

AUTOMATED BLENDED PETROL GAS SYSTEM

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Abstract: The use of ethanol blended with petrol is receiving more attention in recent times. It was shown that ethanol-diesel blends were technically acceptable for existing diesel engines. Ethanol as an attractive alternative fuel is a renewable bio-based resources and it is oxygenated, thereby providing the potential to reduce particulate emissions in compression-ignition engines. In the fast growing world dependency on fuel in various kinds of use like vehicle, domestic, industrial, etc has been a great demand. The gaseous form of fuel is mostly used in domestic and industrial needs. LPG is widely used in domestic. In future, demand on LPG increases rapidly. To solve this problem, in this paper a blended petrol gas is used. Petrol evaporates at normal room temperature and that form of gas is utilized. Microcontroller along with a sensor is used in this project, which will maintain petrol tank temperature between evaporation temperature and auto ignition temperature.

Keywords: Arduino, Microcontroller, Thermocouple, GSM module, Load cell

1. Introduction

Petrol evaporates faster than other liquids because of its weak inter molecular attraction. Evaporation of a liquid can be considered as the movement of molecules from the surface into the vapor phase above it. Petrol is a mixture of hydrocarbons with the main constituent being octane (C_8H_{18}). Evaporation rates may vary depending upon the atmosphere in which the petrol is being kept. The evaporation rate strongly depends on temperature. When the temperature is increased evaporation time decreases slowly. Petrol does not burn when it is in the liquid state. Only when the vapours comes out it will burn and this idea is used in the carburetor to spray fuel to an engine. A blended petrol is used i.e. Petrol and Ethanol in particular proportions (i.e. 10% of ethanol and 90% of petrol) is used in this project to reduce the carbon monoxide emission from the petrol and improve the fuel octane and increase efficiency. Ethanol has proved to have a significant potential for reducing life-cycle greenhouse gas emissions, as acknowledged by the European

directive 28/2009/CE. Current interest in ethanol as a transportation fuel involves its use as an oxygenate to reduce carbon monoxide (CO) combustion emissions. Also, its octane-boosting quality makes it useful as a ease of use replacement for octane-supplying aromatics that are slated for removal from reformulated petrol to be sold in ozone nonattainment areas. Despite its desirable qualities as a fuel and the fact that it is renewable, ethanol has serious competition. The main motive of is to curb the evaporation rate of blended petrol and to use the evaporated gas in a more efficient way with the aid of various control instruments and sensors.

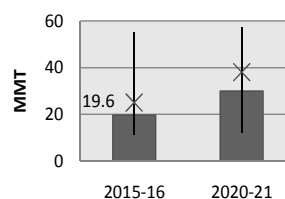


Figure 1. LPG Demand Rate

2. Existing Methodology

As it is regardless to say that the average petrol station in the emirate is thought to lose about 35 gallons of petrol to evaporation every day or 1,050 gallons a month as tankers offload into underground storage tanks, leading to monetary losses and unknown environmental damage. Evaporation is a problem for petrol stations globally. When petrol tankers offload fuel into the station's storage tank the increase in pressure causes some of the petrol to evaporate and there is a system which captures that vapour then convert it into petrol and send it back to the storage tank. The vapour recovery unit is fixed to the storage tank and it absorbs the evaporating petrol into silica gel before converting it back into petrol and routing it back to the underground tank.

The world's fossil fuel reserves are limited and there has been intensive research to find out alternatives to fossil fuels. Hence, there is a progressive

petrol is pumped into the tank from the substation and evaporation of the petrol occurs. Subsequently the temperature is checked inside the tank using thermocouples. According to the temperature, the speed of air flow changes with a help of the blower and the process continues. The solenoid valve is placed over the tank and it starts to function only when there is an inlet of air. When there is an issue (i.e.) in case of fire or gas leakage around the system, the system is turned off using a relay. The response from each part of the system is assigned to the pins of the arduino and when there is no or poor response from any one of these parts of the system, the information is passed to the control station using GSM module.

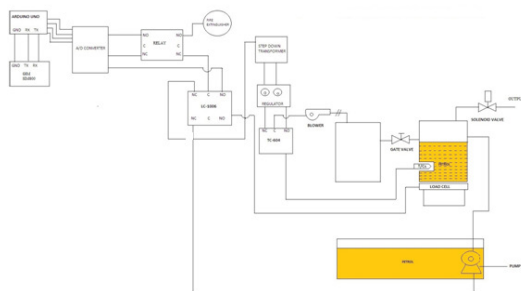
Pic-1006 is used to design a load controller. Function of load controller is fully based on relay operation. The display shows current process weight in Kg as per Range. 0 mV input display will show 0 Kg and at 20 mV input display will show the full selected range 4 to 20m. ADC retransmitted output is provided at back terminal of the instrument. means at 0 mV (rt-low range) input, 4 mA . DC output is provided and at 20 mV (rt-high range) input, 20mA DC output is provided at back terminal. 10V DC transmitter output is also provided to load cell. For relay 1 mode if the level comes down, then, relay 1 will ON when current process. The Value is less than SET value and relay 1 become OFF at SET+HYS value.

A blended petrol i.e. Petrol and Ethanol in particular proportions (i.e. 10% of ethanol and 90% of petrol) is used in this project to reduce the carbon monoxide emission from the petrol and improve the fuel octane and increase its efficiency. The main objective is to curb the evaporation rate of blended petrol and to use the evaporates gas in a more efficient way with the aid of various control instruments and sensors.

The N79E825AD an 8-bit 8051 microcontroller which has in-system programmable flash EPROM which Flash EPROM can program by hardware writer. A temperature controller is programmed by using that. It maintains a particular temperature, which is petrol evaporate temperature based on atmosphere and require output. It consists of one blower that controls the low and high temperature by using a relay.

Arduino microcontroller is used for its high processing speed, easy to use analog to digital conversion, and low power requirement and capable of performing multitask at a time. It requires a 5V DC power supply. It performs all control operations, fetching input signal, processing it and provides controlled output to GSM module .The microcontroller program is programmed using Arduino 1.6.5 software.

SIM800A is used as a GSM module and it has RS232 port for communicating and develop embedded or other application to control sending or receiving messages,



When the system is turned on the load of the tank (amount of fuel weight) is checked initially using the load cell and the level of the tank is also checked. Once the level of the tank is reduced or emptied, the

data transfer. Its interface with Arduino UNO through serial communication.

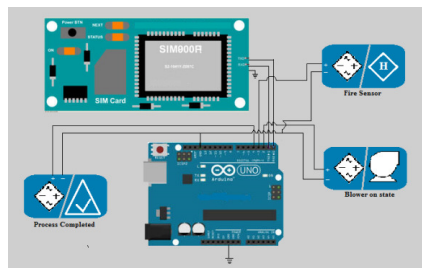


Figure 3. GSM & Instruments Interface

3.5 Sensors : Thermocouple

Thermocouple sensor is used for its feature such as flexibility, reliability, accuracy. Many types of thermocouple is available, we use in K-type thermocouple (Nickel chromium/nickel Alumel) which has temperature range -270°C to 1260°C . It connected with temperature control.

3.6 Load Cell

Strain gauge type load cell is used for flat surface and high accuracy. It's made of aluminum alloy metal. Weight range is 0-20 kg. Fuel level measure in terms of weight.

3.7 Main Power Supply

AC and DC power supply are used in AC standard 230V is given to the process control unit. Controller and safety instruments operates on AC. The sensor, relays, valve, Arduino, GSM module is operated in DC at different rates. All instruments provides an AC output that converts into DC because the Arduino input pin operate in 5Vdc. That conversion is made by using bridge rectifier.

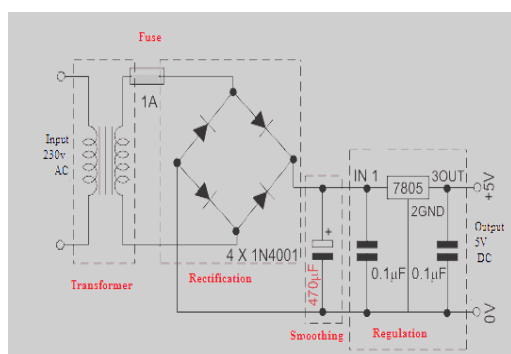


Figure 4. Power Circuit Diagram

3.8 SMPS

12v, 24v power supply is needed for relay and solenoid valve operation that provided by SMPS. It converts AC to DC with high power efficiency and low heat dissipation.

3.9 SAFTEY

Fire alert and system shut down provides more safety to avoid accidents. Bimetallic strip is used as a fire sensor with relay operation.

4. Fuel

Evaporation is an important process for most oil spills. Vaporize oil is used in fuel. We take petrol as the main fuel. Ethanol mixture small amount (E10) with petrol. Petrol is composed of a variety of ingredients that evaporate at different temperatures. The faster vaporizing components evaporate at lower temperatures then the slower vaporizing components. Evaporation plays a prime role in the fate of most oils.

Table 1. Fuel characteristics

	Propane	Petrol(E10)	Diesel
Boiling point $^{\circ}\text{F}/^{\circ}\text{C}$	-44/-42	(81464) / (27-240)	-
Energy content(volume) (BTU/ft ³)/(KJ/L)	637,500 /25,535	861,100/31 ,625	950,400/ 35,082
Auto ignition temperature $^{\circ}\text{F}/^{\circ}\text{C}$	1004/540	464- 536/246- 280	437/225
Peak flame temperature $^{\circ}\text{F}/^{\circ}\text{C}$	3596/1980	3880/ 2138	3997/2758
Flammability lower range (volume %)	2.1	1.5	0.6
Flammability upper range (volume %)	10.1	10.4	7.5

5. Results and Discussions

The main object is a change of phase from liquid to gas. The evaporation rate strongly depends on temperature. Temperature is controlled and monitored by a temperature controller with thermocouple. Petrol consisting of bulk ($\text{C}_4\text{-C}_{12}$) hydrocarbons with a mixture of naphtha, and alkenes. Petrol contains volatile hydrocarbon and octane which helps in evaporation. 10% of ethanol is a mixture with petrol to control the carbon monoxide emission and increase renewable energy in petrol. When more ethanol is added it affects the petrol evaporation rate and hence 10% of ethanol is mixed for more efficiency and

increase evaporation. Petrol temperature is maintained between evaporation point and auto ignition point.

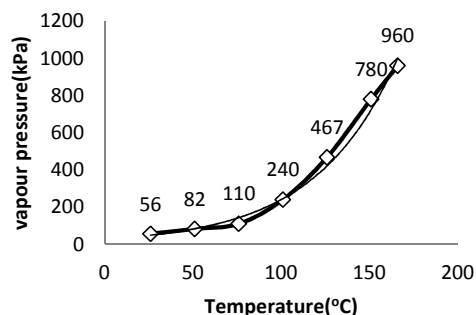


Figure 5. Petrol Vapour Pressure.

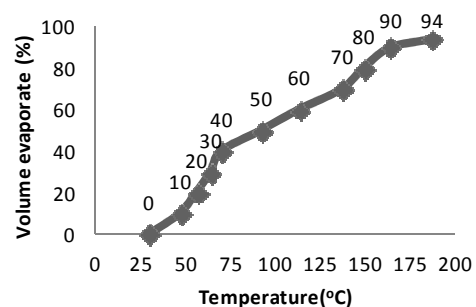


Figure 6. Evaporated Volume.

The petrol vapour pressure for different temperature rates are given in table 2.

Table 2. Petrol Vapour Pressure

Temperature (°C)	Vapour Pressure(kPa)
26	56
51	82
76	110
101	240
126	467
151	780
166	960

Evaporation time of 18 ml petrol is 2 hours at normal room temperature and is shown in table3. When

the temperature is increased evaporation time will be decreased slowly.

Table 3. Petrol Evaporation Percentage

Temperature (°C)	Volume Of Evaporated(%)
30	0
47	10
56	20
64	30
70	40
92	50
113	60
137	70
149	80
164	90
187	94

6. Conclusion

In analysis the evaporation rate of blended petrol and result are obtained from proper experiment thus plotted in the graph. Blended petrol evaporates at various temperature and is shown table by curve. Ethanol blended petrol evaporation is simulated and controlled by using microcontroller. The system is designed for all vaporize fuel to control their evaporation and use it for heat purpose. And it absolutely solves LPG demand. Hazard and fire explosion problems are prevented by the major safety equipment. The evaporation process is fully automated by process controlling unit (PCU). PCU consist of microcontrollers, sensors and valve.

In future the system can be implemented for higher alcohols such as propane and Butane. Other evaporation fuels could be taken into consideration so that the efficiency of utilization of various fuels could be drastically elevated. In existing method microcontrollers has been used for load and temperature control further the controlled can be replaced by Internet of Things.

References

- [1] Michigan, department of agriculture and rural development laboratory division/ motor fuels quality "Gasoline Volatility Information"
- [2] Ted R. Aulich, Xinming He, Ames A. Grisanti& Curtis L. Knudson (1994) Gasoline Evaporation–Ethanol and Nonethanol Blends, Air & Waste, 44:8, 1004-1009, DOI:10.1080/10473289.1994.10467294
- [3] Larisa Chernyak, Sergey Boychenko, Ludmila Fedorovich Valentina Novikova, Rasa Prentkovskiene & SaugirdasPukalskas (2010) Dependence of

evaporation losses in petrol quality, Transport, 25:4, 442-447

[4] Gasoline Vapor Pressure & US RVP Control
Glenn W. Passavant MWV

[5] Studies on the Evaporation Regulation Mechanisms of Crude Oil and Petroleum Products.
Merv F. Fingas Spill Science, Edmonton, Canada. Vol. 2 No. 2 (2012)

[6] A study on analysis of 2-stroke petrol engine using ethanol as an additive Mr. SoumyaRanjan Nanda, Dr. Prof. Amitabh Biswas. International Journal of Scientific & Engineering Research, Volume 5, Issue 9, September-2014 836 ISSN 2229-5518

[7] U.S Department of energy-energy efficiency and renewable energy."Alternate fuel".

[8] "Flammability of Alcohol-Gasoline Blends in Fuel Tanks"r. Vaivads, m. F. Bardon and V. K. Rao,Royal Military College. Kingston, Ontario. Canada.V. BATTISTA Transport Canada, Ottawa, Ontario, Canada.

[9] Directive 28/2009/CE of the European Parliament and of the Council for the Promotion of the Use of Energy from Renewable Sources, 2009.

