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Smart Fleet Monitoring System using Internet of Things(IoT)

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Abstract—In day to day life resource management plays an important role. Especially some forms of the resources like fuel which are non-renewable in nature needs to be managed in a proper way in order to avoid economical loss. This issue needs to be rectified with a proper solution. Major part of the transportation depends on buses and fleets', having reliable control for the management over the fleets using minimal human resource, money is duly needed. This provides (control) saving of fuel due to the unmaintained condition of the vehicle. So, we have developed this solution which provides fleet organizations to have secured, reliable and remote control over the fleet of its organization using Internet of Things (IoT). This fuel continuously monitors the status of the vehicle using fuel sensors, GPS based Odometer provides status related information of the vehicle to the fleet control management. The control management from remote place using IoT platform can provide precautionary measures for driver in maintaining the vehicle.

***Keywords*—fleet, Internet of Things, GPS, Odometer**

I. INTRODUCTION

In a developing country like India saving fuel plays an important role in development process. About 35% of the total population depends on public transport and usage of public transport helps in saving the most part of the fuel loss. Monitoring and maintaining of this is important. Since buses contribute 90% of the total public transport, thus monitoring the fuel usage in buses is highly necessary.

As we can see digitalization is main reason in development of the country using modern technology like Internet of Things in reducing the non-renewable resource and human resource is much important.

Keeping this in consideration we are developing an Internet of Things (IoT) based smart fleet monitoring system. The system monitors the vehicle with the help of fuel level sensor and a GPS based odometer. The vehicle fuel tank will be installed with the fuel level sensor which provides the information of fuel level at a required instant. The GPS based odometer generates a pulse at every meter covered by the vehicle.

These information's are manipulated in the Arduino which is connected with the sensors and the GSM/GPRS modem. The information is sent to cloud database using GSM/GPRS modem. The cloud database holds all the information related to the status of the vehicle and the website will be developed for displaying these results. The Organization authorized person holds the login details and can access the website for monitoring the status of the vehicle and can provide control measures to the driver during the unmaintained condition of the vehicle.

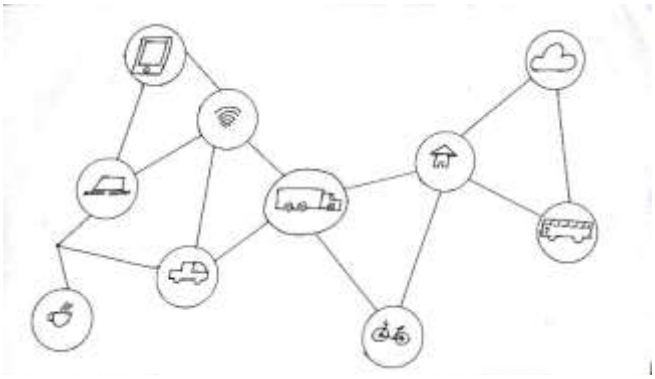

Fig.1: Internet of things in fleet management logistics

II. LITERATURE SURVEY

Ankur B Mokal, Snehal R Pawar, Pankaj P Patil [1] describes the focus on safety and effective utilization of traffic capacity. Smart traffic monitoring along with traffic management and smart road way gives a feature with product scope. Breaking of traffic rule sometimes lead to a very critical consequence the basic idea of this paper is to indicate the vehicles about various zones like school, hospital etc. The objective of this paper focuses on designing a Smart Display and Control (SDC) running on embedded system which monitors the zone, SDC is made to place on dash board and displays the information of vehicle, as soon as possible the information received from zone embedded unit will automatically indicate the driver, in case of not receiving response from driver SDC will automatically reduce speed.

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Saket Yadav, Rushikesh Gujar, MayurJadhav, TusharLimbore [2] explains about an android application called as ASCMS which is a friendly informative and time saving application. This application allows the user to locate and interact with any of the nearest car service center. It also facilitates the user to choose any of the services provided at that particular located center. By using this application, the user can also fix an appointment for test drive at the particular dealer and will receive the response through push message, this application also acts as a reminder for next service, EMI and other instalments.

DashmirIstrefi, BetimÇiço[3] has explained the use of fleet management and cloud to communicate between two machines. The vehicle is installed with GPS, GPRS and sensors. The information from the vehicle is sent to the cloud and also saved, so that it could be accessed from any device which has access on the server cloud web page.

Sachin S. Aher, Kokate R. D.[4] proposed work focuses on maintenance of record of fuel condition of vehicle, by implementing fuel monitoring system using Microcontroller MSP430F149 the above system also facilitates tracking of vehicle, in this system reed switch is used which works according to hall effect principle for detecting the fuel condition. The detected value is stored in system memory. In this GPS technology is used to track the vehicle. The maps are used to determine the location where the fuel is being wasted.
Muhammad Ahmad, Javaid Iqbal, Quart-Ul-Ain, Sumaira Ghazal [5] describes the tracking of multiple vehicles on real time bases using GPS and digital mapping hardware solution. The vehicle is tracked using base station which is in synchronization with client vehicle. The exact location and surrounding environmental information is sent to the client and base station. The vehicle accordingly to the environment will be guided to the base station and hereby will be secured.

III. OBJECTIVES

The objectives of our project are

- Monitor the fuel level in the vehicle.
- To measure fuel consumption by the vehicle with respect to distance traveled.
- To minimize the fuel wastage due to the unmaintained status of the vehicle.
- To minimize the hardness in monitoring the entire vehicle in a large organization.
- To build a system which is possible to do all the things mentioned above with high reliability and low cost.

IV. METHODOLOGY

- Nowadays maintenance of an organization is emerging as a big issue. The maintenance of fleet organization which holds large number of vehicle requires large resources. A smart solution for organizing and maintaining the fleets is the proposed methodology.
- The Smart Fleet Monitoring System Using Internet of Things (IoT) uses simple sensors to monitor the status of the vehicle. The fuel content of the vehicle will be monitored by the fuel level sensor along with which the distance travelled will be monitored simultaneously.
- A multilevel fuel sensor repeatedly senses the fuel level in the tank and send the information to the controller. The received data will be converted to a transmittable form and the sent to the control database which will be operated with internet in a suitable and convenientmedium (likely air is the medium). The same transmitter is used in transmitting the distance travelled information simultaneously.
- The database receives all the data related to status of the vehicle. Accordingly to the control mechanism it compares the fuel consumption to predefined amount as mentioned by the organization. As per the condition of the vehicle initial control measures are sent to the driver and the status related information is sent to the control organization.
- The fleet management organization provides severe control measures to the driver in maintaining the condition of the vehicle in a proper way.
- The interface to the organization with the vehicle can be provided in any convenient platform (i.e. it can be amobile platform or any web portal) for the organization.

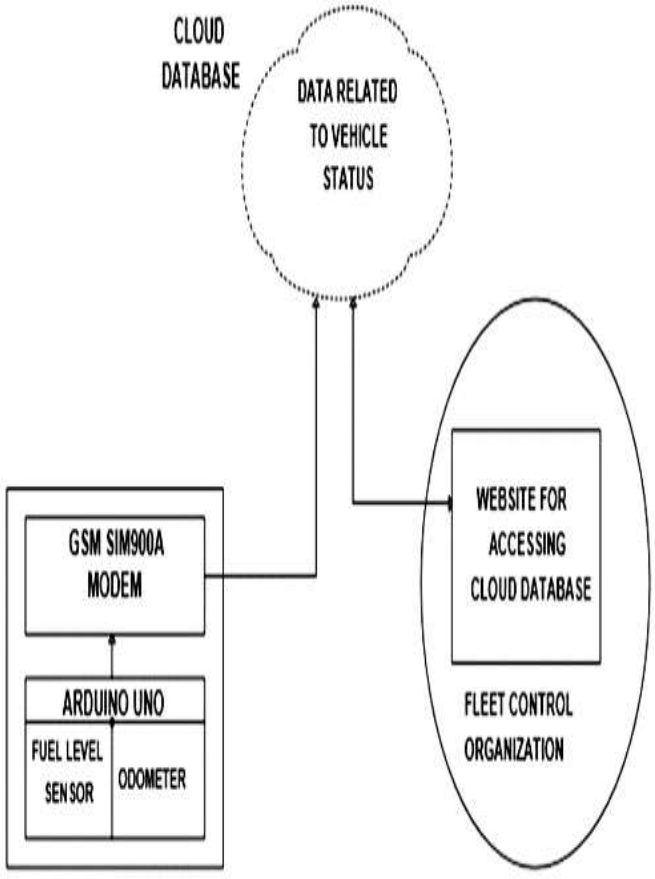

Fig. 2: Block Diagram of Smart Vehicle Management Using Internet of Things (IoT)

A. Pseudo codes

- Initialize http service
  gprsSerial.println("AT+HTTPINIT");
- Set http parameter value
  gprsSerial.println("AT+HTTPPARA=\"URL\",\"http://fleetmonitors.000webhostapp.com\"");

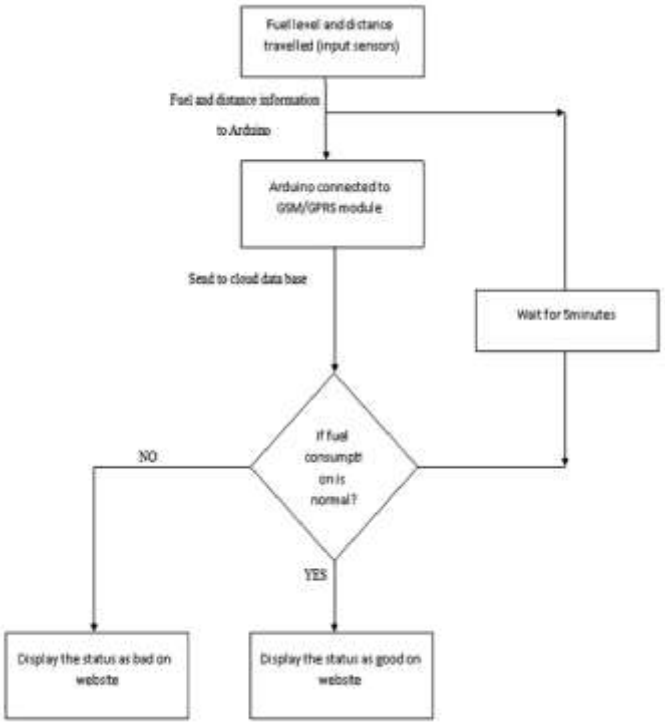

Fig.3: System Flowchart

V. HARDWARE COMPONENTS

A. Microcontroller

The high-performance Microchip picoPower microcontroller which works with 8 bit data. The microcontroller has 23 pins for general purpode input and output operation in which the pins are further divided as digital and analog pins. The operating voltage of the de vice is 2 – 5. 5 volts. This microcontroller consists of serial pins for serial communication and inbuilt 10bit Analog to digital converter for backend applications.

Fig.4: ATmega328P Microcontroller.

B. Odometer

GPS based odometer is GPS and ATMEGA328/P based Odometer which operates at voltage range of 4.5v-10.5v. The odometer runs on Arduino Board power supply and generates a pulse every one meter cover by the GPS. I.e. the board generates 1000 pulses per kilometer. These pulses can be used to determine the distance travelled by the vehicle at any particular instant using a suitable program.
The measurement equation for the odometer is given by

$$\Delta \underset{\sim}{\nu} = \underset{\sim}{\tilde{\nu}}^{n} - \tilde{C}_{b}^{n}\underset{\sim}{\tilde{\nu}}_{D}^{b}$$

Fig.5: GPS based odometer

C. Fuel Sensor

- SS pin molded within Polypropylene
- Cable Length: 1.5 Meters
- Completely insulated wire joints
- SS-314 pins are used in it to avoid the rust and chemical resistant
- Best used for variable level detection of fuel.
- Highly reliable for fluctuations of current

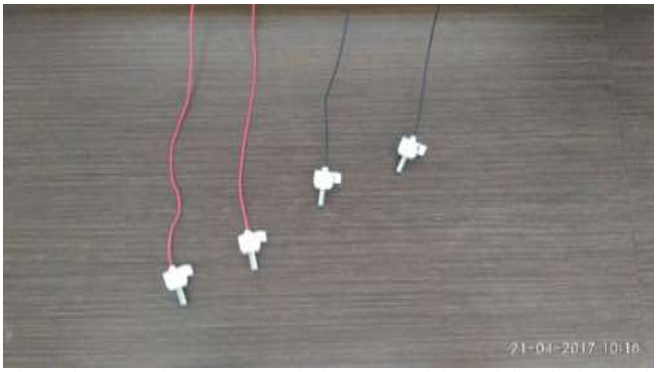

Fig.6: Shows SS pin contact type fuel sensor used determining the levels of fuel in the fuel tank

D. Arduino UNO

Arduino UNO board is open source development board compatible with ATMEGA328/P microcontroller and much more. The board can be interfaced with computer using USB cable and can be coded with Arduino software (IDE) version 1.0 and above. It provides 14 pins for digital I/O operation and 6 pins for analog I/O operation. The board single handily controls other devices connected to it accordingly to the requirement.

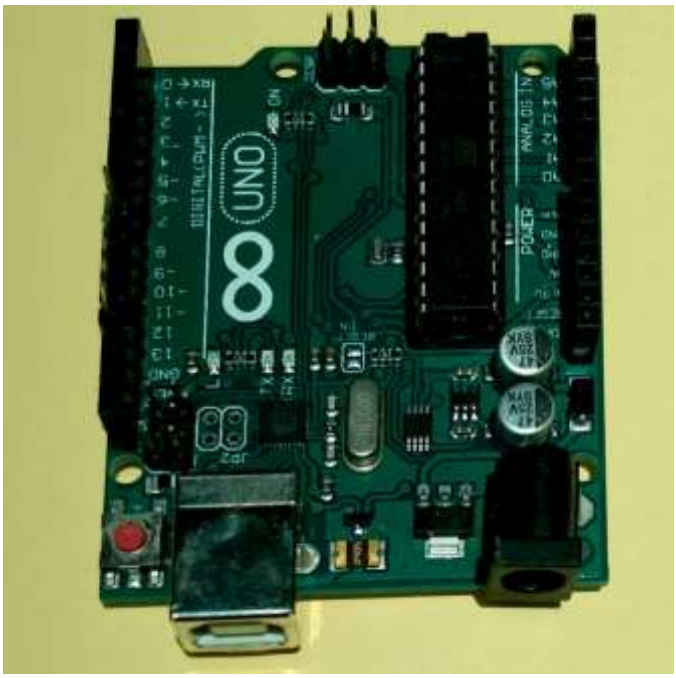

Fig.7: Arduino Uno Board

E. GSM SIM900 Modem

Fig.8: Shows GSM/GPRS sim900 Modem

SIM900 GSM/GPRS includes a quad band module with a dimension of 24*24*3(in mm). It can be used to send data as per the requirement of the project using a particular network. This modem can be controlled with AT commands and required file transfer applications can be achieved. The device consumes very less power for its operation at the range of 1.35mAmps in sleep mode.

VI. RESULTS

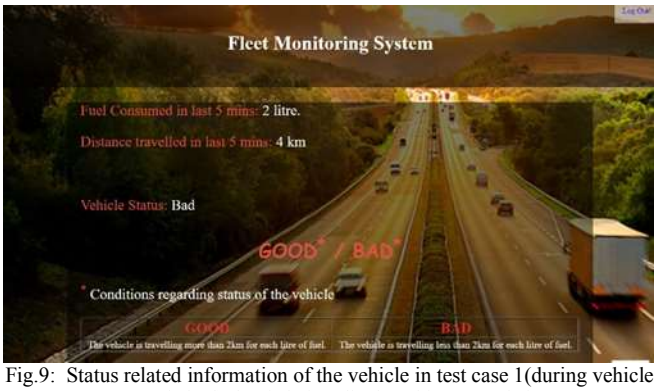

Fig.9: Status related information of the vehicle in test case 1(during vehicle status is bad) that is being displayed in our website

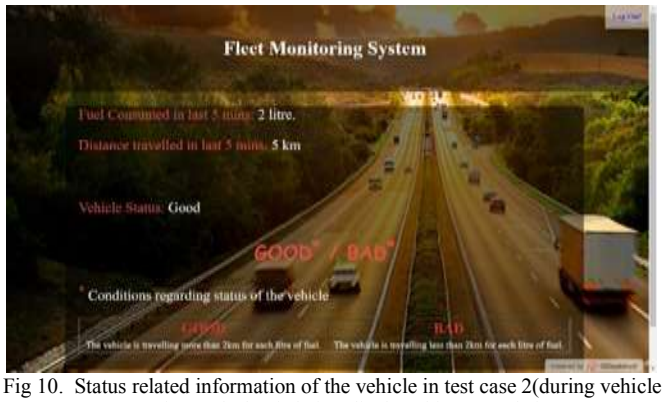

Fig 10. Status related information of the vehicle in test case 2(during vehicle status is good) that is being displayed in our website

TABLE I. Vehicle status comparison

Vehicles status before and After / Parameters Considered During the case study	Before System installation in the fleet	After system installation in the fleet
Distance travelled by the vehicle at not serviced condition	60KM	60KM*
Fuel consumed by the vehicle	25Ltrs	20Ltrs
Fuel loss/profit by the vehicle	₹250 loss	₹250 profit

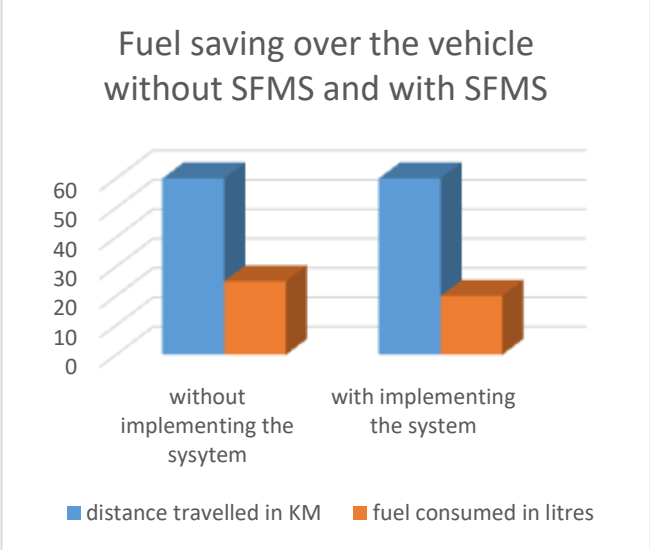

Fig.11: Case study considering the status related information of the vehicle

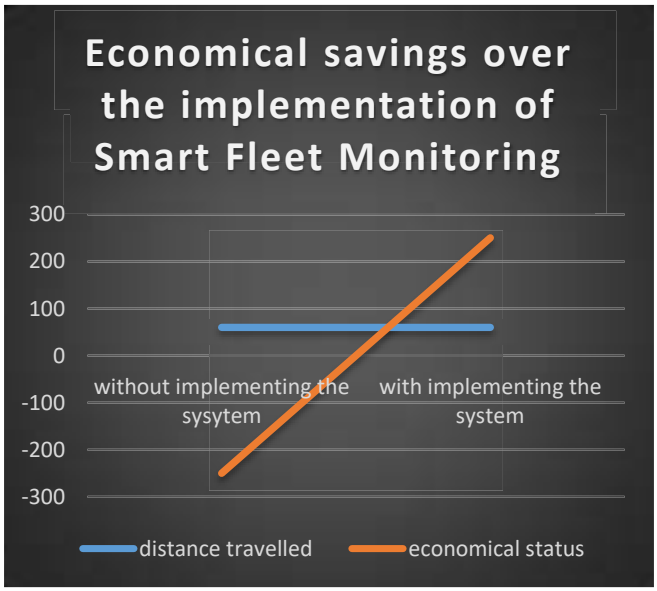

Fig.12: Case study considering the money saved for vehicle with and without system implementation

CONCLUSION AND FUTURE SCOPE

The fuel monitoring system will check the distance travelled by the vehicle and also checks the fuel consumption with respect to the distance travelled. Thus by providing initial control measures for the driver for the proper maintenance of the vehicle. This will be implemented in the routes where fuel economy is required. It will reduce resource

for maintaining a large number of vehicles and also restricts fuel tapping by driver. It mainly provides convenience and timeliness which is main concern in the day today life.

The system in future can be added with a RF id sensor for a particular driver and vehicle information can be linked with the driver. In further an alcohol sensor can be used for the safety of driver and vehicle.

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