Requirement Specification and Analysis

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Power Enjoy

- PowerEnjoy is a digital management system for a car-sharing service that exclusively employs **electric cars**.
- It allows registered clients (**Power Users**) to use a vehicle paying only on the basis of the actual use during each individual **rental**.
- In addition to the classic functionalities expected on a car sharing service, it will also incentivize environment-friendly and virtuous behaviours of the Power Users, providing **discounts** on the regular **ride fee**.

Power Enjoy

- PowerEnjoy employs a single model of electric car which comes with pre-installed sensors that can be used to monitor the car status (battery level, location, etc..) at any given time.
- The car can be picked up from a safe areas or from a Power Enjoy Charging Stations, and **should be left in another safe area.**
- The Power User will be charged only for the time he has rented the car, there are no subscritions or additional prices to use the service.

Text Assumption

- The text doesn't specify:
- **What should happen if a user parks in a unsafe area.**
- How the payment should be processed
- How the car is recharged on site or fixed in case of malfunctioning

Text Assumption

- As soon as a Power Uses turns the engine off, it will be notified through the car display if he has parked in an unsafe area.
- If he decide nevertheless to exit the vehicle, the rent will not stop and the user will continue to be charged.
- The Power User can still unlock the car and park it a safe area.

Text Assumption

- If the car is left in the same unsafe area for more than 1 hour, the rent will eventually end:

- The car will become unavailable.
- The AS will be notified to take the car back to a safe area.
- User will be charged for the extra time to cover the costs.
- Fines may still apply.

External Services

- **Payment Service**
- Every Power Enjoy user, in order to use our service, is required to have an account registered to a third party payment service, with a valid payment method.
- Power Enjoy will calculate for any renting the final fee but the actual payment will be handled by the payment service (PS).
- The PS will be notified of the amount of money owed from which Power User and we will be informed when such payment occurs.

External Services

- **Assistance Service**
- Power Enjoy is in charge of the management of the car-sharing system. All the secondary functionalities are handled by an assistance service, which is responsible for:

- Ordinary Maintenance of the vehicles
- Cleaning of the vehicles
- Repairing malfunction vehicles
- Recharging vehicles onsite
- Bringing car back from unsafe areas to safe areas

Domain Assumptions

1. GPS always gives the correct position
2. Every car has an always available GPS.
3. Cars are able to determine the number of passengers currently on board.
4. Cars are able to detect current battery level.
5. Cars are always able to detect and signal to the system if they are malfunctioning. 6. Every car is equipped with an onboard display.
6. Cars with locked door cannot be opened from the outside
7. System knows the car status at any time.
8. The car notifies the system when the engine has been ignited/turned off.
9. The system has remote control of the cars.
10. Every power user can be geolocalized.
11. The set of safe areas and power grid stations is predefined
12. The system knows when a car has been plugged for recharge
13. The system is able to verify user and payment credentials

Domain Assumptions on External Services

- **PS Assumptions**

  1. There exists an third party payment service for processing payments
  2. Every user is registered with a valid payment method to the external payment service.
  3. Payment service notifies as soon as a payment occur

- **AS Assumptions**

  1. AS automatically takes care of fixing malfunctioning cars
  2. AS automatically takes care of recharging of site cars with less than 20% of Battery
  3. AS automatically dispatches employees to bring cars from unsafe areas back to safe areas
  4. AS notifies when car are available again providing, eventually, new location and battery status

Discount Policies

- Shared Ride Discount **-10%**
- More than 50% of the Battery **-20%**
- User recharges car **- 30%**
- Car left with low battery or 3km from Charging Station **+30%**

Discount Policies

- Discounts applied only if car in safe area.
- Shared Ride: 2 passengers for at least the 90% of the Ride lenght.
- Only the Shared Ride Discount is Comulative

Legal Policy

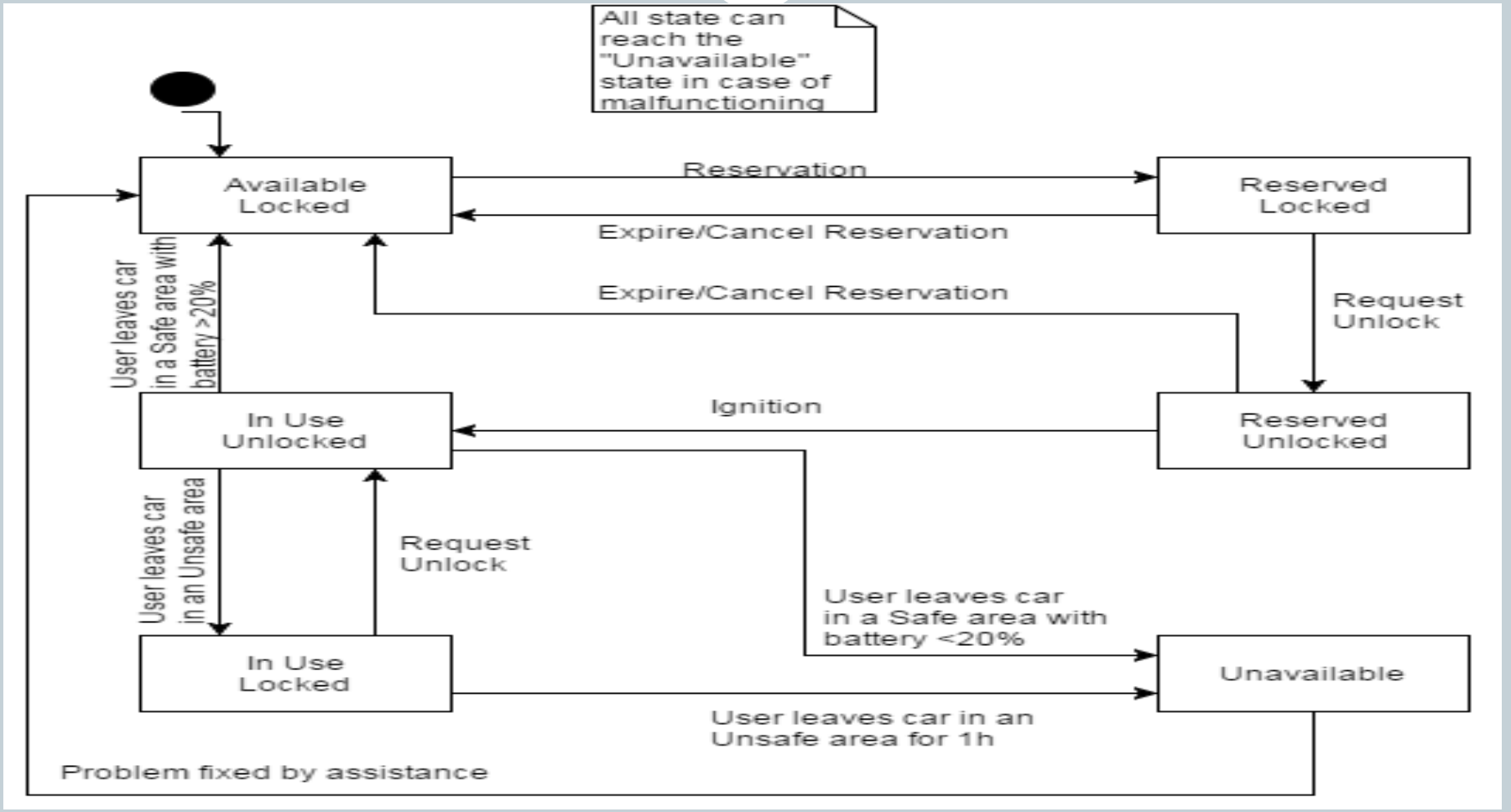
- Power Enjoy doesn't prevent a Power User from delegating some else as the driver.
- The Power User will be held responsible for any possible damage caused.
- Any financial penalties for violation of the legal rules relating to the movement of vehicles will be notified to the Power User who undertakes to pay the fines

Electric Car

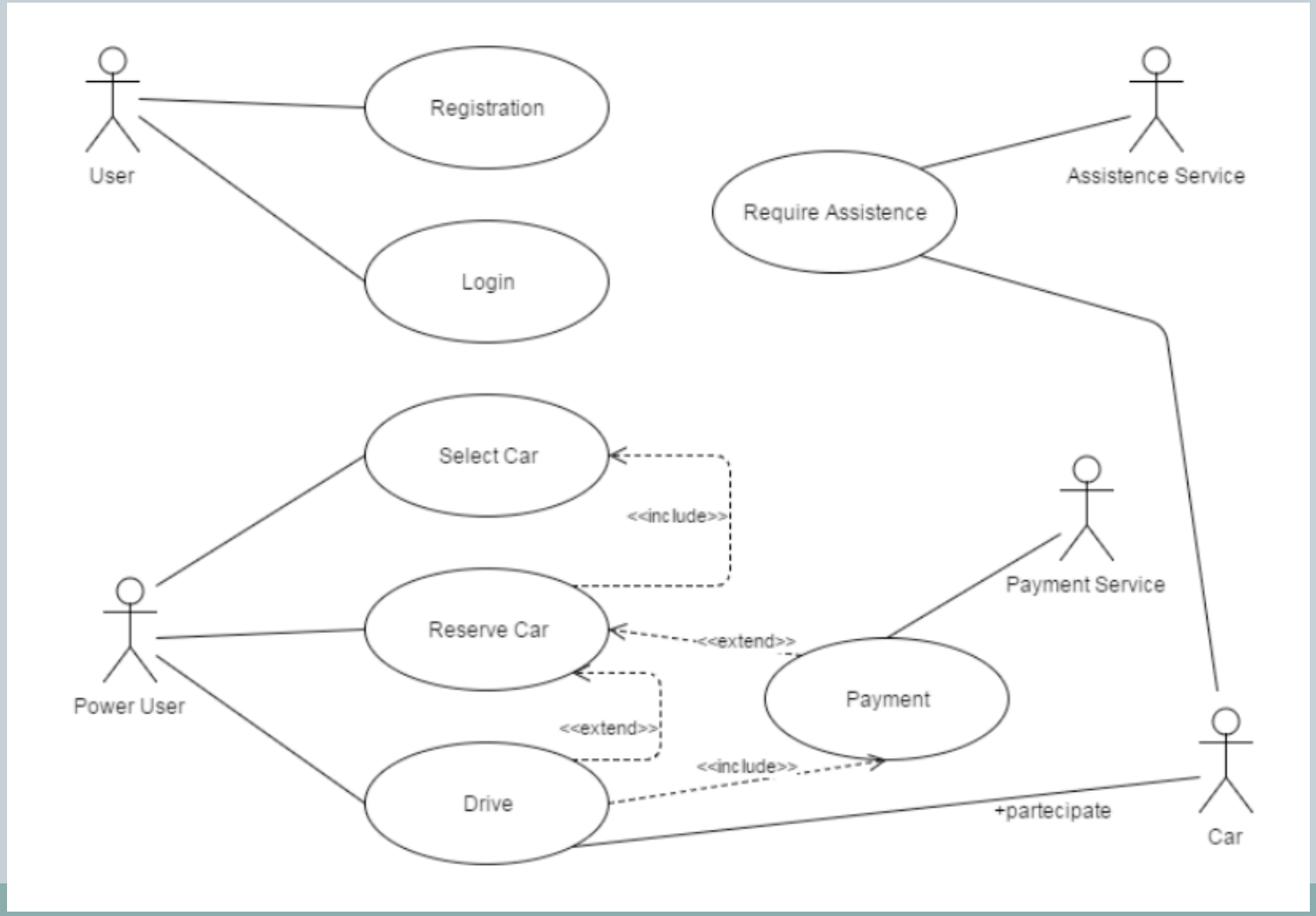
- PowerEnjoy service employs a single model of electric car in the first release, but the system is designed to allow any electric vehicle as long as is provides the minimum functionality needed

- **Weight sensors** to detect the number of people inside
- **Ignition sensors**
- **Battery Level sensors**
- Global Positioning System (GPS)
- Automatic keyless entry
- Remote control
- Lcd touchscreen
- Internet connectivity

Electric Car



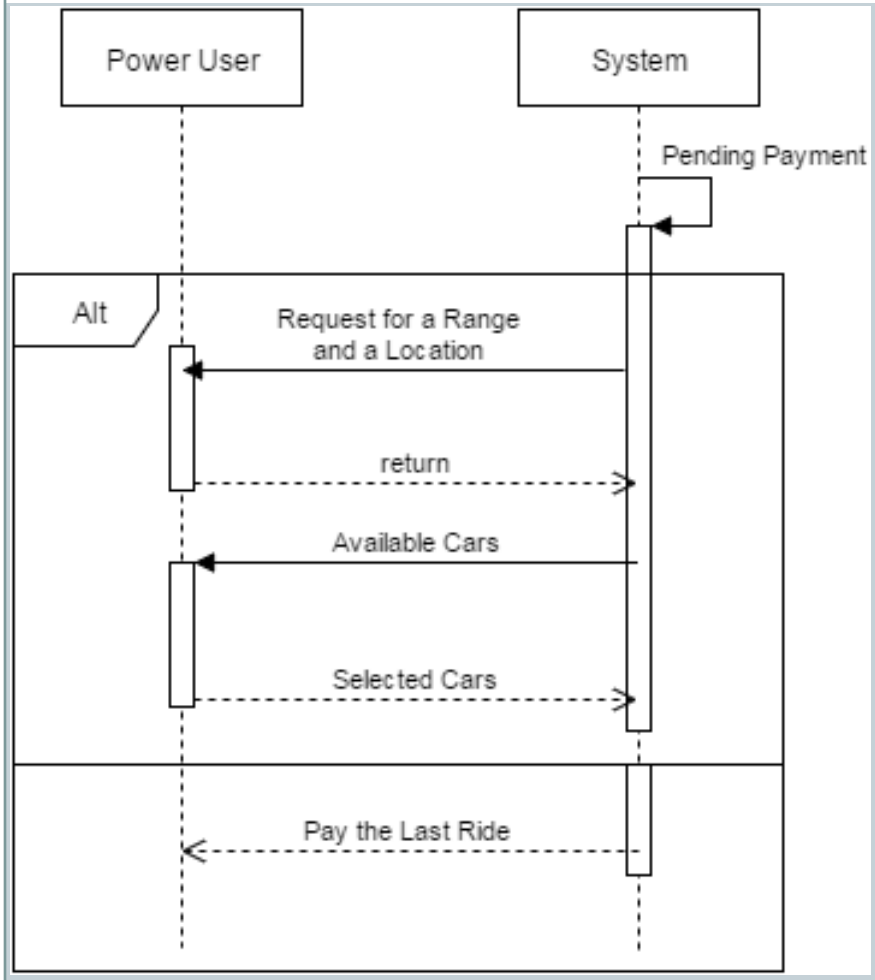
Use Cases

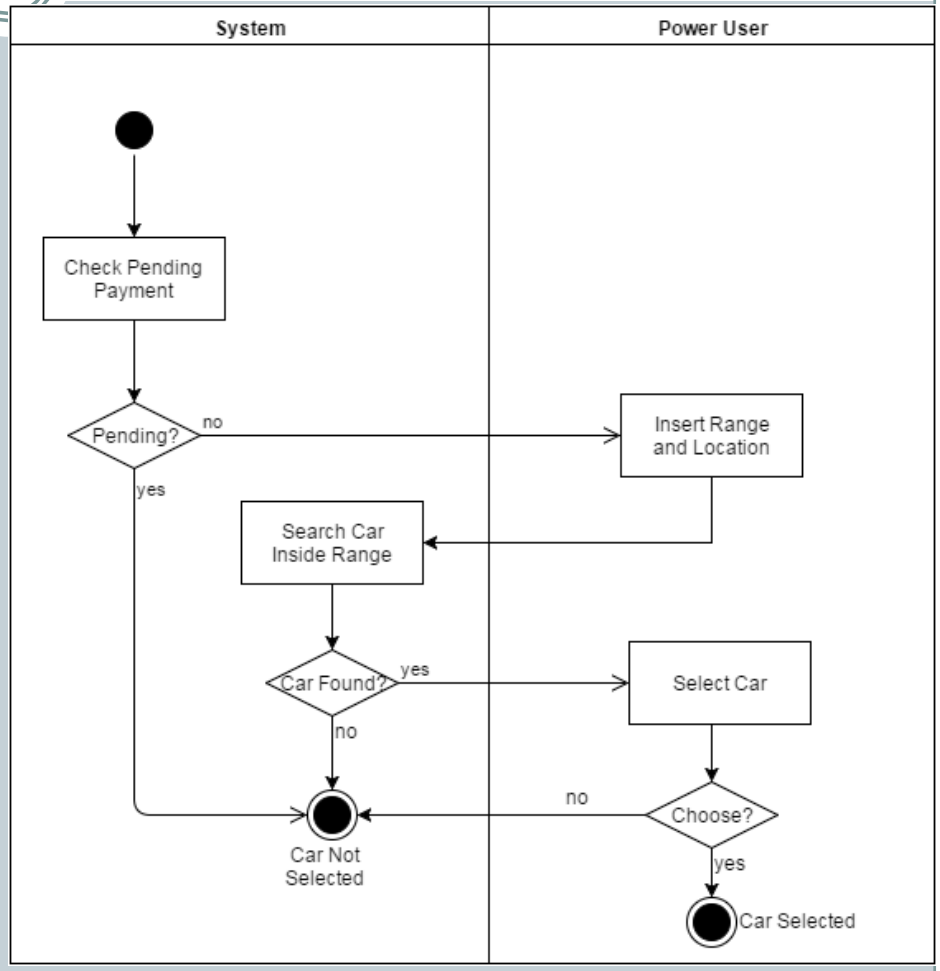

User
Registration
Login
Assistence Service
Require Assistence
Select Car
<<include>>
Reserve Car
<<extend>>
Payment Service
Payment
Power User
<<extend>>
<<include>>
Drive
+partecipate
Car

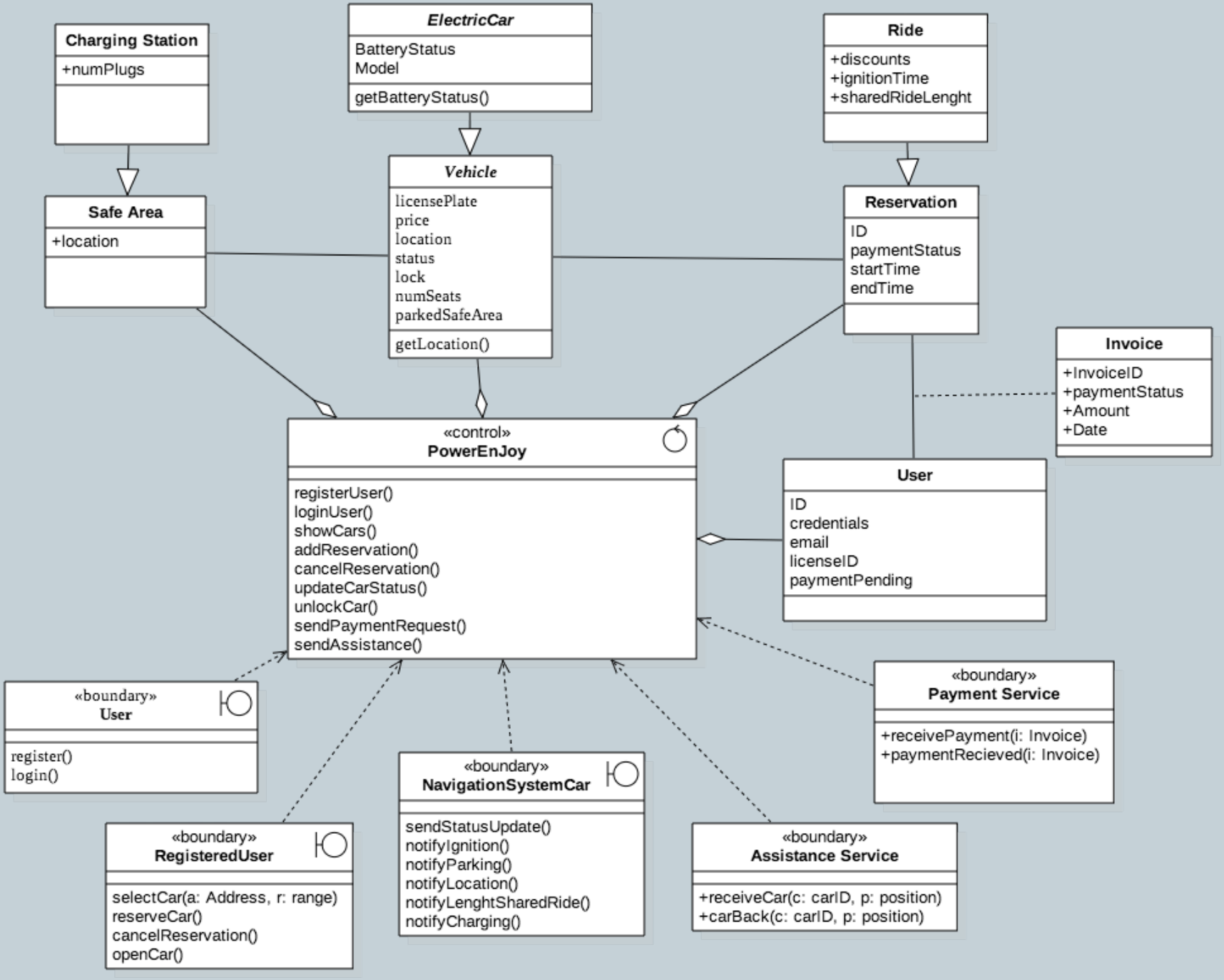
Use Cases

- **3.3 Use Case 3 [UC3]: Select Car**
- Participating Actors:
  - PowerUser
-
- Entry Condition
  - A service requires the user to select a car.
-
- Flow of events
  - The system checks the power user doesn't have pending payments.
  - The system asks the power user to select an address or to provide his gps location and to select a distance range.
  - The power user inputs the required data.
  - The system computes the list of all the available cars within the range from the given location and shows it to the user.
  - The power user is shown for each car the distance from the user given location, the level of battery and whether or not it is charging.
  - The power user selects a specific car and the identifier of the car is given back to the system.
-
- Exit Condition
  - The identifier of the selected car is given back to the system.
  - The power user selects no cars.
-
- Exceptions
  - If no such a car is available no car will be shown to the user.
- If there are pending payment on the power user, the system will ask to pay the debt (UC6)

UML Diagrams






Charging Station
+numPlugs
ElectricCar
BatteryStatus
Model
getBatteryStatus()
Ride
+discounts
+ignitionTime
+sharedRideLenght
Safe Area
+location
Vehicle
licensePlate
price
location
status
lock
numSeats
parkedSafeArea
getLocation()
Reservation
ID
paymentStatus
startTime
endTime
Invoice
+InvoiceID
+paymentStatus
+Amount
+Date
«control»
PowerEnJoy
registerUser()
loginUser()
showCars()
addReservation()
cancelReservation()
updateCarStatus()
unlockCar()
sendPaymentRequest()
sendAssistance()
User
ID
credentials
email
licenseID
paymentPending
«boundary»
User
register()
login()
«boundary»
Payment Service
+receivePayment(i: Invoice)
+paymentRecieved(i: Invoice)
«boundary»
NavigationSystemCar
sendStatusUpdate()
notifyIgnition()
notifyParking()
notifyLocation()
notifyLenghtSharedRide()
notifyCharging()
«boundary»
RegisteredUser
selectCar(a: Address, r: range)
reserveCar()
cancelReservation()
openCar()
«boundary»
Assistance Service
+receiveCar(c: carID, p: position)
+carBack(c: carID, p: position)

Traceability Matrix

- **USER**
- **G1. USER can register to the system with valid credentials**
- DX Every user is registered with a valid payment method to the external payment service.
- DX The system is able to verify user credentials and external payment credentials
- 1. System has a registration mechanism that allow user to insert their credentials
- 2. The system checks for duplicate users
- 3. The system sends a password to access the system

- **G2. Only USER which are registered can login to the system**
- 1. System has a login functionality that allows users to enter their login informations
- 2. If provided information is correct, the system allows the user to access the service.

- **POWER USER**
- **G3. POWER USER can modify its personal informations**
- DX The system is able to verify user credentials and external payment credentials
- 1. System should allow POWER User to modify only their personal credentials
- 2. The system accepts the new credentials after validation

Traceability Matrix

- **G4. POWER USER can see locations and battery levels of available CARs within a specific distance from a location (eg. POWER USER location or specified address)**
- D1. GPS always gives the correct position
- D2. Every car has an always available GPS.
- D4. Cars are able to detect current battery level.
- D8. System knows the car status at any time.
- D11. Every power user can be geolocalized.
- 1. POWER User must be able to specify a position and a distance range
- 2. System must be able to compute the distance between two positions
- 3. System must show a list of the CARs that qualify as "AVAILABLE" and are in the specified range

- **G5. POWER USER can reserve one available CAR.**
- D8. System knows the car status at any time.
- 1. System must allow the user to select a car from the list above
- 2. POWER USER can’t have more than one reservation pending

- **G6. POWER USER can cancel a CAR RESERVATION within an hour before unlocking the car**
- D8. System knows the car status at any time.
- 1. The system should offer an option to the user to cancel the pending reservation
- 2. Reservations expire after one hour

Traceability Matrix

- **G7. POWER USER can unlock his RENTED CAR**
- D1. GPS always gives the correct position
- D2. Every car has an always available GPS.
- D7 Cars with locked doors cannot be opened from the outside
- D8. System knows the car status at any time.
- D10. The system has remote control of the cars.
- D11. Every power user can be geolocalized.
- 1. POWER User must be able to signal he wants the currently rented car to be unlocked
- 2. System should unlock the car only if the POWER USER is within a certain distance

- **G9. POWER USER knows the current RIDE FEE**
- D6 Every car is equipped with an onboard display.
- D9. The system knows when the engine of a car has been ignited.
- D8. System knows the car status at any time.
- 1. The RIDE FEE is computed in real time on a per minute base
- 2. The RIDE FEE for the ride must be constantly displayed in the car
-

Traceability Matrix

- **G10. POWER USER knows the FINAL FEE**
- D2. Every car has an always available GPS.
- D3. Cars are able to determine the number of passengers currently on board.
- D4. Cars are able to detect current battery level.
- D13. The set of safe areas and power grid stations is predefined
- D15. The system knows when a car has been plugged for recharge
- System notify the user of the FINAL FEE
- FINAL FEE will be calculated applying discounts/fines to the RIDE FEE according to the power enjoy discount policy

- **G11. CARs are automatically locked when parked and the POWER USERS gets out**
- D3. Cars are able to determine the number of passengers currently on board.
- D10. The system has remote control of the cars.
- D9. The system knows when the engine of a car has been ignited/turned off.
- D8. System knows the car status at any time.
- 1. The system must lock a car with no passenger inside and engine off.

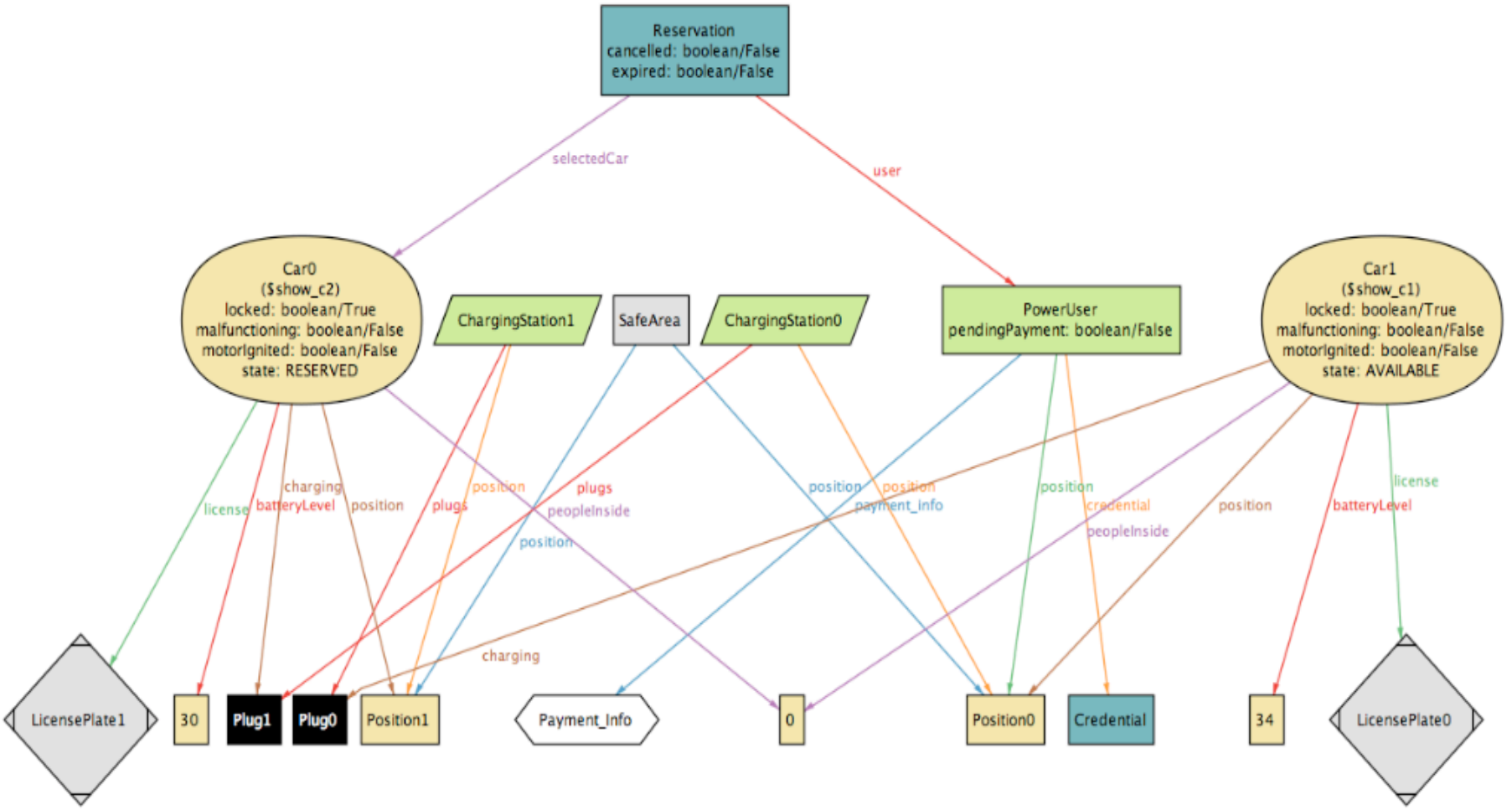
Traceability Matrix

- **Payment**
- **G12. POWER USER with pending payments can't reserve cars**
- D18. Every user is registered with a valid payment method to the external payment service.
- D19. Payment service takes care of the payment process and notifies when the payments occur
- 1. POWER USERS should be prevented from reserving cars if the have pending payments

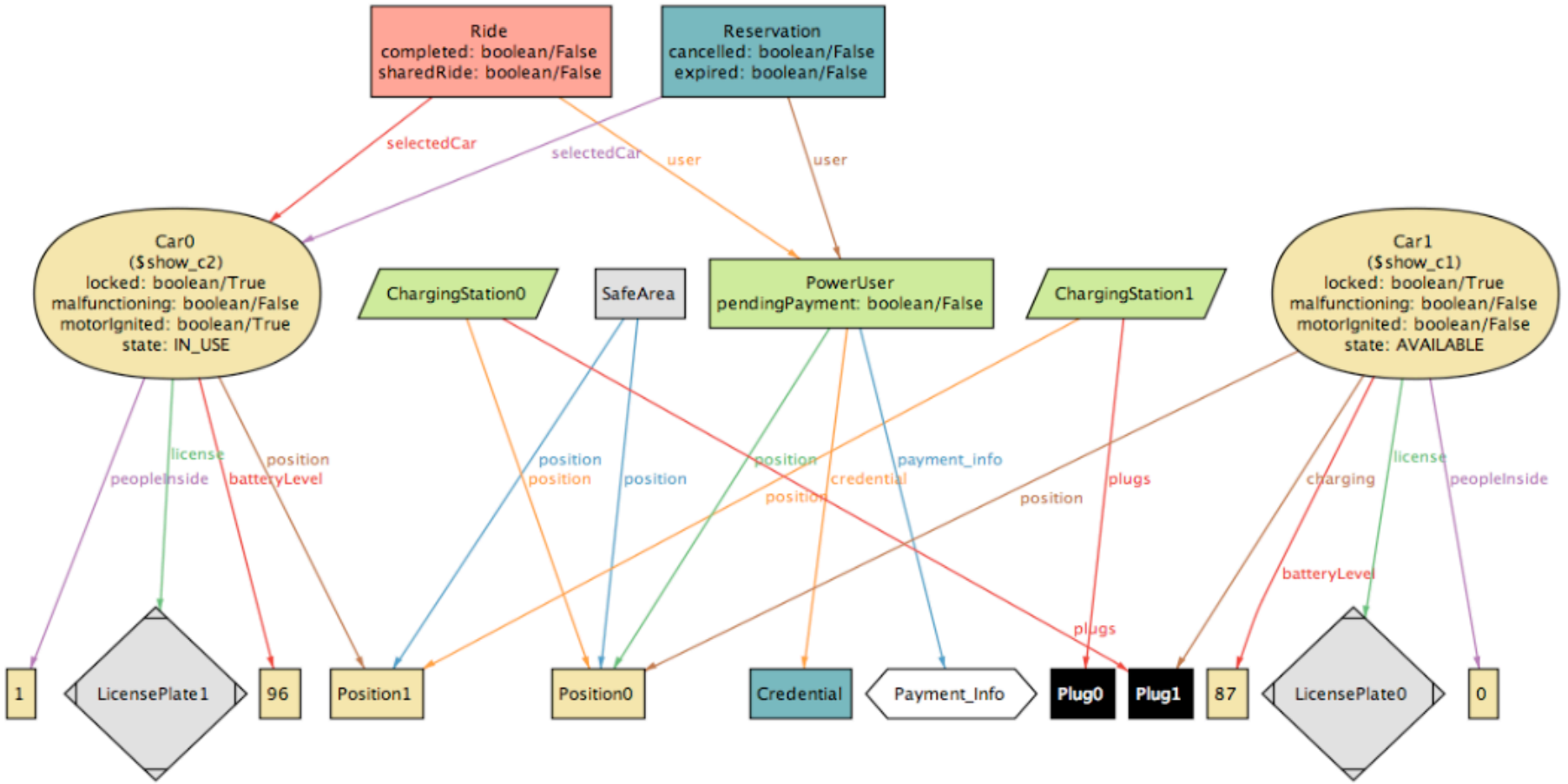
- **G13. POWER USER is charged of the FINAL FEE**
- D19. Payment service takes care of the payment process and notifies when the payments occur
- 1. System should ask the PS to process the POWER USER payment
- 2. System should add a pending payment
- 3. System should notify the user of the pending payment

- **G14. If a car is not picked-up within one hour from the reservation the user pays a FEE of 1 EUR.**
- System should keep track of the reservation time

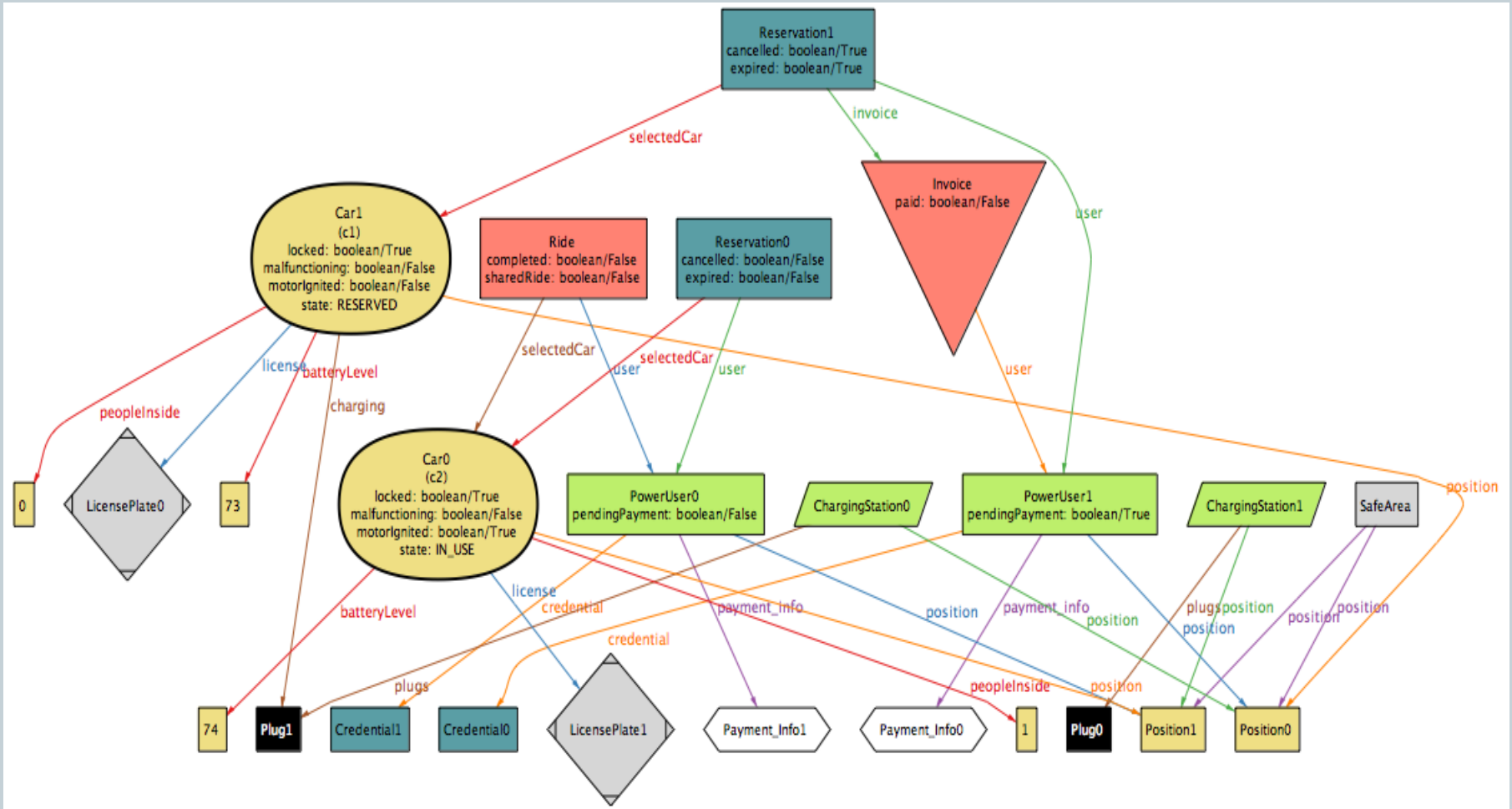
Alloy


Reservation
cancelled: boolean/False
expired: boolean/False
selectedCar
user
Car0
($show_c2)
locked: boolean/True
malfunctioning: boolean/False
motorIgnited: boolean/False
state: RESERVED
ChargingStation1
SafeArea
ChargingStation0
PowerUser
pendingPayment: boolean/False
Car1
($show_c1)
locked: boolean/True
malfunctioning: boolean/False
motorIgnited: boolean/False
state: AVAILABLE
license
charging
batteryLevel
position
plugs
position
plugs
peopleInside
position
position
payment_info
position
credential
peopleInside
position
batteryLevel
license
position
charging
LicensePlate1
30
Plug1
Plug0
Position1
Payment_Info
0
Position0
Credential
34
LicensePlate0

Alloy


Ride
completed: boolean/False
sharedRide: boolean/False
Reservation
cancelled: boolean/False
expired: boolean/False
selectedCar
selectedCar
user
user
Car0
($show_c2)
locked: boolean/True
malfunctioning: boolean/False
motorIgnited: boolean/True
state: IN_USE
ChargingStation0
SafeArea
PowerUser
pendingPayment: boolean/False
ChargingStation1
Car1
($show_c1)
locked: boolean/True
malfunctioning: boolean/False
motorIgnited: boolean/False
state: AVAILABLE
peopleInside
license
batteryLevel
position
position
position
position
position
position
credential
payment_info
plugs
plugs
position
charging
batteryLevel
license
peopleInside
1
LicensePlate1
96
Position1
Position0
Credential
Payment_Info
Plug0
Plug1
87
LicensePlate0
0

Alloy


Reservation1
cancelled: boolean/True
expired: boolean/True
selectedCar
invoice
user
Invoice
paid: boolean/False
Car1
(c1)
locked: boolean/True
malfunctioning: boolean/False
motorIgnited: boolean/False
state: RESERVED
Ride
completed: boolean/False
sharedRide: boolean/False
Reservation0
cancelled: boolean/False
expired: boolean/False
peopleInside
license
batteryLevel
charging
position
0
LicensePlate0
73
Car0
(c2)
locked: boolean/True
malfunctioning: boolean/False
motorIgnited: boolean/True
state: IN_USE
PowerUser0
pendingPayment: boolean/False
ChargingStation0
PowerUser1
pendingPayment: boolean/True
ChargingStation1
SafeArea
credential
payment_info
plugs
74
Plug1
Credential1
Credential0
LicensePlate1
Payment_Info1
Payment_Info0
1
Plug0
Position1
Position0