

Analysis and Design of Digital Meter in Vehicles to Control Fuel Consumption Using UTLP

P.Sureshbabu¹, P.Mohan², N.Santhiyakumari³, M.Thangavel⁴

PG Scholar, Department of ECE, Knowledge Institute of Technology, Salem, India^{1,2}

Prof and Head, Department of ECE, Knowledge Institute of Technology, Salem, India³

Professor, Department of ECE, Knowledge Institute of Technology, Salem, India⁴

ABSTRACT: India is expected to become the world's third-largest passenger vehicle market by 2019, but the consumption of fuel is increasing in metropolitan cities due to enhancement of triped lengths that shifts for a modal share towards personalized modes of travel and congested intersection. When the vehicles were stopped at the signal and wait to turn green, many drivers do not off their vehicles, this result in unwanted fuel wastage. The minimum amount of fuel wasted and aggregated over a number of days per month, number of cycles per day and number of signalized intersections that in turns become huge quantity. To overcome this, digital meter is instigated in this paper, using Unified Technology Learning Platform kit. This is done by Interfacing the external input and Unified Technology Learning Platform by the General Purpose Input and Output port which is in a Unified Technology Learning Platform kit. The implementation of digital meter with fuel consumption is controlled by RF transceiver. Due to this fuel consumption rate will be reduced in traffic signal. Also the calculation of current Speed and distance travelled by particular vehicle from one place to another is also calculated, where in the fuel consumption rate is determined and fuel wastage is reduced to extent.

KEYWORDS - Digital speedometer, Fuel Consumption, General purpose input output (GPIO), Unified Technology Learning Platform (UTLP) Kit,

I. INTRODUCTION

Now days a country is expected to consume 166.87 million tonnes of refined fuels in 2015/16 versus an estimated 161.57 million tonnes this fiscal year, according to a forecast by India's energy data body the Petroleum Planning and Analysis Cell (PPAC). Indian economy is projected to grow close to 7.4 percent this fiscal year to March 31. It grew at 7.5 percent in December quarter from a year ago. In 2015/16, India's GDP is estimated to grow at 8-8.5 percent. The growth in the demand for diesel, which accounts for more than 40 percent of refined fuel consumption in India, is set to rise 4.1 percent to 71.32 million tonnes while that of gasoline is expected to grow 7.2 percent to about 19.72 million tonnes.

Only about 15 percent of the energy from the fuel in the tank gets used to move the bike down the road. The rest of the energy is lost due to engine and driveline inefficiencies and idling. Therefore, Nowadays the potential to improve fuel efficiency and to reduce fuel wastage is significant. The innovative technique in this paper can overcome these day by day increasing problems.

To implement Digital Speedometer with Fuel consumption control using RF technology a microprocessor comes out as a simple and cost effective solution. But, on choosing open multimedia application platforms (OMAP3530), it has a large amount of code and data memory and sufficient RAM to accurately. It has an inbuilt oscillator so it do not have to connect an external crystal. The display used in alphanumeric dot matrix liquid crystal display (HD44780) compatible 16x2 character display.

A speedometer or a speed meter is a gauge that measures and displays the instantaneous speed of a land vehicle .A Digital meter converts the pulses obtained from read-magnet mechanism to a speed and displays this speed on an

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Special Issue 6, May 2015

electronically-controlled analog-style needle or the digital display. Pulse information is used for a variety of other purposes by the Engine Control unit (ECU) or full-vehicle control system.

Nowadays many wireless controlling technologies are available. To use a Radio Frequency (RF) technology for wireless control system. RF technique uses a transmitter and receiver for wireless transmission using which fuel consumption at traffic signal interactions can be controlled. In this techniques specified the literature survey it has been cleared that reduction of fuel consumption became most essential part in traffic protocols. Using RF technology to reduce the automatic turning ON and OFF the engines of vehicle at traffic signal as per the requirement. It is normally required to electrical switch from a distance without being a direct line of view between the transmitter and receiver. An RF based wireless remote control system (RF Transmitter & RF Receiver) can be used to control an output load from a remote place. The RF receiver can received the signal from predefined signal/data pattern. An ideal solution of this application is provided by compact transmitter and receiver module, which operate at a frequency of 434 MHz Here, the (RF) transmission system employs Amplitude Shift Keying (ASK) with transmitter (and receiver) operating at 434 MHz .To use the RF module simplifies the construction of a wireless remote control system and also makes it more reliable.

Coifman.B [1] et al. described that the vehicle reidentification algorithm for consecutive detector stations on a freeway, whereby a vehicle measurements made a downstream detector station is matched with the vehicle's corresponding measurement at an upstream station. The method is illustrated using measured vehicle lengths from paired loop detector speed traps. Where the speed traps are quite common, often placed at half mile spacing or less than the urban freeways. In conventional operation, these detectors only monitor traffic conditions over the loops at leaving freeway unmonitored. By taking a difference in known arrival time for a matched vehicle, it is possible to measure a true link travel time and the quantify conditions between detector stations. This approach is very significant because no one has attempted to use a existing detector infrastructure for match vehicle measurements between the detector stations. These results of work suggest that it is possible to extract a sufficient number of vehicle matches for a traffic surveillance application. An algorithm determines a possible to assess the applications of travel time data without deploying new detector hardware.

Honghong Gao [2] et al. described the wireless magnetic sensor network offers an attractive and low-cost alternative to inductive rounds for traffic measurement in freeways and intersection points. In addition to provide a vehicle count, occupancy, and speed of these sensors yield information (such as non-axle-based vehicle classification) that cannot be obtained from standard series data. The detection capabilities of magnetic sensors on the basis of two field experiments. The first experiment collected a 2-h trace of measurements on Hearst Avenue in Berkeley at California. A vehicle detection rate was improved 99% (100% for vehicles other than motorcycles), and estimate a average vehicle length and speed appear to have been better than 90%.

The measurements also yield intervehicle spacing or headways, revealing interesting phenomena such as platoon formation downstream of traffic signals. Resulting of the second experiment are preliminary. A Sensor data from 37 passing vehicles at the same site are processed and classified into six types. 60% of the vehicles are classified correctly when length is not used as a feature. To organize the algorithm can be executed in real time by the sensor node itself, in contrast to other method based on high-scan-rate inductive loop signals, which require extensive off-line computation. It is believed that if length were used as a feature, 80% to 90% of vehicles would be correctly classified.

Kosuge,[3] et al. described a method and apparatus for indicating mileage corresponding to remaining fuel for vehicles includes a microprocessor connected to receive input signals respectively indicating a traveled distance and a consumed fuel quantity in a predetermined short period. During such time when quantity of fuel remaining in the tank is above a certain threshold level, the mileage corresponding to the remaining fuel is calculated by multiplying the remaining fuel quantity by a fuel consumption (Km/l) which substantially corresponds to the average fuel consumption during a period between two recent successive fillings of the fuel tank. After the remaining quantity of fuel has reduced below the threshold level, the value of the fuel consumption is updated by increasing the weight of the momentary fuel consumption which reflects the actual running condition. The microprocessor repeatedly calculates the mileage at predetermined intervals and the numerical value of the calculated mileage corresponding to the remaining fuel is displayed on a display unit digitally.

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Special Issue 6, May 2015

Min Goo Lee[4] et al. proposed the estimation method of fuel consumption from vehicle information through on board diagnostics(OBDII).A production of fuel consumption from a vehicle Revolution Per Minute (RPM), Throttle Position Sensor(TPS) as input by using polynomial equations. We had modeling as quadric function and surface function with OBDII data and fuel consumption data supported by automotive company in real.

In order to verify the effectiveness of proposed method, 5 km road test was performed. The results showed that the proposed method can estimate precisely the fuel consumption from vehicle multidata. It was observed that the proposed models using instantaneous engine RPMTSP and (RPM, TPS) can predict the fuel consumption quite well with the coefficient of determination were 76%,88% and 71% respectively.

Valerie H. Johnson [5] et al.described the Hybrid electric vehicles (HEV’s) offers additional flexibility to enhance the fuel economy and emissions of vehicles. A Real-Time Control Strategy (RTCS) presented here to optimize efficiency and emissions of a parallel configuration of HEV. In order to determine the ideal operating point of the vehicle engine and motor, to control the strategy of possible engine-motor torque pair. For the given operating point, a strategy predicts in possible energy consumption and the emission can emitted by the vehicle. The strategy calculates a “replacement energy” that would restore the battery state of charge (SOC) to the initial level. In this replacement energy accounts for inefficiencies in the energy storage system conversion process.

A User and standard-based weightings of time-averaged fuel economy and emissions performance determines the overall impact function. The strategy continuously selects a operating point at is the minimum of the cost function. A Previous control strategy employed a set of static parameters optimized in a particular drive cycle, and they showed a little sensitivity to subtle emissions tradeoffs.

The new control strategy adjusts its behavior based on the current driving conditions. A Simulation results for RTCS and a static control strategy on a PNGV-type base line parallel HEV (42 kW engine and a 32 kW motor) using ADVISOR are presented. A Comparison of the simulation demonstrates the flexibility and advantages of RTCS. Compared to an optimized static control strategy, the RTCS reduced NOx emissions by 23% and PM emissions by 13% at a sacrifice of only 1.4% in fuel economy.

Zonglin Zhang[6] et al.developed a kind of motorcycle speedometer tested system is introduced. Based on this industrial computer, plug-in data acquisition card, frequency converter and roller test bench, a real-time acquisition of motorcycle actual speed is realized.

According to GB7468-2005, motorcycle speedometer is evaluating to the supply of basis in safe operation and speedometer calibration. During this process a speedometer, the operator can control a motorcycle speed at any stable value with a speed regulation box and complete the test without any other auxiliary staffs. Compared with the instruments used in real road test of speedometer, a test system not only simplifies the operating process, but also provide more accurate and reasonable.

II. BLOCK DIAGRAM

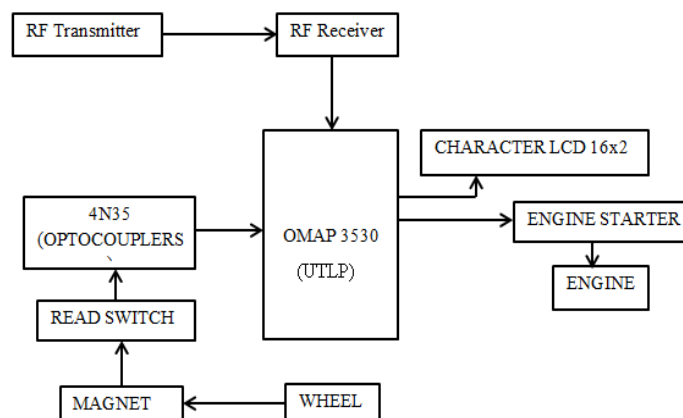


Fig.1. Block diagram of digital speedometer

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Special Issue 6, May 2015

A. Description

The block diagram of digital speedometer is shown in the figure 1. The program is coded and compiled using eclipse software. After assembling, the Unified Learning Kit (ULK) control panel is interfaced to the UTLP. The code is loaded in control panel to run the system. It is processed by using two devices. They are Texas OMAP 3530 processor and Xilinx spartan6 FPGA. According to the given input, the output is displayed in console window, Character Liquid Crystal Display.

B. Eclipse

Eclipse is multi-language software which is developed by development environment tool including an Integrated Development Environment (IDE) and an extensible plug-in-system. It is written mostly in Java. It can be used to develop the applications in Java program and, by means of various plug-in systems, other programming languages including Ada, C, C++, COBOL, FORTRAN, Haskell, Perl, PHP, Python etc. Eclipse IDE tool is a tool which is used for developing applications based on C language for UTLP.

C. ULK control panel

The ULK control panel is an application program and it is developed using Ubuntu development personal computer which facilitates the communication between the Ubuntu Host personal computer and the UTLP. It also enables downloading and executing the UTLP program in usual mode. Fig.2. shows the host and client interface.

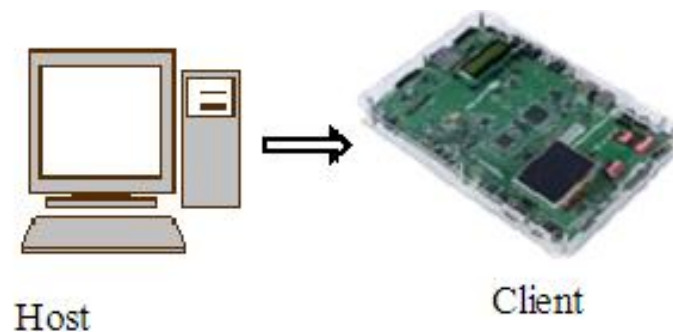


Fig.2. Host and Client Interface

D. Texas OMAP3530

The ULK is based on Texas Instruments OMAP3530 application processor and Spartan-6 FPGA. The Texas Instrument OMAP 3530 processor is a high performance processor which is based on OMAP architecture. It is used to support high-speed devices and number of thread processing applications.

The OMAP3530 processor supports with different interfaces such as Mobile DDR, Nand Flash, Audio in & out, TV out, Touch screen LCD, VGA out, Ethernet, Keyboard, USB two SD cards, Control sensor header, I/O expansion connector, I2C header for GPS, Bluetooth & Modern Connectors, Simple Digital Interface connector, IrDA connector, Camera Connector & LCD connector.

E. .Spartan-6 FPGA

Spartan 6 FPGA has 2 mega byte of SPIROM from Atmel. Then, it has 10 bit ADC with parallel interface and 12 bit DAC with parallel interface. It contains JTAG interface, 7-segment LED's, 20 pin header and 70 pin I/O expansion connector, DIP switches and Status LED's.

F. UTLP- Interfaces

UTLP has different devices and interfaces which can be accessed both in the normal mode and in the lab mode. The program developing and executing them using control panel for the following devices in the normal mode such as 7 segment display, Character LCD, Keyboard, Graphics LCD, Touch panel.

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Special Issue 6, May 2015

Application Programming Interface (API) are the functions provided by interface libraries. By using these library calls in the programs for an interface functionally. At the linking time, the API library binaries to make an executable program. In the UTLP normal mode, there are interface libraries provided for different devices and functionality.

Reads a string from the control panel input window-

Void ulk_scanf_string(char*user_string)

Outputs a string on the serial port-

Uin8 ulk_printf(const char*fmt...)

Prints a string in the control panel output window-

Void ulk_cpanel_printf(const char*fmt...)

Reads a hex value from the control panel input window-

Void ulk_scanf_hex(unsignedlong*hex_variable)

G. Character LCD

A 16x2 LCD shows to display 16 characters per line and has 2 lines.

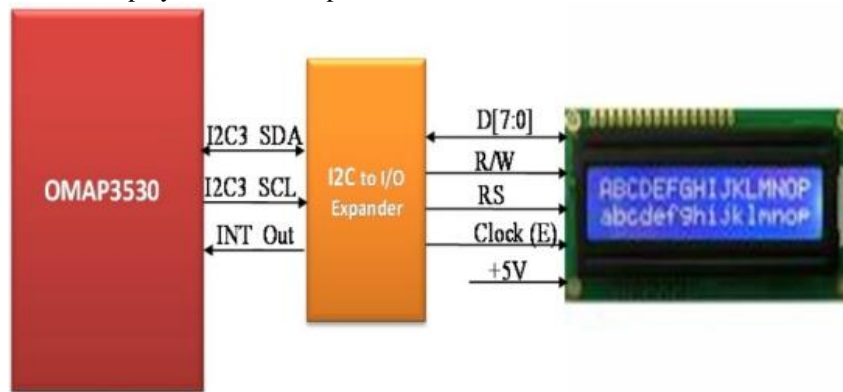


Fig.3. Character LCD

Each character is displayed in 5x7 pixel matrix. Character LCD interface is shown as Fig.3. The 16x2 character LCD is connected through the I2C interface.

H. Implementation

The ARM-8 Cortex processor, based on the ARMv7 architecture, has the ability to scale in speed from 600MHz to greater than 1GHz. The Cortex-A8 processor can meet the requirements for power-optimized mobile devices needing operation in less than 300mW.

III. RESULTS AND DISCUSSION

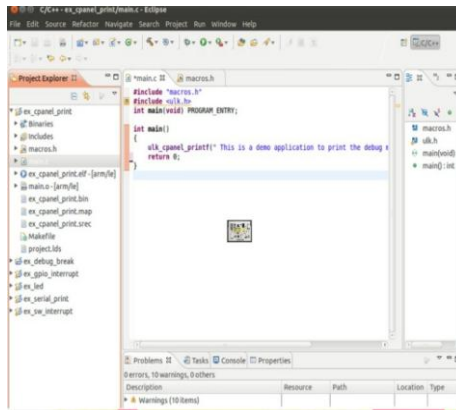
The program written in Embedded C was executed using the Eclipse software. C application program window is shown in the figure 6a. After successful execution, it is interfaced with the UTLP kit through ULK control panel.

Fig. 6b shows the execution window of the ULK panel where the program was interfaced with the kit. ULK load and execution operation was done in the ULK panel; it was shown in the fig.6.c. Then the output of fuel consumption in traffic signal shown in fig.6.d.

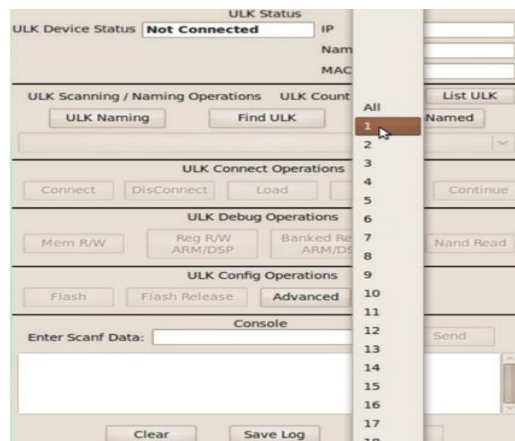
International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

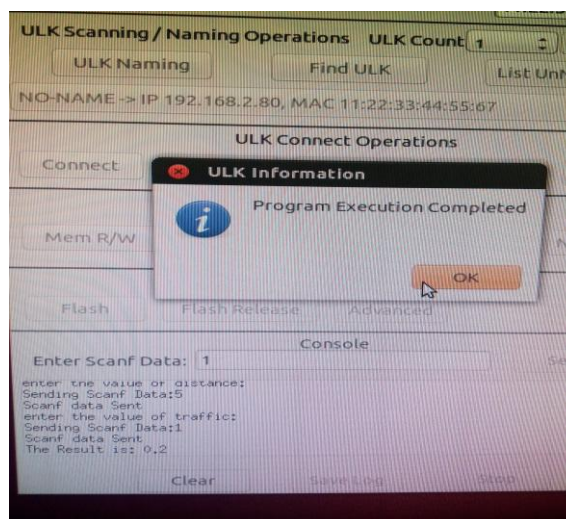
Vol. 4, Special Issue 6, May 2015



(a)



(b)

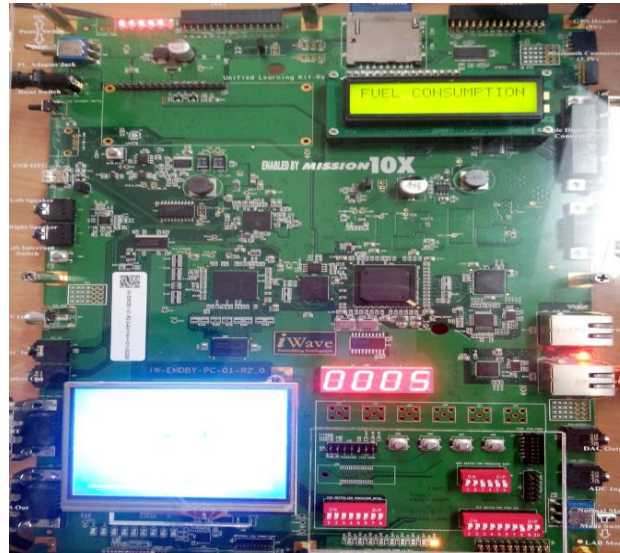


(c)

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Special Issue 6, May 2015



(d)

Fig.6. (a) Eclipse Software program window, (b) ULK Control panel,
(c) ULK Load operation, (d) Character LCD and 7 segment display Output,

IV. CONCLUSION

By implementing UTLP based Digital Speedometer with Fuel consumption control using RF transceiver, 25-30% of fuel consumption of vehicle at traffic signal is reduced and in turn its controls the pollution. By mounting the Digital Speedometer on the vehicle exact speed and distance traveled by the vehicle is recorded with very high accuracy. It representative signalized intersections of varying traffic volume have been selected in this study to as certain fuel loss during idling of vehicles. Ganesh Kute proposed Delhi, 0.37 million kilograms of CNG, 0.13 million liters of diesel and 0.41million liters of petrol is wasted everyday due to wasting of vehicles. After the implementation of this project, a total of 30 per cent of fuel funds and 18 per cent savings in the economic loss shall be ensued. In 2010–11, a total of 0.5 Million Metric Tonne (MMT) of petroleum products was sold in Pune, which are estimated to have generated 1.7 million tonne CO₂ emissions. The transport sector generated 51% of the overall emissions from the use of petroleum products. Petrol and diesel were responsible for about 30% and 19% of the emissions from the petroleum products generating 0.5 million tonne CO₂ and 0.320 million tonne CO₂ emissions, respectively. The other large source of emissions was from the consumption of domestic LPG, which generated 0.4 million tonne CO₂ emission. So it will also help to reduce substantial amount CO₂ emission which will be beneficial for the environment.

REFERENCES

- [1]. B. Coifman and M. Cassidy, "Vehicle reidentification and travel time measurement on congested freeways," Transportation Research Part A: Policy and Practice, vol. 36, no. 10, pp. 899-917, December 2002.
- [2]. Honghong Gao and Fang Luo, "Design of Motorcycle Speed Measuring System," Small Internal Combustion Engine and Motorcycle, vol. 37, no. 2, pp. 46-48, April 2008.
- [3]. Kosuge, et al, "Method and apparatus for indicating mileage corresponding to remaining fuel for vehicles," US Patent 4400779, August 1983.
- [4]. Min Goo Lee, Yong Kuk Park, Kyung Kwon Jung and Jun JaeYoo, "Estimation of Fuel Consumption using In-Vehicle Parameters," International Journal of u- and e- Service, Science and Technology, Vol. 4, No. 4, December, 2011.
- [5]. Valerie H. Johnson, Keith B. Wipke. HEV control strategy for real-time optimization of fuel economy and emissions, SAE2000-01-1543, 2000.
- [6]. Zonglin Zhang, Lin Yang, Development for Motorcycle Test Stand, Shandong Internal Combustion Engine, vol.73, no.3, pp. 22-24, Sept. 2002.
- [7]. Robert M. Bucks, Norristown, Frederick M. Ayars, "Vehicle Data Recording System", US Patent 3792445, February 1974.
- [8]. Hojat Ghassemi, Hamidreza Farshi Fasih, "Application of small size cavitating venturi as flow controller and flow meter", Science Direct, p.

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Special Issue 6, May 2015

- 406-412, May 2011.
- [9]. Rashmi R, Mrs.Rukmini Durgale, "The Novel of Embedded Based Digital Fuel Gauge," International Conference on Computing and Control Engineering (ICCCE 2012), 12 & 13 April, 2012.
 - [10]. Low Cost Intelligent Real Time Fuel Mileage Indicator for Motorbikes "Jaimon C hacko Varghese, Binesh Ellupurayil Balachandran, (IJITEE) ISSN: 2278-3075, Volume-2, Issue-5, April 2013.
 - [11]. Daniel R. McGlynn, "Vehicle Usage Monitoring And Recording System", US Patent 4072850, February 1978.
 - [12]. A. Beaulieu, E. Foucault, P. Braudb, P. Micheau, P. Szegez, "A flowmeter for unsteady liquid flow measurements," Science Direct, p. 131-137, January 2011.
 - [13]. Electronic equipment on rail vehicles (<http://www.selectron.ch/downloads/kataloge/normen-EN-50-155/Standard-EN-50155>).
 - [14]. INSTALLATION INSTRUCTIONS DIGITAL FUEL LEVEL 2650-1239-00 Rev. A, © 2007 Auto Meter Products, Inc. UAF 2115 Speedometer and Mileage indicator" Edition Jan. 15, 1997 6251-435-1DS ITT Semiconductors.
 - [15]. M.A.S Kamal, M.Mukai, J.murata "On Board eco-driving System for Varying Road Traffic Environments using Model Predictive Control," 2010. IEEE International Conference on Control Application, 2010, pp.1636-1641.
 - [16]. H Haibo Qiao, Yicheng Zhang, Yongtao Yao, Li Wei, "Analysis of Buck-Boost Converters for Fuel Cell Electric Vehicles," IEEE Conf. Vehicular Electronics & Safety, pp. 109-113, 13-15 Dec. 2006.
 - [17]. Premananda Pany, R.K. Singh, R.K. Tripathi, "Bidirectional DC-DC converter fed for electric vehicle system." J. Eng. Science & Tech, vol. 3, no.3, pp.101-110, April 2011.
 - [18]. D.R. Northcott, S. Filizadeh, A.R. Chevrefils, "Design of Bidirectional Buck-Boost DC/DC Converter for a Series Hybrid Electric Vehicle Using PSCAD/EMTDC," IEEE Conf. Vehicle Power & Propulsion, pp. 1561-1566, 7-10 Sept. 2009.