AUTOMOBILE PRUDENT SYSTEM

CLASS MODELING

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List of Domain Terms:

Automobile, accident, safety, vehicle, two-wheeler, brake, four-wheeler, passengers, acquaintance, injury, seat-belt, helmet, maintenance, mobile safety application, speedometer, circuit, odometer, location, speed-breaker, pillion-rider, level detector, traffic-signal , driver, zebra crossing, ignition, Antilock breaking system, User, airbag system, tyre, Global Positioning System, Rear View Camera, alcohol sensor, road safety helpline, accelerator, insurance company, insurance, Ambulance, Heartbeat Sensor, Traffic Police, Service Provider, Central lock system, GSM module. Accident detector, Sensor

Step 1: Finding Classes by extracting nouns from the list of domain terms as-well-as using a category list:

Automobile, Vehicle, Two-wheeler, Brake, Four-wheeler, Passengers, Acquaintance, Seat-belt, Helmet, Speedometer, Mobile safety application, Circuit, Odometer, Speed breaker, Pillion rider, Level detector, Traffic signal, Driver, Ignition, Antilock breaking system, User, Airbag system, tyre, Global Positioning System, Rear View Camera, alcohol sensor, Accelerator, Insurance, Ambulance, Heartbeat sensor, Traffic Police, Service Provider, Central lock system, GSM module, Location. Accident detector, Sensor

Step 2: Refining the above list by eliminating spurious classes:

Automobile, Two-wheeler, Four-wheeler, Acquaintance, Helmet Sensor, Mobile safety application, Circuit, Level detector, Driver, Ignition, User, Airbag system, Alcohol Sensor, Heartbeat Sensor, Service Provider, GSM Module, Location. Accident detector, Sensor

Step 3: Preparation of Data Dictionary:

- **Automobile –** Consists of the technical specifications of the automobile. Has an in-built GSM module and a circuit. Driver can start the automobile and reach the destination.
- **Two-wheeler -** Consists of the technical specifications of the two-wheeler.
- **Four-wheeler -** Consists of the technical specifications of the four-wheeler.
- **Acquaintance –** Related to the driver. A user of the system.
- **Sensor -** Triggers the circuit to start/stop the ignition depending upon the situation.
- **Helmet Sensor –** Triggers the ignition of the two-wheeler. Gets activated/de-activated depending upon the state of the helmet.
- **Alcohol Sensor –** Triggers the stoppage of the vehicle in-case the driver is intoxicated. Gets activated/de-activated depending upon the state of the driver.
- **Heartbeat Sensor –** Trigger the ignition of the four-wheeler. Gets activated when the driver wears the seatbelt properly.
- **GSM Module –** Tracks the location of the vehicle. It is built-onto the automobile during the manufacturing process.
- **Ignition –** Holds the state of ignition of the vehicle. Can be triggered using the keys as-well-as the mobile safety application.

- **Level Detector –** Detects an accident. It triggers the circuit when the skid angle crosses the threshold, which in-turn informs the app to send a notification.
- **Airbag System –** Detects an accident. It triggers the circuit when the airbags get ejected, which in-turn informs the app to send a notification.
- **Accident Detector -** Detects an accident when the parameters of the vehicle cross the threshold
- **User –** Makes use of the functionalities provided by the system.
- **Circuit –** Stimulates the ignition of the vehicle depending upon the state of the sensors. Sends notification to the driver's acquaintances depending upon the state of the level detector/ airbag system.
- **Service Provider –** A user of the system. Deals with the service of the vehicles whenever requested by the driver. Updates the status of the service and generates bill when its over.
- **Location –** Indicates the position of the vehicle.
- **Driver –** A user of the system. Has the ability to start/stop the vehicle.
- **Mobile safety application –** Integrates the entire system. Tracks the location of the vehicle. Driver/Acquaintances can send notifications to helpline workers in-case of an emergency. Driver can fix the date of service of his vehicle. Service Provider can update the service status as-well-as generate the bill when its over. Consists of a built-in payment system.

Step 4: Finding associations-using relationships that are verbs

- Application **Tracks** Automobile
- Application **Tracks** Two-wheeler
- Application **Tracks** four-wheeler
- Circuit **Stimulates** Ignition
- Circuit **Monitors** GSM Module
- Sensor **Triggers** Circuit
- GSM Module **Pings** Driver's Acquaintance
- Driver **Drives** Automobile
- User **Utilizes** Application
- Driver **Utilizes** Application
- Service Provider **Utilizes** Application
- Driver's Acquaintance **Utilizes** Application
- Service Provider **Assists** Driver
- Driver **ContactedBy** Driver's Acquaintance
- Service Provider **Services** Automobile
- Level Detector **Signals** Circuit
- Airbag System **Signals** Circuit
- GSM Module **Locates** Location
- Level Detector **Reports** GSM Module
- Airbag System **Reports** GSM Module
- Driver's Acquaintance **Receives** Location
- Sensor **Activates/Deactivates** Ignition
- Automobile **ConsistsOf** Ignition **(Composition)**
- Circuit **Notifies** Driver's Acquaintance
- Level Detector **Informs** Ignition
- Airbag System **Informs** Ignition

Step 5: Refining associations by eliminating spurious associations:

ASSOCIATION	DESCRIPTION
Application **Tracks** Automobile	Application tracks the state of the automobile at each and every instant of time.
Circuit **Stimulates** Ignition	Circuit stimulates the ignition depending on the state of the sensors and detectors.
Sensor **Triggers** Circuit	Sensors trigger the circuit depending on whether they are activated or deactivated.
GSM Module **Pings** Driver's Acquaintance	In case of an accident GSM Module pings the driver's acquaintances.
User **Utilizes** Application	User makes use of the functionalities provided by the system with the help of the application.
Service Provider **Assists** Driver	When driver's vehicle is in need of service, the service provider assists him.
Driver **ContactedBy** Driver's Acquaintance	In case of an accident the driver's acquaintances get notified as they are related to the driver.
Airbag System **Signals** Circuit	Airbag System Signals Circuit depending upon its state.
Level Detector **Signals** Circuit	Level Detector Signals Circuit depending upon its state.
Level Detector **Reports** GSM Module	Level Detector Reports GSM Module when the parameters of the vehicle cross the threshold.

Airbag System **Reports** GSM Module	Airbag System Reports GSM Module when the parameters of the vehicle cross the threshold.
Automobile **ConsistsOf** Ignition	Ignition is a part of the automobile and it can't independently exist without it.
GSM Module **Locates** Location	GSM Module Locates Location at every instant of time and notifies the driver's acquaintance in case of an accident.

Reasons for eliminating spurious associations:

ASSOCIATION	REASON
Application **Tracks** Two-wheeler Application **Tracks** four-wheeler	Removed as Two-wheeler and Four-wheeler classes can be generalized to an Automobile class.
Circuit **Monitors** GSM Module	Redundant as the circuit indirectly achieves this functionality by signalling the accident detector, which in turn reports to the GSM Module.
Driver **Drives** Automobile	Redundant as it doesn't specify any functionality of the system.
Service Provider **Services** Automobile	Redundant as it doesn't specify any functionality of the system.
Driver's Acquaintance **Receives** Location	Redundant as the driver's acquaintance indirectly receives the location of the vehicle when the GSM Module pings him/her after detecting the location.
Driver **Utilizes** Application	Removed as Driver, Service Provider and Driver's Acquaintance

Service Provider **Utilizes** Application Driver's Acquaintance **Utilizes** Application	classes can be generalized to a User class.
Sensor **Activates/Deactivates** Ignition	Redundant as the sensor indirectly activates/deactivates the ignition by triggering the circuit, which in turn stimulates the ignition.
Circuit **Notifies** Driver's Acquaintance	Redundant as the driver's acquaintance receives a notification when the accident detector reports to the GSM Module in case of an accident, which in turn pings the driver's acquaintance.
Level Detector **Informs** Ignition Airbag System **Informs** Ignition	Level Detector/ Airbag System classes are generalized to an accident detector class which signals the circuit to stimulate an ignition.

Step 6: Identifying the attributes of the associations.

ASSOCIATION	ATTRIBUTES
Application **Tracks** Automobile	1 **TO** 1..*
Circuit **Stimulates** Ignition	1 **TO** 1
Sensor **Triggers** Circuit	1..* **TO** 1
GSM Module **Pings** Driver's Acquaintance	1 **TO** 1..*
User **Utilizes** Application	1 **TO** 1..*
Service Provider **Assists** Driver	1 **TO** 1..*
Driver **ContactedBy** Driver's Acquaintance	1..* **TO** 1..*
Level Detector **Signals** Circuit	1 **TO** 1
Airbag System **Signals** Circuit	1 **TO** 1
Level Detector **Reports** GSM Module	1 **TO** 1
Airbag System **Reports** GSM Module	1 **TO** 1
Automobile **ConsistsOf** Ignition	1 **TO** 1 It's a **composition** relationship.
GSM Module **Locates** Location	1 **TO** 1

Step 7: Identifying the attributes of the classes.

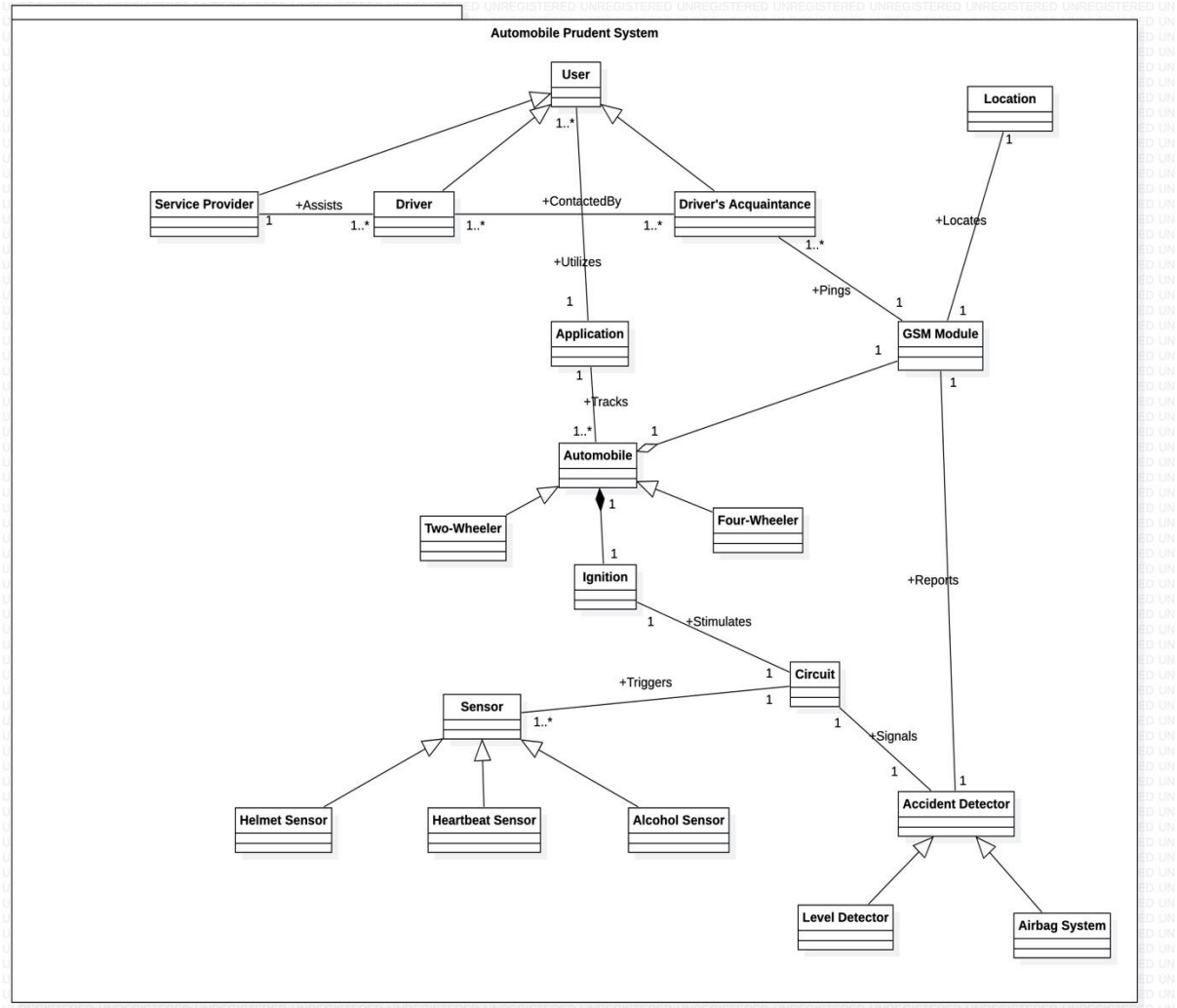
CLASSES	ATTRIBUTES
Automobile	Manufacturing Company Fuel tank capacity Mileage Fuel type Colour Model Engine Number
Two-wheeler	Threshold Angle Chassis Number
Four-wheeler	Number of Airbag modules Number of Crash Sensors Number of cylinders
Driver's Acquaintance	Relation Blood Group
Helmet Sensor	Dimensions Arduino Microcontroller Version
Mobile safety application	Name Version
Circuit	RF Transmitter RF Receiver
Level detector	Dimension Skid Angle
Driver	Driving License ID Vehicle Registration No Insurance ID Blood Group
Ignition	State Threshold electrical pulse

User	Username Password Name Aadhar Number Contact Number
Airbag system	Threshold Torque Response Time
Alcohol Sensor	Output Voltage Active Temperature Optimum Power
Heartbeat Sensor	Pulse Rate Scale
Service Provider	Automobile Company Company Identification Number Server Centre Location
GSM Module	Standard Fixed Dialling Number Embedded AT commands
Location	Latitude Longitude
Accident Detector	State Manufacturing Company Model No.
Sensor	State Model No. Manufacturing Company Sensitivity Range

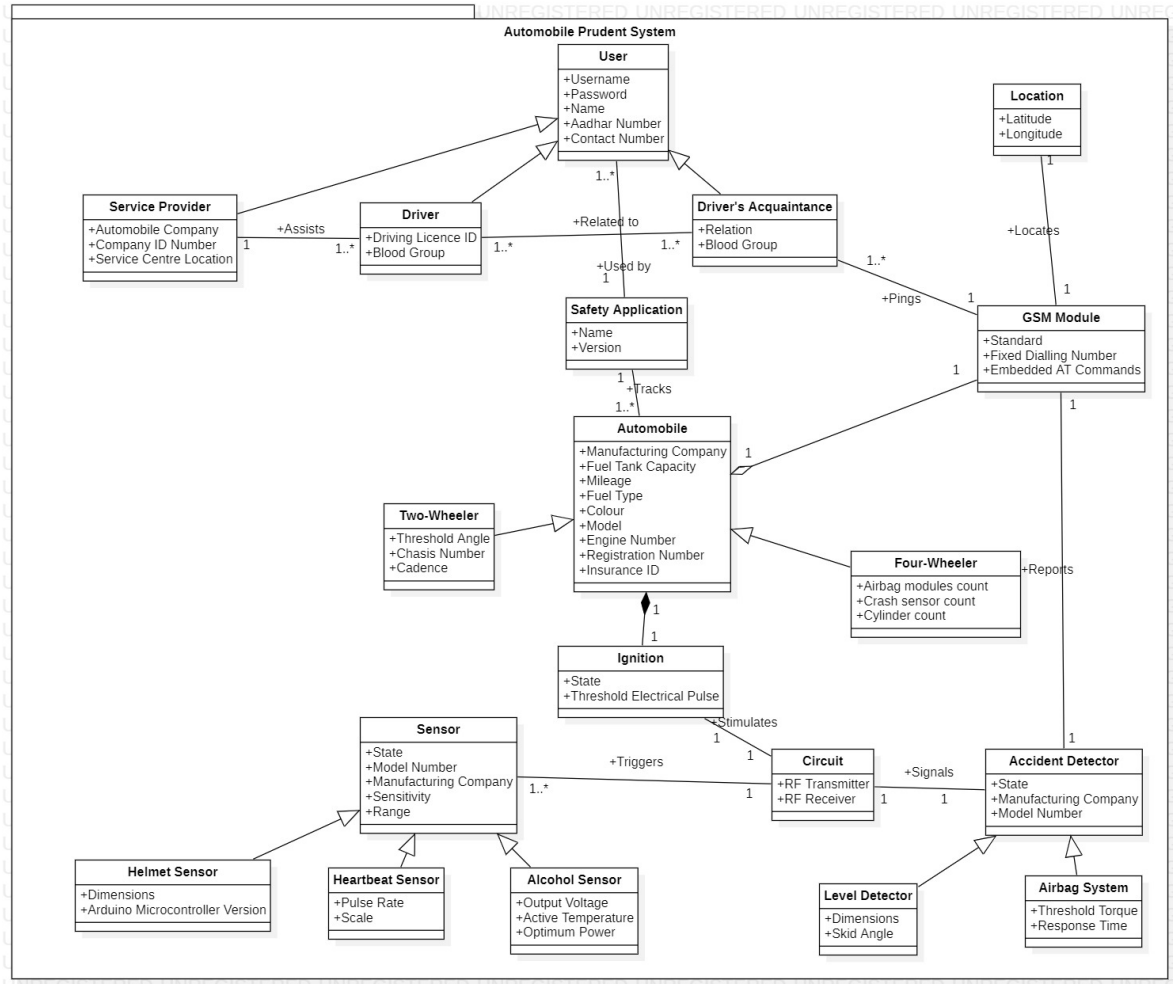
Step 8: Organizing and Simplifying classes using inheritance.

- **User** – Generalized Version of Driver, Service Provider and Driver's Acquaintance
- **Sensor** - Generalized Version of Helmet Sensor, Heartbeat Sensor and Alcohol Sensor
- **Accident Detector** - Generalized Version of Level Detector and Airbag System.

Step 9: Partial Class Model



Step 9: Partial Class Model – Version 2



CLASS RESPONSIBILITY COLLABORATION CARDS

SAFETY APPLICATION	
RESPONSIBILITY	**COLLABORATION**
Login(),Update_Details(), Change_password(), Make_payment()	User, Automobile

AUTOMOBILE	
RESPONSIBILITY	**COLLABORATION**
Start(), Stop()	Safety Application, Ignition, GSM Module

DRIVER	
RESPONSIBILITY	**COLLABORATION**
Fix_service_date(), Check_service_status(), Send_emergency_notification()	ServiceProvider, Driver's Acquaintance

DRIVER'S ACQUAINTANCE	
RESPONSIBILITY	**COLLABORATION**
Detect_driver_location(), Send_notification()	Driver, GSM Module

SERVICE PROVIDER	
RESPONSIBILITY	**COLLABORATION**
Update_service_status(), Generate_bill()	Driver

USER	
RESPONSIBILITY	**COLLABORATION**
Plan_trip()	Safety application

IGNITION	
RESPONSIBILITY	**COLLABORATION**
Find_state(), Check_condition()	Automobile, Circuit

CIRCUIT	
RESPONSIBILITY	**COLLABORATION**
Convert_to_state()	Sensor, Accident detector, Ignition

SENSOR	
RESPONSIBILITY	**COLLABORATION**
Trigger_circuit(), Activate(), Deactivate()	Circuit

LEVEL DETECTOR	
RESPONSIBILITY	**COLLABORATION**
Detect_state(), Signal_circuit(), Report_GSM_Module()	Circuit, GSM Module

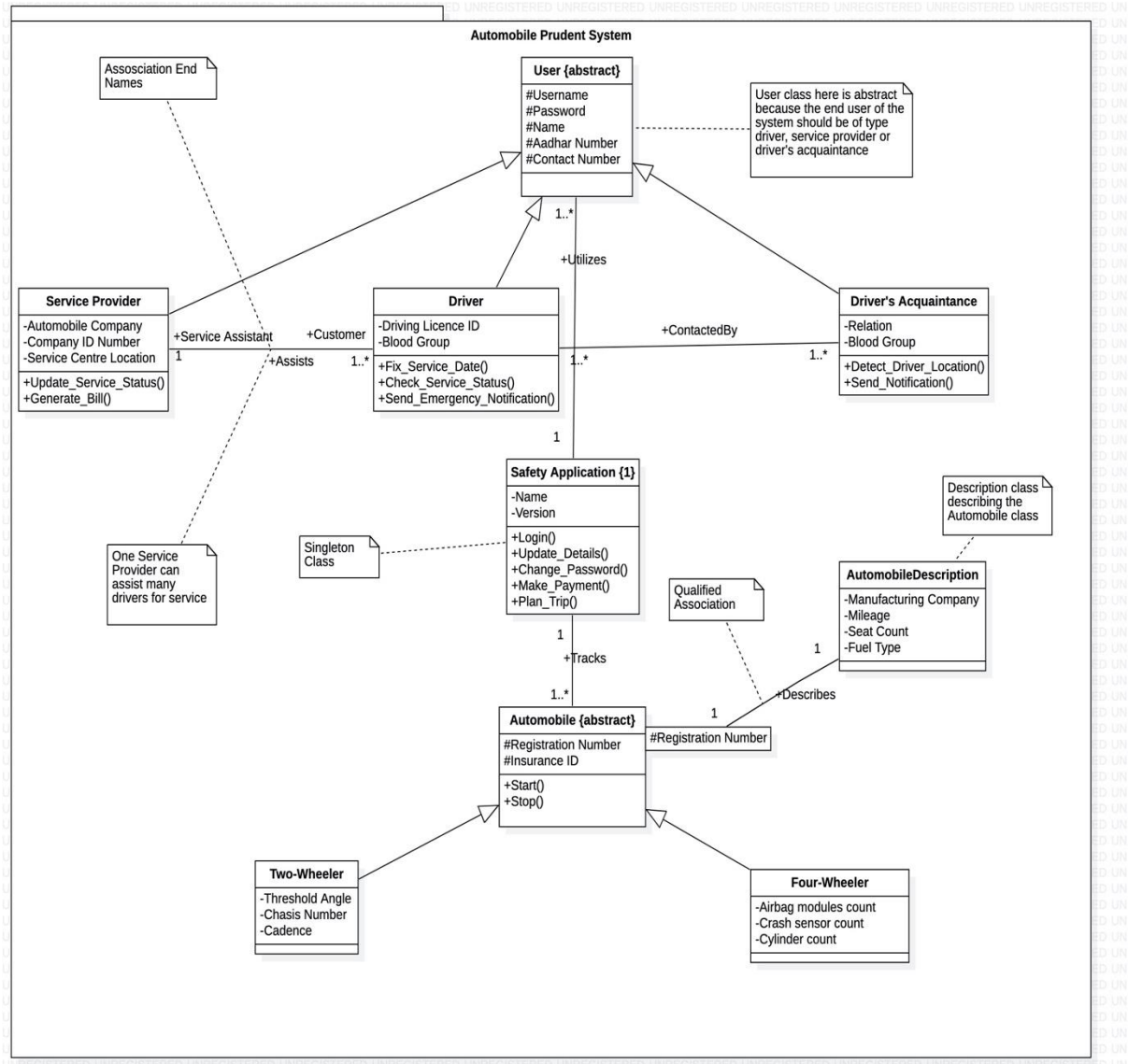
AIRBAG SYSTEM	
RESPONSIBILITY	**COLLABORATION**
Detect_state(), Signal_circuit(), Report_GSM_Module()	Circuit, GSM Module

GSM MODULE	
RESPONSIBILITY	**COLLABORATION**
Send_location()	Level detector, Airbag System, Automobile, Location, Driver's Acquaintance

LOCATION	
RESPONSIBILITY	**COLLABORATION**
Get_Location()	GSM Module

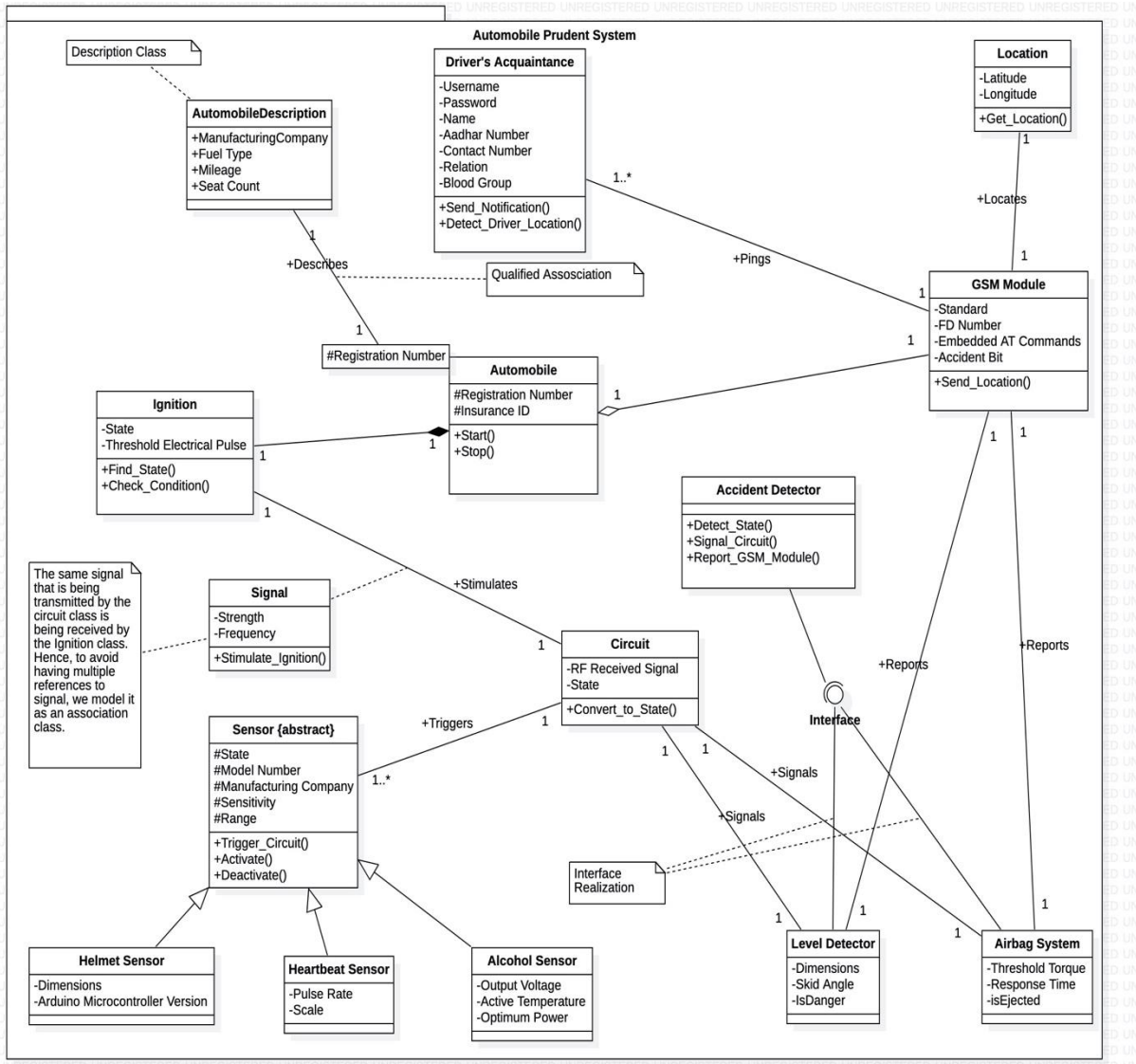
SIGNAL	
RESPONSIBILITY	**COLLABORATION**
Stimulate_ignition()	Ignition, Circuit

CLASS DIAGRAM - 1



METHOD	DESCRIPTION
Plan_Trip	It returns the distance to the destination location from the current location when the user enters it.
Update_Service_Status	Service Provider updates the status of the service into the application.
Generate_bill	Service Provider generates the final bill upon completion of the service
Fix_Service_Date	Driver chooses the required service date.
Check_Service_Status	Driver checks the current status of his automobile's service.
Send_emergency_notification	Driver requests help from emergency workers in case of an accident.
Detect_driver_location	Used to detect the current location of the vehicle.
Send_notification	Driver's acquaintance requests help from emergency workers in case the driver undergoes an accident.
Login	User logs into the application using this functionality.
Update_details	User updates his account details.
Change_password	User updates his password upon entering his valid current password.
Make_payment	Driver uses this functionality to pay for his service.
Start	Used by the driver to start the automobile.
Stop	Used by the driver to stop the automobile.

CLASS DIAGRAM - 2



METHOD	DESCRIPTION
Find_state	If Check_condition() returns a true flag, state of the ignition is set to “active”.
Check_condition	If the strength of the received signal crosses the threshold electrical pulse, it returns a true flag.
Send_location	GSM Module sends the driver’s location to his acquaintances in the event of an accident.
Trigger_circuit	If the state of the sensor is active, the circuit gets triggered.
Activate	It activates the sensor if the helmet/seatbelt is worn by the driver, or the level of intoxication is less than the threshold.
Deactivate	It de-activates the sensor if the helmet/seatbelt is not worn by the driver, or the level of intoxication crosses the threshold.
Convert_to_state	Converts the received RF signal into a boolean value that indicates the state of the circuit.
Stimulate_ignition	If the state of the circuit is true, it sends an electrical pulse indicating the same to the ignition circuit.
Detect_state	It activates the accident detector if the skid angle crosses the threshold or if the airbag system gets ejected.
Signal_circuit	If the state of the accident detector is true, it sends a signal indicating the same to the circuit.
Report_GSM_Module	If the state of the accident detector is true, it reports the GSM Module to track the driver’s location and in-turn inform his acquaintance.