International Journal of Application or Innovation in Engineering & Management (IJAIEM)
Web Site: www.ijaiem.org Email: editor@ijaiem.org
Volume 6, Issue 9, September 2017 ISSN 2319 - 4847

REAL TIME MONITORING OF VITAL HEALTH PARAMETERS OF THE VEHICLE

Gopalakrishna K[1], Dr.Hariprasad S A [2]

[1]Research Scholar- Jain University Bangalore

[2]Research Guide -Jain University Bangalore

ABSTRACT

Every day, many a people die because of road accidents. A number of factors contribute to the risk of the accidents; such as, vehicle design, the speed of operation, driver skills and behaviour etc., which leads to disabilities or even death. This, in turn, leads to financial costs for both society and individuals involved. So monitoring a few important parameters of the vehicle and reporting of any problem with the monitored parameters plays an important role in reducing the risk of accidents and also helps the government agencies in solving the accident cases. The available systems are monitoring a few parameters of the vehicle, but they are not designed to analyse the reason for the accidents. The proposed system is designed such that, the vital parameters of the vehicle are recorded in a data logger so that, it can be used to analyse the reasons for the accident or the vehicle breakdown. In this paper, monitoring of four important parameters of the vehicle such as Engine RPM, Tyre Pressure, Engine oil level and brake pad wear detection, are successfully implemented and the results are found to be satisfactory.

Keywords: Engine RPM, Tyre Pressure, Engine Oil level, Brake pad, Data logger

1. Introduction

Vehicle health monitoring systems are often used to monitor various health characteristics of vehicles. Such operational health characteristics of the vehicles are further decomposed into the health characteristics of its major operational systems and subsystems. For example, when a vehicle is currently not in use, a health monitoring system may obtain and assemble data regarding prior operation of the vehicle along with other data, in order to provide support for an operator or other individual for making decisions regarding future maintenance and usage of the vehicle. These operational data are stored in database for monitoring the operational reliability and maintenance history of the vehicle subsystems and may be given as a feedback to original equipment manufacturer for improving the reliability of the vehicle system design. This can also be used by the government agencies such as police department, RTO and the legal departments to solve the accident cases. Condition monitoring of vehicles requires the use of many sensors for effective vehicle fault detection. A simple and robust on-board vehicle fault detection system using minimal sensors could ensure reliable operation of vehicular systems and aid in effective vehicle health management. Accordingly, it is desirable to provide a vehicle health monitoring system having an improved architecture and connected to the reliability and maintenance databases. This paper is structured as follows:

1. **Introduction –** This section describes the introduction to the work and also gives the importance of this research.
2. **Related work –** This section describes the earlier work in this area, their limitations and the importance of this research.
3. **Proposed Method –**This section describes the block diagram of the proposed system.
4. **Research method –**This section describes the methodology adopted in designing the proposed system.
5. **Results –**This section describes the result obtained from the proposed system and
6. **Conclusion –**This section describes the outcome of the work.

2. Related Work

Sridhar Babu M et al, [1] describes about the monitoring of the battery health, gas emission, fuel quantity, mileage and hydrocarbons emission in the engine using fuzzy logic.

Panja B et al [2], proposed a system with Wireless Sensor Network for the Health Monitoring of the vehicle. It comprises of both interactive and non-interactive methods with respect to aerospace vehicles.

R.priyadharshini et al [3], discuss about displaying the parameters of vehicle such as pressure of the oil, temperature of the coolant, level of the fuel in the tank and the engine RPM in the digital form using Thin Film Transistor (TFT). These parameters are displayed in both graphical and in data form.

Rui Loureiro et al [4], proposed a method to diagnose the fault using bond-graph-model-based technique with the recoverability of the structure and fault tolerant control of the heavy autonomous vehicles used inside the port terminals.

R.Ganesan, S.Mydhile [5], discuss about the method to find the actual position of the vehicle in the real time so as to take the decision in real time. They have also proposed a web based approach to model the dynamic behaviour of interactive web service.

Ivan S. Cole et.al in their paper [12] describes about the intelligent sensor network to monitor the corrosion of aircraft structures. This is to identify the occurrence of corrosion at the places where it cannot be observed directly.

Even though many researchers discuss about recording of vital parameters, they are not giving emphasis on analysing these data to find the cause for accident.

In this paper, it is proposed to monitor the vital parameters of the vehicle such as engine RPM, engine oil level, brake pad wear out and the tyre pressure. These parameters plays the important role in avoiding accidents and also helps the government agencies such as Police department, RTO and legal departments in solving the accident cases.

3. Proposed method

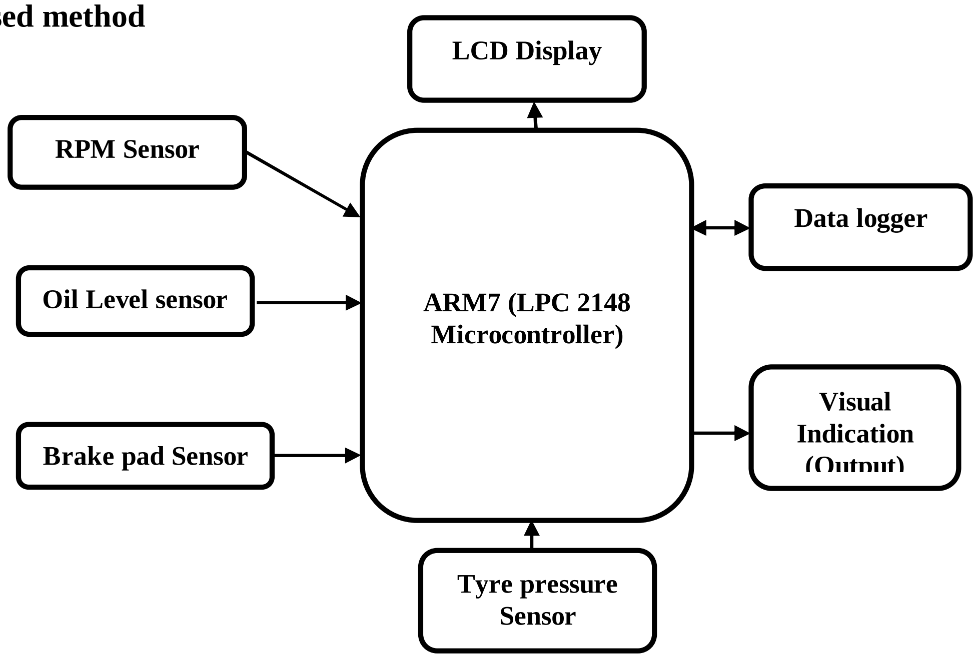


Figure 1: Block diagram of the proposed system

Figure1 shows the Block diagram of the proposed system in which ARM 7 based LPC 2148 microcontroller is used to monitor the vehicle parameters such as engine RPM, engine oil level, Brake pad wear out and the tyre pressure. The engine RPM is monitored using an Inductive proximity sensor, the tyre pressure is monitored using MPS-2000 Pressure sensor, the engine oil level is monitored using a Magnetic Float switch liquid level sensor and the brake pad condition is monitored using a wire loop sensor. The respective sensors are interfaced to LPC 2148 microcontroller along with the LCD Display to display the above said parameters.

4. Research Method

4.1 Hardware

The proposed system is designed and a prototype model is implemented and tested as explained below. It comprises of four sub modules as there are four parameters to be monitored and they are;

- RPM monitoring,
- Tyre Pressure monitoring,
- Engine oil level monitoring, and
- Brake pad wear monitoring

The design, implementation and results of each module mentioned above are discussed below.

4.1.1 RPM Monitoring:

Engine RPM is a vital parameter that can be considered to find the engine speed which in turn indicates the speed of the vehicle at a particular time. The RPM is monitored by using inductive proximity sensor. Inductive sensor is used as it is highly reliable, operates in non-contact mode, robust and economical.

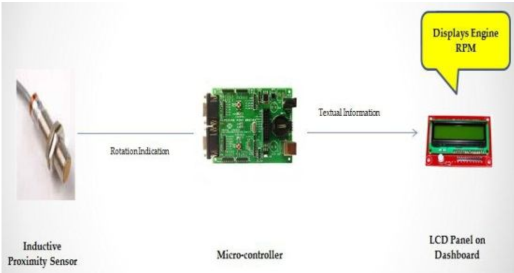


Figure 2: Hardware implementation of RPM monitoring System

Figure 2 shows the hardware implementation of RPM monitoring System. It comprises of inductive proximity sensor, LPC2148 microcontroller and an LCD. The inductive proximity sensor consists of an oscillator, Signal evaluator and a switching amplifier. The oscillator generates a high frequency alternating field which is emitted at the sensing face of the sensor. When the attenuating material is placed near the sensor, eddy current and hysteresis loss occurs based on the material. The oscillations are reduced due to these losses. This reduction in the signal is detected by the Signal evaluator and it is converted into the switching signal. The different switching states of the inductive proximity sensor are termed as “attenuated” and “unattenuated” and by further processing of these switching signals the RPM is calculated.

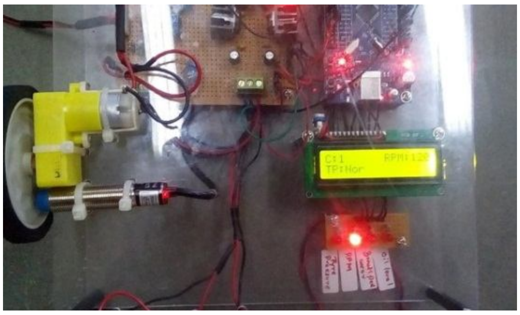


Figure 3: Visual indication of the speed

Figure 3 shows the results of the system designed to monitor the RPM of the engine in which, the system will display the RPM along with a text message to warn the driver when the Speed is exceeded.

4.1.2 Tyre Pressure Monitoring:

The tyre pressure is another important parameter of the vehicle, which is to be monitored to prevent the accident and also it helps in finding the reason for the accident. Hence it needs to be monitored regularly in a vehicle. In the proposed system, MPS-2000 Pressure sensor is used to achieve this. MPS-2000 Pressure sensor is used in the proposed system due to its low hysteresis, high reliability and stability.

4.1.2.1 Block Diagram to measure Tyre Pressure:

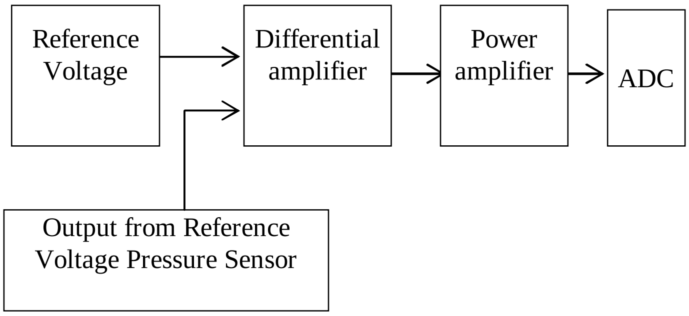


Figure 4: Block diagram to measure tyre pressure

Figure 4 shows the block diagram of the tyre pressure measuring System. It consists of an Op-amp comparator, Power amplifier and an ADC. The available tyre pressure is compared with the reference level, it is amplified and converted to the digital form and then applied to the microcontroller, which in turn sends the signal to the LCD to display the status of the pressure in the tyre.

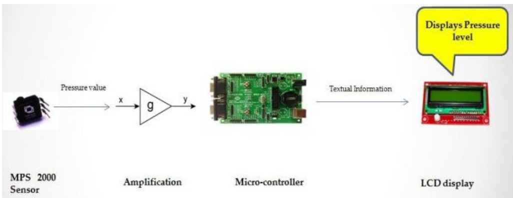


Figure 5: hardware implementation of tyre pressure monitoring system

Figure 5 shows the hardware implementation of the tyre pressure monitoring system. It consists of the pressure sensor MPS 2000, whose output is amplified and converted to the digital form and then fed to the microcontroller. The LCD is connected to the output of the microcontroller, which is used to display the actual tyre pressure.

Figure 6: Result When Pressure Is Low

Figure 6 shows the result, which is giving a warning with visual indication when the tyre pressure is low. The text message is displayed on the LCD as shown as in the figure. When the pressure is low, the result is displayed on the LCD as " TP:Low". On the other hand, when the pressure in the tyre is normal it is displayed on the LCD as "TP:Nor" as shown in the figure 7.

Figure 7: Result when pressure is normal

4.1.3 Engine Oil Level Monitoring:

The engine oil level is monitored using a magnetic float switch liquid level sensor, since it is very simple, reliable and economical. The float position in the liquid decides and sends either ‘1’ or ‘0’ to the microcontroller. If the oil in the tank is sufficient, then ‘1’ will be sent to the microcontroller, otherwise ‘0’ will be sent. When the oil level is low in the tank, a red indicator will glow.

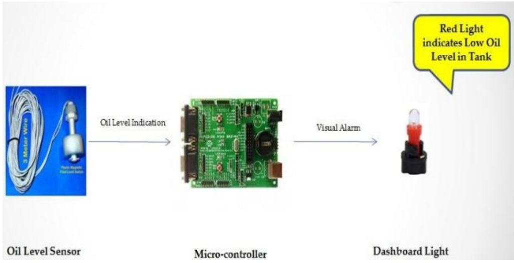


Figure 8: Hardware implementation of oil level monitoring system

Figure 8 shows the Hardware implementation of oil level monitoring system. The magnetic float switch is fitted inside the tank, which will open or close based on the oil level in the tank. When the oil level is at low, the switch is open and it will send ‘0’ to microcontroller and a red indicator glows as shown in the figure 8.

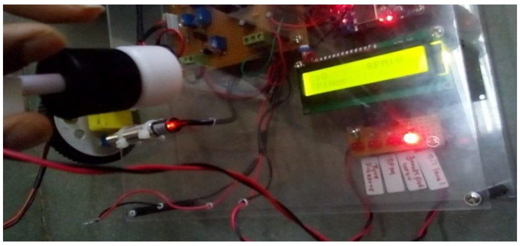


Figure 9: Result with warning of visual indication when oil level is low

Figure 9 shows the result with warning of visual indication when oil level is low. The Red indicator glows to give a warning signal to indicate the low oil level in the oil tank and figure 10 shows the normal indication when the oil is at sufficient level in the tank.

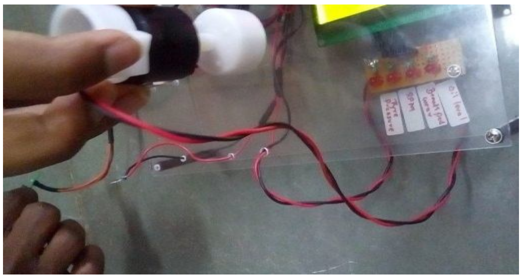


Figure 10: Result when Oil Level is normal

4.1.4 Brake Pad Wear monitoring

A loop of wire in a rubber housing that connects on one end to the brake pad is used as a brake pad wear sensor as shown in figure 11. When the brake pads wear down far enough, the rotor wears though the brake pad sensor housing and breaks the wire, opening the circuit.

Figure 11: Sensor Connection to Brake Pad

When the wire connected to the brake pad wear sensor gets cut by the rotor, it breaks the circuit and sends the information to the microcontroller regarding the same and a Red LED is ON and if the brake pad is normal, then there is no indication. Figure 12 and Figure 13 shows the results from the system to indicate the worn brake pad and the normal brake pad respectively.

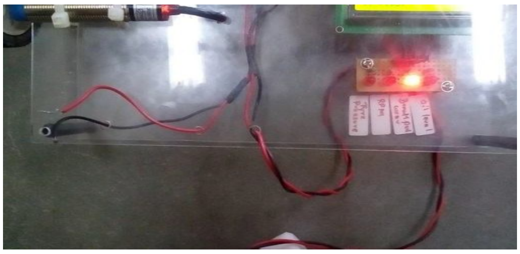


Figure 12: Result when brake pad is worn

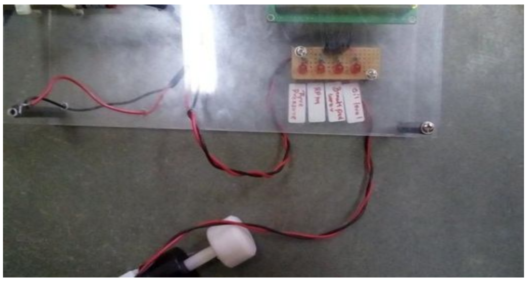


Figure 13: Result when brake pad is normal

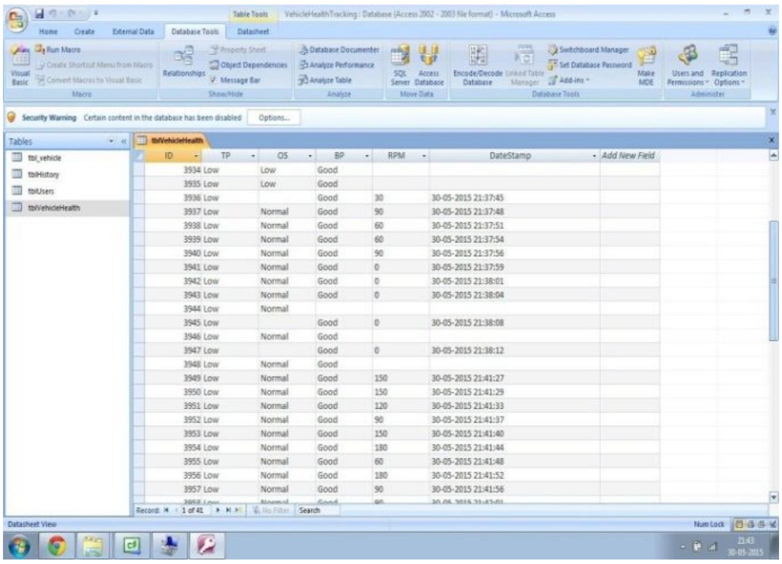
4.2 Software Implementation

4.2.1 Data logger

A data logger is used to record the data at a convenient time interval using sensors. It is used as a black box in the system to store the data gathered by the various sensors used in the system at an appropriate interval of time. This data can be retrieved at any time to study the health of the vehicle. It is implemented using C# and .NET Framework.

5. Results

A system to monitor the vital health parameters of the Vehicle is designed, implemented and the results of the parameters such as Engine RPM, Tyre Pressure, Engine oil level and Brake pad condition monitoring were discussed in the respective sections and the data logger results are as shown below in the figure 14 and figure 15.



ID	TP	OS	BP	RPM	DateStamp	Add New Field
3934	Low	Low	Good			
3935	Low	Low	Good			
3936	Low		Good	30	30-05-2015 21:37:45	
3937	Low	Normal	Good	90	30-05-2015 21:37:48	
3938	Low	Normal	Good	60	30-05-2015 21:37:51	
3939	Low	Normal	Good	60	30-05-2015 21:37:54	
3940	Low	Normal	Good	90	30-05-2015 21:37:56	
3941	Low	Normal	Good	0	30-05-2015 21:37:59	
3942	Low	Normal	Good	0	30-05-2015 21:38:01	
3943	Low	Normal	Good	0	30-05-2015 21:38:04	
3944	Low	Normal				
3945	Low		Good	0	30-05-2015 21:38:08	
3946	Low	Normal	Good			
3947	Low		Good	0	30-05-2015 21:38:12	
3948	Low	Normal	Good			
3949	Low	Normal	Good	150	30-05-2015 21:41:27	
3950	Low	Normal	Good	150	30-05-2015 21:41:29	
3951	Low	Normal	Good	120	30-05-2015 21:41:33	
3952	Low	Normal	Good	90	30-05-2015 21:41:37	
3953	Low	Normal	Good	150	30-05-2015 21:41:40	
3954	Low	Normal	Good	180	30-05-2015 21:41:44	
3955	Low	Normal	Good	60	30-05-2015 21:41:48	
3956	Low	Normal	Good	180	30-05-2015 21:41:52	
3957	Low	Normal	Good	90	30-05-2015 21:41:56	

Figure 14 : Snapshot of Vehicle health database

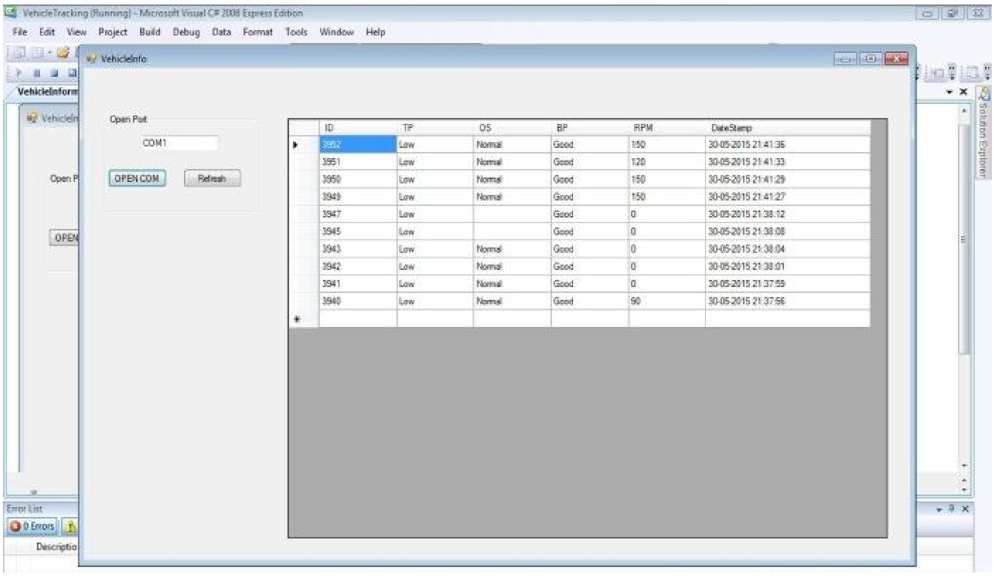


Figure 15: Snapshot of Vehicle information

6. Conclusion

A cost effective and low power embedded system that performs a real-time measurement of the vital health parameters of the vehicle has been designed and implemented. This model records the data in real time and stores the same at the regular interval, which can be used to analyse the reason for the accident, the parameter responsible for the accident and also helps in solving legal cases.

Acknowledgment

I would like to take this opportunity to express my sincere gratitude to Anilkumar S K, Deepak K V, Vasudev A and Syed Ziyaulla the students of BMSIT, Bangalore for helping me in carrying out this project. Also, I would like to thank Jain University for providing me the overall support in my academic and research activities.

REFERENCES

[1] Sridhar Babu M, Anirudh TA, Jayashree P, Fuzzy system based vehicle health Monitoring and performance calibration, International Conference on Electrical, Electronics, and Optimization Techniques (ICEEOT) – 2016.

[2] Panja, Biswajit, and Lars Wolleschensky. Vehicle Health Monitoring System using Secure Wireless Sensor Network. No. 2015-01-0204. SAE Technical Paper, 2015.

[3] R.Priyadharshini, S.Vijayakumar, On Board Vehicle Health Monitoring System Using Dynamic Priority Protocol, International Journal of Innovative Research in Science, Engineering and Technology, Volume 3, Special Issue 3, March 2014.

[4] Rui Loureiro, Samir Benmoussa, Youcef Touati, Rochdi Merzouki, and Belkacem Ould Bouamama, Integration of Fault Diagnosis and Fault-Tolerant Control for Health Monitoring of a Class of MIMO Intelligent Autonomous Vehicles, IEEE Transactions on Vehicular Technology, Vol. 63, No. 1, January 2014.

[5] R.Ganesan, S.Mydhile, Design and Development of Remote Vehicle Health Monitoring System using Context Aware Web Services, Proceedings of 2013 IEEE Conference on Information and Communication Technologies (ICT 2013).

[6] B. Venkatalakshmi, S.Vijayakumar, K. Aravindhan, Siva. V. Girish, On-board Vehicle Health Monitoring system for Wheel Loaders, Proceedings of 2013 IEEE Conference on Information and Communication Technologies (ICT 2013).

[7] Dhrupal R Shah, N.S.Vyas,Health monitoring of a small Indian car, Summer undergraduate research for excellence 2013, IIT Kanpur.

[8] V.Ramya, B. Palaniappan, Embedded Technology for vehicle cabin safety Monitoring and Alerting System, International Journal of Computer Science, Engineering and Applications (IJCSEA) Vol.2, No.2, April 2012.

[9] M.Jyothi kiran, S.Ravi teja, VEHICLE HEALTH MONITORING SYSTEM, International Journal of Engineering Research and Applications, Vol. 2, Issue 5, September- October 2012, pp.1162-1167.

[10] Ivan S. Cole, Penny A. Corrigan, Wayne Ganther, Development of a Sensor-Based Learning Approach to Prognostics in Intelligent Vehicle Health Monitoring, International Conference on Prognostics And Health Management, 2008.

[11] Williams, Benefits of IVHM, An analytical approach, IEEE Proceedings, USA, 2006, Paper No.1507.
[12] Hok K. Ng, Robert H. Chen, and Jason L. Speyer,A Vehicle Health Monitoring System EvaluatedExperimentally on a Passenger Vehicle , IEEE TRANSACTIONS ON CONTROL SYSTEMS TECHNOLOGY, VOL. 14, NO. 5, SEPTEMBER 2006.
[13] Hok K. Ng, Robert H. Chen and Jason L. Speyer, A Vehicle Health Monitoring System Evaluated Experimentally on a Passenger Vehicle, 44th IEEE Conference on Decision and Control, and the European Control Conference 2005Seville, Spain, December 12-15, 2005.
[14] Xian Li, Hui Huang, Ye Sun, DriTri: An In-Vehicle Wireless Sensor Network Platform for Daily Health Monitoring, 2016 IEEE SENSORS, Year: 2016, Pages: 1 -3, DOI: 10.1109/ICSENS.2016.7808894. IEEE Conference publications.

AUTHORE

Gopalakrishna K has awarded the B.E degree in Electronics from Bangalore University, M.Tech degree in VLSI Design and Embedded Systems from VTU, M. Phil degree in Computer Science from M.S.University, Tirunelveli, Tamil Nadu and pursuing PhD. from Jain University. He has 23 years of teaching experience. He is currently working as Associate Professor, Dept. of Electronics & Communication Engineering, School of Engineering & Technology,
Jain University. His field of interests includes Advanced microprocessors, Microcontrollers, Embedded Systems, VLSI Technology and VLSI Designing.

Dr.Hariprasad S A obtained B.E degree in the year 1991 and M.E in the year 2000. He has completed Ph.D. degree in the year 2011 and two additional highest degrees, Doctor of science degrees in the year 2013 and 2014 for the post-doctoral research work on communication and embedded systems. He has published 60 papers in International and National Journals/conferences and a text book on "Advanced microprocessors". Dr. Hariprasad has 22 years of teaching experience and 09 years of research experience. He held key posts, like Director for Cognitive science, RVCE, Vice-principal, BMSIT, Pro-vice-Chancellor-Dayananda Sagar University, Academic mentor for DSCE and DSATM. Dr. Hariprasad established industry supported labs and served as visiting professor to various reputed colleges in Bangalore. Currently he is working as Director, School of Engineering Technology, Jain University.