Smart Generator using Remote Monitoring Access

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Abstract— This project focuses on the design and implementation of smart generator using remote monitoring access system. Our project aims at developing a smart generator which has various features that can nullify many day to day issues. The aim of this project is to gather all the information about the temperature rise by using a temperature sensor, vibration detection with the help of a vibration sensor and the level of fuel by using an ultrasonic level indicator. All these three parameters are detected continuously and if they cross the pre-defined limit, then the user gets alert as the buzzer will automatically turn on. Moreover the accurate billing and service reminders are being sent to the respective users with the help of GSM (Global System for Mobile Communication). The owner can continuously monitor the location of the generator using the Global Positioning System (GPS). Clubbing all these features into a generator makes this real time system a smarter one. Hence here, we have integrated web and embedded technology to remotely control the on-site equipment through the network without any barrier of region and time. Making any system smart is a basic need in today's world.

Key words: Temperature sensor, vibration sensor, fuel level indicator, smart generator

I. INTRODUCTION

In today's world, there are lots of issues regarding continuous power supply. In such situations we require generators for uninterrupted power supply as an alternate source of electricity. People do business by giving their generators on rent. Many times the owners and the customers face problems like billing hassles , failure of servicing etc. to overcome these demerits we need to make generators smart. .the design of our project includes how to remotely control, manage, monitor, maintain and analyze the operation from different geographical areas. The generator monitoring system is especially used to access and control the power generators which are placed at remote areas by using GPS.

Moreover the efficiency of the system is increased and the system is made smart by using real time on /off. Awareness of real time fuel level can be obtained by using fuel sensor. The temperature analysis and thereby its controlling can be achieved by using temperature sensor and vibrations of the system can be controlled by using vibration sensors. Using GSM messages can be sent regarding oil change reminder, proper billing, generator failure and emergency service dispatch if required.

Here, we have used ARM 9 as microcontroller, LM 35 as temperature sensor, ultrasonic sensors for fuel indication, buzzer for alarm sound, LCD for display of various data, GPS and GSM.

II. BLOCK DIAGRAM

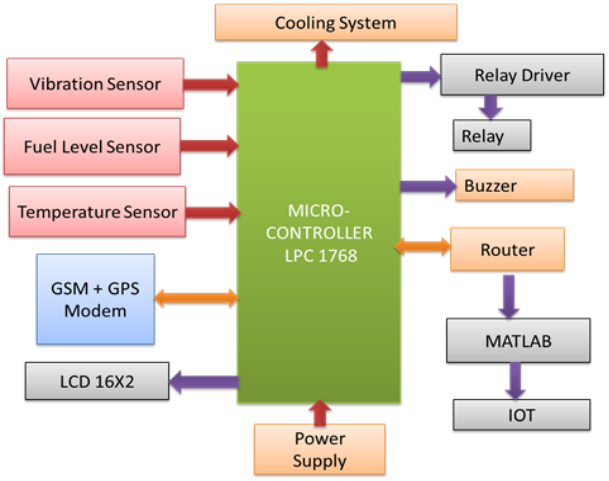

Fig. 1: Block Diagram

III. MICROCONTROLLER

In this project we have opted ARM 9(Advanced RISC Machine) instead of ARM7 microcontroller owing to the availability of Ethernet port which can directly access with the cloud network. ARM 9 is basically a 64 pin IC. It is a 32 bit, RISC processor with separate data and instruction busses. It has greater speed and is has high performance. We have used here LPC 1768 for embedded applications which features high level of integration low power consumption.

Features of LPC 1768:-

1) CPU frequency is up to 100MHz.
2) It includes peripheral component of up to 512KB of flash memory and up to 64KB of data memory, Ethernet MAC, USB device, 8 channel general purpose DMA controller, 2 CAN channels, 4 UARTs, SPI interface, 2 SSP controllers,8 channel 12 bit ADC, 10 bit DAC, PWM.
3) In system programming (ISP) and In application programming (IAP) via on chip boot loader software

IV. TEMPERATURE SENSOR

The temperature sensor, LM 34 senses the real time temperature in Fahrenheit scale and will send the sensed data to the microcontroller and it will be displayed on the LCD. If the generator is used for many hours, then there is a probability of getting the system to be heated up, which can lead to malfunctioning of the system. So once the sensed data increases beyond the specified limit then the cooling system turns on automatically and will thereby control the temperature. The temperature sensor consists of three terminals i.e. analog voltage output terminal, ground terminal and input terminal (2.7V-5.5V). The data is sensed in terms of voltage and it is converted to temperature by this sensor with the help of the following formula:-

Temp in c=[(voltage in mV)- 500]/10

We can use any of the two sensors i.e., LM 35 or LM 34, where LM35 gives the values in Celsius and LM 34 gives in Fahrenheit. LM 36 differs from the rest of the two by having wide range as it does not need negative values of voltage to read sub-zero temperatures.

A. Specifications of LM 34 that we have used in our project:-

1) Temperature range: -50F to +300F
2) Accuracy: +3.0F
3) Output: 10mV/F

V. VIBRATION SENSOR

It may happen that due to some disorder, the generator may vibrate and to overcome the problem, we have used a vibration sensor which is connected to the microcontroller.

A. Pin configuration

1) VCC
2) Output
3) Ground

B. Specification

1) The default state of the switch is open.
2) Digital output
3) Supply voltage:- 3.3V-5V
4) On-board LM393 voltage Comparator chip and Vibration sensing probe
5) Signal detection sensitivity can be adjusted
6) Dimensions:- 3cm x 1.5cm

VI. FUEL INDICATOR

During the run time there is a chance that the fuel may get finished off. Hence in order to know the level of fuel we have used a fuel level sensor which can let us know when the fuel decreases under a certain limit using buzzer. Here we have used ultrasonic sensor which acts as a level sensor in this project. The HC- SR04 ultrasonic sensor works on SONAR technology in order to find the distance to an object. In our project this object is nothing but the level of the fuel. The distance is ranged from 2cm to 400cm or 1to 13 feet. Any type of black material or the sunlight does not affect the operation of the sensor. Both transmitter and receiver are in the same module. This ultrasonic level indicator sends sound waves to know the level of the fuel. The frequency range is between 20 kHz to 200 kHz. The level sensors are normally kept at the top of the fuel tank so that it can send the sound waves in the downward side. Time taken by the reflected wave after the incident wave is being calculated and from that , we can obtain the level of the fuel.

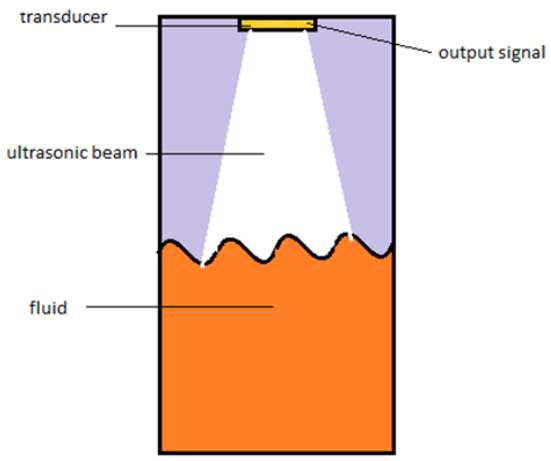

Fig. 2: Level Sensor Process

A. Features

1) Measuring Angle: 30 degree
2) Working Current: 15Ma
3) Dimension: 45mm x 20mm x 15mm
4) Effectual Angle: <15°
5) Resolution : 0.3 cm
6) Power Supply :+5V DC
7) Trigger Input Pulse width: 10uS

VII. GPS

GPS provides exact location and time location irrespective of weather conditions with the help of satellites. Multiple satellites are monitored using a GPS receiver and the exact position is found by solving equations. The global positioning system is used over here to track the on-site location of the generator system by using latitude longitude method. By this the owner gets to know where the generator is actually located at any instant of time.

VIII. GSM

Global system for mobile communication (GSM) works on the frequencies 900/1800 MHz as SIM 900A can search these two bands automatically. The AT (attention) commands provide the frequency band and with the help of these AT commands we can send and receive messages i.e. SMS (short message service).

This plays a vital role in our project. It helps us to send all the data regarding billing, oil & service reminders etc. The system also keeps a track of the generator's run hours and thereby send the message to both the customer and the owner using GSM. These data are sent to the cloud, from where we can fetch them later. By this we get proper billing of our generator use and are sent to both the owner and the customer. The oil change and the service reminder messages are given to the owners at proper instant of time.

IX. IOT

Finally all the data such as temperature, vibration measure, fuel level, total billing, service reminders etc are sent to MATLAB and thereby these data are sent to IOT i.e. internet of things using thinkspeak.com. IOT concept is used where the data is collected from different devices, buildings, vehicles or sensors and then later, these data can be exchanged or extracted when needed. Using IOT we can

fetch or store data at any time. these data are fetched, sorted and send to the user. Hence, making is more user friendly.

X. APPLICATIONS

1) Remote Service Access
2) Fair Billing
3) Industrial Application
4) Business purpose

XI. CONCLUSION

In this project, a cost effective, web based control system has been designed and implemented, which helps us to know the real time location of the generator, provides accurate billing , fuel indication and accordingly switches the buzzer on, temperature and vibration are sensed and message services using GSM.

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