# Arduino Based Monitoring and Control System for Heavy Vehicles

Shashidhar Kasthala<sup>[1]</sup>, Ramakrishna G<sup>[2]</sup>, G.K.D Prasanna Venkatesan<sup>[3]</sup>

Faculty of ECE <sup>[1]</sup> Indian Naval Academy, Ezhimala, Kerala SNS College of Engineering <sup>[3]</sup> Coimbatore, Tamil Nadu

India

## ABSTRACT

The aim of this paper is to design a system for detecting the leakage of fuel (i.e. petrol or diesel) and control the speed of the vehicle. The system is also extended to monitor the engine temperature and also to detect Metal if carried by the passenger in luggage or with him. The proposed system uses arduino to control actions like activating the buzzer, display the status to driver and send message to the control station(bus point) using the GSM Module.

Keywords :--- Gas sensor, Temperature senor, Metal detector and arduino.

#### I. INTRODUCTION

In the recent past, fire mishaps in vehicles due to fuel leakage have lead to large number of causalities in form of human life and properties. Accidents in the heavy vehicles, like long distance travelling buses, may also happen due to over speeding of vehicle or engine overheating. There can be also some worst scenarios like hijacking or terrorist attacks [1][2].

The idea in the design proposed in this paper is to develop a system which monitor and present all the above mentioned scenarios. The status of these cases is also indicated to the driver and simultaneously the information is passed to the control station[3][4].

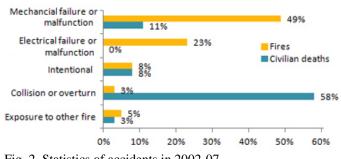


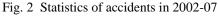
Fig. 1 Fire mishap of moving bus

In the proposed design, a monitoring system is developed in heavy vehicles to detect certain parameters which may lead to fatalities. The parameters verified are.

- fuel leakage in vehicle
- over heating of engine
- over speeding of vehicle
- metal in passenger luggage cabin
- metal carried by passenger into vehicle

The Statistics of the various types of factors leading to accidents on highways during 2003-2007 is illustrated in Figure 2 [5].





These parameters are monitored and controlled by arduino and if any abnormalities are detected then the buzzer is activated and the related problem is displayed on the LCD screen placed in the drivers cabin. The information is also simultaneously sent to the control center through GSM module. This instant information to the control center will help the maintenance guys at the bus point to send immediate relief/rescue team and ensure safe travel of the passengers [6][7][8].

This paper is organized as follows. In the section II, the system architecture is explained. In Section III, the hardware implementation and the components used are discussed. In the final section, the designed system is discussed for its limitation and scope of improvement.

#### **II. WORKING PRINCIPLE**

Functionality of proposed work is divided into three stages. In the first stages, detection of fuel fume because of fuel leakage using gas sensor, temperature rise in engine and detecting metal in passenger luggage. In the second stage, control action by arduino when any one of the sensor gets activated, basically converting the analog inputs from sensors to digital form. In the third stage, the brakes are applied and the ignition is switched off to control the speed of the vehicle. The information is also sent to the control center simultaneously to the control centre by GSM module. The same information is displayed on the LCD display placed in the drivers cabin [9][10][11].

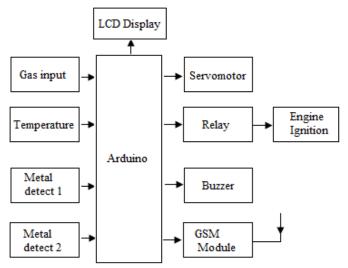


Fig. 3 Statistics of accidents in 2002-07

The functionality of each sensor will be explained in subsequent sections. In the initial stage, the arduino receives input signals from gas sensor, temperature sensor and both the metal detectors placed in different locations of the vehicle. The gas sensor gets activated due to the fuel leakage in terms of fuel fume. This fume may over heat the engine that may cause sparks. This heat produced by the spark is detected by temperature sensor. Similarly carrying of any kind of weapon in luggage or with the passenger is detected by the metal detector 1 and 2 respectively. This is depicted in Figure 3 [12][13][14].

In this proposed work, Gas sensor will be placed inside the cabin i.e. above the engine mounted area. If the gas sensor is placed near engine it obviously will not give accurate data due to continuous fuel fumes. The Gas sensor plays major role, in case of fire, to alert the vehicle control station. In case the fuel fume is detected by the sensor, it will alert the passengers by activating the buzzer and display to the bus driver. But there are more chances to catching up of fire if the problem is not attended with in specified time. Hence, it will also alert the vehicle control station by sending a message through GSM module [15][16][17].

Temperature sensor will be placed near the engine cabin to monitor temperature. If the engine temperature raises above the rated value, buzzer will be switched on and will also be displayed on LCD screen. In case the problem is unattended the vehicle will automatically slows down and simultaneously the relay control will cut-off ignition. This action will avoid the subsequent actions like catching fire because of spark from the engine.

Metal detector1 is mounted inside luggage cabin to check if any passenger is carrying any kind of weapon in luggage. Similarly, metal detector 2 is mounted at the entrance of vehicle to monitor if any passenger is boarding the vehicle with a weapon. In both the cases. it will also the alert through buzzer and will display on LCD monitor [18][19].

#### III. HARDWARE IMPLEMENTATION

In this section, the hardware components used in the proposed design will be explained.

#### A. Gas Sensor

The Gas sensor is used to detect the fuel fume erupting out of engine. This sensor is connected to pin A0 analog input lines of arduino Uno. It requires input voltage of 5V. The sensor has high sensitivity to liquid petroleum gas (LPG), propane and Hydrogen and also has high sensitivity to methane, smoke and other combustible steam.



Fig. 4 Gas sensor MQ2

In case of fuel fume or smoke is detected, the sensor resistance will change. This will cause voltage rise across the sensor to change and activates the signal to arduino

#### B. Temperature sensor

The temperature sensor LM35 is connected to analog input A1 of arduino. LM35 is three terminal devices from National semiconductors. It can measure temperature ranges from  $-55^{\circ}$ C to  $150^{\circ}$ C.

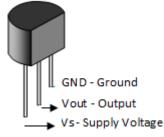


Fig. 5 Gas sensor MQ2

The output voltage varies linearly with the temperature. The output voltage of LM35 increases 10 mV per degree celsius rise in temperature.LM35 operates from 5V. When the temperature rises specified limit temperature sensor activates the arduino which has inbuilt analog to digital converter [20].

#### C. Metal detector

Metal detector k1208065 will be used to detect the presence of metal within its proximity. In this proposed work, two metal detectors are used to monitor the luggage cabin and the bus entrance [21].

#### D. Arduino Board

Arduino unoR3 board has ATMEGA 328P microcontroller. It has in-built analog to digital converter which can use six analog inputs. It also have 14 digital input/output lines operating at 16Mhz clock. It has a input voltage of 7-12V. Arduino board provides Integrated Development Environment (IDE) for programming the Microcontroller and compiling.

### E. Piezo electric Buzzer

Pizeo electric Buzzer works on the inverse principle of piezo electricity. When subjected to alternating electric field they are stretched or compressed, in accordance with the frequency of signal and produce sound. In the proposed work, buzzer is connected to pin6 of digital input/output lines of arduino for alerting the driver. This is output device for arduino.

#### F. LCD display

Liquid crystal display has several interface pins which has to be controlled by microcontroller for displaying the message. In this proposed work 2x16 LCD is used to display messages. This sensor has activated by working simultaneously with the buzzer. Arduino board facilitates the programming of LCD messages to be displayed on LCD Screen.

#### G. Servo Motor

Servo motor is used to slowdown the vehicle by applying breaks and stops the vehicle gradually. Servo motor will respond in case of temperature rise in the engine. This will be used if the diver is not responding to the alarm. Servo motor is connected to pin7 of digital input/output lines of arduino [22].

### H. GSM Module

GSM SIM900 modules in India are used in communication in 900MHz/1800 MHz band. GSM Module requires 12V, 1A DC Supply. Rx pin of arduino connected to Tx pin of GSM module and Tx pin of arduino connected to Rx of GSM module.

# IV. LIMITATION AND SCOPE OF IMPROVEMENT

The proposed system has some design constraints. The gas sensor should be kept away from humid and water vapour. This should also be isolated from the fuel tank. Similarly, the temperature sensor also should kept away from humid and moisture.

The luggage cabin and the entrance should be covered with plastic material for effective operation of the metal detectors. The buzzer position should be appropriate to the size of the vehicle. GSM module should be powered by a separate battery source, so as to alert the control station personnel for quick action.

# **V. CONCLUSIONS**

The Proposed system is tested successfully and can be implemented to avoid the fire mishaps. In the recent past, such

#### International Journal of Engineering Trends and Applications (IJETA) – Volume 5 Issue 1, Jan-Feb 2018

accidents are very frequent on National highways. This system can be further extended by placing few extra sensors like proximity sensors to avoid collision with other vehicles.

### REFERENCES

- Ramakrishna G, Shashidhar Kasthala and G.K.D. Prasanna Venkatesan, "Photovoltaic Based Energy Efficient Air Compressors for Ships," International Journal of Engineering Trends and Applications, Vol. 4, No. 6, 2017.
- [2] Ramakrishna G, Shashidhar Kasthala and G.K.D. Prasanna Venkatesan, "GSM Based Health Monitoring of Critical Equipments," International Journal of Scientific Research in Science and Technology, Vol. 3, No. 8, 2017.
- [3] Ramakrishna G, Shashidhar Kasthala and G.K.D. Prasanna Venkatesan, "Arduino Based Automatic Vehicle Control System", International Journal of Scientific Research in Computer Science, Engineering and Information Technology, Vol. 2, No. 6, 2017.
- [4] Ramakrishna G, Shashidhar Kasthala and G.K.D. Prasanna Venkatesan, "Relevance of Ocean Thermal Energy Conversion in Maritime Applications," International Journal of Scientific Research in Science and Technology, Vol. 3, No. 8, 2017.
- [5] Shashidhar Kasthala and Krishnapriya, "Fault Management of Electrical Drives Onboard Ship using Power Line Communication," International Research Journal of Engineering and Technology, Vol. 4, No. 10, 2017.
- [6] Shashidhar Kasthala and G.K.D. Prasanna Venkatesan, "A Review on PLC Modeling Techniques for Residential Networks," International Journal of Advanced Research in Computer Science, Vol. 8, No. 8, 2017.
- [7] Krishnapriya and Shashidhar Kasthala, "Double Input Buck Converter with One Cycle Control for Solar Energy," Shanlax International Journal of Arts, Science & Humanities, Vol. 5, SI. 1, 2017, pp. 20-33.
- [8] Shashidhar Kasthala, G.K.D Prasanna Venkatesan and A Amudha, "MIMO PLC Channel Modelling on Indian Residential Networks" International Journal of Applied Engineering Research, Vol. 12, No. 14, 2017.
- [9] Krishnapriya and Shashidhar Kasthala, "Implementation of One Cycle Control Method in Buck and Boost Converter," International Journal of Engineering Science Invention, Vol. 6, No. 6, 2017.

- [10] Shashidhar Kasthala, G.K.D Prasanna Venkatesan and A Amudha, "Design and Development of Protective Coupling Interface for Characterizing the Residential Broadband PLC Channel," Journal of Advanced Research in Dynamical and Control Systems, Vol. 9 SI.2, 2017.
- [11] Krishnapriya and Shashidhar Kasthala, "Identification of Cable Faults Onboard Ship using Power Line Communication," International Journal of Advanced Research in Computer Science, Vol. 8, No.3, 2017.
- [12] Shashidhar Kasthala and G.K.D Prasanna Venkatesan, "Experimental Verification of Distributed Parameters on Indian Residential Networks for Power Line Communication," International Journal of Engineering and Technology, Vol. 8, No.6, 2016.
- [13] Shashidhar Kasthala and G.K.D. Prasanna Venkatesan, "Evaluation of Channel Modeling Techniques for Indoor Power Line Communication," Progress in Advanced Computing and Intelligent Engineering, Advances in Intelligent Systems and Computing, vol 54, Springer, Singapore.
- [14] Krishnapriya and Shashidhar Kasthala, "A Comparative Analysis on Different Control Techniques for Buck Converters," The Journal of CPRI, Vol. 12, No. 4, 2016, pp.715-721.
- [15] Shashidhar Kasthala and Saka Rajitha, "Non Intrusive Monitoring of Electrical cables in Ship Power systems," The Journal of CPRI, Vol. 12, No. 4, 2016, pp.665-670.
- [16] Shashidhar Kasthala, Krishnapriya and Saka Rajitha, "An Efficient Photo Voltaic System for Onboard Ship Applications," International Journal of Engineering Research and Applications, Vol 6. No. 2, pp 75-81, 2016.
- [17] Shashidhar Kasthala and Saka Rajitha, "Power Consumption Pattern in Residential Buildings: A Case Study," International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, Vol. 4, No. 4, 2015.
- [18] Shashidhar Kasthala, "Reactive Power Management in Industries: An analysis," International Journal of Emerging Technology and Advanced Engineering, Vol. 3, No. 11, 2013.
- [19] Shashidhar Kasthala and G.K.D Prasanna Venkatesan, "Estimation of Channel Capacity for MIMO Power Line Communication using Multi-Conductor Transmission Line Theory," IEEE International Conference on Applied and Theoretical Computing and Communication Technology, Bangalore, July 2016.
- [20] S. Saranya, A.Vijay, G.K.D Prasanna Venkatesan. ,"A Hybrid Communication Infrastructure Power System Using Effective Sensor Network", International Journal

### International Journal of Engineering Trends and Applications (IJETA) – Volume 5 Issue 1, Jan-Feb 2018

of Research in Engineering and Advanced Technology, Volume 2, Issue 2, Apr-May, 2014.

- [21] Shashidhar Kasthala and Saka Rajitha, "Ethernet Based Monitoring and Controlling of Real Time Security Parameters," International Conference on Innovations in Electrical & Electronics Engineering, Gurunanak Technical Institutions, Hyderabad, 2015.
- [22] Shashidhar Kasthala and Saka Rajitha, "Harmonic Mitigation in Ship Power Systems using Passive Harmonic Filters," International Conference on Innovations in Electrical & Electronics Engineering, Gurunanak Technical Institutions, Hyderabad, 2014.