Fleet Maintenance and Driver Behaviour Analysis System

S P Roja Rani, Sreenidhi Institute of Science and Technology, CSE,
Prof. Dr. Aruna Varanasi, Sreenidhi Institute of Science and Technology, CSE,

Abstract

A Fleet is a group of vehicles like cars, trucks, or heavy-duty vehicles etc; which are either owned or leased by business organizations, corporations, or government agencies etc; to provide goods or services to the required clients. These fleets are used by organizations which majorly depend on transportation. Such firms need to maintain and manage their fleets well, to improve their productivity and efficiency and at the same time reducing their operational costs and maintenance costs. The fleet organizations should be able to provide reliable transportation and avoid untimely breakdowns, failing which might cause loss of business or loss of good will. To avoid undesirable situations, we come up with a system, which can perform fleet maintenance and driver behaviour analysis effectively. The advantage of this system is to assist and ease fleet manager operations. Moreover, the system will alert or notify the driver using a voice user interface (a better choice than a usual visual interface which is difficult for the driver to monitor it often while driving) in case of any problem in the vehicle or in his driving behaviour, thus avoiding unwanted situation and increasing the efficiency and the productivity of the fleet.

Keywords: Fleet maintenance, driver behaviour analysis, notifications, voice user interface.

I. INTRODUCTION

Fleet maintenance supporting systems are gaining growing prominence in the transportation industry. These systems help the organisations to manage and maintain their fleets of vehicles very efficiently and productively.

Transportation is a primary resource for businesses, especially for businesses involved in areas such as logistics, courier services, taxi cabs, public transport, and rescue services [1]. Such firms need to manage their fleets well to provide services in time and meet their goals. The goal for any Fleet owner is to minimize transportation costs while also meeting demand for products [2]. Having such targets, these business firms take the benefit of modern technologies and concepts and make use of software systems which can aid them in performing fleet maintenance more effectively.

The chief goal of this system is that it allows the fleet manager to locate the vehicles in real time, and obtain accurate and timely data about the whereabouts of the vehicle, receiving alerts and notifications, visualizing and interacting with statistics of drivers or vehicles, seeking to combine a comprehensive platform for monitoring vehicles and evaluating driver behaviour [3].

This system reduces the maintenance cost by reducing the repair costs or wear and tear costs as the driver is suggested with precautionary measures given by the voice interface avoiding unforeseen breakdowns. This is possible because not only the data regarding current state of the vehicle is displayed but the history of the vehicle and driver behaviour data is maintained.
and analysed to make useful reports of information for future recommendations of the vehicle and further training of the driver.

Our system performs various tasks like storing vehicle data, driver information, vehicle health analytics and process that data to generate alerts or notifications in times of need thus suggesting vehicle maintenance in time and ensuring driver safety. It helps drivers to comply with traffic rules and regulations and lets them avoid problems. For example, if tyre pressure or fuel level is low, an alert is generated to intimate the driver about upcoming problem and helps him taking precautionary measure.

Here in our system simulation modelling approach is followed to test, validate and illustrate vehicle data and driver behavioural data for large scale fleet management systems. This is because a simulation can reproduce the behaviour and functionalities of a real-world process in a virtual environment. In processes that involve people or expensive and sophisticated machinery, one must be sure, that the application performs as expected, before implementing it on the real system. Hence, the need for a simulation platform is undeniable [4].

This project also helps to locate the routes in which vehicles are travelling and displays the vehicle position in map. The motion of the vehicle is traced continuously, and the message is sent to the owner of the vehicle on demand or automatically [8].

One of the major challenges faced by fleet industry is driver safety/behaviour. Common causes of the accidents are Over Speeding, rash driving violating traffic rules. There are huge expenses associated with fleet accidents [6]. Driving behaviours include acceleration, deceleration, steering and lane changing. People usually use these driving behaviours to analyse drivers. Each driver has his unique driving behaviour. With the help of these parameters we can evaluate driving behaviour [7]. Fleet management is to improve the efficiency of the fleet by taking them from source to destination; reduce costs; provide driver safety management; manage the fleet databases and information and hence maximize the profits [5].

The main aim of this project is to perform fleet maintenance optimally and analyse the driver behaviour, at the same time alert the fleet manager as well as the driver in case of any problem in the vehicle’s health status or driver behaviour and suggest him for the appropriate precautionary measure.

As a part of the objective the following tasks are performed:

a) Vehicle data processing to check for deviations from normal range values of different parts of vehicles.

b) Driver behavioural data processing is done to check for limitations of different activities like over speed, sudden breaks, idle time etc.

c) Trigger the alarm to notify the driver using a voice interface and send alert message to the fleet manager.

II. RELATED WORKS

Based on the literature survey done on various fleet management systems, we come to know that these applications would greatly help the fleet organizers to maintain their fleets in an optimal way. Different systems help in different ways and whereas some systems yet need
some improvements. From them we consider a few systems which can give us some comparisons or relativities.

The Smart Fleet Monitoring System Using Internet of Things (IoT) uses the fuel level sensor to know the fuel level along with which the distance travelled will be monitored simultaneously [9]. Here the major focus is only on fuel consumption and the user interface chosen is mobile app or web portal, whereas in our project we work on various parameters and the user interface chosen is voice interface where the driven is given the comfort of just listening to the alert notifications whenever triggered instead of checking the visual screens often for the alerts, which is distractive.

A vehicle tracking system is one of the most common applications used for tracking vehicles which is also used to prevent vehicle from theft. It provides real time data on the movement of vehicles. Android phones are widely used for this purpose because they have GPS device attached with it [8]. Vehicle tracking feature is also embedded in our system.

III. METHODOLOGY

In this system the data regarding different parts of the vehicle such as fuel level, tyre pressure, engine coolant level, coolant temperature, engine RPM, vehicle speed, engine oil level and GPS etc; are taken into consideration. Here we are simulating the data and performing the processing on it to check the implementation of the system.

![Fig.1 Architecture of the system](image-url)

In this system, the data is processed to check for any deviation from the threshold value or normal range of statistics of the vehicle parts. If there is any deviation from the normal range, an alert is triggered to notify the fleet manager as well as the driver.

Here, the notification system or device chosen for driver is a voice user interface or voice operator (a better choice than usual visual user interface as visual one needs to be checked by the driver very often, which would be difficult and distractive) so that the alerts are heard by the driver and he can make appropriate precautionary measures to solve the problems in the vehicle. Whereas the notifications can also be seen by the fleet manager on the application system.

In addition to the vehicle’s maintenance, we attempt to analyse the driver behaviour. For that, we consider the data parameters like overspeed, number of brakes applied, idle time(engine
is on without movement) etc; which are related to driving behaviour and we analyse them. Even the driving alerts are notified to the driver to alert him of his behaviour.

The behaviour of the driver is displayed on the dashboard of the application in the form of graphs, which can be observed and monitored by the fleet manager. In case of any bad driving instance, the fleet manager can alert the driver. The driver behaviour analysis data can also be used for further training of the drivers with suitable changes or recommendations required.

IV. RESULT ANALYSIS

The system displays the routes travelled by different vehicle trips in the form of maps as shown in the Fig.2 Here the following figure shows the route of a vehicle trip. Likewise, we can see routes of entire fleet vehicle trips.

![Fig.2 Route of a vehicle trip](image)

In addition to the route maps, a comparison is also made between the scheduled number of trips and the actual number of trips in a particular week to understand the fleet operations better and is represented in the form of a graph as shown in the Fig.3

![Fig.3 Scheduled trips Vs Actual trips](image)
Following Table-1 is the table of notifications seen by the fleet manager on the system to know and understand the driver behaviour and the vehicle health status, whereas these notifications are heard by the driver through voice interface.

<table>
<thead>
<tr>
<th>Driver Name</th>
<th>Alert Type</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Takuma Sato</td>
<td>Over Speed</td>
<td>27/7/2020 05:46:20 PM</td>
</tr>
<tr>
<td>Felipe Massa</td>
<td>Sudden Break</td>
<td>27/7/2020 05:45:20 PM</td>
</tr>
<tr>
<td>Jarno Trulli</td>
<td>Over Speed</td>
<td>27/7/2020 05:43:20 PM</td>
</tr>
<tr>
<td>Sebastian Vettel</td>
<td>Idle Time</td>
<td>27/7/2020 05:40:20 PM</td>
</tr>
<tr>
<td>Christjan Albers</td>
<td>Low Tyre Presure</td>
<td>27/7/2020 05:35:20 PM</td>
</tr>
</tbody>
</table>

Table -1 Notifications list

The behaviour of a driver can be illustrated with the help of following Fig.4 from which we can know how good or bad he was in his total trips driven and the number of alerts he got during his ride, the amount of money he saved by driving the vehicle properly, and the amount of expense he could have avoided by driving the vehicle optimally.

Fig. 4 Driver’s behaviour

V. CONCLUSION AND FUTURE SCOPE
The Fleet Maintenance and Driver Behaviour Analysis System will help the fleet organizations to manage, monitor and maintain their fleet of vehicles to achieve productivity, efficiency, and the ability to provide the services on time, keep up their good will and make
more profits. In addition, the driver behaviour analysis will be helpful to monitor the driver and also train him further accordingly.

As a future work, we plan to include collaboration with different maintenance shops and send notifications to those shops to provide necessary equipment and required vehicle maintenance.

References


