# 4. USECASE 4: “Student Acquiring and Managing Parking Permits - Parking System Portal”

## 4.1 Requirements :

400.101 User Details:

The system must allow students to enter Student Details.

Student Details Entry:

400.102 The system must prompt the student to enter their full name, student ID number, phone number, and email address.

400.103 Entered student details must be stored in the "Personal Details" data repository.

Vehicle Details Entry:

400.104 After student details entry, the system must prompt the student to enter vehicle details, including make, model, year, license plate number, and vehicle registration information.

Entered vehicle details must be stored in the "Vehicle Details" data repository.

401.101 Parking Authorization Entry:

The system must display a message to the student to enter parking authorization data, including the type of parking (acquire, cancel, renew).

401.102 Depending on the selection, the system must transmit the operation to the "Parking Authority" Entity.

401.103 Parking Permit Handling:

In response to the parking authorization entry, the system must transmit the operation (acquire, cancel, renew) to the "Parking Authority" Entity.

401.104 The Entity must send a message back to the system indicating the success of the parking permit operation.

401.105 After the parking permit handling, the student must receive Parking Permit Details.

## 4.2 Student Acquiring and Managing Parking Permits - Parking System Portal

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| Use Case Name: Managing parking permits | ID:  UC-4 | Priority:  High |
| Actors: Student (Primary) , Personal Details (secondary), Vehicle Details(secondary), Parking Authority(secondary), | | |
| Description: Student login into the Authorizes Student and Vehicle and does the Parking Selection. | | |
| Trigger: Student initiates the process of acquiring or managing parking permits in the George Mason University Parking System Portal. | | |
| Type: X External Temporal | | |
| Preconditions: The Student must be registered in the university system and parking portal. There should be available parking spots . | | |
| Normal Course:  4.1 Authorizes Student and Vehicle:  4.1) Student enters the Student Details which will include Student ID, Full Name, and Contact Information Phone Number, Residential Address into Authorizes Student and Vehicle  4.1a ) The Student details are then store by the system in the Personal Details data repository.  4.1)b The System receives a message of "Student Details Entered Successfully and Provide Vehicle details" message from the Personal Details  data repository.  4.2 ) System displays to Student the "Enter Vehicle Details" message .  4.3 ) Student provides Vehicle Details Authorization (Vehicle Model ,Vehicle License Plate Number,  Vehicle Registration Information) data to the System.  4.3.a) The System saves Details of Vehicles to the Vehicle Details data repository.  4.3.b) The System receives a "Vehicle Details Entered Successfully" message from the Vehicle Details data repository.  4.3.b) The Student receives a of "Vehicle Details Entered Successfully" message from the Authorizes Student and Vehicle System .  Processes Parking :  4.4) The System receives Student and Vehicle details from the previous stage/process.  4.5) The System displays to the Student the “Enter Parking Type” message .  4.6) Student provides Parking Authorization data to the System. (assume that this is one operation performed by the Student regardless of the acquiring, cancelling , renewing parking.  4.6.a) If Student enters Acquire Parking , the System transmits it to Parking Authority entity.  4.6.b ) Parking Authority entity sends message of "Parking Permit Acquired Successfully" to the System.  4.6.c) If Student enters Cancel Parking , the System transmits it to Parking Authority entity.  4.6.d ) Parking Authority entity sends message of "Parking Permit Cancelled Successfully" to the System.  4.6.e) If Student enters Renew Parking , the System transmits it to Parking Authority entity.  4.6.f) Parking Authority entity sends message of "Parking Permit Renewed Successfully" to the System.  4.7)  The Student receives a " Parking Permit Details" from the System . | | Information for Steps:  4.1 ← Student Details  4.1.a → Student Details  4.1.b ← “Student Details Entered Successfully and Provide Vehicle details” message  4.2 → "Enter Vehicle Details" message  4.3 ← Vehicle Details Authorization  4.3.a → Details of Vehicles  4.3.b ← “Vehicle Details Entered Successfully” message  4.3.b → “Vehicle Details Entered Successfully” message  4.4 ← Student and Vehicle details  4.5→ “Enter Parking Type” message .  4.6 ← Parking Authorization  4.6.a → Parking Acquired  4.6.b ← "Parking Permit Acquired Successfully" message  4.6.c → Parking Cancelled  4.6.d ← "Parking Permit Cancelled Successfully" message  4.6.e → Parking Renewed  4.6.f ← "Parking Permit Renewed Successfully" message  4.7 🡪 Parking Permit Details |

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| --- | --- | --- | --- |
| Alternative Course: N/A | | | |
| Postconditions: Upon successful completion of the "Acquiring and Managing Parking Permits" , the student parking permit status is updated in the system, and they are provided with parking ticket permit and access to the parking facilities. | | | |
| Summary Inputs | Source | Summary Outputs | Destination |
| * 1. 4.1 Student Details   4.1.b  "Student Details Entered Successfully and Provide Vehicle details" message  4.3 Vehicle Details Authorization 4.3.b “Vehicle Details Entered Successfully” message  4.4 Student and Vehicle details  4.6  Parking  Authorization  4.6.b "Parking Permit Acquired Successfully" message  4.6.d "Parking Permit Cancelled Successfully" message  4.6.f "Parking Renewed Successfully" message | 4.1 Student  4.1.b Personal Details  4.3 Student  4.3.b Vehicle Details  4.4 Authorizes Student and Vehicle  4.6 Student  4.6.b Parking Authority  4.6.d Parking Authority  4.6.f Parking Authority | 4.1.a Student Details  4.2    "Enter Vehicle Details" message  4.3.a Details of Vehicles  4.3.b “Vehicle Details Entered Successfully” message  4.5 "Enter Parking type" message  4.6.a Parking Acquired  4.6.c Parking Cancelled  4.6.e Parking Renewed  4.7 Parking Permit Details | 4.1.a Personal Details  4.2 Student  4.3.a Vehicle Details  4.3.b Student  4.5 Student  4.6.a Parking Authority  4.6.c Parking Authority  4.6.e Parking Authority  4.7 Student |

## 4.3 UML for UC-4:

A diagram of parking permit

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## 4.4 DFD-4 for UC-4:

A diagram of parking permit

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### *4.4.1 Description for DFD-4:*

**4.1: Authorizes Student and Vehicle:**

a. EE "Student" enters the IDF "4.1 Student Credentials" which will include university ID as username and a Password into P4.1.

b. Process P4.1 enters the IDF "4.1. a Student Details" which will include university ID as username and a Password into DS “D6 Personal Details.”

c. Process P4.1 “University Parking Portal” obtains message 4.1.b   "Student Details Entered Successfully and Provide Vehicle details" message (IDF 4.1.b   "Student Details Entered Successfully and Provide Vehicle details" message) from DS “D6 Personal Details”. P4.1 displays via ODF “4.2 "Enter Vehicle Details" message” to EE “Student”.

d. Process P4.1 enters IDF "4.3. a Details of Vehicles" which includes Vehicle Make, Model, and Year Vehicle License Plate Number Vehicle Registration Information into DS “D7 Vehicle Details”.

e. Process P4.1 “Authorizes Student and Vehicle” obtains message 4.3.b "Vehicle Details Entered Successfully" message (IDF 4.3.b "Vehicle Details Entered Successfully" message) from DS “D7 Vehicle Details”. P4.1 displays via ODF “4.3.b "Vehicle Details Entered Successfully" message” to EE “Student”.

**4.4 Processes Parking:**

a.P4.4 receives IDF “4.4 Student and Vehicle details” from stage/process P4.1.

b.P4.4 “Processes Parking” displays via ODF “4.5 "Enter Parking type” message to the EE “Student”

c.EE “Student” provides data labelled as IDF “4.6 Parking Authorization” to P4.4 “Processes Parking”.

d. If the EE “Student” chooses to acquire parking then “P4.4” transfers the data flow labelled ODF "4.6. a Parking Acquired " to the “Parking Authority“ External Entity .

e. “Parking Authority” External Entity sends back acknowledgement message to P4.4 which is 4.6.b "Parking Permit Acquired Successfully" message.

f. If the EE “Student” chooses to Cancel Parking then “P4.4” transfers the data flow labelled ODF "4.6.c Parking Cancelled" message to the EE “Parking Authority”.

g. “Parking Authority” External Entity sends back acknowledgement message to P4.4 which is IDF 4.6.d "Parking Permit Cancelled Successfully" message.

h. If the EE “Student” chooses to Renew Parking then “P4.4” transfers the data flow labelled ODF "4.6. e Parking Renewed" to the “Parking Authority “External Entity.

i. “Parking Authority” External Entity sends back acknowledgement message to P4.4 which is IDF 4.6.f "Parking Permit Renewed Successfully".

j.P4.4 “Processes Parking” displays via ODF “4.7 Parking Permit Details” message to the EE “Student”

## 4.5 Class Diagram CD-4:

A diagram of a student accounting and managing parking permit

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### *4.5.1 Description of Class Diagram CD-4:*

**Class Student**:

**Description**: Represents a student engaging with the University Parking System

**Traceability**: Matches DFD-4 EE "Student".

**Multiplicity:** An instance of class “Student” holds as [1]-to-[1-to-many] instances of class “Personal Details” because the relationship line Student "1" --> "1. \*" Personal Details signifies a 1-many relationships where one instance of Student is associated with many instances of Personal Details. A student can’t have null details. At least one instance of class “Student” must exist in the system.

An instance of class “Student” holds as [1]-to-[1-to-many] instances of class “Vehicle Details” because the relationship line Student "1" --> "1. \*" Vehicle Details signifies a 1-1 relationship where one instance of Student is associated with many instances of Vehicle Details.

An instance of class “Student” holds as [1]-to-[1-to-many] instances of class “Parking Authority” because the relationship line Student "1" --> "1. \*" Parking Authority signifies a 1-many relationships where one instance of Student is associated with many instances of Parking Authority.

**Main attributes:**

* “student”, “full Name”, “phone Number, residential Address” - holds the student entered details **(matches DFD-4, IDF 4.1 Student Details)**

• personal Details - holds a list of instances of class “Personal Details” that belong to

the “Student”.

* vehicle Details - holds a list of instances of class “Vehicle Details” that belong to the “Student”.
* vehicle, vehicle License Plate Number, vehicle Registration Information - holds the student entered details **(matches DFD-4, IDF 4.3 Vehicle Details Authorization)**
* “Acquire Parking”, “cancel Parking”, “renew Parking”- holds the student entered details **(matches DFD-4, IDF 4.6 Parking Authorization)**

**Main methods:**

* `getAuthorizesStudentDetails()`: returns private attributes "studentID," "fullName," "phoneNumber," "residentialAddress." **(matches DFD-4-, ODF 4.2.a “Enter Vehicle Details” message))**
* `getAuthorizesVehicleDetails()`: returns private attributes "vehicleModel”, "vehicleLicensePlateNumber," "vehicle Registration Information." **(matches DFD-4-, ODF 4.3.b “Vehicle Details Entered Successfully” message)**
* `getProcessesParkingType()`: returns private attributes "Acquire," "Cancel," and "Renew" Parking. **(matches DFD-4, ODF 4.5 “Enter Parking Type” message)**
* receiveProcessesParkingPermitDetails() : returns details of the parking permit issued to the student. **(matches DFD-4-, ODF 4.7 Parking Permit Details)**

**Class PersonalDetails:**

**Description**:

Stores information of student about each Student’s PersonalDetails (matches DFD-4, DS "D6 Personal Details") such as "studentID," "fullName," "phoneNumber," "residentialAddress" (matches DFD-4, IDF 4.1.a "Student Details").

The system queries the attributes in this class such as "studentDetails" to control the interaction with the student. Class "PersonalDetails" is in charge of:

(a) checking the student details entered by the Student is successful and will provide an acknowledgement sendMessage(): sending back an acknowledgment message to System. **(matches DFD-4-, IDF 4.1.b "Student Details Entered Successfully and Provide Vehicle details" message)**

**Traceability:**

**Matches DFD-4 DS D6 “Personal Details”.**

**Multiplicity:**

An instance of class “Personal Details” can accommodate exactly one instance of class “Student”, [1] -to- [1]. At least one instance of class “Personal Details” must exist in the system.

**Main attributes:**

studentDetails: – holds the student’s details in the Student’s Personal Details. **(matches DFD-1, IDF 4.1.a Student Details)**

**Methods:**

storesStudentDetails (): This method is responsible for storing student details which includes “studentID”, “fullName”, “phoneNumber”,”resendtialAddress” **(matches DFD-1, IDF 4.1.a Student Details)**

sendMessage (): sending back an acknowledgment message to System **(matches DFD-4-, IDF 4.1.b   "Student Details Entered Successfully and Provide Vehicle details" message)**

**Class VehicleDetails:**

**Description**:

Stores information of Vehicle about each Student’s VehicleDetails **(matches DFD-4, DS “D7 Vehicle Details”)** such as “vehicleModel”, “vehicleLicensePlateNumber”,” vehicle Registration Information**” (matches DFD-4, IDF 4.3.a “Details of Vehicles”)**. The system queries the attributes in this class such as “vehicleDetails” to control the interaction with the student. Class “VehicleDetails” is in charge of: (a) checking that the vehicle details entered by the student is correct of class their identification is successful and provides acknowledgement.

sendMessage (): sends back an acknowledgment message to System **(matches DFD-4-, IDF 4.3.b   " Vehicle details Entered Successfully" message)**

**Traceability:**

**Matches DFD-4 DS D7 “Vehicle Details”.**

**Multiplicity:**

An instance of class “Vehicle Details” can accommodate exactly one instance of class “Student”, [1] -to- [1]. At least one instance of class “Vehicle Details” must exist in the system.

**Main attributes:**

vehicleDetails: – holds the Vehicle’s details in the Student’s Vehicle Details. **(matches DFD-1, IDF 4.3.a Vehicle Details)**

**Methods:**

storesVehicleDetails():This method is responsible for storing vehicle details which includes “vehicleModel”, “vehicleLicensePlateNumber”,”vehicle Registration Information” . **(matches DFD-1, IDF 4.3.a Vehicle Details)**

sendMessage (): sends back an acknowledgment message to System **(matches DFD-4-, IDF 4.3.b   " Vehicle details Entered Successfully" message)**

**Class ParkingAuthority:**

**Description**:

This class acts as the control entity that manages parking permits and regulates the details of the vehicles registered by the students. Parking permits are issued, managed, and recorded by the parking authority.

**Traceability**: **Matches with DFD-4 EE "Parking Authority".**

**Multiplicity:**

An instance of class “ParkingAuthority” can accommodate exactly one instance of class “Student”, [1] -to- [1]. At least one instance of class “ParkingAuthority” must exist in the system.

**Main attributes:**

permitID (): Holds a unique ID assigned to each parking permit of the student.

parkingType (): Holds the value of “Acquire”, “Cancel” and “Renew” Parking.

permitType(): Holds the value of Semester-Based, Annual and Daily type of Parking.

**Main methods:**

* getAuthorizesStudentandVehicleDetails(): returns private attributes “studentID”, “fullName”, “phoneNumber”, “resendtialAddress” , “vehicleID”,”vehicleLicensePlateNumber”,”vehicle Registration Information”

**(matches DFD-4, IDF 4.4 Student and Vehicle Details)**

* acquireParking(): Initiates the process of acquiring a parking permit. If the student enters acquire parking, then this method returns the newly acquired ParkingPermit instance. **(matches DFD-4-, IDF 4.6.a Parking Acquired)**
* cancelParking(): Initiates the process of cancelling a parking permit. If the student enters canceled parking, then this method returns the newly cancelled ParkingPermit instance. **(matches DFD-4-, IDF 4.6.c Parking Cancelled)**
* renewParking(): Initiates the process of renewing a parking permit. If the student enters renewed parking, then this method returns the newly renewed ParkingPermit instance. **(matches DFD-4-, IDF 4.6.e Parking Renewed)**
* getParkingPermitStatus() : This method includes the acknowledgement message whether the parking permit for a student is acquired , cancelled , renewed. **(matches DFD-4-, ODF 4.6.b “Parking Permit Acquired Successfully” message, ODF 4.6.d “Parking Permit Cancelled Successfully” message, ODF 4.6.f “Parking Permit Renewed Successfully” message)**
* sendProcessesParkingPermitDetails(): sends all the parking details of the issued parking permits to Student. **(matches DFD-4-, IDF 4.7   "Parking Permit Details”)**

## 4.6 Sequence Diagram SD-4:

A parking permit form with text

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### *4.6.1 Description of Sequence Diagram SD-4:*

**Description of Sequence Diagram SD-4:**

1. The process begins with an instance of the class “: Student” object invoking “getAuthorizesStudentDetails()” method to retrieve the student's personal information.
2. The “PersonalDetails” class is involved when the “: Student” interacts to store or update personal information through “storeStudentDetails()”.
3. This data is likely retrieved from a data repository, indicated by the class “PersonalDetails”, which stores such information. **(matches DFD-4 P4.1, method Student:getAuthorizesStudentDetails ())**.After successfully storing the details in Object “:Personal Details” invokes method “PersonalDetails:: sendMessage ()".
4. The method returns acknowledgement after successfully entering student details and it messages "Student Details Entered Successfully and Provide Vehicle details" message (**matches DFD-4 P4.1 method “Personal Details”: sendMessage ()).**
5. The “: Student” object calls “getAuthorizesVehicleDetails()” to fetch details about the student's vehicle.(**matches DFD-4 P4.1, method Student::getAuthorizesVehicleDetails())**
6. The “VehicleDetails” class is involved when the “: Student” interacts to store or update personal information through “storesVehicleDetails()”.
7. After successfully storing the details in “VehicleDetails” Object “: VehicleDetails” invokes method “VehicleDetails:: sendMessage ()".
8. The method returns acknowledgement after successfully entering student details and it messages 4.3.b "Vehicle Details Entered Successfully" message. **(matches DFD-4 P4.1 method “VehicleDetails”: sendMessage ()).**
9. The instance of class “ParkingAuthority” calls method “getAuthorizesStudentAndVehicleDetails”. **(matches DFD-4 P4.4 method ParkingAuthority::getAuthorizesStudentAndVehicleDetails()) .**
10. Upon receiving student and vehicle details, the “: Student” instance proceeds to invoke “getProcessesParkingType()” to determine the types of parking available. This decision is based on the student's details and vehicle specifications. **(matches DFD-4 P4.4 method Student::getProcessesParkingType())** .
11. With the parking type determined, the “: Student” object decides to invoke “acquireParking()” to request a new parking spot. This action involves communication with the “Parking Authority”, which manages the parking permits.The “Parking Authority” processes the parking request by invoking its own method “acquireParking()”. This method checks for parking availability and, if successful, returns a parking permit detail string to the “: Student”. If the “: Student” desires to cancel an existing parking permit, they invoke the “cancelParking()” method on the “Parking Authority”. The “Parking Authority” processes this request and returns a confirmation of cancellation. In the case of parking renewal, the “: Student” calls the “renewParking()” method provided by the “Parking Authority”. The authority validates the renewal request and issues updated permit details upon success.
12. The “: ParkingAuthority” instance proceeds to invoke “getParkingPermitStatus()” to determine the types of parking selection. This decision is based on the student selection whether he wants to acquire,cancel or renew parking.
13. The method returns acknowledgement after successfully entering student details and it messages "Parking Permit Acquired Successfully" message/ "Parking Permit Cancelled Successfully"/ "Parking Permit Renewed Successfully" **(matches DFD-4 P4.4 method “ParkingAuthority”:: getParkingPermitStatus ()).**
14. After successfully getting the Parking Permit Status details in “Parking Authority” Object “: ParkingAuthority” invokes method “ParkingAuthority:: sendProcessesParkingPermitDetails()"**(matches DFD-4 P4.4 method “ParkingAuthority”::sendProcessesParkingPermitDetails()).**If the acquisition of parking permit is successful the method might return details about Permit Type: Information about the type of parking permit acquired, such as whether it's a monthly pass, semester pass, or annual pass. the start and end dates during which the parking permit is valid. Information about the specific parking lot or zone to which the permit is assigned, this might include the lot/zone name, location, and any restrictions associated with it, details about the cost of the permit, payment method used, and any transaction or payment confirmation. If the cancellation of a parking permit is successful, the method might return a confirmation message Refund Information (if applicable): If there is a refund associated with the cancellation, the method might return details about the refund amount, the method of refund (e.g., credit to the student's account or a refund check) and the expected time frame for receiving the refund. If the renewal of a parking permit is successful, the method might return a confirmation message or a new permit ID, the updated expiration date of the renewed parking permit, Details about the cost of the renewal, payment method used,any transaction or payment confirmation for the renewal and Information about any changes in terms and conditions associated with the renewed permit.
15. The method returns acknowledgement after successfully getting the Parking Permit Status details and “: Student” receives “Parking Permit Details”.**(matches DFD-4 P4.4method “Student”::receiveProcessesParkingPermitDetails ()).**