GSM BASED SUBSTATION MONITORING AND CONTROL SYSTEM

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ABSTRACT

A mobile embedded system is implemented in this project to observe the quality of load current, frequency, voltage and temperature of a power substation. Integration of a microcontroller, different sensors and global service mobile (GSM) modem is installed at the transformer site and above key parameters are observed. With the help of analog to digital converter parameters are processed and stored in system memory. Any disastrous failure occurs the system sends a SMS to the mobile phone according to predefined values given by microcontroller. Hence helps in smooth functioning of power substation.

Keywords: GSM, Microcontroller, Temperature sensor, Frequency sensor, Voltage sensor, Current sensor.

I.   INTRODUCTION

The utilization and demand of the electrical supply is increasing day by day. Thus proper supply and no wastage of the electricity are crucial. Therefore an electromagnetic relay is used to protect the circuitry. The electrical quantities: current, voltage, frequency and temperature are acquired and sent to the substation using GSM. The relay can be used to operate the circuit breaker during the time of fault by switching of the supply. Hence the user can send the SMS to the system and vice-versa with the help of microcontroller to maintain the power continuity.

II.   METHODOLOGY

GSM technology is used in this project for monitoring and controlling the parameters of substation. The information is sent through communication to the nearby intermediate station. The intermediate station has an authorized person who receives and sends SMS with the help of GSM technology. In this way many substations can be connected to the station via communication and the critical conditions are regularly sent to the main station through GSM modem.

III.   MODELING AND ANALYSIS

This diagram gives a quick about the fundamental functions of remote monitoring. The parts are shown below so as to demonstrate the overall presentation of the hardware. Here in this diagram the Microcontroller is the central device which is regulated by 5v supplied by rectifier and filter from transformer that supplies 230v. The microcontroller has interference with LCD that indicates current and voltage data on a regular basis. For resetting the whole circuit program reset button can be used. A translator is used to convert the signal. This signal that is converted is sent to the mobile via GSM module regarding the controls and monitoring of substation.
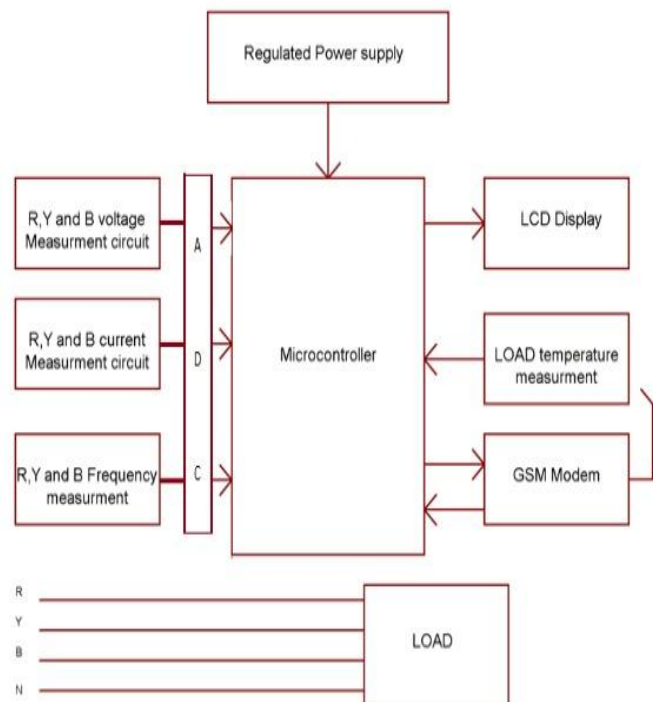
Figure1: Block diagram.

Power supply: A desired DC voltage can be taken from power supply to run the circuits. The required DC voltage is 5v DC and the voltage we get from main line is 230v DC. Hence, a step-down transformer to get the desired voltage is used. The transformer step downs the voltage to 12v AC and it is then converted to 12v DC using rectifier. The output that we get from rectifier contains ripples even if it is DC signal thus called Pulsating DC. To removes these ripples filter circuits are used to obtain smoothened DC power. The 12v DC is again rated down to 5v by a positive voltage regulator chip. Thus, 5v fixed DC voltage is obtained.

- Transformer - high voltage AC mains is stepped down to low voltage AC.
- Rectifier –AC is converted to DC, but the DC output is varying.
- Smoothing - smoothens the DC from varying greatly to a low ripple.
- Regulator –ripple is eliminated by setting DC output to a fixed voltage.

Microcontroller: Microcontroller is a part on the PC chip which encompasses number of peripherals like RAM, EPROM, etc, that performs a predefined task. Based on different applications as per their capability and feasibility various microcontrollers are used to perform a particular task. Mostly used are 8051, AVR and PIC microcontrollers. The microcontroller transmits and receives data of 8 bits.

GSM modem: It's a wireless modem that works with a GSM wireless network. A wireless modem is comparable to a dial-up modem. The sole difference is that a dial-up modem receives and sends data through a telephone line while a wireless modem receives and sends data via waves. Same as a GSM portable, GSM modem requires a SIM card. SIM 300 is a FCT (Fixed Cellular Terminal) that is used in data applications. Due to its compact structure and portable terminal it satisfies various data transfer over GSM. The GSM modem can even be connected to a computer with a standard RS232C serial port. The features provided by SIM 300 are: SMS, Data services, Fax services and data file connectivity. It also has various applications in IT companies, Banks, Financial Institutions, far away project sites, Service Providers and lots of others.

Design Procedures:

1. Interfacing parameters for LCD and Data registers.

2. Selecting values for circuit relays, LED, LCD and Analog Inputs.

3. Initializing input and output ports of microcontroller.

4. Displaying parameter values.

Hardware Implementation:

1. Current measurement circuit.

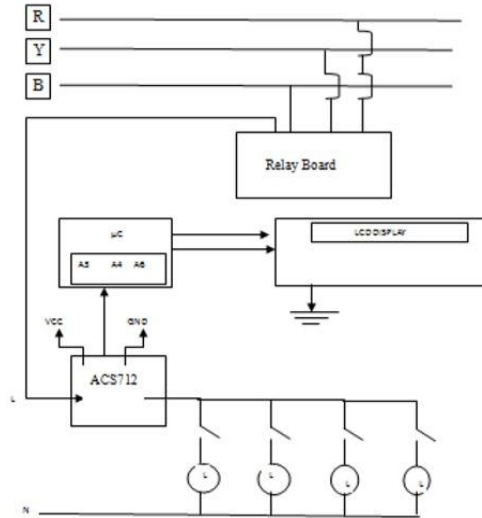ACS712 current sensor: 185mv/A output sensitivity, supply 8v. pin no VCC=5v, out, gnd

Figure2: Current Measurement Circuit.

2. Frequency measurement circuit.

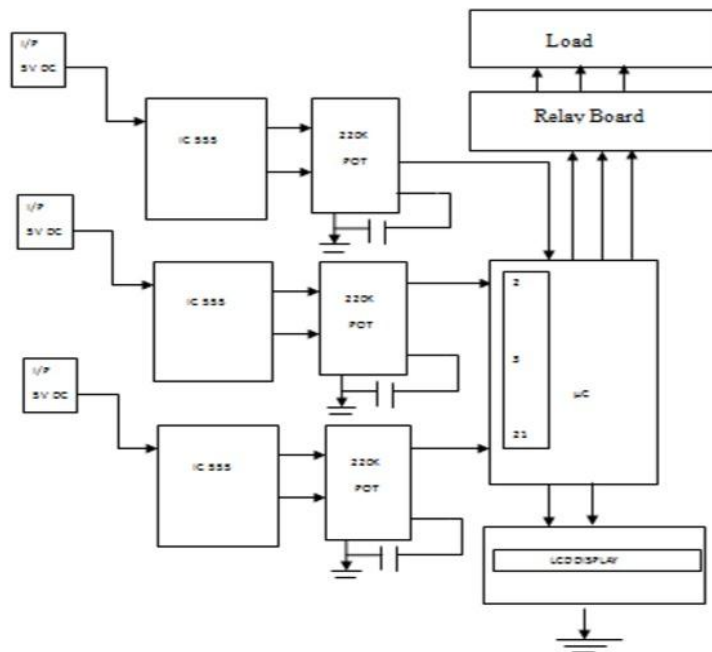IC 555timer, 220k pot, 5v DC supply, GSM, LCD display

Figure3: Frequency Measurement Circuit.

3. Voltage Measurement Circuit.

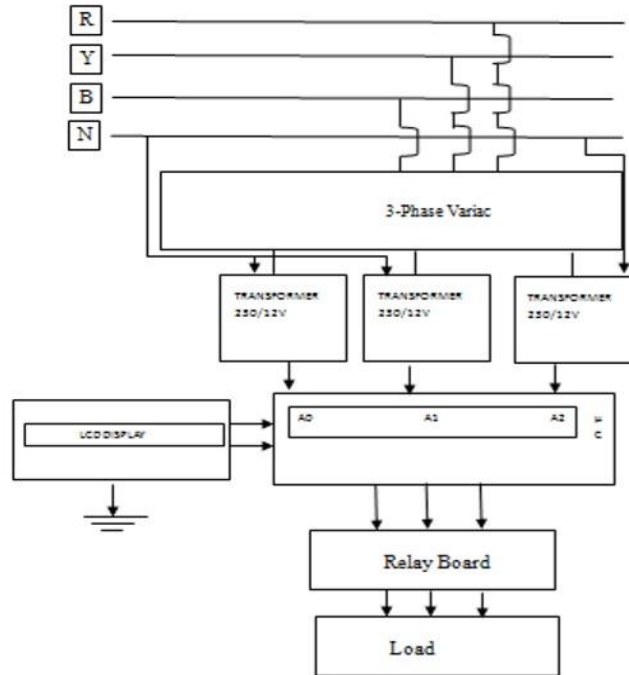Apparatus: supply 3phase, variac-3phase, transformer, Arduino, bridge rectifier, register, LCD display

Figure4: Voltage Measurement Circuit.

4. Temperature measurement circuit.

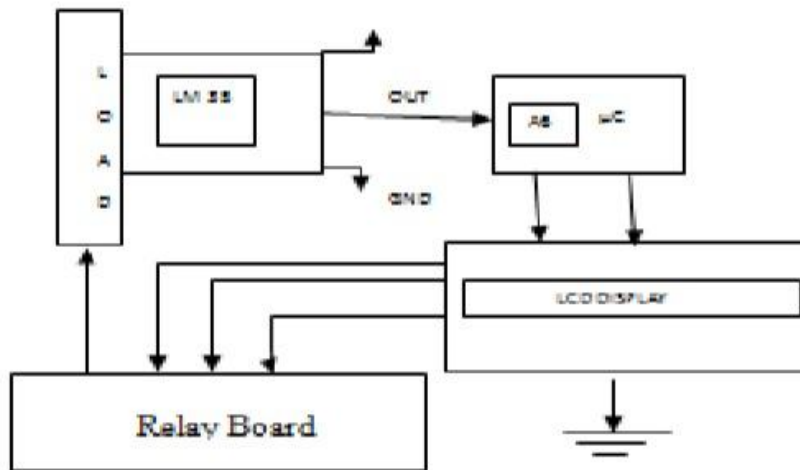LM35 temperature sensor, LCD display, load

Figure5: Temperature Measurement Circuit.

IV.   RESULTS AND DISCUSSION

GSM modem, temperature sensor, frequency sensor, current sensor, voltage sensor and other devices like relays are interfaced to the microcontroller in the system. The designing of microcontroller is such that it takes input from the GSM modem via SMS through a system in a particular format so as to operate other devices. A feedback message will be sent to the system. Real monitoring of temperature, frequency, voltage and current can be done also can be controlled. If any of the parameters cross a predefined limit the relay can be operated through GSM. This project can be extended by using GPRS technology, which sends the monitored and controlled data to any place in the world.
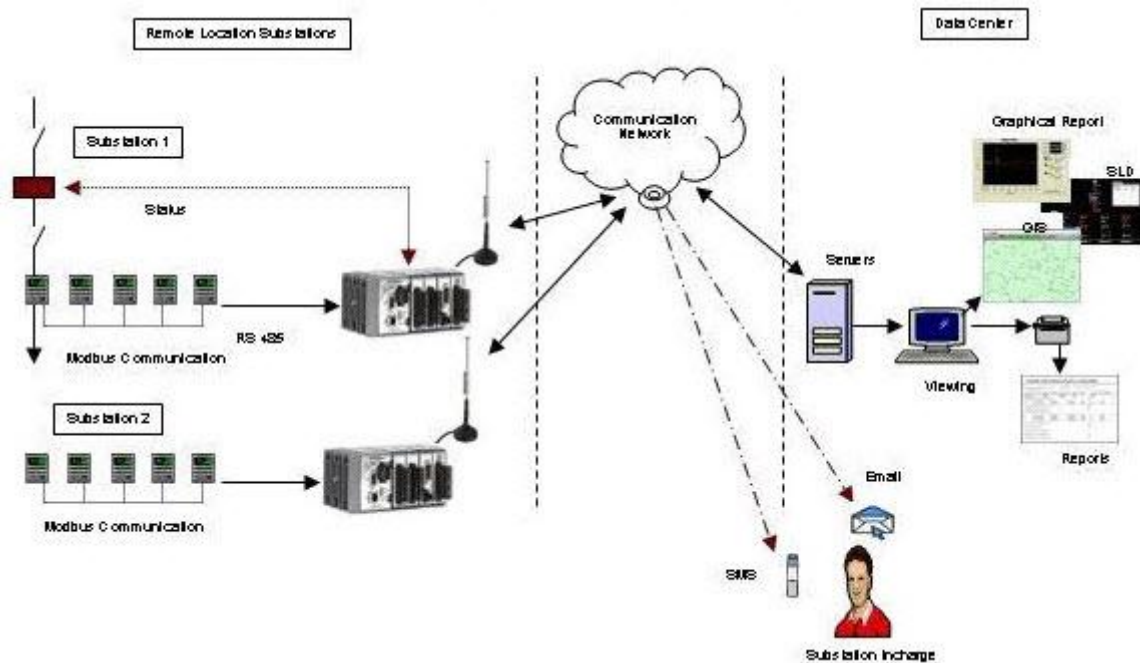
Figure6: Ideal view of project

V.   CONCLUSION

Using GSM, the system can send the SMS from an intermediate station. This also reduces human effort with good accuracy and less error and hence the project 'GSM BASED SUBSTATION MONITORING AND CONTROL SYSTEM' was designed.

Advantages:

1. Cost efficient design

2. Continuous real time monitoring

3. Can be operated from anywhere

4. Instant feedback of devices being operated is present

5. Lower power consumption

6. Devices can be operated from mobile, computer systems

Disadvantage:

1.Depends on the network signal strength.

VI.   REFERENCES

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