

Parking Assignment Problem

Software Engineering Lab Report 2

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Professor In-Charge

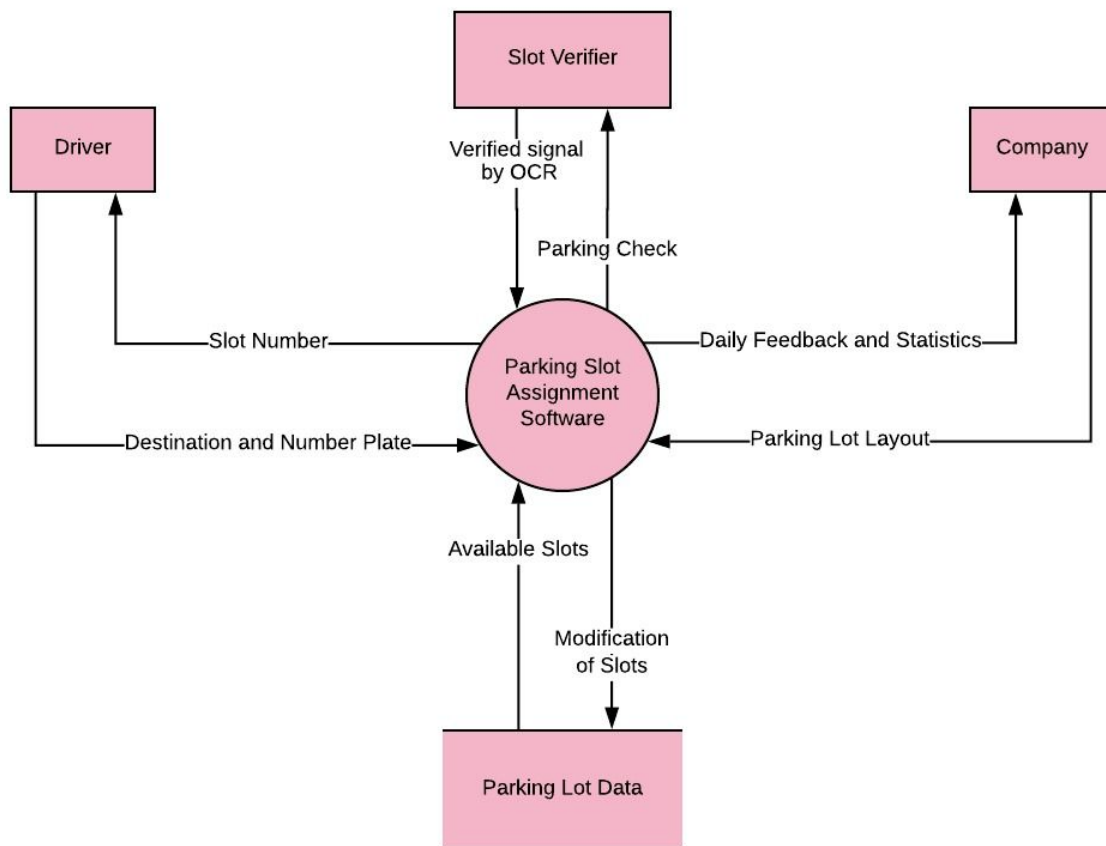
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Context Diagram

Context Diagram

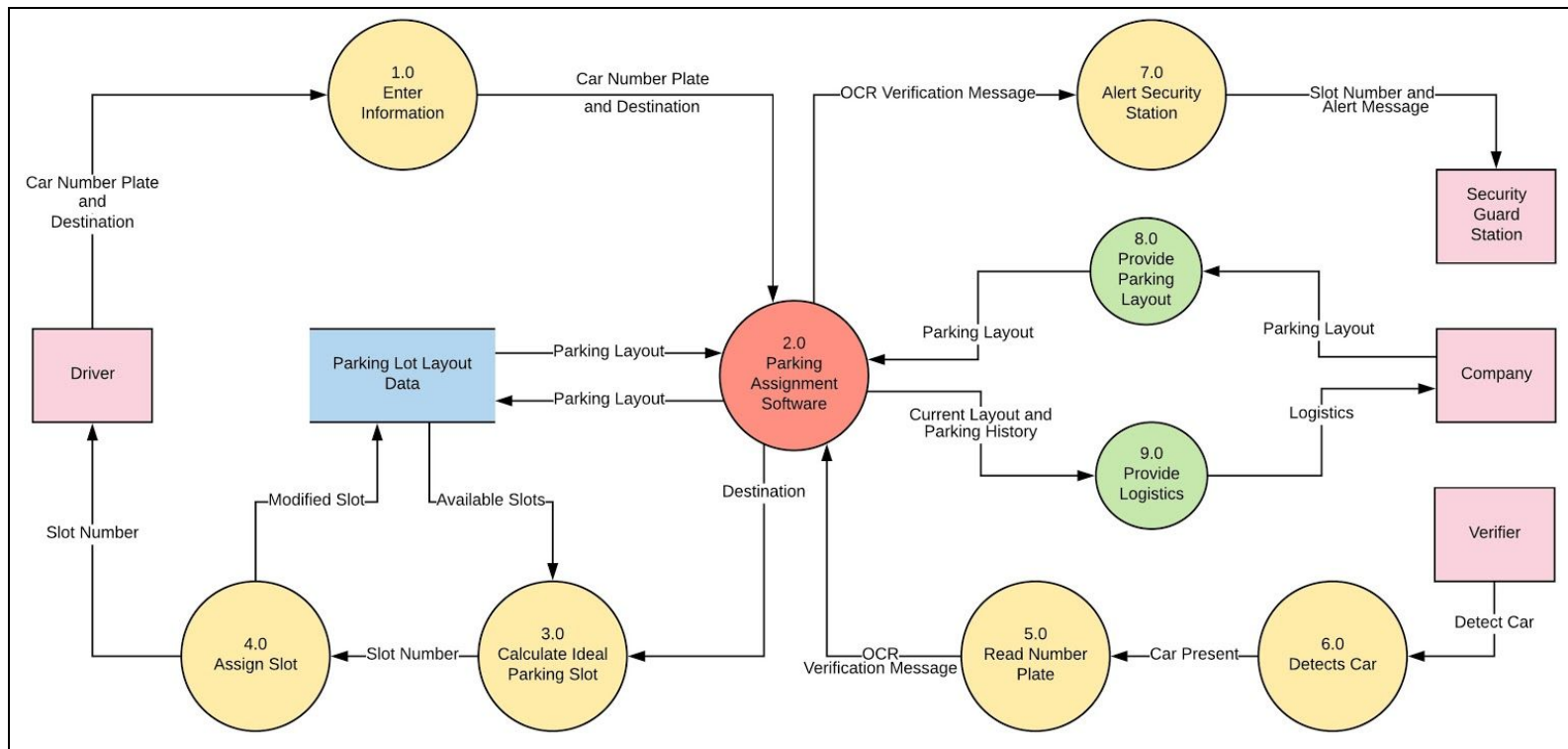


Description of the Entire System

- The first external entity in our system is the **Company**, or in other words the '**Client**' to whom the software has been provided to. The Client provides the '**Parking Slot Assignment Software**', which is the **main process**, the Parking layout. The software, in return at the end of the day provides daily statistics and feedback at the end of the day after performing its tasks.
- '**Parking Lot Data**' is the only **Data Store** in our system. It contains the parking layout provided by the client. It makes the system context-sensitive due to frequent dynamic changes in its data as and when a car parks and/or leaves a parking slot. It interacts with the main process by providing available slots and in return gets modified slots from the software.
- Another important external entity present is the '**Driver**' who is going to park his/her car at the parking lot. They provide the destination and number plate to the main process which processes this information and returns the appropriate slot number back to the driver.
- The last external entity present in the system is the '**Slot Verifier**' which is responsible for verifying whether a driver has parked their car in the right assigned slot with the help of an OCR. It interacts with the main process by communicating this verification information.

Data Flow Diagram

Data Flow Diagram



List of Entities

Entities are the various objects that interact with the process and form the main physical components of this system. Our software has a total of 4 entities who have been listed down below.

E.ID	Entity Name	Description
1	Driver	Owns car and is the entity that requires the slot so as to park their car. Provides number plate and destination for this purpose.
2	Company	The client , i.e , the user of the software. Owns parking lots and wants efficient and systematic solution to the Parking Assignment Problem. Provides parking layout as input.
3	Security Station	Responsible for making sure all cars park at designated parking slot. Alerted by software if inconsistency in parking.
4	Verifier	OCR reader responsible for detecting and reading number plates of cars parking at their slot. Each slot has a verifier. Gives the software the above said number plate information for verification purposes.

List of Data Stores

Data store is basically the database where critical information is stored which is necessary for proper functioning of this system. We have one data store in our system which has been listed down below.

D.ID	Data Store Name	Description
1	Parking Lot Layout	Has the parking slots, numbers, number plate details and destinations.

List of Processes

Processes are the functions that provide necessary functionalities to our system and to our software. They take in input and provide necessary output. Our software has a total of 9 processes, which have been listed down below.

P.ID	Process Name	Description
1	Enter Information	Used to obtain number plate and destination from driver and provides it to the software process.
2	Parking Slot Assignment Software	Responsible for driving all process. Main software process.
3	Calculate Ideal Slot	Calculates ideal parking slot based on destination and available slots
4	Assign Slot	Assigns slot to the driver and updates data store
5	Read Number Plate	Reads number plate of parked car via OCR
6	Detect Car	Checks if car present at slot
7	Alert Security Station	Sends alert signal to security station based on input
8	Provide Parking Layout	Used by company to provide parking layout to the software
9	Provide Logistics	Obtain statistics and logistics from software to provide to company. Tells the number of cars parked, most used sector in lot, most visited destination etc.

List of Data Flows

Data flows show the flow of information between entities, processes and data stores. They are depicted via labelled arrows. Our software have the following data flows.

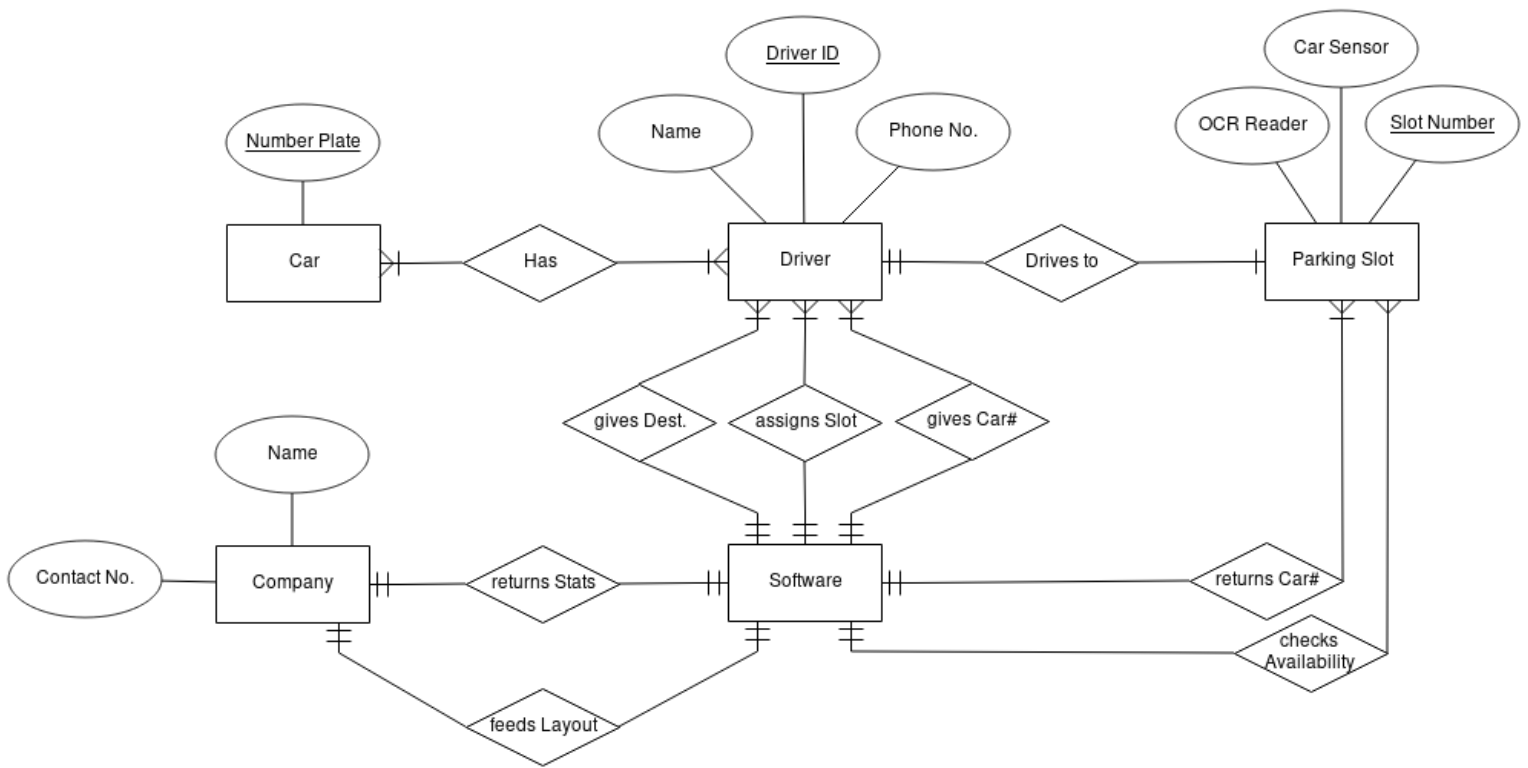
DF.ID	Data Flow	Description
1	Number plate and Destination	Contains the number plate of the car and the destination the driver wants to go to.
2	Destination	Contains the destination the driver wants to go to.
3	Slot Number	Contains the slot number of the slot the software assigned the car to.
4	Parking Layout	Contains the parking layout provided by company.
5	Available Slots	Contains the available slots for parking.
6	Modified Slots	Contains the modified slots for assignment.
7	OCR Verification Message	Contains information of whether the right car has parked at a slot.
8	Logistics	Contains the statistics and logistics the software generated for the company.
9	Detect Car	Contains prompt to check if car is present.
10	Car present	Contains a positive information about car being present at a slot.
11	Slot number and Alert Message	Contains the information about wrong parking and an alert message for security office.
12	Current Layout and History	Contains information from Parking data store.

Entity Relationship Diagram

An entity–relationship model (ER model for short) describes interrelated things of interest in a specific domain of knowledge. An entity–relationship model is usually the result of

systematic analysis to define and describe what is important to processes in an area of a business.

ER - Diagram

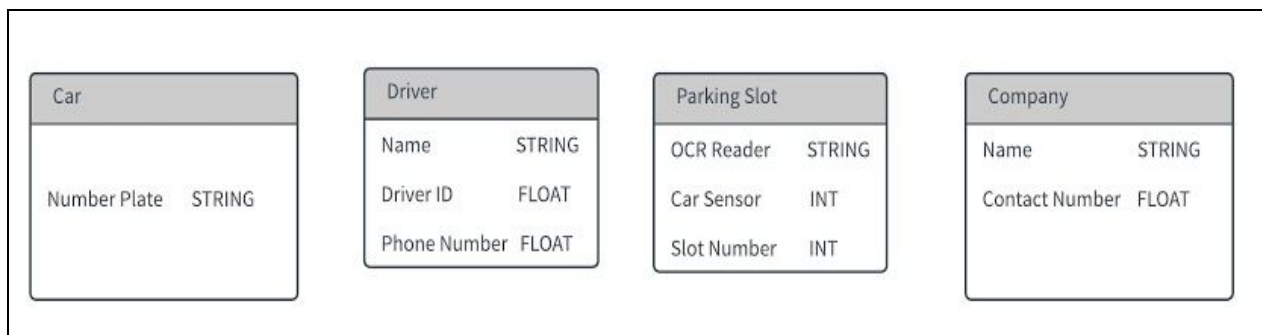


List of Entities and Attributes

ET.ID	Entity	Description	List of Attributes and Type
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1	Car	The car that requires the parking slot.	Number plate (String)
2	Driver	Owns car and is the entity that requires the slot so as to park their car. Provides number plate and destination for this purpose.	Name (String) Driver ID (float) Phone Number (float)
3	Parking Slot	Area allocated for parking cars.	OCR Reader (Char) Car Sensor (int) Slot Number (int)
4	Company	The client , i.e , the user of the software. Owns a parking lot and wants efficient and systematic solution to the Parking Assignment Problem. Provides parking layout as input.	Name (String) Contact Number (float)

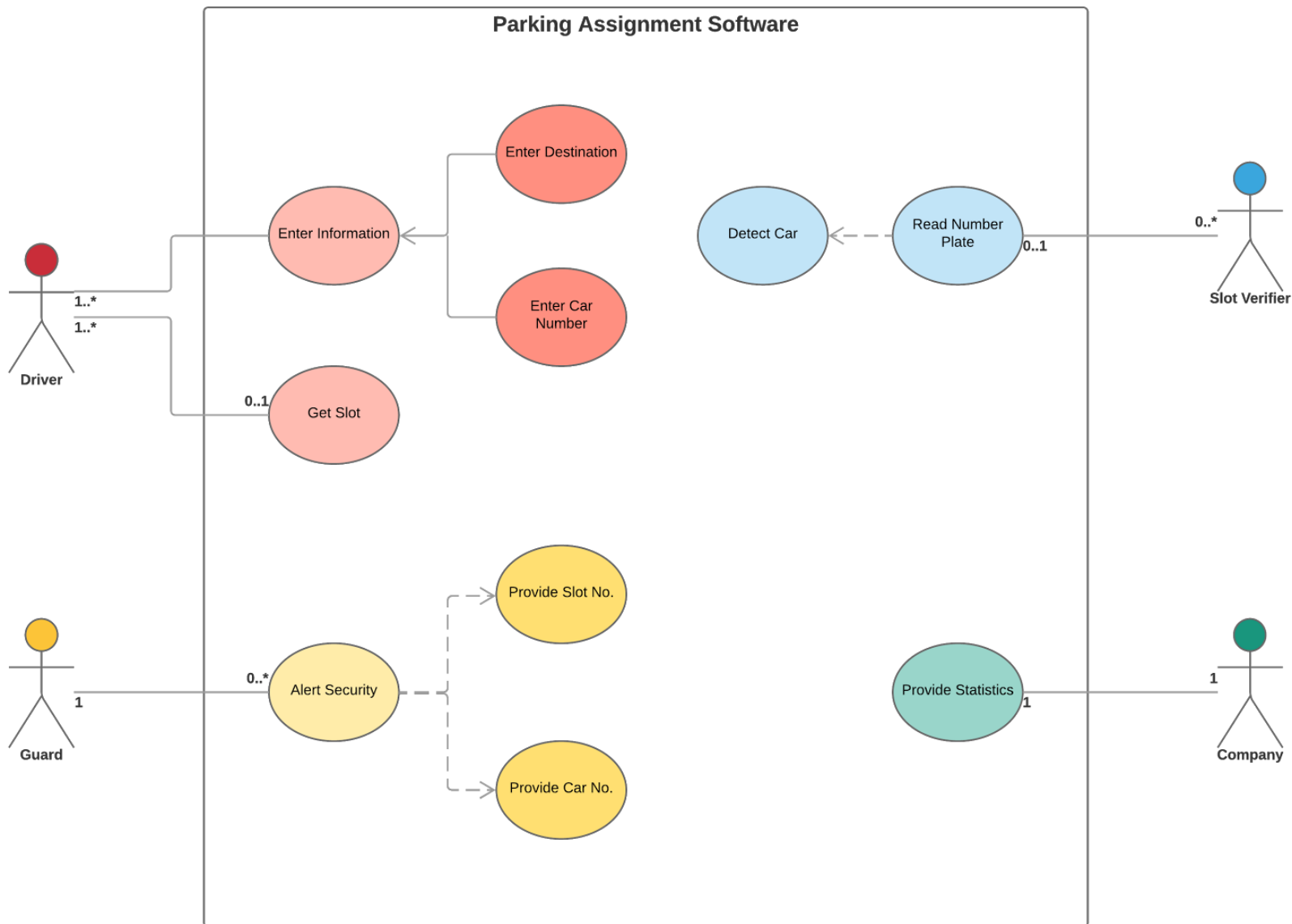
Relational Model



Use Case Diagram

A use case diagram at its simplest is a representation of a user's interaction with the system that shows the relationship between the user and the different use cases in which the user is involved.

Use Case Diagram - Main



List Of Use Cases

A use case is a kind of behavior classifier that specifies a unit of functionality performed by one or more subjects to which the use case applies in collaboration with one or more actors, and which yields an observable result that is of some value to those actors of each subject.

Sl.No	Use Case Name	Description	Pre Conditions	Post Conditions
1	Enter Information	The driver enters his destination and Car Number for the software to log and calculate an ideal slot	A driver needs to be present. The car must have a number plate.	A slot would be allotted based on the information provided.
1.a	Enter Car Number	The Driver enters his Car Number	Same as above	Same as above
1.b	Enter Destination	The Driver enters his destination	Same as above	Same as above
2	Get Slot	The system displays/provides a slip with the allocated slot to the driver.	Driver Information needs to be provided.	The allotted slot would now be closed to other drivers.
3	Alert Security	The software alerts a guard to penalize drivers of cars that are parked in unallocated slots/ violating parking rules.	The car must be parked in a wrong slot.	The system modifies its layout depending on the action taken. The driver is fined.
3.a	Provide Slot No	The software provides the guard with the slot no. under scrutiny	Same as above	Same as above
3.b	Provide Car No	The software provides the guard with the Car No. to be penalized	Same as above	Same as above
4	Read Number Plate	The OCR reads the number plate at its parking slot and returns it to the system.	A car must be present at a slot.	The software confirms the presence of the car in its allocated spot.
4.a	Detect Car	The hardware must first detect the car for the OCR to be activated	Same as above	Same as above
5	Provide Statistics	The software uses its logged data and prepares	A set period of time must have	The software may be asked to

		a report with useful information for the client.	elapsed for collection of data.	clear its logs for new information and statistics.
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List of Actors

An actor is behavior classifier which specifies a role played by an external entity that interacts with the subject (e.g., by exchanging signals and data), a human user of the designed system, some other system or hardware using services of the subject.

SI No	Actor Name	Description
1	Driver	The actor that wants to park a car in some layout. The driver has a specific destination and must have a car with an unique number plate.
2	Guard	The actor that would enact punishment and penalties on drivers that do not park in allocated slots and/or break traffic rules.
3	Slot Verifier	The hardware that would detect cars and recognize number plates. It returns the values to the software which then confirms the presence of the car in question.
4	Company	The Software's client who would periodically receive performance statistics and logged information.

List Of Associations, Generalizations & Relationships

SI No.	Association	Type	Description
1	Driver to Enter Information	Association	The Driver interacts with the software to enter his details

2	Enter Information to Enter Destination	Generalization	The Enter Information use case is a generalization of Enter Destination and Enter Car Number.
3	Enter Information To Enter Car Number	Generalization	The Enter Information use case is a generalization of Enter Destination and Enter Car Number.
4	Driver To Get Slot	Association	The driver receives his allocated slot through a display or some slip.
5	Guard To Alert Security	Association	The guard is alerted of wrongly parked cars and is expected to penalize these cars.
6	Alert Security To Provide Slot Number	Include	Under Alert Security, the guard must be provided with the Slot where the car was wrongly parked
7	Alert Security To Provide Car Number	Include	Under Alert Security, the guard must be provided with the Car number of the wrongly parked car.
8	Slot Verifier To Read Number Plate	Association	The Slot verifier reads the number plate of the car.
9	Read Number plate To Detect Car	Include	The car must be detected first to read the number plate. So Read Number Plate must include car detection.
10	Company to Provide Statistics	Association	The company receives parking statistics from the software.

Summary

In this report, we have represented our software through various software domain models: Context diagram , Data flow diagram, Entity Relationship diagram and Use case diagram. We have described, in detail, every attribute of the diagram and, consequently, our proposed software.

A Context diagram represents the high level view of the software. It allows us to get a gist of how the software would interact with various entities. It does not divulge into the details of the software and its processes.

A Data flow diagram allows us to understand how the software would process, store and move the data provided to it. It gives us a deeper sense of how the would handle processes and information.

An entity relationship diagram describes how the software would interact with various entities that are in the software's environment. It describes in detail where the software would get its data and from whom.

A use case diagram is a high level representation of how various actors would interact with the software. It does not describe how the interaction would occur but merely states that an interaction can occur. It describes how the software can be used by various actors.

Thus, after representing our software through various software domain models, a clear picture of how the software would work is painted.