

Runtime Vehicle Diagnostics for Maintenance and Feedback

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Abstract

For any vehicle user, knowing the health of his car is of significant importance. Before every long journey, before and after renting out cars, for scheduling appropriate repairs or even as an everyday safety measure, knowing how your car is feeling today is always encouraging. In spite of the increasing use of cars in the consumer market, with the lack of technical knowledge, and sadly increasing number of road fatalities, there is an increasing need of a widespread general-purpose car monitor. This paper is aimed to study and design such system that will allow the easy feedback of important vitals of your vehicle and thus reducing the chances of risking your life due to bad equipment.

1. Introduction

Every vehicle has different components like, engine, carburetor, battery, transmission, cooling system, wheels, suspension, etc. All these components together give us a smooth vehicle experience.

All the components are continuously subjected to various stresses, vibrations and other parameters. These parameters can change the working efficiency of vital components of the vehicle and hence affect the overall performance.

Some factors that can affect the overall efficiency of the vehicle, and which can also reduce the economy and increase future maintenance:

1. Engine oil level, if below a certain level, can increase the friction losses in the engine.
2. Transmission system can wear out if enough lubrication is not present.
3. Overheating of engine can be harmful.
4. Low coolant levels can cause engine overheating.
5. Tire pressure below or above a certain rating can cause accidents.
6. Engine misfire.

All these factors can be overcome by regular vehicle maintenance. For this reason, every vehicle is equipped with various kinds of sensors which track the vehicle vitals and keep a track of the running history. This data is helpful for a smoother and efficient running of the vehicle.

All the required data will be collected by the present on-board sensors. These sensors are optimized as per the specifications of the vehicle, and hence inaccuracies due to various factors like temperature, vibrations, etc. are minimum. So, the data from the sensors can be directly utilized for further diagnostics.

After the data is collected by an On-Board System, it will be wirelessly transferred to the user specified device.

A proposed mobile application will compile the data and compare, process it according to user requirement.

The application will be fed with recommended sensor output ratings for comparison.

With the help of this system explained in this paper, a user will have easier access to the vitals of his vehicle, and he can have a daily track on the maintenance needs of the vehicle.

2. Data to be collected

The vehicle has many vitals and hence the data collected will be displayed to the user, which he will use to assess his vehicle condition. The following factors can be considered for the collection of data;

1. Engine oil level
2. Engine oil temperature
3. Engine output power
4. Engine knocking
5. Coolant temperature
6. Coolant quantity level
7. Fuel level
8. Camshaft timing
9. Air fuel Ratio
10. Battery level
11. Cabin Temperature
12. Fuel consumption
13. Tire pressure
14. Exhaust gas analysis

The data is useful for the user as he can predict when the vehicle needs its maintenance, and what exact components are to be checked.

3. Sensors used

As said earlier, every vehicle is equipped with various sensors to check its vitals. So, every component has its corresponding sensor to keep track of its proper functioning.

Table 1 Sensors which are to be used

Sr. No.	Sensor	Data collected
1	Engine oil level sensor	Engine oil level
2	Engine oil temperature sensor	Oil temperature

3	Coolant level sensor	Coolant level
4	Coolant temperature sensor	Coolant temperature
5	Knock sensor	Engine knocking
6	Dynamometer	Engine output power
7	MAP Sensor	Fuel Metering
8	Cam position sensor	Valve timing
9	Air-Fuel Ratio monitor	Air-Fuel ratio
10	Lambda Sensor	Oxygen level in Exhaust
11	Vehicle speed sensor (VSS)	Vehicle speed
12	In-cabin temperature sensor	Cabin Temperature
13	TPMS	Tire pressure
14	Car battery monitor	Battery Voltage
15	Fuel Level sensor	Fuel Level
16	Odometer	Total vehicle running
17	Exhaust Gas Analyzer	Effluent contents

Using the above specified sensors present in the vehicle, all the data required for a general overall analysis of the vehicle can be obtained. All the sensors are available in the certain vehicle. When a vehicle is running, all these sensors are continuously collecting the information from all the components and feeding to the On-Board Diagnostics (OBD) System, which collects this data, interprets it, and controls the other components as per the readings for an overall better efficiency.

For example, the lambda sensor collects data from the Exhaust, and the engine to find the oxygen level in the exhaust gases and the corresponding air-fuel ratio. This data is sent to the control unit and a closed-loop control system is formed which optimizes the fueling system instantaneously to keep the tolerances minimum.

Every sensor present, for every vehicle has a certain optimal rating under which it should operate, so as to obtain the most efficient functioning of the vehicle. These ratings are provided by the vehicle manufacturer which will be fed to the mobile application for the later diagnostics.

4. Data Collection on OBD

The OBD system of a vehicle is connected to all the sensors, hence collecting information from the OBD system directly is much more efficient.

5. Data Transmission to the Mobile application

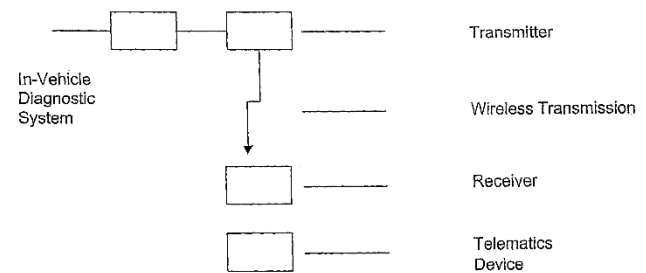


Fig.1 Transmission of Data

Once the data is collected by the Mobile application, the user can access it and diagnose the vehicle by himself. The mobile application will be pre-fed with the recommended sensor output ratings as per the company model. The application will provide with the following diagnosis:

1. Warning and current oil, coolant temperature level for the engine.
2. Warning and current oil, fuel, and coolant quantity levels.
3. Optimal and current tire pressure for all individual tires.
4. Engine efficiency, and its knocking property.
5. Current Battery voltage.
6. Total Mileage of the vehicle.
7. Exhaust gas analysis containing information about percent per effluent present, as well as unburnt fuel.
8. General trip details like, Trip distance covered, total distance covered, average speed of the vehicle, total time taken, and trip average.

Conclusions

The system developed will be quiet helpful for the vehicle passengers as all the required information about the recent functioning of the vehicle, as well as the current required maintenance parameters will be available to the user on his palms. This will help achieve a better and safer road trip for the user.

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