# Automation Substation using Gsm and Microcontroller

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**Abstract**: -The electricity is the most essential form of energy according to the nation's financial wealth and environment. The electricity is basically classified into three fields i.e. generation, distribution and transmission. Asthe distribution transformer gives fluctuations at the substation, an analyst is always there to monitor the different electrical parameters like voltage, current and temperature. At times there is sudden changes in current and voltage due to rise in temperature at the distribution transformer. The distribution transformer are at risk to damage because the temperature of oil rises when there is an overload or surplus current flows in the internal winding of thetransformer. As the distribution substation's complexity is growing day by day, automation of substation has become a need to every utility company in orderto increase the efficiency and improve quality of power being delivered. The proposed project which is automation of substation using GSM and microcontroller will help the utility companies, by ensuring that the local substation faults recognized and circulated to their concerned departments through GSM, so that the duration of fault or power interruption is decreased. Thus the objective of this system is to monitor various electrical parameters of distribution transformer continuously and send the measured parameters to the electricity board in the form of SMS messages. This system will protect the distribution transformer or power transformer from getting damage due to obstructions such as over temperature, overload and input high voltage. In case any of the parameters exceeds its limit then the systems informs the operator at distant place and can shut down the whole unit and communicate with the maintenance unit for solving the fault of the machine. This enables to minimize the labor cost at substation as well as saves time.

## 1. INTRODUCTION

A substation consist of transformers, voltage regulators switches, and metering equipment which is used to adjust voltage and monitor circuits. Basically there are transmission substation and distribution substation, and the project is concentrated on distribution side of substation. The substation receives power from generating station via feeders at high voltage, this high voltage is step down using distribution transformer and is send to various consumers through distribution network.

In the electric power system, controlling of electric power substation equipment is essential in the daily maintenance. In case of extra high voltage substation, it is difficult to keep the substation reliable. The main objective of this project is to ensure that the expensive equipment such as the distribution and power transformer are protected against damages like over voltage, overloading, short-circuit, surges etc. The transformers are continuously monitored by the designed monitoring system and various electrical parameters like voltage, temperature readings are received in case these parameters exceeds its limit.

## 2. PROPOSED METHODHODOLOGY

This research paper focus at constantly monitoring the load conditions of the Smart grid. It also examines the temperature of the devices existing in the Smart grid. In case the load increases beyond the smart grid's rated capacity, the microcontroller will automatically inform this to the operator by sending SMS via a GSM module. A GSM module or modem provides communication interface. It sends precisely over the network via a serial interface. A GSM module is basically a wireless modem which operates using wireless network. A wireless modem acts as a dial-up modem. Basically, the difference between these is two modem is that the dial-up modem transmits and receives Vdata through a permanent telephone line whereas the wireless modem transmits and receives data through radio waves. In case the temperature of smart grid increases, then the microcontroller will automatically start the cooling system for the smart grid.

The design of this system consists of three part:

a) Part-1 - It consist of the microcontroller that receives electrical parameters at regular intervals from the transformer via a sensor (the interval is set during the time of programming of the microcontroller). Various parameters like current, voltage, frequency and angle are saved in the registers of microcontroller and out of them voltage and current are compared using the threshold values fixed, these threshold values for example can be the rated values of transformer; and these values are dangerous if sensed by the transformer due to overloading or high voltage.

b) Part-2 - In this part the analog parameters are converted to digital via analog to digital convertor (ADC) and send through the GSM cellular network in the second.

c) Part-3 - The third part comprises of the GSM receiver where the mobile phone operator receives various parameters and outputs of the system. The main substation can also be deliver output on the digital display eg. LCD which is connected to the output port of the receiver microcontroller.
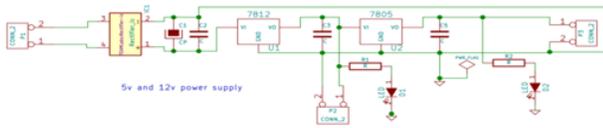


**Fig -1:** Power supply unit

The figure shows the circuit diagram of the power supply unit. This block mainly consists of a two regulating IC 7805 and a bridge rectified and it provides a regulated supply approximately 5V.

The transformer used in this circuit has secondary rating of 7.5V. The main function of the transformer is to step down the AC voltage available from the main. The main connections are given to its primary winding through a switch connected to a phase line. The transformer provides a 7.5V AC output at its secondary terminals and the maximum current that can be drawn from the transformer is 1 Amp which is well above the required level for the circuit.

The bridge rectified the AC voltage available from the secondary of the transformer, i.e. the bridge rectifier convert the AC power available into DC power but this DC voltage available is not constant. It is a unidirectional voltage with varying amplitude.

To regulate the voltage from the bridge rectifier, capacitors are connected. Capacitors C1 filter the output voltage of the rectifier but their output is not regulated and hence 7805 is connected which is specially designed for this purpose.

Although voltage regulators can be designed using op-amps, it is quicker and easier to use IC voltage regulator. Furthermore, IC voltage regulators are available with features such as programmable output current/ voltage boosting, internal short circuit current limiting, thermal shut down and floating operation for high voltage applications.

The 78 XX series consists of three terminals viz, input, output & ground. This is a group of fixed positive voltage regulator to give and output voltage ranging form 5V to 24V. These IC's are designed as fixed voltage regulators and with adequate heat sinking, can delivery output current in excess of 1 Amp although these devices do not require external components and such components can be used to obtain adjustable voltage and current limiting. In addition, the difference between the input and output voltages (V in Vo) called the dropout voltage must be typically 2V even from a power supply filter. Capacitors C2, C3, C4, and C5 are small filters which are used for extra filtering.LED1& LED2 are used for Power ON indicator for IC1 and IC2, current-limiting resistors R2&R4, which prevents the LED's from getting heated and thus damaged.

## 3. CIRCUIT DESCRIPTION

The block diagram describes the purpose of remote monitoring.
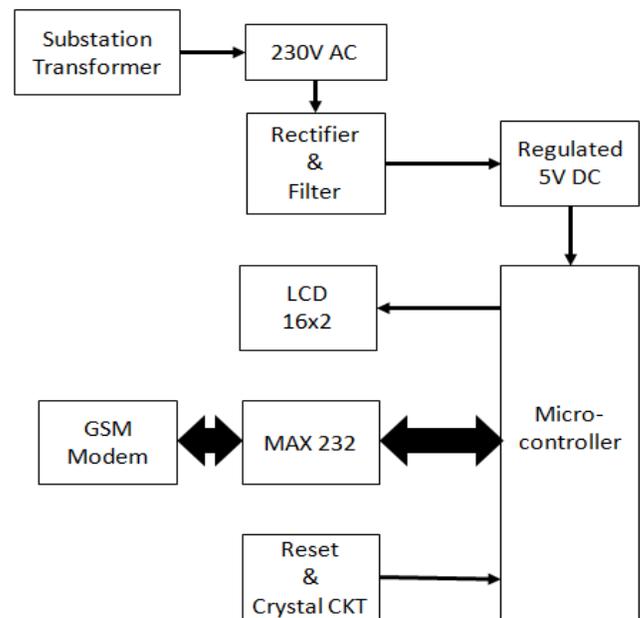


**Fig- 2:** Block Diagram of Circuit

Description of block diagram: Here microcontroller is working as the important device and regulated 5V supply is supplied to the microcontroller through rectifier and filter via transformer which is supplying 230V. This microcontroller is interfaced to LCD that indicates data of voltage regularly. The reset button reset the whole circuit program. In order to convert the single from TT1 to RS 232 and vice versa a translator called MAX 232 is used. This converted signal is send to GSM module. The GSM module will thus send the message to mobile to alert the concerned mobile operator when the voltage exceed its limit.

## 4. HARDWARE IMPLPEMENTATION

The hardware of the project is shown below. It basically consist of transformer, Led units, voltage sensor, load, regulator, microcontroller, GSM module, etc

**Fig -3:** Hardware implementation
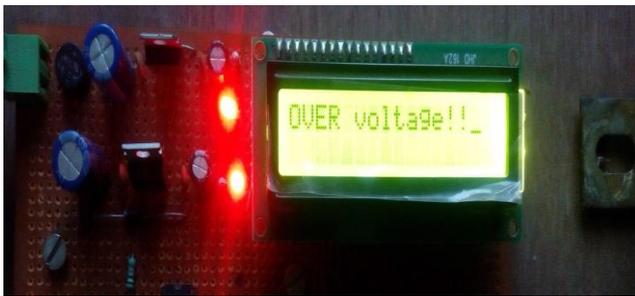


**Fig -4:** Message display (over voltage)

The above figure shows the message on LED screen during the working condition of circuit under during over voltage. After the message is displayed on the screen; GSM sends the message to the mobile phone whose number is registered in the program.
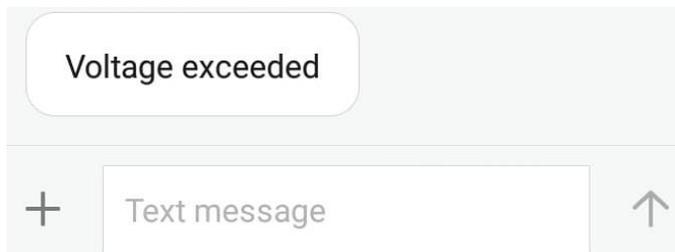


**Fig-5:** Messages of over voltage in mobile

The above figure shows the SMS message on the registered mobile number that is received after the voltage is exceeded to a limit.

## 5. ADVANTAGES ANS DISADVANTAGES

The advantages are numerous with regards to its application. These are listed below.

- Devices can be operated from anywhere in the world.
- Feedback of the devices being operated is present.
- Efficient and low cost design
- Low power consumption.
- Real time monitoring

The only disadvantage found as of now is the dependency on the network signal strength.

Considering the above advantages and disadvantages it can be used in following application.

- This system can be implemented in industries.
- This system can be used to monitor the home appliance.

## 6. FUTURE SCOPE

Today's distribution systems are becoming more and more complicated. New methods of producing and storing electrical energy such as PV, fuel cells, and battery storage systems and new methods of consuming electric energy such as smart appliances and plug-in electric vehicles are being connected to the distribution grid. The rate of adoption of these devices will be driven faster as the economic and environmental benefits improve. In response, the automation systems used to monitor, control, and protect them will need to become more sophisticated. This will have the effect of reducing the costs.

This project can be extended by using GPRS technology, which helps in sending the monitored and controlled data to any place in the world. The temperature controlling systems like coolant can also use in places where temperature level should be maintained. The monitoring and controlling of the devices can be done from the personal Mobile and we can use to handle so many situations. By connecting temperature sensor, we can get the temperature of dangerous zones in industries and we can use personal device itself instead of sending human to there and facing problems at the field. The temperature sensor will detect the temperature and it gives information to the micro controller and micro controller gives the information to the mobile phone.

## 7. CONCLUSION

The project "Automation Substation Using GSM and Microcontroller" is designed such that the substation

various electrical parameters can be monitored from anywhere in the world via GSM which is connected to the mobile phone. By using the advanced GSM module with the help of power supply, the project is successfully implemented. Thus the project is successfully designed and tested. Moreover after doing some changes in the system, the project can be controlled by sending the message from the mobile phone to the system. This project minimizes human work and thus this gives more accuracy and specific data of various electrical parameters of equipment.

The project is designed such that the system can be monitored from all over the world through GSM modem connected to mobile phones. This system is designed to continuously monitor the various electrical parameters of distribution transformer or power transformer throughout its operation. In case the microcontroller identifies any rise in the level of voltage or temperature values the display shows the exact values of parameters throughout the process for the use's reference. This declares that the proposed system makes the distribution transformer more robust against power quality issues which makes the voltage or temperature to peak. Hence the distribution is made more secure, reliable and efficient by means of the proposed system.

## REFERENCES

[1]  "Noida power company Ltd."-Approved Rate Schedule Of Hon'able Up Electricity Regulatory Commission For FY 2014-15

[2] "Smart Personal Sensor Network Control for Energy Saving in DC Grid Powered LED Lighting System"- IEEE TRANSACTIONS ON SMART GRID, VOL. 4, NO. 2, JUNE 2013.

[3] "Implementation of remote monitoring of substation equipment using GSM"- International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, Vol. 5, Issue 6, June 2016.

[4]  Radhika, N., and V. Vanitha. "Smart grid test bed based on GSM." Procedia Engineering 30 (2012): 258-265.

[5]  Nurmi, Petteri, Sourav Bhattacharya, and JoonasKukkonen. "A grid-based algorithm for on-device GSM positioning." In Proceedings of the 12th ACM international conference on Ubiquitous computing, pp. 227-236. ACM, 2010.