Real Time Intelligent Driver Assistance System

Thanima Thulaseedharan, Vijayakumar.K, Nishitha Gerison

Electronics Engineering Department, Toc H Institute of Science & Technology, CUSAT, Kerala India

Email: Thanima.Aus@gmail.com

Abstract— Real Time Intelligent Driver Assistance System is an in-vehicle embedded system, which assist the driver and generate a vehicle health report. It predicts the errors so that the driver can have an uninterrupted journey and can avoid accidents. Thus, it alerts the driver about future errors and assists for a safe drive especially through Indian roads.The main objective is to monitor various vehicle parameters such as temperature, battery voltage, CO level in the exhaust, fire detection, fuel status and road surface nature. It detects and reports the surface conditions of the roads. This system uses ARM 7 microcontrollers at the Engine/Environment Data Processing Unit as well as Driver Assistant Status Unit and Controller Area Network (CAN) protocol for the communication between the two units. CAN bus is a vehicle bus that is designed to communicate microcontrollers and other electronic devices without a host computer. The program is compiled in Keil µVision3 using Embedded C.

Keywords—Controller Area Network (CAN) protocol, CO level, fire detection, Battery voltage, fuel status, road surface, Keil

INTRODUCTION

Based on statistics, it reveals that road accidents on an average cause 2 million deaths and 100 million injuries around the world each year. As a first step, an intelligent driver assistance system is being developed. Vehicles in Indian roads faces damaged pavements or roads, human interference, random vehicle movements which lead to sudden and unexpected stops. This calls for the monitoring of vehicle condition as well as surroundings.

The proposed Real Time Intelligent Driver Assistance System is an in-vehicle embedded system, which assist the driver and generate a vehicle health report. It predicts the future errors so that the driver can have an uninterrupted journey and can avoid accidents. Thus, it alerts the driver about future errors and assists for a safe drive especially through Indian roads.The main objective is to monitor various vehicle parameters such as temperature, presence of CO level in exhaust, battery voltage, fire detection, fuel status and road surface nature. It detects and reports the surface conditions of the roads. It also acts as an efficient eco-friendly system by regulating the environmental pollution.

LITERATURE SURVEY

Ray F et al (2002) Describes the substrate technologies for harsh environment automotive electronics applications [9]. Along with the environmental concerns come the challenges of meeting overall size constraints required of increasinglycomplex controllers by utilizing finer features and the geometries. Electronic substrate technologists have been responding to this challenge effectively in an effort to meet the performance, size and cost requirements. The key to successful automotive electronics is the recognition that the automobile is an electronic system fully integrated with its moving parts as opposed to a mechanical device replete with electronic monitors and controls. The environments for automotive electronics products differ from location to location within the vehicle. In general, these environments are harsher than the consumer electronics products that are used in more benign home or office environments. The high-density organic substrate technology will be a leading choice for many automotive electronics applications.

Knoll P. M.et.al (2002) Describes the liquid crystal display unit for reconfigurable instrument for automotive applications [11]. Electro-optical displays and flat screens incorporating liquid crystal technology will be used to an increasing extent in future vehicles. Their use will expand from the instrument cluster through the centre console to the rear passenger compartment area. The classic instrument cluster will be enhanced with graphics capable display modules displaying information relevant to the driver from the vehicle. The centre console is the obvious choice for display of information relevant to driver and passenger from various information components. Owing to the availability of appropriate transmission methods to the moving vehicle, smaller monitors for entertainment and multimedia purposes will be found in the future in the rear passenger compartment area. Flat PC monitors, integrated in the passenger seat's backrest, will, in the future, make possible the mobile office with all usual components of the office workstation, in conjunction with the familiar mobile services. Various LCD technologies, from the simple TN-LCD to the actively addressed flat screen, will allow effective adaptation of the display performance to the relevant application.

Axelsson J.et.al (2003) Presents the correlating business needs and network architectures in automotive applications [8]. The main challenge is cost efficient development of the system with respect to business, standards, functionality, architecture, and quality for the automotive industry. There are three different architectures – used in passenger cars, trucks, and construction equipments. Communication networks in automotive vehicles replace the numerous cables and harnesses, thereby reduce the number of connection points, cost and weight. Networking enables the demand for increasingly efficient diagnostic, service and production functionality. The diagnostic system provides status of the vehicle.

Johnson R. W.et.al (2004) Describes about the changing automotive environment [10]. The underhood automotive environment is harsh and current trends in the automotive electronics industry will be pushing the temperature envelope for electronic components. The desire to keep engine control units on the engine and transmission control units either on or in the transmission will push the ambient temperature above 125 C. The number of sensors in vehicles is increasing as many electrically controlled systems are added. Many of the sensors must work in high-temperature environments. The applications are exhaust gas sensors and combustion sensors or cylinder pressure. High temperature electronics use in automotive systems is growing, but it will be gradual as cost and reliability issues are addressed.

Johansson. K. H (2005) Describes about the vehicle application of Controller Area Network [6]. In the automotive industry, embedded control has grown from stand-alone systems to networked and highly integrated control systems. By networking electromechanical systems, it becomes possible to modularize functionalities and hardware, which facilitates add-on and reuse capabilities. The Electronic Control Unit handles the control of engine, fan, turbo etc. but also the CAN communication. Combining mechatronic and networks modules makes it possible to reduce both the cabling and the number of connectors, which increases reliability and facilitates production. Introducing networks in vehicles also makes it possible to more efficiently carry out diagnostics and to coordinate the operation of the separate subsystems.

Li R.et.al (2008) Describes about the design for automotive CAN bus monitoring system [7]. This system is designed to test automotive CAN (Controller Area Network) controlled devices or entire network. This system not only display CAN frames (CAN 2.0A/B) received from or sent onto a CAN bus, but also can record data on log files for off-line evaluation. Users can configure CAN channel features and several monitoring modes of the system with PC application. The USB technology adopted in the system make it a more practical and convenient CAN bus testing system.

Gupta S. D.et.al (2012) Describes about the design and implementation of water depth measurement and object detection model using ultrasonic signal system [5]. There are several ways to measure water depth without physical contact. Some devices use infrared light transmitters and receivers to determine water depth. There are devices that have laser-based systems which have improved accuracy and precision. The detection techniques of laser, infrared, radar, and ultrasonic have been widely applied at the aspect of water depth measurement. The research of the water depth measurement system backing up with high ratio of capability to low price has ended at Ultrasonic Range Finder. This technique has provided a useful tool to more accurately to identify the water depth and object. Presented the noble methodology for measuring water depth and object detection using Ultrasonic sounds to provide efficient and effective way.

Sakhardande J.et.al (2013) Describes about Arduino Based Mobility Cane [3]. The cane a mechanical device which is dedicated to detect static obstacles on ground, uneven surfaces, holes, steps and other hazards via simple tactile force feedback. The light weightiness and the capability to be folded into a small piece can be advantageous to carry around when not required. This designed canes are only capable of detecting below waistline obstacles like street curves, steps and stair- cases etc. These canes are capable of detecting obstacles but receiving feed- back is low. Therefore visually impaired individuals still find it difficult to navigate especially in unknown milieu. It is low cost, robust and user friendly. The designed mobility stick can be easily operated uses ultrasound sensors for detecting the obstructions before direct contact. It provides haptic feedback to the user in accordance with the position of the obstacle.

Reddy. B. N. K.et.al (2013) Present about efficient online mileage indicator by using sensors for automobiles [4]. Motor vehicles displays the amount of fuel in the fuel tank by means of some indication like bars running through the Empty and Full indicators. The manufacturer provides specification that each bar maps to the corresponding litres of fuel approximately. Usually drivers experience the problem with improper estimations of the current fuel level in the tank with existing representation system. Aims at overcoming the drawbacks of this existing system by providing clear information to the user about the exact indication of fuel level digitally in litres and further distance to travel with the available fuel with respect to the different conditions of travelling such as in Highways and heavy traffic roads there by removing the ambiguity to the user.

Vijayalakshmi S (2013) Discuss about the vehicle control system implementation using CAN protocol [2]. Generally a vehicle was built with an analog driver-vehicle interface for indicating various vehicle status like speed, engine temperature, fuel level etc. this explains about the development and implementation of a digital driving system for a semi-autonomous vehicle for improving the driver-vehicle interface. It uses ARM based data acquisition system that uses ADC to bring all control data from analog to digital format and visualize via LCD. The communication module used is embedded networking by CAN which has efficient data transfer. Also it takes feedback of vehicle conditions like Vehicle speed, temperature etc., and controlled by main controller. Additionally this unit is equipped with GSM which communicates to the owner during emergency situations.

Presi. T. P (2013) Describes the design and development of PIC Microcontroller based vehicle monitoring system using Controller Area Network (CAN) protocol [1]. Controller Area Network (CAN) is an attractive alternative in the automotive and automation industries due to low cost, ease in use and provided reduction in wiring complexity. It was developed for communication between various digital devices inside an automobile where heavy electrical interferences and mechanical vibrations are present. Presence an idea of implementation of CAN protocol using PIC for monitoring vehicle. The main feature of the system includes monitoring of various vehicle parameters such as Temperature, Battery Voltage and Light due to spark or fire and presence of CO level in the exhaust.

PROPOSED METHODOLOGY

With rapidly changing computer and information technology and much of the technology finding way into vehicles. Technologies are undergoing dramatic changes in their capabilities and how they interact with the drivers. Although some vehicles have provisions for deciding to either generate warnings for the human driver or controlling the vehicle autonomously, they must make these decisions in real time with only incomplete information. So, it is important that drivers still have some control over the vehicle. Advanced vehicle information systems provide vehicles with different types and levels of intelligent to assist the driver.

The driver should be aware of certain parameters of vehicle such as engine temperature, battery voltage, gas emission and light due to spark or fire for the safeguard of both the driver and the vehicle, also fuel availability, and road surface nature for safe and well-planned journey. Some modules of the network will be high speed and other modules will be low speed. Therefore, in-vehicle network need to integrate many modules that interact with environment and process low and high speed information. i.e., testing is more challenging. Real time intelligent driver assistance system uses ARM processor and CAN protocol as shown in Figure. 1 which works on real time basis. This provide an efficient monitoring system that aids the driver.

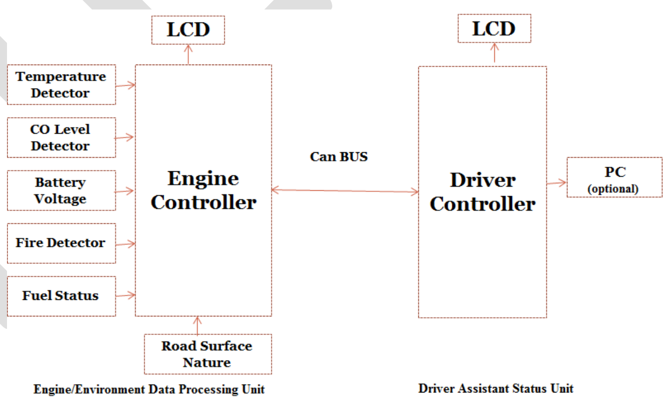


Figure 1: Block Diagram

SIMULATION RESULTS

The following figures show the simulation output in Keil µVision.

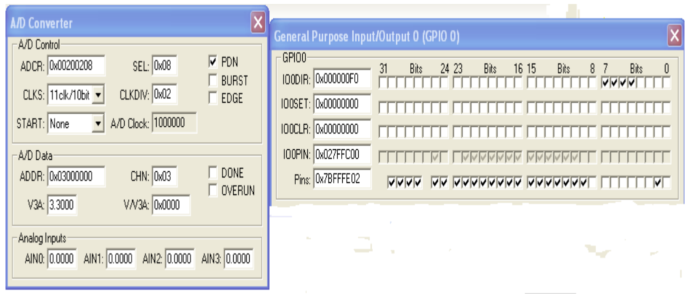


Figure 2: Analog and Digital input ports

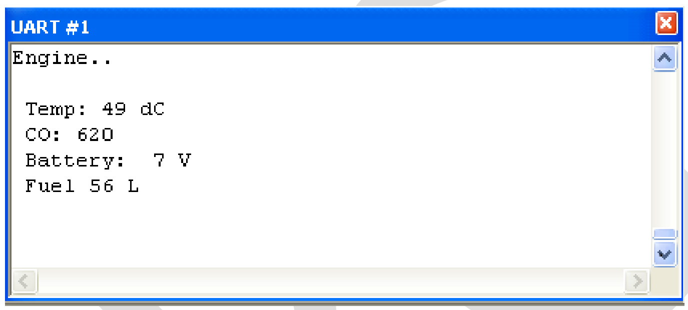


Figure 3: Display at Engine/Environment Data Processing Unit

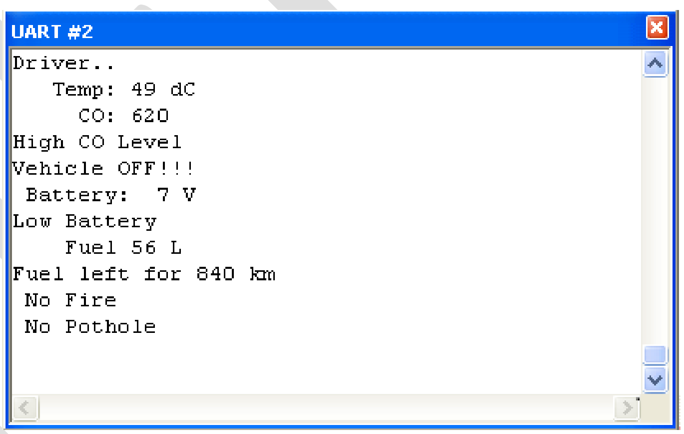
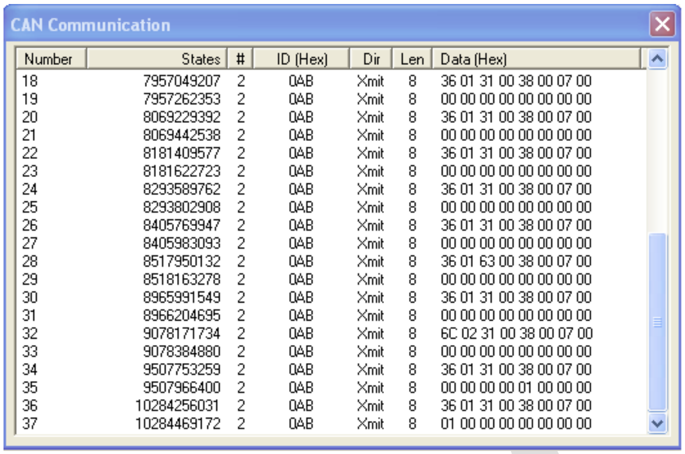


Figure 4: Display at Driver Assistant Status Unit



CAN Communication

Number	States	#	ID (Hex)	Dir	Len	Data (Hex)
18	7957049207	2	0AB	Xmit	8	36 01 31 00 38 00 07 00
19	7957262353	2	0AB	Xmit	8	00 00 00 00 00 00 00 00
20	8069229392	2	0AB	Xmit	8	36 01 31 00 38 00 07 00
21	8069442538	2	0AB	Xmit	8	00 00 00 00 00 00 00 00
22	8181409577	2	0AB	Xmit	8	36 01 31 00 38 00 07 00
23	8181622723	2	0AB	Xmit	8	00 00 00 00 00 00 00 00
24	8293589762	2	0AB	Xmit	8	36 01 31 00 38 00 07 00
25	8293802908	2	0AB	Xmit	8	00 00 00 00 00 00 00 00
26	8405769947	2	0AB	Xmit	8	36 01 31 00 38 00 07 00
27	8405983093	2	0AB	Xmit	8	00 00 00 00 00 00 00 00
28	8517950132	2	0AB	Xmit	8	36 01 63 00 38 00 07 00
29	8518163278	2	0AB	Xmit	8	00 00 00 00 00 00 00 00
30	8965991549	2	0AB	Xmit	8	36 01 31 00 38 00 07 00
31	8966204695	2	0AB	Xmit	8	00 00 00 00 00 00 00 00
32	9078171734	2	0AB	Xmit	8	6C 02 31 00 38 00 07 00
33	9078384880	2	0AB	Xmit	8	00 00 00 00 00 00 00 00
34	9507753259	2	0AB	Xmit	8	36 01 31 00 38 00 07 00
35	9507966400	2	0AB	Xmit	8	00 00 00 00 01 00 00 00
36	10284256031	2	0AB	Xmit	8	36 01 31 00 38 00 07 00
37	10284469172	2	0AB	Xmit	8	01 00 00 00 00 00 00 00

Figure 5: CAN Communication

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CONCLUSION

Based on the literature survey, the real time intelligent driver assistance system is simulated using Keil µVision. The simulation was completed successfully. In this system, six critical parameters of vehicle were included for monitoring. ARM processor is used as controllers at both engine and driver side and CAN bus for communication between engine and driver side for real time application.
This system was simulated and generated a vehicle health report that enables to know about the current condition of vehicle so as to provide a safe drive. It monitors engine temperature, CO level, battery voltage, presence of fire, fuel status and road surface nature and also provides necessary alarms whenever abnormal conditions occur.

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