GSM Based Generator Fuel and Temperature Monitoring System

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Abstract: Pakistan is facing energy crisis since last many years, that’s why frequent power outages have become an unavoidable routine of our life. In order to reduce such disturbances of power outages, various industrial and domestic sectors including academic institutions and several other departments are moving towards the use of generators during power outages. No doubt, the use of generators is much more expensive as compared to the country’s local electricity system but it gets extreme expensive if it includes the misuse and theft of the fuel. The aim of designing this project is to develop a complete fuel and temperature monitoring system and the main objective is to control the misuse or theft of fuel.

Keywords: microcontroller, buzzer, temperature, fuel level, GSM module, SMS, switch.

1. Introduction

The use of generators have become very common in almost every infrastructure companies [1], industries, hospitals, townships etc. [2-3]. As the application of generator has become common, the problem occurred [4] in using them have also become very common such as low fuel and high temperature [5-6], these problems can be solved by continuous monitoring of generators, a system which can remotely monitoring generators and provide all the information through mobile [7]. The GSM module is used to monitor the power generators placed at remote areas and increases its efficiency by monitoring the various parameters of generator [8-10]. Reporting critical problems minimizes downtime and maximize availability by sending if a failure in generator through messages instantly to diagnosis and emergency service dispatch if required and the GSM is used in standby [11], prime and rental power applications [12]. This system provides the ideal solution to the problems caused in situations when a wired connection between a remote appliance or device and the control unit might not be feasible [13]. We are using GSM technology and fluid level sensors to monitor the following parameters.

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- To measure the current fuel level in the tank using level sensor [14]
- To measure the temperature of generator using temperature sensor
- To detect the occurrence of various activities such as generator start/stop, fuel tank cap open/close and engine oil low
- Finally to send an SMS of all the above mentioned parameters to the concerned authority to get him informed about the real time change in parameters.

2. Methodology

The microcontroller is interfaced with GSM module for sending the SMS of real time change to authorities. Fuel level and temperature sensors are interfaced with the microcontroller to provide the real time data of fuel and temperature of generator. Switches are also used connected with microcontroller to detect the oil level low, generator on/off and fuel tank cap on/off. As any change occurs these sensors and switches send the signal to the microcontroller and microcontroller analysis the data then send information through GSM to the authorities as shown in Fig. 1.

![Fig.1- Block Diagram](image)

3. Hardware Description

The component used in this project are ATMEGA16 microcontroller, GSM module, LM35 temperature sensor, Fluid level sensor, Switches, LCD, buzzer and power supply.

ATMEGA16: It is an 8-bit microcontroller of Atmel’s Mega AVR family with low power consumption. Atmega16 can work on maximum frequency 16MHz. it has 16KB programmable flash memory, static RAM of 1KB and EEPROM of 512 bytes. It has 40 pins and various built-in peripherals like USART, ADC, Analog comparators, SPI etc. as depicted in Fig. 2.

![Fig. 2 – Arduino UNO Board](image)
GSM MODULE SIM 900 A: SIM900A GSM Module is the smallest and cheapest module for GPRS/GSM communication as shown in Fig. 3. It is common with microcontroller in most of embedded application. The module offers GPRS/GSM technology for communication with the uses of a mobile sim. It uses a 900 and 1800MHz frequency band and allows users to receive/send mobile calls and SMS. The keypad and display interface allows the developers to make the customize application with it. Furthermore, it also has modes, command mode and data mode. In every country the GPRS/GSM and different protocols/frequencies to operate. Command mode helps the developers to change the default setting according to their requirements.

![Fig. 3 – Current Transformer SCT013-30](image)

Magneto Resistive Level Sensor: Magneto resistance float level sensors are similar to float level sensors however a permanent magnet pair is sealed inside the float arm pivot as in Fig. 4. As the float moves up the motion and location are transmitted as the angular position of the magnetic field. This detection system is highly accurate down to 0.02 degrees of motion. The field compass location provides a physical location of the float position.

![Fig. 4 - Voltage Transformer 230/9V](image)
LM35: The LM35 is an integrated circuit sensor than can be used to measure temperature with an electrical output proportional to the temperature in centigrade as in Fig. 5. It can measure temperature more accurately. This sensor is sealed and not subject to oxidation. The LM35 generates a higher output voltage than thermocouple and may not require that the output voltage be amplified.

LIMIT SWITCH: A limit switch is operated by the motion of a machine part or presence of an object. They are used for controlling machinery as part of a control system, as a safety interlocks or to count object passing a point. It is an electromechanical device as shown in Fig. 6.
4. Results and Discussions
The system makes use of an embedded system based on the GSM technology. An interfacing mobile is connected to the microcontroller. When a person attempts fuel theft then the microcontroller commands the GSM modem to send a text message to the owner and further an alarm is raised by buzzer. Fig. 7 defines the complete design of the system due design protection some of the project is blur. However, the many components are well shown.

![Fig. 7- Complete Prototype](image)

After switching ON the system, system initialize and activated the LCD and GSM to show the current status. It also send SMS of initial states to owner. Fig. 8 describes the very step of project design as the system is turn on the massage of Initialization on the LCD is screen is shown. You need to wait for a while to reach at the main functionality of the system and other commands responses that are required to be use in the system. In the next as the system is properly initialize the readings and measurements are well shown as in Fig. 9.

![Fig. 8 – Initialization of Prototype](image)
Fig. 9 defines the measurements of the parameters after the initialization. It is important to note that the system is showing different parameters such as fuel related aspects, environmental aspects. The fueling related parameters are fuel in Liters, temperature of atmospheric in °C. The message will be received by the registered user as inserted in the system. The reading in Fig. 9 are shown, when the system is initialization and as the system is operated at peak performance the readings will be changes accordingly.

![Generator Fuel Monitoring System](image1)

**Fig. 9 – Owner Received SMS**

The system is also tested for the performance as well. The system has given the input in terms of fuel and the temperature is also measured for that fuel as shown in Fig. 10. After filling of fuel in tank it display the current level of fuel and temperature of tank. It is important to note that measurement received for the system is based fuel as 1.9 Liters and temperature of 20.3°C. The data may vary as the input qualities are varied.

![Status of Fuel & Temperature](image2)

**Fig. 10 – Status of Fuel & Temperature**

When tank cap is open then it start buzzer and send SMS to owner. Fig. 11 defines the final message sent to the user as the system has given the input in terms of fuel and the temperature variations.
Fig. 11 defines the fuel alert the as the fuel tank cap is opened the SMS is sent to the owner for fuel cap alert. The generator is stopped. The measurement as the SMS is shown as temperature 20°C as the fuel recorded as 0.27 Liters.

5. CONCLUSION

A cost effective, simple and robust GSM based monitoring system has been successfully designed and constructed. Level and temperature sensor continuously monitoring the fuel level and temperature of generator, microcontroller receiving the data and sending commands to the GSM module to send information of temperature and fuel level through SMS to the owner. When any one open the cap of fuel tank, limit switches trigger the signal to microcontroller and microcontroller gives command to send SMS of cap of fuel tank is open to the owner. Using the designed system it is possible to monitor the real time values of each parameters of generator to avoid fuel theft and other unavoidable conditions.

6. Future Recommendation

The system can be designed and implemented on vehicle to make secure and real time monitoring. Cameras with mobile based application can be used to real time view of the situations to avoid the theft and other conditions.

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References


