Automobile Maintenance Diagnostic System Design Problem (3 points)

Overview

For this exercise ***each*** student will create a high-level design of a software product. The design will be presented as a single UML diagram showing the overall class structure of the system. The diagram should contain class names, responsibilities (don't worry about including every single minor behavior), and the relationships among the classes (inheritance, association, aggregation, and possibly cardinality and role names). A separate section of the document should give brief (1-2 sentence max.) descriptions of the responsibilities for each class. The total document size, including diagrams, must not exceed 2 pages.

Each individual is responsible for submitting in a ***hard copy*** his or her own design sketch ***at the start*** of the class on 16th January. Make sure your **name and roll number** is printed on top of the sheet. Please bring in an ***additional copy*** of the design sketch to class for your reference. Students who make a good faith effort to develop a design can expect to receive 2 points, even if the design itself is suboptimal. The goal is to start students on the path to reflecting about design at a higher level than individual classes and methods.

The class session on 16th January will be divided into two sub-sections. In the first sub-section, small groups (4-5 students each) will quickly sketch consensus designs that incorporate the best aspects of their individual designs. ***Since you will have to discuss your individual design with your team be sure to have a second hard copy to take into the team session.*** In the second sub-section, some teams will present their sketches to the class as a whole (6-8 minutes per presentation). After all the presentations, we will revisit the problem and the analyze the designs.

All the teams must submit their consensus design by the end of the class. Teams who make a good faith effort to develop a consensus design can expect to receive 1 point.

The Problem - Automobile Maintenance and Diagnosis System (Auto MDS)

You are a member of a software design team working for a major multi-national automobile manufacturer. Your team is developing a software program that assists a mechanic in performing standard maintenance and problem diagnosis on a new line of automobiles. These automobiles contain advanced electronics that place them into a class of vehicle known as "drive-by-wire". Except for a mechanical emergency brake, there is no direct mechanical connection between the driver's input and the drive terrain of the car. All driver actions are input signals to the car's central computer which then sends commands to the engine, transmission, brake, etc. controllers.

Requirements

1. The AMDS will support use by one or more mechanics working on multiple automobiles. At any given time there will only be one mechanic working on one car however.

2. The AMDS will provide the ability to keep track of all work done on an automobile. Work performed on a vehicle is described as individual maintenance tasks with several tasks making one maintenance entry.
3. The AMDS will support a variety of maintenance tasks such as tune-up, wheel alignment, tire rotation, oil change, etc. Each of these tasks have some elements in common such as the average time for completion, the actual time, a list of needed parts. There are also some activities specific to each task such as a set of instructions for performing the task.
4. The AMDS will allow the mechanic to access standard maintenance schedules from the automobile manufacturer's website. These schedules can be used as the basis for a maintenance entry.
5. The user will control the AMDS from a standard graphical user interface. There is also a handheld control unit (HCU) that the mechanic can use to control the AMDS while standing next to the vehicle. The HCU is directly connected to the computer running the AMDS.
6. The AMDS connects to the automobile's central computer via a pod connection. There are different pods for different cars. The AMDS can detect when a new pod is attached to the system. If an internet connection is available the AMDS will automatically connect to the automobile manufacturer's website to download the appropriate profile information for the pod that was just connected. The AMDS interprets this profile information. Based on this information the AMDS is able to interface with the new pod and provide an appropriate user interface for that particular pod.
7. The AMDS will use an emissions sensor to read exhaust gas emissions from the car. This sensor is directly connected to the computer running the AMDS.
8. The AMDS will be able to control the car's engine, transmission and most other car components through the pod. This will allow different test sequences to be run.
9. The AMDS will allow the mechanic to define custom test sequences. The mechanic will build the test sequence from individual test step building blocks. Pre-defined and custom test sequences can be used as a test step in another test sequence.
10. The AMDS will allow the mechanic to specify data to be captured while a test is running. Data such as engine speed, emission levels, fuel economy along with a number of other data points can be collected. The AMDS will provide for the real-time display of multiple data streams on a plot. It is expected that some of the data will be noisy. The mechanic can choose any one of several smoothing algorithms to pre-process the data before plotting.
11. The AMDS will allow results of tests to be stored for later recall and plotting. As test data from multiple tests is gathered the mechanic can do statistical comparisons on the data.

Hints

You have neither enough time nor enough information to do a complete design for this system. You are to do a first-draft of a design that covers the requirements specified above. There will be many details that you will not be able to specify. At this stage that is fine. You will need to learn how to work at different levels of abstraction based on the detail needed and the information that is available to you.