MICROCONTROLLER BASED TRANSMISSION LINE PARAMETER SENSING AND MONITORING WITH GSM MODULE

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ABSTRACT: The purpose of this paper is to acquire the transmission line parameters like Voltage, Current, ABCD parameter and power and send these real time values over GSM network using GSM modem. This facilitates the remote monitoring of these parameters without any geographical constraints, since a GSM module is used. Variationin any transmission line parameter will affect the power system. These transmission line parameters are kept in control by means of monitoring. Microcontroller 4520 is used. Voltage and current from transmission line are measured with the help of PT's and CT's respectively. We required two units for sensing and one unit for monitoring. Two units for sensing the parameters at different points on transmission line and send to central monitoring unit by using GSM module. Microcontroller 4520 is provided with some internal memory. The controller is programmed using Embedded 'C' language.

Keywords: GSM modem, microcontroller 4520, Embedded 'c' program, ABCD parameter.

I. INTRODUCTION

Electrical power is generated at different generating stations. These generating stations are not necessarily situated at the load center. During construction of generating station number of factors to be considered from economical point of view. These all factors may not be easily available at load center; hence generating stations are not normally situated very nearer to load center. Load center is the place where maximum power is consumed. Hence there must be some means by which the generated power must be transmitted to the load center. Electrical transmission system is the means of transmitting power from generating station to different load centers.

During planning of construction of generating station the following factors to be considered for economical generation of electrical power.

1) Easy availability of water for thermal power generating station.
2) Easy availability of land for construction of power station including its staff township.
3) For hydro power station there must be a dam on river.
4) For thermal power station easy availability of fuel is one of the most important factors to be considered.
5) Better communication for goods as well as employees of the power station also to be kept into consideration.
6) For transporting very big spare parts of turbines, alternators etc, there must be wide road ways, rain communication, and deep and Wide River must pass away nearby the power station.
7) For nuclear power plant, it must be situated in such a distance from common location so that there may be any effect from nuclear reaction the heath of common people.

All the factors listed above are very difficult to be available at load center. The power station or generating station must be situated where all the facilities are easily available. This place may not be necessarily at the load center. The power generated at generating station then transmitted to the load center by means of electrical power transmission system as we said earlier.

The power generated at generating station is in low voltage level as low voltage power generation has some economical values. Low voltage power generation is more economical than high voltage power generation. At low voltage level, bot weight and wide of insulation is less in the alternator, this directly reduces the cost and size of alternator. But this low voltage level power cannot be transmitted directly to the consumer end as because this low voltage power transmission is not at all economical. Hence although low voltage power generation is economical but low voltage electrical power transmission is not economical.

Electrical power is directly proportional to the product of electrical current and voltage of system. So for transmitting certain electrical power from one place to another, if the voltage of the power is increased then associated current of this power is reduced. Reduced current means less I2R loss in the system, less cross sectional area of the conductor means less capital involvement and decreased current causes improvement in voltage regulation of power transmission system and improved voltage regulation indicates quality power. Because of these three reasons electrical power mainly transmitted at high voltage level.

Fundamentally there are two systems by which electrical energy can be transmitted.

(1) High voltage DC electrical transmission system.
(2) High voltage AC electrical transmission system.

There are some advantages in using DC transmission system-

- Only two conductors are required for Dc transmission system. It is further possible to use only one conductor of DC transmission system if earth is utilized as return path of the system.
- The potential stress on the insulator of DC transmission system is about 70% of same voltage AC transmission system. Hence less insulation cost is involved in DC transmission system.
- Inductance, capacitance, phase displacement and surge problems are absent in DC system.

Even having these advantages in DC system, generally electrical energy is transmitted by three phase AC transmission system.

- The alternating voltages can easily be stepped up & down, which is not possible in DC transmission system.
- Maintenance of AC substation is quite easy and economical compared to DC site.
- The transforming in AC electrical substation is much easier than motor-generator sets in DC system.

ABCD Parameter

The circuit of a 2 port network is shown in the diagram below. As the name suggests, a port network consists of an input port PQ and an output port RS. Each port has 2 terminals to connect itself to the external circuit. Thus it is essentially a 2 port or a 4 terminal circuit,

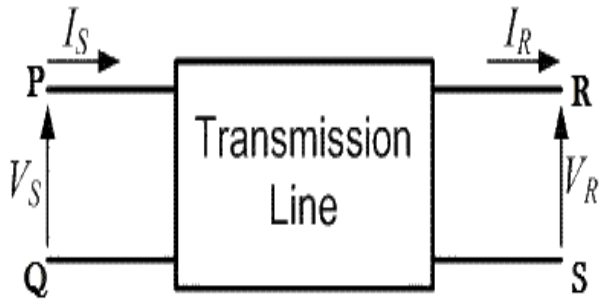


Fig.Two port network

Supply end voltage = Vs
& Supply end current = Is
Given to the input port PQ.
receiving end voltage = VR
& Supply end current = IR
Given to the output port R S.

Now the ABCD parameters or the transmission line parameters provide the link between the supply and receiving end voltages and currents, considering the circuit elements to be linear in nature. Thus the relation between the sending and receiving end specifications are given using ABCD parameters by the equations below.

Vs = AVR+BIR ----------(1)
Is = CVR+DIR ----------(2)

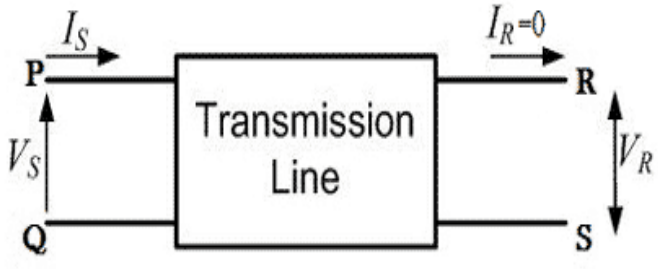


Fig.Two port network when RS is open

The receiving end is open circuited meaning receiving end current IR = 0.
Applying this condition to equation (1) we get,
A=Vs/VR
Applying the same open circuit condition i.e. IR = 0 to equation (2)
C = Is/VR

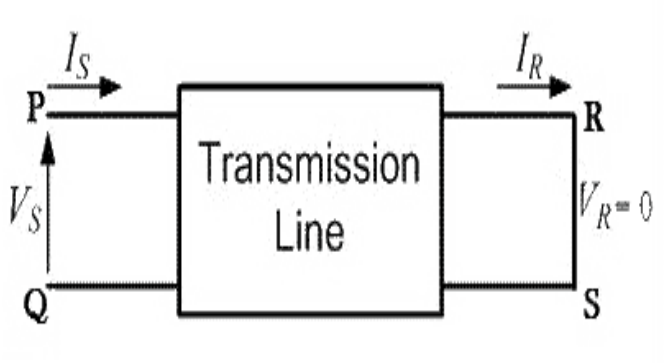


Fig.Two port network when RS is short

Receiving end is short circuited meaning receiving end voltage VR = 0
Applying this condition to equation (1) we get,
B = Vs/IR
Applying the same short circuit condition i.e. VR = 0 to equation (2) we get
D = Is/IR

Parameter	Specification	Unit
A = VS / VR	Voltage ratio	Unit less
B = VS / IR	Short circuit resistance	Ω
C = IS / VR	Open circuit conductance	Mho
D = IS / IR	Current ratio	Unit less

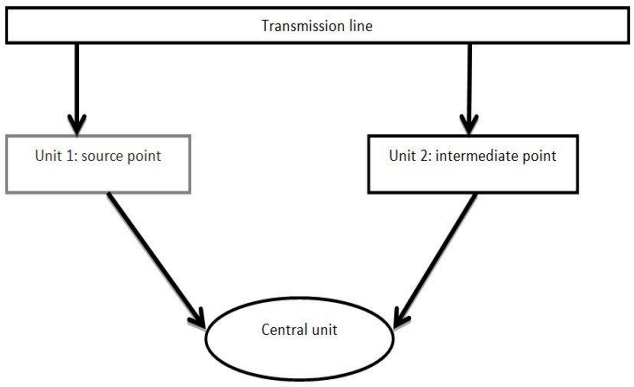
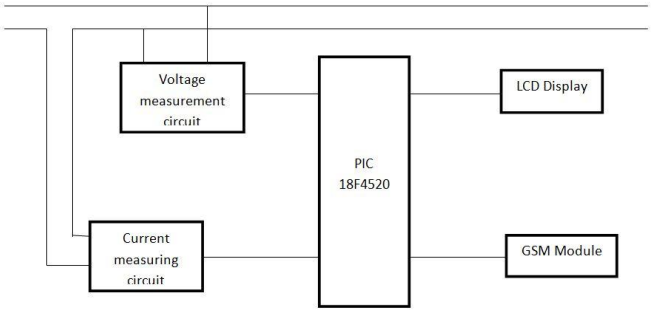


Fig. Basic block view of proposed system.

In above fig we can see that unit 1 and unit 2 are on transmission line at different points having some distance. At unit 1 and unit 2 transmission line parameters are measured and send that data to central unit using GSM module. At central unit GSM module receives data and display on screen.

Following diagram shows the block schematic of the proposed unit.



The system is design based on microcontroller PIC18F4520 that measures the parameter to be monitored the measured values at unit1 and unit2 are then transmitted through a GSM module to the central unit at remote place where it will be displayed on PC/LCD.
The required parameters such as current and voltage are measured using PIC18F4520, using the ADC conversion facility CT's and PT's are used to measured transmission line current and voltage. These values of current and voltage are then multiplied in the microcontroller to find power.

Current transformer
A current transformer (CT) is an electric device that produces an alternating current (AC) in its secondary which is proportional to the AC in its primary. Current transformers, together with voltage transformers (VTs) or potential transformers (PTs), which are designed for measurement, are known as instrument transformers.
Ratio of current transformer used is 30A/30mA.
When a current is too high to measure directly or the voltage of the circuit is too high, a current transformer can be used to provide an isolated lower current in its secondary which is proportional to the current in the primary circuit. The induced secondary current is then suitable for measuring instruments or processing in electronic equipment. Current transformers also have little effect on the primary circuit. Often, in electronic equipment, the isolation between the primary and secondary circuit is the important characteristic.
Current transformers are used in electronic equipment and are widely used for metering and protective relays in the electrical power industry.
Potential transformer
Voltage transformers (VT), also called potential transformers (PT), are a parallel connected type of instrument transformer, used for metering and protection in high-voltage circuits or phasor phase shift isolation. They are designed to present negligible load to the supply being measured and to have an accurate voltage ratio to enable accurate metering. A potential transformer may have several secondary windings on the same core as a primary winding, for use in different metering or protection circuits. The primary may be connected phase to ground or phase to phase. The secondary is usually grounded on one terminal.

LCD - 16 X 2
LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on.
A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data.

Max 232
The MAX232 IC is used to convert the TTL/CMOS logic levels to RS232 logic levels during serial communication of microcontrollers with PC. The controller operates at TTL logic level (0-5V) whereas the serial communication in PC works on RS232 standards (-25 V to + 25V). This makes it difficult to establish a direct link between them to communicate with each other.
The intermediate link is provided through MAX232. It is a dual driver/receiver that includes a capacitive voltage generator to supply RS232 voltage levels from a single 5V supply. Each receiver converts RS232 inputs to 5V TTL/CMOS levels. These receivers (R1 & R2) can accept ±30V inputs. The drivers (T1 & T2), also called transmitters, convert the TTL/CMOS input level into RS232 level.

GSM (SIM 800)
GSM Modem can accept any GSM network operator SIM card and act just like a mobile phone with its own unique phone number. Advantage of using this modem will be that you can use its RS232 port to communicate and develop embedded applications. Applications like SMS Control, data transfer, remote control and logging can be developed easily.
GSM/GPRS MODEM is a class of wireless MODEM devices that are designed for communication of a computer with the GSM and GPRS network. It requires a SIM (Subscriber Identity Module) card just like mobile phones to activate communication with the network. Also they have IMEI (International Mobile Equipment Identity) number similar to mobile phones for their identification. A GSM/GPRS MODEM can perform the following operations:
1. Receive, send or delete SMS messages in a SIM.
2. Read, add, search phonebook entries of the SIM.
3. Make, Receive, or reject a voice call.
PIC18F4520
Some features of PIC18F4520 are as given below:

- It is 4o pin PDIP
- Operating frequency is DC 40 MHz
- Program Memory (Bytes) is 32768.
- Data memory is (Bytes) is 1536.
- Data EEPROM memory (Bytes) is 256.
- I/O ports are port A, port B, port C, port D, port E.
- There are 4 timers used.
- 10 bit analog to digital module: 13 input channels.
- Parallel communication is possible.
- There are 75 instructions set.

II. CONCLUSION

The project "microcontroller based transmission line parameter monitoring and sensing with GSM modem" was designed such that the device can be monitored from anywhere in the world using GSM modem connected.

Future scope:

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 monitoring and controlling of the devices can be done from the personal computers and we can use to handle so many situation. in future we can use these project in several application like fault detection and finding the fault in transmission line.

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