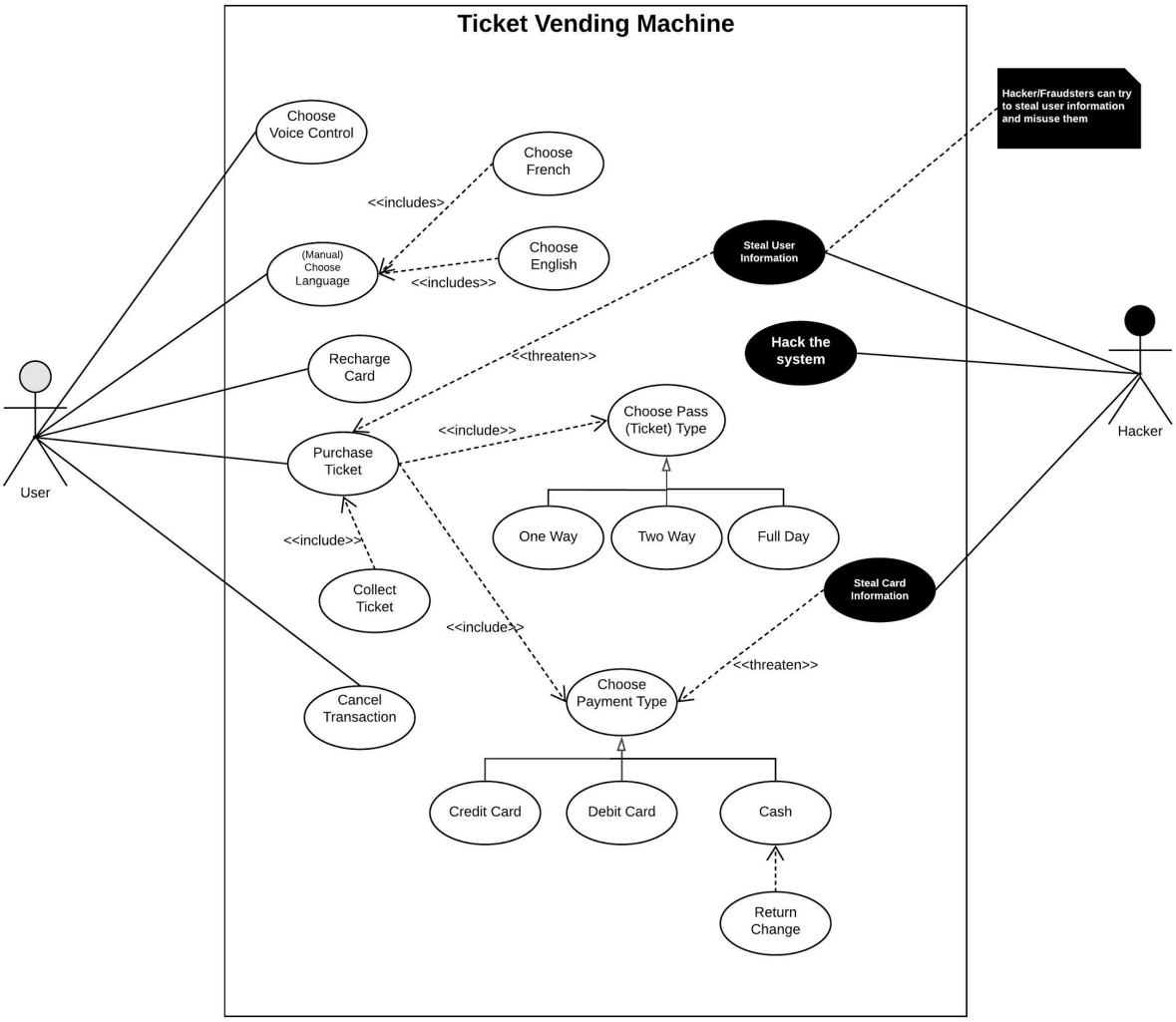


Figure 4.2: *Negative Use Case Scenario*

4.2 Description of relevant Use Cases:

Use Case Id:	UC1
Use case name:	Language Selection
Actors:	Primary: User
Description:	User have to select the language (French, English) he/she is comfortable with.
Trigger:	Selecting the Manual mode option.
Preconditions:	Selection of either Manual mode or voice Control mode
Postconditions:	The machines User interface will appear in the selected language
Normal Flow:	• The TVM will display the option of language (French/English). • User will have to choose one of the two options or else the TVM follows the default language.
Exception Flow:	User cancelling the process
Priority:	High
Note:	User can select one of the 2 languages specified (French, English)

Table 4.1: *Language Selection*

Use Case Id:	UC2
Use case name:	Voice Control
Actors:	Primary: User
Description:	If the user finds it difficult to operate the system manually, he/she can choose voice control option to perform the transactions
Trigger:	Selecting the voice Control option
Preconditions:	Selection of either Manual mode or voice Control mode
Postconditions:	The machines voice control system responds to the user
Normal Flow:	• The TVM will display the option of voice control/Manual. • User will choose one of the two options.
Exception Flow:	User cancelling the process
Priority:	High
Note:	User can select one of the 2 languages specified (French, English)

Table 4.2: *Voice Control*

Use Case Id:	UC3
Use case name:	Type of Ticket
Actors:	Primary: User
Description:	User has to select the type of ticket. (One way Pass/Two Way Pass/ Full Day Pass) and the number of fares.
Trigger:	Selecting the buy ticket.
Preconditions:	Selection of either Manual mode or voice Control mode and the language selected.
Postconditions:	User selects the type of ticket.
Normal Flow:	• The TVM will display the option of language (French/English). • User will have to choose one of the two options or else the TVM follows the default language. • TVM displays either to buy One Way Ticket/Two Way Ticket/ Full Day Ticket. • User selects required ticket type. • User selects the number of tickets
Exception Flow:	User cancelling the process
Priority:	High
Note:	The Fares may depend on the type of ticket selected.)

Table 4.3: *Type of Ticket*

Use Case Id:	UC4
Use case name:	Recharge E-Card
Actors:	Primary: User, Secondary: Bank
Description:	User recharges his Rechargeable card.
Trigger:	Selecting Recharge card option.
Preconditions:	Card must be valid, and in proper condition.
Postconditions:	Rechargeable card will be recharged for certain duration depending on the amount paid by the user.
Normal Flow:	• The TVM will display the option of language (French/English). • User will have to choose one of the two options or else the TVM follows the default language. • TVM displays either to buy Rechargeable/Non-Rechargeable ticket. • User selects required ticket type. • User selects the payment option (Credit/Debit/Cash) • User enters his/her pin number (if Credit/Debit card is inserted) • Users card is recharged
Exception Flow:	• User cancelling the process • Users rechargeable card is expired or in a bad condition • User entering the wrong PIN number.
Priority:	High
Note:	• The Fares may depend on the type of ticket selected. • User must enter Valid Pin number.

Table 4.4: *Recharge E-Card*

Use Case Id:	UC5
Use case name:	Purchase Ticket
Actors:	Primary: User, Secondary: Bank
Description:	User selects all the required conditions to purchase a Ticket.
Trigger:	Selecting Purchase Ticket option.
Preconditions:	User selects the type of ticket and number of tickets.
Postconditions:	Payment has been made and ticket is printed.
Normal Flow:	• The TVM will display the option of language (French/English). • User will have to choose one of the two options or else the TVM follows the default language. • TVM displays either to buy Rechargeable/Non-Rechargeable ticket. • User selects Non-Rechargeable ticket. • User selects the Destination. • User selects the number of tickets. • User selects the payment option (Credit/Debit/ Cash) • User enters his/her pin number (if Credit/Debit card is inserted)
Exception Flow:	• User cancelling the process • User entering the wrong PIN number.
Priority:	High
Note:	• The Fares may depend on the number of tickets selected. • User must enter Valid Pin number.

Table 4.5: *Purchase Ticket*

Use Case Id:	UC6
Use case name:	Payment
Actors:	Primary: User, Secondary: Bank
Description:	User selects all the required conditions to purchase a Ticket and selects the payment option.
Trigger:	Selecting the payment option.
Preconditions:	User selects the type of ticket and number of tickets.
Postconditions:	Payment has been made and ticket is printed.
Normal Flow:	• The TVM will display the option of language (French/English). • User will have to choose one of the two options or else the TVM follows the default language. • TVM displays either to buy Rechargeable/Non-Rechargeable ticket. • User selects the type of ticket. • User selects the payment option (Credit/Debit/Cash) • User enters his/her pin number (if Credit/Debit card is inserted) • User inserts the Cash in the machine (If Cash is selected).
Exception Flow:	• User cancelling the process • User entering the wrong PIN number. • User inserting invalid currency. • User not inserting sufficient Money.
Priority:	High
Note:	• User must enter Valid Pin number. • User must insert valid Currency. • User must insert required amount of money or more.

Table 4.6: *Payment*

Use Case Id:	UC7
Use case name:	Print Ticket
Actors:	Primary: User
Description:	Prints ticket after the required transactions are done.
Trigger:	User selects print ticket option.
Preconditions:	Payment confirmation from bank or machine (if used cash)
Postconditions:	Ticket is printed.
Normal Flow:	• The TVM will display the option of language (French/English). • User will have to choose one of the two options or else the TVM follows the default language. • TVM displays either to buy Rechargeable/Non-Rechargeable ticket. • User selects Non-Rechargeable ticket. • User selects the Destination. • User selects the number of tickets. • User selects the payment option (Credit/Debit/Cash) • User enters his/her pin number (if Credit/Debit card is inserted) • User selects Print Ticket option.
Exception Flow:	• User cancelling the process • User entering the wrong PIN number.
Priority:	High
Note:	• User cancelling the process • User entering the wrong PIN number.

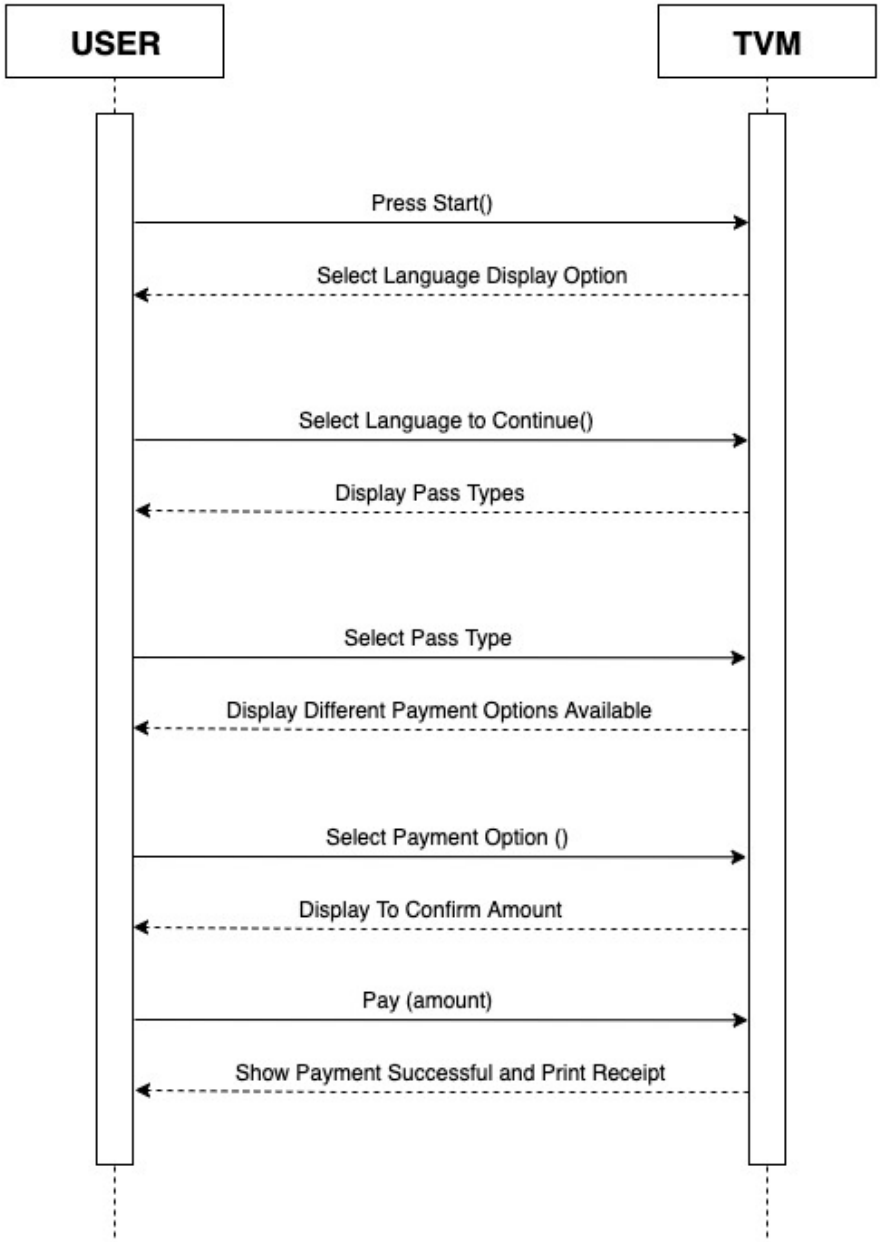
Table 4.7: *Print Ticket*

Use Case Id:	UC8
Use case name:	Return Change
Actors:	Primary: User
Description:	If User overpays the money, machine returns the remaining money.
Trigger:	User overpays the money.
Preconditions:	User makes payment by cash.
Postconditions:	User receives the remaining amount.
Normal Flow:	• User selects the ticket type • User selects payment by cash. • If user overpays the money, the TVM returns the remaining amount.
Exception Flow:	• User cancelling the process • If user pays through card
Priority:	High
Note:	• User have to use valid currency for the TVM to accept the transaction.

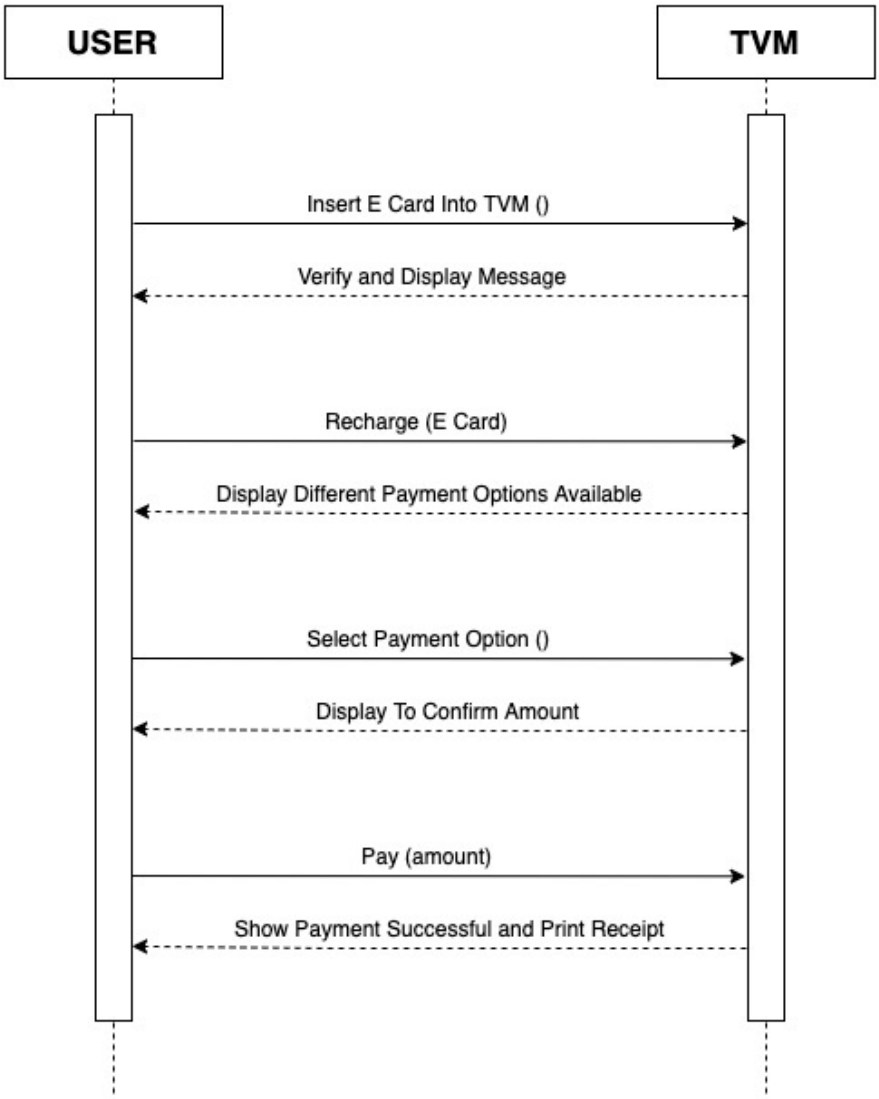
Table 4.8: *Return Change*

4.3 Relevant System Sequence Diagrams:

Purchase Ticket:



Recharge E-Card:



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