Kingdom of Saudi Arabia Ministry of Education Umm Al-Qura University



المملكة العربية السعودية وزارة التعليم جامعة أم القرى ۲۲۰

Software Design & Construction 1 (Group Project)

Green Zone Monitoring System

Group members:

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Section: 3

Supervised by:

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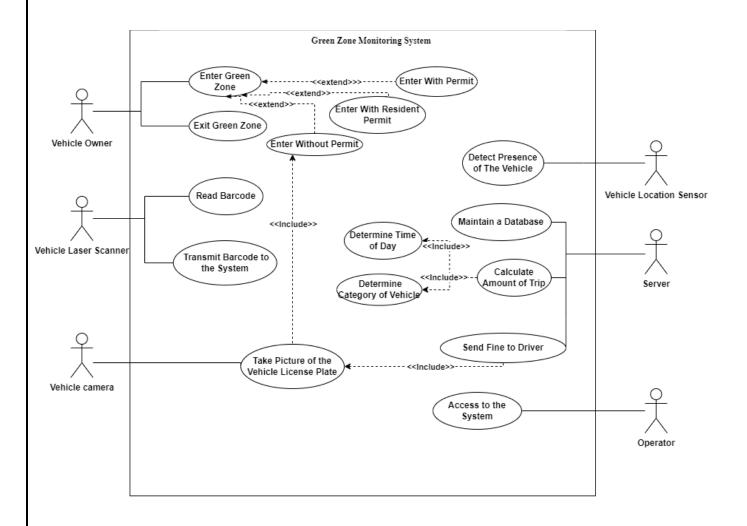
Objective:

This group project involves applying software design principles to a real-world scenario of a Green Zone Monitoring System.

Consider the following scenario:

A modern city has decided to create a green zone. The green zone is an area in the center of the city in which there is restricted access by motor vehicles. Vehicles (such as cars and trucks) are only allowed to enter the green zone if they have a green zone permit. The permit number is encoded on a bar code sticker, which is displayed on the windshield of the vehicle. When the vehicle enters the green zone, a remote laser scanner reads the barcode permit number and transmits it to the Green Zone Monitoring System. When the car leaves the zone, its bar code is also scanned and sent to the system. The system maintains a database of pre-paid green zone permits, from which the owner of the vehicle is billed for each trip and for the duration of the trip. There is a maximum charge for each day. The amount billed varies by time of day: peak-time, off-peak and night, and vehicle category, such as car, SUV, truck, taxi, bus, etc... The amount is deducted from the pre-paid green zone account at the end of each green zone trip. A person that resides in the Green Zone and has a vehicle registered in the same address needs to apply for a resident permit, which allows unrestricted access into and out of the Green Zone. If the car does not have a green zone permit, then a video camera takes a picture of the vehicle license plate. From an external vehicle license database, the address of the vehicle owner is determined and a fine is sent to the driver. The system includes an automated vehicle license recognition capability, which decodes vehicle license photographs taken by the vehicle camera. The system is also accessed by Green Zone operators who may view information about green zone permits and accounts, green zone trips, monitoring points, and vehicle fines. The order of the sensors at the green zone entry and exit points is vehicle location sensor (which detects the presence of the vehicle), vehicle laser scanner, and vehicle camera. For the software design (design model), you may assume that each of these sensors is asynchronous. You may assume that there is a microcomputer at each entry point and each exit point, to which are connected the vehicle location sensor, vehicle laser scanner, and vehicle camera. You may also assume that there is one centralized server, which stores all the system information in a database.

1) Develop a Use Case Model, consisting of a description of the actors and use cases that fully define the system. Each use case is described in terms of the actors and their interactions with the system.



Use Case Name	Enter Green Zone
Summary	Owner enters the green zone.
Actors	Vehicle Owner

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Use Case Name	Enter with Permit
Summary	Owner enters the green zone with permit.
Actors	Vehicle Owner

Use Case Name	Enter with Resident Permit
Summary	Owner enters the green zone with resident permit.
Actors	Vehicle Owner

Use Case Name	Enter without Permit
Summary	Owner enters the Green Zone without Permit.
Actors	Vehicle Owner

Use Case Name	Exit Green Zone
Summary	Owner exits the Green Zone.
Actors	Vehicle Owner

Use Case Name	Read Barcode
Summary	Vehicle laser scanner reads barcode.
Actors	Vehicle Laser Scanner

Use Case Name	Transmit Barcode to the System
Summary	Vehicle laser scanner transmits barcode to the system.
Actors	Vehicle Laser Scanner

Use Case Name	Take Picture of the Vehicle License Plate
Summary	Vehicle camera take picture of the vehicle license plate
Actors	Vehicle Camera

Use Case Name	Detect Presence of The Vehicle
Summary	Vehicle location sensor detects presence of the vehicle.
Actors	Vehicle Location Sensor

Use Case Name	Maintain a Database
Summary	Server maintains a database
Actors	Server

Use Case Name	Calculate Amount of Trip
Summary	Server calculates amount of trip.
Actors	Server

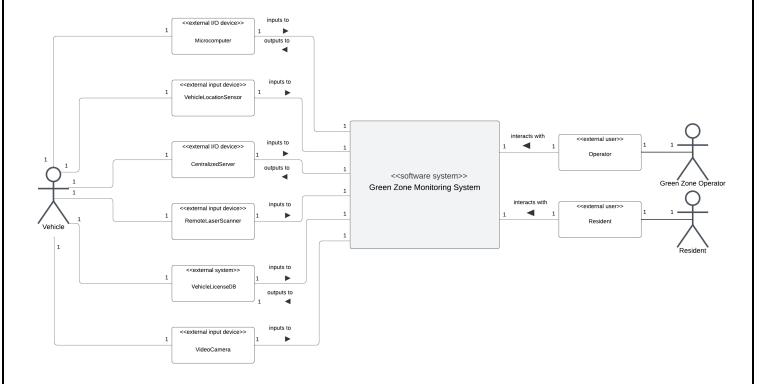
Use Case Name	Determine Time of Day
Summary	Server determine time of day.
Actors	Server

Use Case Name	Determine Category of Vehicle
Summary	Server determine category of vehicle.
Actors	Server

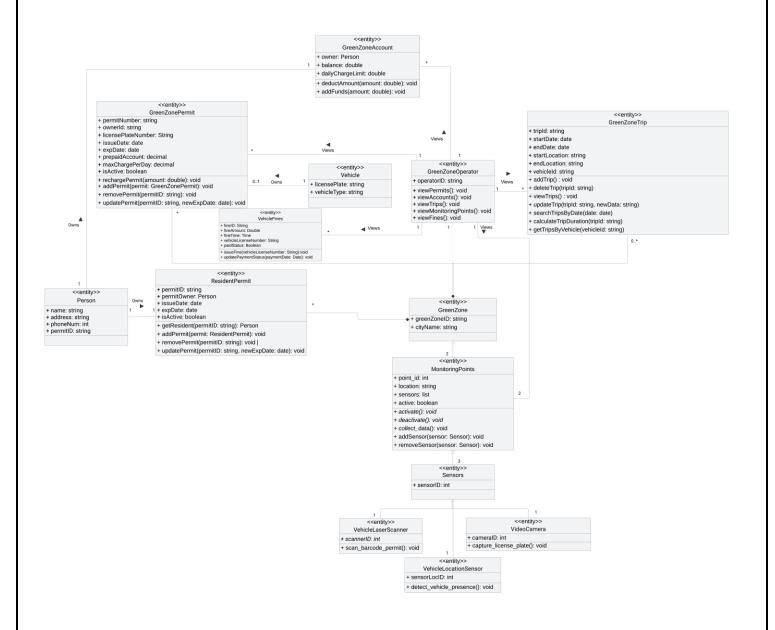
Use Case Name	Send Fine to Driver
Summary	Server sends fine to driver.
Actors	Server

Use Case Name	Access to the System
Summary	Operator access to the system.
Actors	Operator

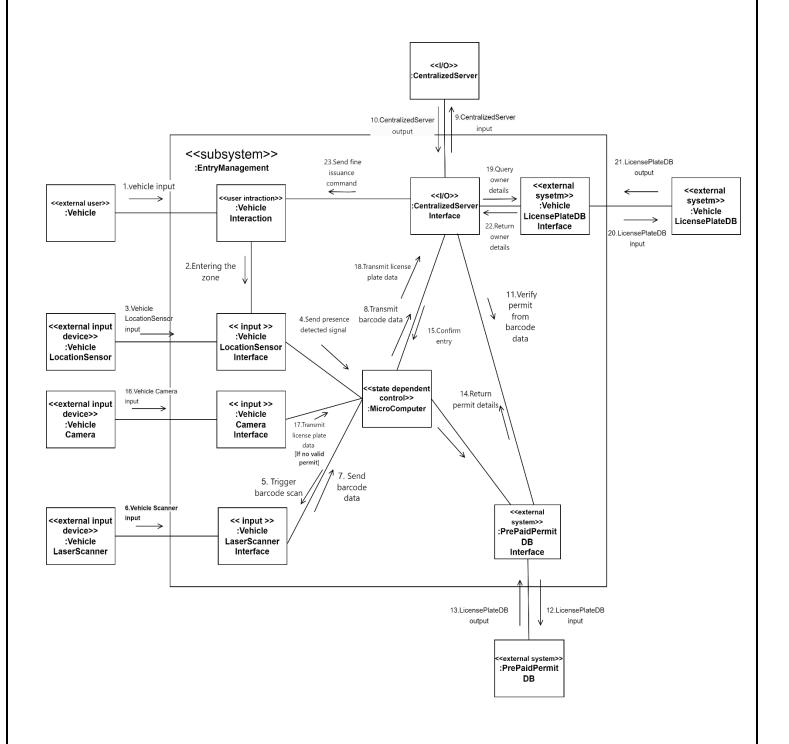
2) Develop a System Context Class Model depicted on a class diagram showing how the system interfaces to the external environment.

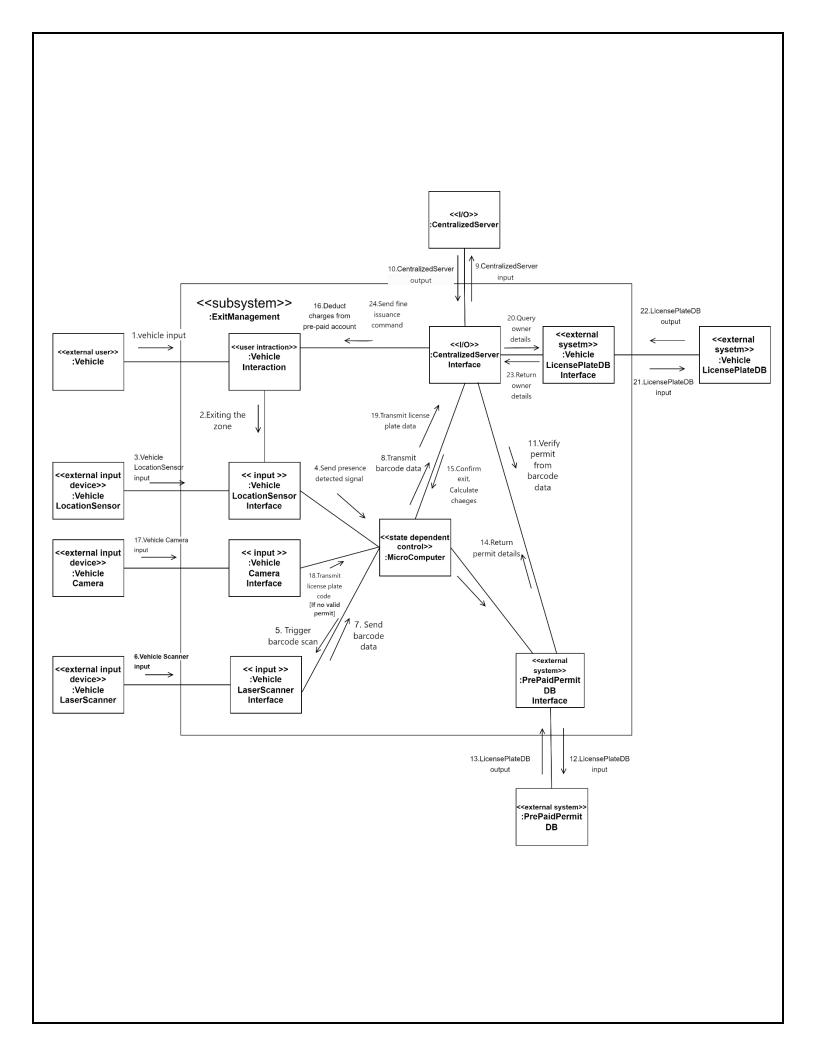


3) Develop a static model showing the classes in the system, attributes and operations of the classes, and the relationships between them.

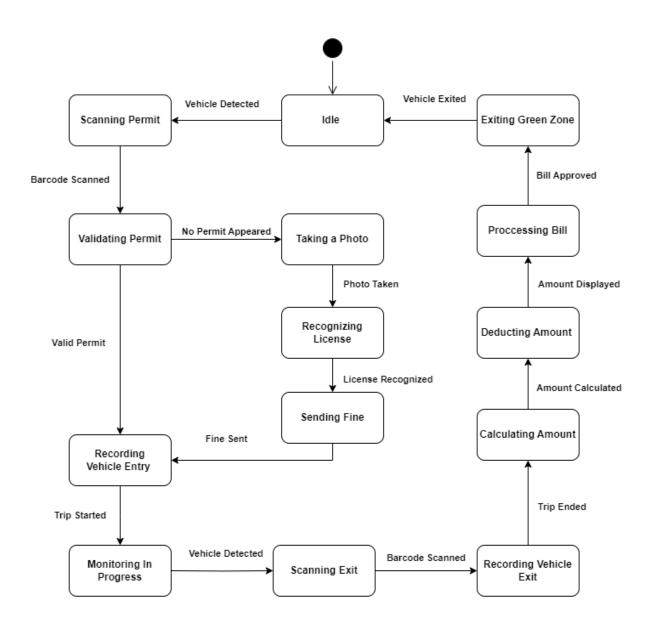


4) Develop an integrated Communication Diagram depicting interactions among the objects participating in use cases.



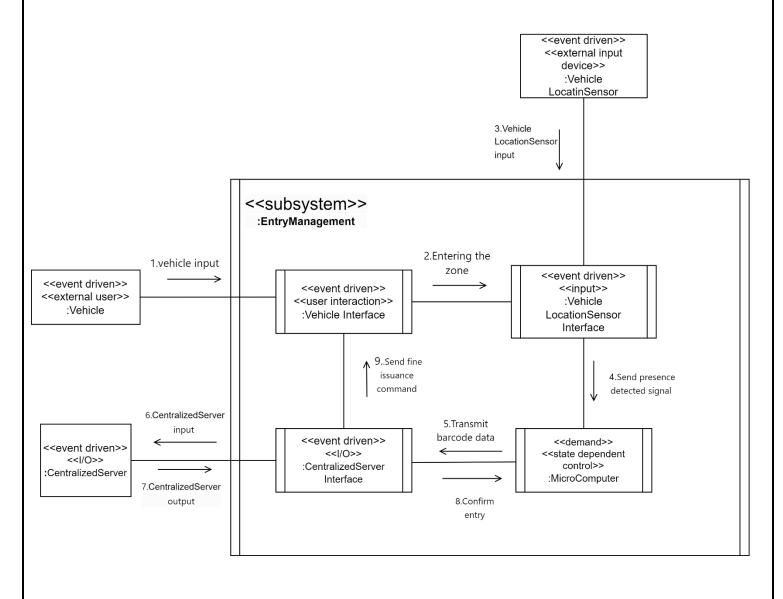


5) Develop a statechart for use cases involving entering and leaving the green zone. Make sure that statechart is consistent with the appropriate interaction diagram.



6) Develop a task architecture (depicted on concurrent communication diagrams) showing the concurrent tasks in subsystems and the interfaces between them. Define the message communication interfaces.

- Entry Management Subsystem:



Exit Management Subsystem: <<event driven>> <<external input device>> :Vehicle LocatinSensor 3.Vehicle LocationSensor input <<subsystem>> :ExitManagement 2.Exiting the 1.vehicle input zone <<event driven>> <<event driven>> <<event driven>> <<input>> <<external user>> <<user interaction>> :Vehicle :Vehicle :Vehicle Interface LocationSensor Interface 10.Send fine issuance 4.Send presence commanddetected signal 6.CentralizedServer 5.Transmit input barcode data <<event driven>> <<demand>> <<event driven>> <<|/0>> <<state dependent <<I/O>> control>> :CentralizedServer :CentralizedServer :MicroComputer Interface 7.CentralizedServer 8.Confirm 9.Deduct charges output exit,Calculate from pre-paid Charges account

User Interface Subsystem: <<Passive>> <<external sysetm>> :Vehicle LicensePlateDB 7.LicensePlateDB 6.LicensePlateDB output input <<Passive>><<external <<subsystem>> sysetm>> :UserInterface :Vehicle LicensePlateDB Interface 5.Fetching License Plate detiles 8.Return detiles 3.CentralizedServer input 2.Request view the License Plates <<event driven>> <<event driven>> <<event driven>> <<I/O>> <<I/O>> <<user interaction>> :CentralizedServer :CentralizedServer :Operator Interface Interface 9. License Plates data 4.CentralizedServer output 10.Display 1.Operator data input <<event driven>> <<external user>> :Operator

Database Management Subsystem: <<Passive>> <<external sysetm>> :Vehicle LicensePlateDB 8.LicensePlateDB 7.LicensePlateDB output input <<Passive>> <<subsystem>> <<external sysetm>> :DatabaseManagement :Vehicle LicensePlateDB Interface 6.Fetching License Plate details 9.Return detiles 10.CentralizedServer 5.Return permit output details <<event driven>> <<Passive>> <<event driven>> <<I/0>> <<external sysetm>> <<I/0>> :CentralizedServer :PrePaidPermitDB :CentralizedServer Interface Interface 2.Verify permit from 1.CentralizedServer barcode data input 3.PrePaidPermitDB 4.PrePaidPermitDB input output <<Passive>> <<external sysetm>> :PrePaidPermit DB