Remote multi parametric monitoring of diesel generator for standalone power station

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Abstract--**The Generator usage has become a very common in almost every infrastructure companies, Industries, hospitals, communication towers etc. The problems occurred in using them have also become very common such as low fuel, High temperature and these problems can be solved by continuous monitoring of generator, a system which can remotely monitoring generator and provide you all the information through GSM modem. This paper focuses the detection of power failure and takes reflex action to solve the problem with help of modem communication using GSM. The power failure will be intimated to the Microcontroller it drive the GSM modem to send a text message to the concern person mobile number which was already programmed in Microcontroller and also monitoring the parameter are temperature, oil level, fuel level and when they exceed predefined limits an automatically intimated to authorized person and also This system can be designed to send SMS alerts whenever the Circuit Breaker (Relay) trips.**

Keywords **--Oil level; Temperature; Fuel level; Reflex action; Pic controller**

I. INTRODUCTION

In general diesel power plant has been the most important form of energy sources in small industrial network as emergency unit .Equipment, such as cars, motorcycles, trucks, generators, and compressors, which powered by internal combustion engine needs a means of refueling so that it can run for as long and efficiently as possible. Presently industry is increasingly shifting towards automation. Two main components of today's industrial automations are programmable controllers and robots. In order to aid the complex work and to serve the mankind, today there is a general tendency to develop an intelligent operation. PIC Microcontroller is the brain of the device which handles all the sub devices connected across it. We have used as microcontroller. It has flash type reprogrammable memory. It has some peripheral devices to play this project perform. It also provides sufficient power to inbuilt peripheral devices. We need not give individually to all devices. The peripheral devices also activates as low power operation mode. These are the advantages are appear here. These generators are cheap and come equipped with a self-start mechanism built into the generator. On the push of a button, the user can start

the generator easily. In urban areas , normally generators are used for a short period of time when the power from the grid is not available. When the power from the grid is interrupted, the user starts the generator and connects the load to it manually. The user disconnects the generator from the load,while the power from the grid becomes available and turns off the generator , connects the load to the grid manually. Normally this function is performed manually and requires the engagement of the user for turning the generator on and off and shifting the load between the generator and the grid. In this paper we use a controller which performs these tasks automatically. The controller monitors the grid supply and when there is no voltage, the controller disconnects the load from the grid, starts the generator and shifts the load to the generator. The controller continuously monitors the grid voltage and when it comes back on the system turns off the generator and transfers the load to the grid. This system is very useful in the high rate of power failure crisis occurring in Pakistan and relieves the user from the tedious selection describes the manual operation of the generator and builds the background for implementing the automatic controller.

The generator works on the principle of electromagnetic induction . The generator is started by battery. The generator battery charged by supplying it with a precise 'float' voltage. If the float voltage is very low, the battery will remain charging. If the float voltage is very high, it will reduce the life span of the battery. To prevent from corrosionbattery chargers are usually made of stainless steel. They are also fully automatic and do not require any adjustments to be made or any settings to be changed. The DC output voltage of the battery charger is set at 2.33 Volts per cell, which is the precise float voltage for lead acid batteries.

Due to the broader applications of nonlinear loads, the degree of waveform distortion and other transients found in a power system has become increasingly serious. In order to maintain a certain high level of electric power quality, uninterruptible power supply (UPS) has emerged as a potential alternative, which was also widely applied at the customer side in order to mitigate the unexpected disturbances over the last few decades.

Principally, the UPS employs the static power converter as well as batteries to supply the critical load. Its circuit structure can be categorized into three types that include off-line, on-line, and line-interactive ones. For the off-line UPS, when the utility source encounters any event that leads to the interruption of power supply, the off-line UPS circuit would supply the power to the load through the inverter, yet the load needs to shoulder the power interruption blame for about 4–12ms. As for the on-line UPS, because of its voltage-stabilizing function, the power quality of the connected loads would be better assured. However, the resultant large heat losses through the double ac/dc operation may degrade the energy conversion efficiency. Different from the aforementioned structure, the line interactive UPS employs one inverter (dc/ac power converter) to operate in parallel with the utility grid, by which the battery charge and discharge can be both served for, hence, facilitating the mode change within a shorter time in case of power outage, while the operational losses can be controlled in a significant manner.

At last, an effective approach for the control circuit design of the line-interactive UPS becomes critical for both utility engineers and industry manufacturers. In this work, based on the paradigm of the inverter operation, a new design approach for a line-interactive UPS is proposed. In the method, a unified control system associated with the special

connection scheme in the inverter is developed for simplifying the system structure, where each phase only requires one current transformer (C.T.) to serve the controller for both operating schemes. In this way, the overall circuit design becomes easier to accomplish and the implementation cost can be also reduced. Besides, as this approach was aimed to minimize the mode-switching transients, the transfer time spent for the switch made between the parallel operation and the off-grid operation can thus be shortened.

II.BACKGROUND AND LITERATURE REVIEW

Amitsachen et al proposed that the user can send commands through SMS to read the electrical parameters remotely. This system also can automatically send the real time electrical parameters periodically (based on time settings). Whenever the Circuit Breaker trips or the Voltage or Current exceeds the predefined limits this system send SMS alerts. This project makes use of an onboard computer which is PIC microcontroller [1]. Mallikarjun proposed that, the diesel generator operates in analog. In order to increase data accuracy, the controller needs to be digitalized[2].ChetanPatil et al have discussed the design of BTS safety and fault management system. The measures are taken to rectify these problems. The GSM modem which gives the instant message about the each activity happening in the site. The temperature sensors continuously monitor the room temperature andthe GSM modem will send the message to the master mobile which is already set in the system if it rises above thethreshold value [3].

III.AN OVERVIEW ABOUT EXISTING SYSTEM

Traditionally, diesel power plants have been the most important means of energy generation in islanded power station, and as emergency units in small industrial networks. Nowadays, several systems are being developed to generate hybrid (wind and/or solar) power with diesel generators [4], by applying the reliability of diesel generators in a efficient way. This methodology maximizes renewable power utilization and minimizes diesel fuel consumption, reducing the CO2 emission level

The maintenance system of this type of generating unit is based on the periodic review of the elements of the diesel engine and not in the analysis of voltage, current or electric power of the generator. These analyses are more common in hydraulic generators [5], wind generators [6] and even more in induction motors [7]. In these systems, it is usual to analyze harmonics in the electrical currents, using tools such as the Discrete Fourier Transform (DFT). The torque of an internal combustion engine is the addition of the individual torques from the cylinders. Hence, ithas periodic fluctuations of several frequencies depending on engine speed, the number of cylinders, and firing asymmetries caused by defective combustion in one or more cylinders. Once the generator is connected to the grid, the engine torque fluctuations include active power and reactive power [8] [9], which affects the voltage as well as the grid frequency in the case of islanded networks [10]. When combining diesel with renewable generation, it is necessary to improve the power quality of the diesel generation units, minimizing diesel fuel consumption.

During unbalanced diesel engine operation, with, for example, misfiring in one of the cylinders, power fluctuations and vibrations increase, which consequently raises the risk of the diesel engine generator unit failing and becoming unavailable. The method provides information from the engine that would make a repair possible before a generator

breakdown; it allows the operator to know which cylinder needsto be repaired; and to reorganize the service schedule, as it can anticipate programmed stops for maintenance, or delay them,as long as the engine doesn´t need to be examined. This newmethod is an alternative to the mechanical diagnosis based on cylinder pressure measurements.

IV. PROPOSED METHODOLOGY

The Real-time data reporting architecture is useful for remote surveillance and control, if communication network can be convenient to access. In the new era of technology, mobile phone redefines communication. The worldwide trend for wireless communication has elevated into wide band data instead of voice only. Sending written text messages is very popular among mobile phone users. We have used the embedded based control the generator plant from a remote area. Remotely the user can establish effective monitor and control via the mobile phone set by sending commands in the form of SMS. When a wired connection between a remote appliance/device and the control unit might not be feasible then this system provides better solution.

The generator monitoring system is useful because of the following reasons:

It gives awareness of the power stability and the behavior of power supply thus one can be able to deal with the problem of constant power outage by looking for Alternative means of power supply.It records the time of the duration and in the process letting someone know in advance the effect of the damage caused by the power outage.

If one is far-away from the microcontroller based monitoring unit, with the facilities of reporting the failures to a central control via GSM module, one can be able to respond to the situation as soon as possible..

The purpose of this paper is to develop a new diagnostic method that avoids generator operation in dangerous torque imbalance conditions. Torque in internal combustion engines has a periodic oscillation due to variations in the combustion process and pressure development between cylinders.

A. SYSTEM DESIGN

Power failure detector is used to detect the power is in ON or OFF. When the power failure occurs this detector will give the signal to the PIC microcontroller. Depend upon this signal the controller will on work. When receive the power failure detector signal the controller will be operate the change- over relay driver circuit. At the same time the GSM unit send the SMS to the particular number by the controller signal. When they reply to that GSM that time the controller operate the prime mover through the relay. Now the generator starts and gives power to the load. Here we no need to start the generator with near place. We can operate the generator from any place. An electric generator is a device that converts mechanical energy obtained from an external source into electrical energy as the output. The movement of electric charges constitutes the output electric current supplied by the generator.

On power failure, the system checks the battery to start the pony motor. If the battery has enough voltage, the DG is initiated by starting the DC motor. The DG once switched on the system verifies whether the voltage is developed. Once the voltage is developed the system connects the load to the DG output.

During the running, the running parameters like DG's vibration, load current, temperature and fuel level are continuously monitored. If any of the parameters goes abnormal, the system automatically shuts off the generator and intimates the same to the remote service station.

This system involve multiple PT'S for identifying the best phase and other sensors like fuel level, lubricant oil indicators, temperature sensors and battery status monitors. This system manages a constant voltage power supply from multiple power sources.

V. HARDWARE IMPLEMENTATION

There are three main devices required for monitoring the parameters of diesel generator irrespective of different sensors connected to it. They are

- PIC16F877A
- LCD
- GSM MODEM

A.PIC16F877A

PIC microcontroller acts as a main interfacing device with other components.It has 40 pin DIP Package and Operating speed: DC – 20 MHz clock input DC – 200 ns instruction cycle .It has RISC Architecture and code protection. Serial and parallel communication is done through USART and has wide operating voltage range (2.0V to 5.5V) with Power saving Sleep mode

B.LIQUID CRYSTAL DISPLAY

An LCD is a small low cost display. It is easy to interface with a micro-controller(the black blob on the back of the board). . Very slow response times and poor contrast are typical of passive-matrix addressed LCDs.

High-resolution color displays such as modern LCD computer monitors and televisions use an active matrix structure. The polarizing and color filters are formed by addinga matrix of thin-film transistors (TFTs). Each pixel has its own dedicated transistor, allowing each column line to access one pixel. When a row line is activated, all of the column lines are connected to a row of pixels and the correct voltage is driven onto all of the column lines.

Algorithm to send data to LCD:

1.Make R/W low

2.Make RS=0; if data byte is command .RS=1; if data byte is data (ASCII value)

3.Place data byte on data register

4.Pulse E (HIGH to LOW)

5.Repeat the steps to send another data byte

C .GSM-AS A TRANSMITTER

Global System for Mobile Communications.architecture comprise of databases and messaging systems functions:

- Home Location Register (HLR)
- Visitor Location Register (VLR)
- Equipment Identity Register (EIR)
- Authentication Center (AuC)
- SMS Serving Center (SMS SC)

- Gateway MSC (GMSC)
- Chargeback Center (CBC)
- Transcoder and Adaptation Unit (TRAU)

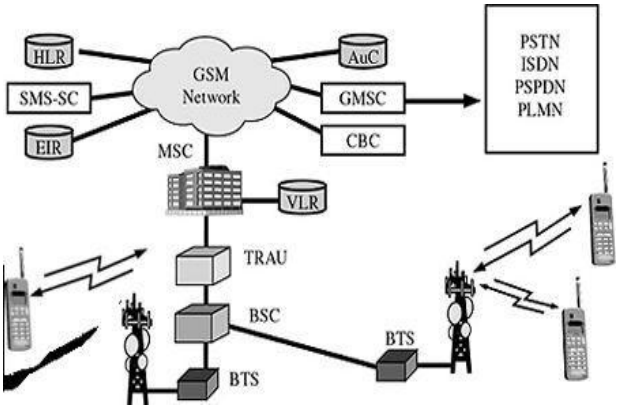
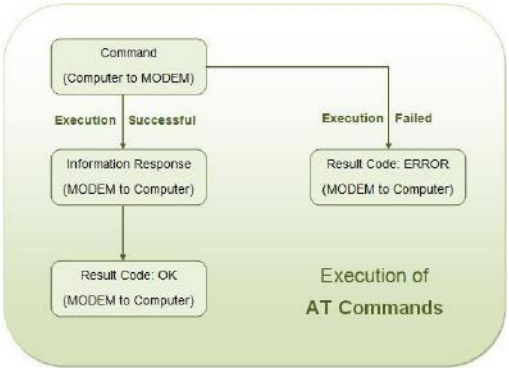


fig 1:shows the GSM network along with the added elements

The Um interface communicate withMS and the BSS. It is also known as the air interface or the radio link. The BSS communicates with the Network Service Switching (NSS) center across the *A* interface.

D.AT Commands:

AT commands are used to control MODEMs. AT is the abbreviation for Attention. These commands come from Hayes commands that were used by the Hayes smart modems. To indicate the attention from the MODEM, Hayes commands started with AT. The dial up and wireless MODEMs (devices that involve machine to machine communication) need AT commands to interact with a computer., Along with other extended AT commands,



Hayes command is set as a subset.

In a single command line,multiple AT commands can be sent to MODEM . The commands in a line are separated by a semi-colon (;).

For example: AT+CGMI; +CBS<Carriage return>

VI. CONCLUSION

The project "automatic un interruptable power restorer" has been completed successfully and the output results are verified. The results are in line with the expected output. The project has been checked with both software and hardware testing tools. In this work "LCD, Microcontroller, temperature sensor, level sensor, battery sensor and relay" are chosen are proved to be more appropriate for the intended application. The project is having enough avenues for future enhancement. The project is a prototype model that fulfills all the logical requirements. The project with minimal improvements can be directly applicable for real time applications. Thus the project contributes a significant step forward in the field of "INTELLIGENT AUTOMATION", and further paves a road path towards faster developments in the same field. The project is further adaptive towards continuous performance and peripheral up gradations. This work can be applied to variety of industrial and commercial applications.

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